Tready - Manual

HEBI Robotics

Version 2.0, 19 Aug, 2024

Contents

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.

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

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 Wattman batteries

in the Tready system.

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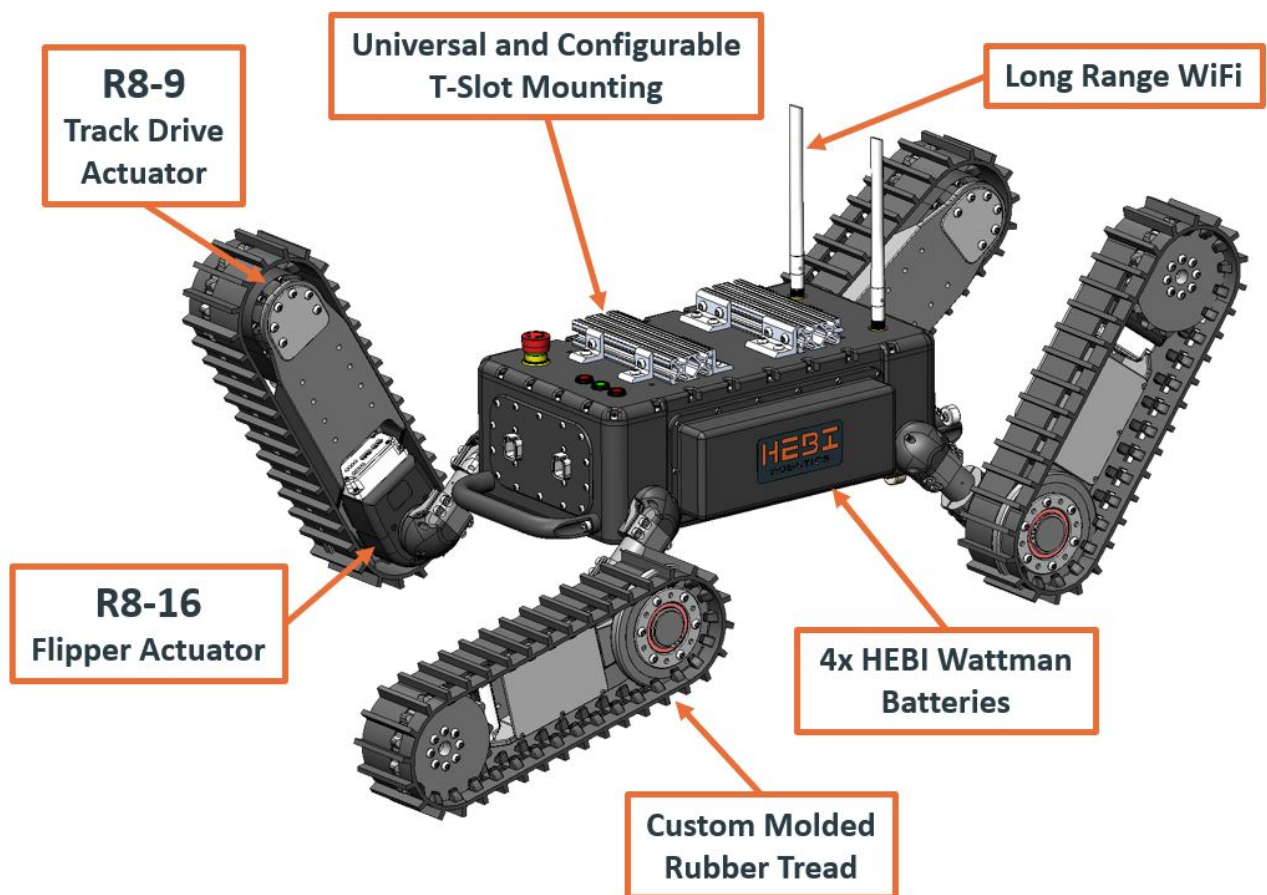
b. Robot example addition - 6-DoF R-Series Arm with Gripper

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 for more information on customizing these bulkheads.

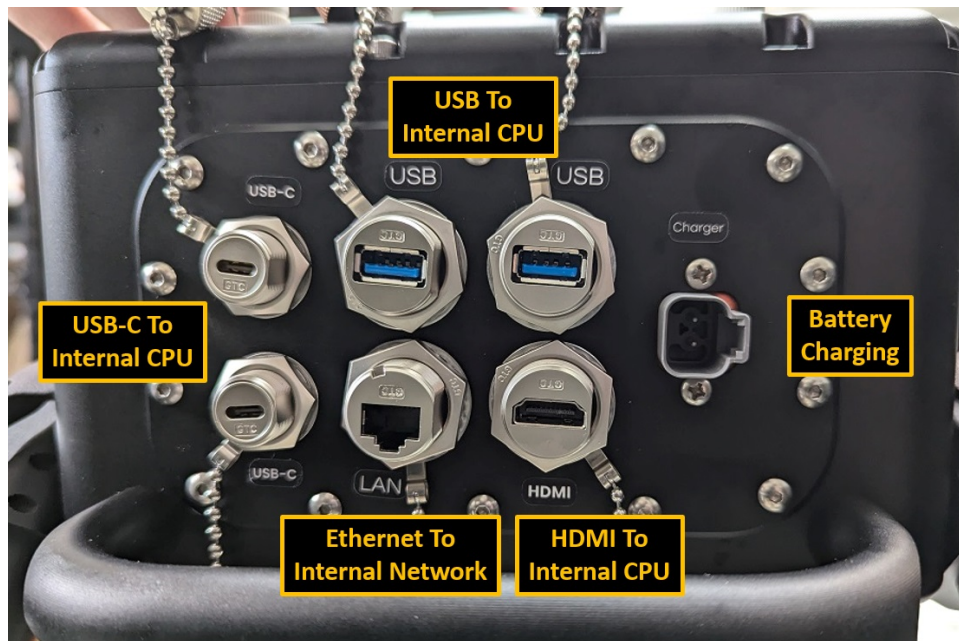a. Top view of robot chassis and associated buttons and bulkhead components.
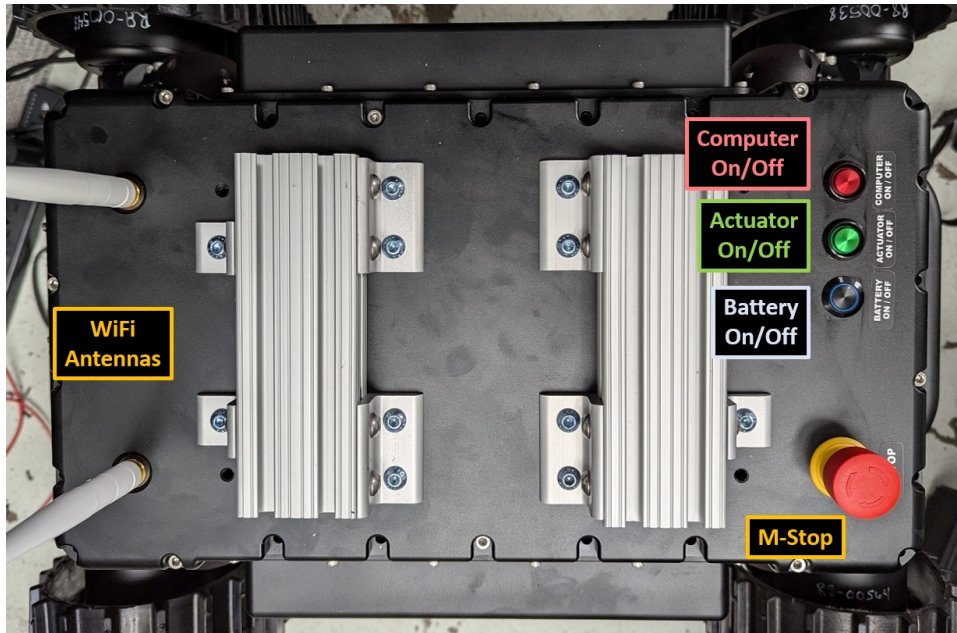
b. Front view of robot chassis and associated bulkhead components.
   (1: V+ | 6: GND | 2: MS+ | 5: MS- | 3-4: Plastic Optical Fiber Data)

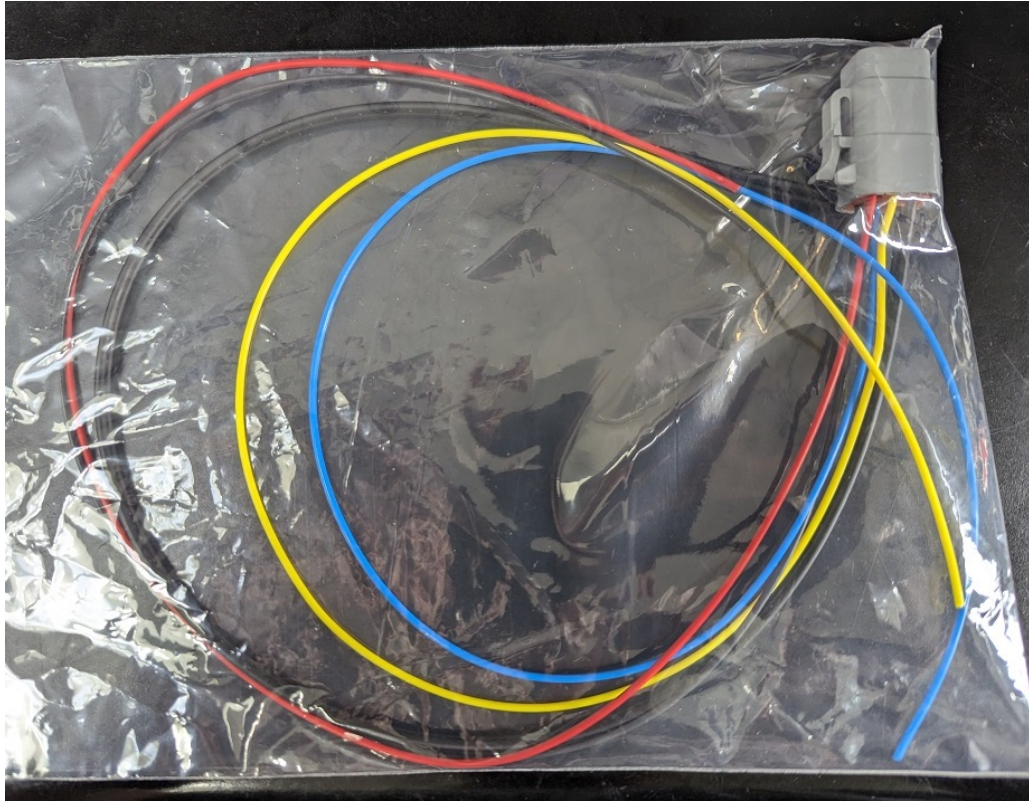c. Rear view of robot chassis and associated bulkhead components.

1.5. Accessories

a. Accessory Power, M-Stop, and Data Connection
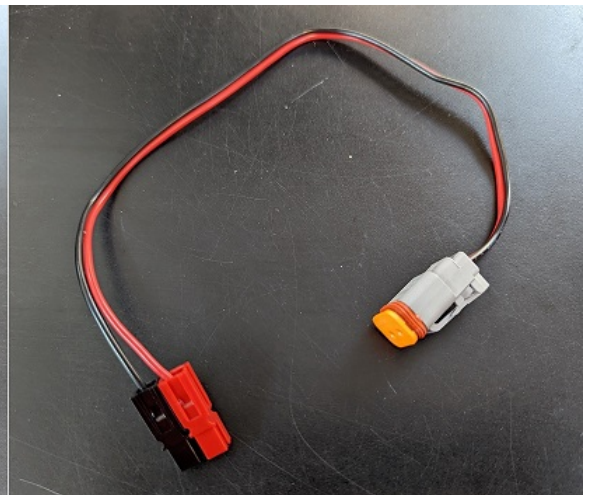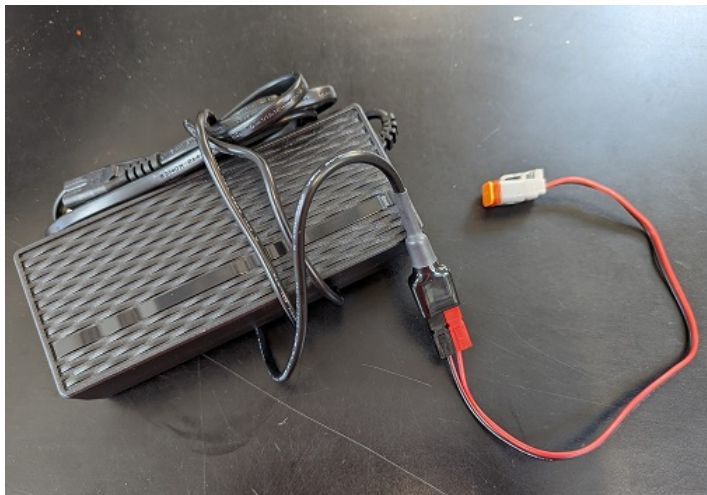(Red: V+ | Black: GND | Yellow: MS+ | Blue: MS- | Plastic Optical Fiber Data)
ATM06-6S Connector Kit

b. Battery charging bulkhead adapter & Charger
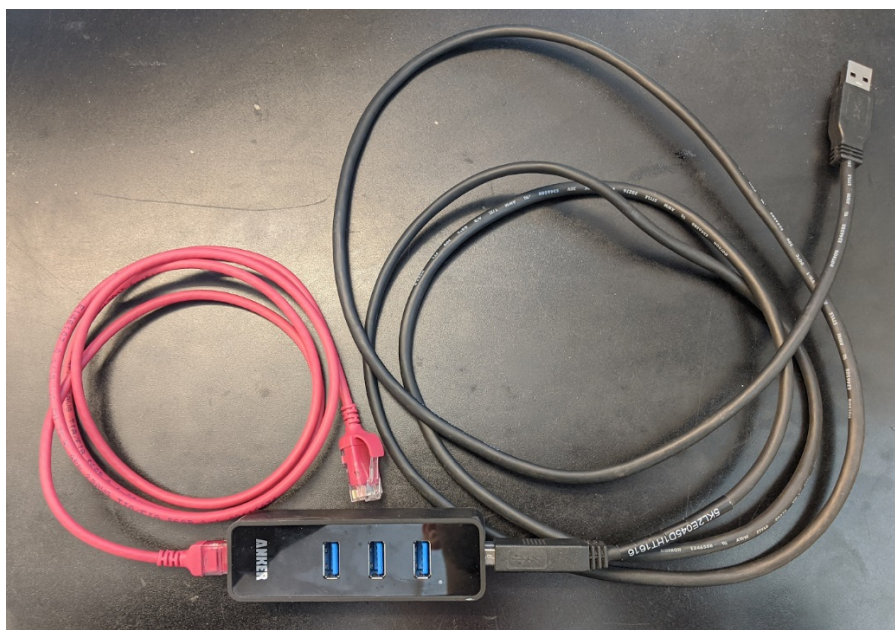DT06-2S Connector Kit
Powerpole Connector Kit

c. Track tensioning tool

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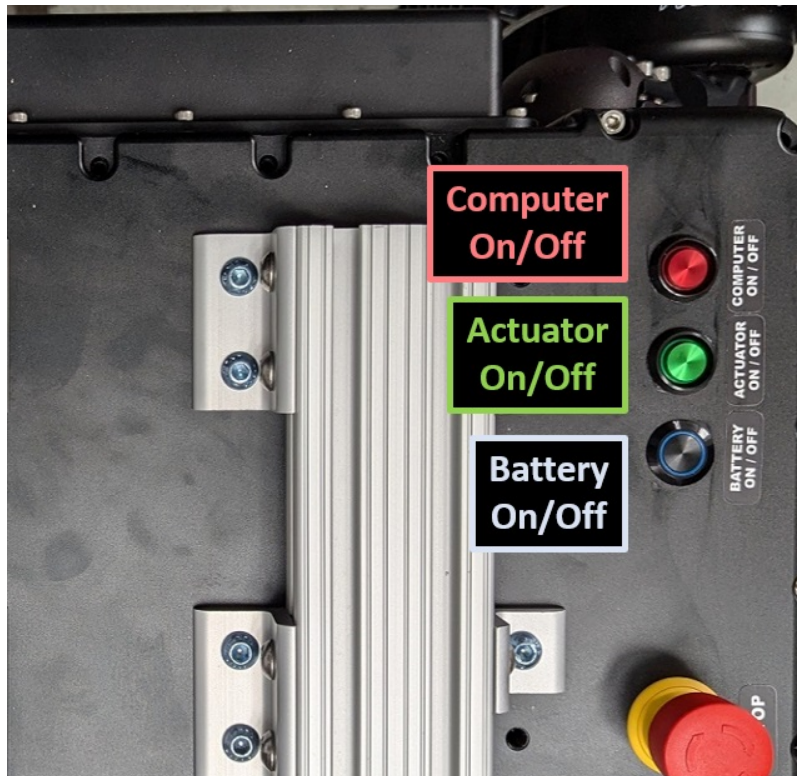3-Port USB Hub with Gigabit Ethernet Converter (Amazon)

e. Connection Toolbox
   (Includes tools for both R-Series Actuators and Tready Robot)

2. Startup

2.1. Power On

1. 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.

2. On your mobile control device check for Tready's WiFi to appear and connect to it (Password: hebi1234)
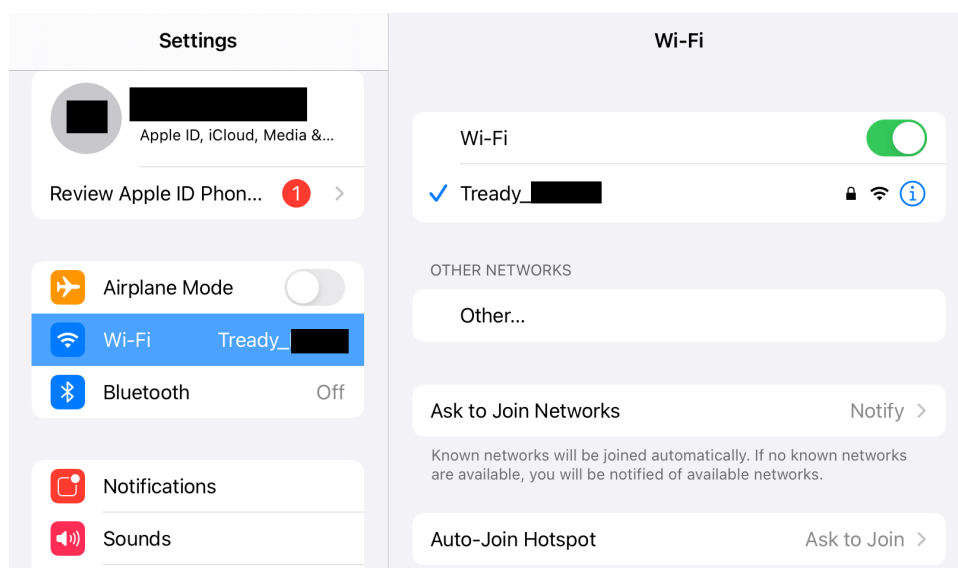
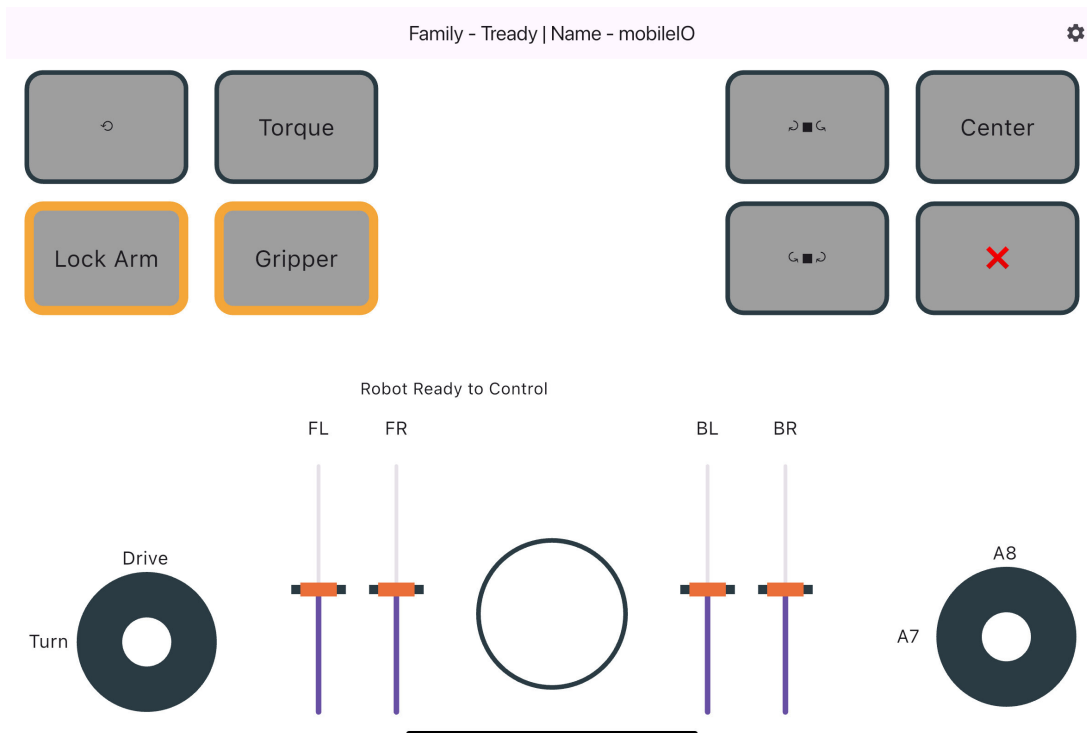3. Make sure that the correct Family and Name are set on your mobile device in the "Mobile I/O" Settings.
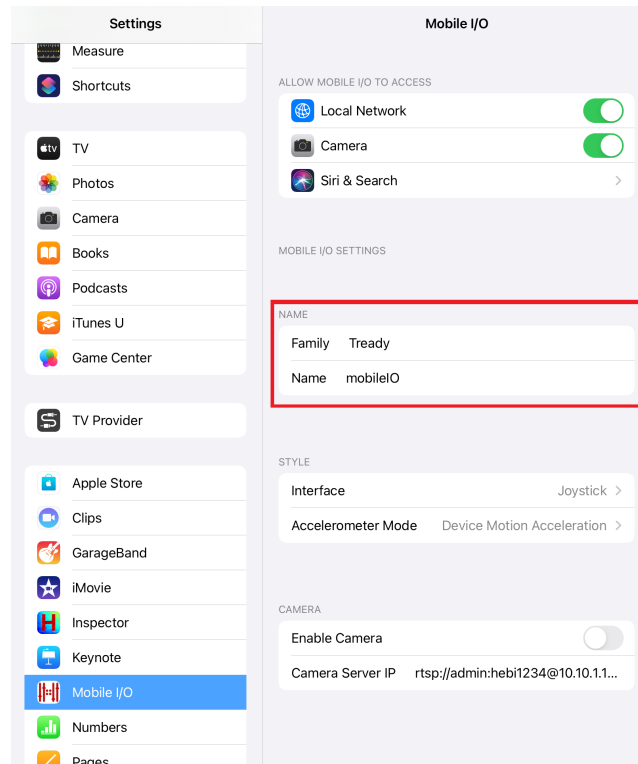
4. Press and hold the "Actuator On/Off" Button (Green) until the button's LED lights up. This sends power to the R-Series Actuators on Tready's tracks as well as the front bulkhead panel for any other accessory components.

5. 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.

6. 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. <<<
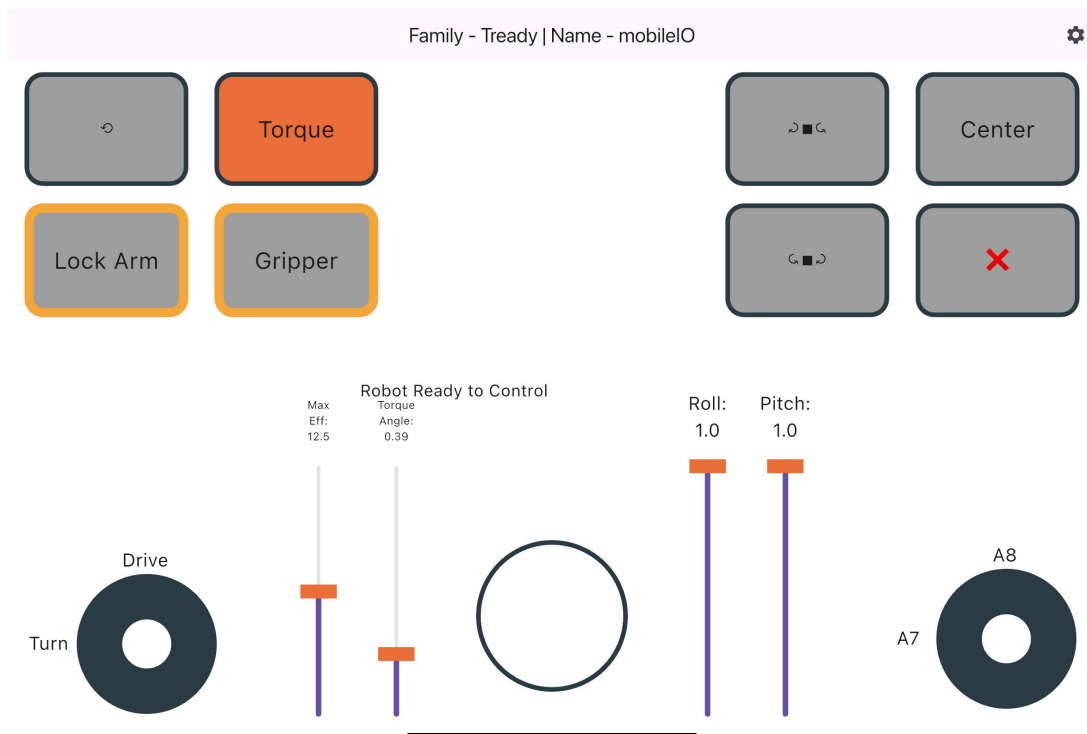
2.2. Control Interface (HEBI Mobile IO App)

1. **Main Control Screen**

Family - Treadly | Name - mobileIO ⚙

| ↺ | Torque | | ⟲■⟳ | Center |

| Lock Arm | Gripper | | ⟲■⟳ | ✕ |

Robot Ready to Control

FL   FR   BL   BR

Drive

Turn

A8

A7

2. **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.

Family - Treadly | Name - mobileIO ⚙

| ↺ | Torque | | ⟲■⟳ | Center |

| Lock Arm | Gripper | | ⟲■⟳ | ✕ |

Max   Robot Ready to Control   Roll: Pitch:
Eff: Torque   1.0   1.0
12.5   Angle:
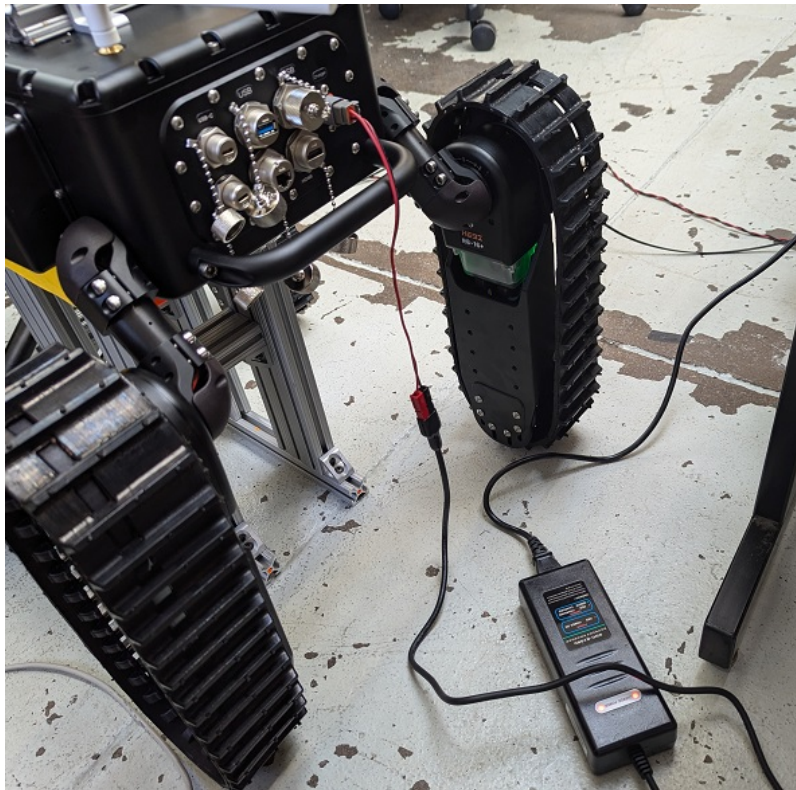   0.39

Drive

Turn

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

To charge batteries not in Tready's chassis use a Battery Connector Cap to turn on and connect the Wattman battery to a charger.
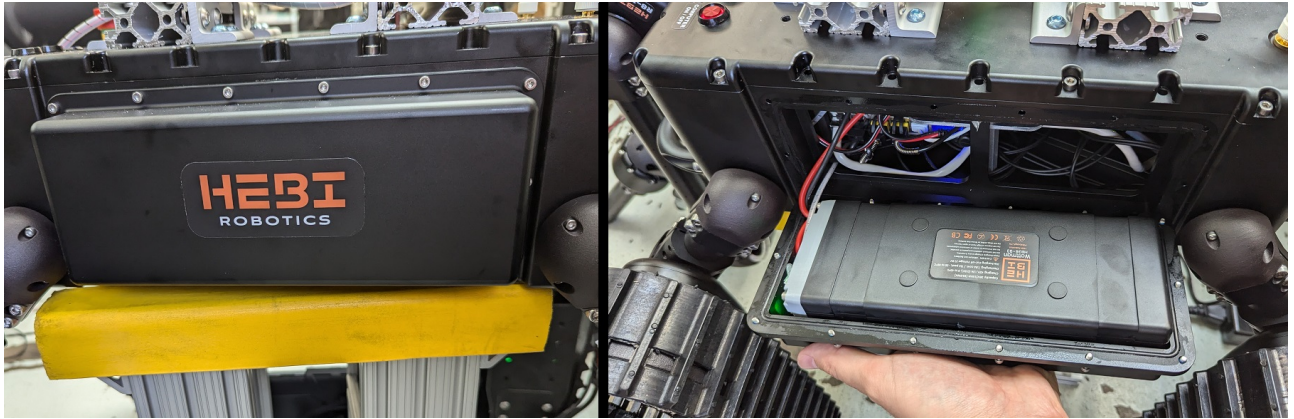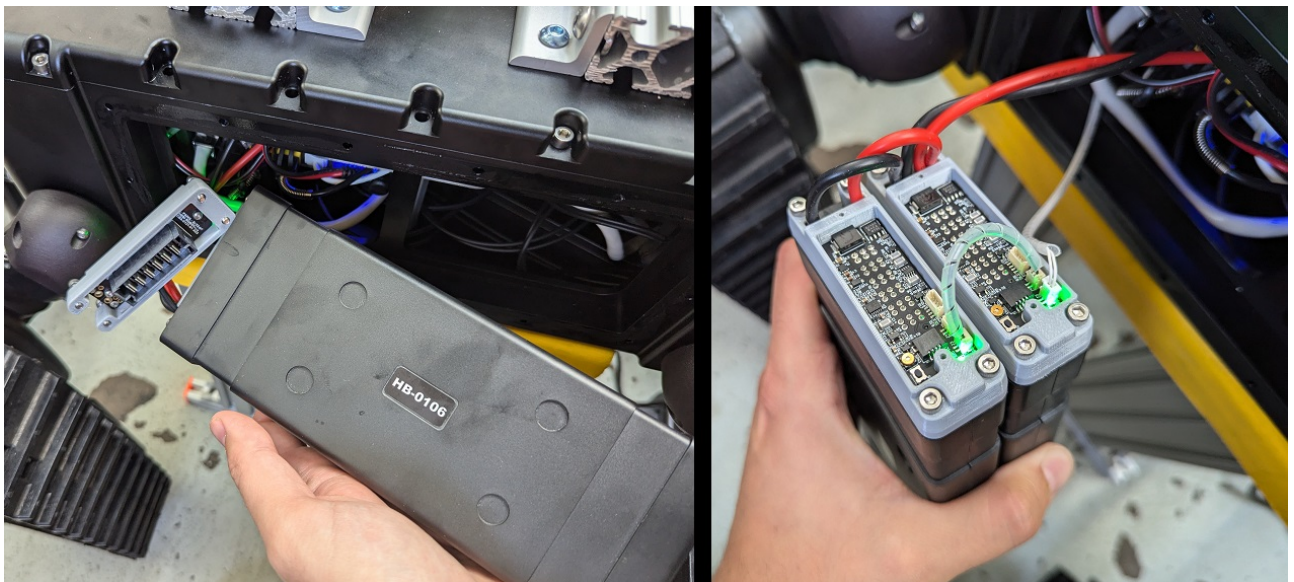
3.2. Installing / Swapping

🛑 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.
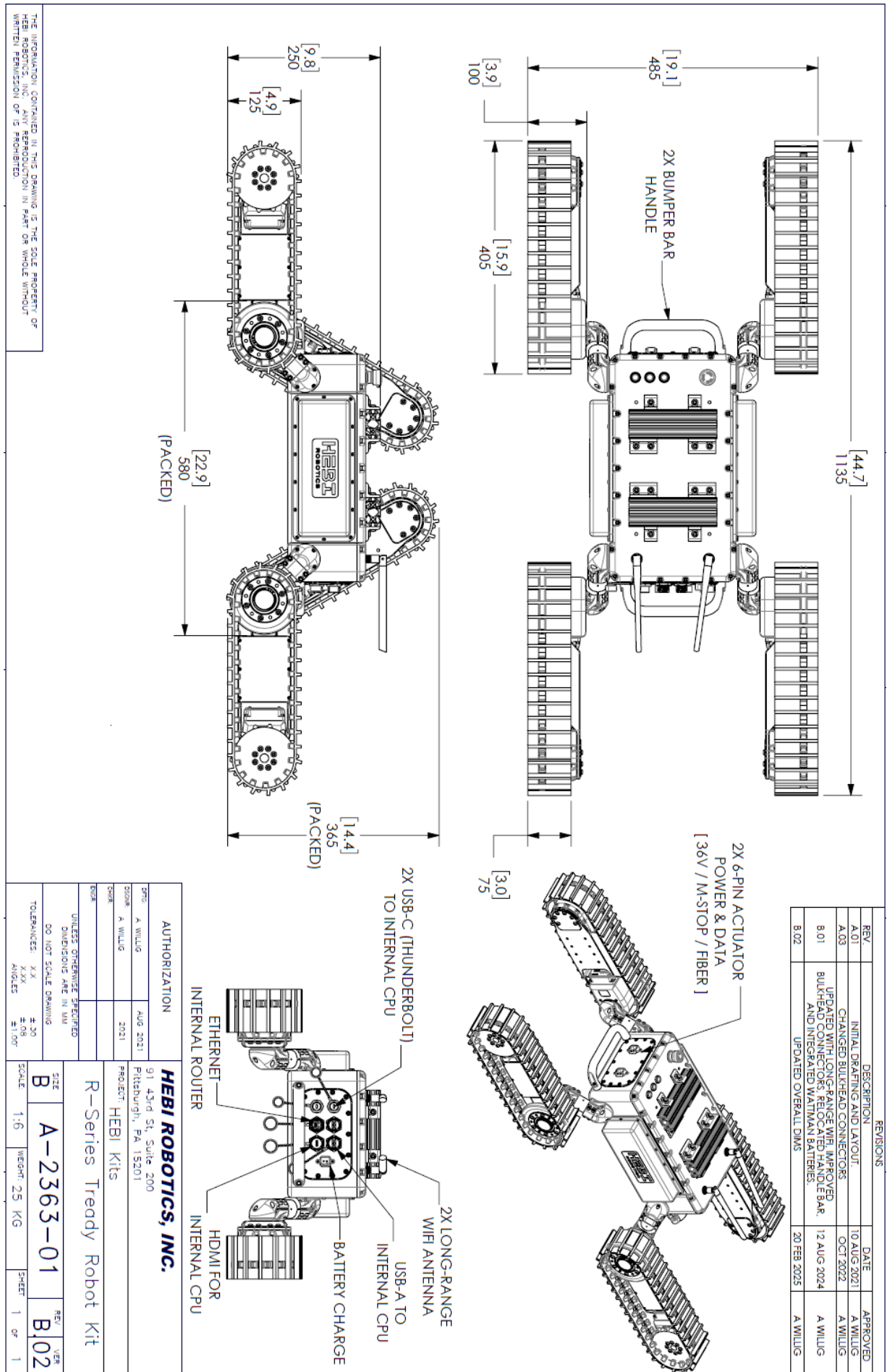
4. Documentation

4.1. Datasheets and Drawings
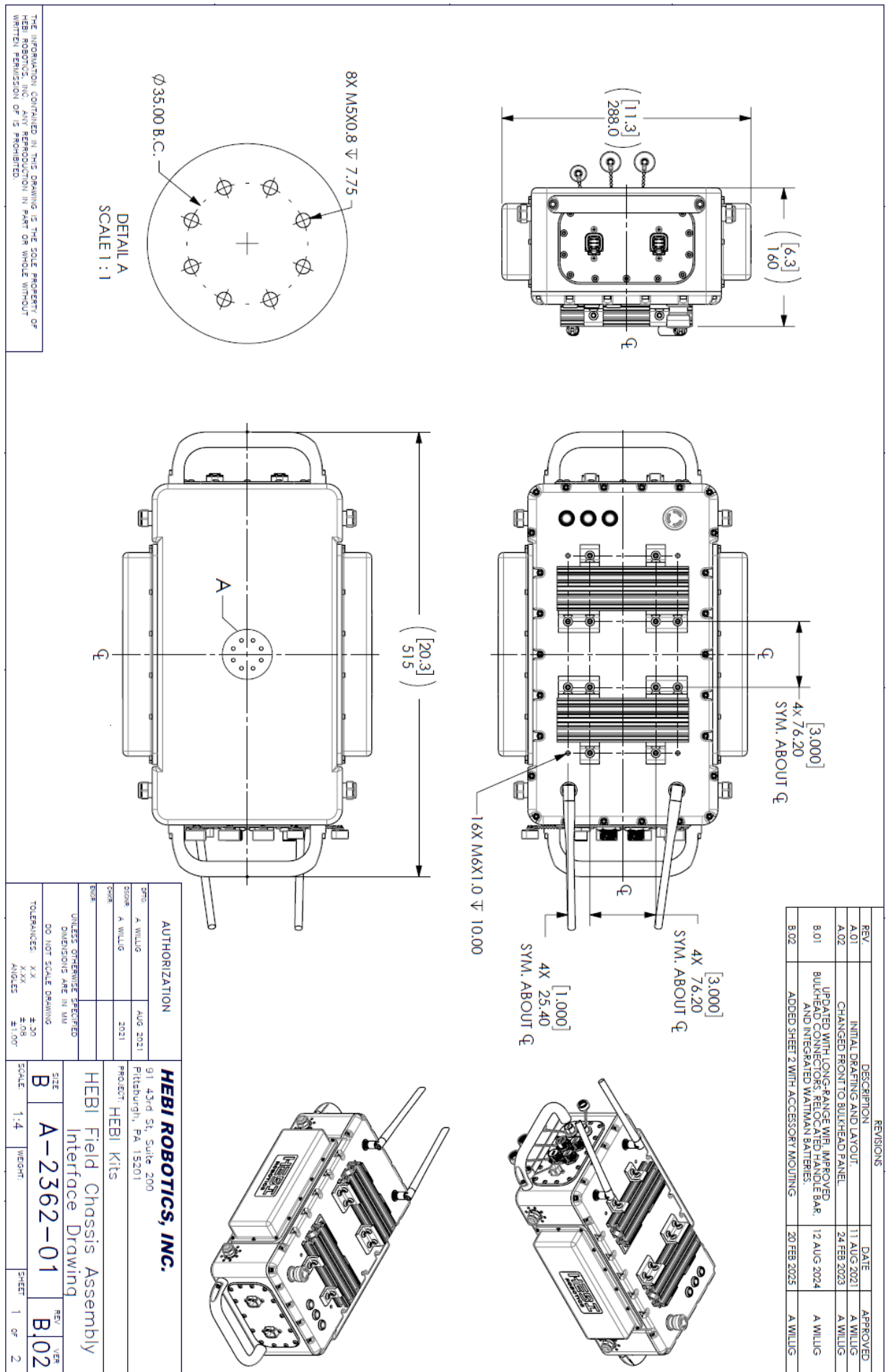
a. R-Series Actuator Datasheet

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
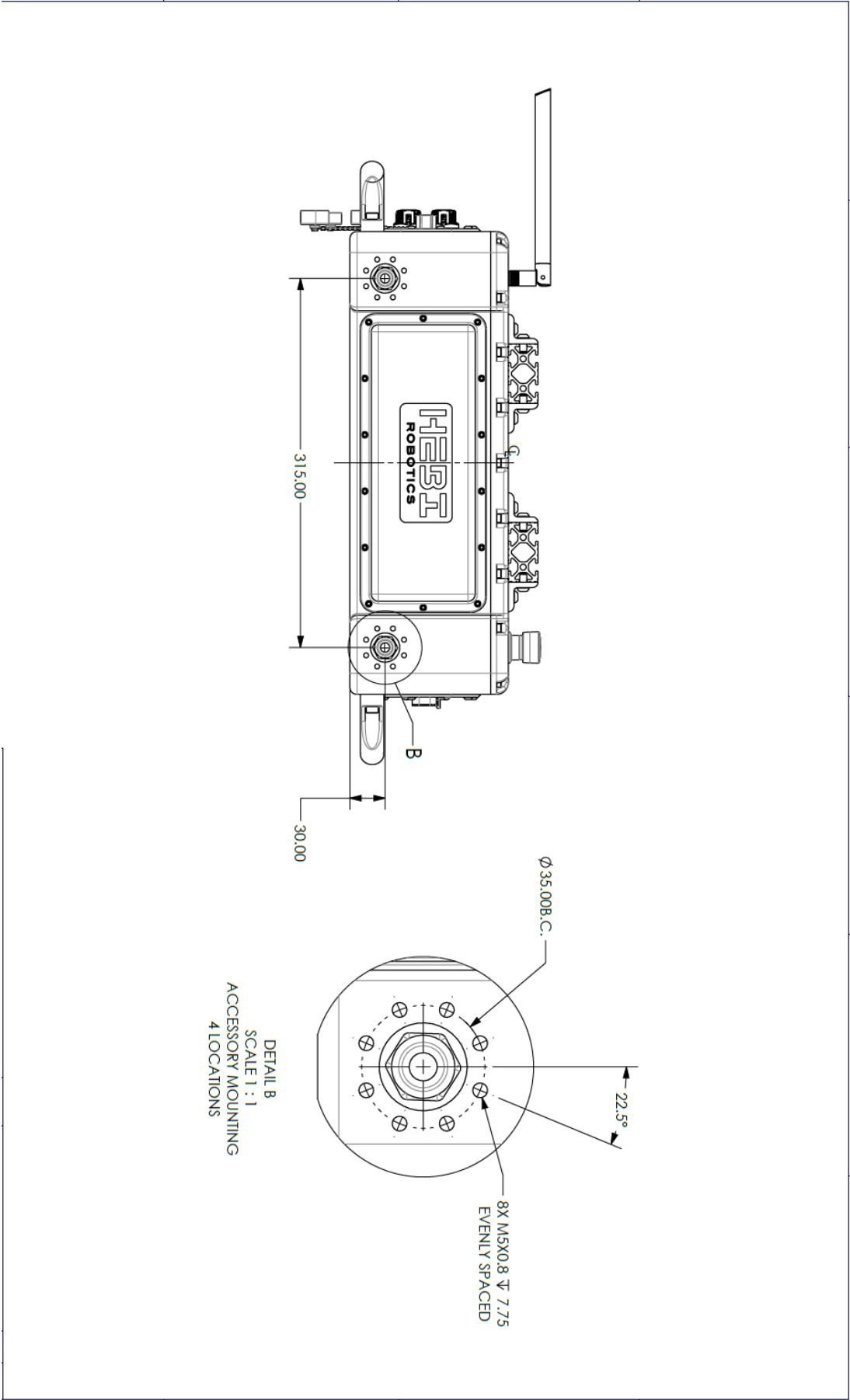Updated on October 1, 2021. Specifications subject to change without notice.

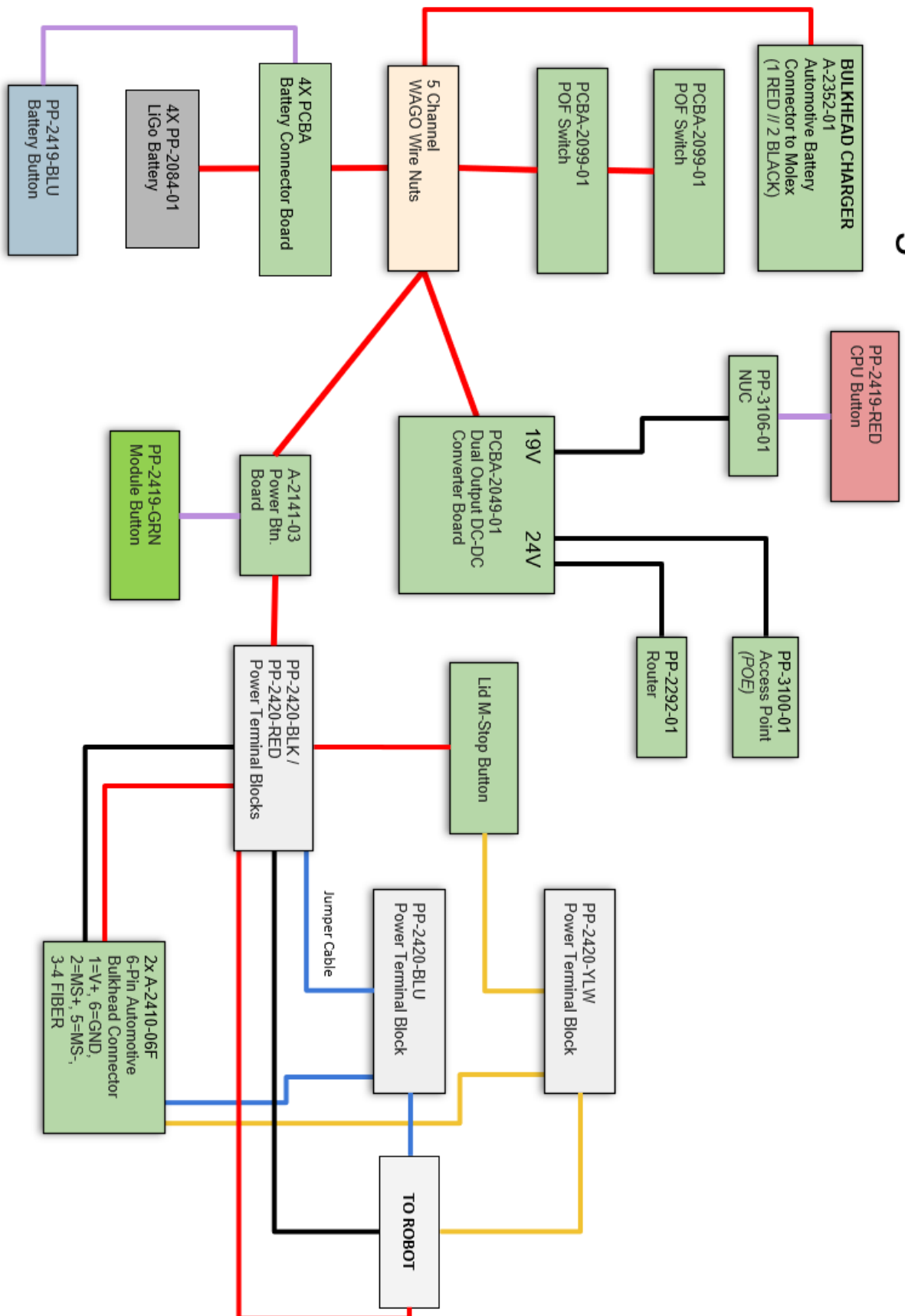b. Tready robot platform mechanical drawing (Sheet 1).

c. Field chassis mechanical drawing (Sheet 1).

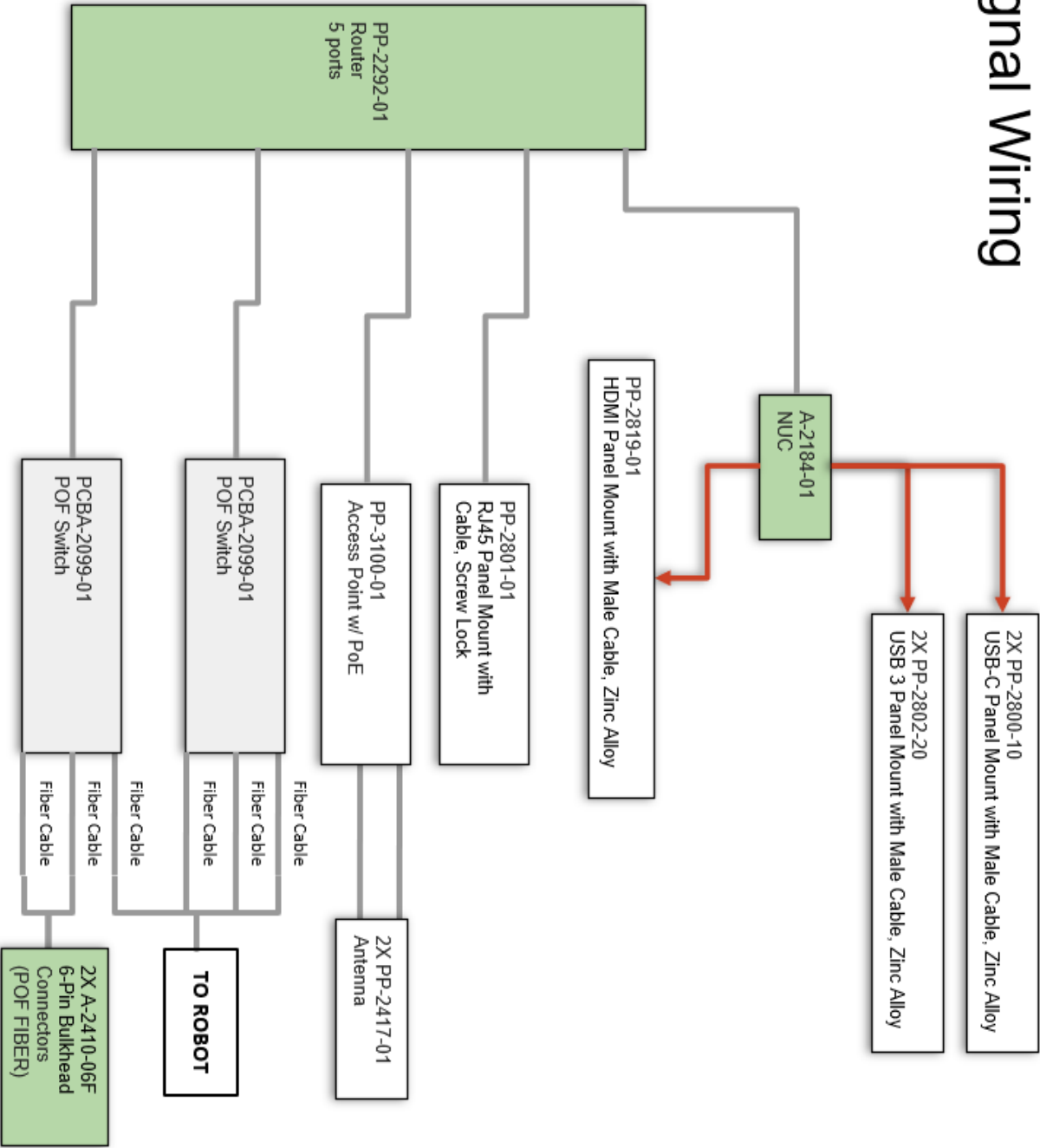d. Field chassis mechanical drawing (Sheet 2).

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DETAIL B
SCALE 1 : 1
ACCESSORY MOUNTING
4 LOCATIONS

B

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)

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

5.2. HEBI Community Forum (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)

- CAD files and drawings

5.4. Contact Us

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