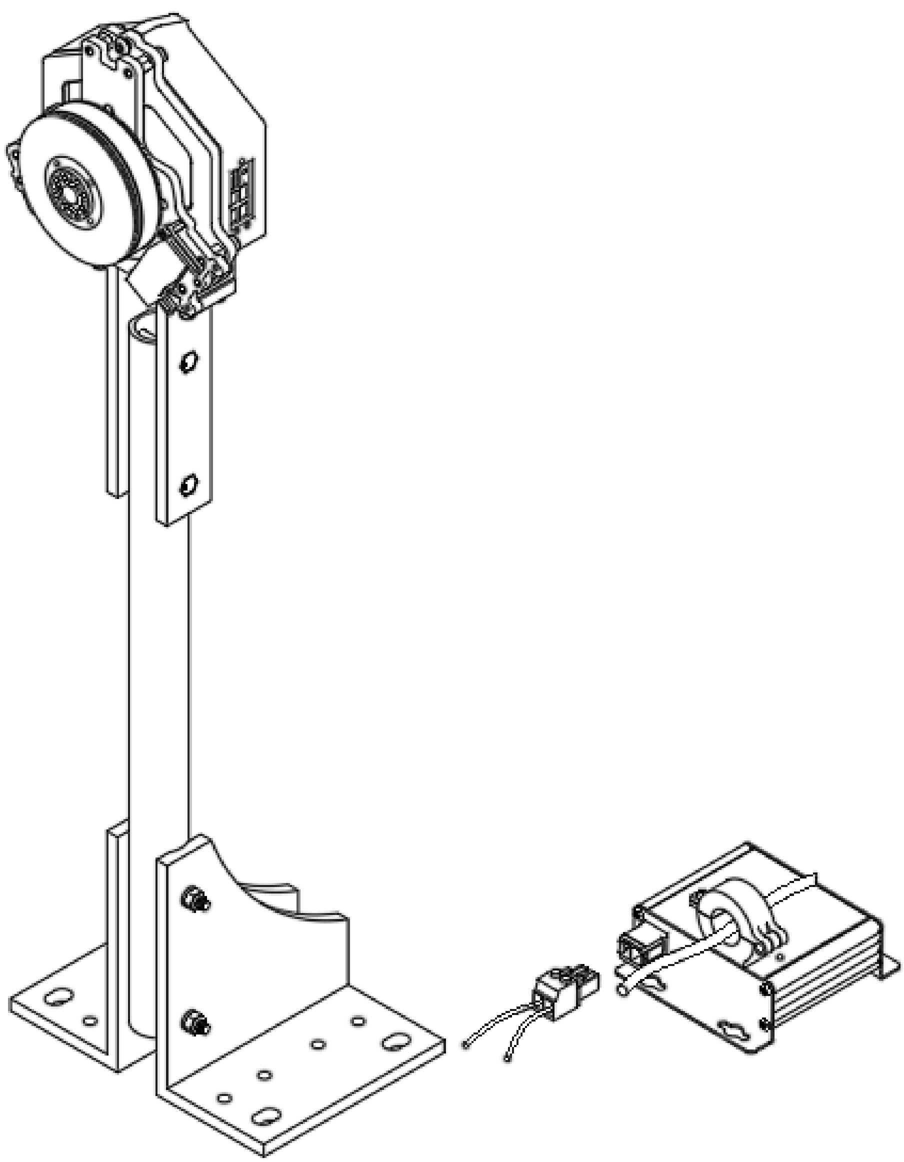
Flight Stand 15/50 Standard and Pro Installation User Manual



Tyto Robotics
B1 - 80 rue Adrien Robert • Gatineau, QC, Canada J8Y 3S2

sales@tytorobotics.com
tytorobotics.com • 1-844-722-8378

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Section 1.1 Introduction and Item Checklist

The Flight Stand 15/50 allows to test a large diversity of powertrains up to 15/50 kgf of thrust and 8/30 Nm of torque. They measure voltage up to 180 V and direct current up to 150/300 A.

You may use the following item checklist to verify the items inside the box.

	FS15 STD	FS15 Pro	FS50 Std	FS50 Pro
SKU#	DEBE	FRWD	FVUG	ZQAB
1 x SKU#EXPA - Flight Stand 15 Standard - Force Measurement Unit 15 kgf - 8 Nm	x			
1 x SKU#HLNR- Flight Stand 15 Standard - Electrical Measurement Unit 180 V - 150 A	x			
1 x SKU#FVGQ - Flight Stand 15 Pro - Force Measurement Unit 15 kgf - 8 Nm		x		
1 x SKU#FVGQ - Flight Stand 15 Pro - Force Measurement Unit 15 kgf - 8 Nm		x		
1 x SKU#YHJU - Flight Stand 50 Standard - Force Measurement Unit 50 kgf - 30 Nm			x	
1 x SKU#DJHD - Flight Stand 50 Standard - Electrical Measurement Unit 180V - 300 A			x	
1 x SKU#QRXS - Flight Stand 50 Pro - Force Measurement Unit 50 kgf - 25 Nm				x
1 x SKU#MVNT- Flight Stand 50 Pro - Electrical Measurement Unit 180V - 300 A				x
1 x SKU#MLGD - Flight Stand 15/50 Standard Motor Mounting Plate	x		x	
1 x SKU#WEGK - Flight Stand 15/50 Standard - Auxiliary Components Box	x		x	
1 x SKU#RBQS - Flight Stand 15/50 Round Tube - Silver	x		x	
1 x SKU#TSTY - Flight Stand 15/50 Upper L-bracket A - Silver	x		x	
1 x SKU#TPAQ - Flight Stand 15/50 Upper L-bracket B - Silver	x		x	
1 x SKU#ZSHA - Flight Stand 15/50 Lower L-bracket A - Silver	x		x	
1 x SKU#LHCZ - Flight Stand 15/50 Lower L-bracket B - Silver	x		x	
1 x SKU#ZYGX - Flight Stand 15/50 Motor Mounting Plate - black		x		x

	FS15 STD	FS15 Pro	FS50 Std	FS50 Pro
1 x SKU#FLGM - Flight Stand 15/50 Pro - Auxiliary Components Box		x		x
1 x SKU#GQTJ - Flight Stand 15/50 Round Tube - Black		x		x
1 x SKU#LZWY- Flight Stand 15/50 Upper L-bracket A - Black		x		x
1 x SKU#WRKL - Flight Stand 15/50 Upper L-bracket B - Black		x		x
1 x SKU#EMVX- Flight Stand 15/50 Lower L-bracket A - Black		x		x
1 x SKU#SYSY - Flight Stand 15/50 Lower L-bracket B - Black		x		x

You should have received the Sync Hub box SKU#WMHX in the same time, here is the checklist for it :

- 1 x GXYY - Flight Stand Sync Hub
- 1 x WQFF - 9V, 2A power adaptor in box
- 1 x RKVR - USB cable type A/B 1.8 m
- 1 x CLHV - Sync cable

Section 1.2: General Safety Rules

Always put safety first! It is your responsibility!

It is always important to stay alert to work with a thrust stand. The Flight Stand has been tested to 15/50 kgf of thrust. However, it needs to be used in a safe environment for the operators, such as an enclosure. Any abuse or misuse of the stand may result in damage to the equipment or injury to the users.

To ensure safety, please follow these instructions:

1. Wear safety goggles during a test.
2. Wear gloves during assembly of the flight stand
3. Make sure you have all the components and tools needed before construction.
4. Inspect all fasteners before every experiment and as often as possible.
5. Do not place the flight stand near the presence of flammable liquids or gases.
6. Always keep your work area clean, do not work on surfaces that are dirty with oil. Small metal chips may be blown up and hit the propeller by accident. Clean your testing room before every test.
7. Respect Murphy's law. If you think something might go wrong, it will.
8. Make sure you are dressed for safety. Do not wear jewelry or long clothing when operating the tool. Tie long hair before a test.
9. Do not let children around the Flight Stand.
10. Do not use or assemble the tool alone.
11. Do not substitute parts or modify the instrument.
12. Always disconnect the power source AND wait for the propeller to stop spinning before approaching the flight stand (or opening the door of the enclosure).
13. Do not store anything near or above the flight stand, especially when performing a test.
14. Do not stay in the plane drawn by the spinning propeller or directly behind it. This is where small parts are most likely to be ejected by the propeller.

Chapter 2. Installation Guide

Section 2.1 Stand Assembly

Open the main box and find the following items inside:

- Flight Stand 15/50 Round Tube
- Flight Stand 15/50 Upper L-bracket A
- Flight Stand 15/50 Upper L-bracket B
- Flight Stand 15/50 Lower L-bracket A
- Flight Stand 15/50 Lower L-bracket B
- Flight Stand 15/50 Pro - Auxiliary Components Box
    - FS15/50 Stand Fastener Bag
    - FS15/50 Hand Tool Bag

You may assemble the stand with the items listed above:

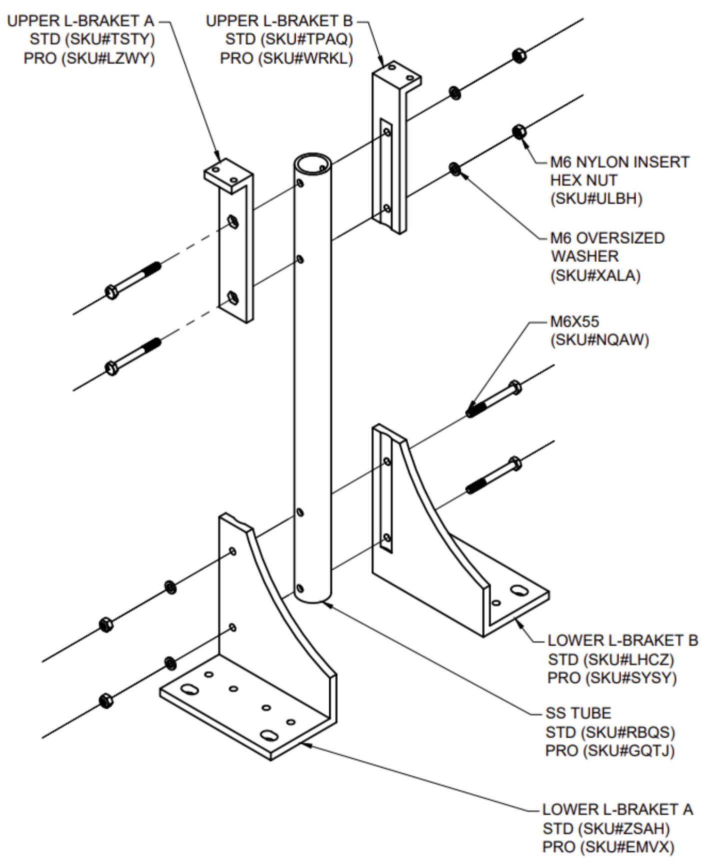


Fig 1. Stand Assembly Instructions

You may then install the assembled stand on the ground structure inside your test lab. You may use anchors, ground screws, rails, or a large piece of metal or plywood to fix the stand. The lower L-brackets provide possibilities to use metric M6, M8, M10, imperial 1/4", 5/16", 3/8" fasteners, choose according to the availability in your local stores. We also recommend using properly rated **oversize flat washers** and **lock washers** to better distribute the loads on the fasteners and tackle with the rough surface on the floor. Please keep in mind that you are responsible for making sure the pulling forces or shearing do not exceed the safety limit of the selected fasteners. Make calculations before your work.

❗❗❗IMPORTANT❗❗❗

The stand has to be attached to a solid ground such as concrete. A soft ground has the risk of causing important vibrations at some rotation speed. This could damage the load cell which would require a replacement and a recalibration.

Stop the test and check the installation if you notice unusual vibration. Contact support in case of doubt. More information about vibrations is available here.

Section 2.2 Force Measurement Unit (FMU) and Motor Mounting

Retrieve the following items from the main box:

- Flight Stand Force Measurement Unit
- Flight Stand 15/50 Motor Mounting Plate
- Flight Stand 15/50 Auxiliary Components Box
  - FS15/50 Motor Mounting Fastener Bag
  - FS15/50 FMU Stand Fastener Bag
  - Threadlocker, Loctite 242
  - FS15/50 Optical Probe Fasteners Bag
  - S15/50 Standard/Pro Optical RPM Probe Bag
  - FS15/50 Hand Tool Bag
  - Tie-wrap 0.1" width, 8" long, black
  - 1 x Hook and Loop Cable Ties 11" Overall Length
  - FS PT-100 Temperature Sensor Bag

You may use the quick installation guide inside the box or continue with this document:
STEP 1. Install the FMU on the stand

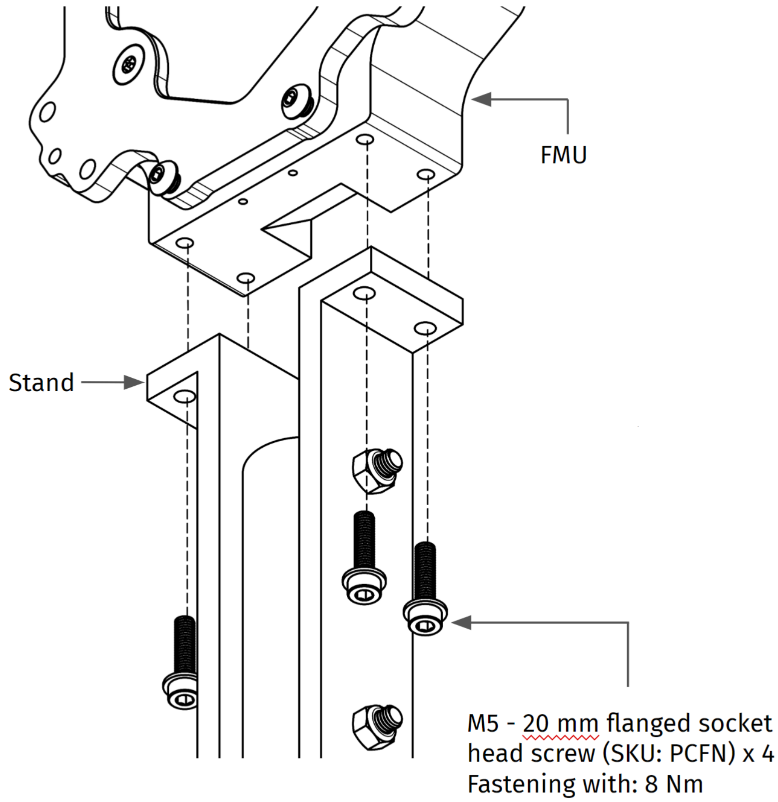


Fig. 2 FMU-Stand assembly instruction

Before STEP 2, we recommend installing the motor on the motor mounting plate first. If you wish to install the PT-100 temperature sensors inside the motor's chamber, you may apply the sensor at this step, with thermal glue.

When using an out-runner brushless motor, please install the motor on the indicated side of the mounting plate. See the laser engrave on the plate for more information.

STEP 2. Install the optical RPM probe on the motor mount, make sure to **apply loctite** for M3 standoffs and screws. Severe vibration from a turning propeller can loosen these fasteners.

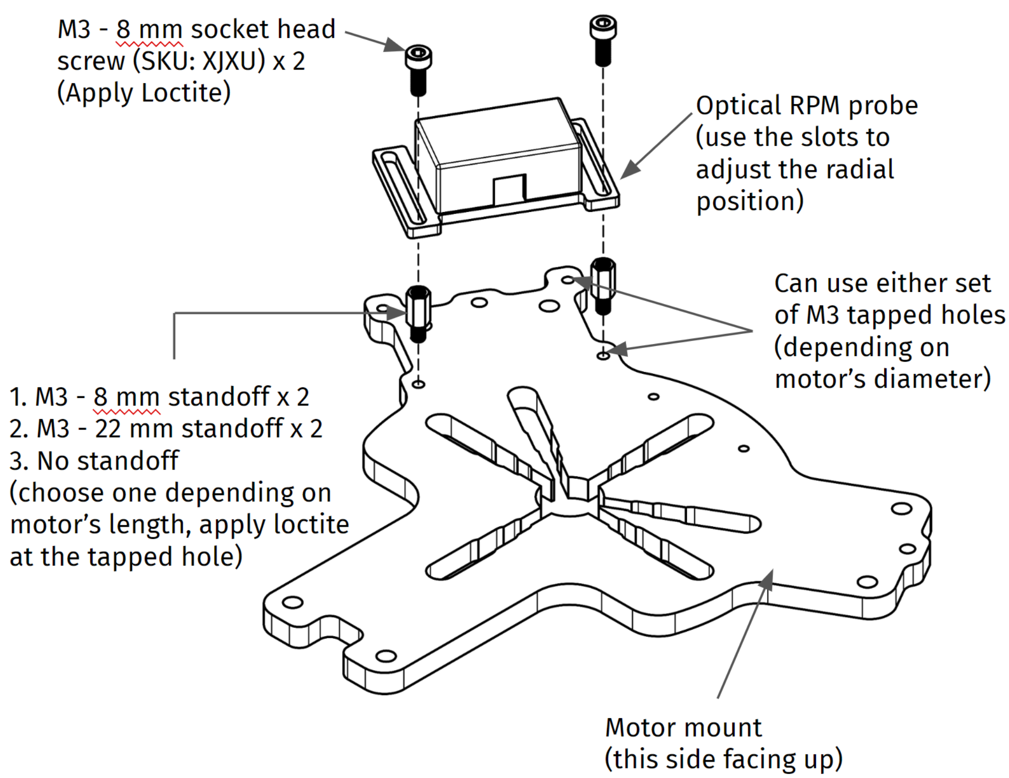


Fig.3 Motor mount assembly instruction

STEP 3: You have the choice between these two following steps

It is always recommended to install the motor mount with the standoffs, as STEP 3.1, unless you run coaxial tests and wish to obtain the minimum possible axial distance between two rotors in a back-to-back setup.

STEP 3.1: Install the motor mount on the FMU with standoffs.

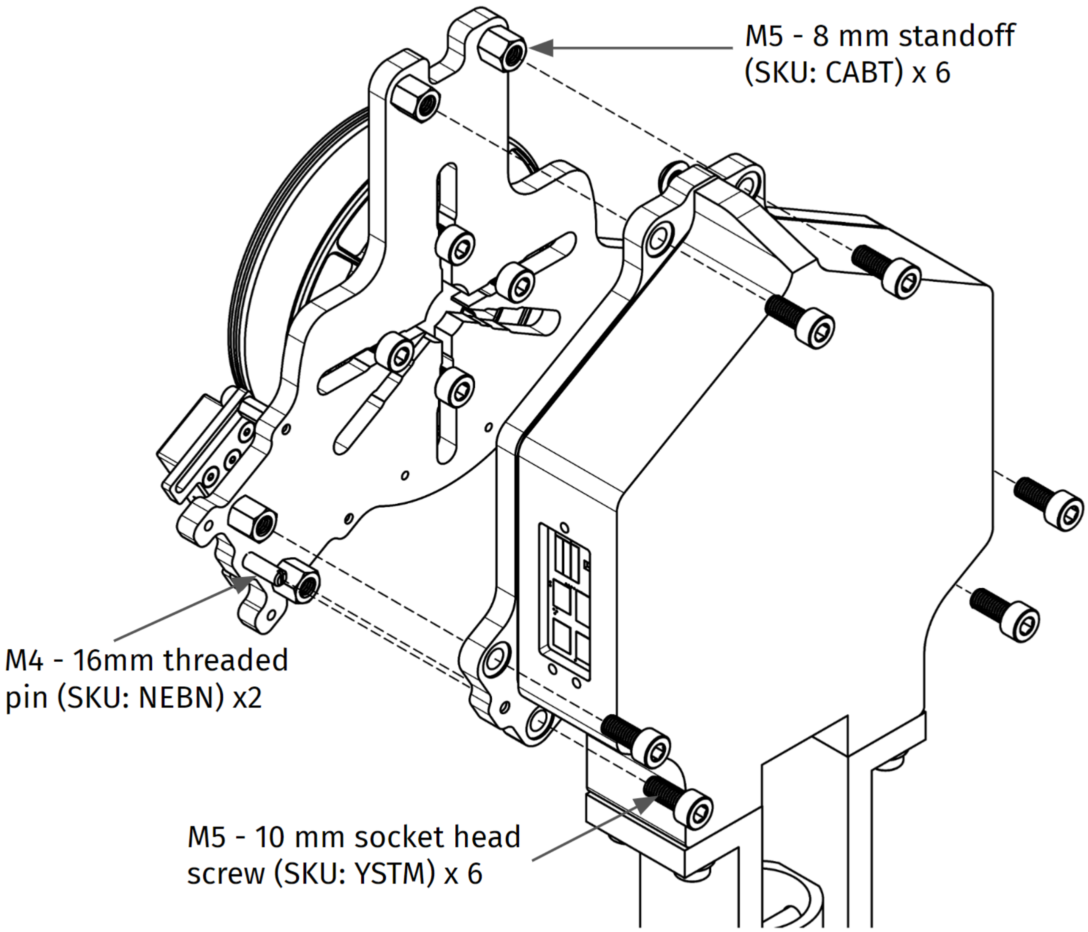


Fig.4 FMU-Motor mount and Stand-off Assembly

STEP 3.2: Install the motor mount on the FMU without standoff

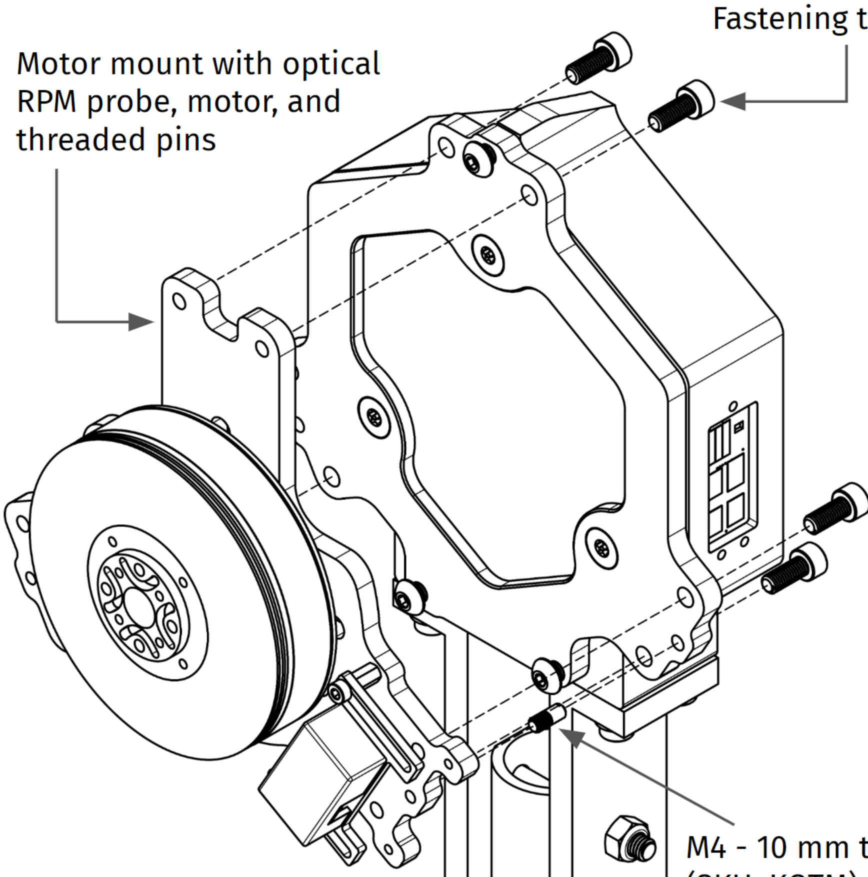


Fig.5 Motor mount-FMU assembly instruction

Step 4. Attach a white or brightly colored tape on the motor. It should pass in front of the optical probe once per revolution. The height of the optical probe can be adjusted: see Fig. 3. The tape should be at least 0.5 in wide and 1 in. long. You can also use bright paint or a white marker. The rest of the section running under the sensor has to be a matte black or another non-reflective color.

Section 2.3 Installation of the Electrical Measurement Unit (EMU)

For this step, you need :

- Flight Stand - Electrical Measurement Unit

Open the EMU box, take out the EMU and read the installation guide.

Step 1. Install EMU on the rails if present using the fasteners from FS15/50 EMU Fixture fastener bag (SKU#: UQLE). If not using the rails, the EMU can be installed on any solid surface, please prepare your own fasteners in this case.

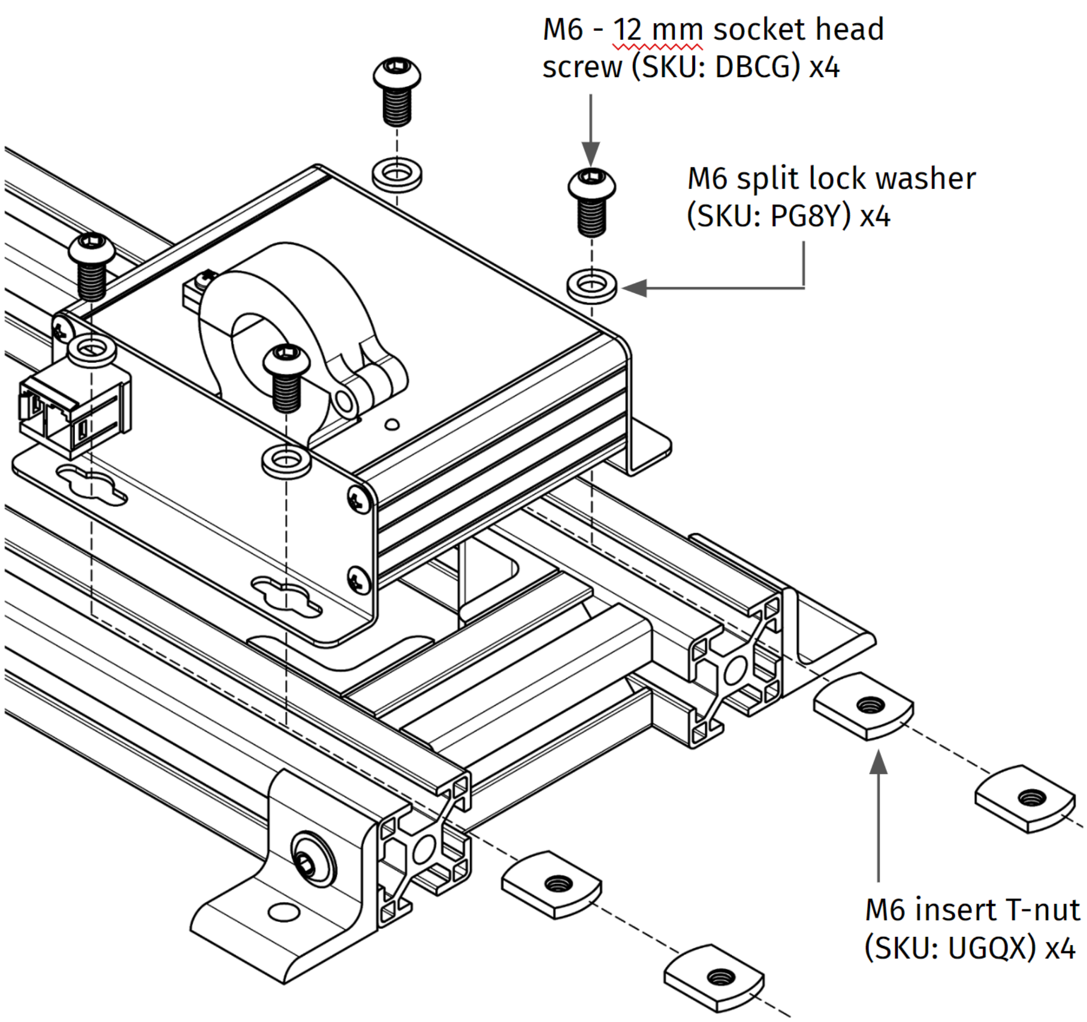


Fig.6 EMU installation

You may also install the EMU on any secured surface. Please take note that during dynamic testing, strong airflow may move the EMU thus affecting its measurement. We recommend fixing it to the ground, or to a wall, or on top of a piece of metal or plywood.

Section 2.4 Wiring and Cable Connection

You may now start connecting the cables and wires for the Flight Stand.

To start, you need :

- 1 x SKU#: WMHX - Flight Stand - Sync Hub

Step 1. Power up the Sync hub with the 9 V, 2 A power adaptor, and connect the USB between the sync hub and your PC.

Step 2. Connect the M8 cable between the force measurement unit and the sync hub.

Step 3. Connect the M8 cable between the electrical measurement unit and the sync hub.

At this moment, you may open the Flight Stand software to see if the force measurement unit and electrical measurement unit are detected. You shall observe a green sign with the name and serial number on the connectivity panel of the software.

Prepare the power source, such as a power supply or battery pack that will be used for the test. It is your responsibility to choose the correct rating for the cables and connectors. Once ready, follow STEP 4.

Step 4. Insert the positive wire into/through the hall sensor. For a better measure, the red and the black wire should not be close to each other. This step will allow the Hall Sensor to measure the DC current input to the ESC.

IMPORTANT: the screw must be fully tighten on the Hall Sensor after passing through the power wire, otherwise it may generate up to 20 % of error in current measurement

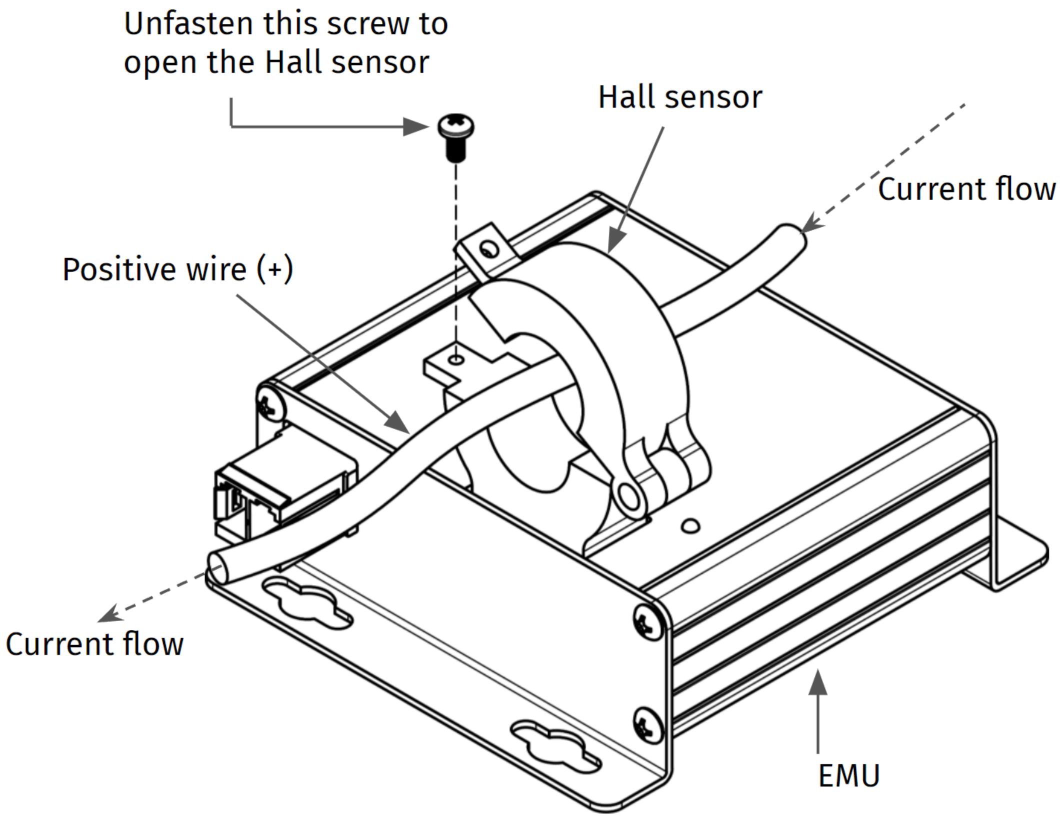


Fig.7 EMU wire installation.

Step 5. Strip the power cords and connect them to the voltage measurement port.

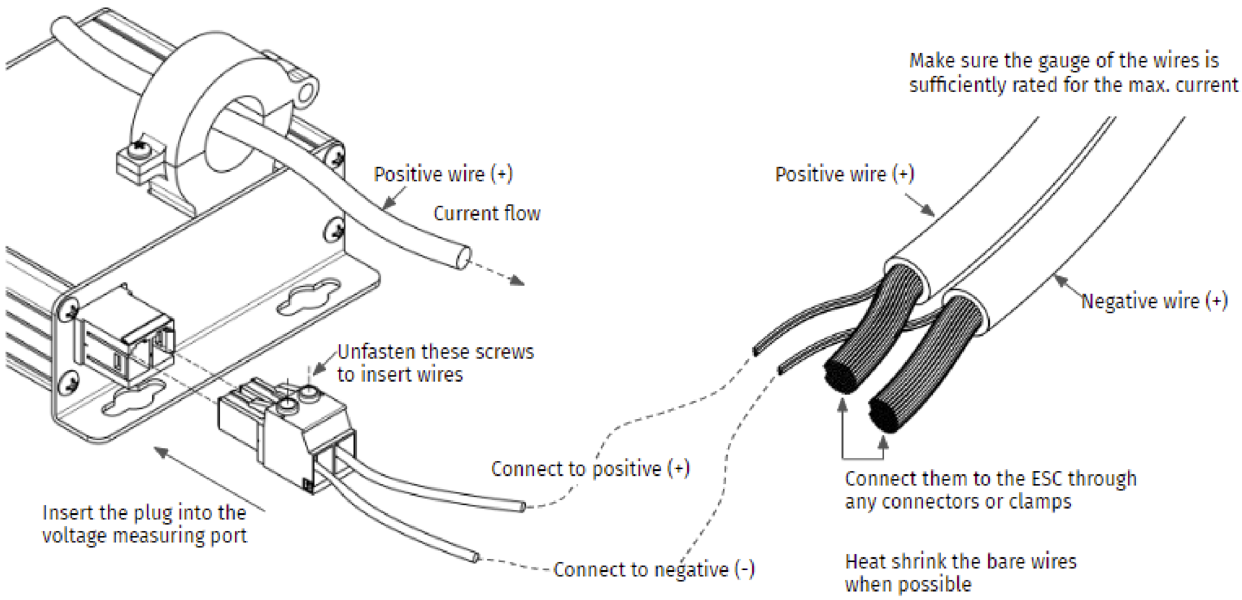


Fig.8 Voltage measurement port installation.

Step 6. On the FMU check the connections between :

- The optical RPM probe to the FMU, using JST 3-pin wire supplied within the optical RPM probe bag (SKU: AVRV)
- Any PT-100 temperature sensor to the TEMP 1 or TEMP 2 ports
- The ESC PWM input to the ESC port on the FMU

Step 7. On the motor, check the power wires and the ESC connection.

Step 8. On the Stand, use the cable ties to secure all loosen cables to the stand except for the three-phase between ESC and motor.

Step 9. Use a lower voltage to make a test run, confirm the rotation speed direction, and then fully tie-wrap all cables.

Note: The control pins on the FMU are ordered: Servo 1, Servo 2, Servo 3, ESC. Beside those pins, you will see two pins that can be shorted with a jumper to power the VCC rail on the control pins. The VCC rail is not connected by default to give the user the opportunity to power the ESC or servos with a different voltage or to leave the ESC unpowered.

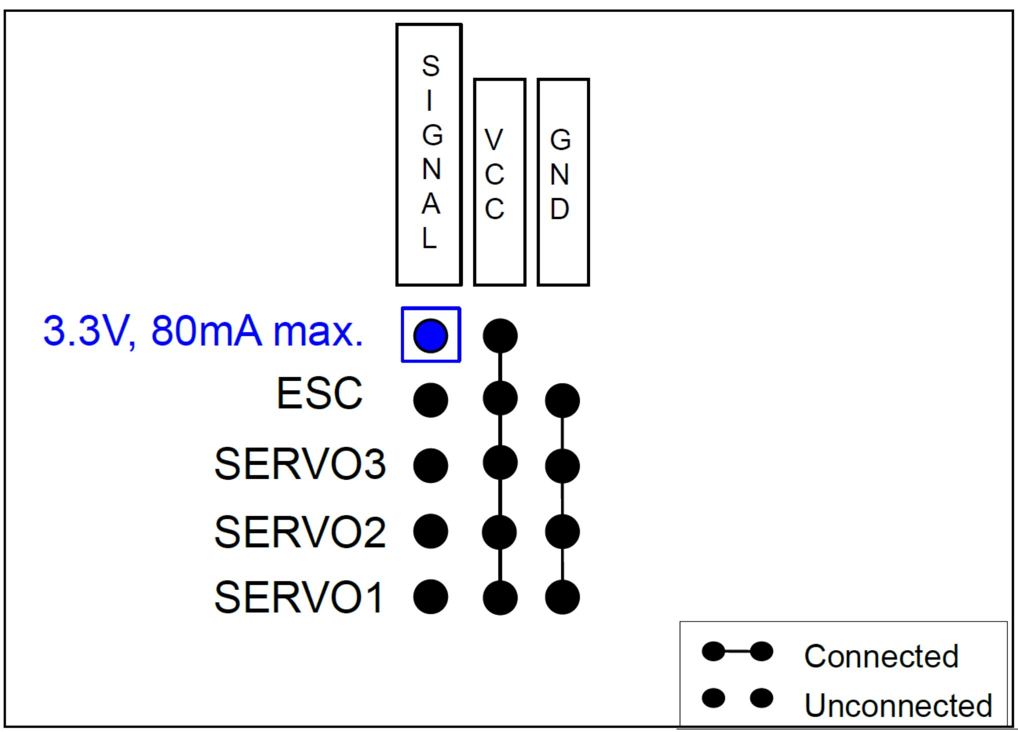
Other EMU features

On the front of the EMU, you will see

- Safety cutoff connector: Reserved for future use.
- Add-on: Reserved for future use.
- Temp 1 and Temp 2: You can connect the temperature sensors included with your tool here. This is particularly useful to measure air temperature or ESC temperature.
- External ADC **(Flight Stand Pro Only):** External sensors can be measured using the ports on the tool. The measurement is differential, from -10 to + 10V. You also have access to a ground port.

Section 2.5 ESC and servo connections

Included in this section is the pinout diagram of the ESC (Electronic Speed Controller) breakout board. Please examine the diagram and silk screens closely to familiarize yourself with the layout and functionalities of the various pins:



- 3.3V Pin: You will find a single 3.3V pin, which is used to supply a constant voltage of 3.3 volts (80mA max.). Most ESCs work with 3.3V.

- Ground Pins: All ground pins on the board are interconnected, providing a common ground reference.
- VCC Pins: There are four VCC pins that are interconnected but do not carry any voltage by default. This unique design feature allows you the flexibility to supply your preferred VCC voltage to the ESC or Servo. You can power the VCC rail from the 3.3V pin (80mA max), from an ESC with a BEC, or from an external power supply. To power the VCC rail with 3.3V, connect the two top pins together.

If your ESC is not working, it may be because it is not receiving power. See point 3 above

Section 2.6 Temperature Probe - IR Sensor

The IR temperature sensor is included by default for Flight Stand 15 PRO and Flight Stand 50 PRO, starting from May 2025. If you are using a STANDARD version, or if you have purchased the product before this time, you may still be able to purchase this sensor as an accessory from our webstore. This sensor is compatible with all Flight Stand 15, 50, and 150 built before May 2025.

Step 1. Assemble the sensor on the sheet metal bracket

Fig. 9. Install the sensor on the bracket using two M2.5 - 6 mm SHCS

Step 2. Connect the JST connector on the sensor

Step 3. Put the sensor assembly on the FMU lower casing

ATTENTION: Severe vibration may loosen the screws, use Loctite to fully secure the fasteners

Fig. 10. Installation of the assembly on the FMU

Step 4. Adjust the position using the slots on the sheet metal bracket

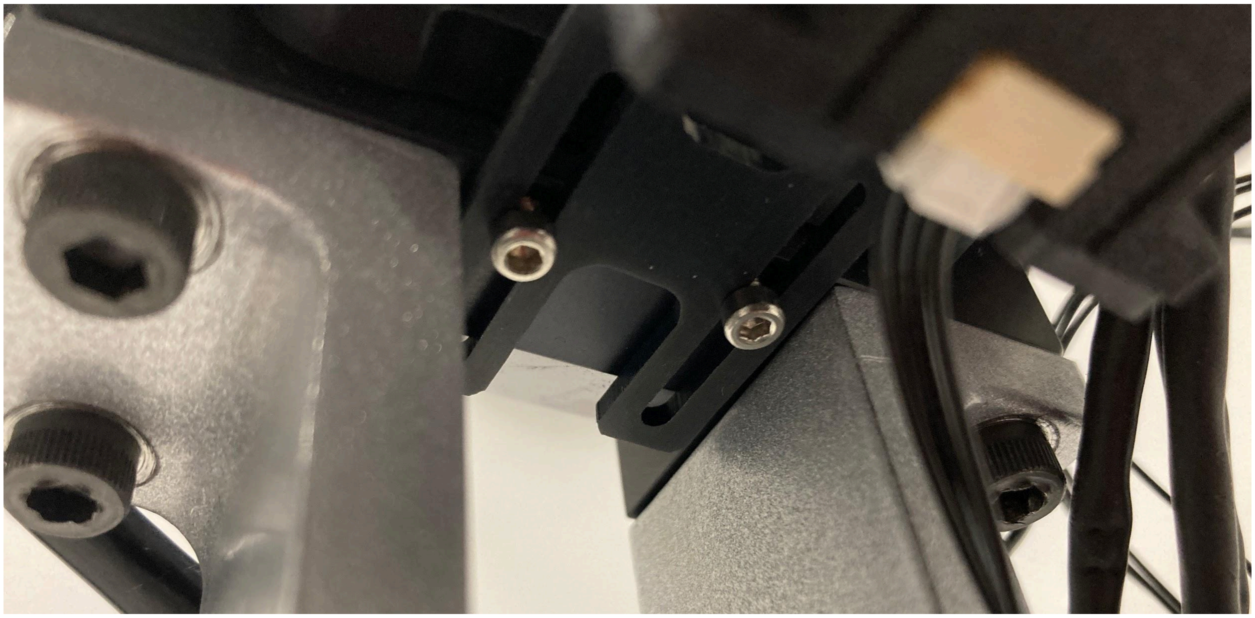


Fig. 11. Adjust the position with the slots

Step 5. Connect the JST connector to the FMU

Section 2.7 Installation of the pressure sensor

You may use the Differential Pressure Sensor on Flight Stand 15 Pro or Flight Stand 50 Pro. For our customers who may purchase Flight Stand 15/50 Pro before August 2025, you may purchase this sensor as an accessory from our webstore. Please note that this sensor uses one general analog port on the EMU and we only support two ports per stand. Retrieve the following items from the Flight Stand 15/50 Pro Auxiliary Sensor Box (SKU: FLGM).

- Differential pressure probe sensor bag (SKU: 8TY8)
- 15 ft Shielded TRRS cable (SKU: JXMB)
- Analog breakout board (SKU: MG6H)

The sensor kit does not include any pitot tube, you also need to design the fixture for the pitot tube to be mounted on the stand. The following steps show an example of how to connect the pitot tube and the pressure sensor.

Step 1. Prepare a fixture and install the pitot tube at the location where you wish to measure the airspeed

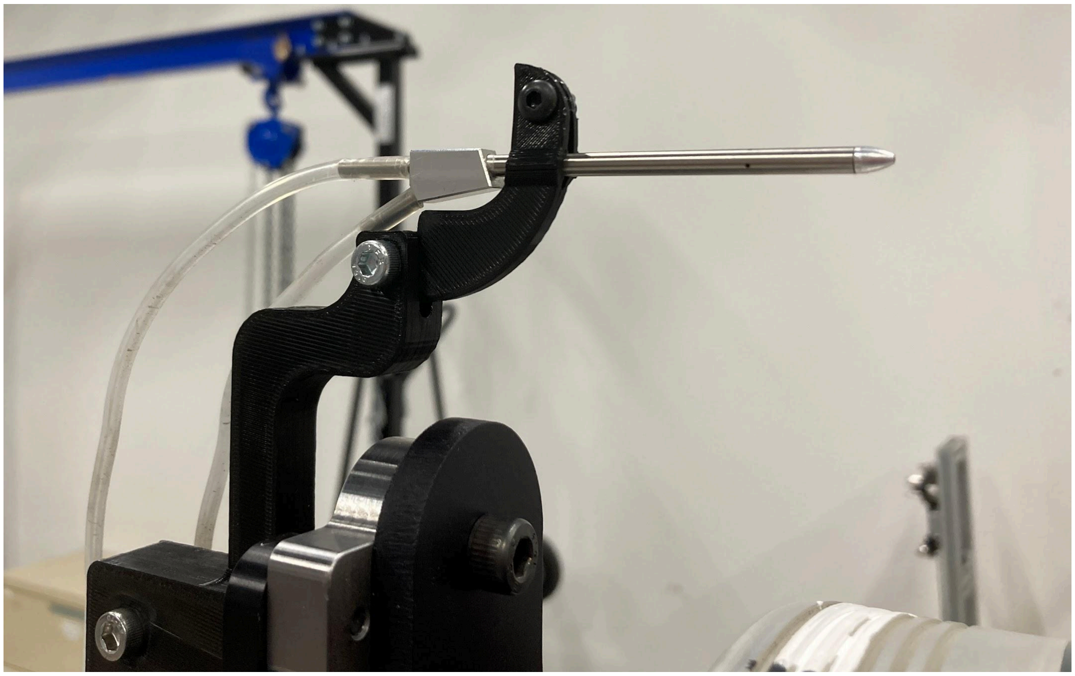


Fig. 12. Example of pitot tube and its fixture (yours to prepare)

Step 2. Connect static pressure end of the pitot tube to either port on the pressure sensor

Step 3. Connect dynamic pressure end of the pitot tube to the other port of the pressure sensor

Step 4. On the analog breakout board, do the following wiring:

- Connect between S- and GND on the screw terminal
- Leave a wire for S+ and GND to be connected to the EMU
- Leave a wire for 5V to be connected to the EMU

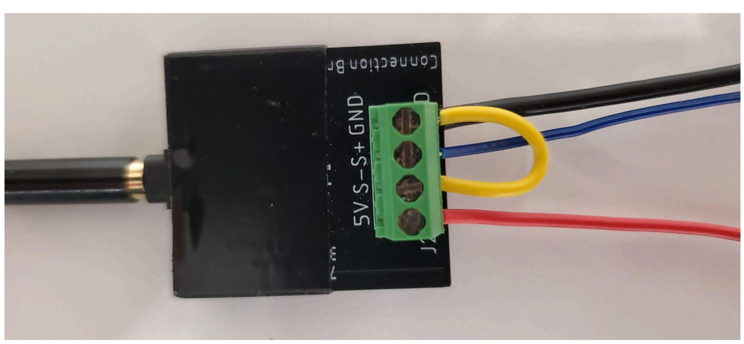


Fig. 13. Wire preparation for the analog breakout board

Step 5. And then, connect the pressure sensor, the analog breakout board, and the EMU's screw terminal

- Shielded TRRS cable between the pressure sensor and the analog breakout board
- The S+ to the V0+ or V1+ on the EMU general analog port
- GND to GND on the EMU general analog port
- 5V to Reserved on the EMU general analog port

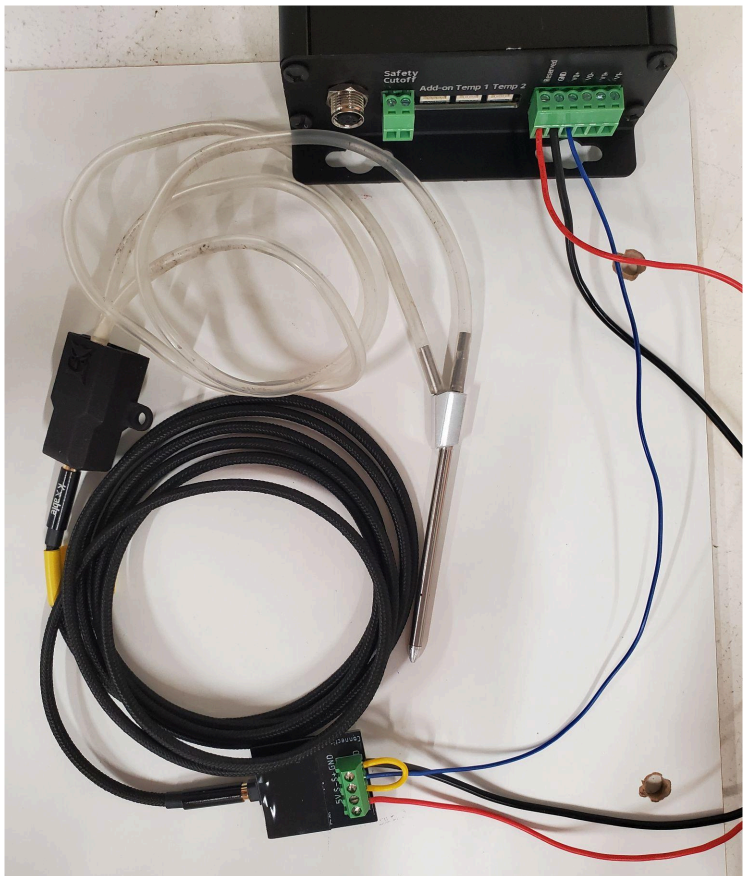
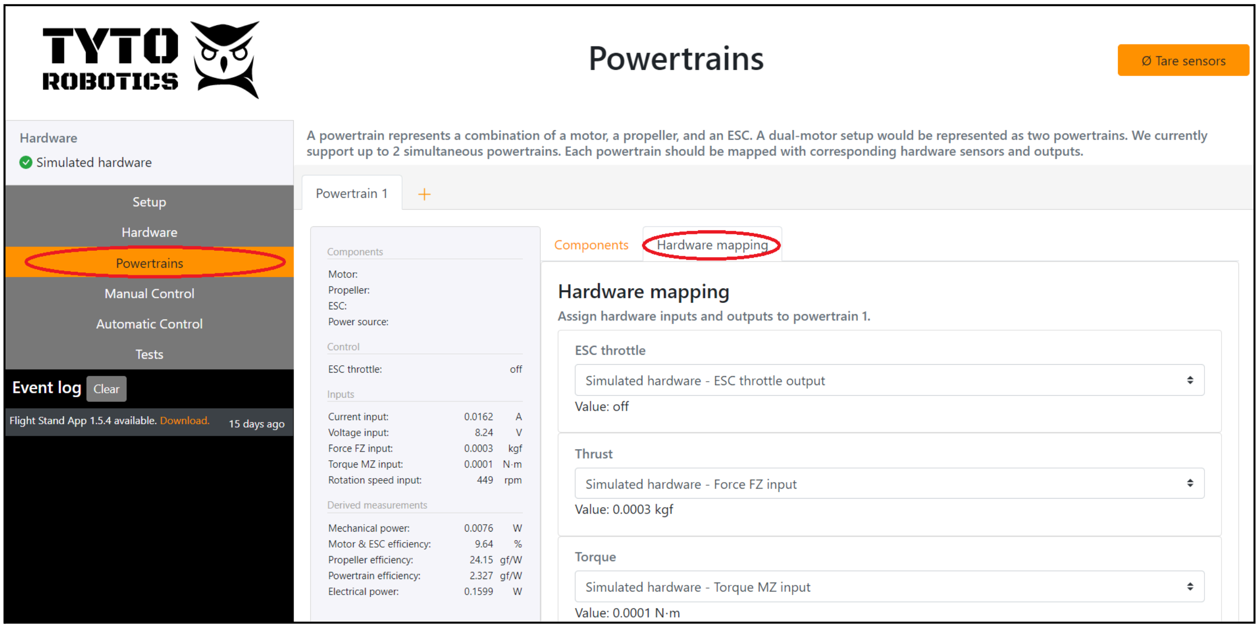


Fig. 14. Connection of the pressure sensor to the EMU general analog port

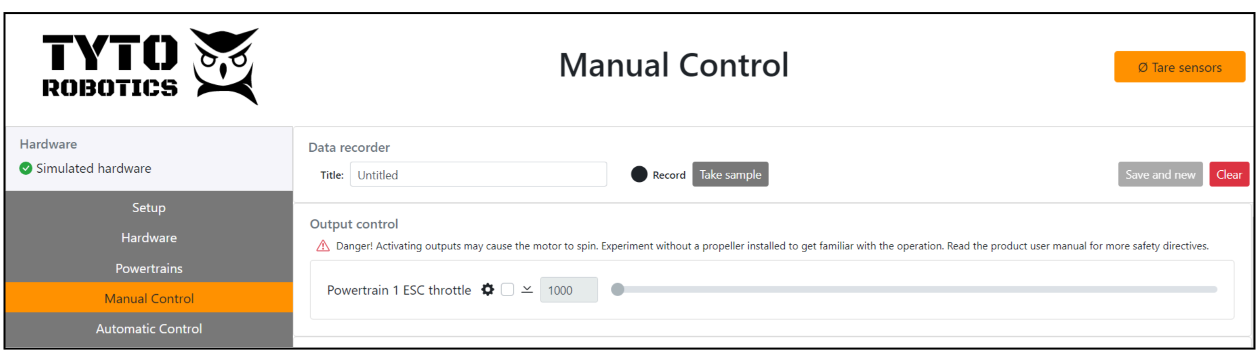
Chapter 3. Software setup

Section 3.1. Software setup and test run.

Step 1. Go to the “**Powertrains**” tab, and then "Hardware **mapping**” to define powertrain components.
Step 2. Leave the test place and close the enclosure.

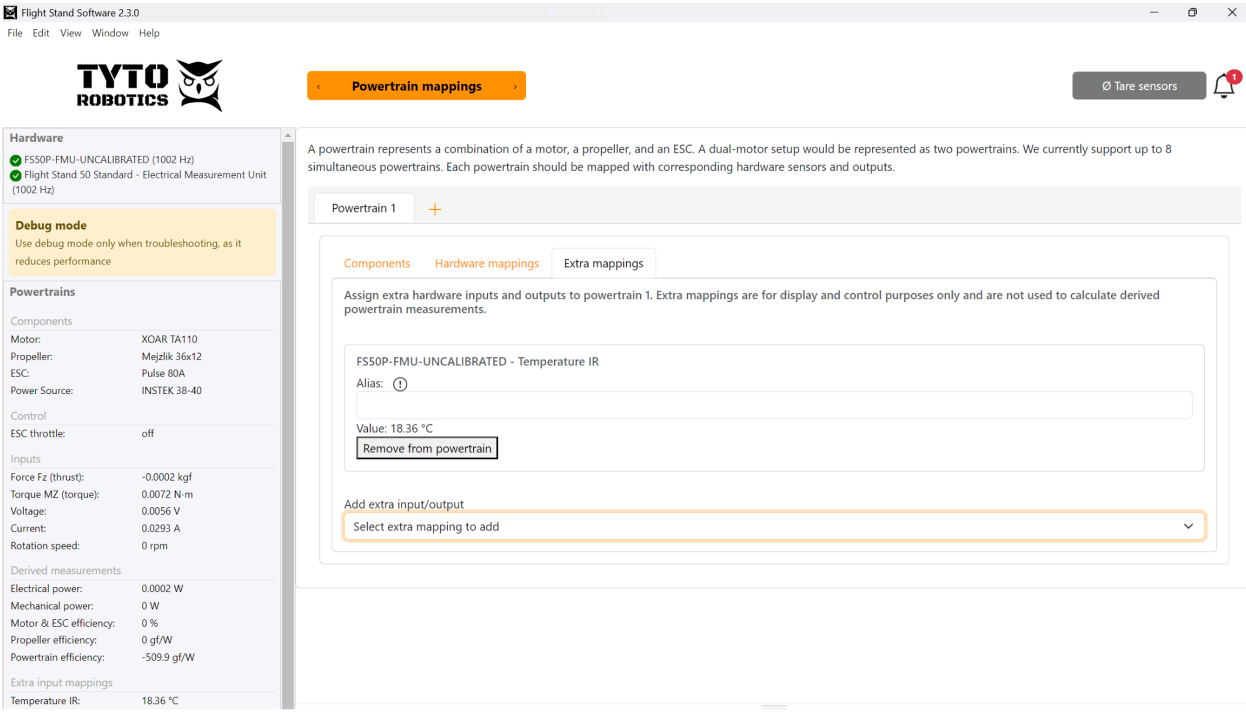


Step 3. Turn on the power and do a quick low-speed test run to determine the rotation direction by using the manual control. If the rotation direction is wrong, turn off the power and switch 2 cables on the three-phase between ESC and the motor. Then re-run the quick test.



Step 4. Check if every sensor works properly by watching values on the software.
Turn off the power. And tie wrap all cables the three-phase between ESC and motor included.

Step 5. If you have an IR temperature sensor connected, you may go to extra mapping for the specific powertrain and add this sensor to be mapped



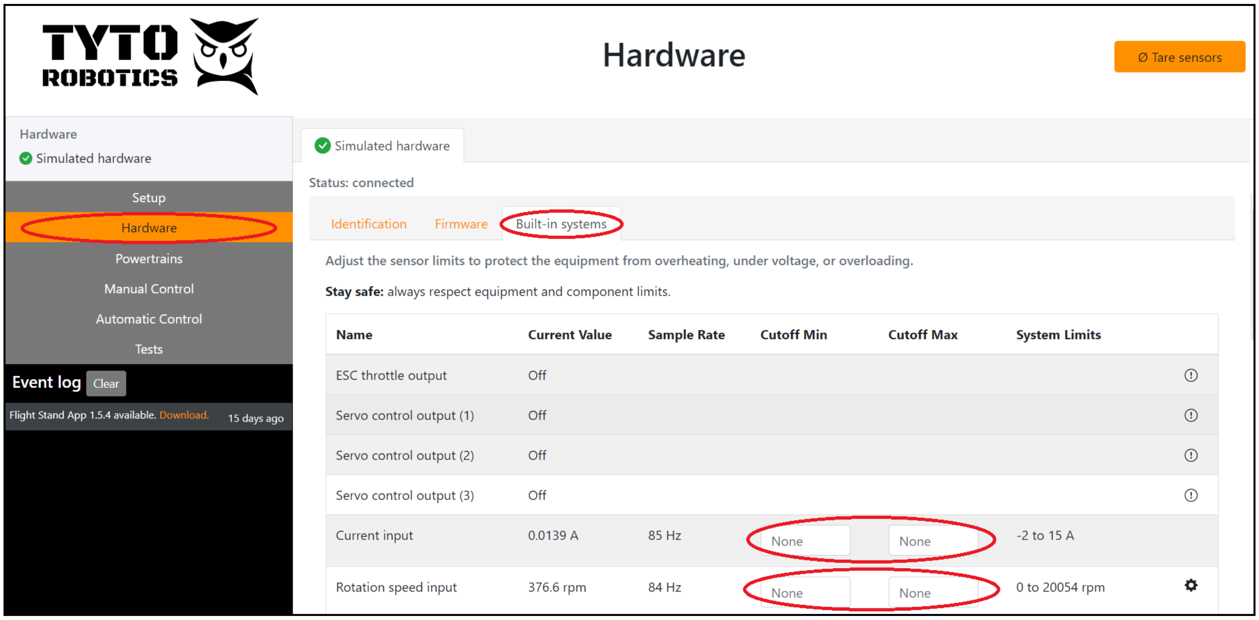
Chapter 4. Test

Section 4.1. Manual test

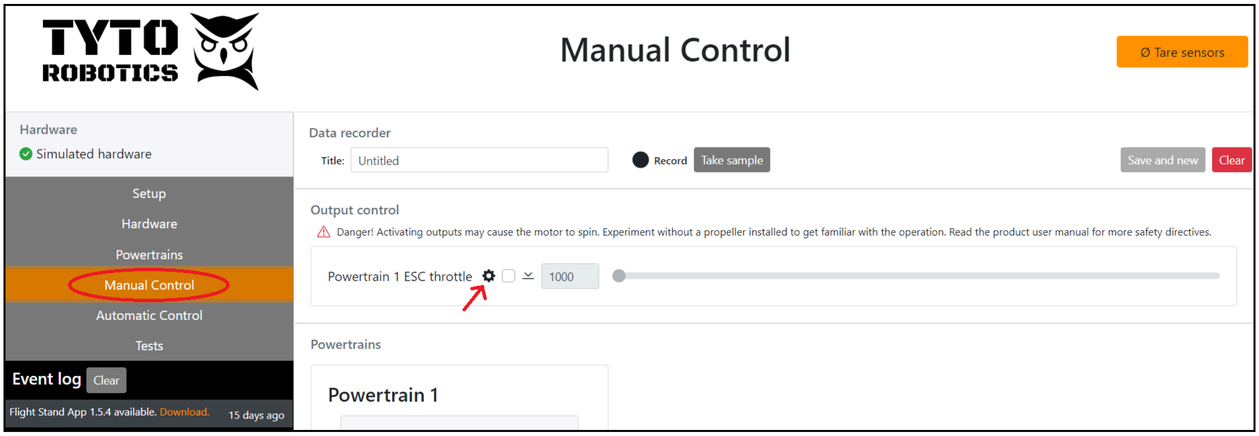
<u>**You have to do theses steps before each test :**</u>

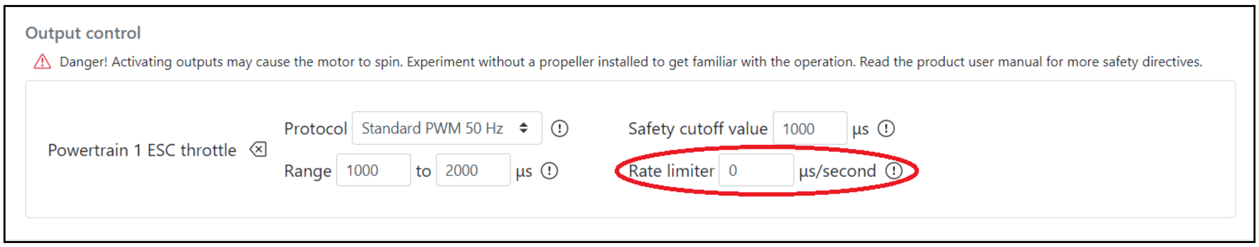
Step 1. Do a large **ground check** and remove everything you find that could fly off, especially small parts.

Step 2. Select safety limit on the software:

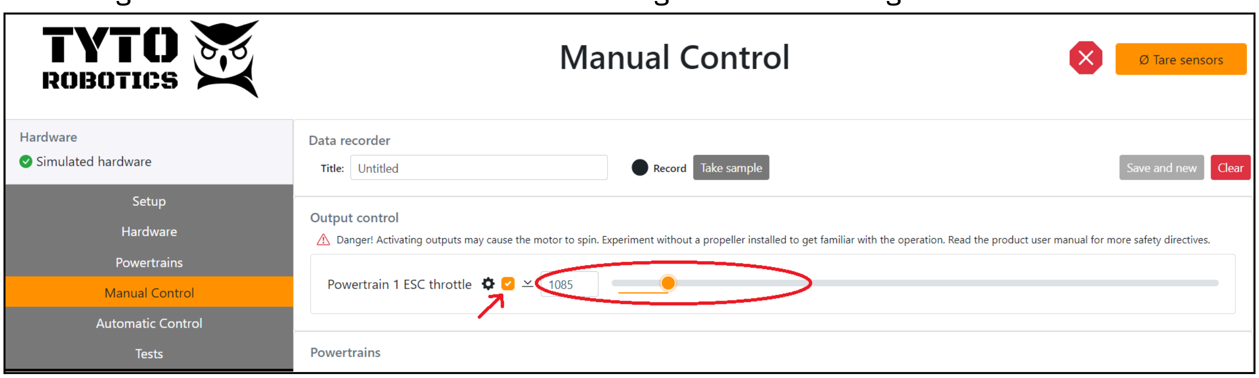


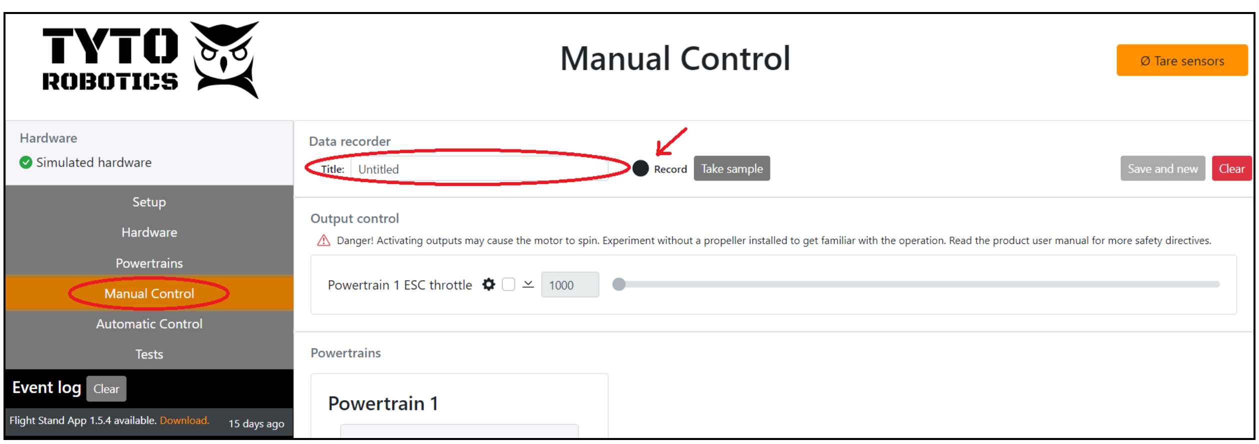
Step 3. Select the rate limiter :



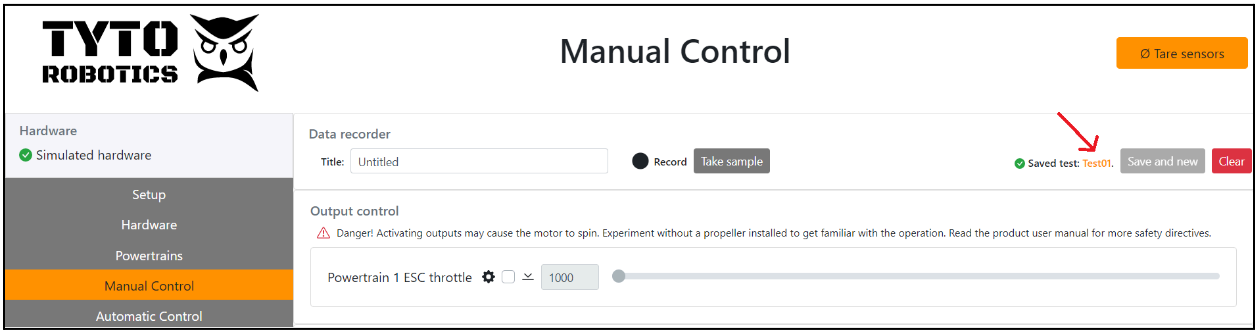


Step 4. You can now start the test by turning on the power on, name the test and start recording data. Use the manual control tab during the test to change the RPM.

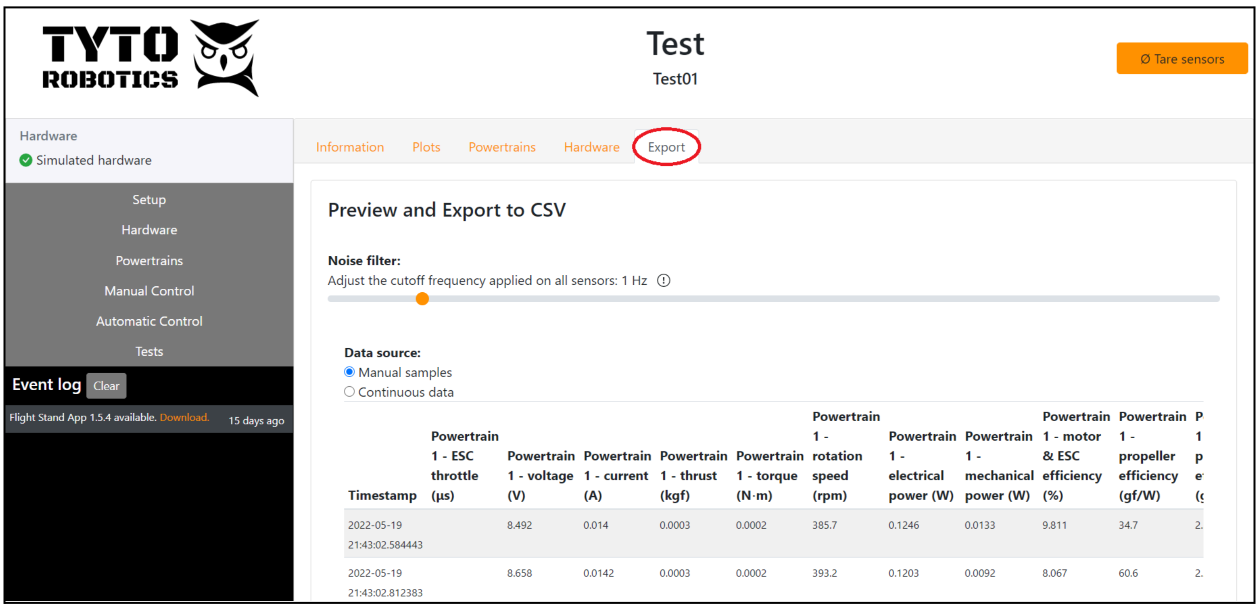


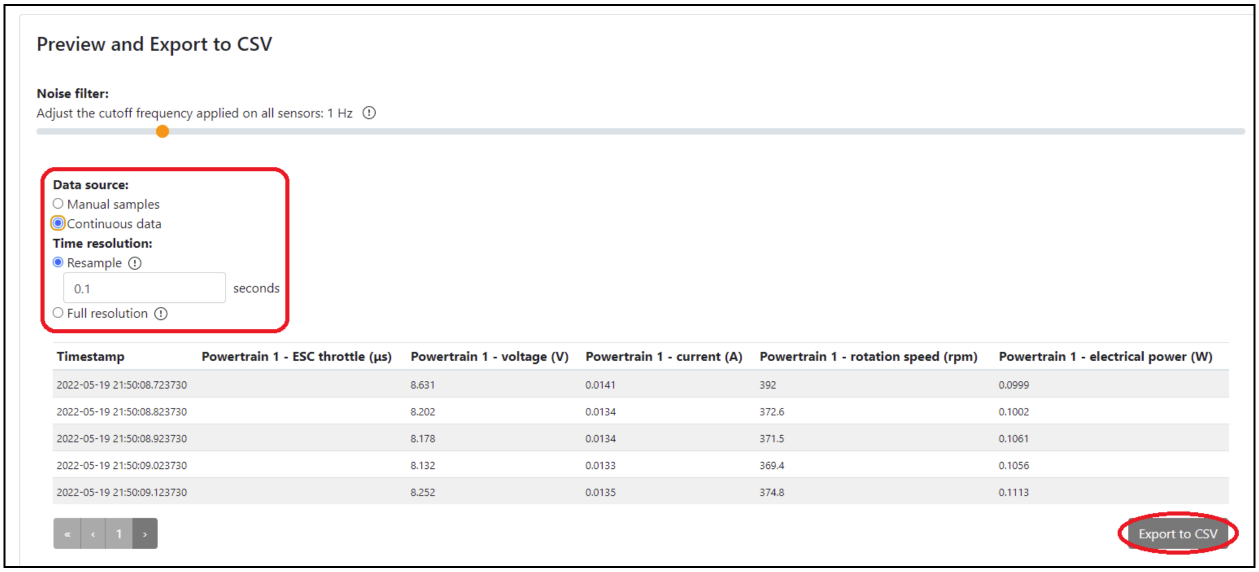


Step 5. Once you've done you can stop the motor, then record and turn the power off.



Step 6. Export the CSV file at the selected data acquisition.





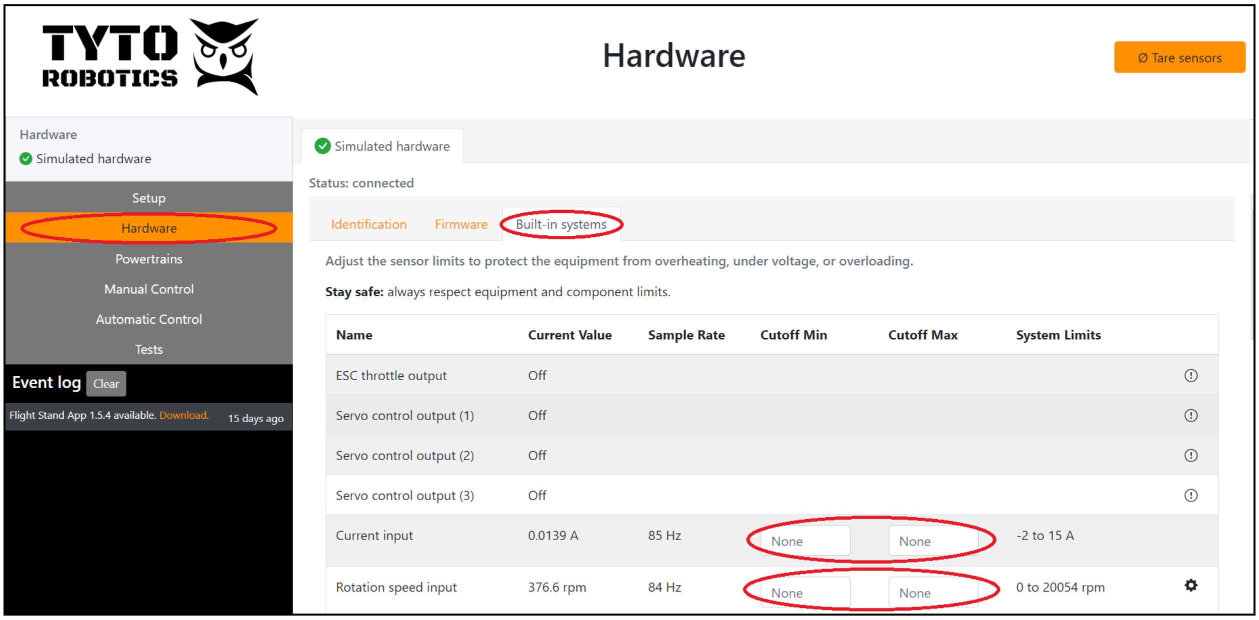
Timestamp	Powertrain 1 - ESC throttle (µs)	Powertrain 1 - voltage (V)	Powertrain 1 - current (A)	Powertrain 1 - rotation speed (rpm)	Powertrain 1 - electrical power (W)
2022-05-19 21:50:08.723730		8.631	0.0141	392	0.0999
2022-05-19 21:50:08.823730		8.202	0.0134	372.6	0.1002
2022-05-19 21:50:08.923730		8.178	0.0134	371.5	0.1061
2022-05-19 21:50:09.023730		8.132	0.0133	369.4	0.1056
2022-05-19 21:50:09.123730		8.252	0.0135	374.8	0.1113

Section 4.2 Automatic test

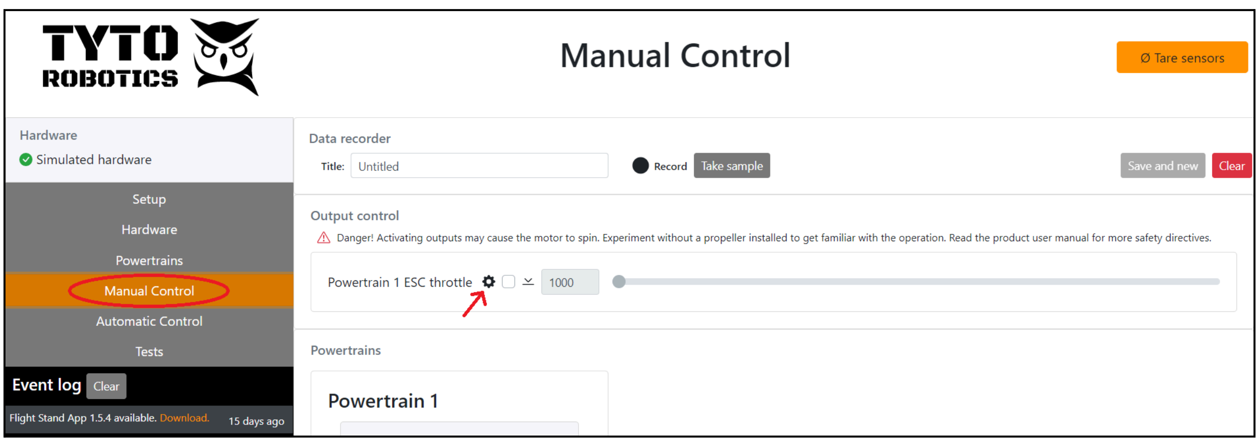
<u>**You have to do theses steps before each test :**</u>

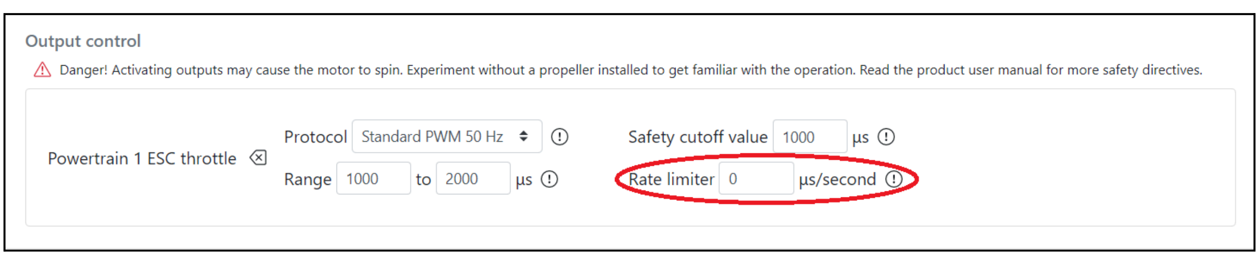
Step 1. Do a large **ground check** and remove everything you find, especially small parts.

Step 2. Select safety limit on the software:



Step 3. Select the rate limiter :

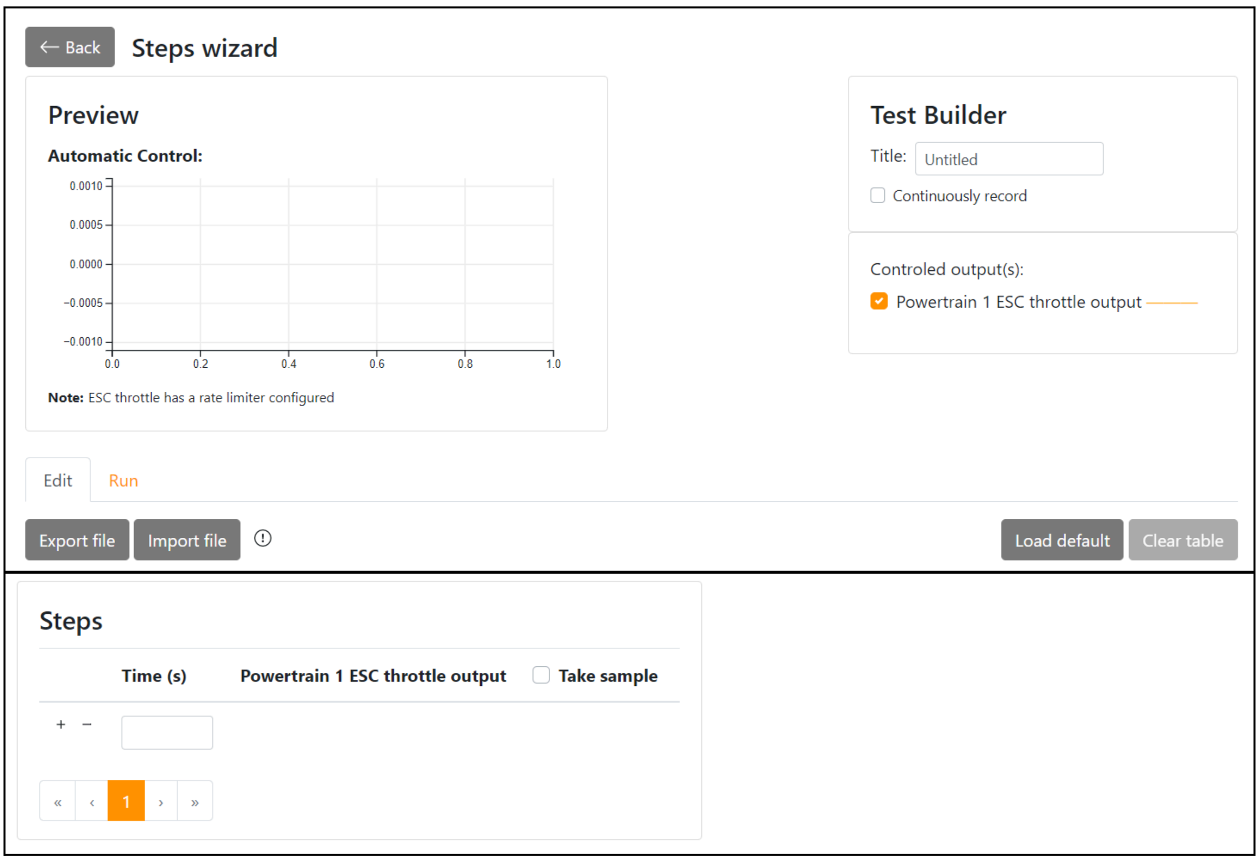


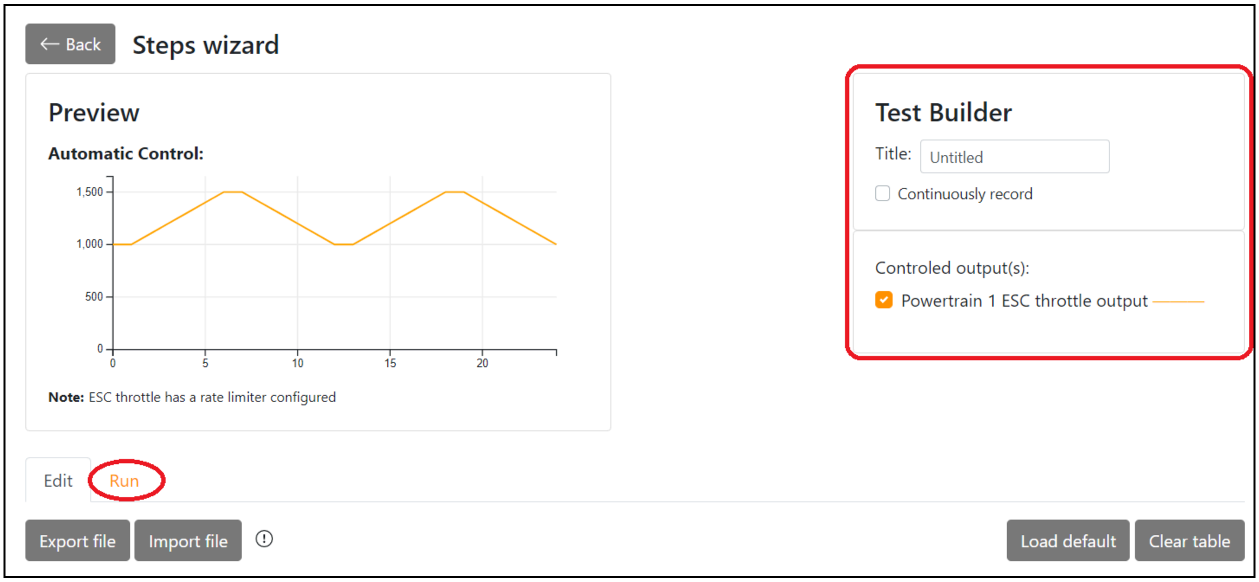


Step 4. Prepare the automatic control:

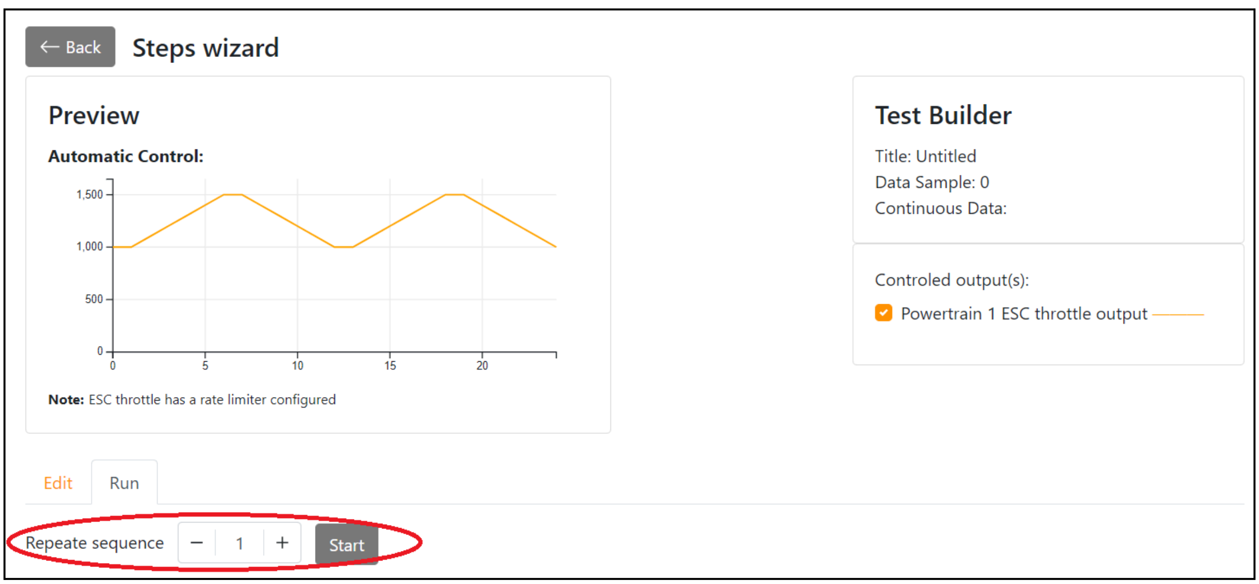
4.1 Select either Steps or Ramp depending on what test you want to run.

4.2 You can either import a CSV file, Load default values or fill the table.

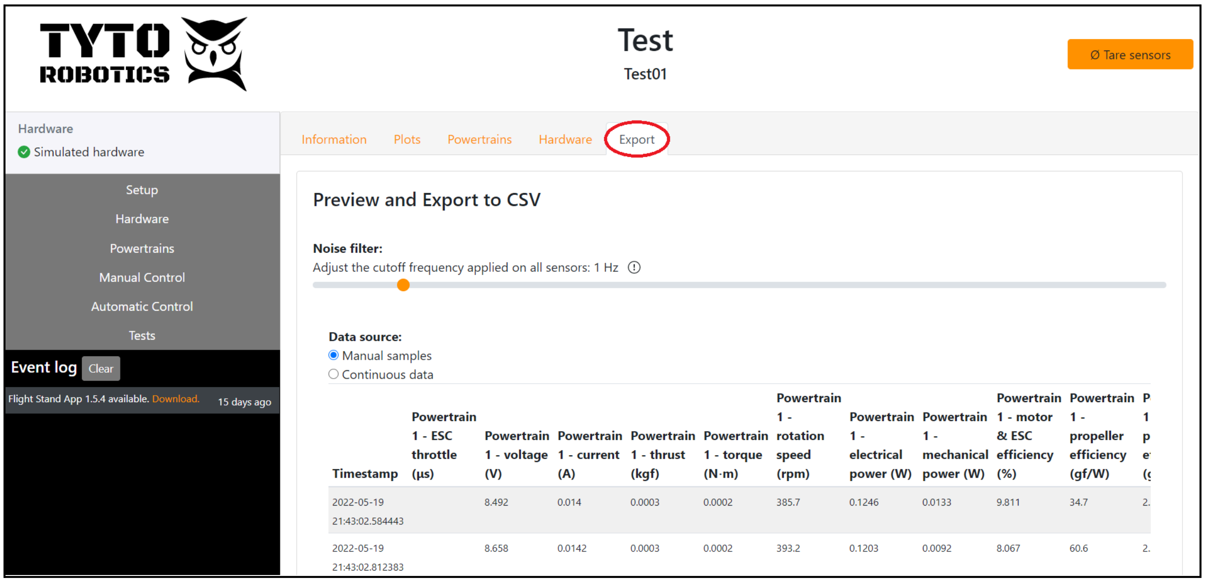


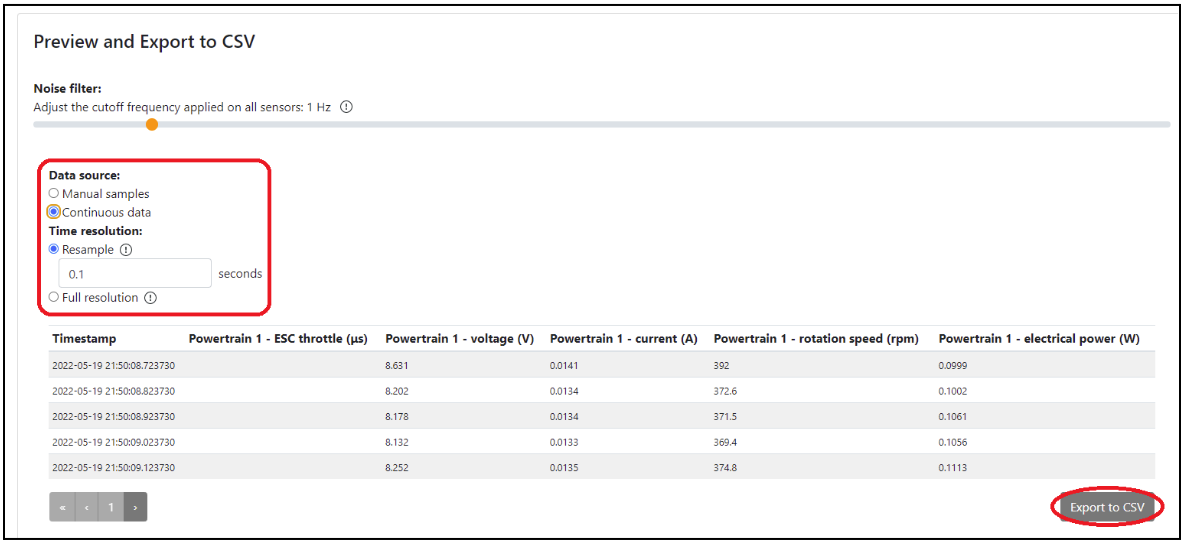


Step 5. Select the number of sequences you want, and then press start to run the sequence.



Step 6. Once the test is finished, you can click the “view saved test” to see the record you just made.





Step 7. Export the CSV file at the selected data acquisition.