



Flight Stand 15/50 Standard and Pro Installation User Manual

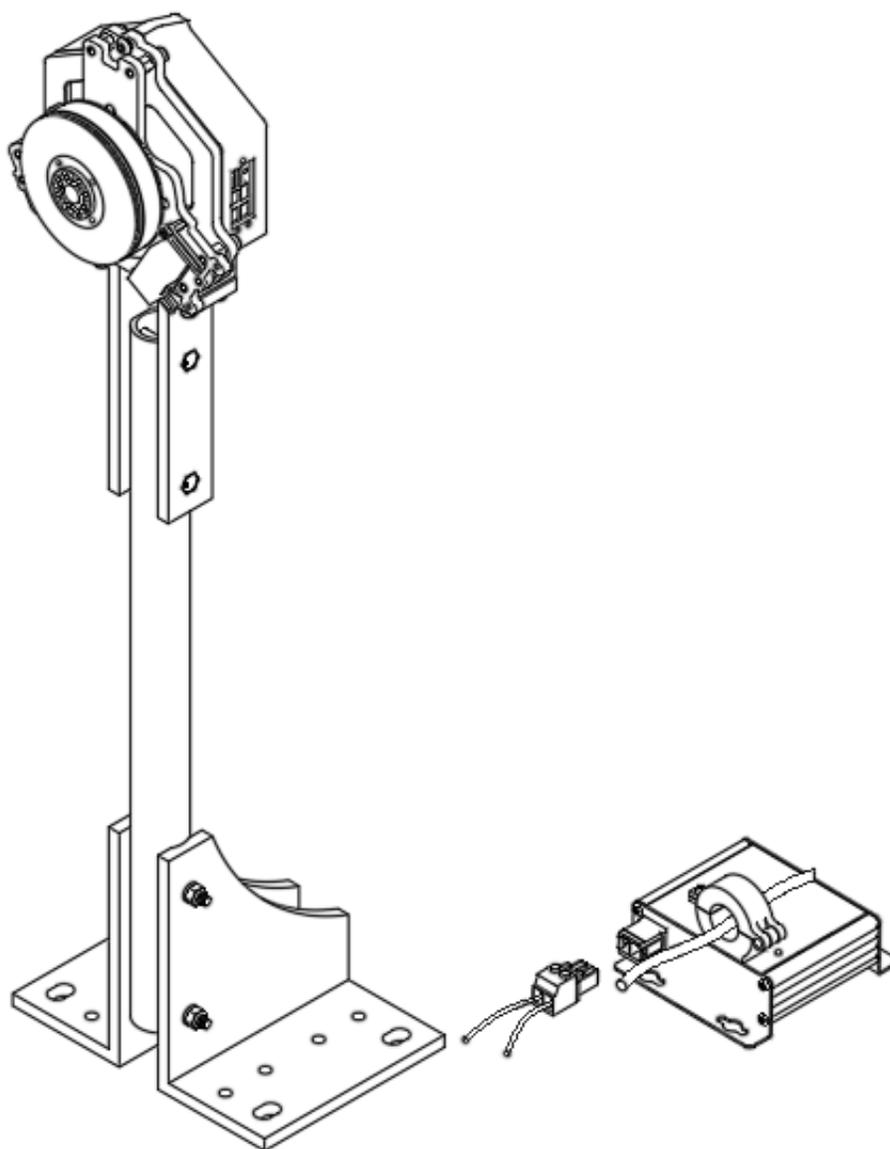


Table of contents

Chapter 1. Item Checklist and Safety Rules	3
Section 1.1 Introduction and Item Checklist	3
Section 1.2: General Safety Rules	5
Chapter 2. Installation Guide	6
Section 2.1 Stand Assembly	6
Section 2.2 Force Measurement Unit (FMU) and Motor Mounting	8
Section 2.3 Installation of the Electrical Measurement Unit (EMU)	12
Section 2.4 Wiring and Cable Connection	13
Chapitre 3. Software setup	16
Section 3.1. Software setup and test run.	16
Chapitre 4. Test	17
Section 4.1. Manual test	17
Section 4.2 Automatic test	20

Chapter 1. Item Checklist and Safety Rules

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:

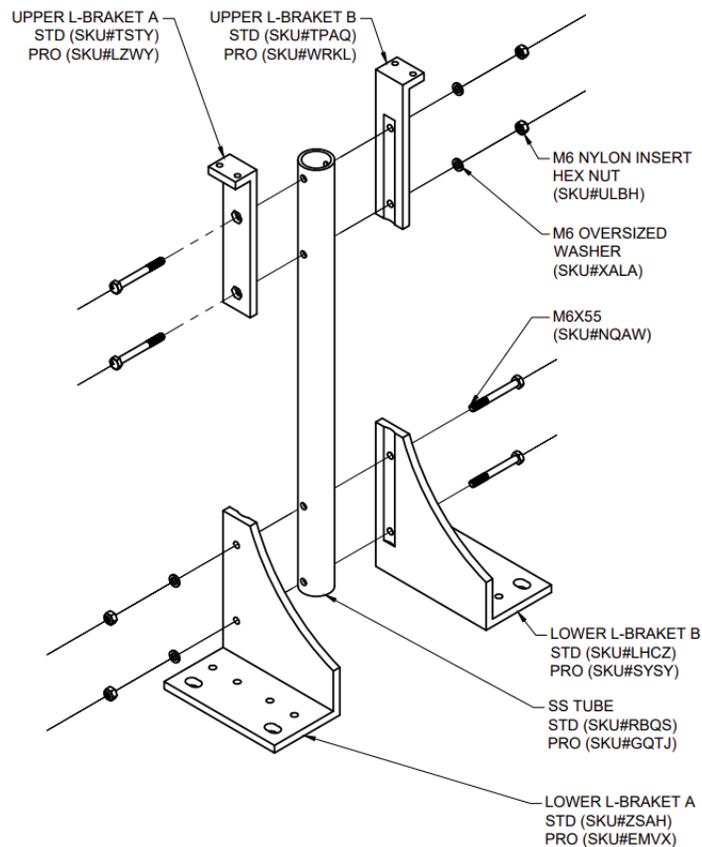


Fig 1. Stand Assembly Instructions

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

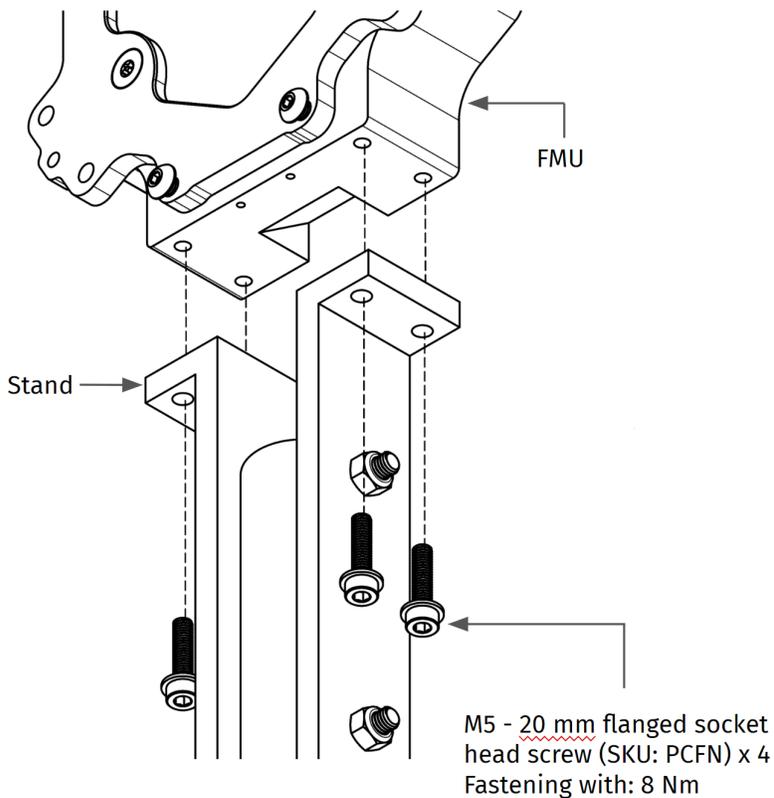


Fig. 2 FMU-Stand assembly instruction

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.

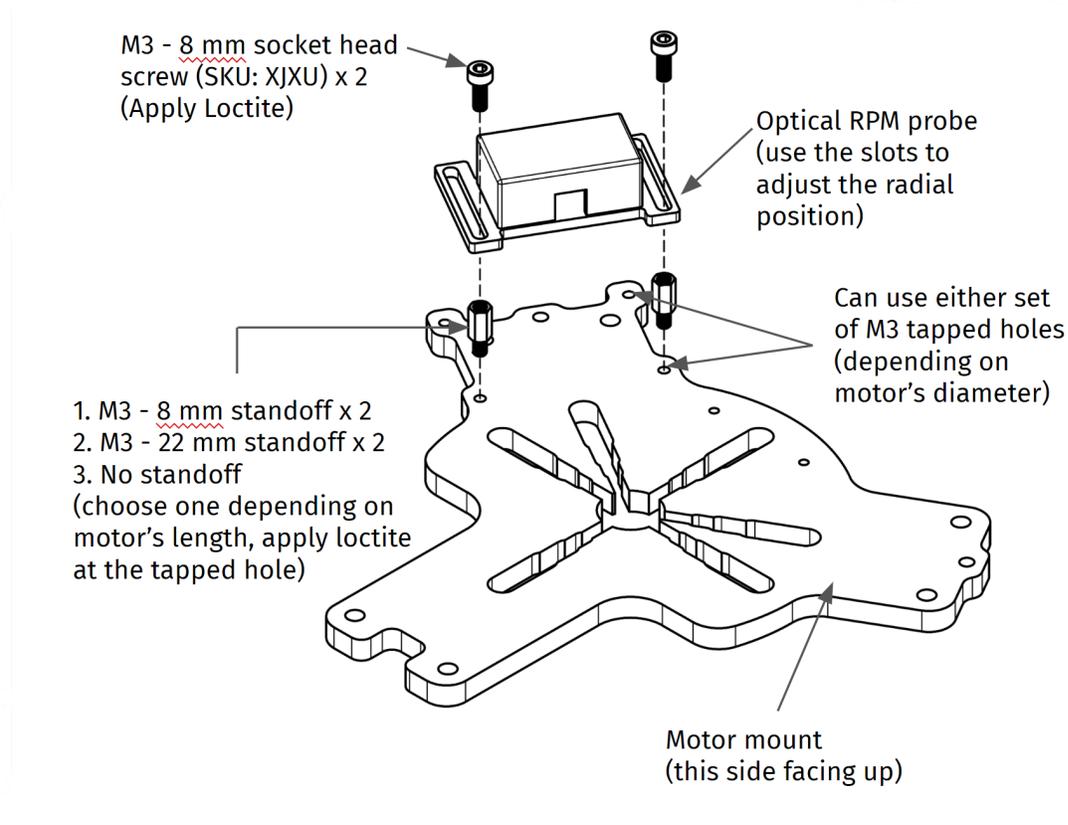


Fig.3 Motor mount assembly instruction



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.

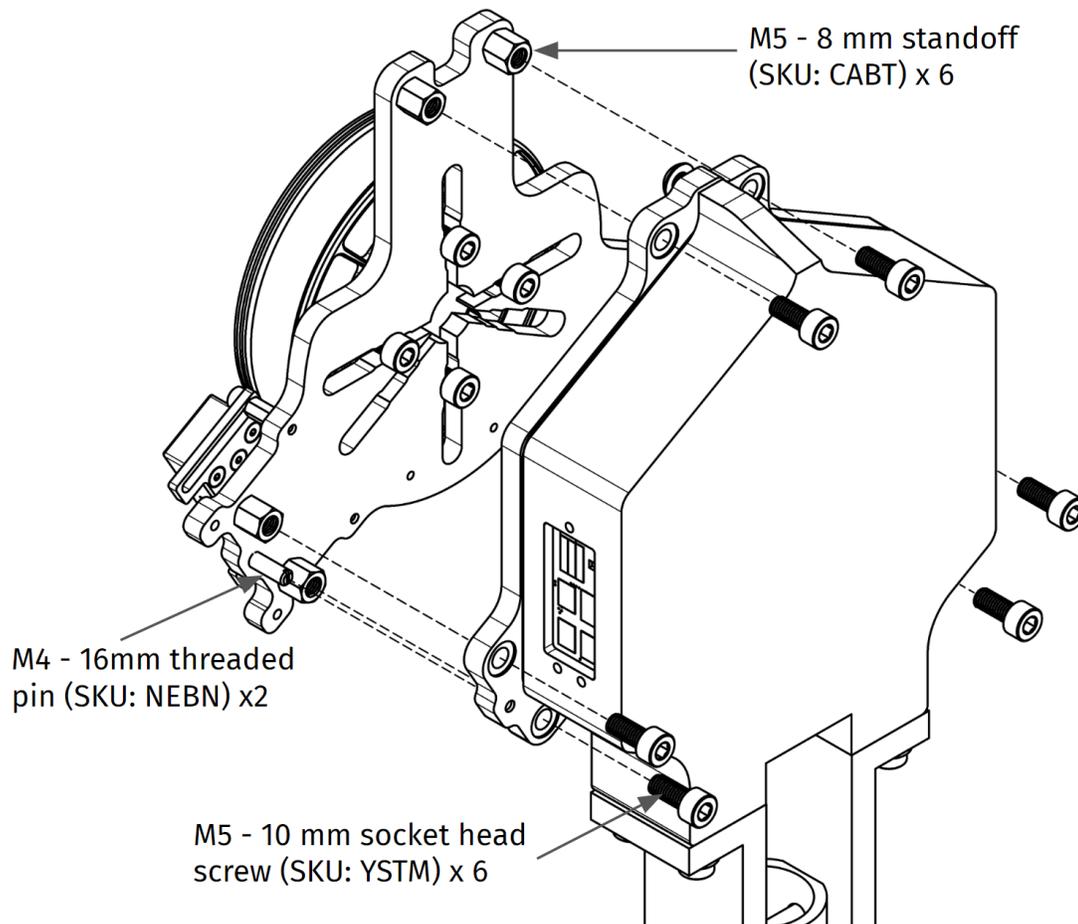


Fig.4 FMU-Motor mount and Stand-off Assembly

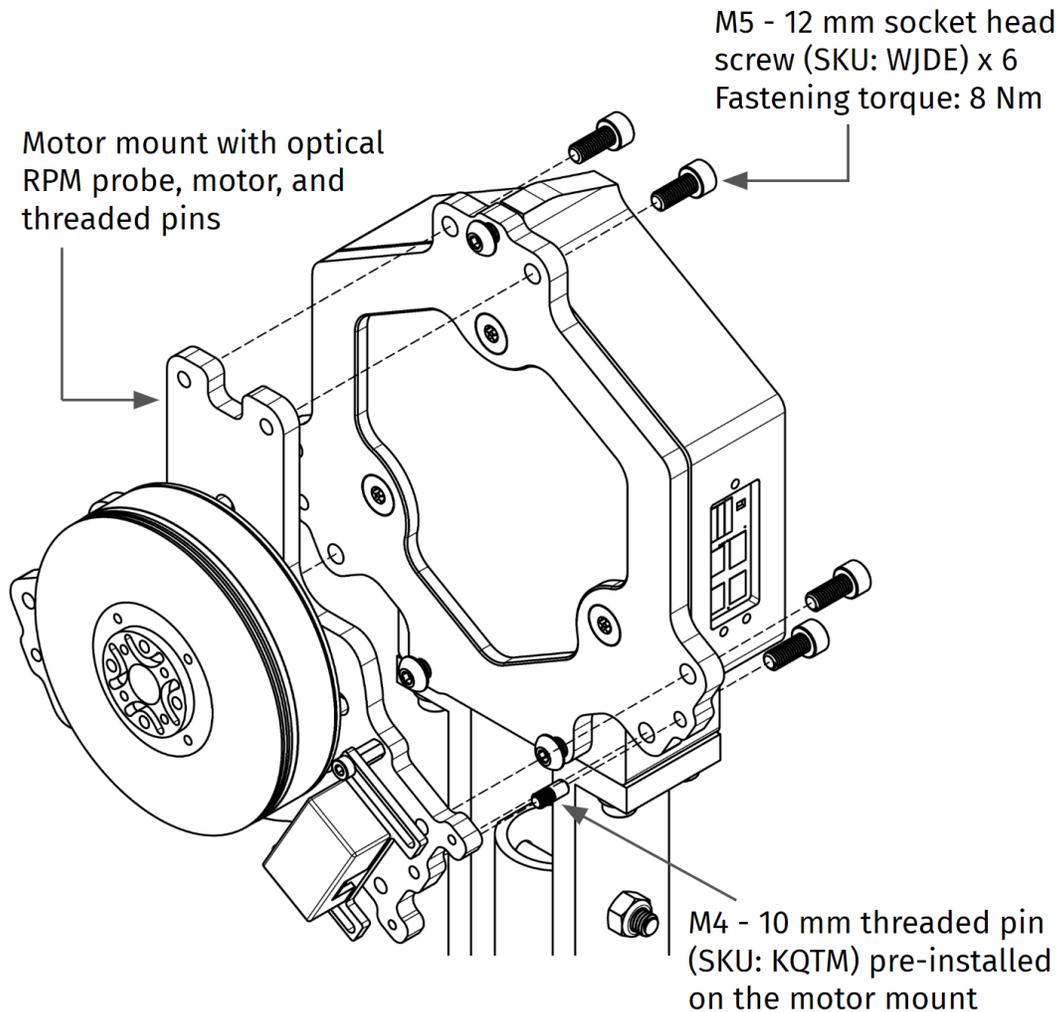
STEP 3.2: Install the motor mount on the FMU without standoff

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.

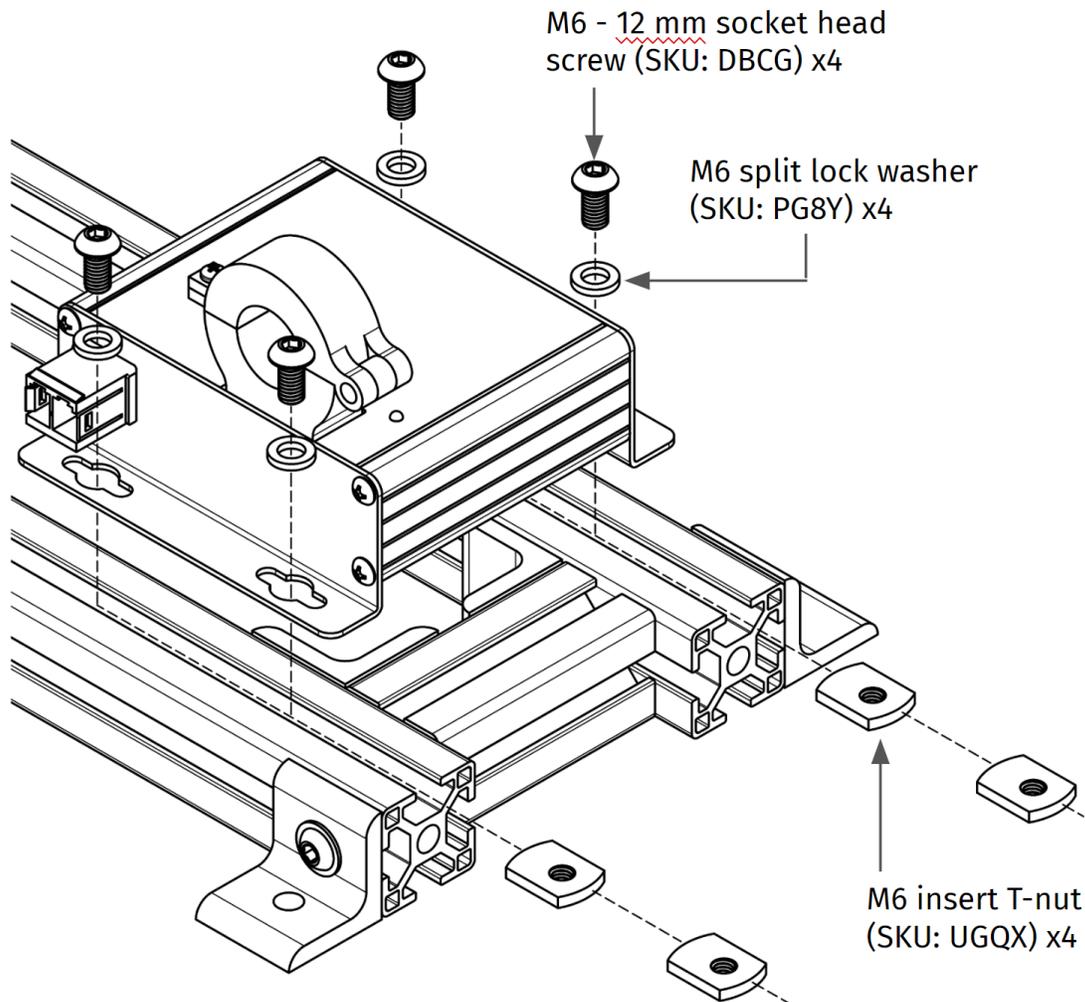


Fig.6 EMU installation

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

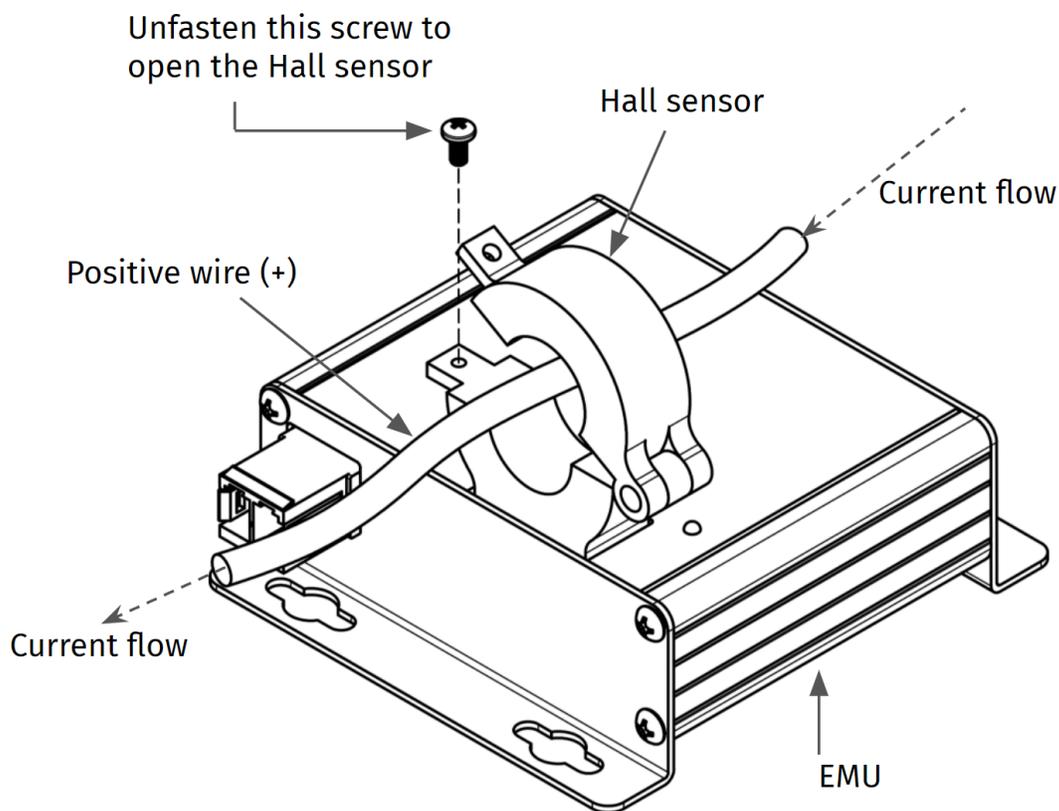


Fig.7 EMU wire installation.

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

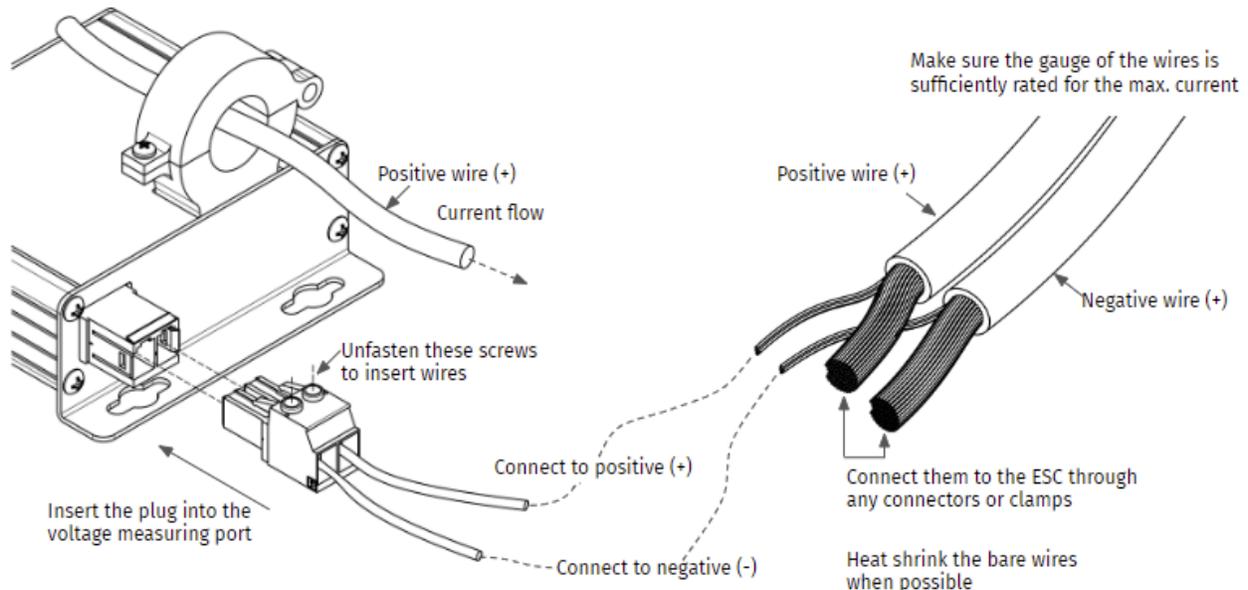


Fig.8 Voltage measurement port installation.

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.

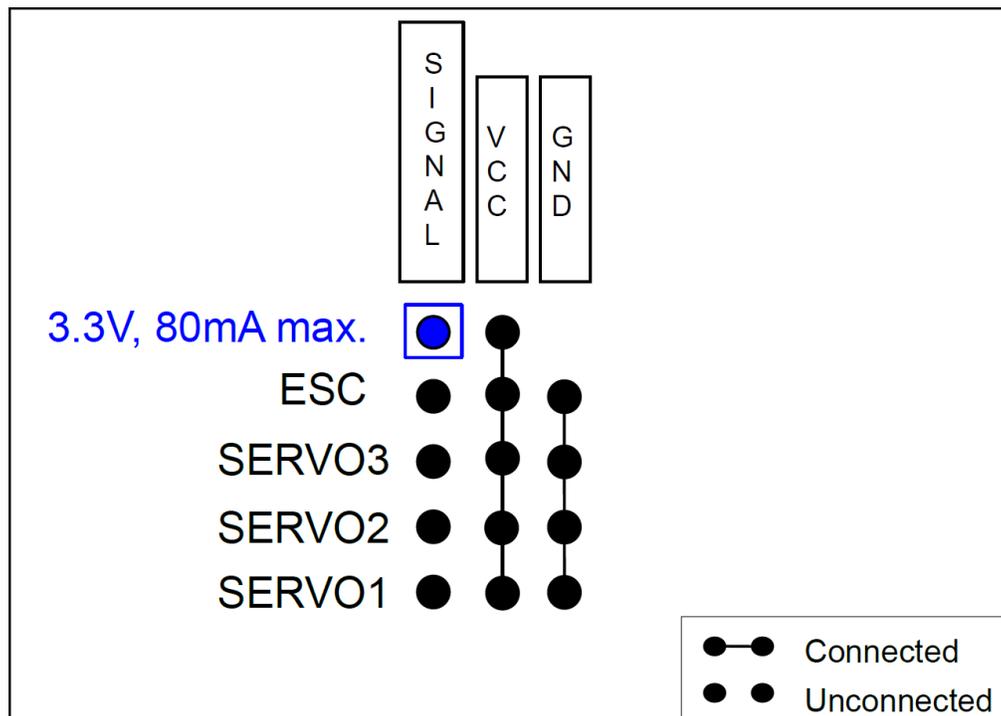
Other EMU features

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

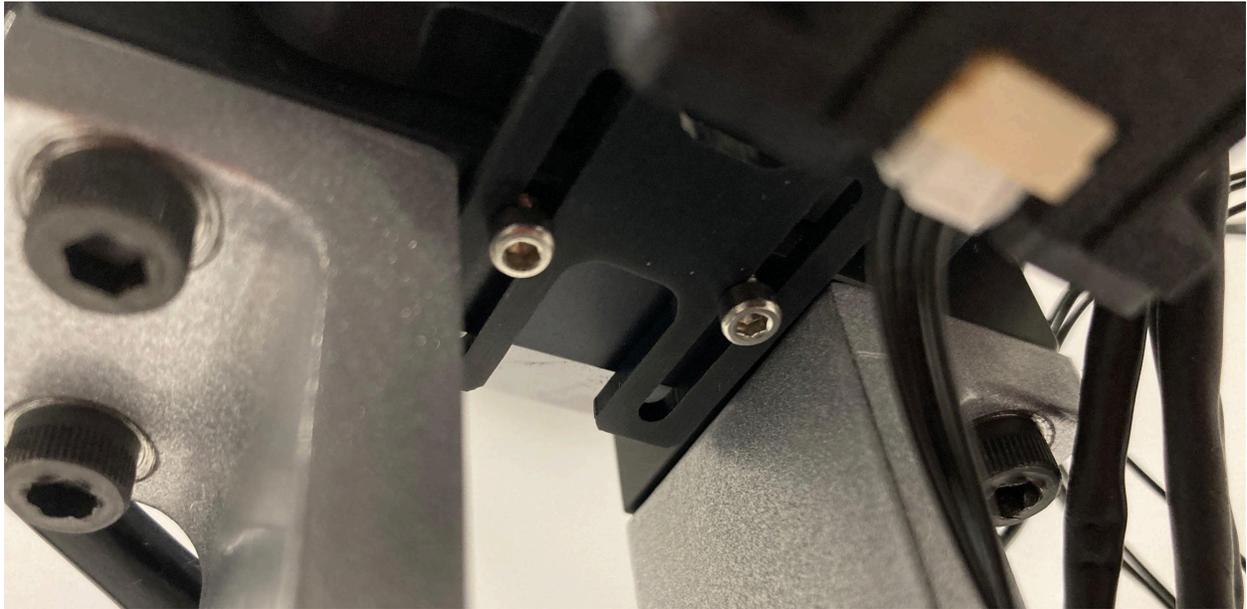


Fig. 11. Adjust the position with the slots

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

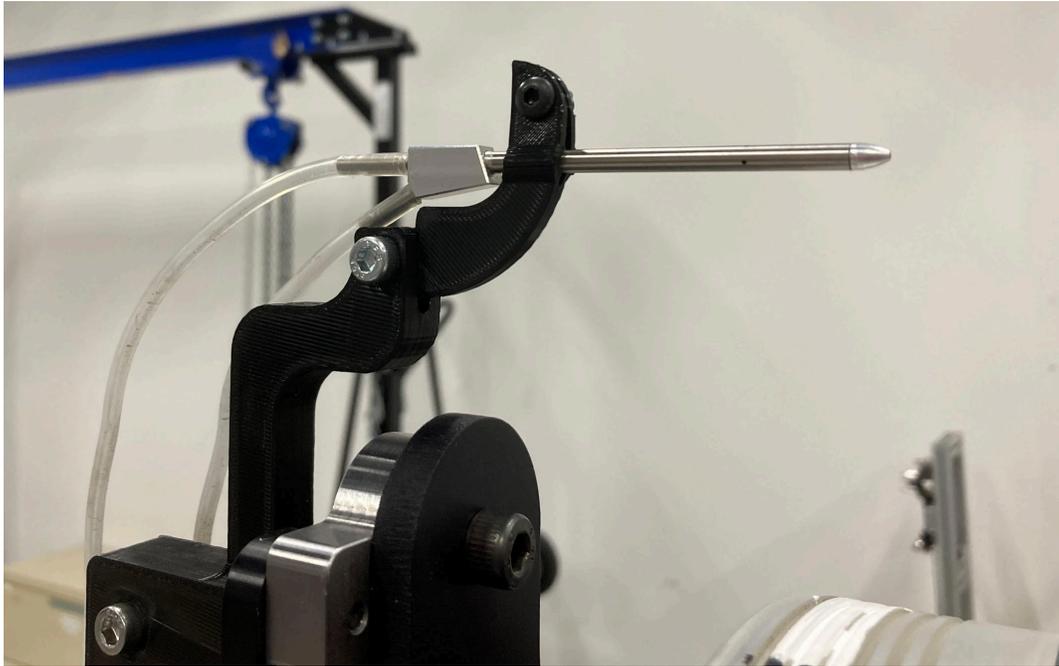


Fig. 12. Example of pitot tube and its fixture (yours to prepare)

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

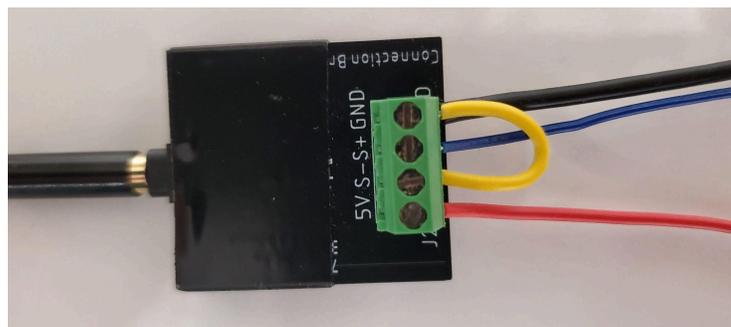


Fig. 13. Wire preparation for the analog breakout board

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

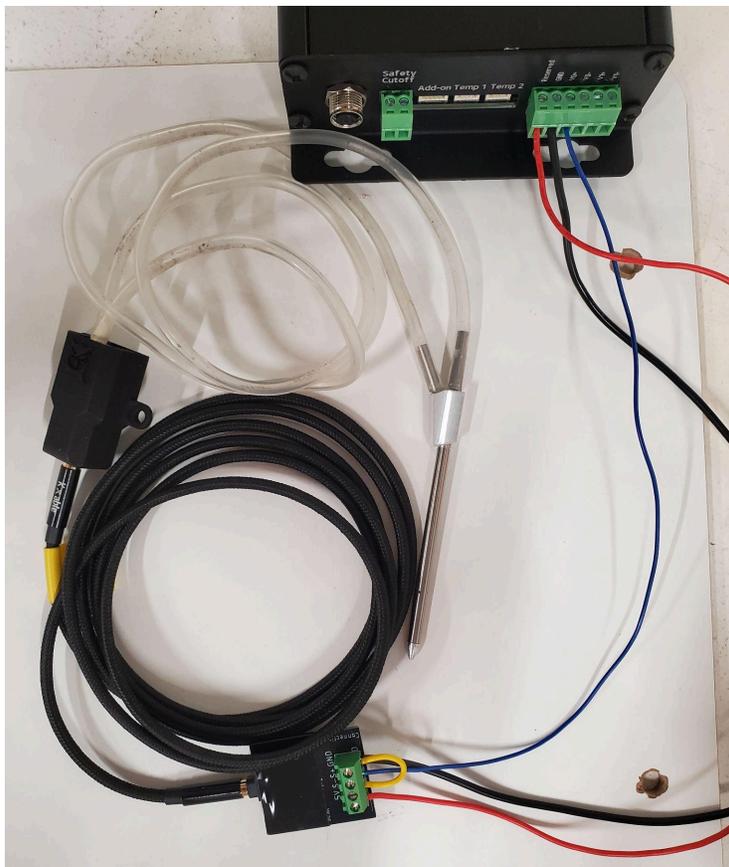


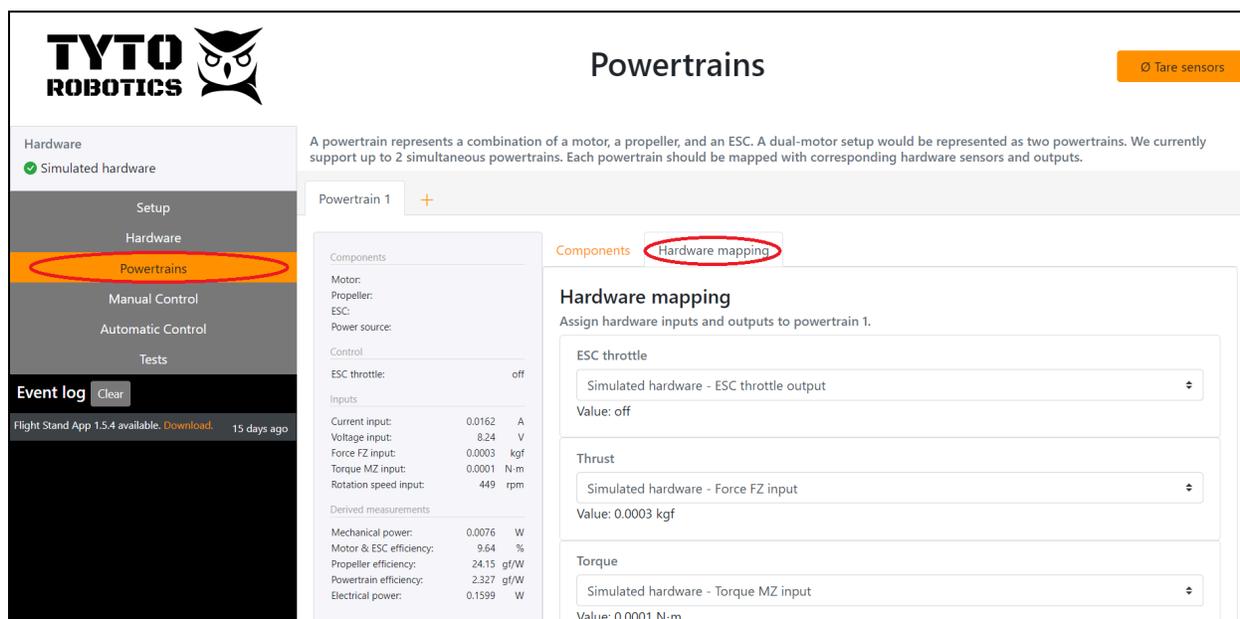
Fig. 14. Connection of the pressure sensor to the EMU general analog port

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.

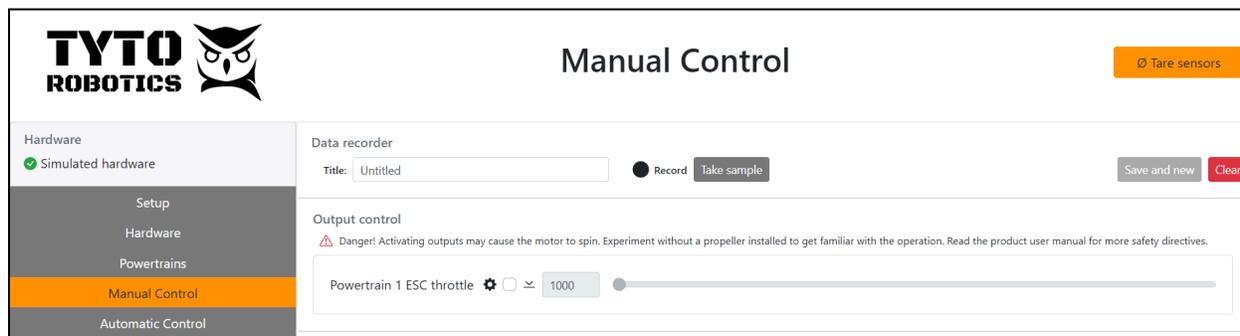


The screenshot shows the 'Powertrains' configuration screen. On the left sidebar, the 'Powertrains' tab is highlighted with a red oval. The main content area is titled 'Hardware mapping' and includes a dropdown menu for 'ESC throttle' set to 'Simulated hardware - ESC throttle output'. Below it, 'Thrust' is set to 'Simulated hardware - Force FZ input' and 'Torque' is set to 'Simulated hardware - Torque MZ input'. A table of inputs and derived measurements is visible on the left side of the main area.

Inputs	
Current input:	0.0162 A
Voltage input:	8.24 V
Force FZ input:	0.0003 kgf
Torque MZ input:	0.0001 N·m
Rotation speed input:	449 rpm

Derived measurements	
Mechanical power:	0.0076 W
Motor & ESC efficiency:	9.64 %
Propeller efficiency:	24.15 gf/W
Powertrain efficiency:	2.327 gf/W
Electrical power:	0.1599 W

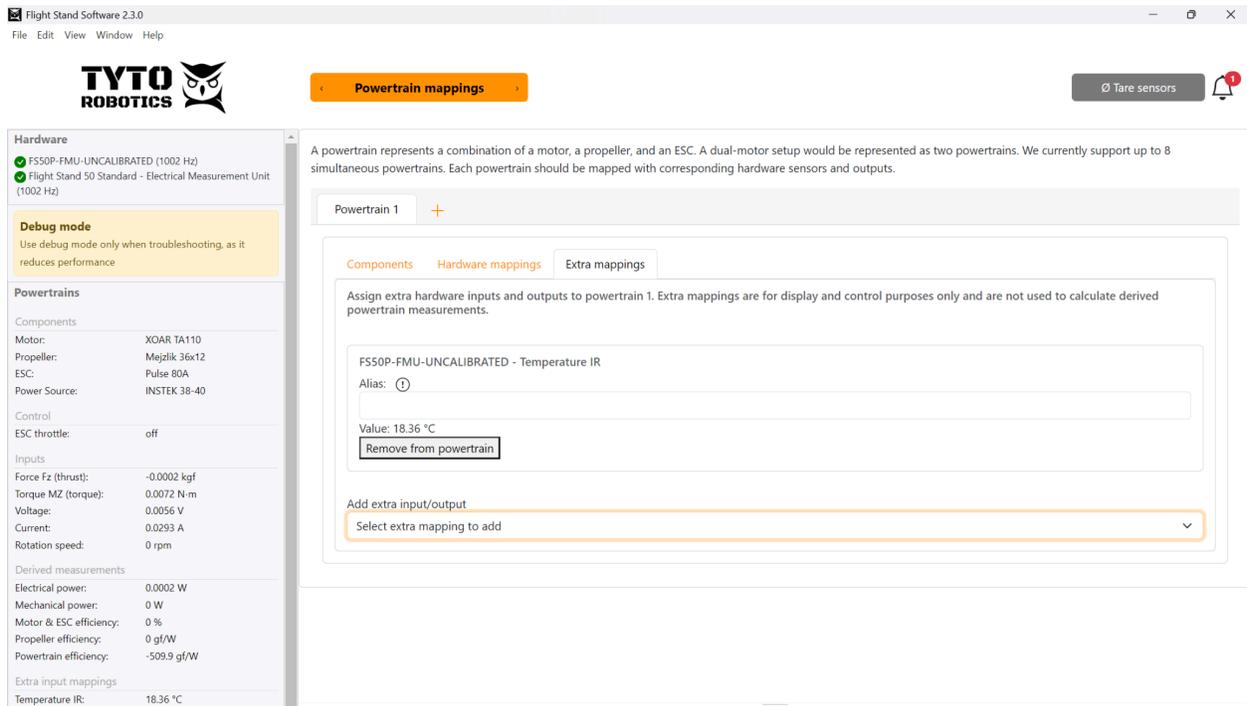
Step 3. Turn on the power and do a quick low-speed test run to determine the rotation direction by using the manual control. If the rotation direction is wrong, turn off the power and switch 2 cables on the three-phase between ESC and the motor. Then re-run the quick test.



The screenshot shows the 'Manual Control' screen. The 'Output control' section features a warning icon and text: 'Danger! Activating outputs may cause the motor to spin. Experiment without a propeller installed to get familiar with the operation. Read the product user manual for more safety directives.' Below this, there is a slider for 'Powertrain 1 ESC throttle' with a gear icon, a '1000' value field, and a range indicator.

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



Flight Stand Software 2.3.0

File Edit View Window Help

TYTO ROBOTICS

Powertrain mappings

Tare sensors

Hardware

- FS50P-FMU-UNCALIBRATED (1002 Hz)
- Flight Stand 50 Standard - Electrical Measurement Unit (1002 Hz)

Debug mode

Use debug mode only when troubleshooting, as it reduces performance

Powertrains

Components

Motor: XOAR TA110
 Propeller: Majzlik 36x12
 ESC: Pulse 80A
 Power Source: INSTEK 38-40

Control

ESC throttle: off

Inputs

Force Fz (thrust): -0.0002 kgf
 Torque MZ (torque): 0.0072 N-m
 Voltage: 0.0056 V
 Current: 0.0293 A
 Rotation speed: 0 rpm

Derived measurements

Electrical power: 0.0002 W
 Mechanical power: 0 W
 Motor & ESC efficiency: 0 %
 Propeller efficiency: 0 gf/W
 Powertrain efficiency: -509.9 gf/W

Extra input mappings

Temperature IR: 18.36 °C

A powertrain represents a combination of a motor, a propeller, and an ESC. A dual-motor setup would be represented as two powertrains. We currently support up to 8 simultaneous powertrains. Each powertrain should be mapped with corresponding hardware sensors and outputs.

Powertrain 1 +

Components Hardware mappings Extra mappings

Assign extra hardware inputs and outputs to powertrain 1. Extra mappings are for display and control purposes only and are not used to calculate derived powertrain measurements.

FS50P-FMU-UNCALIBRATED - Temperature IR

Alias: ⓘ

Value: 18.36 °C

Remove from powertrain

Add extra input/output

Select extra mapping to add

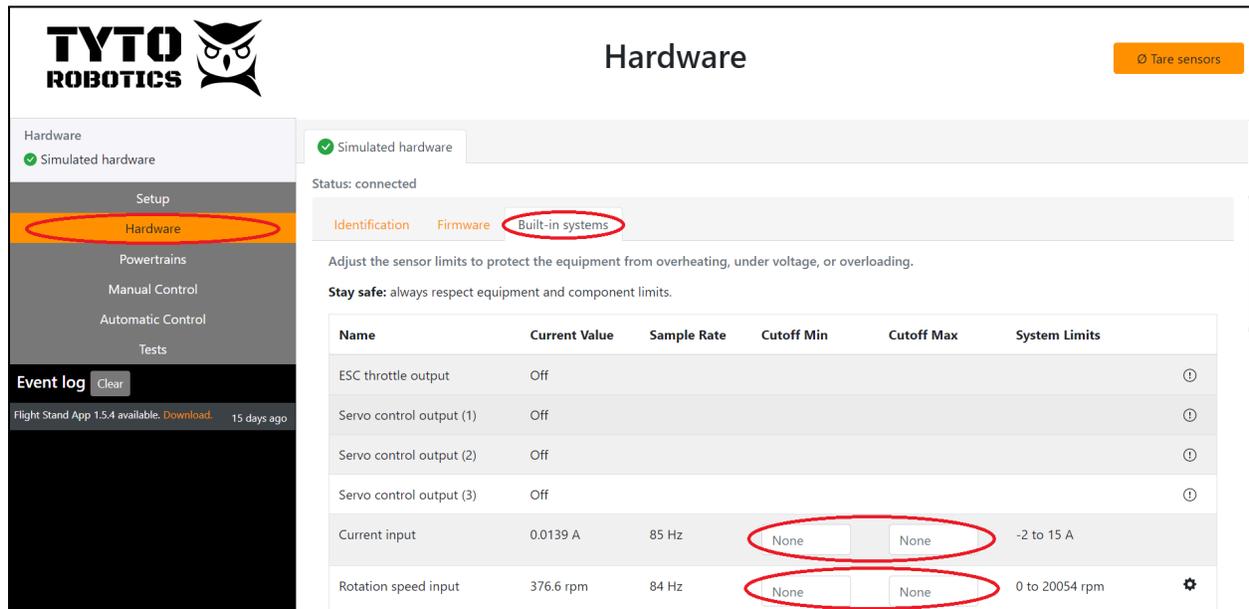
Chapter 4. Test

Section 4.1. Manual test

You have to do these steps before each test :

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:

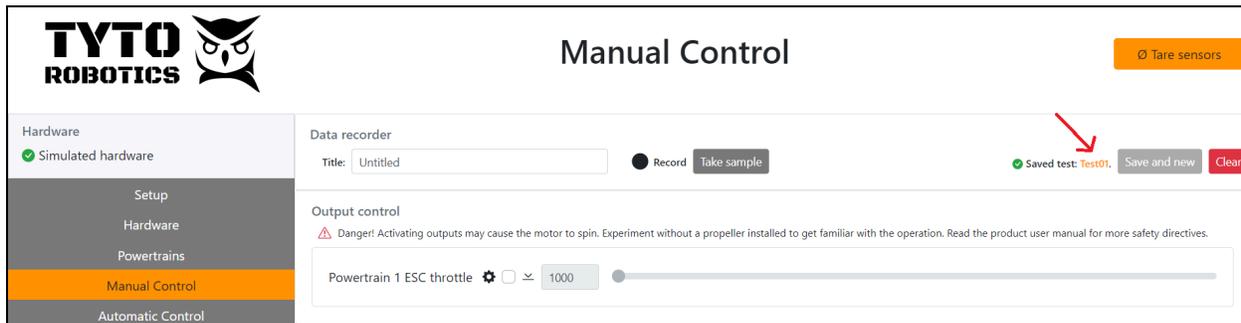


The screenshot shows the 'Hardware' configuration page in the TYTO Robotics software. The left sidebar has 'Hardware' highlighted. The main content area shows 'Simulated hardware' is connected. The 'Built-in systems' tab is selected. Below this, there is a table of sensor limits. The 'Current input' and 'Rotation speed input' rows have their 'Cutoff Min' and 'Cutoff Max' dropdown menus set to 'None'.

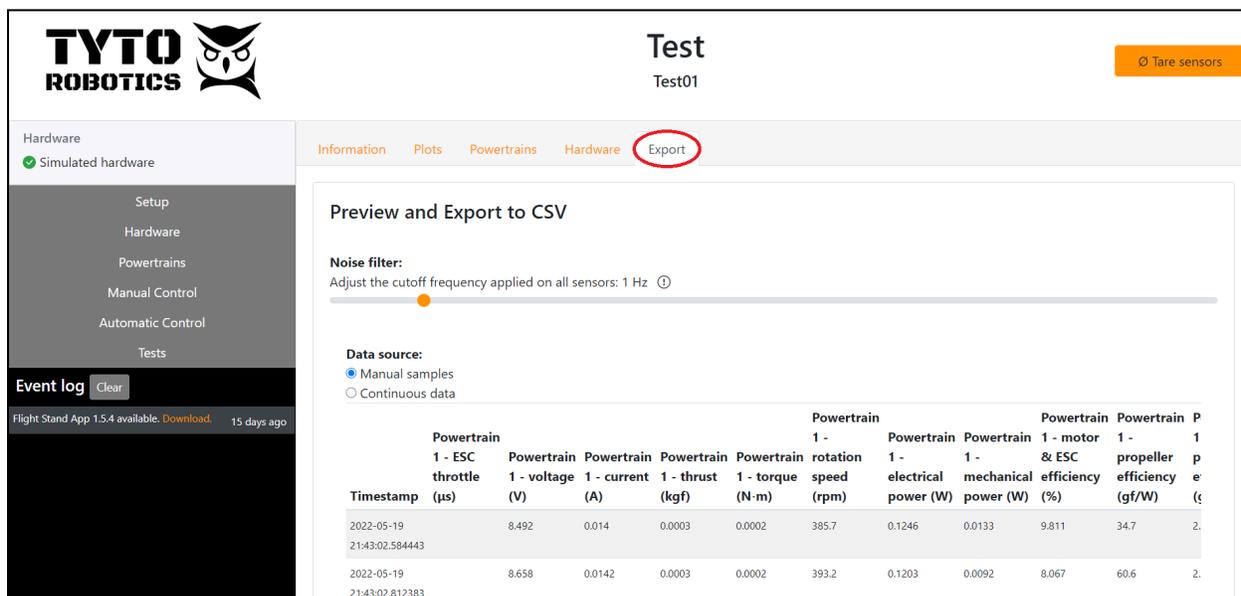
Name	Current Value	Sample Rate	Cutoff Min	Cutoff Max	System Limits
ESC throttle output	Off				
Servo control output (1)	Off				
Servo control output (2)	Off				
Servo control output (3)	Off				
Current input	0.0139 A	85 Hz	None	None	-2 to 15 A
Rotation speed input	376.6 rpm	84 Hz	None	None	0 to 20054 rpm

Step 3. Select the rate limiter :

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 - thrust (kgf)	Powertrain 1 - torque (N-m)	Powertrain 1 - rotation speed (rpm)	Powertrain 1 - electrical power (W)	Powertrain 1 - mechanical power (W)	Powertrain 1 - motor & ESC efficiency (%)	Powertrain 1 - propeller efficiency (gf/W)	Powertrain 1 - P (W)
2022-05-19 21:43:02.584443		8.492	0.014	0.0003	0.0002	385.7	0.1246	0.0133	9.811	34.7	2.0
2022-05-19 21:43:02.812383		8.658	0.0142	0.0003	0.0002	393.2	0.1203	0.0092	8.067	60.6	2.0

Preview and Export to CSV

Noise filter:

Adjust the cutoff frequency applied on all sensors: 1 Hz ⓘ

Data source:

Manual samples

Continuous data

Time resolution:

Resample ⓘ

seconds

Full resolution ⓘ

Timestamp	Powertrain 1 - ESC throttle (μ s)	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	

« < 1 > »

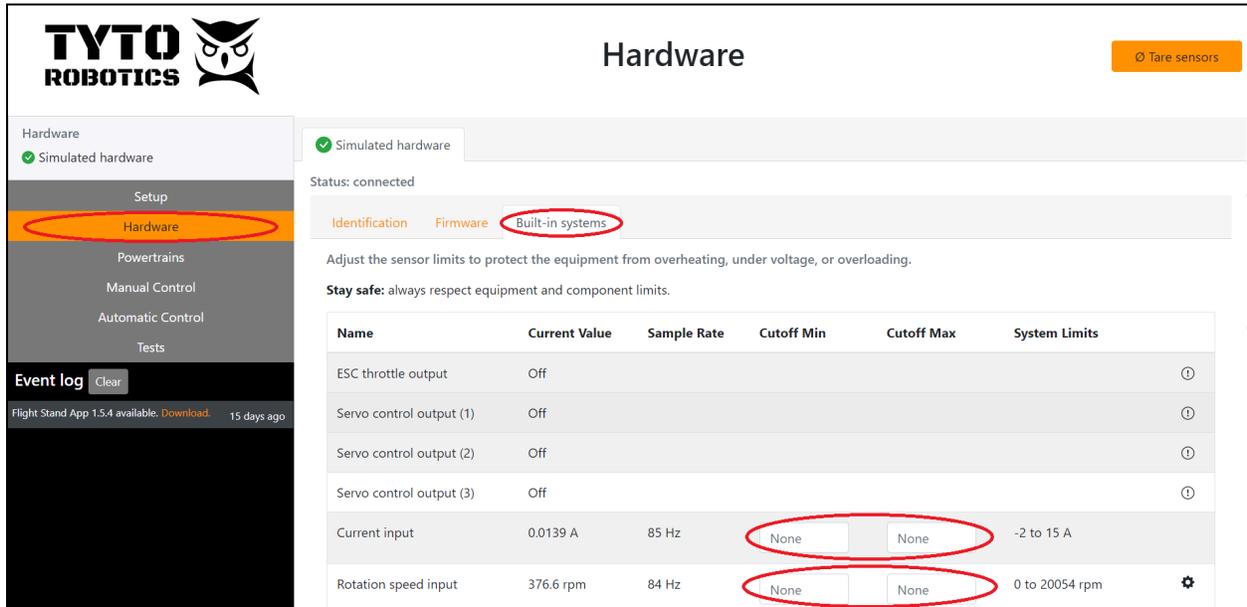
Export to CSV

Section 4.2 Automatic test

You have to do these steps before each test :

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

Step 2. Select safety limit on the software:



Hardware Tare sensors

Hardware
 Simulated hardware

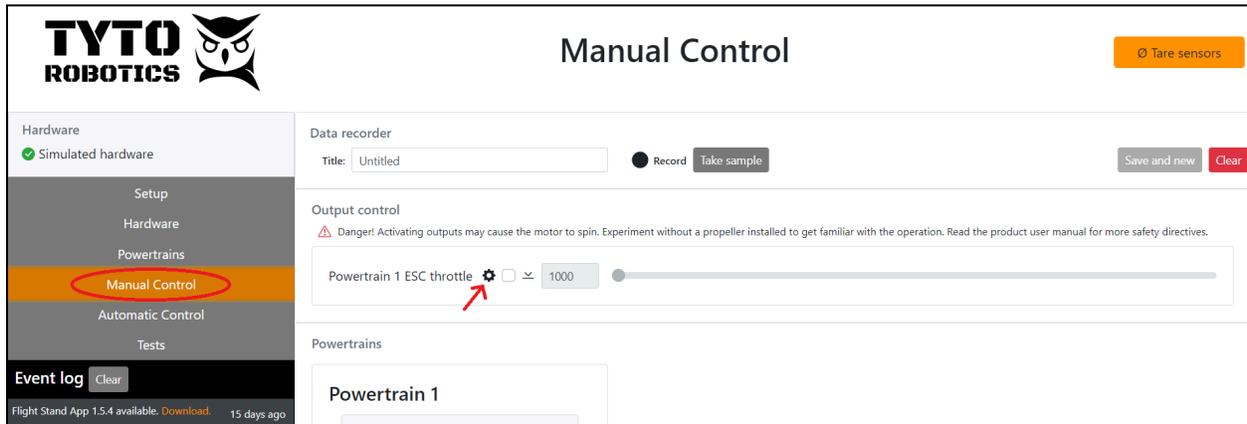
Status: connected

Identification Firmware **Built-in systems**

Adjust the sensor limits to protect the equipment from overheating, under voltage, or overloading.
Stay safe: always respect equipment and component limits.

Name	Current Value	Sample Rate	Cutoff Min	Cutoff Max	System Limits
ESC throttle output	Off				
Servo control output (1)	Off				
Servo control output (2)	Off				
Servo control output (3)	Off				
Current input	0.0139 A	85 Hz	None	None	-2 to 15 A
Rotation speed input	376.6 rpm	84 Hz	None	None	0 to 20054 rpm

Step 3. Select the rate limiter :



Manual Control Tare sensors

Hardware
 Simulated hardware

Data recorder
 Title: Untitled Record Take sample Save and new Clear

Output control
 ⚠ Danger! Activating outputs may cause the motor to spin. Experiment without a propeller installed to get familiar with the operation. Read the product user manual for more safety directives.

Powertrain 1 ESC throttle ⚙ ≈ 1000

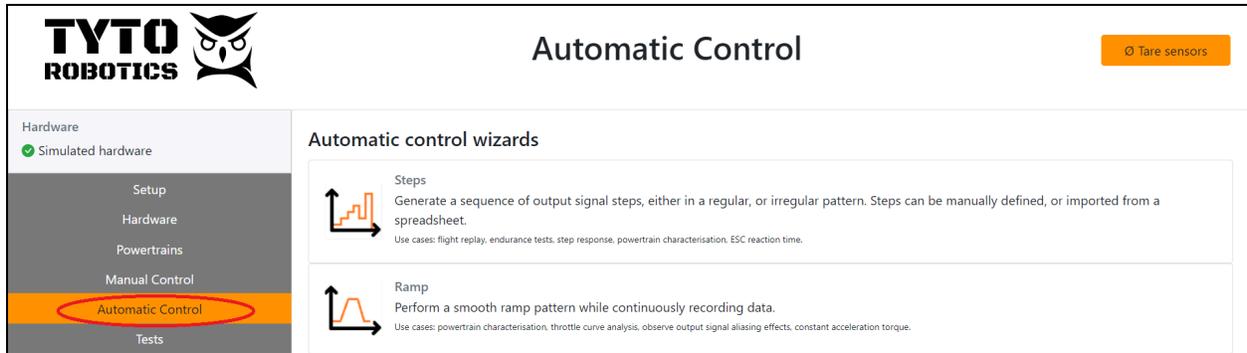
Powertrains
Powertrain 1

Output control
 ⚠ Danger! Activating outputs may cause the motor to spin. Experiment without a propeller installed to get familiar with the operation. Read the product user manual for more safety directives.

Powertrain 1 ESC throttle ⊗ Protocol Standard PWM 50 Hz ⓘ Safety cutoff value 1000 μs ⓘ
 Range 1000 to 2000 μs ⓘ **Rate limiter 0 μs/second ⓘ**

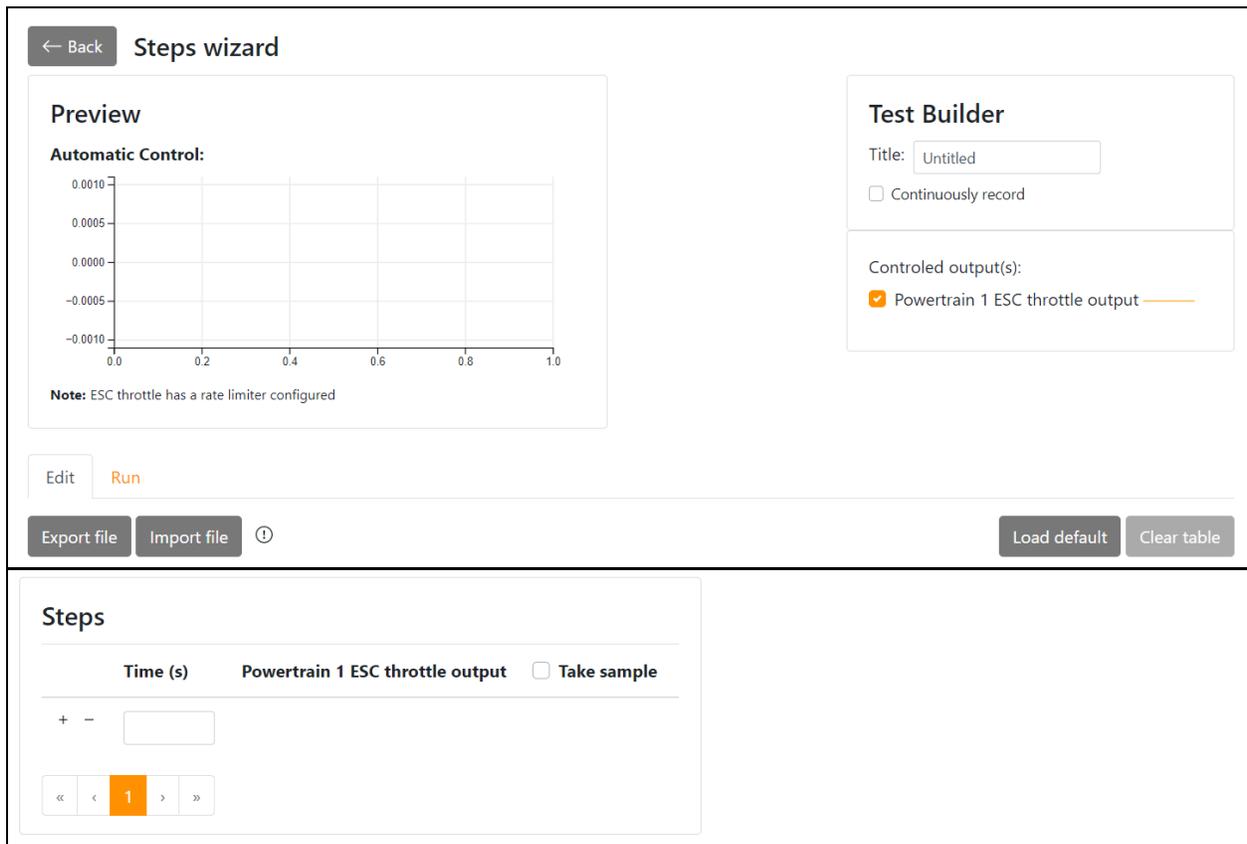
Step 4. Prepare the automatic control:

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



The screenshot shows the 'Automatic Control' interface. On the left, a sidebar contains menu items: Hardware (with a sub-item 'Simulated hardware'), Setup, Hardware, Powertrains, Manual Control, Automatic Control (highlighted with a red circle), and Tests. The main content area is titled 'Automatic Control' and features a 'Tare sensors' button. Below the title, there are two wizard options: 'Steps' (Generate a sequence of output signal steps, either in a regular, or irregular pattern. Steps can be manually defined, or imported from a spreadsheet. Use cases: flight replay, endurance tests, step response, powertrain characterisation, ESC reaction time.) and 'Ramp' (Perform a smooth ramp pattern while continuously recording data. Use cases: powertrain characterisation, throttle curve analysis, observe output signal aliasing effects, constant acceleration torque.)

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

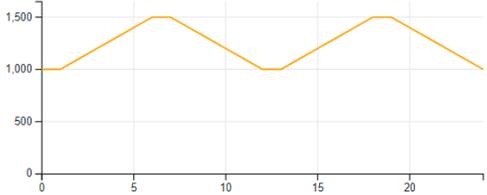


The screenshot shows the 'Steps wizard' interface. At the top left is a 'Back' button. The main area is divided into three sections: 'Preview', 'Test Builder', and 'Steps'.
 - The 'Preview' section shows a graph titled 'Automatic Control:' with a y-axis ranging from -0.0010 to 0.0010 and an x-axis from 0.0 to 1.0. A note below the graph states: 'Note: ESC throttle has a rate limiter configured'.
 - The 'Test Builder' section includes a 'Title' field (set to 'Untitled'), a 'Continuously record' checkbox (unchecked), and a 'Controlled output(s):' section where 'Powertrain 1 ESC throttle output' is selected with a checkbox.
 - Below the preview and test builder are buttons for 'Edit', 'Run', 'Export file', 'Import file', 'Load default', and 'Clear table'.
 - The 'Steps' section at the bottom features a table with columns 'Time (s)', 'Powertrain 1 ESC throttle output', and 'Take sample'. The table currently has one row with a time value of 1. Navigation arrows are present below the table.

← Back Steps wizard

Preview

Automatic Control:



Note: ESC throttle has a rate limiter configured

Test Builder

Title:

Continuously record

Controlled output(s):

Powertrain 1 ESC throttle output —

Edit Run

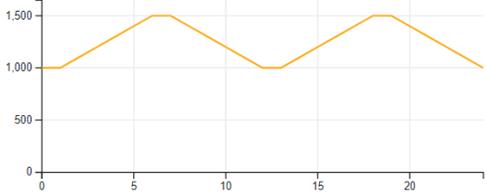
Export file Import file ⓘ Load default Clear table

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

← Back Steps wizard

Preview

Automatic Control:



Note: ESC throttle has a rate limiter configured

Test Builder

Title: Untitled
Data Sample: 0
Continuous Data:

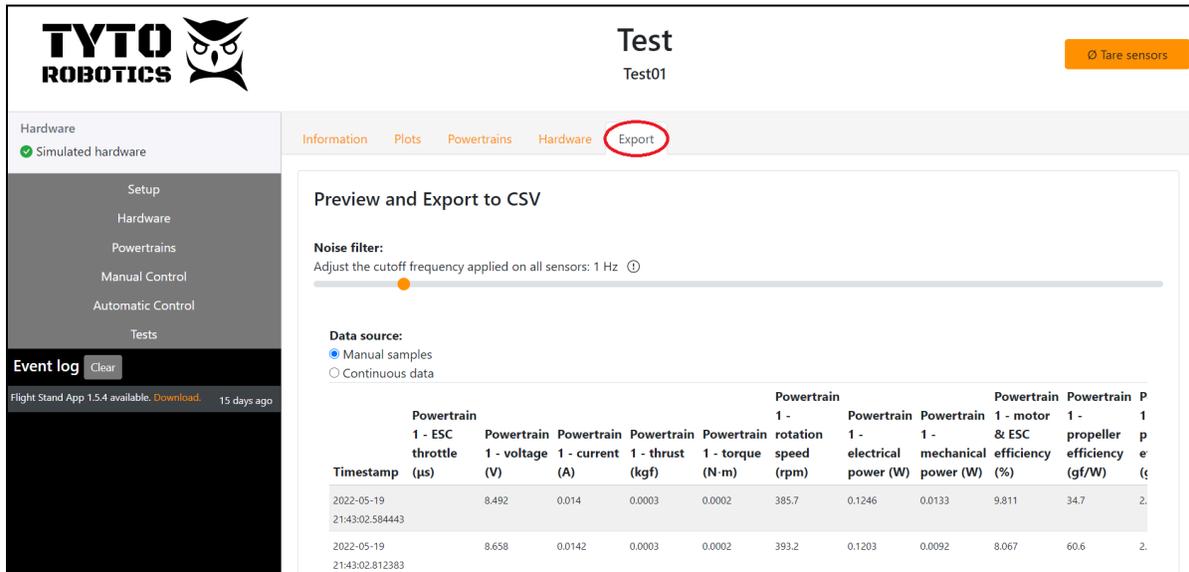
Controlled output(s):

Powertrain 1 ESC throttle output —

Edit Run

Repeate sequence - 1 + Start

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



TYTO ROBOTICS Test Test01 ⊗ Tare sensors

Hardware ⊕ Simulated hardware

Information **Plots** Powertrains Hardware **Export**

Setup
 Hardware
 Powertrains
 Manual Control
 Automatic Control
 Tests

Event log Clear
 Flight Stand App 1.5.4 available. [Download](#). 15 days ago

Preview and Export to CSV

Noise filter:
 Adjust the cutoff frequency applied on all sensors: 1 Hz

Data source:
 Manual samples
 Continuous data

Timestamp	Powertrain 1 - ESC throttle (μs)	Powertrain 1 - voltage (V)	Powertrain 1 - current (A)	Powertrain 1 - thrust (kgf)	Powertrain 1 - torque (N·m)	Powertrain 1 - rotation speed (rpm)	Powertrain 1 - electrical power (W)	Powertrain 1 - mechanical power (W)	Powertrain 1 - motor & ESC efficiency (%)	Powertrain 1 - propeller efficiency (gf/W)	Powertrain 1 - propeller efficiency (g/W)
2022-05-19 21:43:02.584443		8.492	0.014	0.0003	0.0002	385.7	0.1246	0.0133	9.811	34.7	2.1
2022-05-19 21:43:02.812383		8.658	0.0142	0.0003	0.0002	393.2	0.1203	0.0092	8.067	60.6	2.1



← Back **Steps wizard**

Preview

Automatic Control:

Note: ESC throttle has a rate limiter configured

Edit Run

Test Builder

Title: Untitled
 Data Sample: 0
 Continuous Data:

Controlled output(s):
 Powertrain 1 ESC throttle output

Repeats sequence - 1 + View saved test

Preview and Export to CSV

Noise filter:
 Adjust the cutoff frequency applied on all sensors: 1 Hz ⓘ

Data source:

Manual samples

Continuous data

Time resolution:

Resample ⓘ

0.1 seconds

Full resolution ⓘ

Timestamp	Powertrain 1 - ESC throttle (μ s)	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	

[Export to CSV](#)

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