TYTO ROBOTICS

Flight Stand 50 Datasheet
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Flight Stand 50

High-precision professional thrust stand

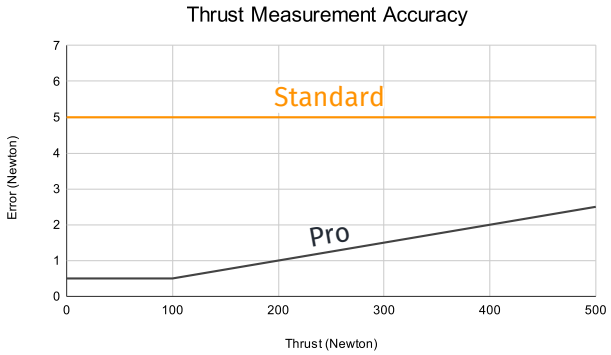
Made in Canada

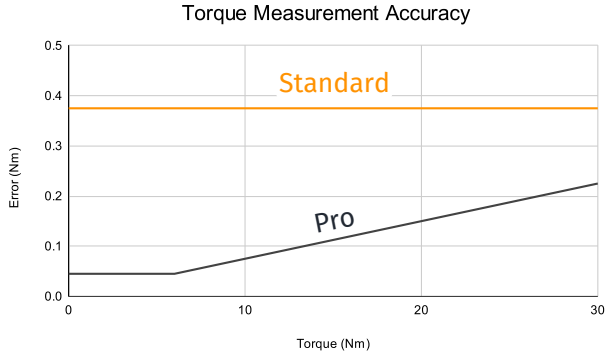
Introduction

The Flight Stand 50 thrust stand allows you to precisely characterize and evaluate the performance of your motors and propellers by measuring thrust, torque, RPM, current, voltage, temperature, propeller efficiency and motor efficiency.

Versions Available

- **FS50 Standard:** essential performance characteristics for static tests over our standard range of values. Constant error rate across measured values.
- **FS50 Pro:** enhanced performance for dynamic tests over a wider range of values with very high accuracy. A higher sampling rate and low error based on measured value.





- **FS50 Dual motor (available in Standard or Pro):** Two powertrains tested simultaneously in one of three configurations: back-to-back, face-to-face, or offset (below).

- **Multi-powertrain version:** for distributed electric propulsion testing up to 8 powertrains

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Technical Specifications

	Specification	Standard	Pro
Basic Information	Storage temp & humidity	23°C, 20% to 80% suggested	23°C, 20% to 80% suggested
	Operating temp & humidity	0°C to 40°C, 20% to 80%	0°C to 40°C, 20% to 80%
	Operating environment	Indoor	Indoor
	Dimensions	28" x 12" x 6"	28" x 12" x 6"
	Input power / Output power	90 - 264 VAC, 1 A input adapts into 9 V, 2 A	90 - 264 VAC, 1 A input adapts into 9 V, 2 A
Measurement Information	Sampling rate	100 Hz	1,000 Hz
	Wireless testing	Yes	Yes
	Thrust calibration	Internal standard (26 points, push & pull)	ASTM E74 (211 points, push & pull)
	Torque calibration	Internal standard (30 points, CW & CCW)	ASTM E2428 (213 points, CW & CCW)
	Crosstalk calibration	Yes with 48 points	Yes with 1056 points
Voltage and Current	Voltage range	0 V to 180 V	0 V to 180 V
	Voltage resolution	0.001 V	0.001 V
	Voltage accuracy	1% measured value from 5 V to 180 V	1% measured value from 5 V to 180 V
	Current range	0 to 300 A	0 to 300 A
	Current resolution	0.001 A	0.001 A
	Current accuracy	1% from 15 A to 300 A	1% from 15 A to 300 A
Thrust	Range	±500 N	±500 N
	Resolution	0.2 N	0.1 N
	Accuracy	± 5.0 N	±0.5% of measured value, with lower limit of ±100 N (± 0.5 to ± 2.5 N)
	Temperature effect	±1.5 N per 10 degree Celsius	±1.5 N per 10 degree Celsius
Torque	Range	±30 Nm	±30 Nm
	Resolution	0.01 Nm	0.005 Nm
	Accuracy	±0.375 Nm	±0.75% of measured value, with lower limit of 6 Nm (± 0.045 to ± 0.225 Nm)
	Temperature effect	±0.5 Nm per 10 degree Celsius	±0.5 Nm per 10 degree Celsius
RPM Sensor	Range	400 to 30 000 RPM	400 to 30 000 RPM
	Accuracy	±1 RPM	±1 RPM
Temperature Sensors	PT100 sensor range	-30 °C to 100 °C, ±2 °C	-30 °C to 100 °C, ±2 °C
	IR sensor range	N/A	-40°C to +125°C for sensor temperature -70°C to+380°C for object temperature
	IR sensor resolution	N/A	0.02 °C
	IR sensor accuracy	N/A	±1 °C around room temperature
General Analog Inputs	Range	N/A	2 inputs of ±10 V differential.
	Resolution	N/A	0.001 V
	Accuracy	N/A	±0.5% of measured value ±0.25 V
	Supply pin	N/A	5 V ± 0.1 V 30 mA max
External Inputs and Outputs	Connect CAN ESCs, pressure sensors, sound level sensors, and more	Included	Included

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Applications

Below is a non-exhaustive list of possible applications for the Flight Stand 50:

- **Real-time dynamic testing:** made possible by the FS50 Pro's 1,000 Hz sampling rate. Perform frequency and step input parameter identification.
- **Flight replay:** upload your flight controller data to the software and recreate your throttle pattern while your propulsion system is hooked up to the thrust stand.
- **Efficiency and power characterization:** measure the efficiency of your motor, propeller and overall system and compare electrical power input with mechanical power output.
- **Endurance and reliability testing:** study the endurance of your system's components using automated tests designed by you. Our user-friendly testing interface allows you to easily design and run step tests, ramp tests, flight replay tests, or any protocol you can come up with.
- **Distributed electric propulsion (DEP) testing:** test up to 8 powertrains simultaneously for a comprehensive understanding of your multirotor's performance. Data is recorded for each individual powertrain as well as the system as a whole.
- **Propeller balancing:** balance propellers to ISO standards in 3 easy steps.

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Advantages

Here's why the Flight Stand is the best propulsion testing tool on the market:

- **Frictionless measurement:** our tools have a solid-state system for measuring thrust and torque, meaning there are no moving parts between the motor and load cells. This design significantly improves the accuracy of measurements and eliminates the need for bearings and hinges, which cause friction and are prone to misalignment.
- **ASTM Calibration:** our Pro thrust stands are rigorously calibrated to ASTM standards to ensure maximum measurement precision. Thrust is calibrated with the 211-point ASTM E74 procedure and torque is calibrated with the 213-point ASTM E2428 procedure.
- **Aerodynamic design:** the compact shape of the Flight Stand ensures that there is minimal airflow disturbance from the tool's hardware and wiring. This promotes more realistic measurements and testing conditions that more closely mimic flight.
- **Realistic dual motor testing:** it is possible to perform dual motor tests in 3+ configurations with the Flight Stand, each representing a different aircraft design. In the back-to-back testing configuration, the motors are separated by a distance as little as 150 mm, similar to the distance you'd have in a multicopter.
- **Superior software experience:** our software allows you to perform manual or automated tests with no programming required. We also offer a Python API and data management system with index, plots, tables, filtering and resampling capability.
- **Exceptional customer support:** our team is ready to respond to any questions you may have in a friendly and timely manner.
- **Wireless control:** remotely control the Flight Stand software from any computer on the same network to maintain a safe distance from the thrust stand.

Award Winning

In 2022, the Flight Stand won the Regional Innovation Award from the Order of Engineers of Quebec, thanks to its ground-breaking design and capabilities.

Hardware and Electronics

The Flight Stand 50 comes fully equipped with software, hardware and electronics. Here's what's included with your Flight Stand:

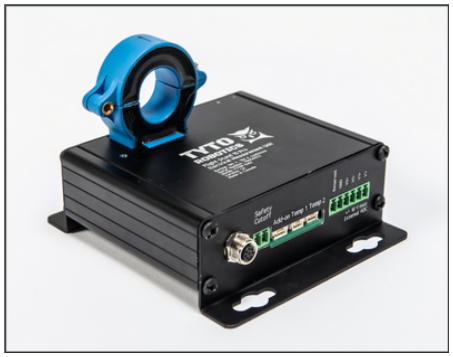
Flight Stand 50:

- Force Measurement Unit (50 kgf /30 Nm) (1x): measures thrust and torque
- Electric Measurement Unit (180 V - 300 A) (1x): measures current and voltage
- Tubular structure (1x): supports the FMU and propulsion system, protects wiring
- Sync Hub (1x): connects the thrust stand to the software
- Temperature sensors (2-3x): records the temperature at the desired location
- Optical RPM sensor (1x): provides a precise measurement of the motor's rotation speed
- Flight Stand Software

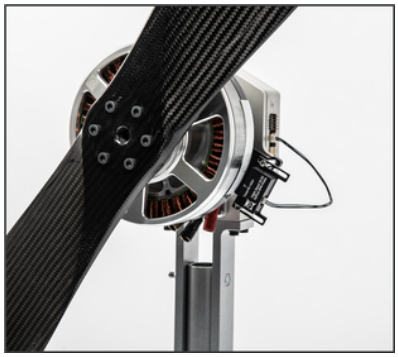
Flight Stand 50 dual motor:

- 2x everything listed under Flight Stand 50 (except sync hub - only 1 needed for 2 FMUs)
- Dual motor fixture kit: ground rails and hardware for securing Flight Stands

Tubular Structure (Pro)

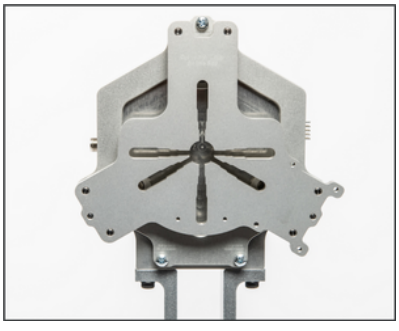


Electrical Measurement Unit (Pro)



Optical RPM Probe

Sync Hub



Force Measurement Unit with Motor Mounting Plate

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Software

The Flight Stand Software controls your thrust stand and records data. You can manually control tests with a throttle slider or automate tests using a table, data from a .CSV file, or the Python API. Supported protocols include:

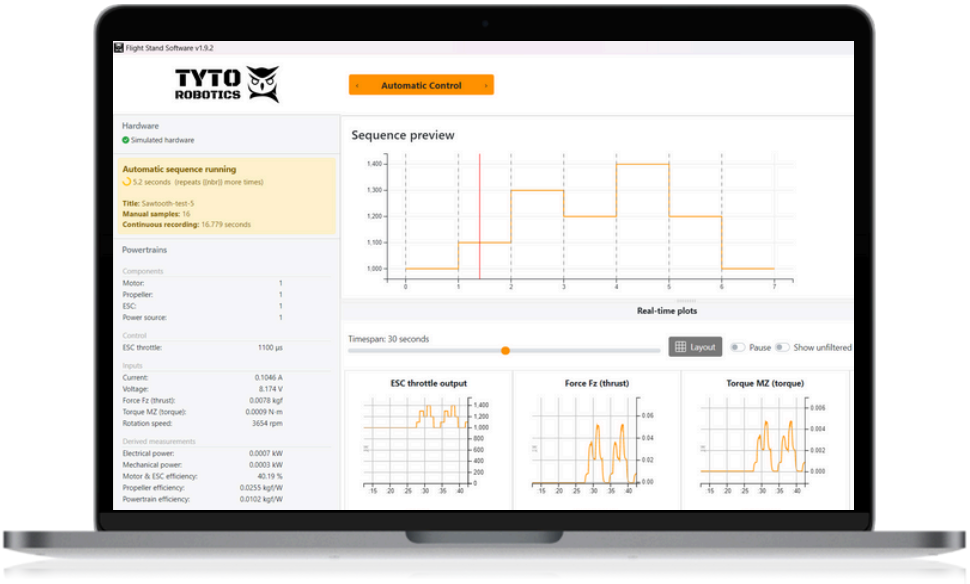
ESC:
Standard PWM: 50, 100, 200, 300, 400, 490 Hz
Dshot: 150, 300, 600
Oneshot: 42, 125
Multishot

Servos:
Standard PWM: 50, 100, 200, 300, 400, 490 Hz

With the Flight Stand Software you can:

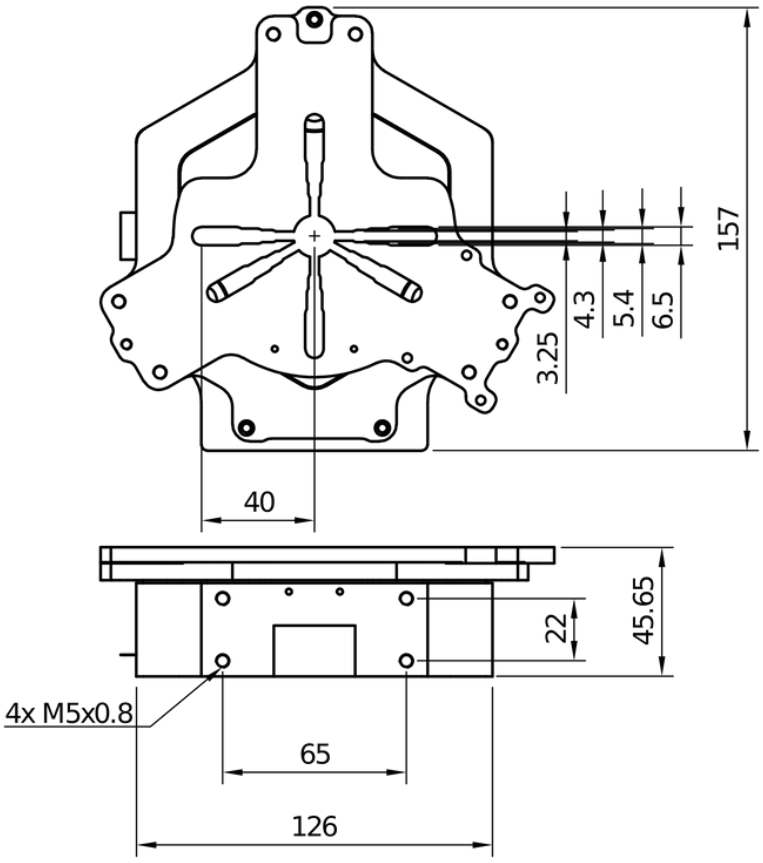
- Control the thrust stand manually and view live data as it is recorded
- Automate tests with an easy-to-use interface that requires no programming
- Control the whole system from a Python API
- Upload .CSV files from your flight controller to perform flight replay tests
- Save tests directly in the software and/or export them as .CSV files
- Re-sample data for smaller files and adjust sensor noise filtering
- Map and test up to 8 powertrains simultaneously (DEP testing)
- Balance propellers

Our I/O API also allows you to connect CAN ESCs and external sensors for various inputs and outputs.

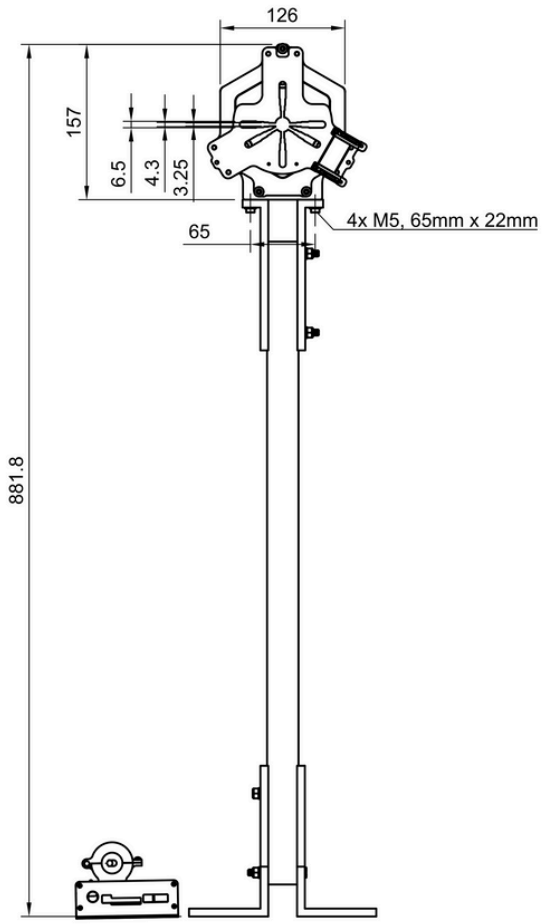


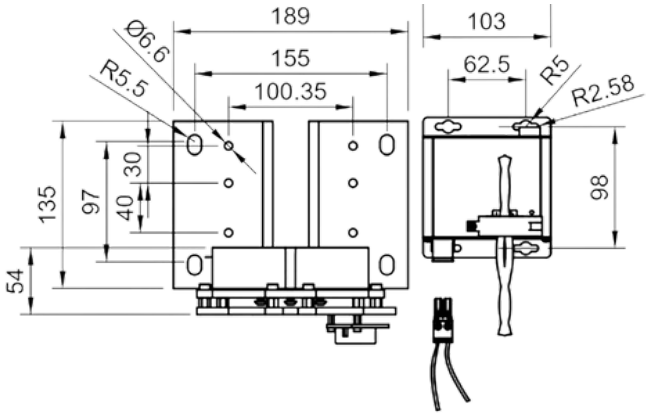
Technical Drawings

Force Measurement Unit:

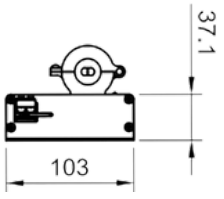


Stand Components:





Electrical Measurement Unit



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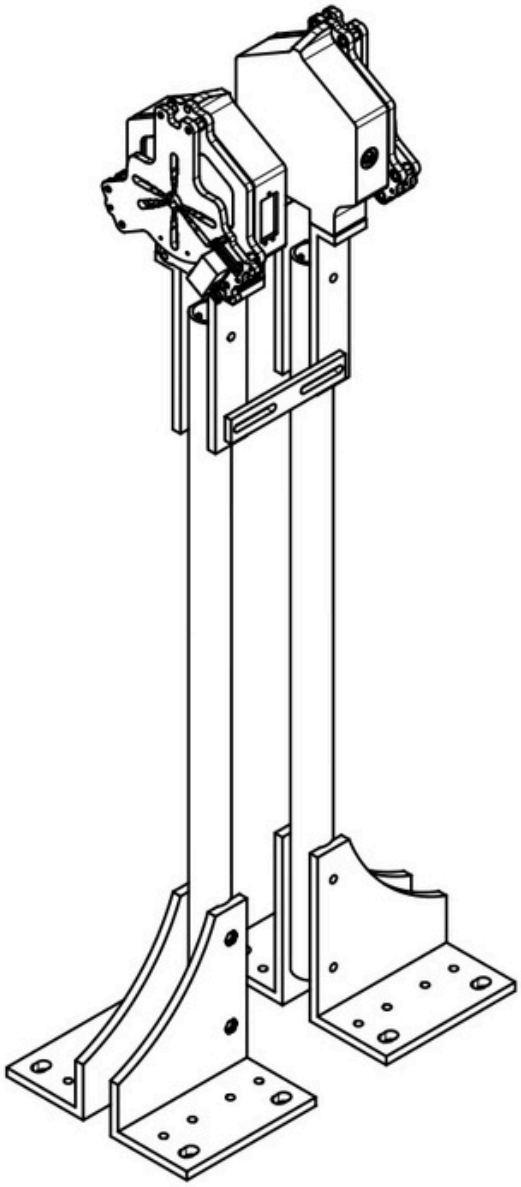
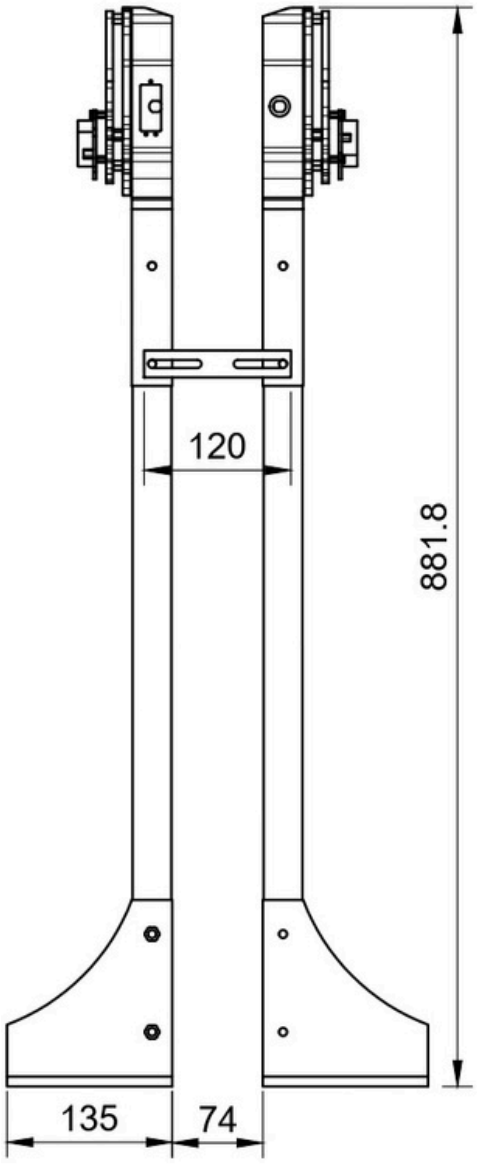
Technical Drawings - Dual Motor Configurations

Dual Motor Configurations:
(Note that many configurations are possible and at different separation distances)





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