FLIGHT STAND 15

THRUST STAND AND SOFTWARE FOR MOTOR AND PROPELLER CHARACTERIZATION

Key Specs

- Thrust: ±150 N
- Torque: ±8 Nm
- RPM: up to 30,000 RPM
- Voltage: up to 180 V
- Current: up to 150 A

See next page for full product specifications.

Applications

- Propulsion system characterization and comparison
- Endurance and reliability testing
- Motor heat testing
- Distributed electric propulsion (DEP) testing
- Propeller balancing
- Maintenance and quality control
- Flight replay
- Real-time dynamic testing

Note: motor and propeller not included

Figure 1: Flight Stand 15 Standard (left) and Pro (right)

Description

The Flight Stand 15 thrust stand precisely characterizes the performance of UAV motors and propellers. Included is the hardware, electronics and software required to measure your propulsion system's thrust, torque, RPM, current, voltage, temperature, electrical and mechanical power, propeller efficiency, motor efficiency, overall efficiency, and more.

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

TYTO ROBOTICS

PRODUCT SPECIFICATIONS

	Specification	Standard version	Pro version
Basic Information	Operating temp & humidity	0 to 40° C, <70% RH suggested	0 to 40° C, <70% RH suggested
	Storage temp & humidity	23° C, 20% RH suggested	23° C, 20% RH suggested
	Net weight	9.5 kg	9.5 kg
	Dimensions	35" (H) x 7.5" (W) x 5.3" (D) 882 mm (H) x 189 mm (W) x 135 mm (D)	35" (H) x 7.5" (W) x 5.3" (D) 882 mm (H) x 189 mm (W) x 135 mm (D)
	Sync Hub power input	9 V, 2 A	9 V, 2 A
Measurement Information	Sampling rate	100 Hz	1,000 Hz
	Wireless testing	Yes	Yes
	Calibration methodology	Tyto Methodology (V2.1)	Tyto Methodology (V2.1)
	Thrust matrix generation	Internal protocol with crosstalk compensation; >20 points push & pull	ASTM E74-derived protocol with crosstalk compensation; >200 points push & pull
	Torque matrix generation	Internal protocol with crosstalk compensation; >20 points CW & CCW	ASTM E2624-derived protocol with crosstalk compensation; >200 points CW & CCW
Thrust	Range	±150 N	±150 N
	Resolution	0.02 N	0.02 N
	Accuracy	±1.5 N	0-10 N: ±0.075 N 10-150 N: 0.75% of the measured value
Torque	Range	±8 Nm	±8 Nm
	Resolution	0.001 Nm	0.001 Nm
	Accuracy	±0.1 Nm	0-2 Nm: ±0.02 Nm 2-8 Nm: 1% of the measured value
Voltage and Current	Voltage range	0 to 180 V	0 to 180 V
	Voltage resolution	0.001 V	0.001 V
	Voltage accuracy	1% measured value from 5 to 180 V	1% measured value from 5 to 180 V
	Current range	0 to 150 A	0 to 150 A
	Current resolution	0.001 A	0.001 A
	Current accuracy	1% from 5 to 150 A	1% from 5 to 150 A
RPM Sensor	Range	Up to 30,000 RPM	Up to 30,000 RPM
	Resolution	0.1 RPM	0.1 RPM
	Accuracy	±1 RPM	±1 RPM
	Operating distance	5 to 15 mm	5 to 15 mm
	Operating environment	Indoor	Indoor

PRODUCT SPECIFICATIONS

	Specification	Standard version	Pro version
Temperature (PT-100, contact)	Range	-40° C to 100° C	-40° C to 100° C
	Resolution	0.1 K	0.1 K
	Accuracy	±0.5 K	±0.5 K
Temperature (Infrared, non-contact) *available for purchase	Range	-40° C to +80° C for sensor temperature -70° C to +380° C for object temperature	-40° C to +80° C for sensor temperature -70° C to +380° C for object temperature
	Resolution	0.02° C	0.02° C
	Accuracy	±1° C around room temperature	±1° C around room temperature
Airspeed Pressure Sensor *available for purchase	Range (differential pressure)	n/a	10 to 498 Pa
	Accuracy (differential pressure)	n/a	±2.25%
	Range (airspeed)	n/a	2 to 28 m/s
	Resolution (airspeed)	n/a	0.1 m/s
	Pitot tube	n/a	Not included
	Max distance between pitot tube and sensor	n/a	1 m
	Humidity	n/a	up to 95% RH - non-condensing
General Analog Inputs	Number of inputs	0	2
	Range	n/a	[-10, -0.015], [0.015, 10] V
	Accuracy	n/a	±0.5% of measured value ±0.25 V
	Supply pin	n/a	5 V ± 0.1 V 30 mA max
Control Outputs	Number of outputs	1 for ESC, 3 for servos	1 for ESC, 3 for servos
	Pin out	2.54 mm header, 3 PIN, 3.3 V, 80 mA max	2.54 mm header, 3 PIN, 3.3 V, 80 mA max
	PWM output protocol / frequency	Standard PWM 50, 100, 200, 300, 400, 500 Hz DShot 150, 300, 600 OneShot 42, 125; MultiShot	Standard PWM 50, 100, 200, 300, 400, 500 Hz DShot 150, 300, 600 OneShot 42, 125; MultiShot
	Other control	CAN-Bus through API	CAN-Bus through API
System Requirements	Windows Version	Windows 10: Version 2004 or newer, Windows 11	Windows 10: Version 2004 or newer, Windows 11
	Storage	NVMe or PCIe SSD Required	NVMe or PCIe SSD Required
	CPU	8 cores+	8 cores+

CALIBRATION AND VERIFICATION

Tyto Methodology for Calibration Verification (V2.1)

Overview
Our matrix generation process is inspired by elements of ASTM E74 and ASTM E2624 and adapted for the multi-axis thrust and torque measurements used in UAV propulsion testing.

The process uses Tyto-developed metrology equipment to apply controlled forces and torques representative of typical UAV test conditions. This includes extensive crosstalk loading scenarios with over 20 points for the Standard version and over 200 points for the Pro version.

More specifically, during the matrix generation process, various combinations of Fx, Fy, Fz, Mx, My, Mz are applied at the same time to characterize the behavior of the unit during a real test. To achieve this, custom machines are used to apply precise forces automatically. The loading sequences are used to generate a matrix for the measurement system, which increases the accuracy of the tool as the matrix is generated using forces representative of real-world loading conditions.

Calibration is then performed using Tyto's internal methodology, which relies on dead weights and precision load cells across representative portions of the tool's measurement range. This process is built around controlled loading, repeatability, and traceability, while accounting for the multi-axis nature of the system. All force, voltage, and current sensors use traceable equipment that is itself recalibrated by external accredited labs at regular intervals.

This verification data is available as a PDF upon request. Contact our sales team for more information.

Technical definitions:

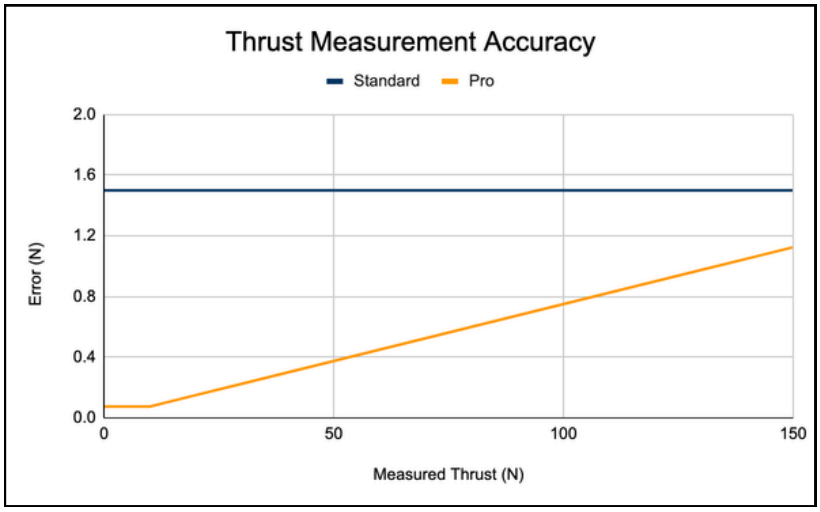
Accuracy: The maximum allowed average error observed during calibration. The calibration is performed using dead weights and precision load cells over a range representative of the tool's intended measurement range. The calibration is done with a single force, after the matrix generation process.

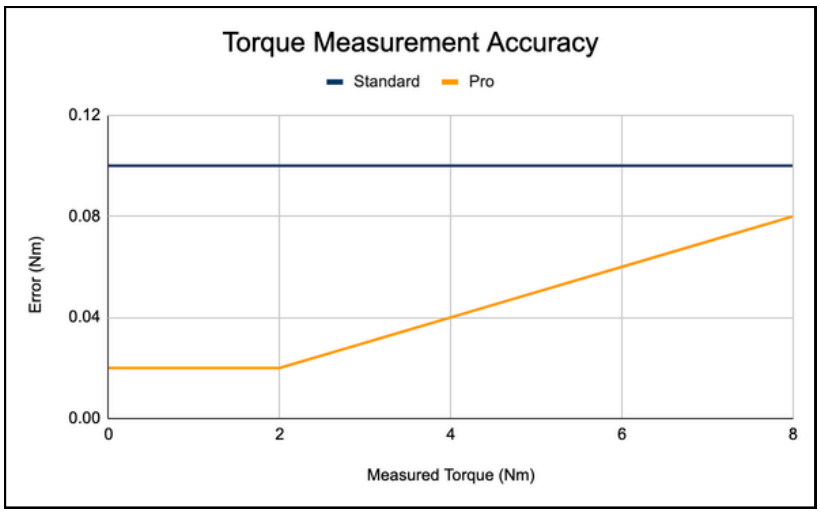
Resolution: Three times the standard deviation of the noise floor measured during a 1-second static recording at the full sample rate. Improved effective resolution may be achieved when exporting filtered data.

ACCURACY

Measurement accuracy was our top priority when designing the Flight Stand. Careful load cell design and calibration has allowed us to offer traceable, industry-leading accuracy with minimal measurement error.

Our Standard thrust stands have a constant error across the measurement range, while our Pro stands have an error proportional to the measured value, offering even higher accuracy.

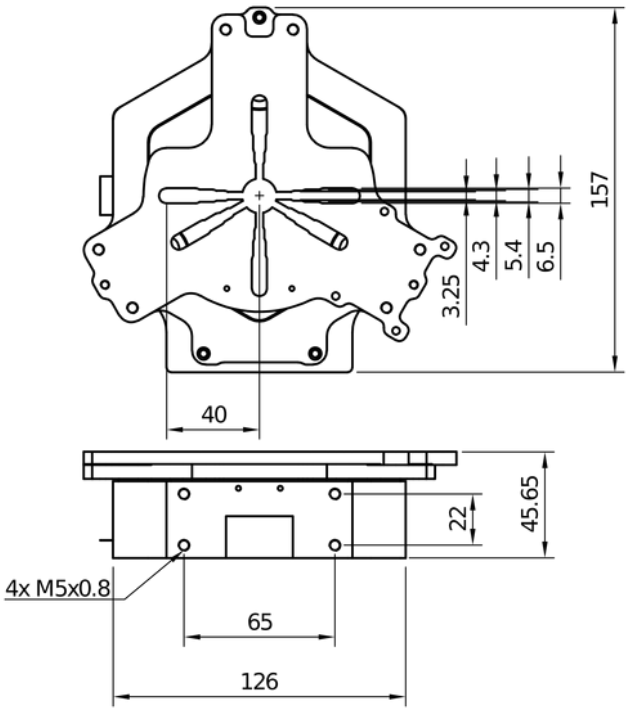




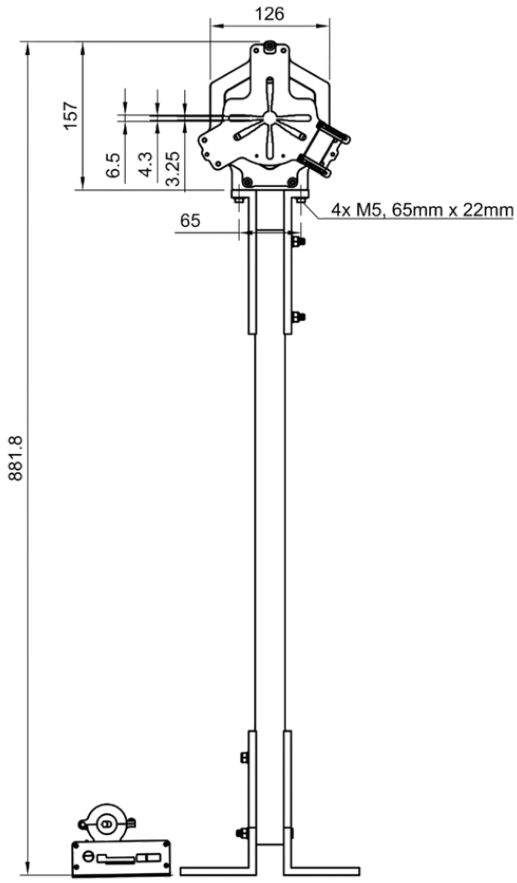
sales@tytorobotics.com
tytorobotics.com • 1-844-722-8378

TECHNICAL DRAWINGS

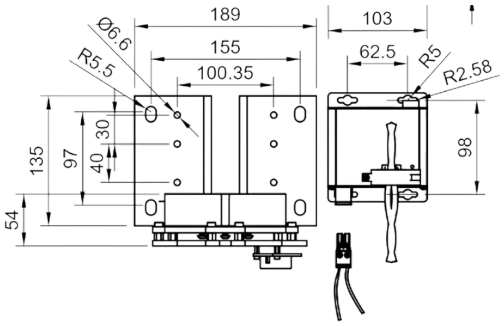
Force Measurement Unit:

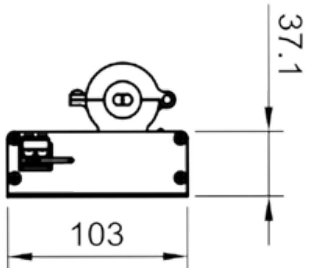


Stand Structure:



Electrical Measurement Unit:

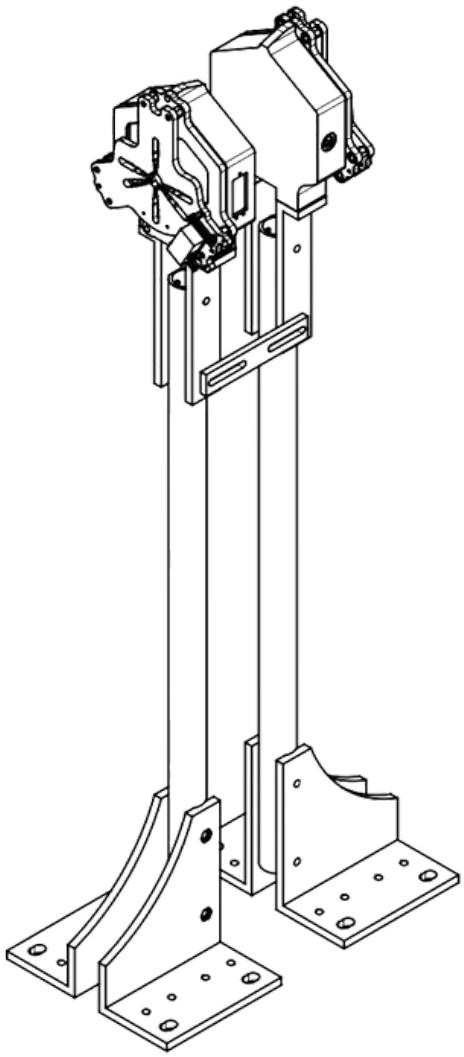


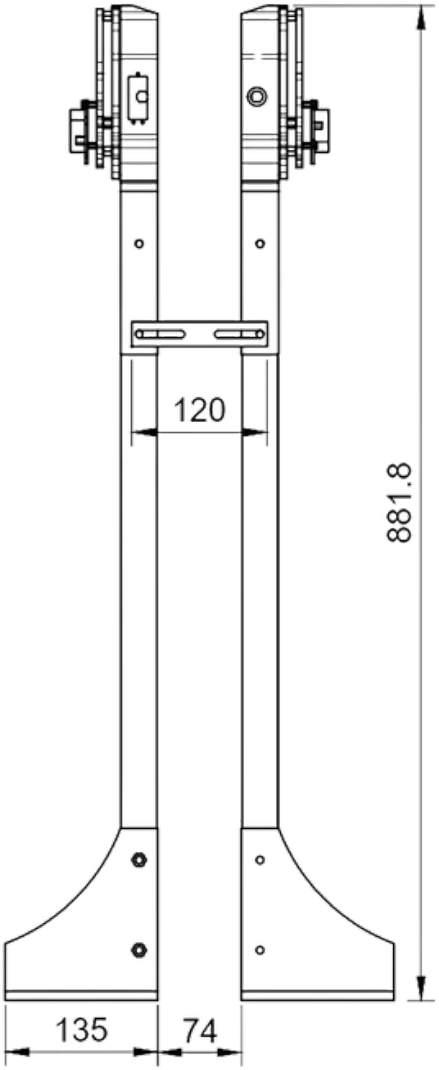


sales@tytorobotics.com
tytorobotics.com • 1-844-722-8378

TECHNICAL DRAWINGS

Dual Motor Configurations:
Note: many configurations possible at different separation distances.





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