

Flight Stand 60

Engine Test Stand for UAV combustion engines and propellers



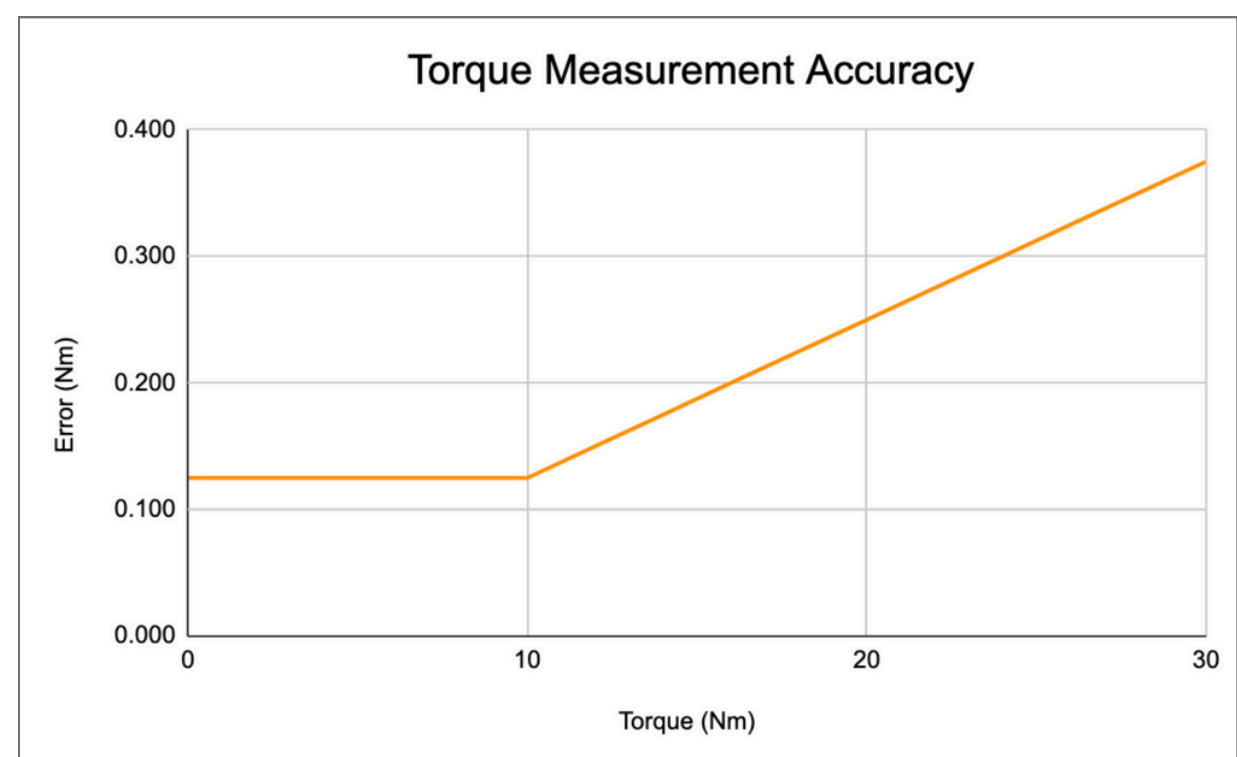
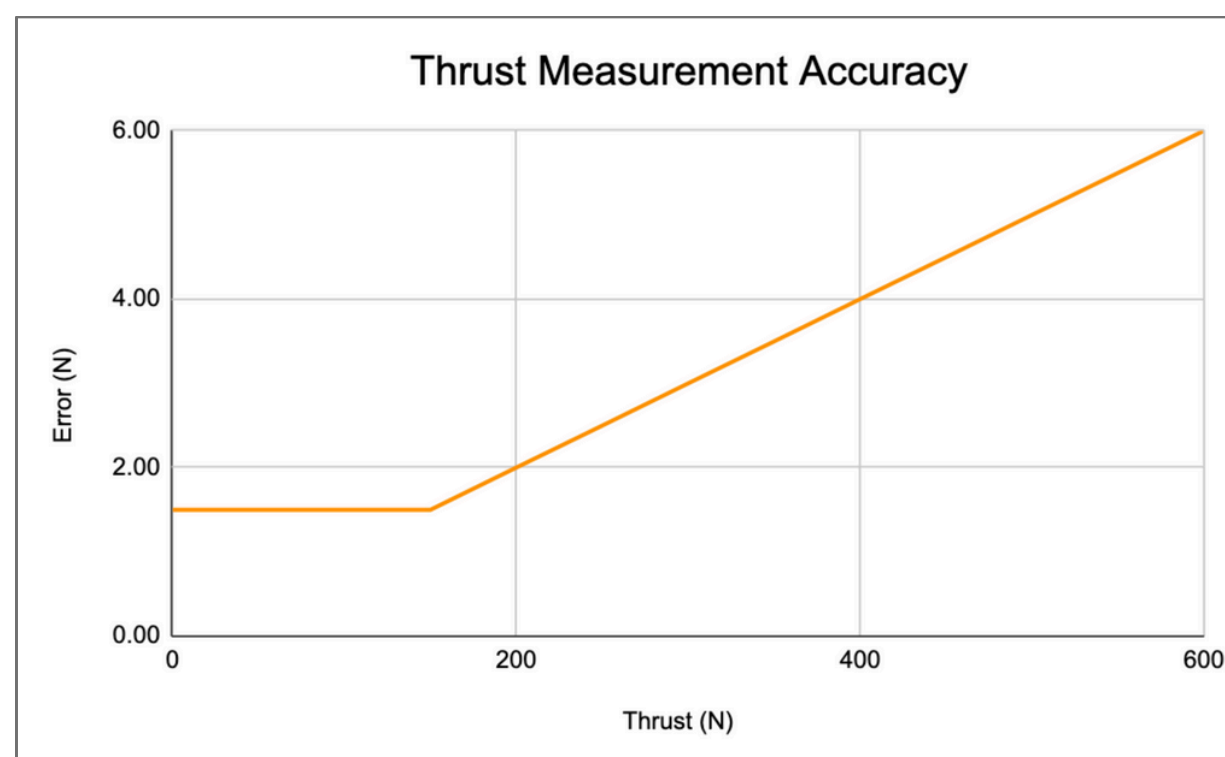
Introduction

The Flight Stand 60 Engine Test Stand provides precise characterization and performance evaluation of internal combustion engines and propellers.

Equipped with an advanced measurement system, it accurately captures thrust, torque, RPM, fuel flow rate, temperature, airspeed, power, and propeller efficiency.

Description

Accuracy

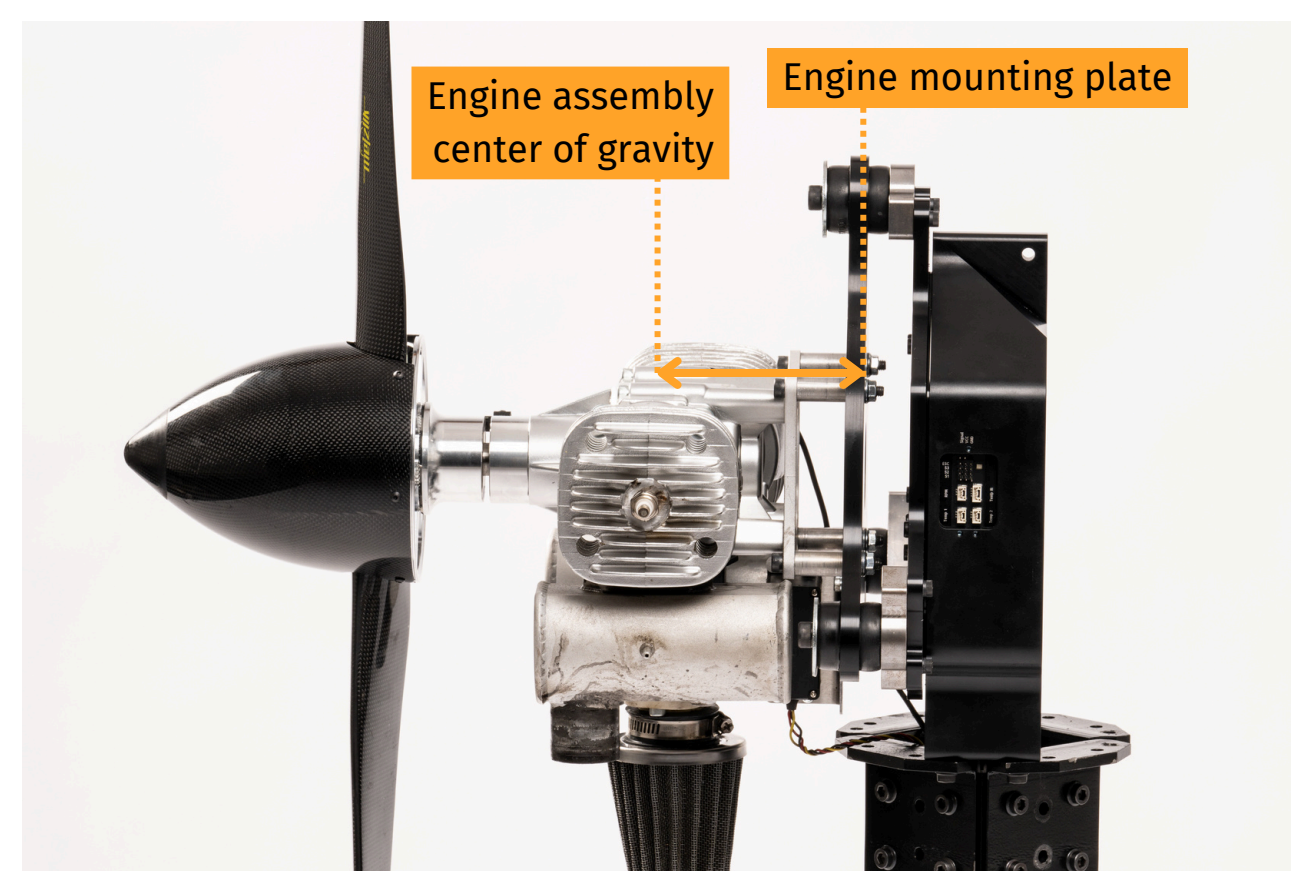


Engine Torque Limit

The torque moment is used to determine if an engine can be tested with the Flight Stand 60. The upper torque limit is 45 Nm, which is a product of the engine's mass and center of gravity (COG) distance.

The distance considered is the separation (in m) between the COG of the engine assembly (engine, carburetor, exhaust, spacers, throttle servo, and propeller) and the engine-facing surface of the motor mount.

See diagram (right) for reference.



Technical Specifications

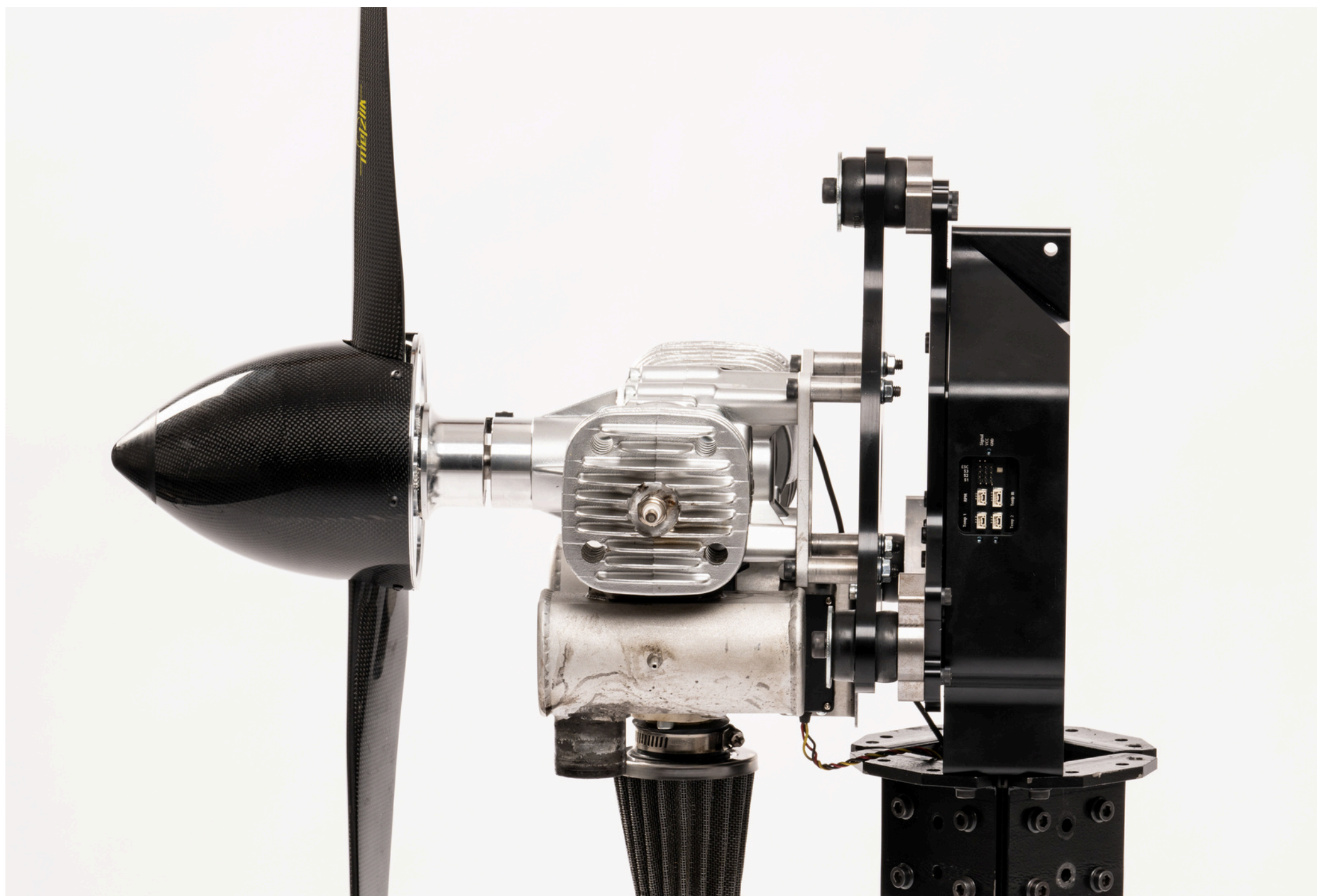
Note: these are preliminary values based on initial tests and may be subject to change.

	Specification	Value
Basic Information	Storage temp & humidity	23°C, 20% - 80% suggested Indoor storage is required for all DAQ components
	Operating temp & humidity	0°C to 40°C, 20% - 80% suggested
	Dimensions	Rotary axe height: 0.8 m
	Input power / Output power	9 V, 2 A, wall plug AC-DC adapters provided
Measurement Information	Sampling rate	Up to 1,000 Hz
	Wireless testing	Yes
	Thrust calibration	ASTM E74 (169 points, push and pull)
	Torque calibration	ASTM E2428 (102 points, CCW only)
	Crosstalk calibration	Pull and Push + CCW only
Fuel Flow Sensor	Range	20 - 800 mL/min
	Resolution	1 mL/min
	Accuracy	±5%
	Power supply	5 V
Thrust	Range	±600 N
	Resolution	0.06 N
	Accuracy	±1.0% of measured value, with lower limit of ±150 N (±1.5 N to ±6 N)
	Temperature effect	1.5 N per 10 degrees Celsius
Torque	Range	±30 Nm
	Resolution	0.05 Nm
	Accuracy	±1.25% of measured value, with lower limit of ±10 Nm (±0.125 Nm to ±0.375 Nm)
	Temperature effect	0.5 Nm per 10 degrees Celsius
Fiber Optic RPM Sensor	Max measurable RPM	Two-blade propeller: 16,800 RPM Three-blade propeller: 11,200 RPM Four-blade propeller: 8,400 RPM
	Min measurable RPM	100 RPM
	Resolution	1 RPM
	Sensor range	Up to 100 mm
	Power supply	12 V, 0.5 A DC output
	Fiber head temperature	Up to 130 degrees Celsius
	Accuracy	±1%
Thermocouple	Range	Up to 800°C
	Sampling rate	1 Hz
	Resolution	1 K
	Accuracy	±1%
Airspeed Sensor	Range (differential pressure)	10 to 498 Pa
	Accuracy (differential pressure)	± 2.25%
	Range (airspeed)	2 to 28 m/s
	Resolution (airspeed)	0.1 m/s
	Response time	0.5 ms
	Pitot tube	Not included
	Humidity	up to 95% RH - non-condensing
	Power supply	5 V (VCC from DAQ)
External Inputs and Outputs	Connect 3rd party sensors	Possible using In/Out API and Transformations feature in Flight Stand software

Key Features

These are some of the key features of the Flight Stand 60 Engine Test Stand:

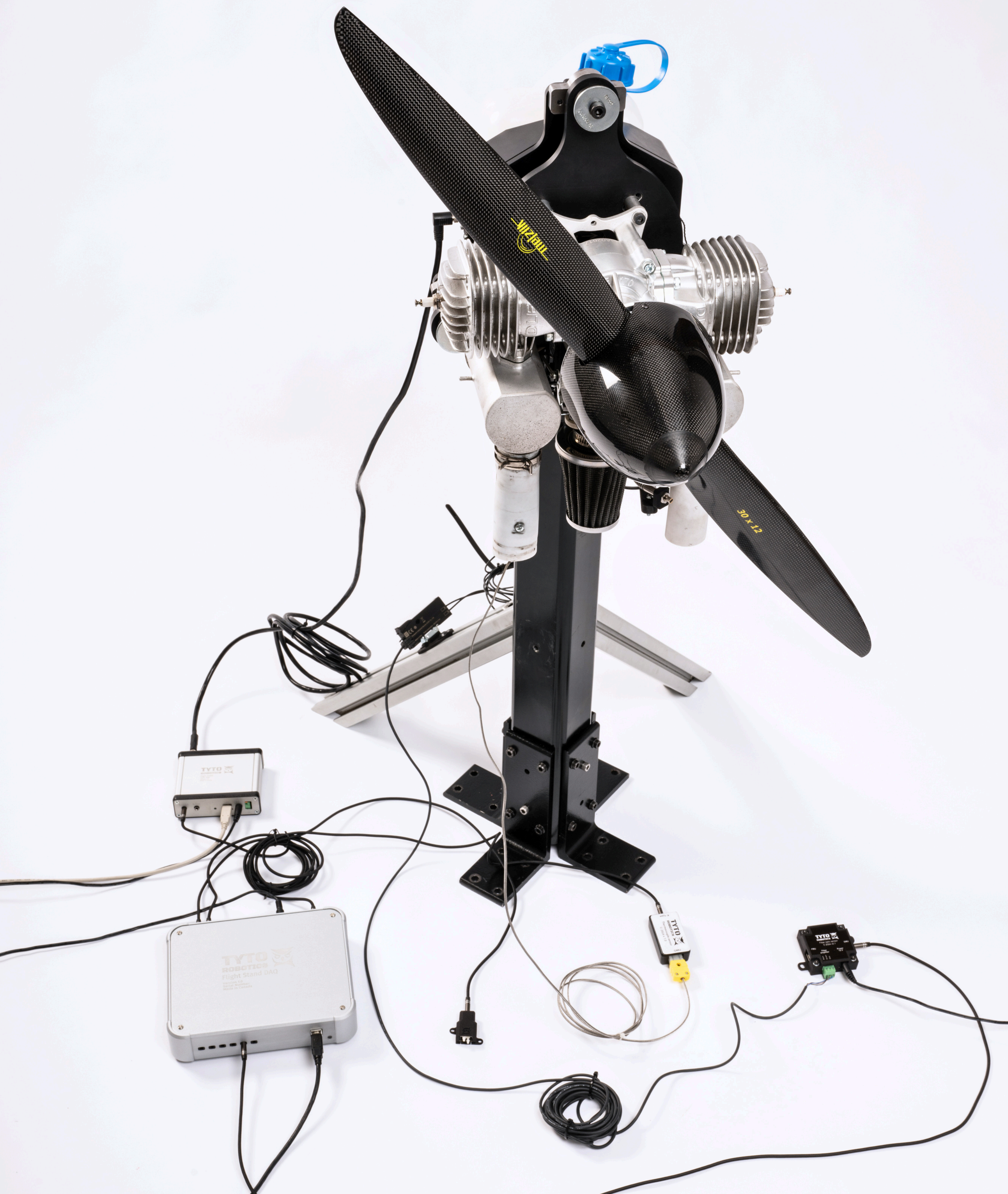
- **Real-time dynamic testing:** made possible by the stand's 1,000 Hz sampling rate on force and torque measurement, enabling advanced analysis of harmonics, vibration, torque ripple, and more.
- **Vibration resistant:** The stand comes with three sets of vibration dampers, each tailored for different engine sizes. The dampers have been carefully chosen to accommodate the weight and structure of combustion engines, based on many hours of testing.
- **ASTM calibration:** our load cells are internally calibrated to ASTM standards to ensure maximum measurement accuracy. Thrust and torque are both calibrated according to ASTM procedures.
- **Wireless control:** remotely control the Flight Stand software from any computer on the same network to maintain a safe distance from the test stand.



Applications

These are some of the possible applications of the Flight Stand 60 Engine Test Stand:

- **Carburetor adjustment and break-in of gas engines:** the Flight Stand 60 provides all the data necessary to fine tune your engine's carburetor before operation. The system provides data on rotation speed, fuel consumption, and exhaust temperature. Easily check the engine's minimum and maximum speed after needle adjustment.
- **Compare engine-propeller combinations:** our automated testing functionality allows you to reproduce the same conditions again and again with different engines and propellers to definitively determine which combination offers the best performance.
- **Measure fuel endurance:** our Flight Replay software feature allows you to upload flight controller data to reproduce your throttle pattern from any flight. This allows you to recreate your flight with your engine and propeller installed on the test stand, replicating your fuel burn to allow you to accurately estimate endurance.
- **Cylinder performance synchronization:** verify the performance of cylinders by comparing the exhaust temperatures and temperature gradients using the thermocouples provided.
- **Generate 3D plots of engine performance:** add a third dimension to your RPM-thrust graphs in order to compare fuel consumption, exhaust temperature, and overall efficiency for engines and propellers generating the same amount of thrust.
- **Test variable pitch propellers with a wind tunnel:** the Flight Stand 60 includes 3 servo ports that allow you to control variable pitch propellers. Pair the test stand with a wind tunnel to characterize propeller performance at various pitches and air speeds.
- **Crank angle optimization:** data acquired with the Flight Stand 60 can be used to optimize the angle of your crank shaft to achieve optimal combustion.

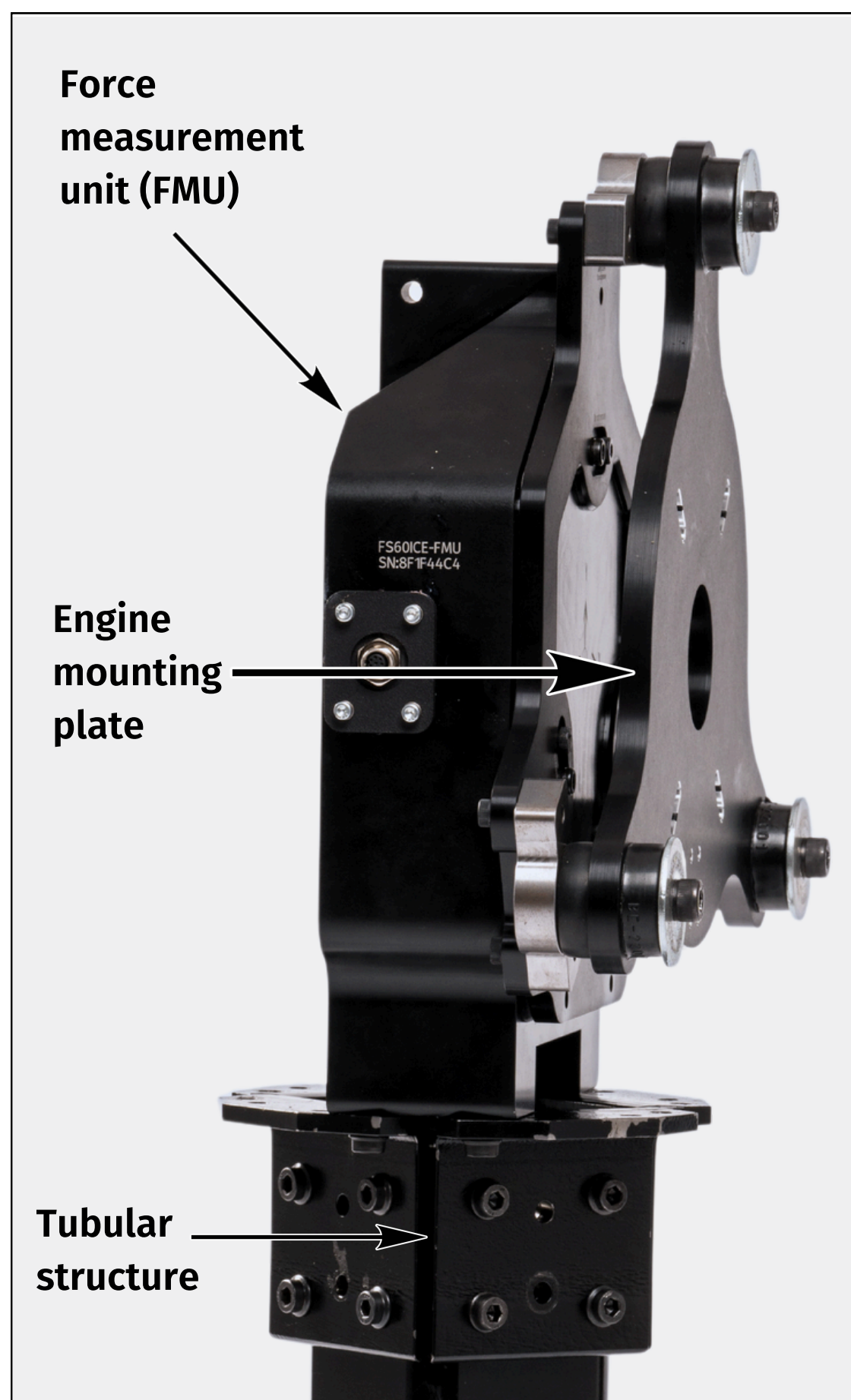


What's Included

The Flight Stand 60 comes fully equipped with hardware, electronics, and software.

Here's what's included with your test stand:

- **Force Measurement Unit (FMU):** measures thrust and torque
- **Data Acquisition (DAQ) unit:** core unit connecting FMU and sensor measurements
- **Sync Hub:** synchronizes measurements from the FMU and DAQ
- **Fuel flow sensor:** measures the rate of fuel flow
- **Tubular structure:** supports the FMU and propulsion system, protects wiring
- **Engine mounting plate:** attaches the engine to the test stand
- **Thermocouples (2):** measures the temperature of your system (i.e. exhaust temperature)
- **Fiber optic RPM sensor:** measures the propeller's rotation speed
- **Airspeed pressure sensor:** measures the airspeed around your system
- **Flight Stand software**



Data Acquisition Unit



Sync Hub



Fuel flow sensor



Fiber optic RPM sensor



Thermocouple



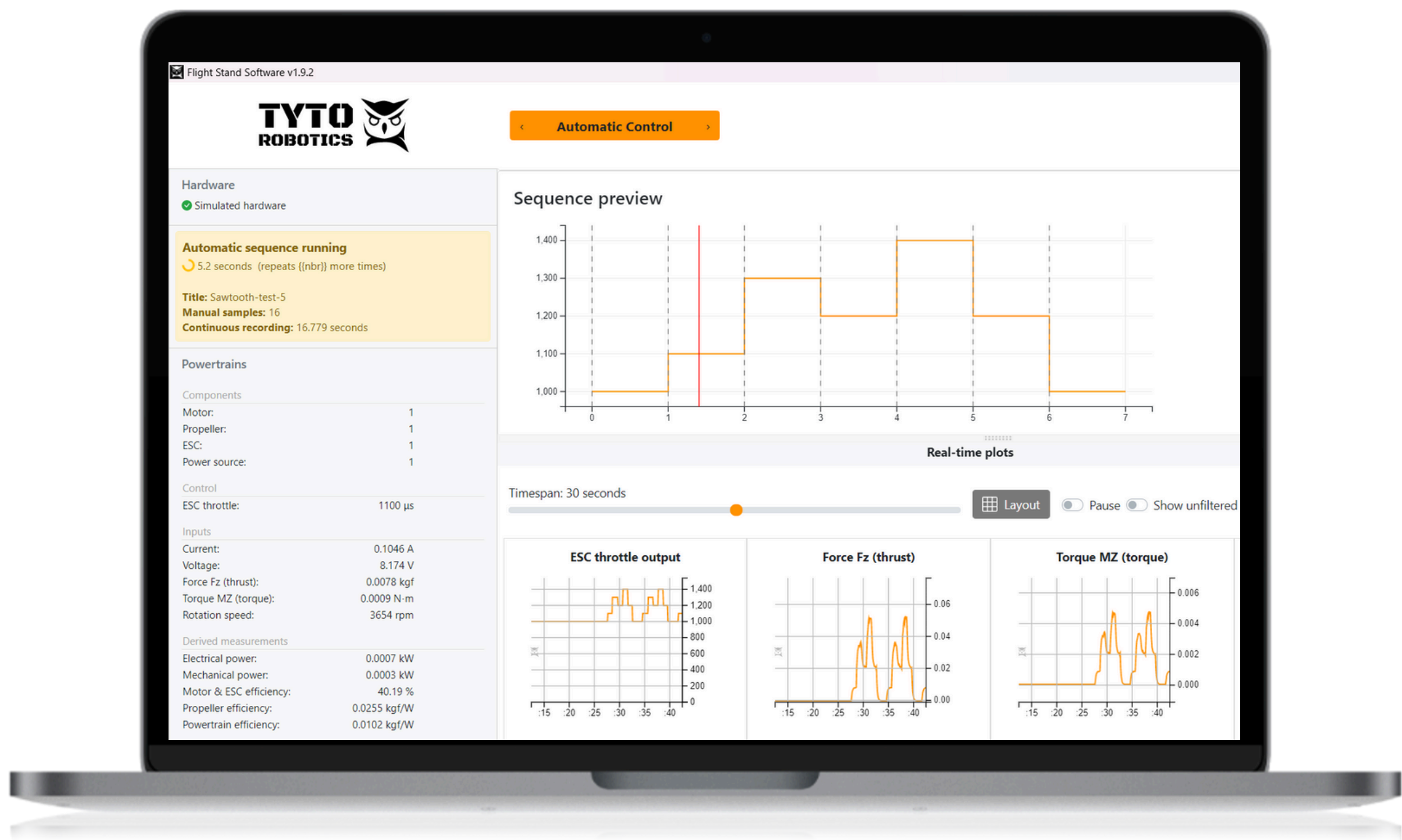
Airspeed pressure sensor

Software Experience

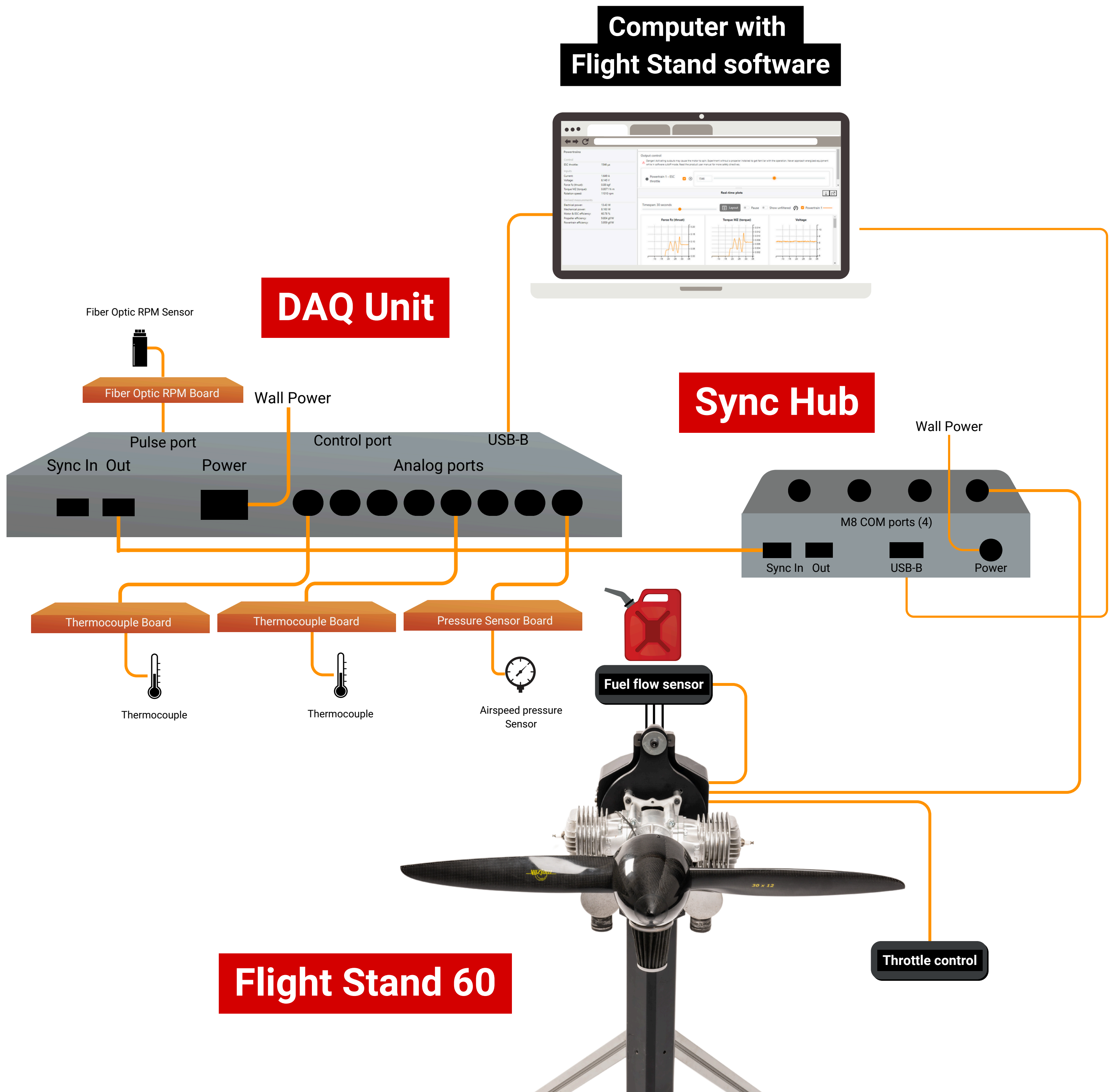
The Flight Stand software is used to control your test stand and record your data. Manually control tests with a throttle slider or automate tests using a data table, data from a .CSV file, or our Python API.

Key Features:

- **Connect analog sensors:** connect and control third party sensors with the Flight Stand software. Examples include acoustic and vibration sensors, wind tunnels, and more.
- **Control variable pitch propellers:** manually control propeller pitch with a slider or automate propeller pitch changes according to pre-set time intervals.
- **Real-time plots:** visualize live performance data as it is collected. Customize your layout, data noise level, and displayed time frame.
- **Detailed software tutorials:** we offer detailed [articles and videos](#) that explain and demonstrate how to use the Flight Stand software. They are easy to follow and will help you make use of all the features available.

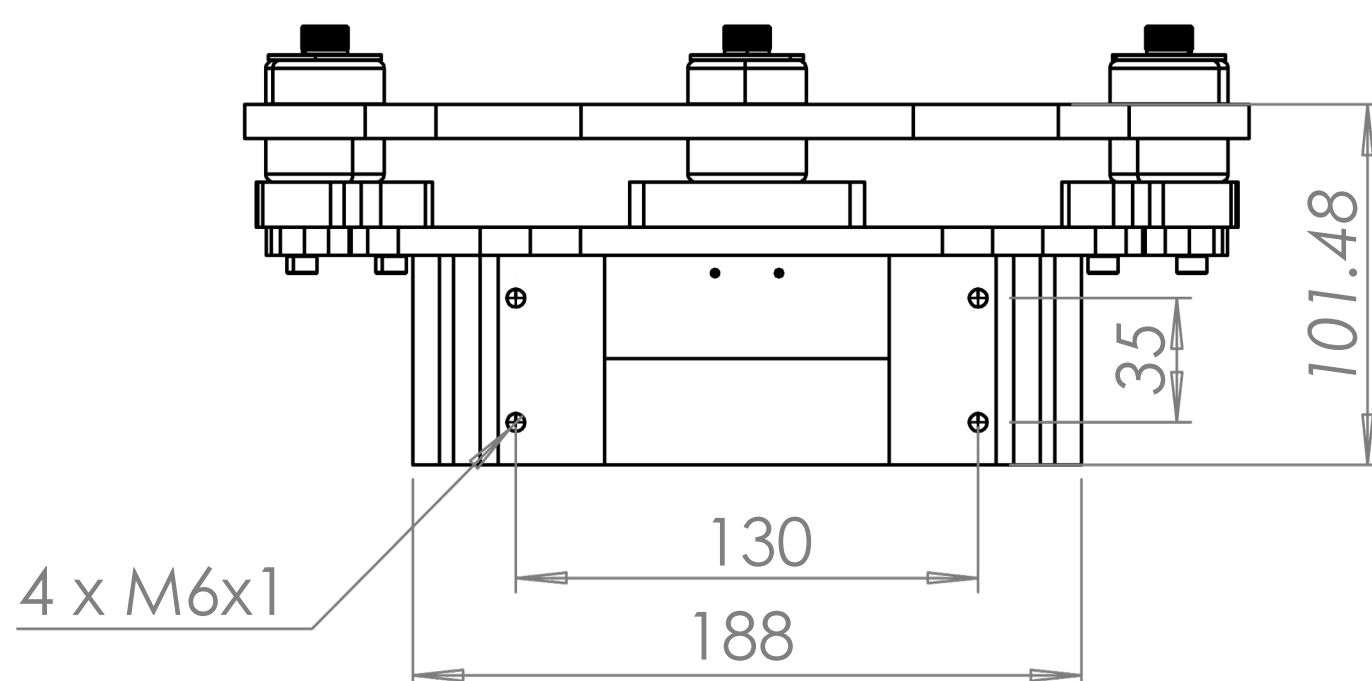
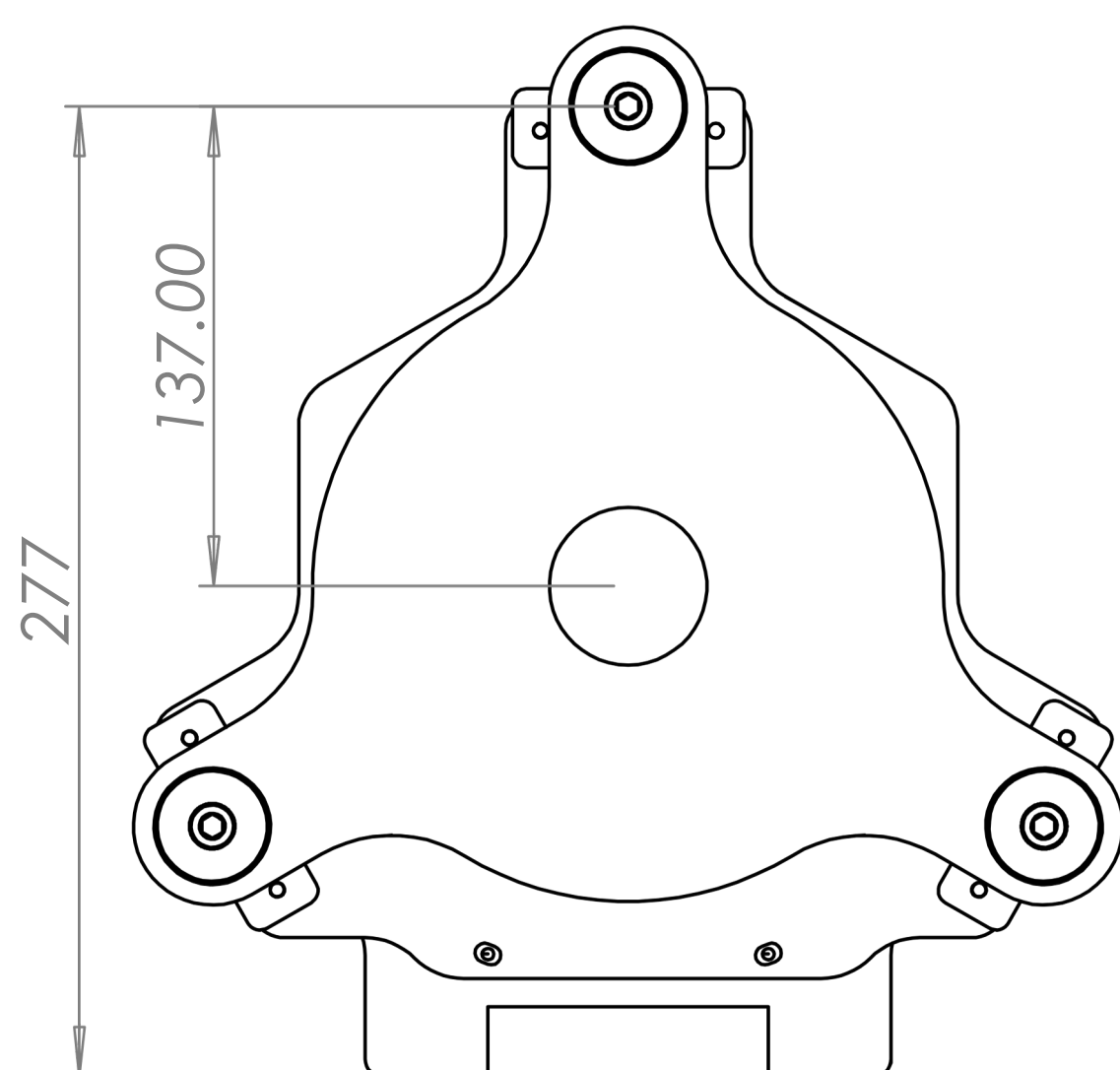


Example Test Schematic



Technical Drawings

Force Measurement Unit:



Stand Structure

