

## Series 1580 dynamometer and thrust stand datasheet

### Typical use

- Inrunner and outrunner brushless motor characterization (0-40A)
- Propeller characterization
- Servo testing and control
- Battery endurance testing
- Factory test



### Features list

- Direct measurements
  - Torque
  - Thrust
  - Voltage
  - Current
  - Rotations per minute
  - Motor winding resistance
  - Accelerometer on PCB
- Derived measurements
  - Motor efficiency (%)
  - Propeller efficiency (g/W)
- USB interface
- ESC manual control
- Three servo control ports
- Automatic control
- Powerful scripting
- Three I2C ports
- Three temperature probe ports
- Read motor winding resistance
- Output data to CSV files
- Real-time sensor plots
- Included calibration hardware

### Technical specifications

**Table 1:** Design specifications of the RCbenchmark motor testing tool.

Specification	Min.	Max.	Tolerance	Unit
Thrust	-5	5	0.5%	kgf
Torque	-1.5	1.5	0.5%	Nm
Voltage	0	35	0.5%	V
Current	0	40	1%	A
Angular speed*	0	190k	-	eRPM
Coil resistance	0.003	240	0.5%	Ohm
Digital scale	0	3	0.5%	kgf

\*Electrical RPM, divide by the number of motor poles to obtain true mechanical RPM.

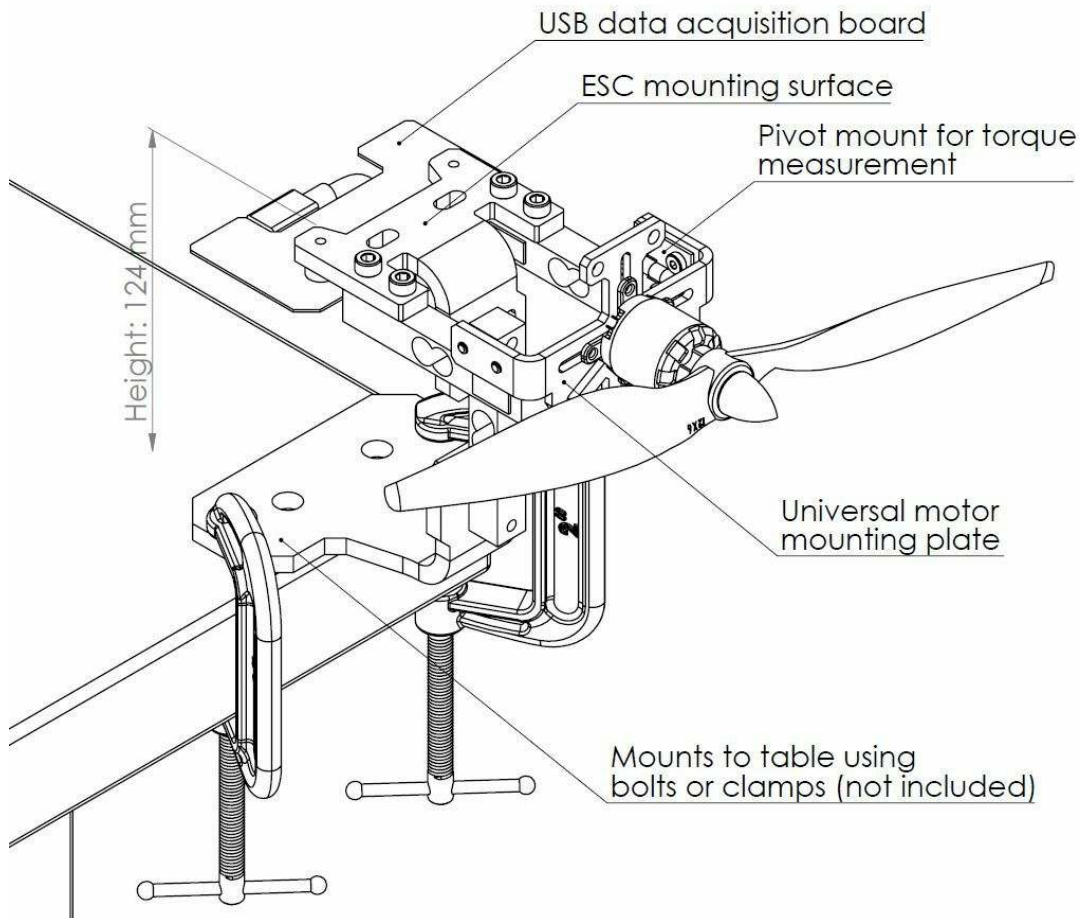
Sampling rate depends on your computer (up to ~50Hz) and is lower for the load cells (~8Hz)

**Software features list**

- Real time graphs
- Manual motor control
- Manual servo control
- Calibration wizard
- Safety cutoffs based on any measured data
- CSV export
- Automated test
  - Ramps
  - Steps
  - Measure Kv
  - Measure number of poles
  - And more...
- User scripts with documentation

**Hardware**

The RCbenchmark dynamometer is designed to greatly reduce the time required for characterizing, testing, and designing brushless motors, while obtaining precise and accurate results. Figure 1 shows an overview of the important components of the tool.

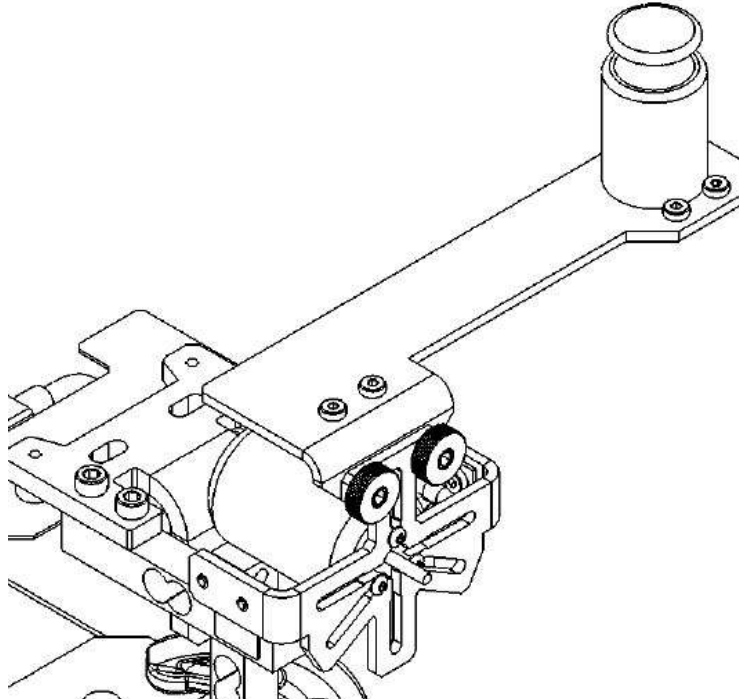


**Fig. 1:** Hardware overview

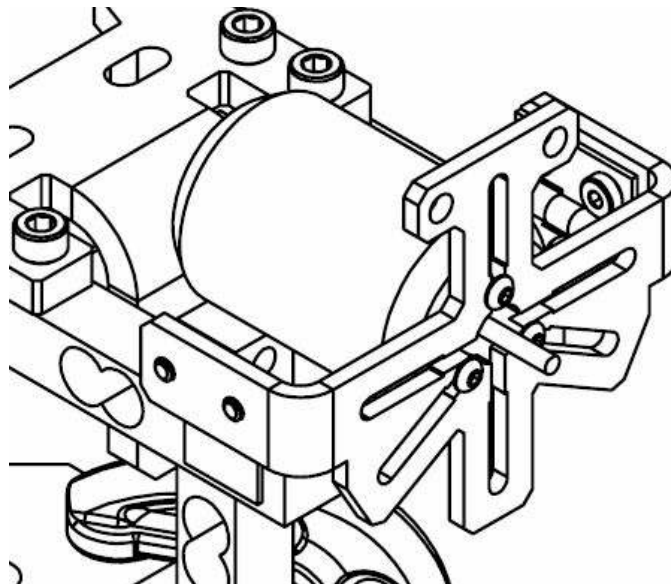
For a given **voltage**, brushless motor **speed** is a function of two variables: the **mechanical load** (in Nm), and the **input** (which can be measured in duty cycle or percentage of the maximum command sent to the ESC). The motors are characterized by changing the **input** from the software and by changing the **load** with multiple propellers. The load changes as the propellers have different size and pitch.

### Calibration

The device is supplied with calibration hardware for both the torque and thrust measurements. Figure 2 shows the device with its included calibration hardware and precision weight. See the manual and the app for calibration instructions.



**Fig. 2:** Calibration Hardware (included)

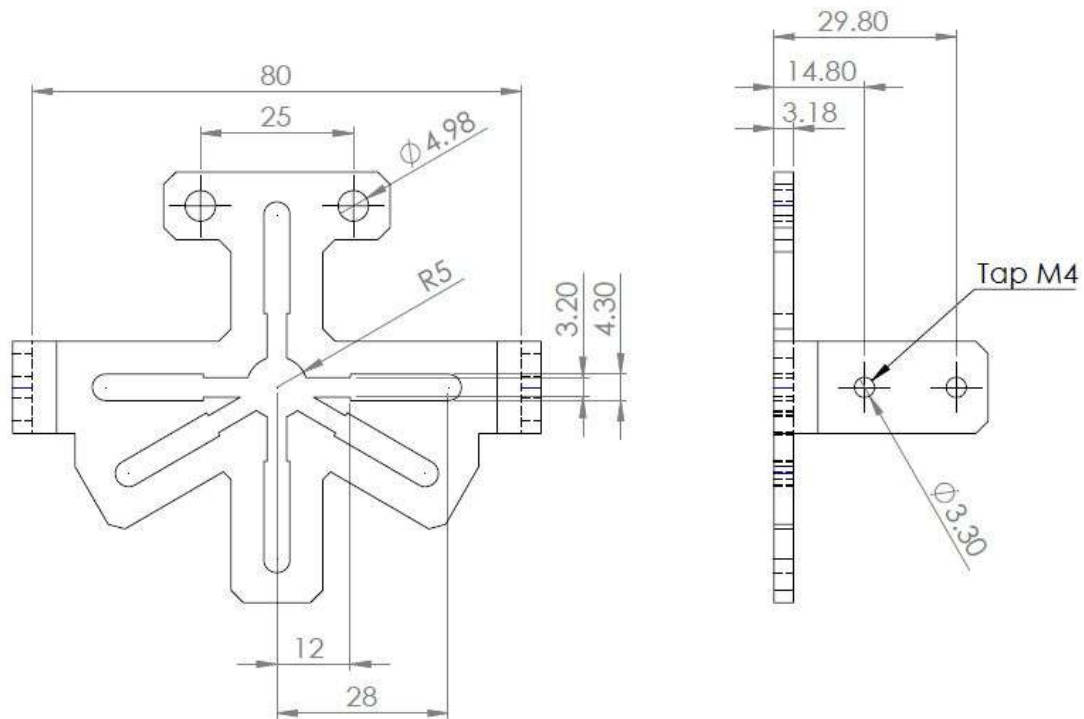


**Fig. 3:** Mounting shown with 36mm  $\varnothing$  and 53mm length inrunner motor.

The test device can accept most inrunner and outrunner brushless motors with M2 to M4 screws and screw spacing of up to 56mm. Inrunner motors can have a maximum length of

55mm and a maximum diameter of 48mm. Figure 3 shows an example of an inrunner mounted on the device.

Use the drawing in Figure 4 to check if you can install your motor on the device. The pattern fits almost all standard motors. Otherwise, you can make a wood adapter, or design your own motor mounting part using the dimensions in the drawing.



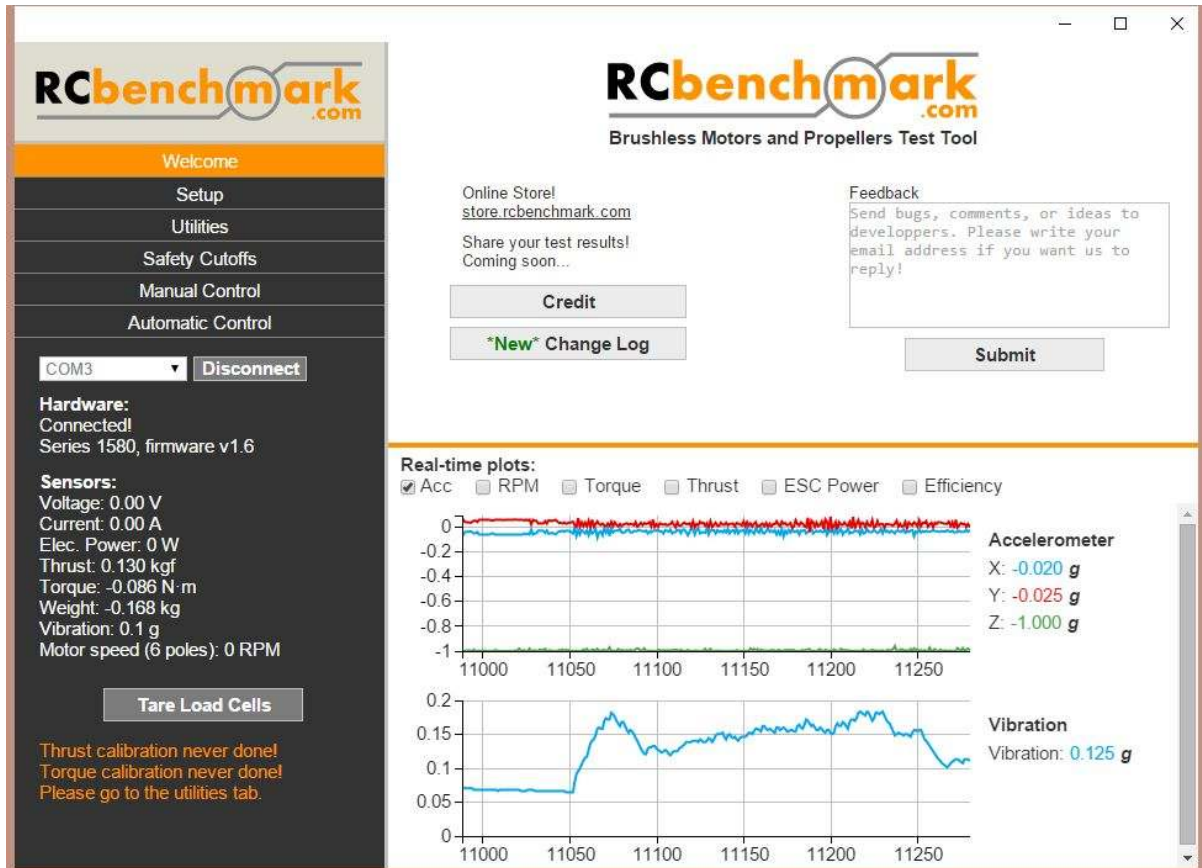
**Fig. 4:** Motor mounting part dimensions

## Safety

Fast spinning propellers and motors can potentially cause harm to the user. Safety goggles must always be worn when testing. The software has automatic cutoffs based on the specifications of the device. These cutoffs can be further limited by the user to, for example, prevent a propeller from spinning too fast or a motor from using too much current.

## Software

The software allows the user to control the motor and up to three servo-motors. It displays the sensor information in text and graphical form. The user can record all of the measured data with a single click, or record continuously. The output is a CSV file, which can be easily opened with spreadsheet software or many other software packages.



### Deployment and custom use

The software is open source. It is a Chrome app that runs Windows, Linux, Mac and Chrome OS. An internet connection is required to download the software. The firmware is written in C and the GUI is written in Javascript, which should be very simple to learn for users with C/C++ experience. Updates are done automatically through the web.