

U3.0 and U4.0



1 Features

- 3 degrees of freedom with one actuator
- Generate thrust & vector thrust in 2 axes
- Enables new vehicle designs
- Rated to 50 hours of flight

2 Applications

- Aerial Robotics
- 2 actuator UAV (4 DOF flight)
- Sliding quadrotor (6 DOF flight)

3 Description

The U3.0 (UPT-23-10-CCW) and U4.0 (UPT-23-10-CW) are propellers designed to allow the control of thrust and propeller angle. With these propellers, a hovering UAV can be built with just two actuators. A second actuator could be an additional underactuated propeller in a coaxial, tandem, or tilt rotor configuration. A standard anti-torque rotor similar to a helicopter can also be used. In this case the performance of a fixed-pitch helicopter can be achieved without the use of a swashplate, dramatically reducing complexity.

On a standard quadrotor the UPT-23-10 can be used to allow for 6 degree of freedom control by vectoring the thrust of the rotors while using standard quadrotor roll and pitch controls to maintain attitude.

The UPT-23-10 is designed to interface with the Vertiq 23-06 2200Kv and Vertiq 23-14 920Kv modules. It can be controlled using the IQUART communication protocol. It is fully supported in PX4 and example code is available for Ardupilot.

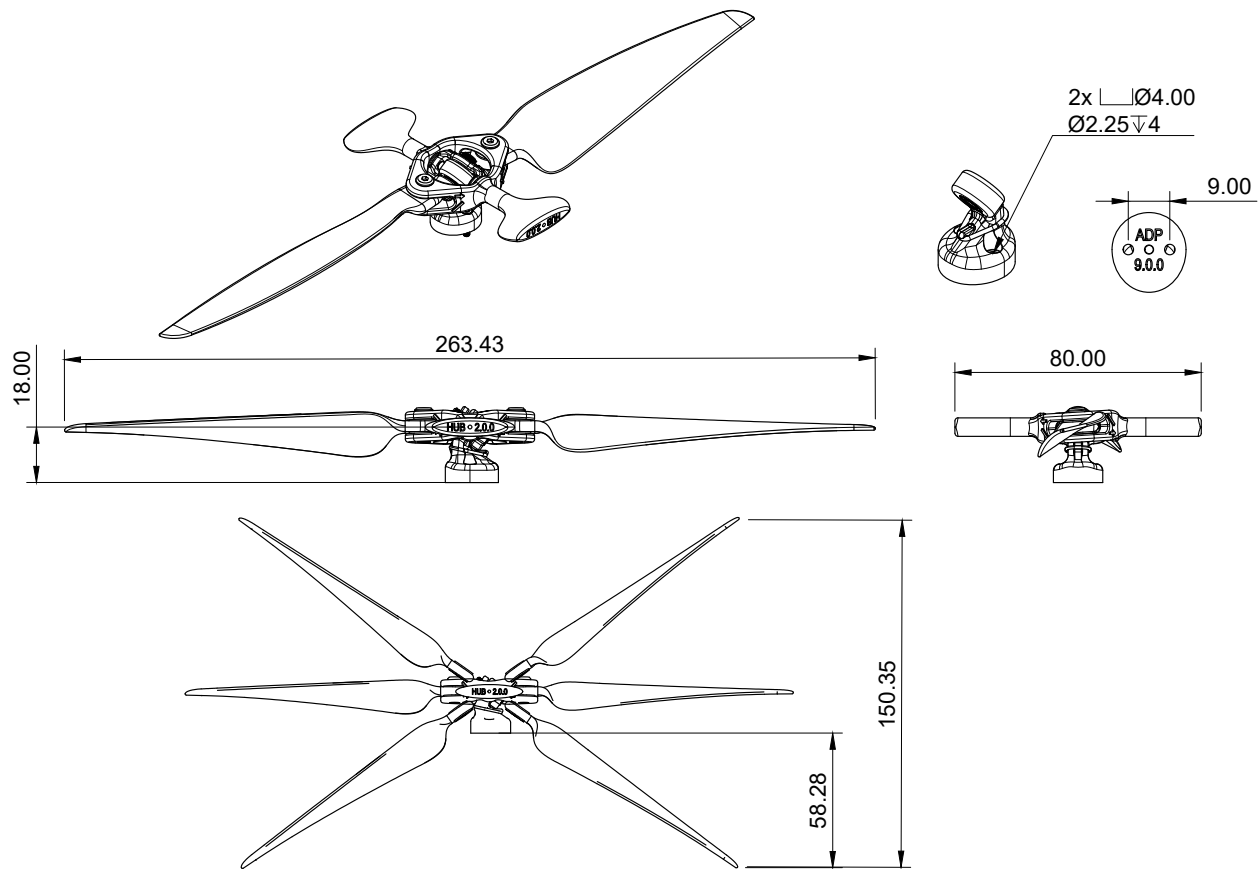
4 Technical Specifications

Table 1: Propeller Specifications

Description	Symbol	Value	Unit	Notes
Diameter	d	10.4	in	
Pitch	p	4.5	in	
Mass	m	24.6	g	
Nominal Thrust	$F_{z,nom}$	300	g	For Vertiq 23-06
Nominal Thrust	$F_{z,nom}$	400	g	For Vertiq 23-14
Max Control Thrust	$F_{xy,max}$	110	g	At nominal thrust of 300g
Max Control Thrust	$F_{xy,max}$	140	g	At nominal thrust of 400g
Max Continuous Thrust	$F_{z,continuous}$	540	g	Thermally limited by Vertiq 23-06 continuous torque
Max Continuous Thrust	$F_{z,continuous}$	750	g	Thermally limited by Vertiq 23-14 continuous torque
Max Tested Thrust	$F_{z,max}$	1100	g	Maximum thrust reached by Vertiq 23-14 during burst

5 Mechanical Interface

The UPT-23-10 is composed of a mast, a pulse collar, a teeter collar, and two blades. The mast interfaces directly with Vertiq 23 series modules via two M2x8mm screws on a 9mm diameter circle. The blades are attached to the teeter collar via an internally threaded shoulder bolt. The teeter collar is attached to the pulse collar by two captive pins. The pulse collar is attached to the mast by a single 3mm shoulder bolt. It is fixed with a single M2 nut.



All measurements are in mm

6 Thrust Performance Data

Note: All data is collected using a Vertiq 23-14 920Kv module.

Figure 1: Thrust vs Speed

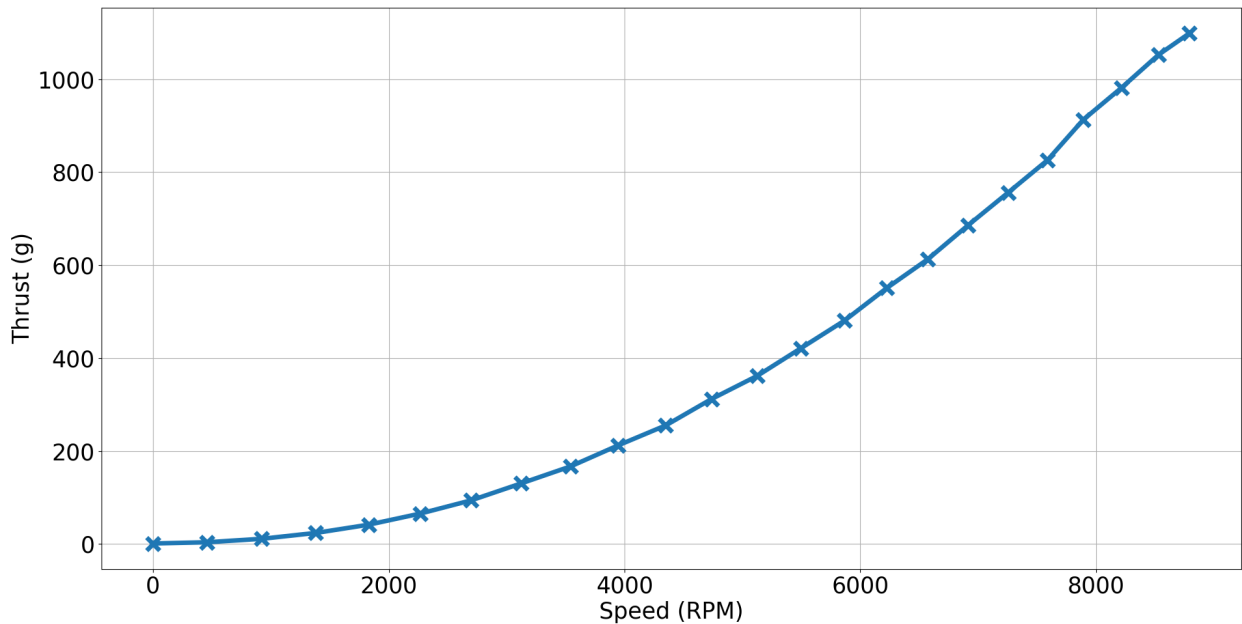


Figure 2: Torque vs Speed

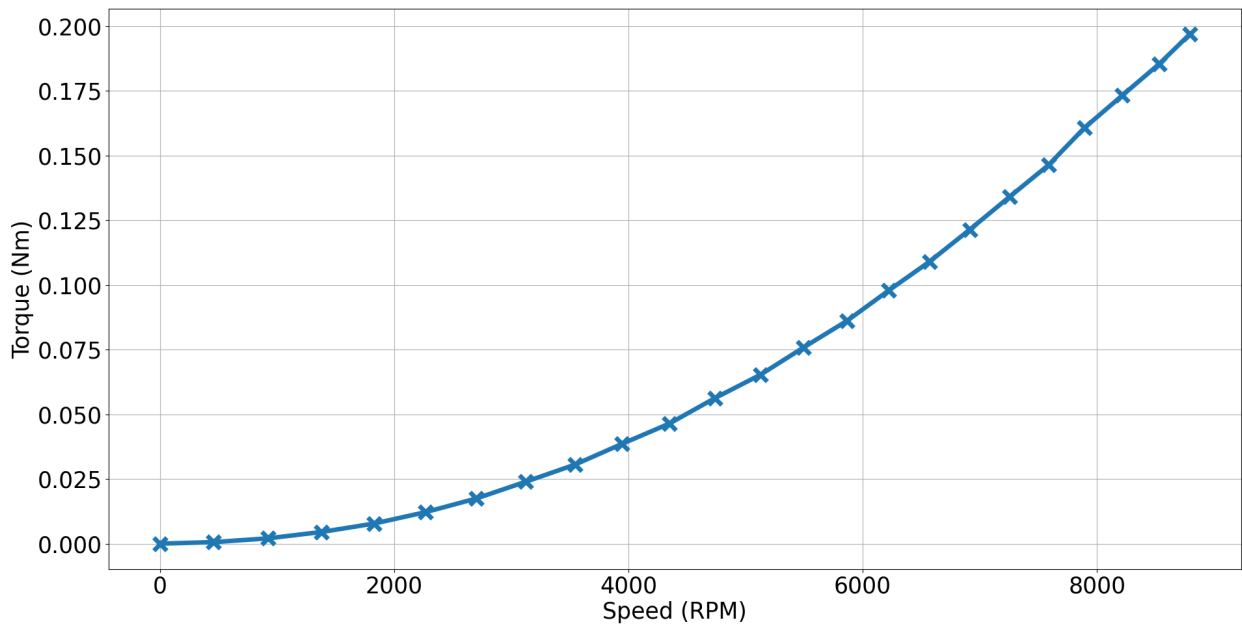
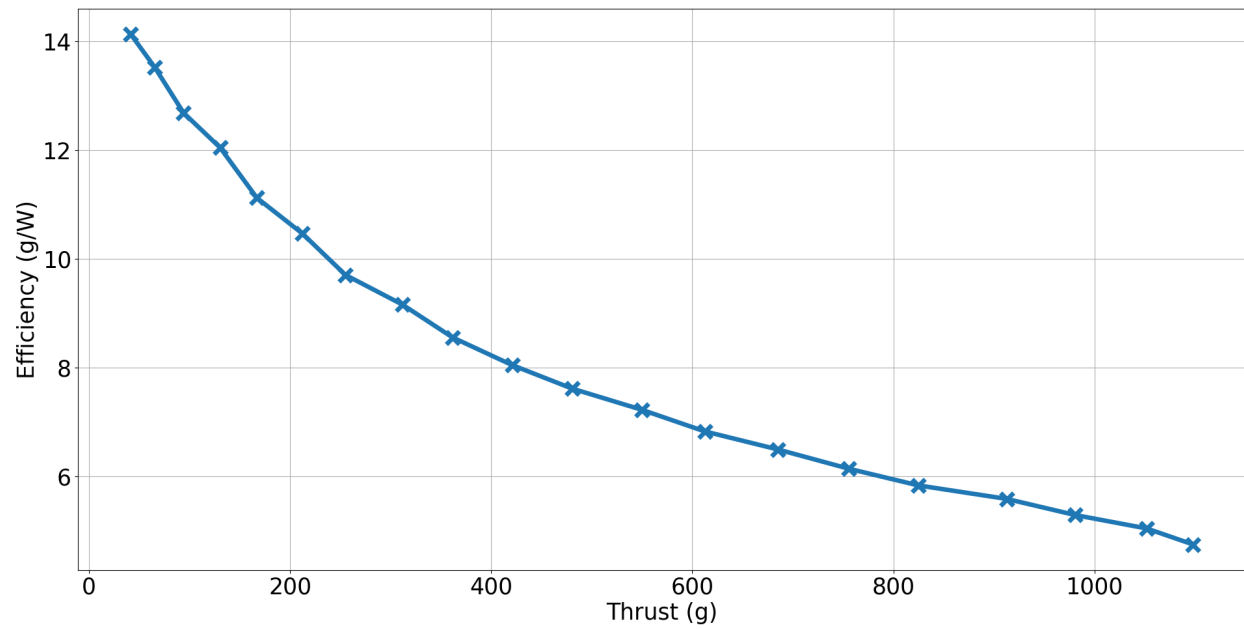


Figure 3: Grams/Watt Efficiency as measured with Vertiq 23-14 920Kv module



7 Control Performance Data

Figure 4: Maximum Control Thrust vs Vertical Thrust

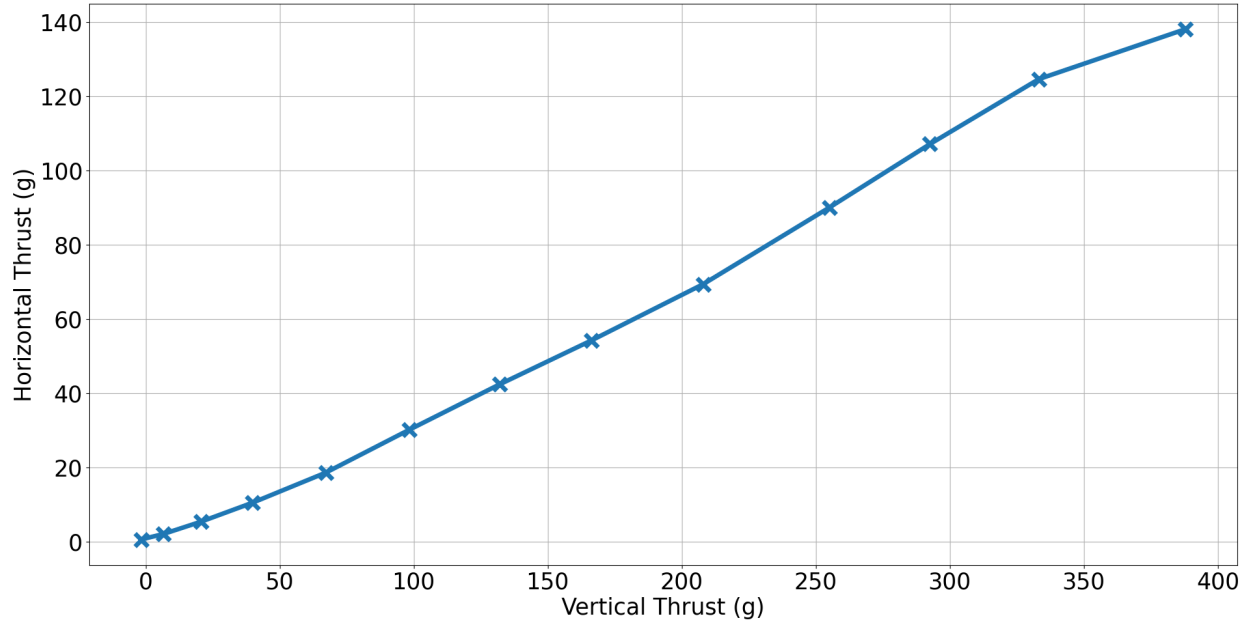


Figure 5: Control Thrust Performance vs Vertical Thrust and Control Thrust (23-06)

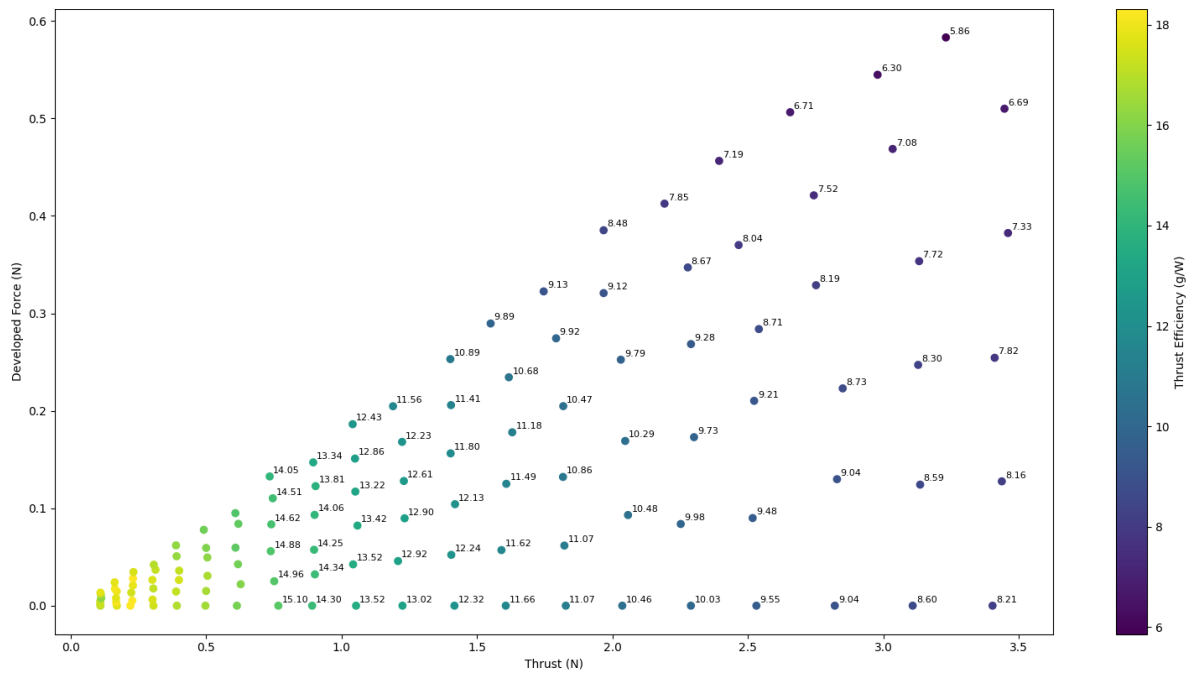
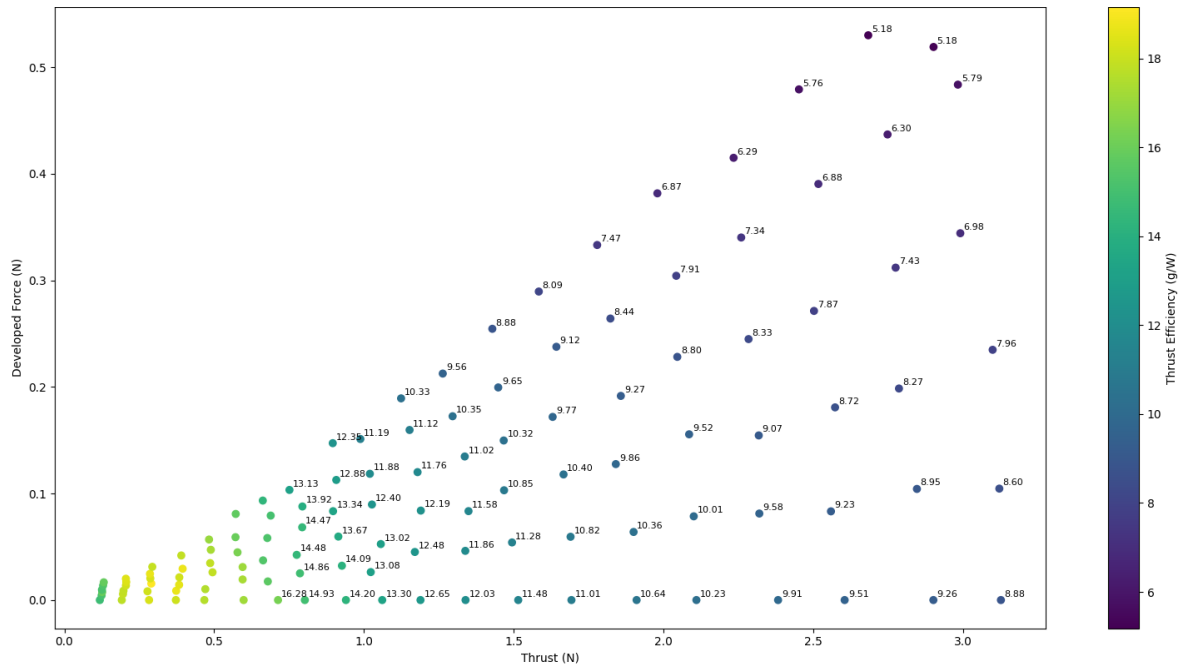


Figure 6: Control Thrust Performance vs Vertical Thrust and Control Thrust (23-14)



8 Additional Documentation

- [Product Page](#)
- [23-06 Thrust data](#)
- [23-14 Thrust data](#)
- [Manual, Tutorials, and API Documentation](#)
- [API Libraries](#)

9 Revision History

Table 2: Revision History

Version	Date	Changes
1.0	2024-11-14	Initial Version
1.1	2026-04-08	Added Control Performance Data