# MULTI-DOF TORSION

Explore torsional dynamics and robotics concepts

The Multi-DOF Torsion module is ideal to introduce principles of robotics and torsional dynamics. Demonstrate real-world control challenges, such as the effect of flexible coupling between an actuator and a load encountered in complex industrial processes.

The Torsion module consists of an instrumented bearing block mounted in a solid frame. A shaft inside the bearing block is free to spin, rotating the torsional load of two disks on a support bar. The shaft rotation is measured by an encoder. The shaft can be outfitted with a flexible coupling allowing to attach another Torsion module.

The Torsion module couples to the Rotary Servo Base Unit, which rotates the flexible coupling attached the torsion load. Up to seven Torsion modules can be coupled in cascade. That allows to create multi-DOF control problems to expand the complexity of experiments.

Features
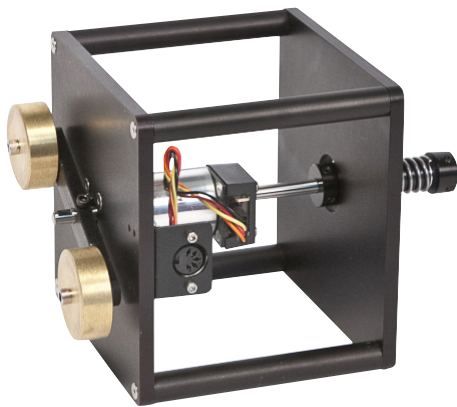
Precise
The system's inherent precision helps deliver accurate, repeatable results required for teaching & research labs.

Robust
A durable system able to accommodate enthusiastic undergraduate students.

Comprehensive Courseware
Courseware for MATLAB®/Simulink® or LabVIEW™ covers modelling and control topics.

Expandable
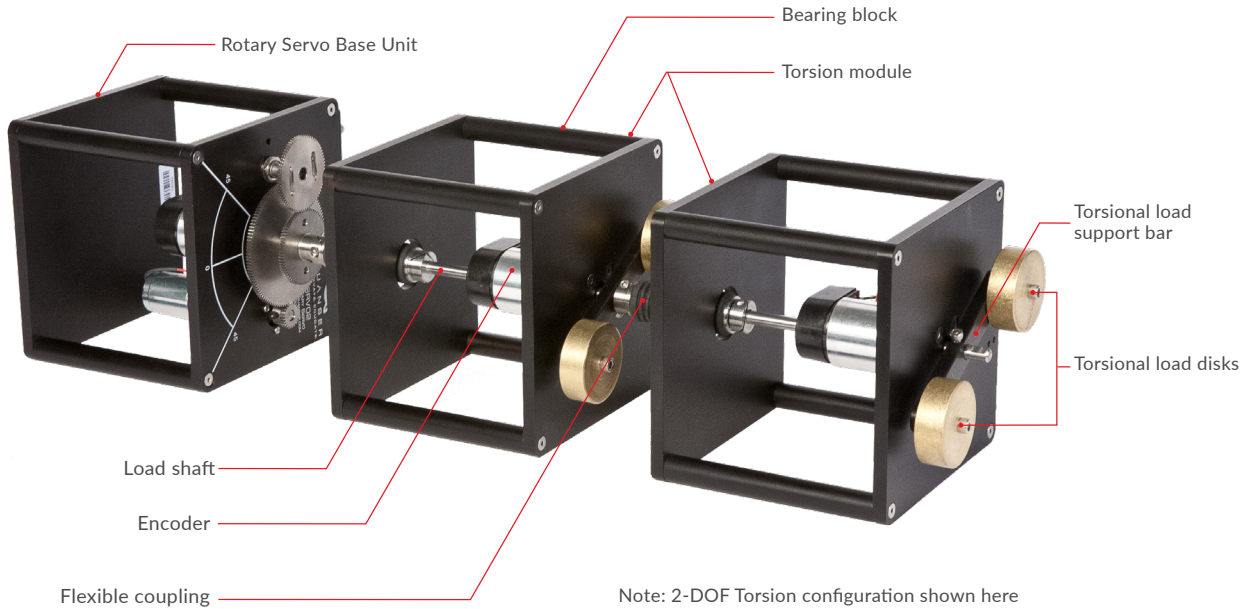Use the Rotary Servo Base Unit on its own, or add one of other nine modules[1] for experiments of varying complexity across a wide range of topics and disciplines.

Workstation Components

Plant	Rotary Servo Base Unit Torsion module
Data acquisition device	Quanser Q2-USB (single Torsion unit) Quanser Q8-USB (two or more Torsion units)
Amplifier	Quanser VoltPAQ-X1
Control design environment	QUARC for MATLAB®/Simulink® QRCP for LabVIEW™

[1] The add-on modules are sold separately

Product Details

Rotary Servo Base Unit

Bearing block

Torsion module

Torsional load
support bar

Torsional load disks

Load shaft

Encoder

Flexible coupling

Note: 2-DOF Torsion configuration shown here

Courseware

Modelling Topics
- First-principles derivations (1 DOF Torsion)
- Lagrange derivation (2 DOF Torsion)
- State-space representation (1 DOF and 2 DOF Torsion)
- Model validation (1 DOF and 2 DOF Torsion)
- Parameter estimation (1 DOF and 2 DOF Torsion)

Control Topics
- Linear quadratic requlator
- Vibration control

Device Specifications

Torsion module dimensions (L x W x H)	21 x 13 x 13cm
Torsion module mass	1.2 kg
Torsion load disk diameter	3.8 cm
Torsion load disk mass	2.2 g
Load support length	4.4 cm
Flexible coupling stiffness	1.0 N.m/rad

About Quanser:

For 30 years, Quanser has been the world leader in innovative technology for engineering education and research. With roots in control, mechatronics, and robotics, Quanser has advanced to the forefront of the global movement in engineering education transformation in the face of unprecedented opportunities and challenges triggered by autonomous robotics, IoT, Industry 4.0, and cyber-physical systems.