



# Cogging Torque and Torque Ripple Test Systems

For DC motors, BLDC motors, AC servo motors, and stepping motors

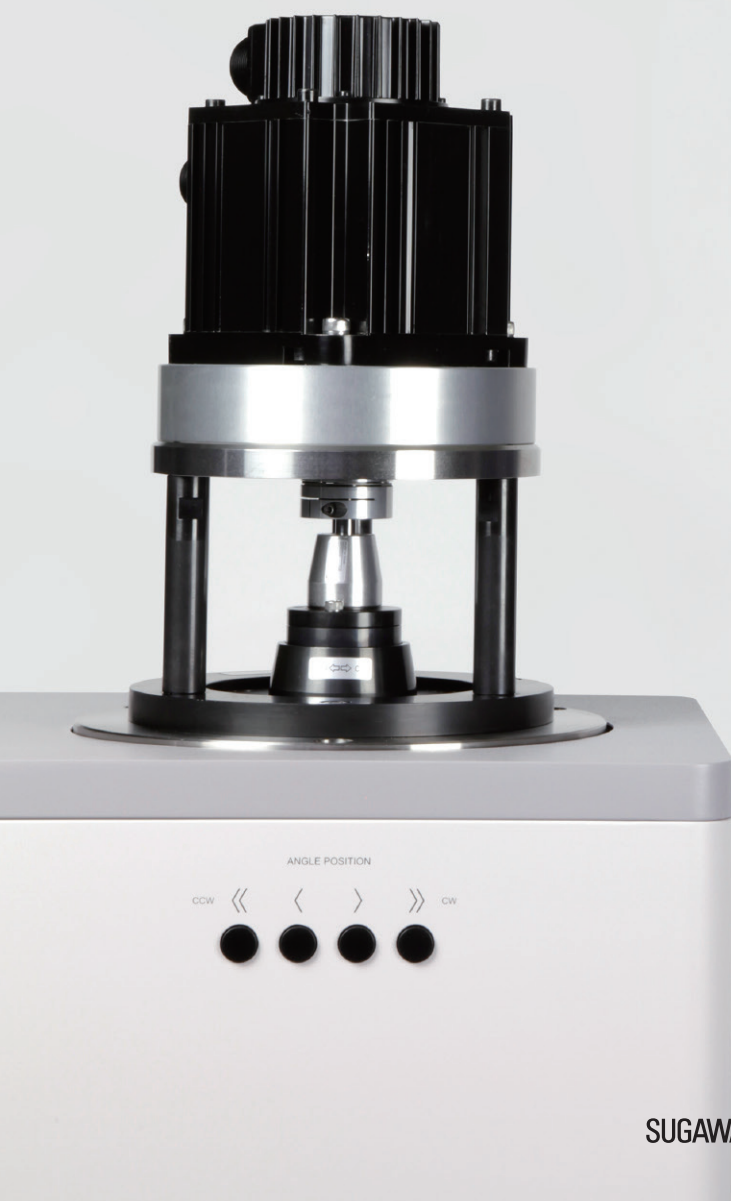
Cogging Torque Tester | **ATM-100**

**ATV-100**

Torque Sensor | **TSA Series**

Motor Evaluation Software | **TORQuick CT**

To reduce motor noise and vibration and achieve high-efficiency motors



SUGAWARA Laboratories Inc.

# Cogging Torque Tester

ATM-100 / ATV-100

To reduce motor noise and vibration, cogging torque must be measured and reduced. Sugawara's Cogging Torque and Torque Ripple Test Systems can measure cogging torque with high accuracy and no mechanical loss for a variety of motors (DC, DC brushless, AC servo, stepping, etc.). These systems can play a significant role in motor development and quality management.

Measures cogging torque with no mechanical loss

Enables measurement of both cogging torque and torque ripple on one piece of equipment

Supports a wide range of torque values at low cost through the switching of torque sensors

High accuracy

Measurement angle resolution: 0.01°  
Maximum number of data items collected per revolution: 36,000

Exceptionally high measurement reproduction

Short takt time

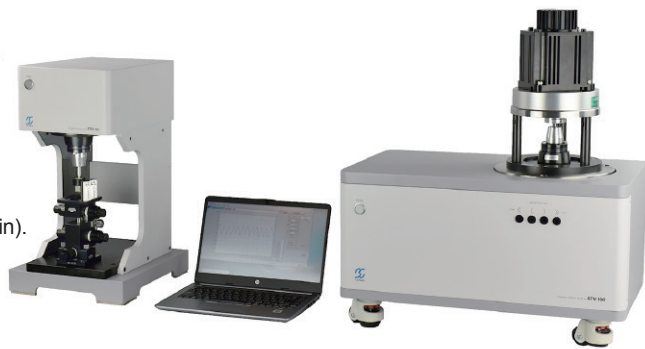
Measurements can be completed in as little as 3 s (at the rotation speed of 20 r/min).  
A vertical structure simplifies axial alignment and shortens measurement time.

Convenient analysis functions

Peak-number and frequency analysis can be performed by FFT in addition to display functions in XY coordinates and polar coordinates.

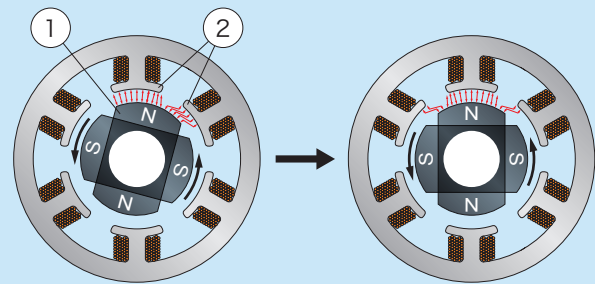
Supports simultaneous measurement of various types of external sensors

Supports voltage, current, and temperature measurements  
Measurement of resolver/hole sensor output contributes to improved controllability (using optional I/O module).



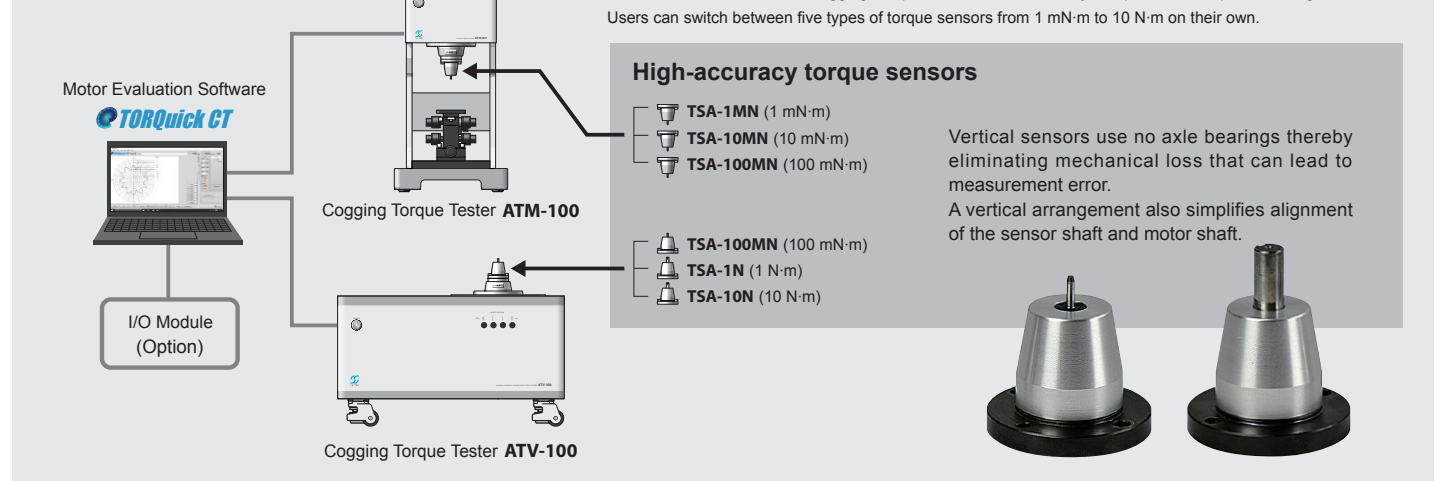
## What is cogging torque?

When turning the shaft of a permanent-magnet type of motor (brushless motor, etc.) in a non-energized state with one's fingertips, you can feel a relatively constant amount of friction torque and a pulsating torque at the same time. This friction is called motor mechanical loss that arises from the bearings used to support the rotor and the contact made between the brushes and commutator. The pulsating effect, on the other hand, arises from the attraction between the rotor magnets (1) and stator-yoke teeth (2). This friction and pulse effect are commonly called loss torque and cogging torque, respectively.



Cogging torque results in uneven torque and rotation when driving the motor, which gives rise to noise and vibration and generates disturbances in the control process. In recent years, brushless motors, which are known for their high-efficiency, compact, and maintenance-free features in addition to high controllability, have been installing high-performance magnets in a small space, which makes it easy for cogging torque to occur. Accurate measurement and understanding of cogging torque is essential to the design and adoption of high-quality motors.

## System configuration



The ATM-100 and ATV-100 Cogging Torque Tester connect directly to a personal computer running Windows. Users can switch between five types of torque sensors from 1 mN·m to 10 N·m on their own.

### High-accuracy torque sensors

- TSA-1MN (1 mN·m)
- TSA-10MN (10 mN·m)
- TSA-100MN (100 mN·m)
- TSA-100NN (100 mN·m)
- TSA-1N (1 N·m)
- TSA-10N (10 N·m)

Vertical sensors use no axle bearings thereby eliminating mechanical loss that can lead to measurement error.  
A vertical arrangement also simplifies alignment of the sensor shaft and motor shaft.



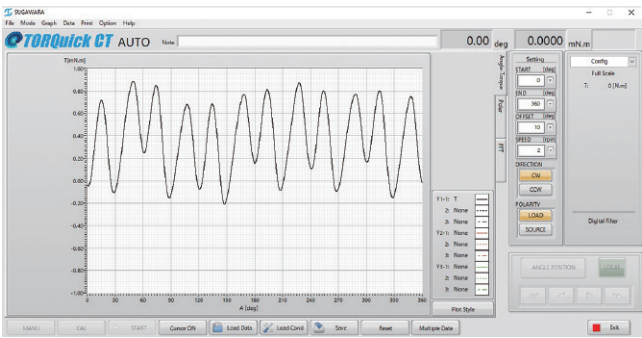
# Motor Evaluation Software



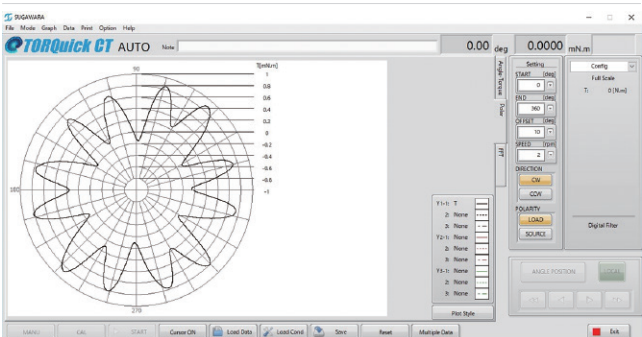
Motor Evaluation Software TORQuick CT is specialized software developed for the ATM-100 and ATV-100 Cogging Torque Testers. It displays cogging torque and torque ripple of the test motor on a variety of graphs.

Displays measurement results on a XY-coordinates graph, polar-coordinates graph, and FFT graph.

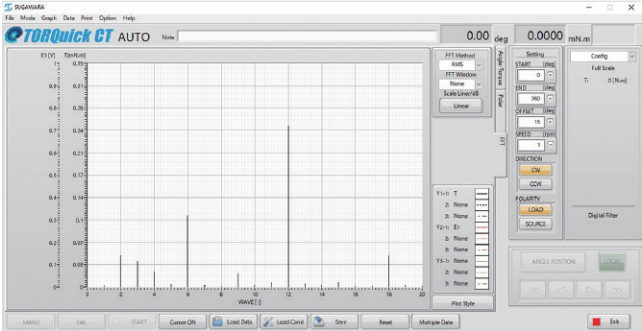
FFT-graph display enables processing method, window function, etc. to be selected from a pull-down menu so that desired measurement conditions can be quickly set.



XY coordinates graph



Polar coordinates graph



FFT graph

Expanded functions through an I/O module

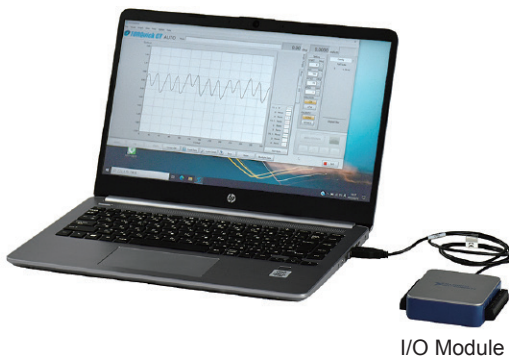
Connecting the I/O module to the personal computer enables a variety of expanded functions to be used.

Simultaneous plotting of input data on graphs

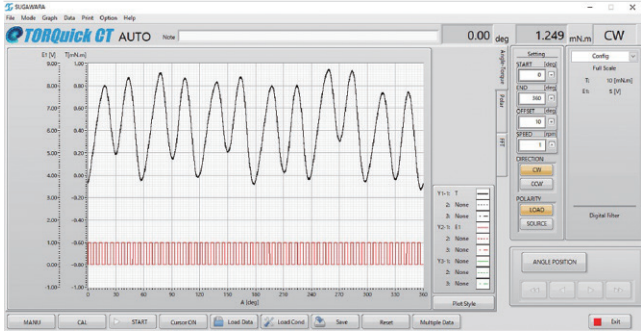
Up to 8 channels of external data can be input and simultaneously displayed with angle-torque characteristics. Units and scaling/offset values can be set. Various types of data such as voltage, current, temperature, and motor rotation position from a position sensor can be simultaneously displayed to support motor-control development.

Control of external motor power supply

Enables ON/OFF control of the motor power supply synchronized with the starting/stopping of torque-ripple measurements. Automatic ON with appropriate timing when starting measurements and automatic OFF when stopping measurements prevents motor damage caused by failure to cut the power supply.



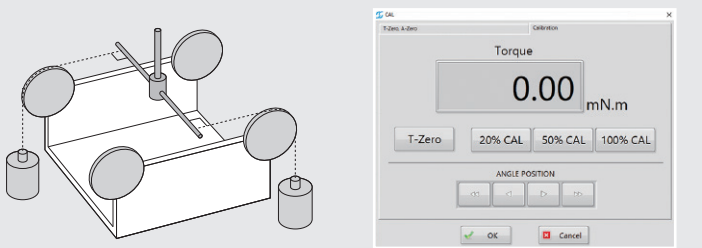
I/O Module



Input voltage signal overlaid on cogging torque

## Torque calibration

Calibration can be easily performed by software. No volume adjustments, etc. are necessary. The ATM/ATV series has a vertical shaft, so the Calibration Jig Set converts the vertical force of the weight into a horizontal force when calibration. (The Calibration Jig Set is an option.)



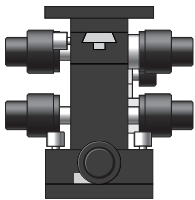
## Operating conditions

OS	Windows 10 Pro (64 bit), Japanese or English
CPU	Intel Core i5 8250U 1.6 GHz or higher
Memory	8 GB or more
Display	HD FWXGA 1366×768 or more
DVD Drive	At least one drive (Required for installation)
Port	USB port x 1 (2 ports when using the I/O module)

# Motor Fixtures for Accurate Measurements

An XYZ stage for the ATM-100 and a standard motor fixtures for the ATV-100 are provided.

Customized jigs and couplings are available according to motor type, shape, and torque characteristics. Customers can also contact us about measurement of fan and pump motors with no protruding shaft.

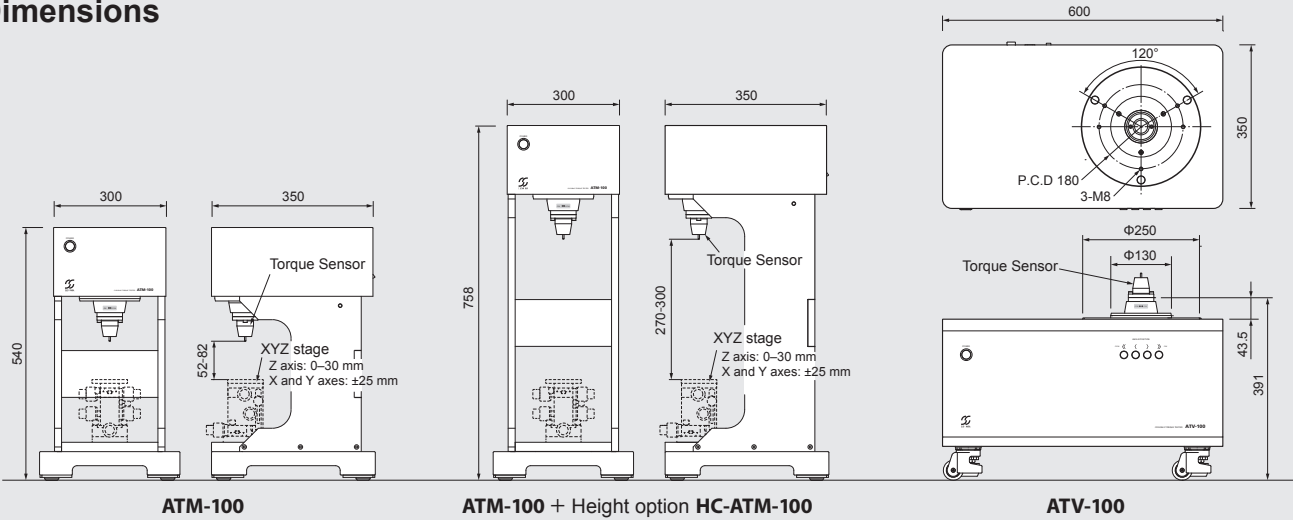


XYZ stage  
for the ATM-100



Standard motor fixture  
for the ATV-100

## ■Dimensions



## ■Specifications of ATM-100, ATV-100

Cogging Torque Tester	ATM-100			ATV-100	
Torque Sensor	TSA-1MN	TSA-10MN	TSA-100MN	TSA-1N	TSA-10N
Rated torque	1 mN·m	10 mN·m	100 mN·m	1 N·m	10 N·m
Sensor shaft diameter	φ 3 mm			φ 10 mm	
Torque accuracy	±0.5% of rated torque *1				
Rotation speed	0.1–20 r/min (at intervals of 0.1 r/min)				
Angle resolution	0.01°				
Number of acquired data items and sampling interval	Rotation speed [r/min]		Data items	Sampling interval	
	0.1– 1.5		36,000	0.01°	
	1.6– 3.0		18,000	0.02°	
	3.1– 8.0		7,200	0.05°	
	8.1–15.0		3,600	0.10°	
	15.1–20.0		1,800	0.20°	
Connection with personal computer	USB (RS422 can be selected as an option at ordering time.)				
Power requirement	90–240 VAC, 50/60 Hz				
Operating temperature	0–40°C				
Operating humidity	20–90%RH, No condensation				
Dimensions	300 mm (W) x 350 mm (D) x 540 mm (H) 300 mm (W) x 350 mm (D) x 758 mm (H) *2			600 mm (W) x 350 mm (D) x 391 mm (H)	
Weight	70 kg 80 kg *2			75 kg	

\*1 After calibration with ATM-100/ATV-100 \*2 When HC-ATM-100 height option is selected.

Data measurement services using Sugawara's motor testers are available. Please visit our website for more information.

The above specifications are subject to change without prior notice for product improvement.

Products: Xenon Flash, Torque Dynamometers, Bearing Inspection Systems, etc.

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