SUGAWARA

Motor Testing Equipment

Torque and speed

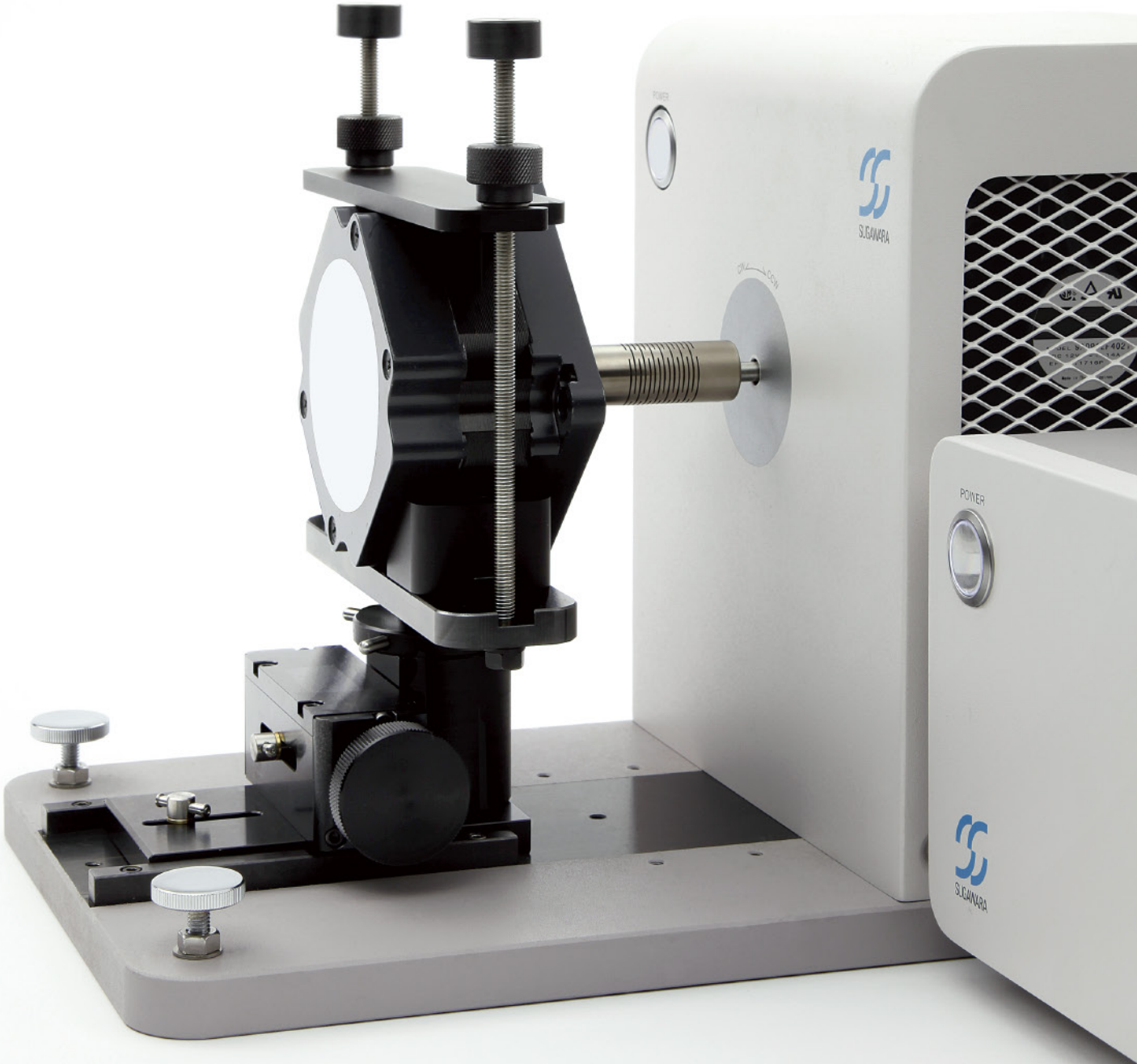
Torque range 5 mN·m–50 N·m
Speed range 5–60,000 r/min

Torque and speed for ultrahigh-speed motor

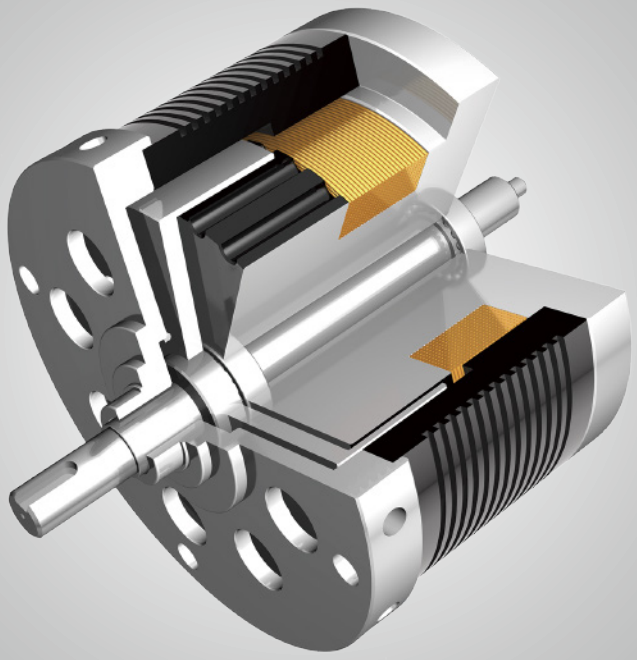
Maximum torque 100 mN·m
Maximum speed 120,000 r/min

Pull-in torque and pull-out torque

Cogging torque and torque ripple



SUGAWARA Laboratories Inc.



Sugawara's Dynamometers use hysteresis brakes.

A hysteresis brake is a high-performance brake used in dynamometers to achieve high measurement accuracy. It generates a stable load torque according to the strength of the excitation current regardless of rotation speed.

■Hysteresis brake features

- **High-accuracy control**
- **Maximum speed 60,000 r/min**
  Stable load control from low-speed to high-speed rotation
  *Maximum speed depends on torque rating and model.
- **Structure that minimizes the inertia moment of the rotor**
- **Long life owing to a non-contact brake**
- **Excellent thermal properties—torque not easily affected by temperature rise in the brake or surroundings**
- **Compact configuration compared with motor brakes**

Torque accuracy ±0.1%

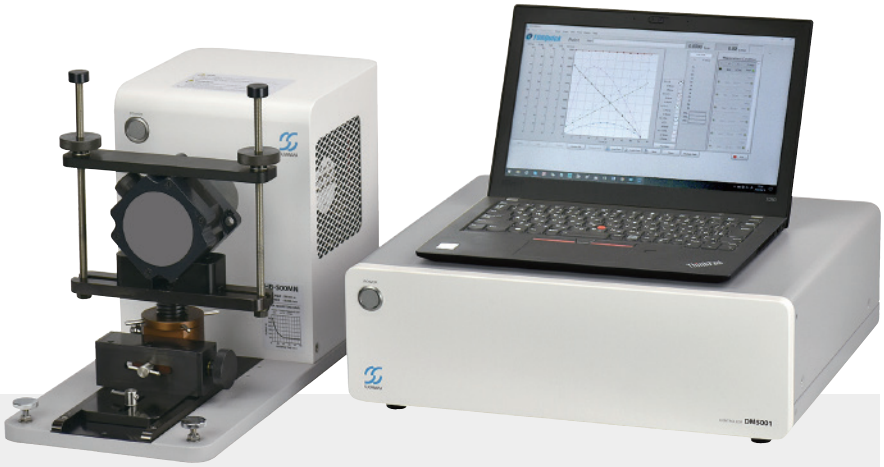
- Speed accuracy ±0.01%
- Maximum speed 60,000 r/min

Dynamometer using a reliable hysteresis brake with superb reproducibility unaffected by inertia

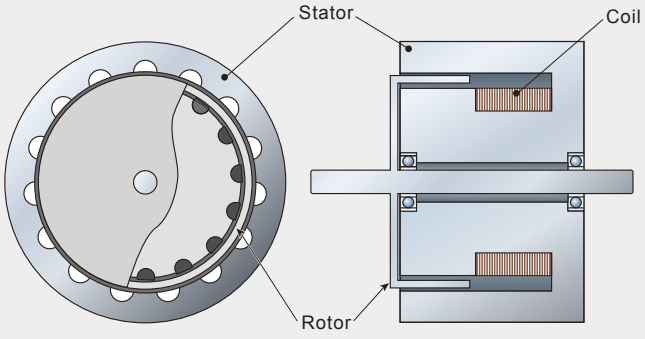
Improved measurement accuracy and ease of use

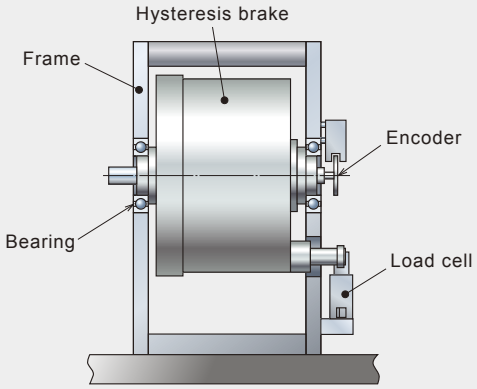
Expanded lineup of convenient functions and strong production-line/development-bench support

- Simple start-up without the need for PID settings
- Simple, software-based torque calibration
- Simultaneous measurement of temperature, flow rate, etc. by adding an I/O option
- Four measurement units can be connected with a single controller
- Endurance tests along time axis enabled by evolved measurement modes



■Hysteresis brake principles





Hysteresis brake structure

A hysteresis brake is structured to rotate a rotor made of high permeability magnetic material inside an air gap containing a magnetic field formed by a cog-wheel-shaped stator. The magnetic flux flowing in the stator passes through the rotor, creating magnetic friction between the rotor and the stator, and acting as a non-contacting brake. This magnetic friction is proportional to the strength of the magnetic flux penetrating the rotor, and the strength of this magnetic flux can be adjusted by changing the strength of the exciting current applied to the coil. Therefore, a hysteresis brake makes it easy to adjust the braking force regardless of the rotation speed of the rotor.

Torque detector structure

The brakes of HB-N series Dynamometers are supported by bearings on the equipment frame. When the rotor is rotated by the motor under measurement and braked by magnetic friction with the stator, a reaction force is generated on the stator and the stator tries to rotate. This reaction force is detected by a load cell as the brake torque. Since the rotational moment acting on the stator is detected in an extremely static fashion, it is less susceptible to vibration than methods that involve detecting torque on a rotating shaft, and results in a stable detection method that is suitable for high-speed rotation.

DM5001 Controller

The DM5001 controller for the HB-N series Dynamometers demonstrates outstanding performance in combination with *TORQuick* specialized software.

■ Main features

- **Four HB-N Series Dynamometers can be connected with a single controller.**
- **Analog torque and speed outputs provided as standard**
- **Diverse expanded functions by adding an I/O option**

  Connections can be made with external equipments enabling a variety of expanded functions.

  ▶**Simultaneous measurement of voltage signal inputs from external sensors**

  Using an analog 4 ch input (0–10 V), it is possible to simultaneously measure and store voltage inputs from external sensors such as temperature and flow rate sensors. The scaling and unit of these inputs are user-configurable. These input data can be plotted simultaneously on a graph of torque measurements, and can also be configured as pass/fail judgment criteria.

  ▶**Controls an external motor power supply**

  This function allows you to switch a motor's power supply on and off (via contact inputs). Also, if you use a power supply that has an analog input function, the analog voltage output function allows you to change the power supply voltage during the measurement sequence.

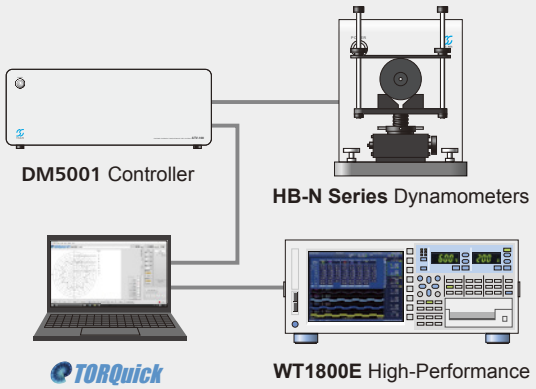
I/O Option
Please specify I/O options when ordering DM5001.

DM5001 Controller

■ Specifications

Analog output	
Torque analog output	Max ±10 VDC ±1% Voltage and torque are individually configurable
Speed analog output	Max ±10 VDC ±1% Voltage and speed are individually configurable
I/O option (Optional)	Digital input 4 ch, Digital output 4 ch Analog input 4 ch, Analog output 2 ch Contact output for power supply control (NO, NC) 1 ch
Interface	USB 2.0 or greater (Type A)
Temperatures	0–40°C
Humidity	20–90%RH, without dew condensation
Power requirement	100–240 VAC±10%, 50/60 Hz
Power consumption	30 VA or less
Dimensions (W×H×D)	430×148×360 mm
Weight	8 kg

■ System configuration



Controls the torque measurement unit by specialized software via the controller

- DM5001 is compatible with the following power meters for voltage and current measurements.

Yokogawa Test & Measurement Corporation
WT5000 Precision Power Analyzer (*1),
WT1800E/WT1800 High-Performance Power Analyzer
WT300E/WT300 Digital Power Analyzer

HIOKI E.E. CORPORATION
Power Analyzer PW3390
Power Meter PW3335/PW3336/PW3337(*2)

*1 Select WT1800E from the command type settings of WT5000.
A maximum of 6 elements can be used. Supports only the 760901 and 760902 elements.
*2 In current measurement, supports only measurements using the current input terminals.

TORQuick Software

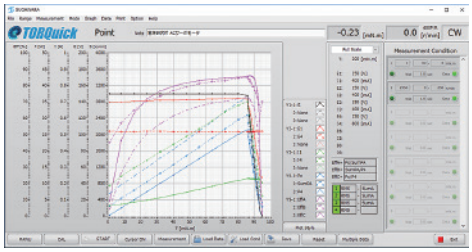
TORQuick software for motor evaluation is developed with the user in mind.

It can measure a variety of motor speed/torque characteristics in combination with a Dynamometer and can manage and store data on Windows. Its user-friendly, highly sophisticated interface enables high-accuracy measurements through simple operations.

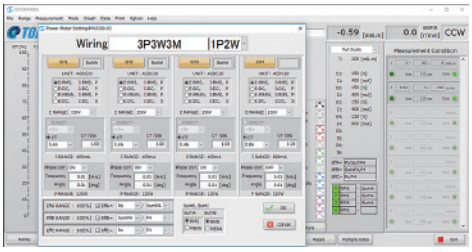
■Main features

●User-friendly graphical user interface

The graph displays 5 axes × 3 items in real time. We have improved the operability of this display by adding a graph axis auto setting function. You can also customize the graph line style and dot appearance. It is also easy to change the power analyzer settings in the software.



Measurement graph



Power meter settings

●Automatically recognizes the models of the connected Dynamometers

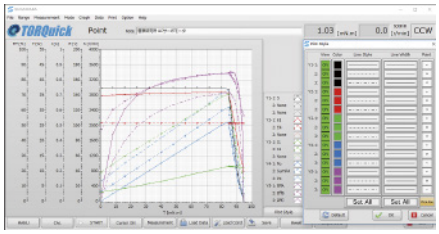
●More than 60 measurement items

Torque / Speed / Time / Output power / Direction of rotation / Voltage / Current / Electric power / Efficiency / Power factor / Voltage frequency / Current frequency etc.

●Diverse measurements according to use

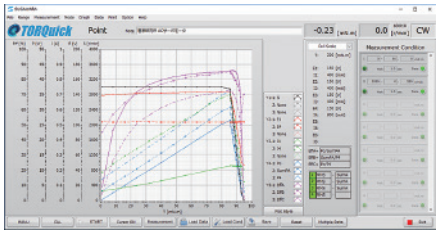
▶High accuracy point measurements with simple settings

S-T characteristics (speed–torque characteristics) can be measured by simply setting measurement points. Torque control, speed control, and brake control can be combined within one measurement. The data is not affected by moment of inertia because it measures values at stable operating points.



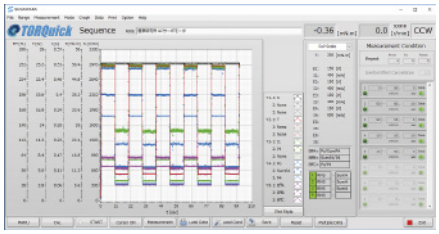
▶Sweep measurements enabling continuous measurements

In addition to point measurements, sweep measurements that continuously vary control values can be performed. Measurement time can be set as desired, which is suitable for making measurements over a short period to suppress heating effects.



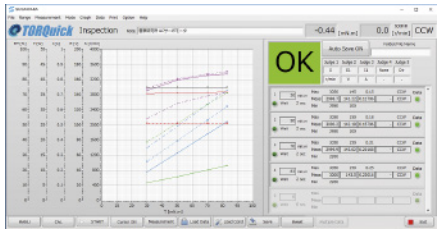
▶Load simulations envisioning actual usage

A variety of tests such as endurance tests and cycle tests can be performed. This enables load simulation tests that envision actual usage conditions, and since measurements can be set up to 10,000 cycles, enables endurance tests that combine testing and idling states.



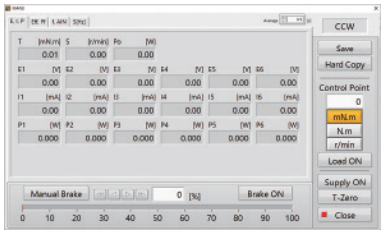
▶Inspection mode specialized for pass/fail testing

Pass/fail testing can be performed by setting the upper and lower limits for up to five measurement items based on torque, speed or braking. By specifying a file name in advance, you can automatically generate a file listing the time, sequence number and results of each measurement.



▶Manual mode where measured values are displayed in real time

In this mode, you can set and control the torque, speed or braking at a single point, and display all the corresponding measured values in real time. This mode can be used for simple behavior observations and for the measurement of starting torque.



■Operating conditions

OS	Windows10 (64bit) Professional Japanese or English version
CPU	Intel Core i5 or later processor
Memory	8 GB or more recommended
HDD	256 GB or more recommended
Monitor	HD FWXGA 1366×768 or greater
DVD drive	One or more units (required for software installation)
Com. Ports	USB port × 1 When connected to a power meter, the following are required separately: Yokogawa WT Series: USB × 1 HIOKI PW Series: LAN (Ethernet 100BASE TX) × 1

HB-N Series Dynamometers

■ Main features

● Measurement accuracy at industry's highest level

Torque accuracy: ±0.1% of the rated torque *1
Speed accuracy: ±0.01%

● Adopts a high-reliability hysteresis brake

The hysteresis brake used here has a long track record of high reliability due to an original structure developed by Sugawara. This structure improves torque control performance and reduces vibration during rotation by narrowing the gap between the rotor and stator and minimizing the inertia moment of the rotor.

● Stable measurement from low-speed to high-speed

Stable measurements can be performed from low-speed to high-speed regions because it detects torque from the force of movement of the brake's stator. The maximum speed is 60,000 r/min (speed differs according to torque rating). An optional rotary encoder for the measurement of extremely low speeds supports 10–10,000 r/min (600 P/R) and 5–5,000 r/min (1200 P/R).

● Extensive product lineup with torque ratings from 5 mN·m to 50 N·m

13 models of Dynamometers to choose from according to motor output power for making high-accuracy measurements

● Features air bearings for low-torque models

● Short base plate models and temperature chamber models are provided as standard.

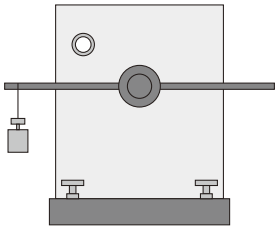
■ Dynamometer Specifications

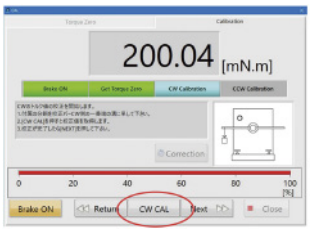
Models	HB-5MN	HB-10MN	HB-20MN	HB-50MN	HB-100MN	HB-200MN	HB-500MN	HB-1N
Torque rating	5 mN·m	10 mN·m	20 mN·m	50 mN·m	100 mN·m	200 mN·m	500 mN·m	1 N·m
Torque detection	Brake-stator reaction force detected by strain-gauge load cell							
Torque accuracy	±0.1% of full scale (accuracy of the system including DM5001 Controller, after calibration) *1							
Max. speed	40,000 r/min			60,000 r/min			50,000 r/min	30,000 r/min
Speed detection	Rotary encoder of 60 P/R (standard models) *2							
Speed accuracy	±0.01%							
Power rating (5 min)	7.5 W	15 W	30 W	75 W	120 W	170 W	300 W	400 W
Power rating (continuous)	1.5 W	3 W	6 W	15 W	25 W	35 W	60 W	80 W
Brake	Hysteresis brake							
Brake support	Air bearings			Ball bearings				
Brake rotor moment of inertia kg·m²	0.6×10^{-6}	0.8×10^{-6}	1.0×10^{-6}	2.6×10^{-6}	3.9×10^{-6}	9.2×10^{-6}	2.8×10^{-5}	1.9×10^{-4}
Brake cooling	–			Air cooling by fan				
Dimensions (W×H×D)	210×246×400 mm						210×276×500 mm	
Weight	18 kg			20 kg			26 kg	29 kg
Power requirement	AC100–240 V							
Power consumption	30 VA or less							
Shaft diameter	Φ3			Φ4	Φ6			Φ10
Shaft shape	Round				D-cut			
Shaft height	130 mm						160 mm	
Standard motor jig	MMJ-7C						MMJ-9C	
Diameter of attachable motor	Φ25–100 mm						Φ50–150 mm	

*1: After calibration with the DM5001 Controller. Torque accuracy is ±0.25% for 1200 P/R optional models of HB-500MN, HB-1N, HB-2N, and HB-5N.
*2: All the models have two kinds of low-speed encoder options, 600 P/R type (10–10,000 r/min) and 1200 P/R type (5–5,000 r/min).
*3: Power rating (3 min) for HB-50N

■ Calibration

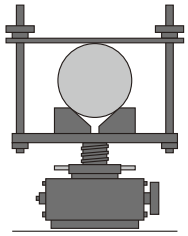
Calibration is necessary for measuring correct torque values.
A separately sold calibration jig set (calibration bar and weight) is used for this purpose. The calibration bar is attached to the shaft and the weight is suspended from the end of the bar. Calibration is achieved by simply pushing the CAL button. No volume adjustments are necessary.





■ MMJ-series Motor Mounting Jigs

MMJ-series Motor Mounting Jigs have an adjustment function for centering the motor and measurement shafts. Four models are available for twelve measurement units ranging from HB-5MN to HB-20N.
Since the surface of the V block of MMJ on which the motor under test is placed is designed to be parallel with the shaft of the Dynamometer, the shafts of the motor and Dynamometer will be parallel when they are simply mounted on the V block if the motor body and the shaft are parallel. As a result, alignment is easy to achieve.



■ Safety cover

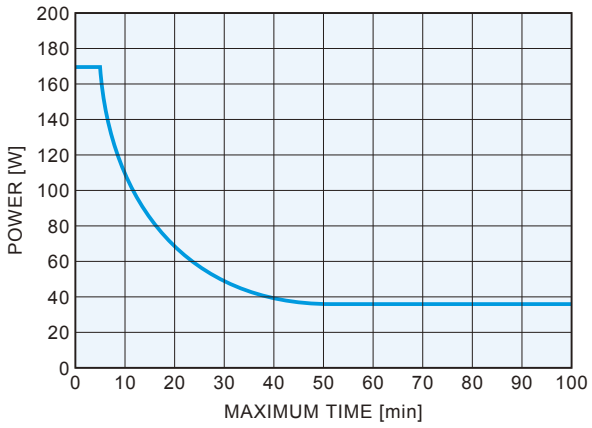
In certain cases, an incorrectly aligned coupling may be damaged during measurements causing it to fly off or scatter, which could cause an injury. Always take appropriate safety measures such as attaching a safety cover. A safety cover is available from Sugawara (option).

HB-2N	HB-5N	HB-10N	HB-20N	HB-50N
2 N·m	5 N·m	10 N·m	20 N·m	50 N·m
25,000 r/min	20,000 r/min	12,000 r/min		7,000 r/min
				600 P/R
600 W	1.5 kW	3.0 kW	6.0 kW	12 kW *3
120 W	0.3 kW	0.7 kW	1.2 kW	4 kW
0.5×10^{-3}	1.8×10^{-3}	6.3×10^{-3}	2.1×10^{-2}	6.1×10^{-2}
			Cooling by fan and blower	
300×325×600 mm		500×500 ×1000 mm	500×537 ×1245 mm	550×1300 ×1300 mm
56 kg	63 kg	180kg	210kg	500kg
		AC100 V		3 Phase AC200/220 V
		200VA or less	1kVA or less	
Φ12	Φ15	Φ18	Φ20	Φ30
Key seat				
200 mm		230 mm		250 mm
MMJ-10C		MMJ-12B		Customization available
Φ60–180 mm		Φ40–200 mm		

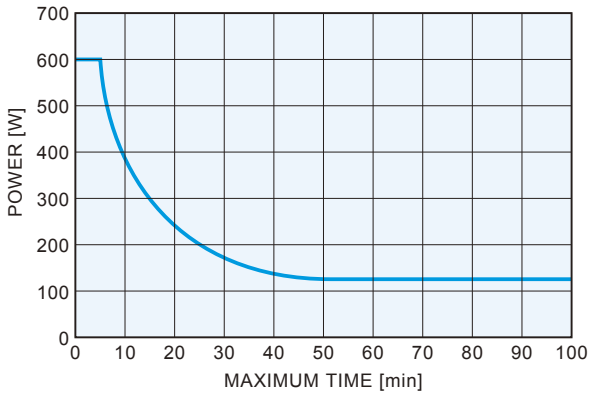
■ Power absorption curve

The allowable time for continuous loading of the Dynamometer varies with the power it absorbs. The Dynamometers must be used correctly according to the following graphs of power absorption curve. Contact us for the graphs of other models. Continuous use beyond the limit indicated in the graphs will make it difficult to obtain correct data and may cause damage. For models greater than the HB-2N, the brake current is automatically cut off to set the brake torque zero when the absorption power exceeds the limit.

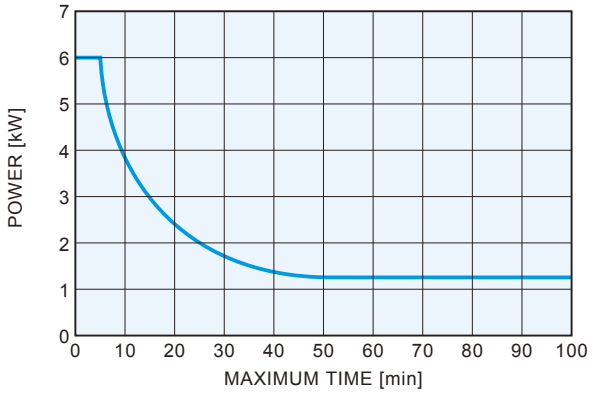
HB-200MN



HB-2N



HB-20N



Power (motor output power) is calculated as follows.

Power [W] =

Torque [N·m] × Speed [r/min] × 0.1047

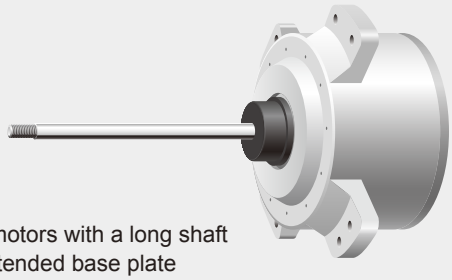
Short-base-plate HB-NS Dynamometers

Ideal for measuring motors with special shapes.

HB-NS is a short-base-plate type of Dynamometer in the HB-N series. A system that combines HB-NS and customized base plates and jigs can be built for specially shaped motors that cannot be mounted with standard MMJ Motor mounting jigs.
Seven models to choose from with torque ratings from 50 mN·m to 5 N·m.

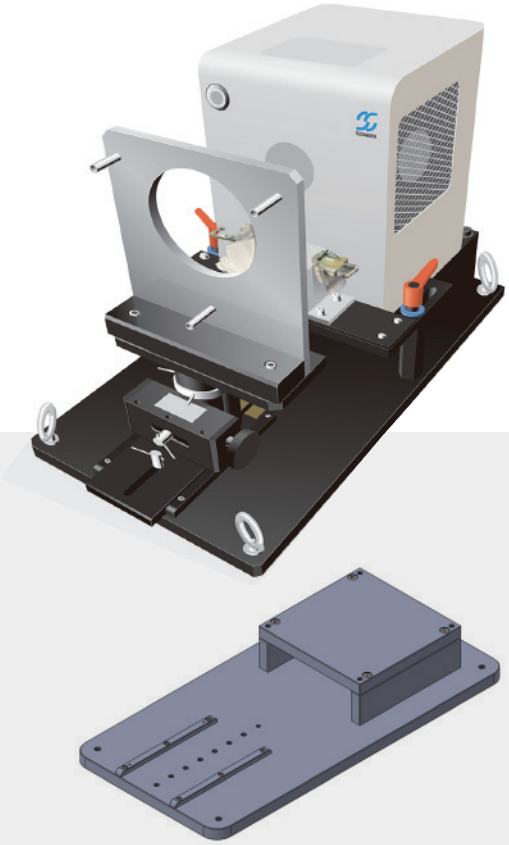
■Application examples

- Development of specially shaped motors for pumps, power tools, in-vehicle use, etc.
- Performance testing of a power tool



Supports measuring of motors with a long shaft by combining with an extended base plate

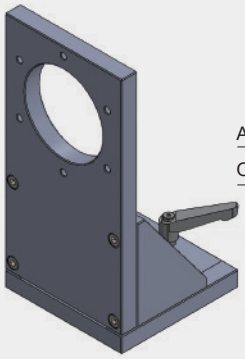
Customized Jigs and Base Plates



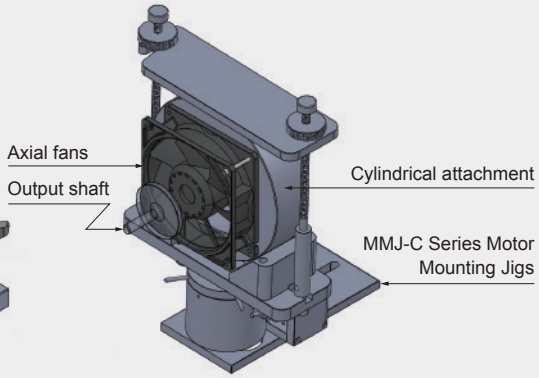
Sugawara can propose a variety of jigs and couplings tailored to motor model and shape to support the customer's measurement needs.

Raised base plates and extended base plates are available for mounting the short-base-plate type HB-NS dynamometers.

Supports measuring of large-diameter motors by combining with a raised base plate

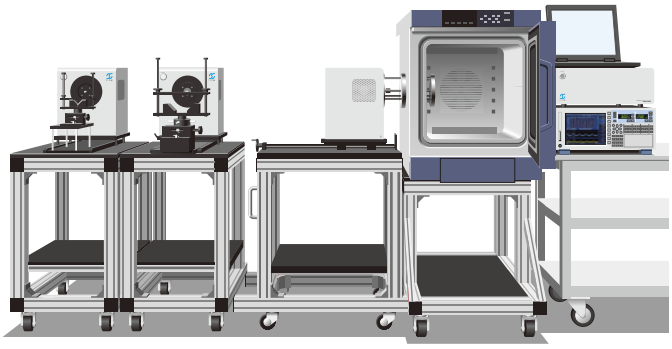


Fixed type motor mounting jig



Jig set for axial fans

HB-NT Dynamometers for Temperature / Humidity Environmental Testing



Measures motor load characteristics in a temperature/humidity-controlled state within a temperature chamber.

HB-NT is a Dynamometer used in combination with a temperature/humidity environmental testing instrument (temperature chamber).

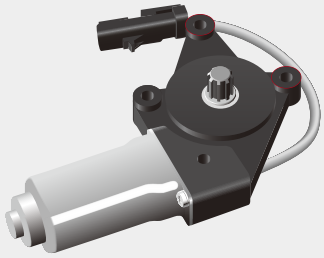
It can be used to perform simulation tests, endurance tests, etc. under diverse environmental conditions.

■ Main features

- **Enables high-accuracy measurements by directly attaching the temperature-chamber motor mounting jig to the Dynamometer to correctly align the measured motor.**
- **Enables simultaneous plotting of chamber temperature, motor winding temperature, etc. on the torque measurement graph using an optional I/O module.**
- **Can be used as an ordinary Dynamometer by attaching a standard MMJ Motor Mounting Jig.**
- **Seven models to choose from with torque ratings from 50 mN·m to 5 N·m.**
- **All seven models have the same size enabling common use with one temperature chamber.**

■ Application examples

- Development/evaluation of motors for continuously variable valve-lifting (CVVL) systems in automobile engines
- Understanding change in torque characteristics under low/high-temperature environments for various vehicle-mounted motors and actuators



Effective for evaluating power-window motors, etc.

Low-speed Measurement Option Minimum Rotation Speed 5 r/min

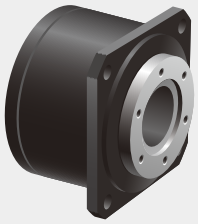
Two options are provided for low-speed measurements.

HB-*e6: 10–10,000 r/min
HB-*e12: 5–5,000 r/min

In addition to evaluating geared motors and near-stall performance of motors, it can be used for measuring pull-out torque of stepper motors. This option can be selected for all HB-N series models including HB-NS and HB-NT (only e12 for the HB-50N model).

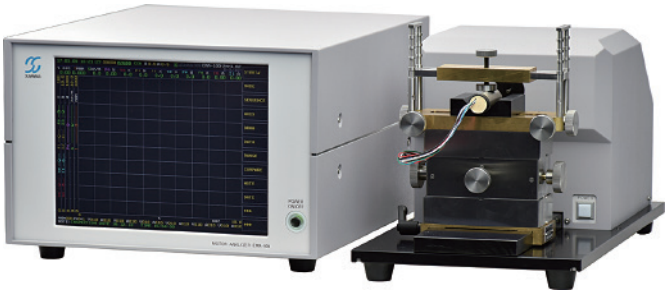
■ Application examples

- Motor development/evaluation
  - In-wheel motor for automated guided vehicle (AGV)
  - Hollow-shaft motors for industrial robots
  - Motors for automobile seat adjusters
  - Motors for automobile door-mirror drivers
  - Motors for audio use
- Measurement of pull-out torque in actuators (stepper motors) for surveillance cameras



Enables measurement of low-speed motors such as hollow-shaft motors for industrial robots

EMA-100 / EMM-100M
Ultrahigh-Speed Motor Torque Tester



EMA-100 EMM-100M

Measures ultrahigh-speed motors using a hysteresis brake

120,000 r/min

There is a growing demand for increasing the speed of motors for use in automobiles, home appliances, and other fields. High-speed operation enables high output without increasing size and a compact configuration while maintaining output.

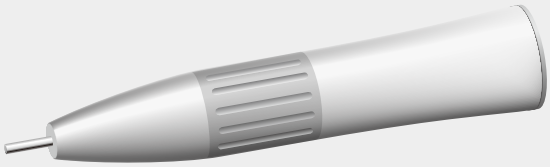
Sugawara's EMA-100/EMM-100M Ultrahigh-Speed Motor Torque Tester features a built-in small-diameter, low-inertia hysteresis brake enabling measurement of rotation speeds up to 120,000 r/min.

■ Main features

- **Max. speed 120,000 r/min, max. torque 100 mN·m.**
- **Stable load control from motor stall to ultrahigh speed using a newly developed hysteresis brake.**
- **Low brake rotor inertia for ultrahigh speed**
- **Simplified setup requiring no PID settings**
- **Safe and simple measurement using a highly accurate motor fixture and novel coupling.**
- **Connected to the power meter, it displays 22 measurement parameters including torque, speed, voltage, current, efficiency, and power factor in real time**
- **A variety of torque control modes, including point measurements, sweep measurements, and load simulation tests.**

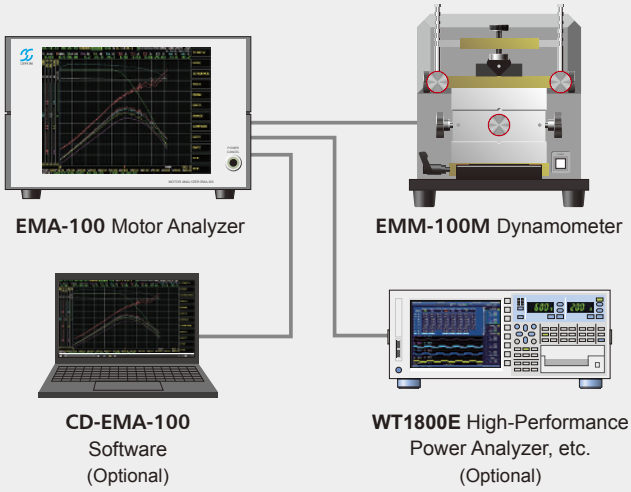
■ Application examples

- Development/evaluation of motors for vacuum cleaners, dental handpieces, etc.
- Performance testing of grinding machines and other cutting tools



Enables measurement of high-speed motors for dental handpieces, etc.

■ System configuration



Specialized Windows software saves measurement values and graphs. Operations can also be performed by software.

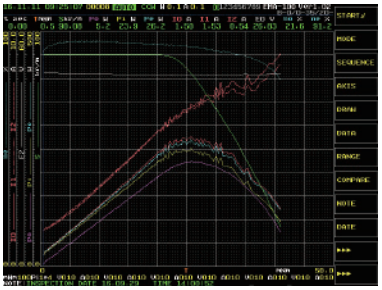
- DM5001 is compatible with the following power meters for voltage and current measurements.

Yokogawa Test & Measurement Corporation
WT5000 Precision Power Analyzer (*1),
WT1800E/WT1800 High-Performance Power Analyzer
WT300E/WT300 Digital Power Analyzer

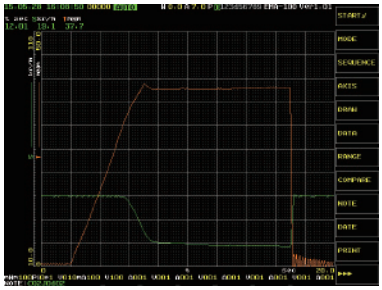
*1 Select WT1800E from the command type settings of WT5000. A maximum of 6 elements can be used. Supports only the 760901 and 760902 elements.

■EMA-100 measurement examples

The use of a hysteresis brake enables applying load torque that is stable in all speed regions from no-load rotation to motor stall enabling correct motor measurements. No PID settings are necessary and measurement conditions are easy to set. Control by torque, speed, and brake amount can be freely combined to perform tests simulating actual usage conditions.



Measurement graph of load characteristics of motor having a maximum speed of 90,000 r/min



Graph of load simulation

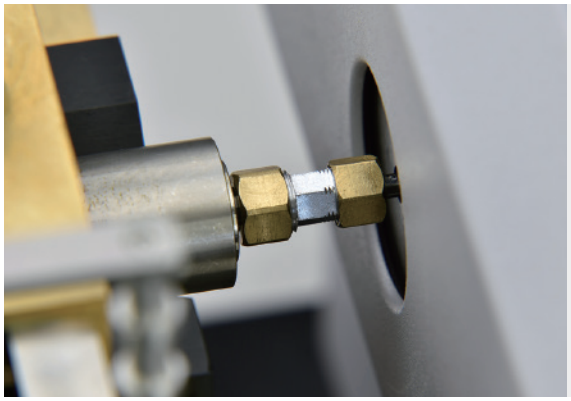
■Calibration

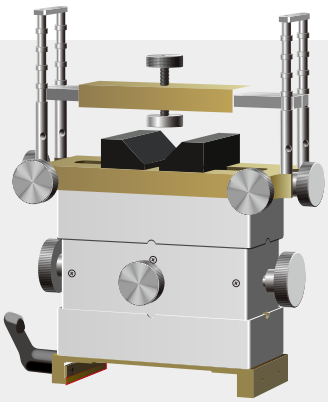
Calibration can be performed in Calibration Mode on the EMA-100 by attaching a calibration bar to the EMA-100 shaft and hanging a weight from the bar.

Calibration Mode display

■Coupling and motor fixture supports correct measurements

A novel coupling (patented) based on new technology enables stable fixing of ultrahigh-speed rotating shafts.

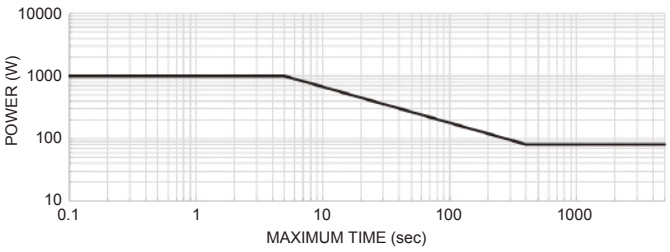




PC3-MLH2

The motor fixture can adjust XYZ positioning in micrometer units, enabling precise alignment essential to ultrahigh-speed measurements.

■Power absorption curve



Dynamometer continuous measurement time differs according to the motor's output power.
Please refer to the above characteristics chart.

■Specifications

Max. speed	120,000 r/min
Speed accuracy	±0.01%+1digit
Torque rating	100 mN·m
Torque accuracy	±0.5% of full scale
Brake	Hysteresis brake
Power absorption	Continuous 80 W Within 10 sec 600 W Within 5 sec 1000 W
Diameter of attachable motor	Φ10–60 mm
Measurable motor shaft diameter	3–5 mm
Power requirement	AC100–240 V±10 V, 50/60 Hz
Dimensions (W×H×D)**, weight**	EMM-100M: 230×250×400 mm, 16.5 kg EMA-100 : 315×218×400 mm, 14 kg

SMC-2 / SMT-2 Stepper Motor Torque Tester

This tester uses the Prony braking (thread winding) method which is most commonly used in stepper motor measurements. Combined with a specialized software, it can measure pull-in and pull-out torque automatically with high precision.

■Main features

●Minimal moment of inertia of the tester

By adopting Prony braking, the system provides stable measurement unaffected by moment of inertia of the tester and coupling loss, which is unavoidable in conventional torque testers. The advantage is obvious especially in pull-in torque testing. The resulting data has a high correlation with the data by traditional double balance method.

●Definition-based measurement

Achieves stable step-loss detection using a Sugawara-developed algorithm. Enables sensitivity of step-loss detection to be selected according to step angle. The pull-in torque is measured exactly according to its definition: the maximum torque at which the motor can start from the holding state without losing steps.

●Broad measurement range

Eight models of Sensors, from 0.2 N to 50 N, allow wide range of high-precision measurement. In addition, selecting and using an appropriate pulley enables measurement of micro motors under 0.1 mN·m and 1N·m motors too. Specialized Windows software makes pulley diameter and other settings easy.

* Any of eight models of sensors can be installed in the Stepper Motor Tester

●Easy-to-see presentation

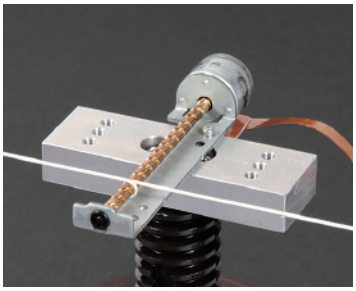
Motor characteristics are easily seen on automatically plotted Frequency-Torque curves. Data can be overlaid on the graph up to four data sets. Torque values at any frequency can be read using a cursor function.

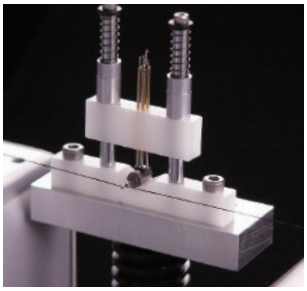
●Can be controlled by standard personal computers

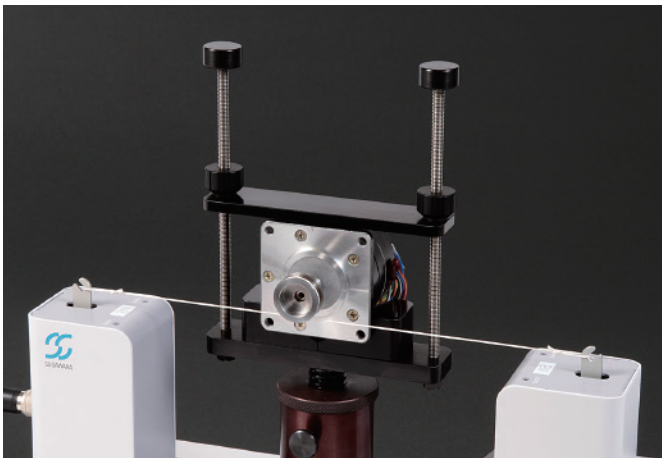
Allows control of measurement, display, and storage of data by standard personal computers running Windows. Data is stored in CSV file format enabling it to be read by other applications.

■Micro stepper motor measurements

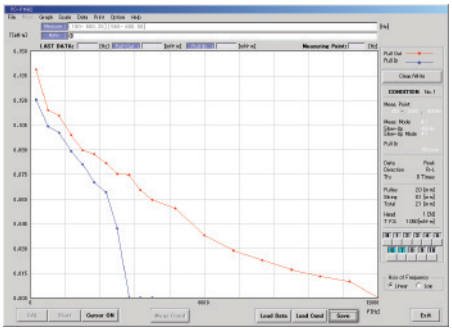
The SS-R2N supersensitive sensor set is now available. Capable of making stable and precise measurements of small stepper motors at torque values less than 0.1 mN·m. Has also been used successfully in measuring micro stepper motors at less than 0.002 mN·m. Can be used to measure lead-screw motors.



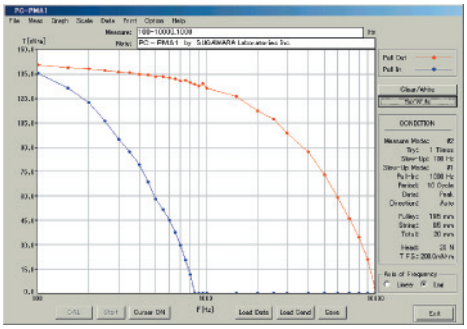




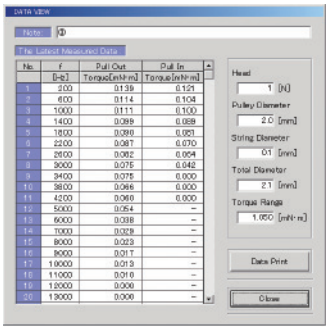
■Sample measurement data



▲Pull-in and pull-out torque curve of a low torque (0.2 mN·m or less) micro stepper motor. (Linear scale)
X axis: frequency Y axis: torque

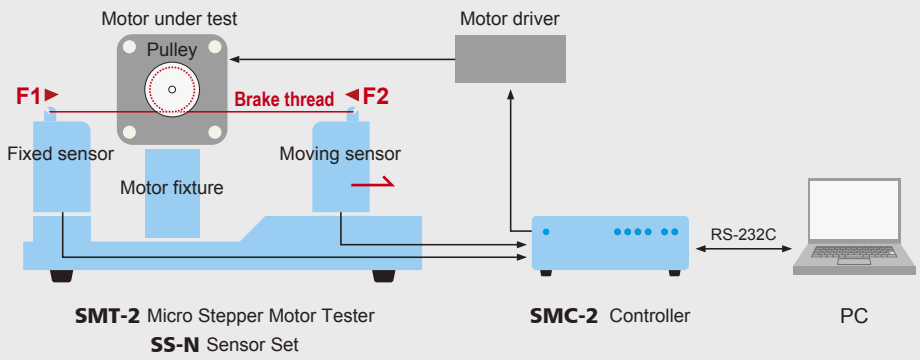


▲Pull-in and pull-out torque curve of a five-phase stepper motor. (Logarithmic scale)
X axis: frequency Y axis: torque



▲Numerical data display

■System configuration



■Load-torque detection system

Detects tension in brake thread with two sensors to calculate torque value. Denoting the forces detected by these two sensors as F1 and F2 [N] and the radius of the pulley including the brake thread as R [mm], torque T [mN·m] is calculated as R×(F1-F2) [mN·m].

■Automatic measurement method

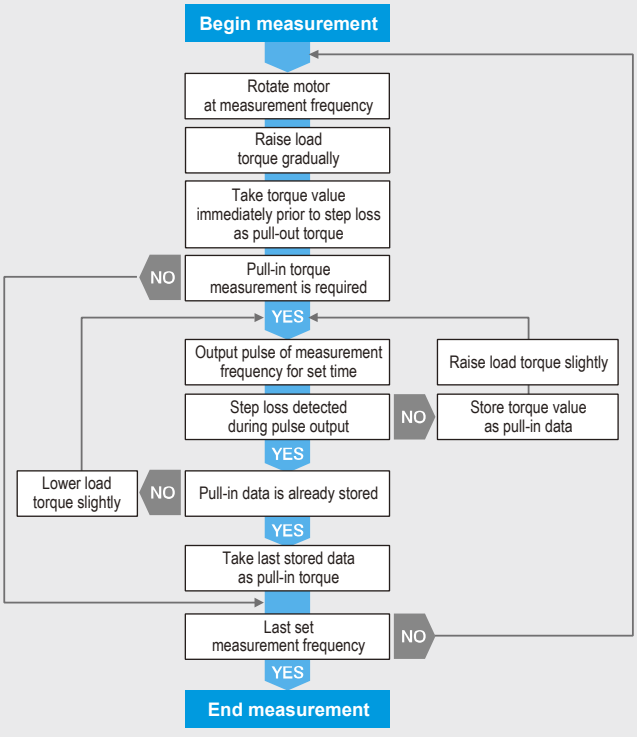
After detecting the motor's rotation direction, this method first measures pull-out torque and then pull-in torque from low frequencies according to settings.

Pull-out torque

After accelerating the motor to the measurement frequency, the load is gradually increased. The value detected immediately prior to step loss is taken to be the pull-out torque.

Pull-in torque

The drive pulse of the set frequency is output to the motor in holding state after pull-out measurement, and the presence/absence of step loss is detected. Load is then increased or decreased depending on that result and the drive pulse is again output to detect the presence/absence of step loss. Repeating this process determines the maximum load torque at which synchronized rotation is possible, which is taken to be the pull-in torque.



■Torque range

(mN·m)

Sensor	Sensor Rating (N)	Pulley Diameter (mm)				
		1	5	10	20	40
SS-R2N	0.2	0.1	0.5	1	2	4
SS-R5N	0.5	0.25	1.25	2.5	5	10
SS-1N	1	0.5	2.5	5	10	20
SS-2N	2	1	5	10	20	40
SS-5N	5	2.5	12.5	25	50	100
SS-10N	10	5	25	50	100	200
SS-20N	20	10	50	100	200	400
SS-50N	50	25	125	250	500	1000

■Specifications

Load method	Prony braking
Sensor rating	8 types: 0.2/0.5/1/2/5/10/20/50 N
Torque accuracy	Within ±1% of torque range
Maximum allowable load	200% of Sensor rating
Torque measurement range	Torque range: T=Sensor Rating × Pulley Diameter/2 (refer to the torque range on the above)
Torque analog output from SMC-2	DC 2 V/torque rating
Drive frequency range	16 Hz–50000 Hz
Drive signals for MUT	Square wave (duty 1:1), TTL-level Voltage signal or open-collector signal
Compatible personal computer	IBM PC/AT-Compatible
OS	Windows10 (64bit) Professional Japanese or English version
Com. Ports	RS232C serial port
Power requirement	AC 100–120 V, 50/60 Hz AC 200–240 V, 50/60 Hz
Power consumption	50 VA or less
Dimensions (W×H×D) and weight	SMT-2: 450×200×370 mm 12 kg SMC-2: 430×132.6×360 mm 9 kg S-N : 80×122×66 mm 0.9 kg

ATM-100 / ATV-100 Cogging Torque Tester

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.

■Main features

●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 sec (at the rotation speed of 20 r/min). A vertical structure simplifies axial alignment and shortens measurement time.

●Convenient analysis functions

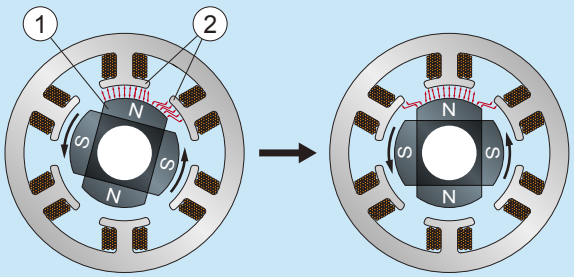
Peak-number and frequency analysis can be performed by FFT in addition to display functions in XY coordinates and polar coordinates.

●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).

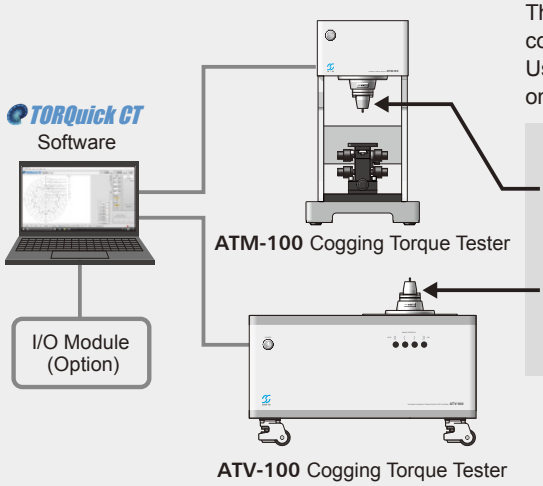
What is cogging torque?

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-100MN** (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.

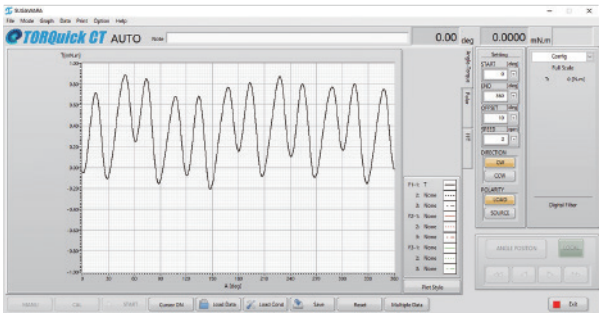
TORQuick CT Software

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.

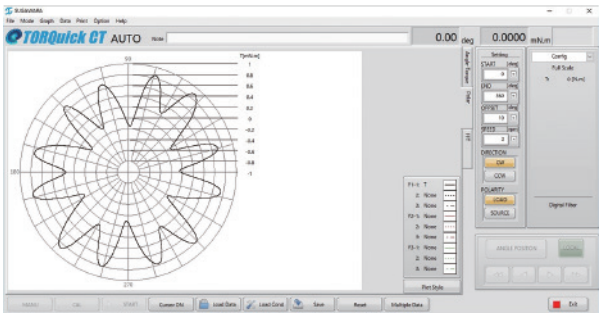
■ Main features

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

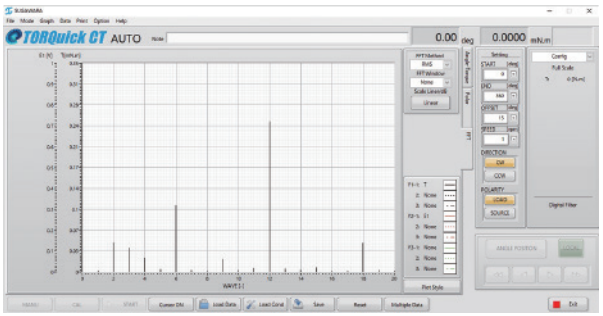
FFT-graph display enables processing method, window function, etc. to be selected from a pull-down menu so that desired measurement conditions can be quickly set.



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.

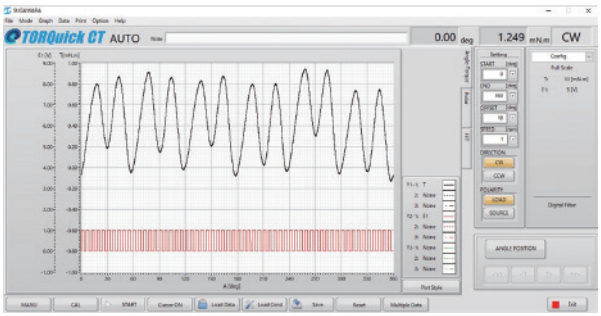
▶Simultaneous plotting of input data on graphs

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.

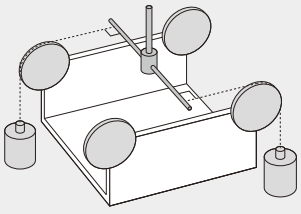
I/O Module (Option)

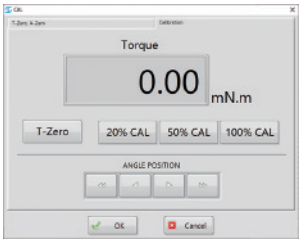


Input voltage signal overlaid on cogging torque

■ 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.)



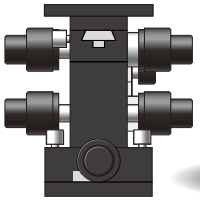


■ Operating conditions

OS	Windows10(64bit) Professional Japanese or English version
CPU	Intel Core i5 or later processor
Memory	8 GB or more recommended
Monitor	HD FWXGA 1366×768 or greater
DVD drive	One or more units (required for software installation)
Com. Ports	USB port x 1 (2 ports when using the I/O module)

Motor Fixtures for Accurate Measurements

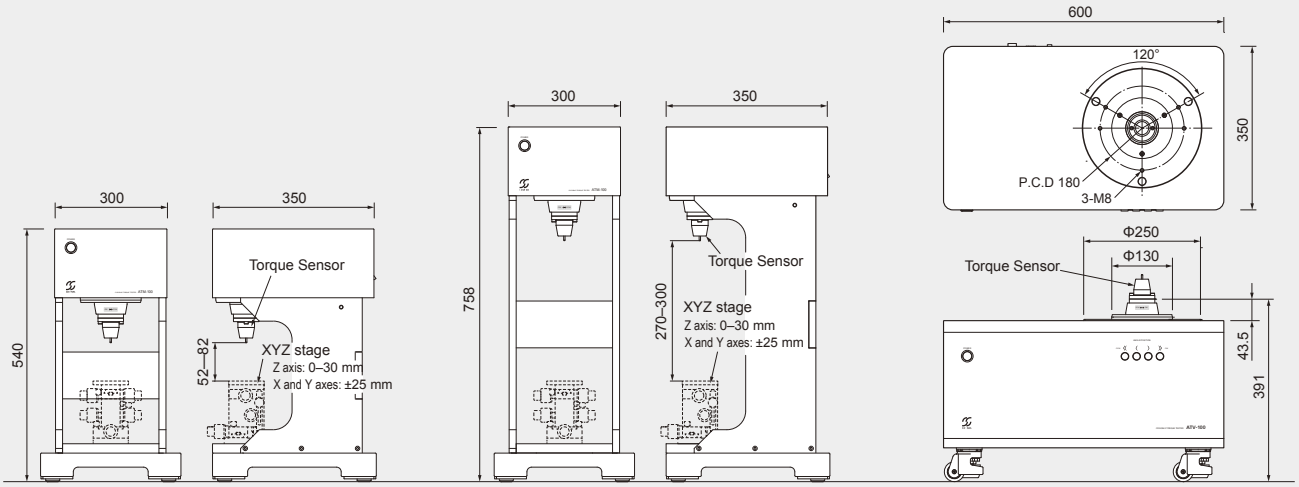
An XYZ stage for the ATM-100 and a standard motor fixtures for the ATV-100 are provided. Customized jigs and couplings are available according to motor type, shape, and torque characteristics. Customers can also contact us about measurement of fan and pump motors with no protruding shaft.



XYZ stage
for the **ATM-100**

Standard motor fixture
for the **ATV-100**

■ Dimensions



ATM-100 | **ATM-100** + Height option **HC-ATM-100** | **ATV-100**

■ Specifications

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	Φ3 mm			Φ10 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	100–240 VAC, 50/60 Hz				
Operating temperature	0–40°C				
Operating humidity	20–90%RH, No condensation				
Dimensions (W×D×H)	300 × 350 × 540 m 300 × 350 × 758 m *2			600 × 350 × 391 m	
Weight	70 kg 80 kg *2			55 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.**

SUGAWARA Laboratories Inc.

☐**Head office**
☐**Tokyo sales office** | 8-2 Minami-Kurokawa, Asao-ku, Kawasaki-shi, Kanagawa, 215-0034, Japan
Tel: +81-44-989-7320 Fax: +81-44-989-7338

☐**Osaka sales office** | 6-17 Yokomakura-Nishi, Higashiosaka-shi, Osaka, 578-0956, Japan
Tel: +81-72-966-1061 Fax: +81-72-966-0961

☐**Nagoya sales office** | 1-2-29 Kamimaezu, Naka-ku, Nagoya-shi, Aichi, 460-0013, Japan
Tel: +81-52-331-6562 Fax: +81-52-331-6604

URL: https://www.sugawara-labs.co.jp/ E-mail: info@sugawara-labs.co.jp

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