



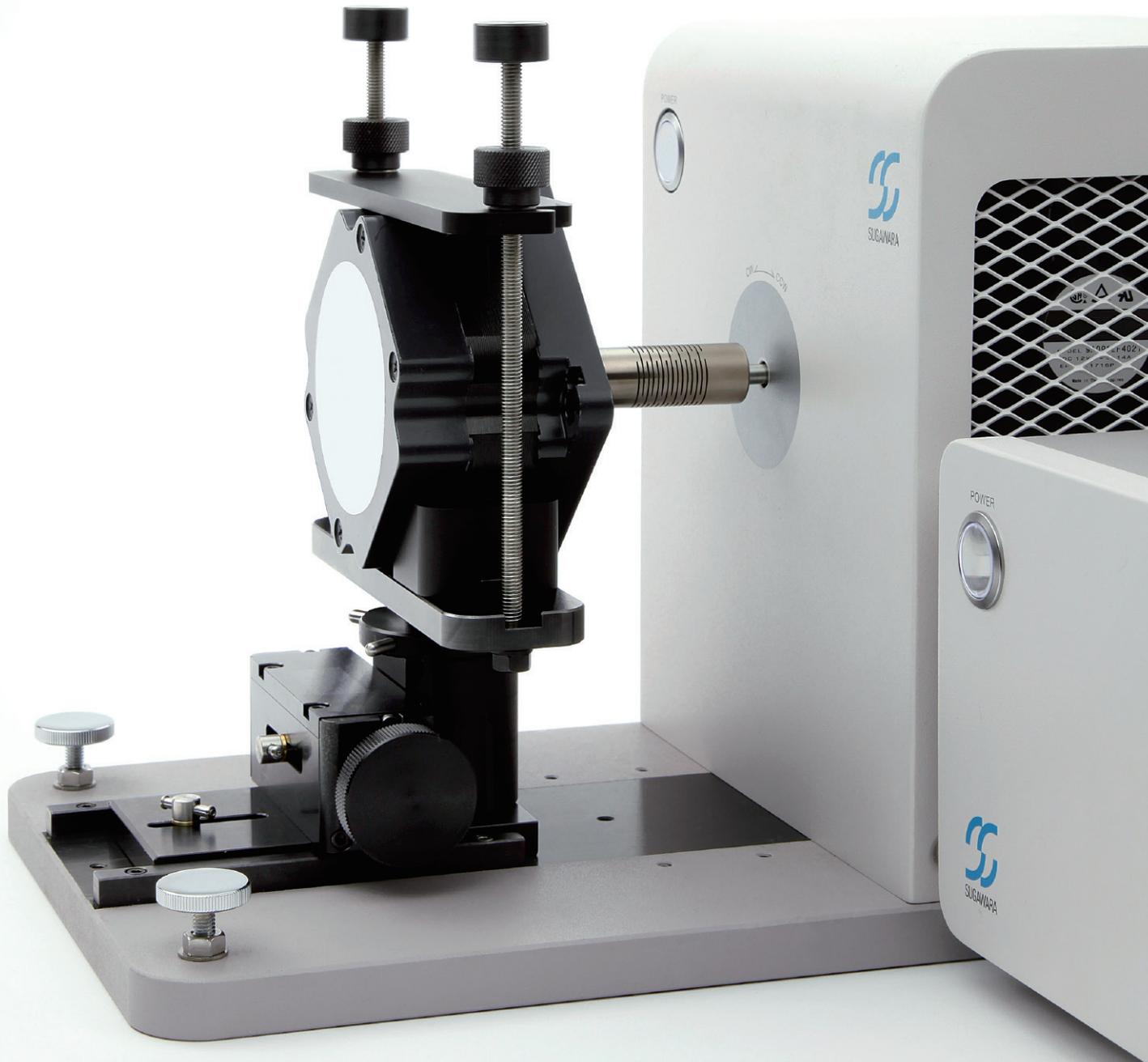
Torque Dynamometer

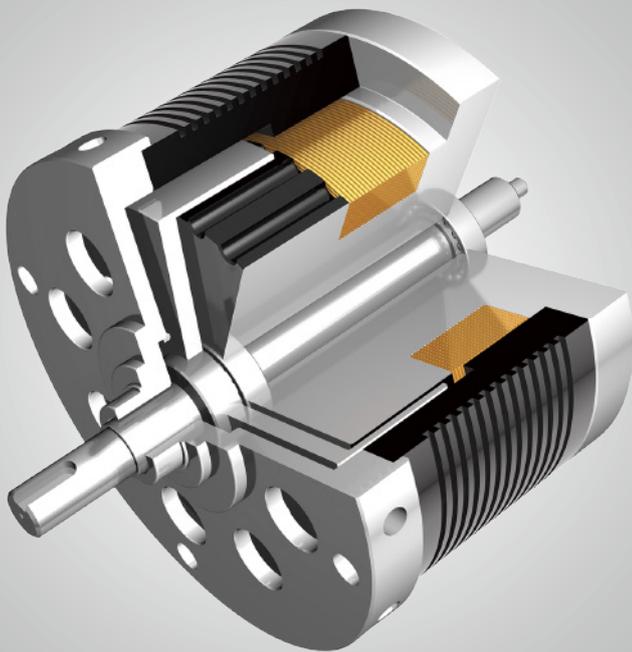
Torque and Speed Measurement

Controller **DM5001**
HB-N Series Dynamometers

Automotive motors
Home appliance motors
Industrial automation motors

DC motors
BLDC motors
AC motors
SR motors
Stepping motors





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 $\pm 0.1\%$

- Speed accuracy $\pm 0.01\%$
- Maximum speed 60,000 r/min

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

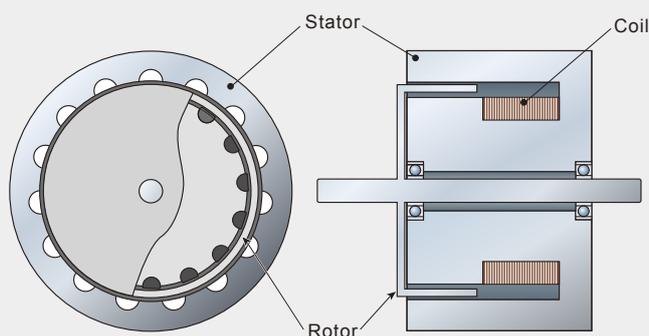
Improved measurement accuracy and ease of use

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

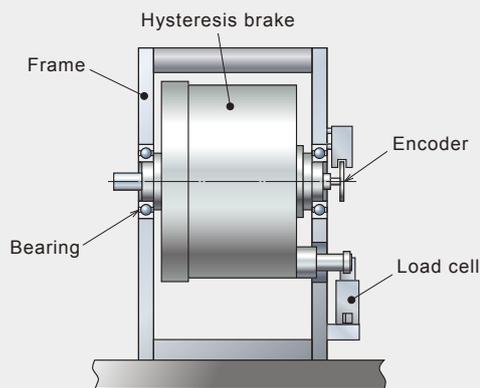


■ Hysteresis brake principles



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.

■ Specifications

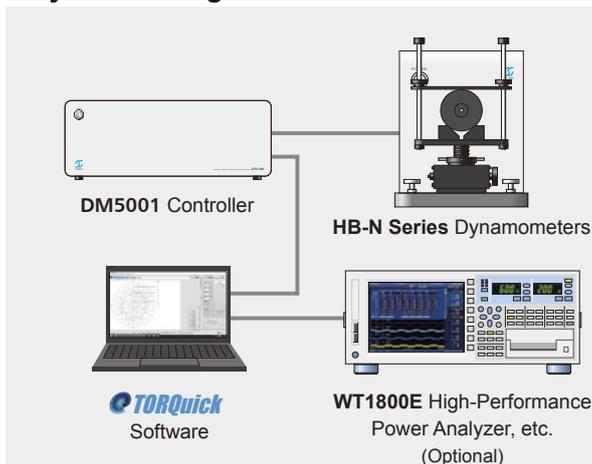
Analog output	
Torque analog output	Max ± 10 VDC $\pm 1\%$ Voltage and torque are individually configurable
Speed analog output	Max ± 10 VDC $\pm 1\%$ Voltage and speed are individually configurable
I/O option (Optional)	Digital input 4 ch, Digital output 4 ch Analog input 4 ch, Analog output 2 ch Contact 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 $\pm 10\%$, 50/60 Hz
Power consumption	30 VA or less
Dimensions (W×H×D)	430×148×360 mm
Weight	8 kg

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



DM5001 Controller

■ 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.

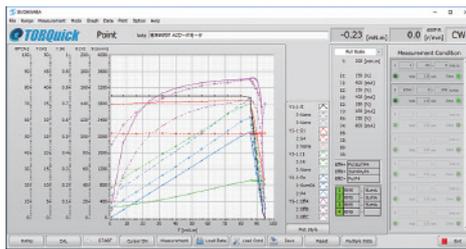
TORQuick software for motor evaluation is developed with the user in mind.

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.

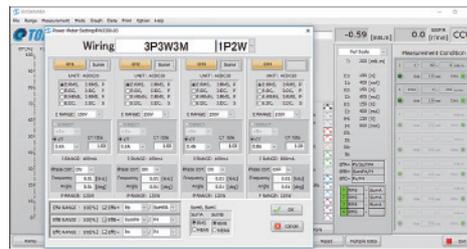
■ Main features

● 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

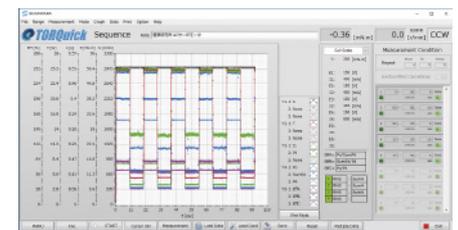
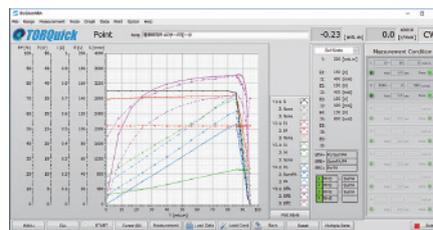
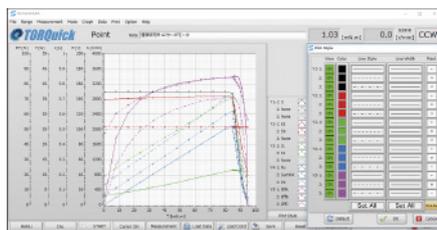
S-T characteristics (speed–torque characteristics) can be measured by simply setting measurement points. Torque control, speed control, and brake control can be combined within one measurement. The data is not affected by moment of inertia because it measures values at stable operating points.

▶ 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

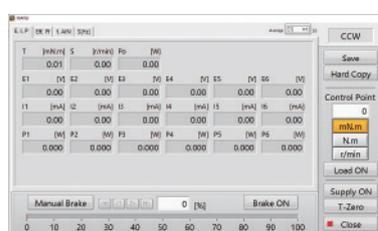
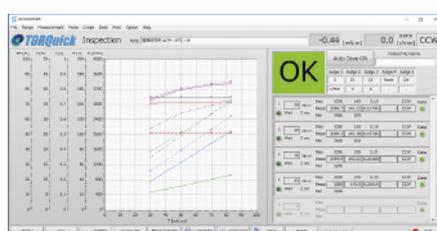
Pass/fail testing can be performed by setting the upper and lower limits for up to five measurement items based on torque, speed or braking. By specifying a file name in advance, you can automatically generate a file listing the time, sequence number and results of each measurement.

▶ 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: $\pm 0.1\%$ of the rated torque *1

Speed accuracy: $\pm 0.01\%$

● 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	$\pm 0.1\%$ 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	$\pm 0.01\%$							
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·m ²	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	

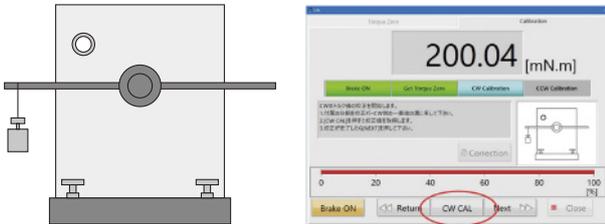
*1: After calibration with the DM5001 Controller. Torque accuracy is $\pm 0.25\%$ for 1200 P/R optional models of HB-500MN, HB-1N, HB-2N, and HB-5N.

*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

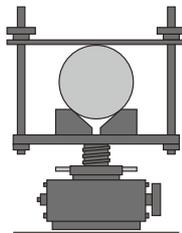
Calibration is necessary for measuring correct torque values. A separately sold calibration jig set (calibration bar and weight) is used for this purpose. The calibration bar is attached to the shaft and the weight is suspended from the end of the bar. Calibration is achieved by simply pushing the CAL 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.



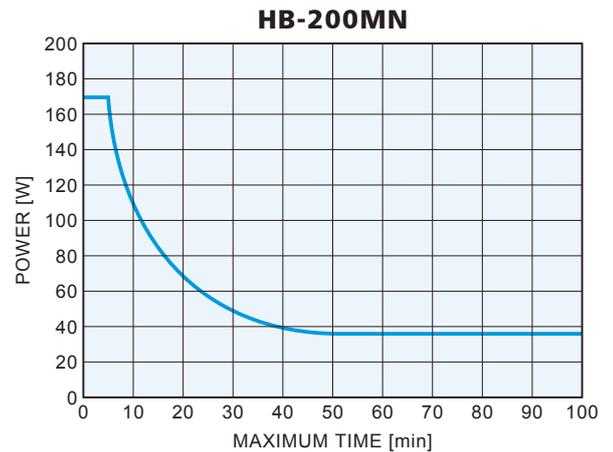
■ Safety cover

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.



Power (motor output power) is calculated as follows.

$$\text{Power [W]} = \text{Torque [N·m]} \times \text{Speed [r/min]} \times 0.1047$$

Short-base-plate HB-NS Dynamometers

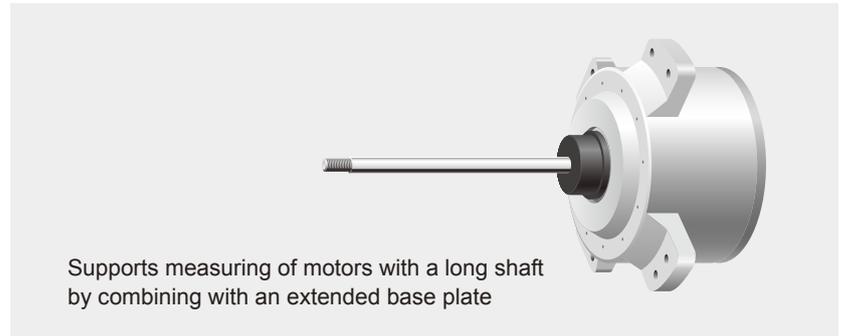


Ideal for measuring motors with special shapes.

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.

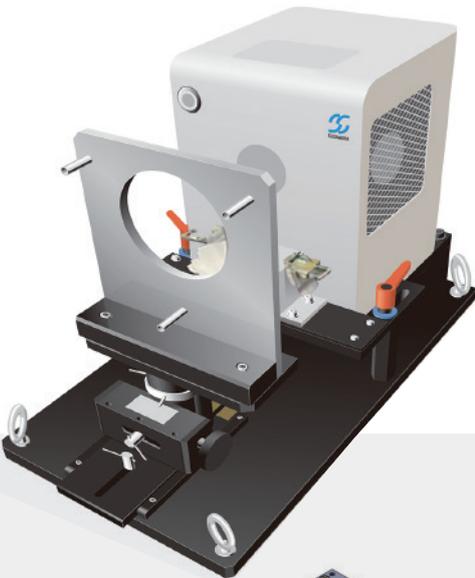
■ Application examples

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



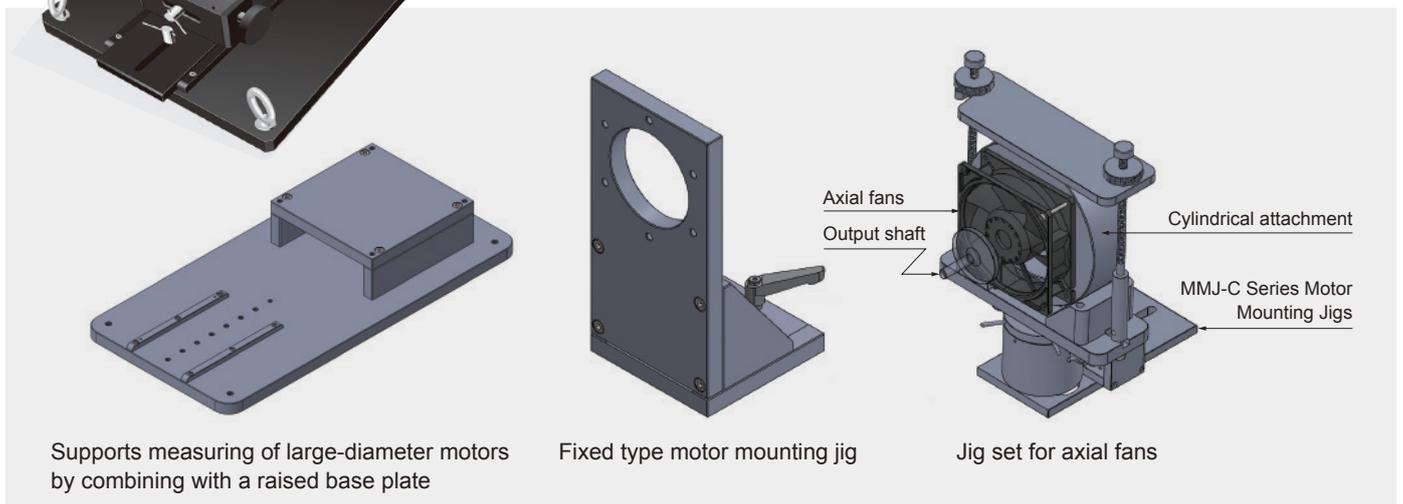
Supports measuring of motors with a long shaft by combining with an extended base plate

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.

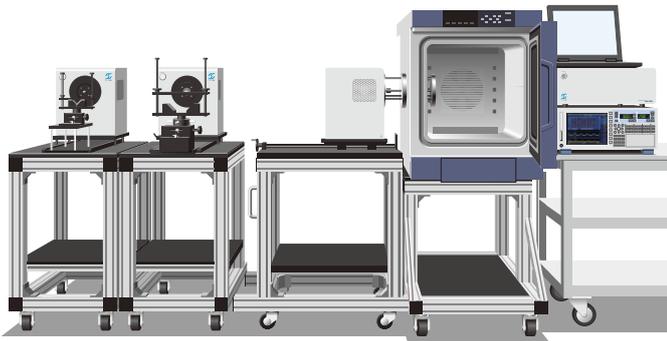


Supports measuring of large-diameter motors by combining with a raised base plate

Fixed type motor mounting jig

Jig set for axial fans

HB-NT Dynamometers for Temperature / Humidity Environmental Testing



■ 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.

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.

■ 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.

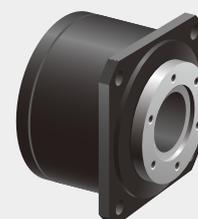
HB-*e6: 10–10,000 r/min

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

Option

Optional items for DM5001

Software	DVD-TORQUICK	Software for motor evaluation
I/O option	77RG-K001	Connector for external input/output
Terminal block for I/O option	8TC1-M37	Screw-type terminals, 37 poles
Terminal block cable for I/O option	8CN-S01-202	D-sub37pin - D-sub37pin, 2 m (1 m available)
Discrete-wire cable for I/O option	8CN-L01-202	D-sub37pin - Discrete-wire, 2 m (1 m available)
BNC cable	8CT-401-202	For Rotation speed/Torque analog output, 2 m (1 m available)
HB connection cable	8CM-C01-202	2 m (1/5/7/10 m available)
Power cable	1C1-002	2 m, 100-110 VAC (Japan) (PSE)
Power cable	8CV-614-202	2 m, 200-240 VAC (China) (CCC)
Power cable	8CU-604-202	2 m, 200-240 VAC (EU/Korea) (KC)
Rack mounting bracket	RKJ-DMC01 (JIS)	RKE-DMC01 (EIA)

Optional items for HB-N series

Short base plate type	HB-*NS	Supports HB-50MN - HB-5N
Temperature chamber type	HB-*NT	Supports HB-50MN - HB-5N
Change of speed encoder	HB-*Ne6	600 P/R (10-10,000 r/min) (not available on HB-50N)
Change of speed encoder	HB-*Ne12	1200 P/R (5-5,000 r/min)
Calibration jig set	CJ-HB-*N	Includes calibration bar and weight, supplied in a wood case
Safety cover	TBSC-*C	(HBCC-1*01 for HB-2N or greater)
Power cable	1C1-002	2 m 100-110 VAC (Japan) (PSE)
Power cable	8CV-614-202	2 m 200-240 VAC (China) (CCC)
Power cable	8CU-604-202	2 m 200-240 VAC (EU/Korea) (KC)
Power cable	8CT-614-202	For HB-20N 100 VAC Round connector - 3P plug

• Safety cover for HB-50N can be custom-made.

Coupling

Product lineup includes small diameter types with low inertia.

Customized coupling attachments that support special shaft shapes are also available.

Dynamometer	Rotation speed			
	30,000 r/min or less	40,000 r/min or less	50,000 r/min or less	60,000 r/min or less
HB-5MN	Sugawara, RC-2.2- * -6	Nabeya Bi-tech, XHW-C Series	—	—
HB-10MN	Sugawara, RC-2.2- * -10		—	—
HB-20MN	Sugawara, RC-2.2- * -13		—	—
HB-50MN	Sugawara, RC-3.2- * -10 Sugawara, RC-3.2- * -13	Nabeya Bi-tech, XHW-C, MST-C Series MIGHTY, MK2 Series		MIGHTY, MK2 Series
HB-100MN	Nabeya Bi-tech, XHW-C Series		MIGHTY, MK2 Series	
HB-200MN	MIGHTY, MK2 Series			
HB-500MN	Nabeya Bi-tech, XHW-C Series MIGHTY, MK2 Series	MIGHTY, MK2 series		—
	10,000 r/min or less	20,000 r/min or less	25,000 r/min or less	30,000 r/min or less
HB-1N	Nabeya Bi-tech, XHW-C, MJT-C Series			Nabeya Bi-tech, MJT-C Series
HB-2N	Nabeya Bi-tech, XGT2-C Series			—
HB-5N	Nabeya Bi-tech, XGT2-C Series	Nabeya Bi-tech, MJT-C Series	—	—
	7,000 r/min or less	10,000 r/min or less	12,000 r/min or less	
HB-10N	Nabeya Bi-tech, XGT2-C, MJT-C Series			
HB-20N				
HB-50N	Nabeya Bi-tech, MJT-C Series Miki Pulley, SFC Series	—	—	

• When using RC-type rubber couplings, difference between coupling hole diameter and shaft diameter or length of fitting may cause slipping preventing application of load up to the maximum allowable torque.

• Coupling hole diameter supports dimensional tolerance h7 of the motor shaft diameter.

• MIGHTY CORPORATION coupling is available via special order (10,000 r/min or higher).

• Please feel free to ask about coupling choices.



Danger

Damage and scattering of the coupling during measurement may cause injury.
Always use the safety cover.

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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