Torque Station for Motor Torque Measuring Systems

TS-7100

ONO SOKKI has integrated its motor measuring functions into a Windows® 95 platform called the TS-7100 torque station. The various characteristics of the motor measured can be obtained by a simple operation. There is a wide choice of detectors available for the different types of motors-AC to DC motors, and their differing capacities. This enables you to configure a measuring system best suited to your application needs. The highly accurate data obtained will not only improve the quality control of your motors, but also increase their power and efficiency.
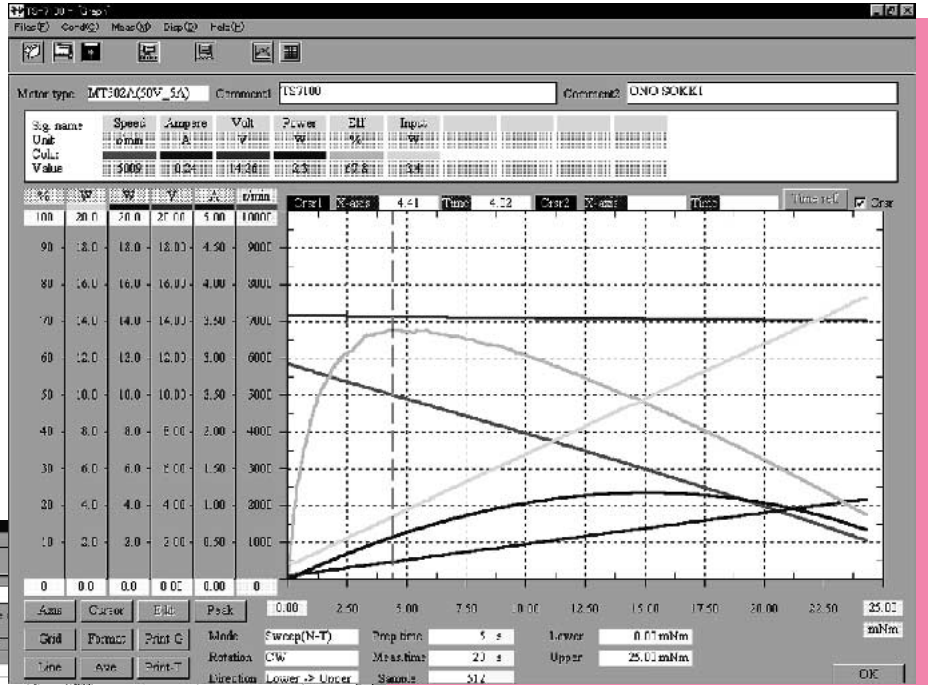
ONO SOKKI

In a simple operation, the TS-7100 torque station automatically acquires the data needed for motor manufacturers or users to do testing or research & development on their motors and motor drivers. In addition to torque and revolutions, the station simultaneously measures up to 16 input signals in order to graphically represent the various characteristics of a motor. To support the advancement of users' measurement environments, the station comes with software that runs under Windows ® 95, making the system easier to operate. There are as many as 53 types of detectors that you can choose from to combine with your system.

▲ Example of Graphic Display

▲ Table Display

Example of Monitor Display ▶

Functions:

Operability

Simply click the mouse to measure data, or show graphs or tables.
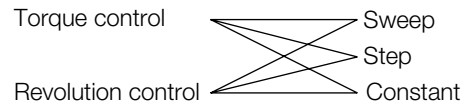
Measure   Graph Table

Measuring Ranges

The general-purpose MT-xxxA series of detectors covers eight ranges of torque, from 0-2 mN·m to 0-500 mN·m. The upper limit of the range of revolutions is as high as 10,000 r/min (no load). The MT-600 series supports ranges not covered by the MT-xxxA series.

Measuring Methods

Torque control   Sweep

Step

Revolution control   Constant

- Sweep : This method linearly varies the given parameter over the selected range.
- Step : This method varies the given parameter in fixed increments over the selected range.
- Constant : This method controls the given parameter according to a keyed-in setpoint.

Data Display

Graph : This mode shows measured data as an X-Y graph or in a time-axis graph.
For the X- and Y-axis parameters, you can choose any desired parameters. In addition, you can hide or show the grid lines, scale marks and cursor.

Table : This mode lists the measured values numerically. You can scroll through a maximum of 1,024 lines, delete unnecessary data and correct or add data.

Monitor : This mode shows the measured values numerically at one-second intervals.

offers both precision measurement and the user-friendliness of a GUI environment.

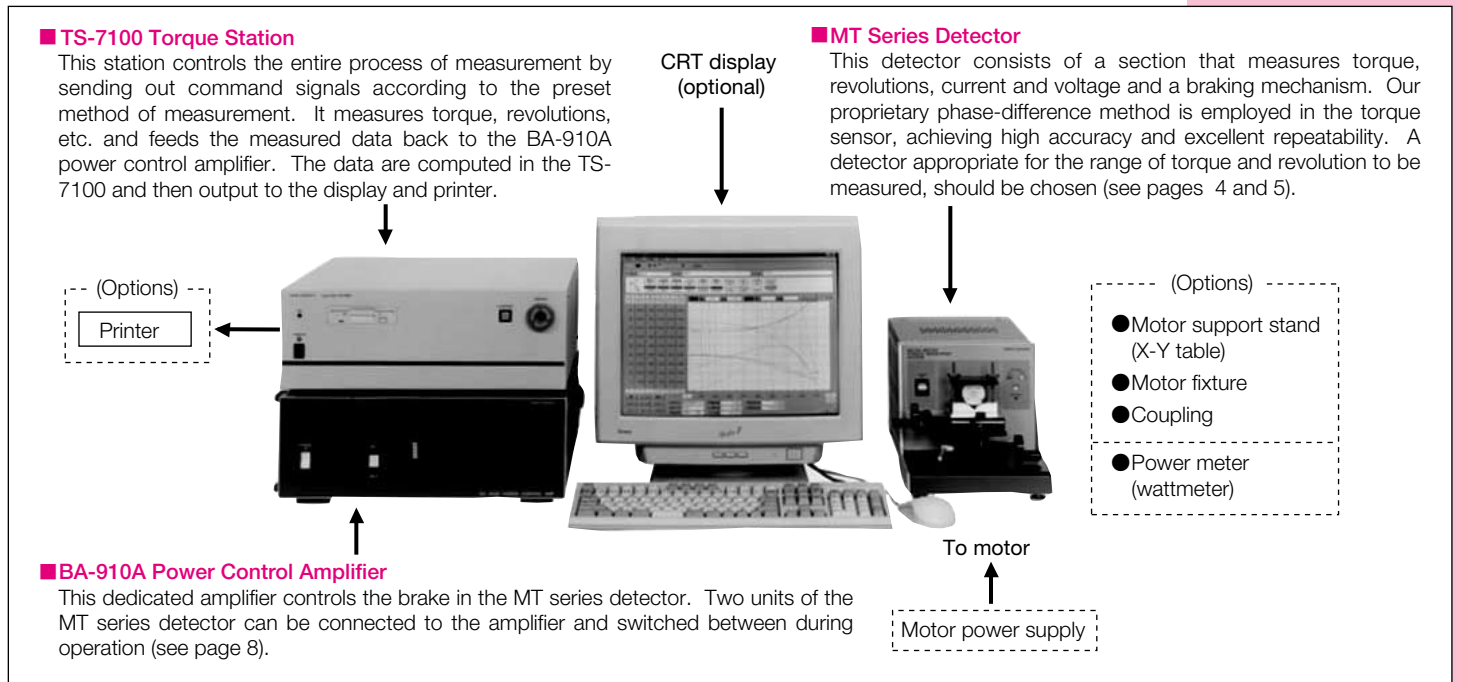**Graphical representation of motor characteristics**

Easy to use

Supports both DC motors and three-phase AC motors

Precision measurement by means of direct digital signal processing

Great versatility, enabling simultaneous measurement of torque, revolution, and other 16 input signals.

Meets requirements for PC-based data management and the effective use of data

System Configuration:

■ **TS-7100 Torque Station**
This station controls the entire process of measurement by sending out command signals according to the preset method of measurement. It measures torque, revolutions, etc. and feeds the measured data back to the BA-910A power control amplifier. The data are computed in the TS-7100 and then output to the display and printer.

CRT display (optional)

■ **MT Series Detector**
This detector consists of a section that measures torque, revolutions, current and voltage and a braking mechanism. Our proprietary phase-difference method is employed in the torque sensor, achieving high accuracy and excellent repeatability. A detector appropriate for the range of torque and revolution to be measured, should be chosen (see pages 4 and 5).

- - - (Options) - - -

Printer

- - - - - (Options) - - - - - -
● Motor support stand (X-Y table)
● Motor fixture
● Coupling
● Power meter (wattmeter)

To motor

■ **BA-910A Power Control Amplifier**
This dedicated amplifier controls the brake in the MT series detector. Two units of the MT series detector can be connected to the amplifier and switched between during operation (see page 8).

Motor power supply

Hard Copy of Data

Measured data can be sent to a Windows® 95-enabled printer for output in graphs and tables. You can also select the size of the graph, and set the scale division so that 1-cm represents 1 mN·m of torque for exanple.
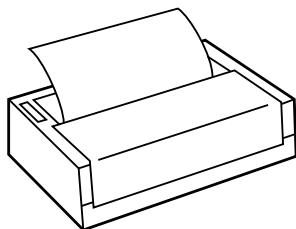
Computing Functions

You can define the desired computational expressions (arithmetic operations) and recalculate the computing results given. In addition, you can add a unit to your computation results to include it in the graph or table, or to show the efficiency, power, slip, and so on.

Compensating Functions

Compensating functions are available for higher precision measurement and easier viewing of graphs. These functions include compensation based on the moving averages or least-squares method, compensation of data values by key input, and correction of the effects of inertia (each compensating function can be applied on each rpm).

Measurement of Torque Ripples and Cogging

These torque-related parameters can be measured with the MT-620 detector. To measure them, set the torque station in the constant-control mode while controlling the motor revolution at ultra-low speeds of less than 5 r/min. A detector with an angle sensor is required to show the torque over the rotational angle between 0 and 360 degrees.

3

MT Series

High-performance motors, including ultra-precision motors used with fully automated cameras, are now in wide use. These types of motors are extremely diversified-ranging from ultra high-speed motors used for electrical home appliances to low-speed motors used for office-automation, audio-visual equipment, ultrasonic motors, and so on.

To support such a variety of motors, ONO SOKKI has developed the MT series of detectors. You can build your own torque measuring system by combining the TS-7100 torque station, which is specifically designed for motor torque measurement, with MT series detectors and a BA-910A power control amplifier.

MT-xxxA Series Detector

Specifications of the MT-xxxA Series of Detectors

Current measuring range : Selectable between 1-A and 5-A full scales; set to 5-A full scale at shipment
(MT-201A, MT-501A, MT-102A, MT-202A, MT-502A and MT-103A)
Selectable between 2-A and 10-A full scales; set to 10-A full scale at shipment
(MT-203A and MT-503A)
Voltage measuring range : Selectable between 10-V and 50-V full scales; set to 50-V full scale at shipment
(MT-201A, MT-501A, MT-102A, MT-202A, MT-502A and MT-103A)
Weight: 7 kg (MT-201A, MT-501A, MT-102A, MT-202A, MT-502A and MT-103A)
23 kg (MT-203A and MT-503A)

Model	Capacity of Torque	Range of Measurement Revolution	Outer Dimensions
MT-201A	2mN·m	200 to 10000r/min	Ⓐ (see page 7)
MT-501A	5mN·m	200 to 10000r/min	Ⓐ (see page 7)
MT-102A	10mN·m	200 to 8000r/min	Ⓐ (see page 7)
MT-202A	20mN·m	200 to 8000r/min	Ⓐ (see page 7)
MT-502A	50mN·m	200 to 6000r/min	Ⓐ (see page 7)
MT-103A	100mN·m	200 to 6000r/min	Ⓐ (see page 7)
MT-203A	200mN·m	200 to 5000r/min	Ⓒ (see page 7)
MT-503A	500mN·m	200 to 4000r/min	Ⓒ (see page 7)

Specifications of MT-610 Series of Detectors for High-Speed Revolution

The MT-610 series is suited for measurement of the high-speed motors used for motor-driven tools, camera film winders, automotive electric equipment, and so on. This series has a wide range of measurement, covering low-speed revolutions also. Specify the desired range of revolutions when ordering.

Braking method : Brushless DC motor
Current measuring range : 0 to 10 A
Voltage measuring range : 0 to 50 V
Weight : Approx. 23 kg

Model	Outer Dimensions
MT-610（10mN·m／600 to 25000r/min）	Ⓒ (see page 7)
MT-610（20mN·m／600 to 25000r/min）	Ⓒ (see page 7)
MT-610（50mN·m／600 to 25000r/min）	Ⓒ (see page 7)
MT-610（100mN·m／500 to 20000r/min）	Ⓒ (see page 7)
MT-610（200mN·m／400 to 15000r/min）	Ⓒ (see page 7)

Note : Each model name consists of the MT-610 base model code, the maximum measurable torque and the range of revolution that can be measured.

Specifications of MT-620 Series of Detectors for Measuring Torque-Ripples/Cogging

The MT-620 series is suited for measurement of ripples during the start of motors and cogging torque when motors are in an unexcited state.

Braking method : Brushless DC motor
Current measuring range : 0 to 10 A (0 to 5 A for models used to measure torque no greater than 100 mN·m)
Voltage measuring range : 0 to 50 V
Weight : Approx. 7 kg (model for 100 mN·m torque)
Approx. 15 kg (models for 200 mN·m, 500 mN·m, 1 N·m and 2 N·m torque)
Approx. 23 kg (models for 5 and 10 N·m torque)

Model	Range of Measurement Revolution	Outer Dimensions
MT-620（2mN·m）	0.5 to 5r/min	Ⓐ (see page 7)
MT-620（5mN·m）	0.5 to 5r/min	Ⓐ (see page 7)
MT-620（10mN·m）	0.5 to 5r/min	Ⓐ (see page 7)
MT-620（20mN·m）	0.5 to 5r/min	Ⓐ (see page 7)
MT-620（50mN·m）	0.5 to 5r/min	Ⓐ (see page 7)
MT-620（100mN·m）	0.5 to 5r/min	Ⓐ (see page 7)
MT-620（200mN·m）	0.5 to 5r/min	Ⓑ (see page 7)
MT-620（500mN·m）	0.5 to 5r/min	Ⓑ (see page 7)
MT-620（1N·m）	0.5 to 5r/min	Ⓑ (see page 7)
MT-620（2N·m）	0.5 to 5r/min	Ⓑ (see page 7)
MT-620（5N·m）	0.5 to 5r/min	Ⓒ (see page 7)
MT-620（10N·m）	0.5 to 5r/min	Ⓒ (see page 7)

Note : Each model name consists of the MT-620 base model code and the maximum measurable torque.
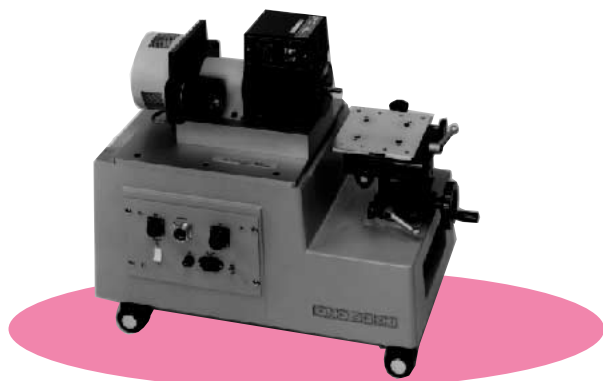
MT-6500 Detector (5-N・m/130-W Model)

Common Specifications

Torque detecting method : Magnetic phase difference method
Revolution detecting method : Optical rotary encoder
Bearing : Ball bearing
Motor power supply : Not included
Options :
- Coupling
- Motor mounting fixture
- MT-092 and -093 motor support stands
  (The MT-6500 series of detectors comes with a dedicated support stand.)
- Large-current detectors (various types with currents of up to 1,000 A)
- Power meter for measuring the AC power supply

Operating power supply voltage : 100 V AC ±10% (50/60 Hz) or other specified voltage
Operating temperature range : 0 to 40 °C

Specifications of MT-630 Series of Detectors for Low-Speed Revolution

The MT-630 series is suited for measurement of low-speed motors used for office-automation and audio-visual equipment. You can specify the measured range of revolution as shown in the following ordering example. For each model, the table right shows the upper limit of the measurable range of revolution. According to the table, specify the lower and upper limits of the span of revolution you use, making sure they are in a 1 : 20 relationship.

Example: Specify as "MT-630 (2 mN・m/10 to 200 r/min)."

Braking method: Brushless DC motor

Current measuring range: 0 to 10 A (0 to 5 A for models used for torque no greater than 100 mN・m)

Voltage measuring range: 0 to 50 V

Weight: Approx. 7 kg (model for 100 m N・m torque)
Approx. 15 kg (models for 200 mN・m, 500 mN・m, 1 N・m and 2 N・m torque)
Approx. 23 kg (models for 5 and 10 N・m torque)

Model	Range of Measurement Revolution	Outer Dimensions
MT-630 (2mN・m)	1000r/min maximum	Ⓐ (see page 7)
MT-630 (5mN・m)	1000r/min maximum	Ⓐ (see page 7)
MT-630 (10mN・m)	1000r/min maximum	Ⓐ (see page 7)
MT-630 (20mN・m)	1000r/min maximum	Ⓐ (see page 7)
MT-630 (50mN・m)	1000r/min maximum	Ⓐ (see page 7)
MT-630 (100mN・m)	1000r/min maximum	Ⓐ (see page 7)
MT-630 (200mN・m)	500r/min maximum	Ⓑ (see page 7)
MT-630 (500mN・m)	200r/min maximum	Ⓑ (see page 7)
MT-630 (1N・m)	100r/min maximum	Ⓑ (see page 7)
MT-630 (2N・m)	50r/min maximum	Ⓑ (see page 7)
MT-630 (5N・m)	20r/min maximum	Ⓒ (see page 7)
MT-630 (10N・m)	10r/min maximum	Ⓒ (see page 7)

Note: Each model name consists of the MT-630 base model code and the maximum measurable torque. The range of measurement revolution varies depending on your ordering instructions.

Specifications of MT-640 Series of Hysteresis-Braking Detectors

The MT-640 series uses hysteresis braking for the load braking. This detector can apply loads even when the motor is at a stop, while at the same time supporting high-speed revolutions.

Note: Since the hysteresis braking involves drag torque, the MT-640 series is not applicable to revolution measurements with no load (0 mN・m).

Braking method: Hysteresis braking

Current measuring range: 0 to 10 A

Voltage measuring range: 0 to 50 V

Weight: Approx. 13 kg (models for 100 and 200 m N・m torque)
Approx. 14 kg (model for 500 mN・m torque)
Approx. 17 kg (model for 1 N・m torque)
Approx. 25 kg (model for 2 N・m torque)

Mode	Range of Measurement Revolution	Outer Dimensions
MT-640 (100mN・m 27W)	Standstill, and 100 to 5000r/min	Ⓑ (see page 7)
MT-640 (200mN・m, 35W)	Standstill, and 100 to 5000r/min	Ⓑ (see page 7)
MT-640 (500mN・m, 40W)	Standstill, and 100 to 5000r/min	Ⓑ (see page 7)
MT-640 (1N・m, 60W)	Standstill, and 100 to 5000r/min	Ⓑ (see page 7)
MT-640 (2N・m, 120W)	Standstill, and 100 to 5000r/min	Ⓒ (see page 7)

Note: Each model name consists of the MT-640 base model code, the maximum measurable torque and the braking capacity (continuous-mode wattage rating [W]).

Specifications of MT-6500 Series of Powder-Braking Detectors

The MT-6500 series is suited for measurement of low-speed motors having comparatively large axial torque, such as motors equipped with a deceleration mechanism and geared motors. In addition to rotational torque, this detector can measure locking (binding) torque.

Note: Since powder braking involves drag torque, the MT-6500 series is not applicable to torque measurement with little to no load (0 mN・m).

Braking method: Powder braking

Current measuring range: 0 to 15 A

Voltage measuring range: 0 to 50 V

Weight: Varies depending on the model.

Model	Range of Measurement Revolution
MT-6500 (1 N・m, 20 W)	1 to 1800r/min
MT-6500 (2 N・m, 50 W)	1 to 1800r/min
MT-6500 (5 N・m, 130 W)	1 to 1800r/min
MT-6500 (10 N・m, 320 W)	1 to 1800r/min
MT-6500 (20 N・m, 450 W)	1 to 1800r/min
MT-6500 (50 N・m, 700 W)	1 to 1800r/min
MT-6500 (50 N・m, 1700 W)	1 to 1800r/min
MT-6500 (100 N・m, 900 W)	1 to 1800r/min
MT-6500 (100 N・m, 3000 W)	1 to 1800r/min
MT-6500 (200 N・m, 1900 W)	1 to 1000r/min
MT-6500 (200 N・m, 4500 W)	1 to 1000r/min

Note: Each model name consists of the MT-6500 base model code, the maximum measurable torque and the braking capacity (continuous-mode wattage rating [W]).

TS-7100 Torque Station

Applicable motors: DC and AC motors, excluding stepping motors

Measured parameters: Torque, revolution, and other analog signals of parameters

Accuracy:
- Torque ±0.2% of full scale
- Revolution ±0.02% of full scale
- Analog signals ±0.2% of full scale

Torque input: Via ONO SOKKI's dedicated detector

Revolution input: Via ONO SOKKI's MP-981 or RP series of detectors

Analog input: 16 channels with 16-bit A/D converters; 0 to ±10 V DC

Control output: 0 to 10 V DC signal, with feedback of measured revolution and torque

Setup of computational expressions: Four user-definable expressions (arithmetic operations only) based on the input signal and existing results of computing

Setup of measuring conditions: Torquemeter and tachometer settings
Setting of control method (revolution/torque)
Measurement mode setting (automatic/manual)
- All these settings can be given a file name and saved on hard disk.

Measuring method:
- Sweep: This method automatically and continuously varies the torque or revolution during measurement.
- Manual: This method controls torque or revolution to a specified setpoint.
- Step: This method is another sweep type that varies the strength of braking in a step-by-step manner.

Monitor display: A maximum of 22 data items can be monitored at the same time.

Graphic display:
- User-selectable X- and Y-axis data items
- Up to 16 graphs on one screen
- Comment capabilities.
- The search cusor functions
- Average reading and overlay drawing functions
- Graph resizing function

Table display: Provides a data editing function.

Toolbar icons: Open, Save As, Overlay, Conditions, Measure, Graph and Table

Files of measured data: Saved on hard or floppy disk

Hard copy: Measured data can be sent to a Windows ® 95-enabled printer for output as graphs and tables.

External interface: A CRT display of 1024 × 768 pixel resolution and capable of handling 256 colors is required.
- RS-232C (standard)

Operating temperature range: 0 to 40°C

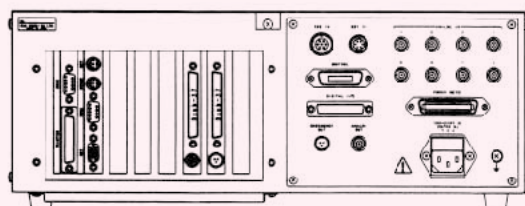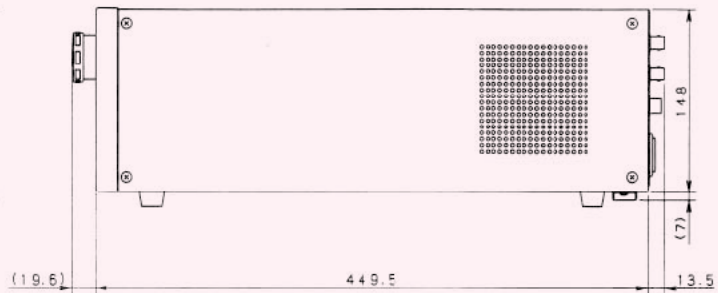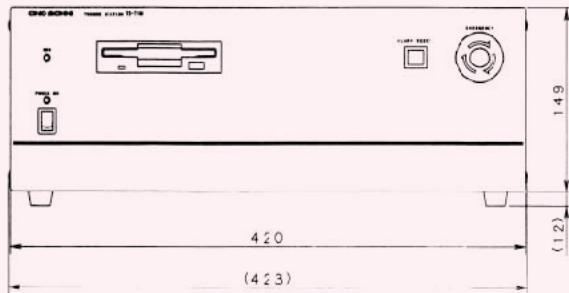**Operating power supply voltage:** 100 V AC ±10% (50/60 Hz) or other specified voltage

Power consumption: 80 VA max.

Weight: Approx. 10 kg
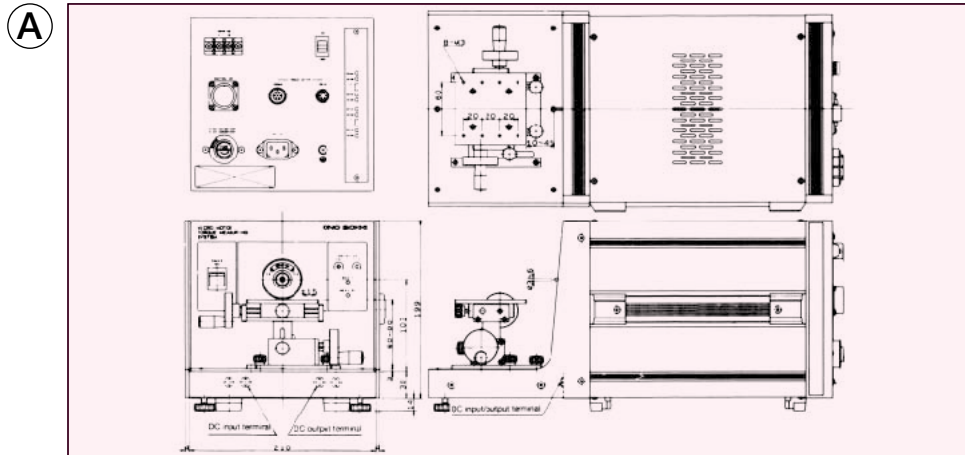
Outer Dimensions:
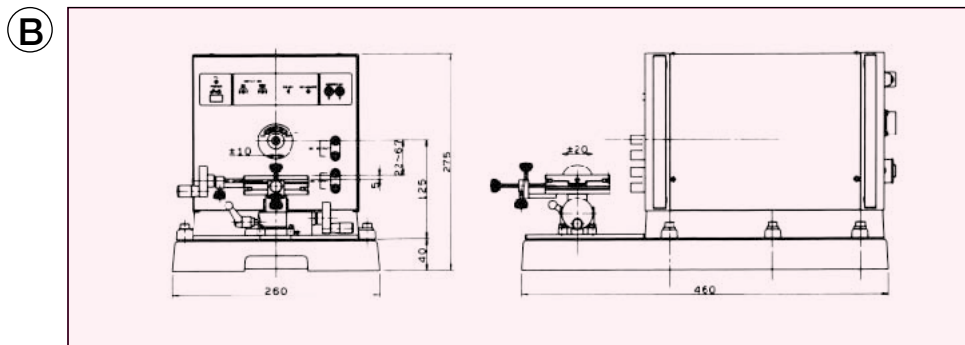
(Unit: mm)

REAR VIEW
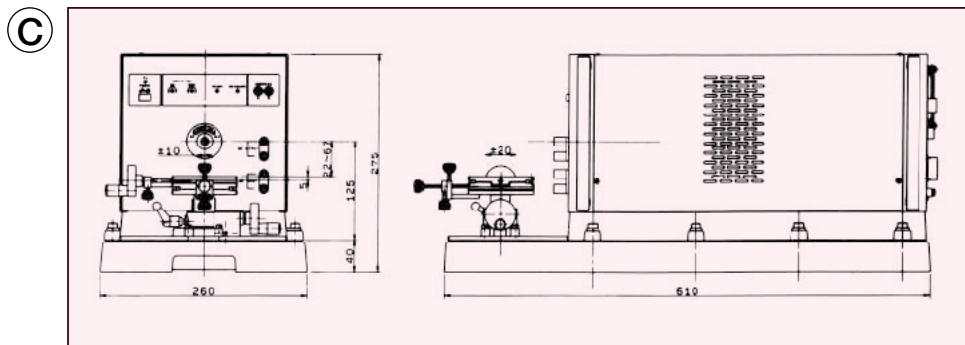
6

Outer Dimensions:

MT Series

(A)

Example of Use of MT-092 Rigid Support Stand (Optional)

(B)

Example of Use of MT-093 Rigid Support Stand (Optional)

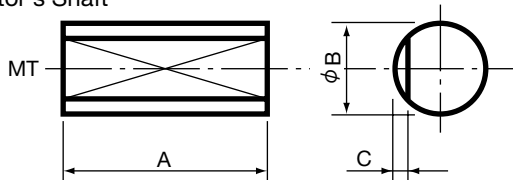The dimensions of the table are the same as those of the MT-092 stand.

(C)

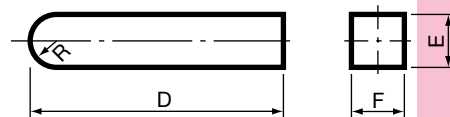Example of Use of MT-093 Rigid Support Stand (Optional)

The dimensions of the table are the same as those of the MT-092 stand.

Dimensions of Coupling Part

Detector's Shaft

Dimensions of the Key (for Coupling)

MT Series	A	ϕB	C
2 and 5mN·m	10	3^{h6}	No chamfering
10 and 20mN·m	10	3^{h6}	No chamfering
50, 100 and 200mN·m	10	5^{h6}	0.5
500mN·m, 1and 2N·m	15	8^{h6}	0.5
5 and 10N·m	20	12^{h6}	Key's groove: 5 × 5

MT-6500 Series	A	ϕB	D	E	F	R
10 and 20N·m	27	14^{h6}	25	5^{h9}	$5\,^{0}_{-0.09}$	2.5
50 and 100N·m	45	25^{h6}	40	8^{h9}	$7\,^{0}_{-0.09}$	4
200N·m	70	36^{h6}	65	10^{h9}	$8\,^{0}_{-0.09}$	5

BA-910A Power Control Amplifier

Specifications

Control function: The amplifier receives a control signal from the TS-7100 torque station to control the braking DC motor, hysteresis brake or powder brake in the detector.
- PID control function : Control via two channels
  These two channels can be configured separately when two MT detectors of different series are used.
  : Configured on the front panel
- Speedup/slowdown control speed function: 0.5 to 5 s

Applicable detector: Any model in the MT series
Operating temperature range: 0 to 40°C
Operating power supply voltage: 100 V AC ±10% (50/60 Hz) or other specified voltage
Power consumption: Approximately 200 VA
Weight: 14 kg

Option: BA-0960 external current/voltage input board
Function: Used to measure the current and voltage of motors with larger output torque by inputting the monitor output from a large-capacity power supply.
External voltage input range: 1 to 100 V DC
External current input range: Current signals are converted to voltage signals of 0.01 to 1 V DC levels.
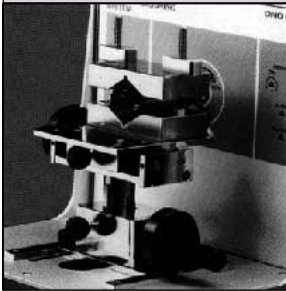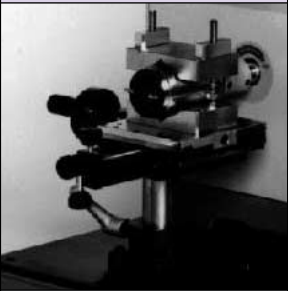Output: Output of direction-of-revolution status (CW/CCW) Contact output
Motor power supply on-off output Contact output
Output for brake control devices Signal of 0 to ±10 V

MT-092/093 Motor Support Stands

Options for the MT Series

These motor support stands are useful when coupling a motor with an MT detector. The stand is designed so that the installed motor can be moved in the X, Y and Z directions to fine-adjust the motor's position. Choose either the MT-092 or MT-093 (rigid) model. Note that the V block (or L bracket) that supports motors is optional. Consult ONO SOKKI before placing an order.

MT-092	MT-093
Applicable to MT-xxxA series of detectors for torque no greater than 100 mN·m	Applicable to all models in the MT series of detectors
Mountable size of motors: • V-block mounting ϕ 16 to 40 mm • L-bracket mounting ϕ 70 mm maximum	Mountable size of motors: • V-block mounting ϕ 16 to 40 mm • L-bracket mounting ϕ 80 mm maximum
Note: These specifications apply when the ONO SOKKI-made V block or L bracket is used.	

Windows® is a registered trademark of Microsoft Corporation in the U.S.A and other respective countries.