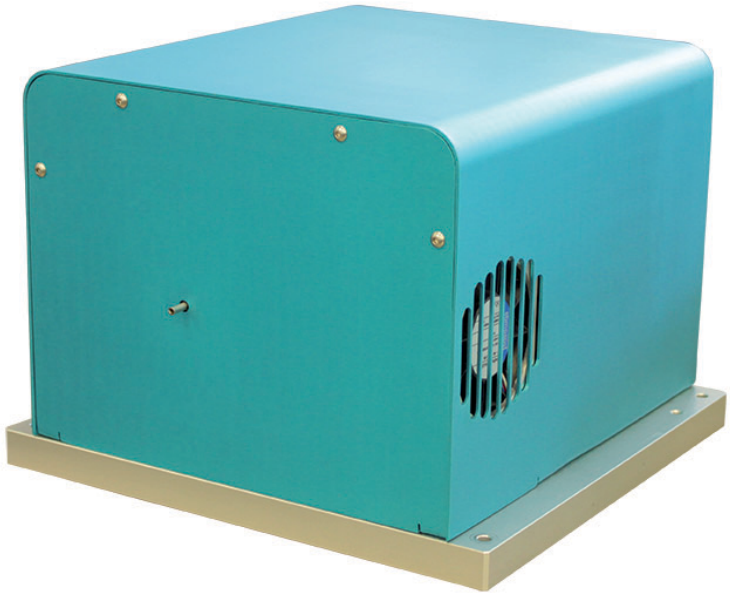
MAGTROL

1WB23 & 1WB27 High-Speed Eddy-Current Dynamometer



User's Manual

Purchase Record

Please record all model numbers and serial numbers of your Magtrol equipment, along with the general purchase information. The model number and serial number can be found on either a silver identification plate or white label affixed to each unit. Refer to these numbers whenever you communicate with a Magtrol representative about this equipment.

Model Number: _____

Serial Number: _____

Purchase Date: _____

Purchased From: _____

First edition revision B – September 2015

MAGTROL

Safety Precautions

WARNING! IN ORDER TO MINIMIZE RISKS, IT IS OF UTMOST IMPORTANCE TO RESPECT THE CURRENT SAFETY STANDARDS WHEN PLANNING, CONFIGURING AND OPERATING THE MOTOR TEST SYSTEM.

1. Make sure that all Magtrol dynamometers and electronic products are earth-grounded, to ensure personal safety and proper operation.
2. Check line voltage before operating electronic equipment.
3. Run the tested motor and the dynamometers only after having taken all the requested safety measures. Make sure that the rotating parts of the system are equipped with appropriate safety guards.
4. Always select a coupling that matches the speed and braking torque of the tested system.
5. Wear protective glasses when working on a test bench.
6. Never wear a necktie or baggy clothes when standing close to the test bench.
7. Never stand too close to the running test bench or bend over a rotating shaft.
8. Electrically insulate the motor terminal block.
9. Always connect the motor envelope to earth ground.
10. Make sure that the safety circuitry of the motor control cannot be deactivated by accident.

WARNING! A DEFECT ON THE ELECTRICAL TRANSMISSION LINE CAN CAUSE A SHORT-CIRCUIT WHICH CAN PROPAGATE TO ALL CONNECTED INSTRUMENTS OR PERSONS IN CONTACT WITH THE APPARATUS.

Revisions To This Manual

The contents of this manual is subject to change without prior notice. Should revisions be necessary, updates to all Magtrol User's Manuals can be found at Magtrol's website at http://www.magtrol.com/support/manuals.htm.

Please compare the date of this manual with the revision date on the website, then refer to the manual's Table of Revisions for any changes/updates that have been made since this edition.

REVISION DATE

First edition revision B - September 2015

TABLE OF REVISIONS

Date	Edition	Change	Section(s)
09/01/2015	First edition revision B	Maintenance of the air filter	2.4 / 2.4.1
06/18/2015	First edition revision A	Removal of the load cell/restraining plate	2.1.3
04/28/2015	First edition		

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2. INSTALLATION / MOUNTING

3. CONFIGURATION / CONNECTIONS

5. CALIBRATION

Preface

PURPOSE OF THIS MANUAL

This manual contains information required for the installation, configuration, starting-up, calibration and general use of Magtrol's 1WB23 and 1WB27 dynamometers. To achieve maximum capability and ensure proper use, please read this manual in its entirety before operating. Keep the manual in a safe place for quick reference whenever a question should arise.

WHO SHOULD USE THIS MANUAL

This manual is intended for bench test operators who are going to use a 1WB23 or a 1WB27 eddy-current dynamometer in order to determine the torque and power of a motor in relation to its speed. It is assumed that the user has sufficient knowledge in mechanics and electronics to be able to install/ operate this system without risk.

MANUAL ORGANIZATION

This section gives an overview of the structure of the manual and the information contained therein. Some information has been deliberately repeated in different sections of the document to minimize cross-referencing and to facilitate understanding through reiteration.

The structure of the manual is as follows:

Chapter 1 : INTRODUCTION – Contains technical data sheets of Magtrol's 1WB23 and 1WB27 dynamometers, which describe its technical characteristics and give a brief overview of its application fields.

Chapter 2 : INSTALLATION / MOUNTING – Provides information needed for the mounting of the dynamometer, as well as limits and precautions to observe during operation.

Chapter 3 : CONNECTION / CONFIGURATION – Provides information about the wiring between the dynamometer and the electronic control unit.

Chapter 4 : OPERATING PRINCIPLE – Describes the physical phenomena on which the eddy-current (WB) dynamometer technology is based.

Chapter 5 : CALIBRATION – Provides recommended calibration schedules along with step-by-step instructions for the calibration procedure of the dynamometer to guaranty precision measurements.

Chapter 6 : MAINTENANCE AND REPAIR – Provides information on how to return a 1WB23 or 1WB27 dynamometer to Magtrol for servicing, preventative maintenance or repair.

CONVENTIONS USED IN THIS MANUAL

The following symbols and type styles may be used in this manual to highlight certain parts of the text:

Note: This is intended to draw the operator's attention to complementary information or advice relating to the subject being treated. It introduces information enabling the correct and optimal functioning of the product to be obtained.

CAUTION: THIS IS USED TO DRAW THE OPERATOR'S ATTENTION TO INFORMATION, DIRECTIVES, PROCEDURES, ETC. WHICH, IF IGNORED, MAY RESULT IN DAMAGE BEING CAUSED TO THE MATERIAL BEING USED. THE ASSOCIATED TEXT DESCRIBES THE NECESSARY PRECAUTIONS TO TAKE AND THE CONSEQUENCES THAT MAY ARISE IF THE PRECAUTIONS ARE IGNORED.

WARNING! INTRODUCES DIRECTIVES, PROCEDURES, PRECAUTIONARY MEASURES, ETC. WHICH MUST BE EXECUTED OR FOLLOWED WITH THE UTMOST CARE AND ATTENTION, OTHERWISE THE PERSONAL SAFETY OF THE OPERATOR OR THIRD PARTIES MAY BE PUT AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT, BEFORE PROCEEDING FURTHER.

1. Introduction

1.1 GENERAL DESCRIPTION

The 1WB23 and 1WB27 dynamometers manufactured by Magtrol are used for testing all types of motors and rotational systems, and measuring their torque and power according to their speed. They have been specially designed for integration in a complete motor testing system.

The 1WB23 and 1WB27 dynamometers feature eddy-current braking systems and are capable of being operated at high speeds. However, as their braking torque is proportional to their speed, they cannot be used at low speeds.

1.2 DATA SHEET

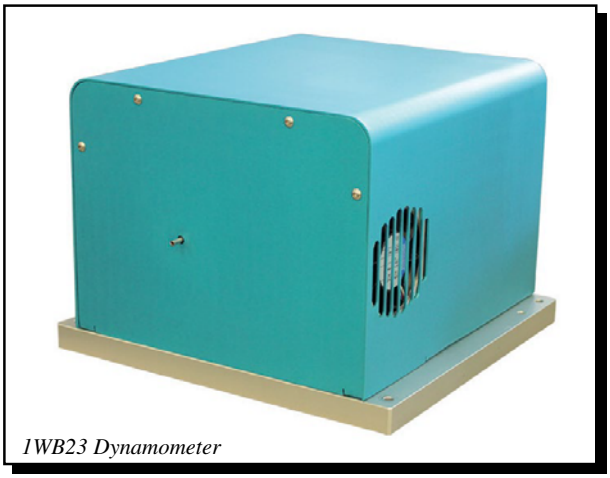
MAGTROL

1WB23 & 1WB27
Data Sheet

1WB23 & 1WB27 High-Speed Eddy-Current Dynamometers

FEATURES

- Torque: 80 mN·m and 150 mN·m
- Speed: up to 100,000 rpm
- Power: 250 W continuous; up to 500W(1WB23) or 1000W (1WB27) intermittent
- Low inertia
- Very low residual torque
- Stable braking torque, without blows
- Measuring system with air-bearing
- Data acquisition via DSP7000 Controller and M-TEST 7 Software
- Built-in electronics with Torque and Speed measurement



1WB23 Dynamometer

DESCRIPTION

Magtrol's 1WB23 and 1WB27 Eddy-Current Dynamometers are designed for very-high-speed motors and turbines testing applications. By providing a braking torque that is proportional to the rotational speed, rated torque is reached at the rated speed.

The Dynamometers features a low level of inertia, due to small rotor dimensions, and brake cooling is provided by an air flow inside the dynamometer housing.

A PT temperature sensor continuously monitors the brake temperature and alarms the DSP7000 Controller to stop the brake excitation current in order to protect the dynamometer from overheating.

Torque is measured by a reaction-force transducer placed on the stator. The dynamometer has a torque measuring accuracy rating of ±0.5% full scale. The speed is measured by an optical sensor and a 2-bit encoder. This sensor measures speeds between 10,000 and 100,000 rpm with a full scale accuracy of ± 0.06 % (using a DSP7000).

Magtrol offers three types of dynamometer brakes to absorb load: Hysteresis, Eddy-Current and Magnetic Powder. Each type of Dynamometer has advantages and limitations and choosing the correct one will depend largely on the type of testing to be performed. With over 50 models to choose from, Magtrol Sales professionals are readily available to assist in selecting the proper Dynamometer to meet your testing needs.

COMPLETE PC CONTROL

Magtrol's M-TEST 7 Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with a Magtrol DSP7000 Programmable Dynamometer Controller, Magtrol M-TEST 7 Software provides the control of any Magtrol Eddy-Current or Powder Brake Dynamometer and runs test sequences in a manner best suited to the overall accuracy and efficiency of the Magtrol Motor Test System. The data that is generated by Magtrol's Motor Testing Software can be stored, displayed and printed in tabular or graphic formats, and can be easily imported into a spreadsheet.

Written in LabVIEW™, M-TEST 7 has the flexibility to test a majority of motor types in a variety of ways. Because of LabVIEW's versatility, obtaining data from other sources (e.g. thermo torques), controlling motor power and providing audio/visual indicators is relatively easy.

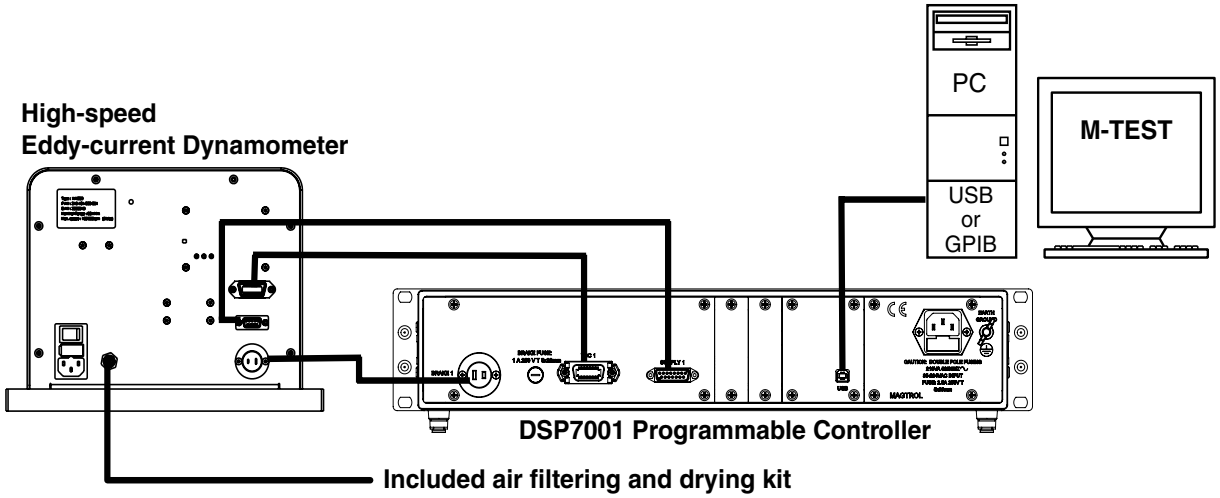
Magtrol's M-TEST 7 Software is ideal for simulating loads, cycling the unit under test and motor ramping. Because it is easy to gather data and duplicate tests, the software is ideal for use in engineering labs. Tests can be programmed to run on their own and saved for future use allowing for valuable time savings in production testing and incoming/outgoing inspection.

Specifications 1WB23 & 1WB27

SYSTEM CONFIGURATION

The 1WB23 and 1WB27 Dynamometers should be used with a Magtrol DSP7000 Programmable Dynamometer Controller in order to supply the necessary excitation current and closed-loop control of the test system. In addition, the DSP7000 displays the measured torque, rotation speed and mechanical power of the motor under test and features a built-in alarm system for user-defined limits.

A Single or Three-phase Power Analyzer, a required component in a test system measuring motor efficiency, can be integrated into this system as well as Magtrol's Temperature Testing Hardware.



OPERATING PRINCIPLES

The 1WB23 and 1WB27 Eddy-current Dynamometer provides their full braking power at high speed. This type of brake has been specially designed to test motors rotating at speeds up to 100,000 rpm, with the braking torque dependent upon the rotation speed. Due to its 2-bits optical speed encoder, the system is not adapted to accurate close loop control below 10'000 rpm.

The dynamometer integrats air bearings for minimizing friction and assuring best possible torque reading accuracy. It is mandatory to connect the air input through the air filtering and drying kit.

RATINGS

Model	Rated Power	Duration at Rated Power	Guaranteed Torque	Rated Speed	Maximum Speed	Drag Torque De-energized at 100,000 rpm	Nominal Input Inertia	Excitation Current max.
	W	*s*	*mN·m*	*rpm*	*rpm*	*mN·m*	*kgm²*	*A*
1WB23	250	steady operation	80	30,000	100,000	2	3.2×10^{-6}	0.8
	400	180	80	50,000				
	500	120	80	60,000				
1WB27	250	steady operation	150	16,000	100,000	2	8.75×10^{-6}	0.5
	500	180	150	32,000				
	1000	45	150	63,000				

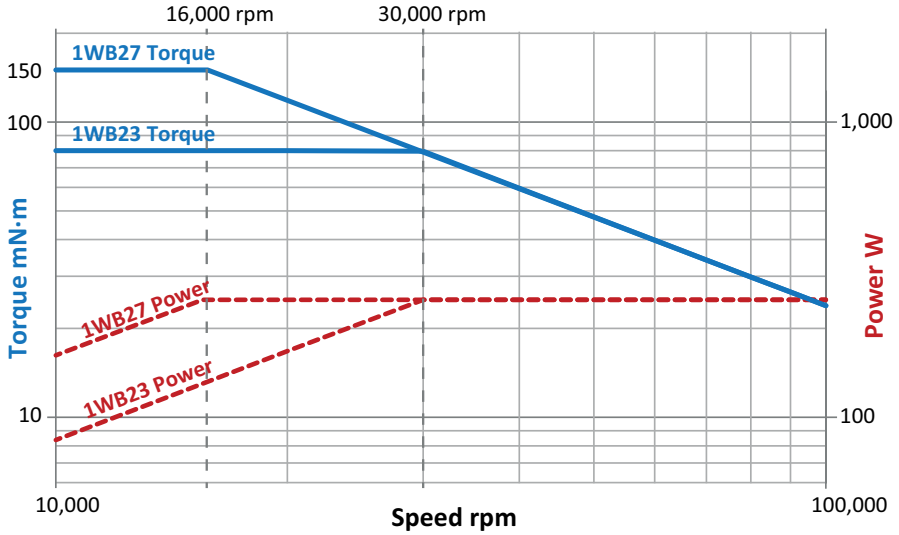
Weight: 18 kg with short base plate / 21 kg with long base plate

Torque-Speed-Power Curves 1WB23 & 1WB27

Continous

Brake	1WB23
Power	250 W
Test duration	Permanent
Rated Torque	80 mN·m
Rated Speed	30,000 rpm

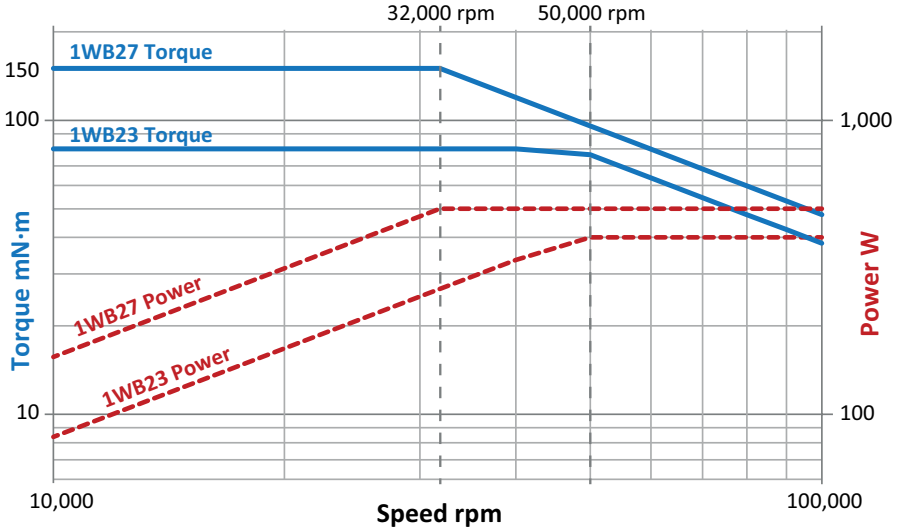
Brake	1WB27
Power	250 W
Test duration	Permanent
Rated Torque	150 mN·m
Rated Speed	16,000 rpm



Short terms

Brake	1WB23
Power	400 W
Test duration	180 s
Rated Torque	80 mN·m
Rated Speed	50,000 rpm

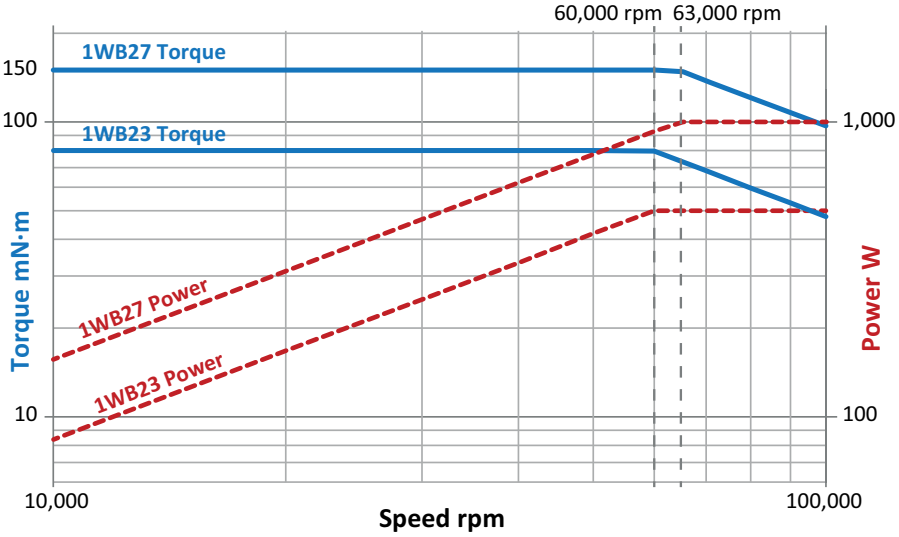
Brake	1WB27
Power	500 W
Test duration	180 s
Rated Torque	150 mN·m
Rated Speed	32,000 rpm



Intermittent

Brake	1WB23
Power	500 W
Test duration	120 s
Rated Torque	80 mN·m
Rated Speed	60,000 rpm

Brake	1WB27
Power	1000 W
Test duration	45 s
Rated Torque	150 mN·m
Rated Speed	63,000 rpm



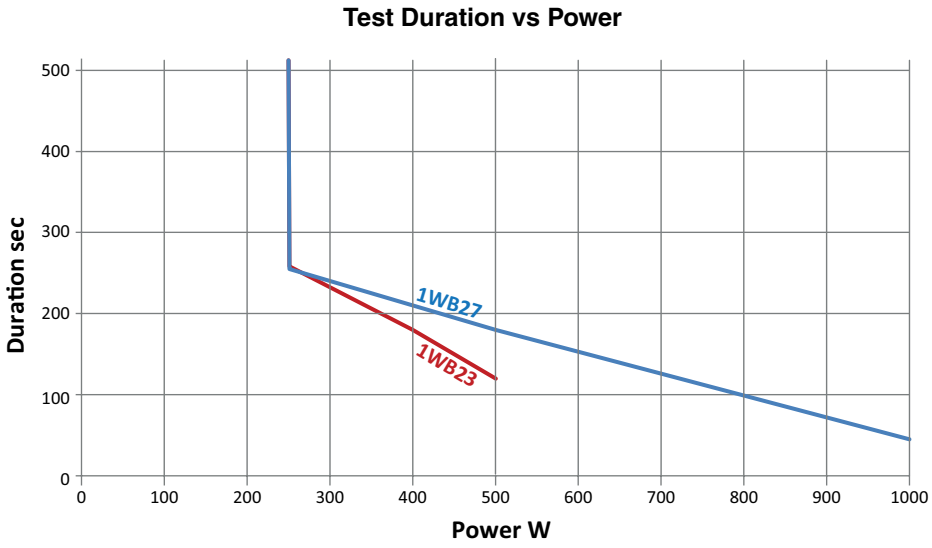
Duration & Temperature Curves 1WB23 & 1WB27

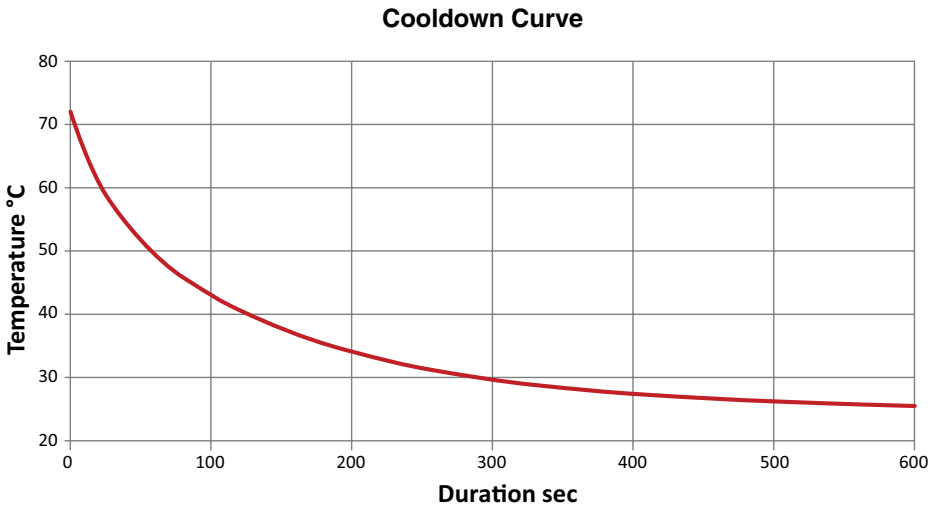
1WB23

Power [W]	Time [s]
500	120
400	180
250	Permanent

1WB27

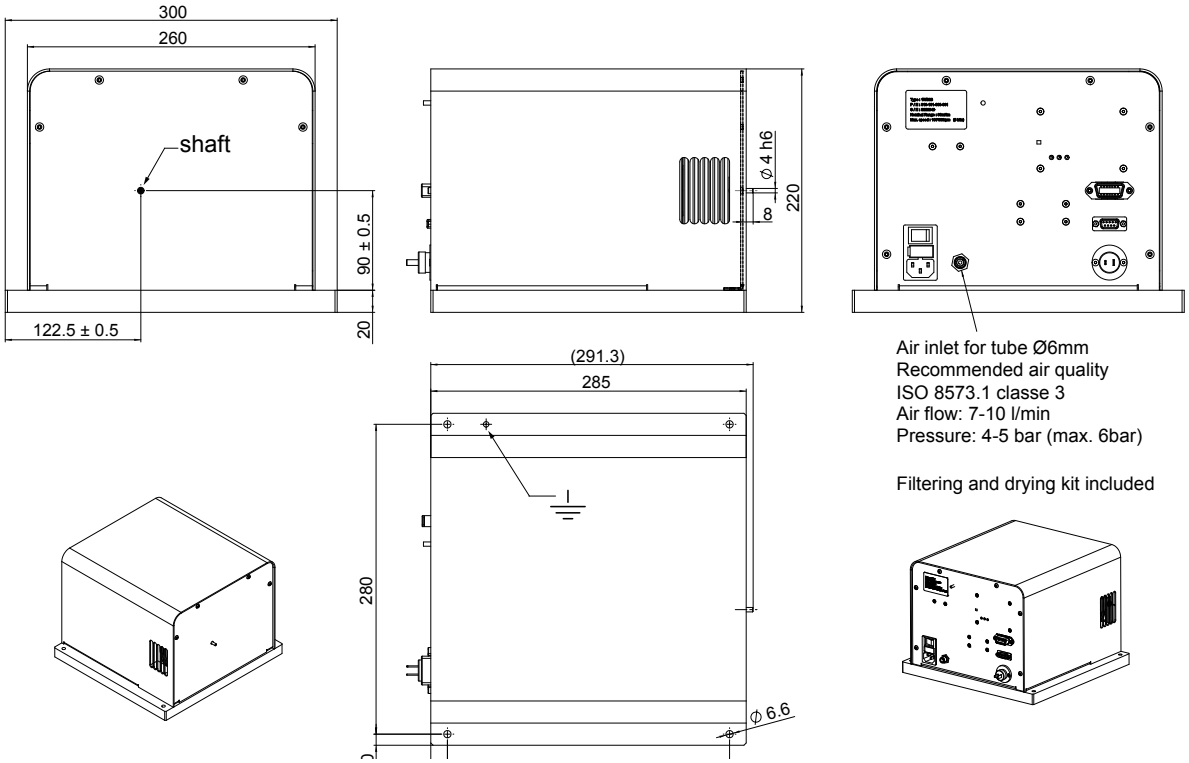
Power [W]	Time [s]
1000	45
500	180
250	Permanent



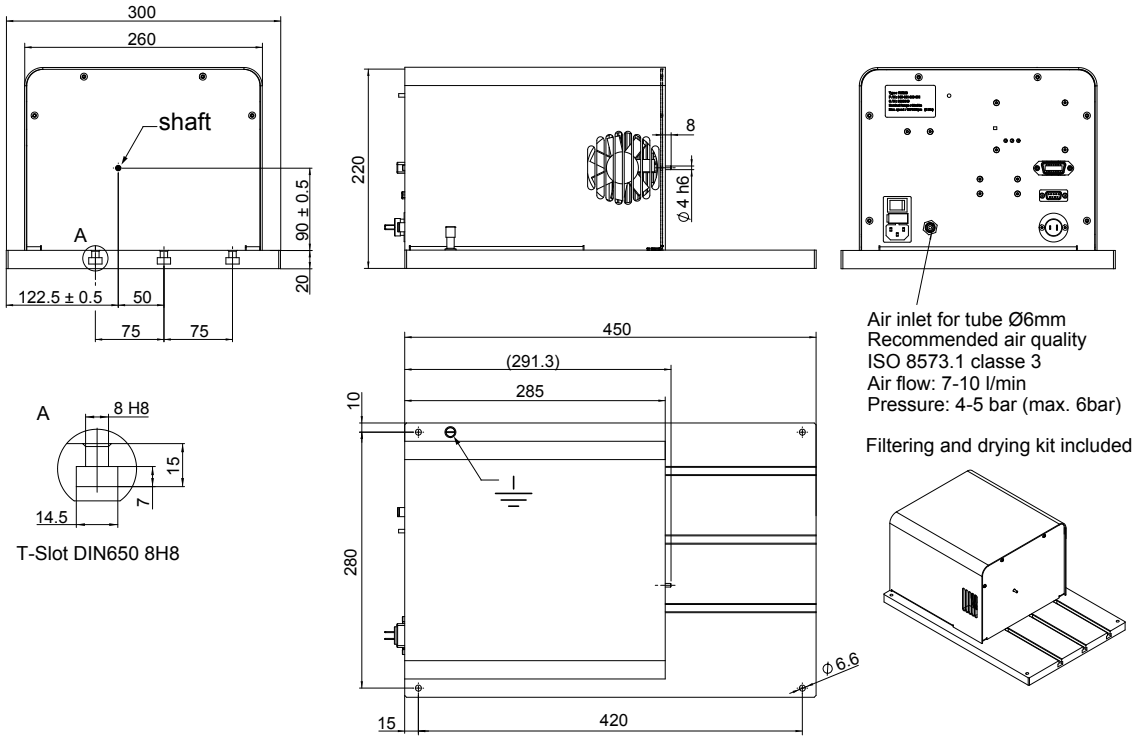


Dimensions 1WB23 & 1WB27

1WB23 AND 1WB27 WITH SHORT BASE PLATE

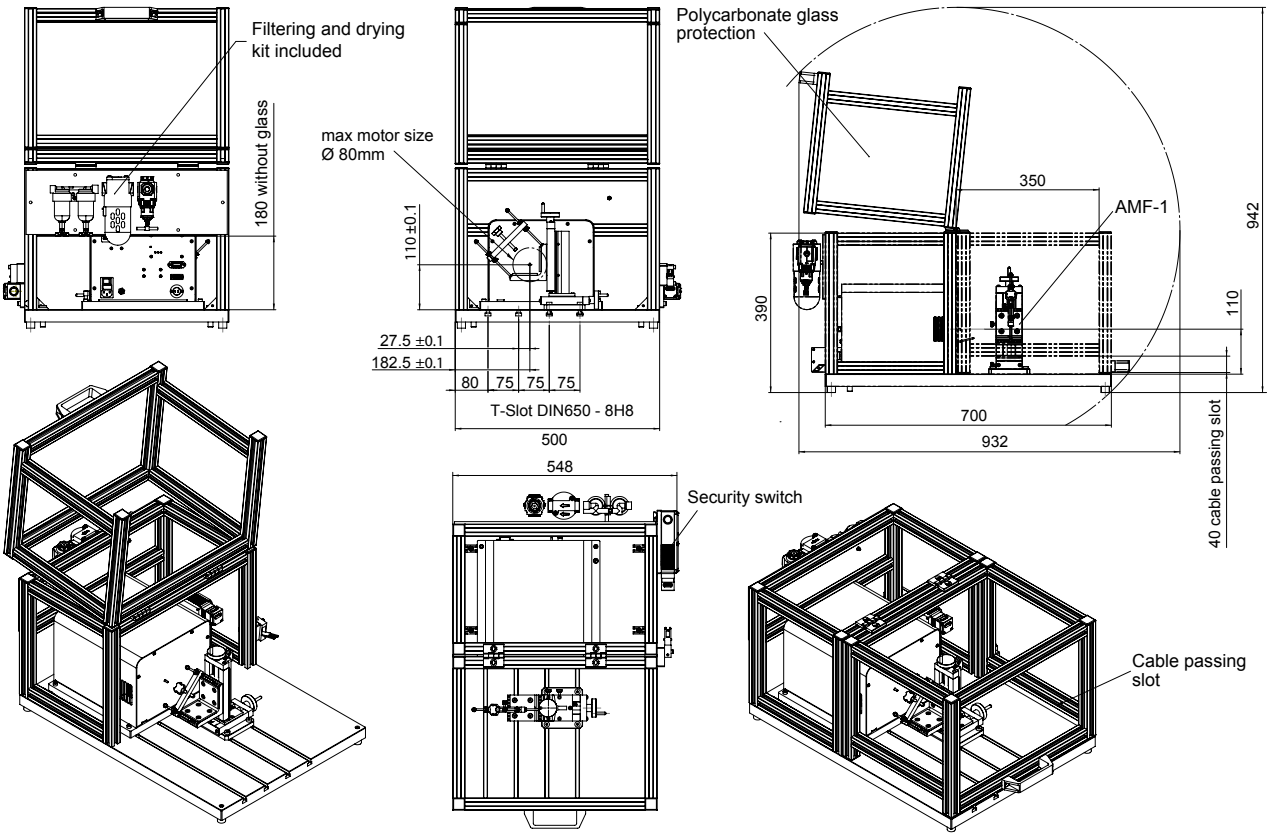


1WB23 AND 1WB27 WITH LONG BASE PLATE



Dimensions 1WB23 & 1WB27

1WB23 AND 1WB27 WITH PROTECTION COVER



ORDERING INFORMATION

DESCRIPTION	MODEL / PART #
1WB23 with short base plate	316-102-000-011
1WB23 with long base plate	316-103-000-011
1WB27 with short base plate	316-202-000-011
1WB27 with long base plate	316-203-000-011
1WB23 or 1WB27 with protection cover, base plate and motor fixture AMF-1	853-125-000-xxx

System Options 1WB23 & 1WB27

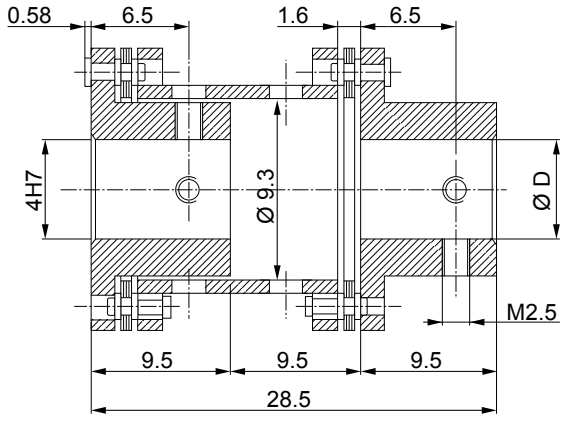
SYSTEM OPTIONS AND ACCESSORIES

CATEGORY	DESCRIPTION	MODEL / PART #
CONTROLLERS	High-Speed Programmable Dynamometer Controller	DSP7000
POWER ANALYZERS	High-Speed Single-Phase Power Analyzer	6510*e*
	High-Speed Three-Phase Power Analyzer	6530
SOFTWARE*	M-TEST 7 Motor Testing Software	M-TEST 7
	Temperature Testing Hardware	HW-TTEST-FP
MOUNTING	Adjustable Motor Fixture	AMF-1
	Miniature coupling (nominal torque 180 mN·m)	MIC-1-0018

** For more information regarding software and temperature testing hardware options, refer to the M-TEST 7 data sheet.*

Coupling MIC-1-0018

- Nominal torque: 180 mN·m
- ØD : min 1.98 mm, max 6.36 mm H7.
- As request :with balancing option for high speed



2. Installation / Mounting

The dynamometer life-span (before being overhauled) may vary from a few months to a few decades, depending on the application, but equally depending on the way it has been mounted. By mounting the dynamometer as described in the following sections, the operating life as well as the measuring precision of the unit may be significantly extended.

2.1 MOUNTING THE DYNAMOMETER TO THE TEST BENCH

The dynamometer should be placed on a stable horizontal base plate—preferably constructed of cast iron, steel or aluminium—in order to eliminate vibrations to the greatest extent possible. Flatness defects should not exceed 0.1 mm.

Note: Magtrol offers standard and custom dynamometer tables specially designed to support the entire range of Magtrol dynamometers.

The dynamometer is placed on the bench by means of four rubber feet.

2.1.1 ALIGNING THE DYNAMOMETERS ON THE TEST BENCH

The proper alignment of the dynamometer with the motor being tested is very important. The higher the speed of the test, the more care must be taken when performing the alignment. The maximum tolerated misalignment depends on the selected coupling.

With the 1WB23 and 1WB27 high-speed eddy-current dynamometers a maximum of 0.01 mm may be tolerated.

2.1.2 VIBRATIONS TRANSMITTED BY THE TEST BENCH TO THE DYNAMOMETER

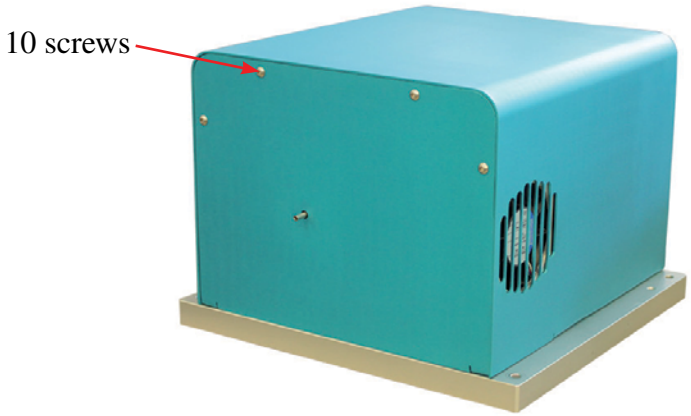
Vibrations generate premature wear of the bearings. Since modifying the motor being tested in order to prevent any vibration is not feasible, measures will have to be taken to forestall any damage to the dynamometer.

CAUTION: OPERATING AT THE RESONANCE FREQUENCY OF THE MEASURING CHAIN WILL SEVERELY DAMAGE THE DYNAMOMETER.

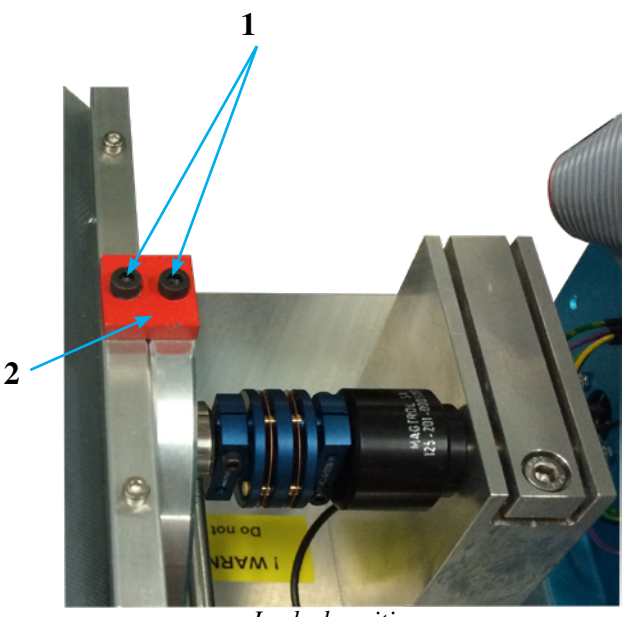
2.1.3 Removal of the Load Cell Shipping/Restraining Plate

Within the dynamometer enclosure there is a load cell shipping/restraining plate that must be removed before dynamometer operation. The plate is identified with red color.

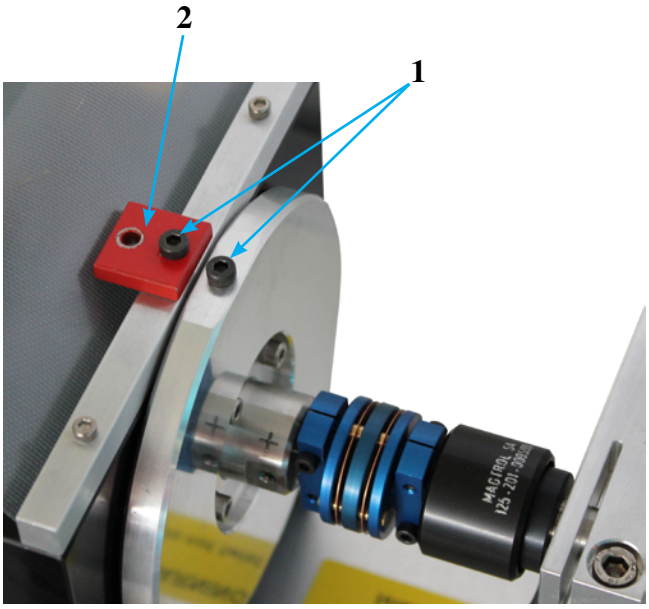
1. Remove dynamometer cover by unscrewing the side screws.



2. Unscrew the two screws (1) and remove the red plate (2).



Locked position



Unlocked position

Note: Retain the shipping/restraining plate for future use when moving or shipping your Magtrol dynamometer, as shown above.

2.2 COUPLINGS

The dynamometer couplings used with the motor being tested is an important factor to take into consideration. In fact, a coupling which is not correctly specified for the application will lead to measuring errors and premature wear of the dynamometer.

Given the fact that the dynamometer is a precision measuring device, high quality couplings should be used. Couplings with insufficient torsion stiffness will generate unwanted sinusoidal signals on the original measuring signal.

For the 1WB23 and 1WB27 dynamometers the coupling must be dynamically balanced (min.Q2.5). This balancing must compensate for maximum tolerated misalignment between the motor being tested and the dynamometer. **Magtrol recommends MIC-1-0018 miniature coupling (Nominal torque 180mN·m)**.

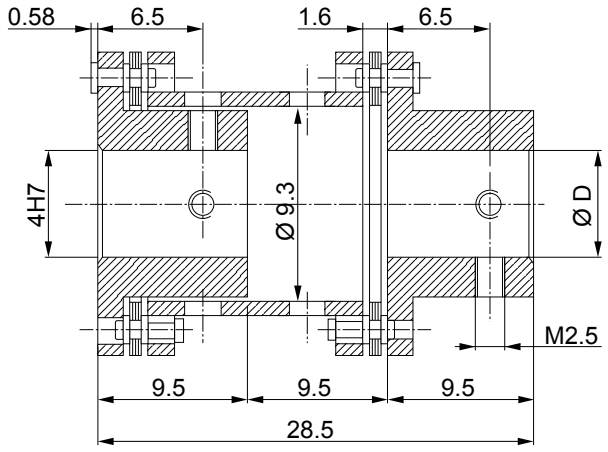


Figure 2–1 Coupling

Couplings must dampen axial and radial vibrations and isolate the dynamometer from the vibrations of the tested element.

☞	Note:	With more than 60 years of experience in the field of motor testing, Magtrol is your best partner to determine the best suited dynamometer for any given application.

2.3 AIR SUPPLY

2.3.1 CHARACTERISTICS OF THE AIR SUPPLY

- The air bearing should be supplied with air that is relatively free of particles, water and oil.

- Recommended air quality :

ISO 8573-1 classe 3*
Air flow: 7-10 L/min
Pressure: 4-5 bar (max.6 bar)

* classe 3=>

Particle size: max. 5 µm
Particle density: 5 mg/m³
Water: max. 880 mg/m³
Oil: Max. 1 mg/ m³ (including vapor)
Air inlet tube: Ø 6 mm

2.4 MAINTENANCE OF THE AIR FILTER

When the silica gel has changed its color because of humidity, follow these instructions.

Percentage of humidity: 0 % = fully activated

20 % = order new desiccant

30 % = have new desiccant on hand

60 % = replace desiccant

The particle and oil filters must be purged when liquid has accumulated. Turn to open the small sump drain valves underneath the filters and to drain the liquid, then close them again. Please refer to the *Figure 2-2*.

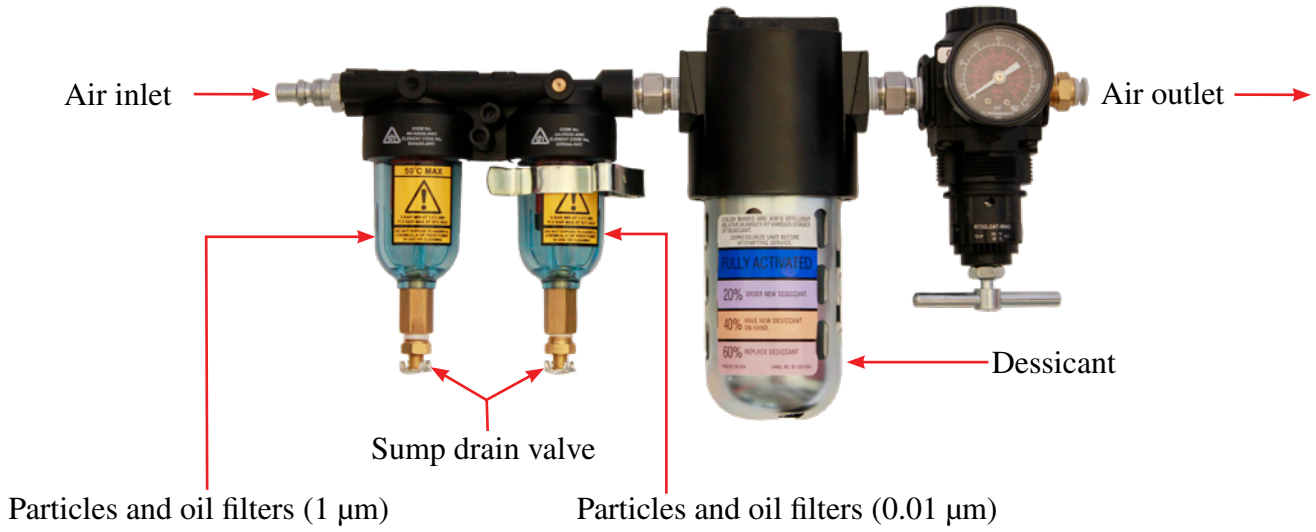


Figure 2-2 Air filter

2.4.1 DISASSEMBLY OF THE AIR FILTER

Remove the metallic protection of the dessicant as shown in the *Figure 2-3,* then simply remove the transparent plastic container as shown in *Figure 2-4* by pulling on it. Fill it with the new silica gel to the top and put it back.

The silica gel is provided as shown in the *Figure 2-5*

Figure 2-3 Air filter to dismount

Figure 2-4 Air filter to dismount

Figure 2-5 Silica gel

2.5 MEASURING RANGE

As with most transducers, dynamometers should be operated in the upper part of their measuring range, between 10% and 100% of their rating, the measuring precision being best at the rated torque.

2.6 DRAG TORQUE

Drag torque (which is measured by the dynamometer) is generated by friction originating from the bearings.

The drag torque of the dynamometer is measured by the internal dynamometer cell. This is not an offset but a real torque, normally measured. Thus, the zero on the electronics must not be set when the dynamometer is mechanically coupled (see Chapter 5 - Calibration, for more information).

CAUTION: MAGTROL DYNAMOMETERS ARE CHARACTERIZED BY A LOW DRAG TORQUE: MAXIMUM 2.5% FOR 1WB23 DYNAMOMETER AND MAXIMUM 1.35% FOR THE 1WB27.

2.7 TOLERATED RADIAL AND AXIAL FORCES

Note: Any radial or axial force exercised on a dynamometer causes an increase of the drag torque.

By applying a radial or axial force on the dynamometer, the bearings are subjected to different stresses. This hinders them from rotating freely and generates torque on the measuring line.

2.8 PROTECTIVE SYSTEMS

WARNING! ROTATING PARTS MUST BE FITTED WITH A PROTECTIVE SYSTEM TO ENSURE THAT THE USER, AS WELL AS ALL OTHER SURROUNDING PEOPLE AND OBJECTS, WILL NOT BE IN JURED OR DAMAGED AS A RESULT OF THE MOTOR BEING TESTED BECOMING BLOCKED, A TORQUE OVERLOAD, OR ANY OTHER POTENTIAL PROBLEM.

The following precautions concerning protective equipment of the drive train must be observed:

- Protective elements must prevent access to moving parts (during test).
- Protective elements must cover all parts which can cause crushing or cutting, and protect against projections of parts that have become loose.
- Avoid attaching protective elements to rotating parts.
- Keep protective elements at a sufficient distance away from rotating parts.

2.9 HEAT DISSIPATION AND THERMAL SAFETY

The Magtrol 1WB23 and 1WB27 dynamometers are instruments which absorbs energy. They convert the kinetic energy of the coupled rotating systems into heat.

The quantity of heat which can be dissipated by the dynamometer is not infinite. Additionally, the dynamometer cannot resist excessive temperatures without damage. The most frequent consequence of too great an energy supply is a premature deterioration of the excitation coils of the stator.

An excessive supply of energy over a long period can cause damage, which may remain undetected if no detailed examination is performed. This can lead to a premature degradation of the bearing lubricant, or defect the insulation of the coil generating the magnetic field.

A temperature sensor (PT) integrated in the dynamometer permanently monitors the dynamometer temperature.

CAUTION: IT IS IMPORTANT TO FAMILIARIZE YOURSELF WITH THE FEATURES OF THE SYSTEM IN ORDER TO PREVENT ANY OPERATION OUTSIDE OF THE LIMITS SPECIFIED IN THE DYNAMOMETER DATA SHEET WHICH COULD CAUSE IRREVERSIBLE DAMAGE.

In case of an overtemperature detection, the 1WB23 and the 1WB27 send the DSP7000 an alarm. The DSP7000 opens its safety relay allowing the user to switch off the motor under test. After 5 s, the DSP7000 sets the excitation current of the dynamometer to zero.

3. Configuration / Connections

3.1 CONFIGURATIONS

The 1WB23 and the 1WB27 dynamometers connected with a DSP7000 offer various test configuration possibilities.

The connection of the DSP7000 dynamometer controller is described in its User's Manual which can be accessed at Magtrol's Web site: *www.magtrol.com*.

3.1.1 MANUAL TEST CONFIGURATION

In a manual test configuration (see *figure 3–1*), all test parameters must be manually entered into the DSP Dynamometer Controller. Data acquisition is then carried out manually.

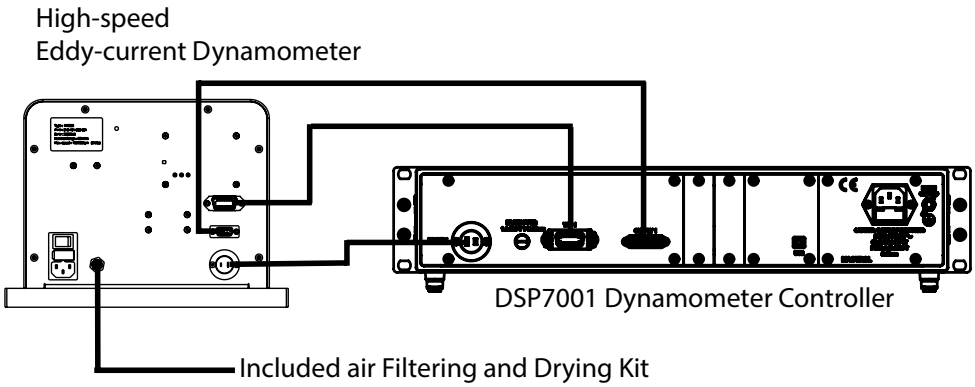


Figure 3–1 Manual Test Configuration

3.1.2 PC-BASED TEST CONFIGURATION

Magtrol offers a solution, where the DSP controller is connected to a PC for processing data collected during the tests. This complete system illustrated with *figure 3–2* includes the M-TEST software developed under LabVIEW™ by the Magtrol engineers. Communication with the programmable dynamometer controller DSP is carried out by an interface board and a connecting USB or GPIB cable.

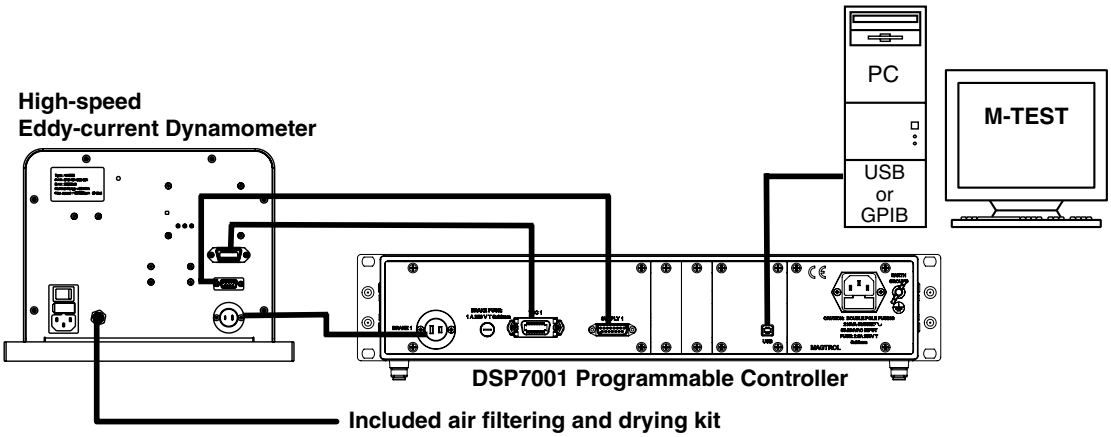


Figure 3–2 M-TEST-based configuration

Note: This system is the ideal solution for performing complete test cycles on all types of rotating systems. Please contact Magtrol for additional information on this type of configuration.

3.2 CONNECTION TO ELECTRONIC CONTROL UNITS

CAUTION: USE EXTREME CAUTION WHEN USING ELECTRONIC CONTROL UNITS PROVIDED BY MAGTROL. MAGTROL MOTOR TESTING ELECTRONICS ARE FITTED WITH SAFETY FEATURES SUCH AS FUSES, CURRENT LIMITERS, THERMOSTATS, ETC. PREVENTING DYNAMOMETERS FROM OPERATING OUTSIDE OF THEIR LIMITS.

3.2.1 POWER AND THERMOSTAT CONNECTION

The 1WB23 and 1WB27 dynamometers torques depend on both the excitation current and its speed. Therefore, the excitation current must be reduced when its speed is being increased to hold a constant torque.

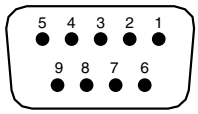
To keep operating temperatures at acceptable levels, it is important to run the dynamometer within its power ratings. The brakeing power of the dynamometer must therefore be regularly checked by using the following equation:

$$\text{Brakeing power [W]} = \frac{\text{Brakeing torque [Nm] x n [rpm]}}{9.55}$$

You can also refer to the power curves printed in *Chapter 1 –Introduction*.

The thermostat is a normally closed contact which opens when a temperature limit of approximately 80 °C is reached. When this limit is reached, the excitation must be stopped. The DSP controller electronics handles this procedure.

3.2.2 TEMPERATURE ALARM CONNECTION



1. SHIELD (GROUND)
2. N/C
3. TEMPERATURE ALARM
4. N/C
5. N/C
6. 0 V
7. N/C
8. N/C
9. N/C

Figure 3–3 9 pin D-Sub temperature alarm connector

3.2.3 DYNAMOMETER EXCITATION CONNECTION

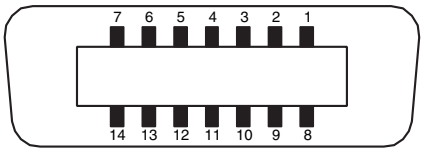
Figure 3–4 Output to dynamometer

3.2.4 TORQUE SIGNAL CONNECTION

The torque signal is supplied by a torque transducer fitted with a bridge strain gauge. This signal is available on pins 13 and 14 of the Centronic 14 pin mini-connector (*see figure 3–5*).

3.2.5 Speed Signal Connection

The speed signal is a pulse type signal with 2 pulses per motor shaft revolution. Supplied on pin 10 of the 14 pin Centronic mini-connector (see *figure 3–5)* as an open collector output. This type of output requires the use of a pull-up resistance and an external supply for pulse shaping (see *figure 3–6)*.



1. N/C
2. N/C
3. N/C
4. SHIELD
5. SHIELD
6. N/C
7. N/C
8. +5.0 VDC COM
9. N/C
10. SPEED SIGNAL
11. N/C
12. N/C
13. TORQUE COM
14. TORQUE SIGNAL

Figure 3–5 14 pin Centronic mini-connector

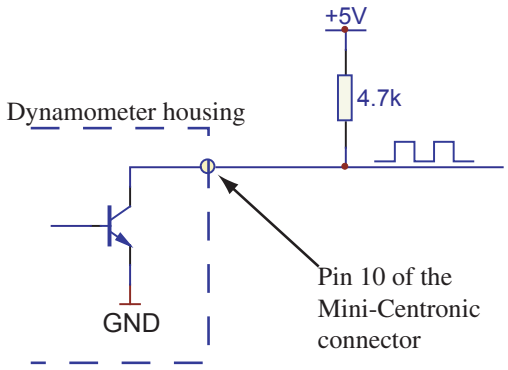


Figure 3–6 Example of a pull-up resistance supply

3.3 AIR SUPPLY

The 1WB23 and 1WB27 High Speed Dynamometers are supplied with an air supply kit for the air bearing system. Use a Ø 6 mm tube to connect the dynamometer with the air kit (see *figure 3–7)*.

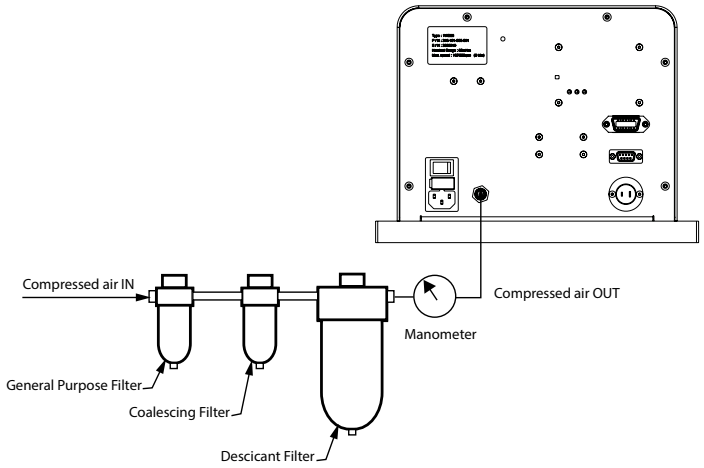


Figure 3–7 Air supply kit

4. Operating Principle

4.1 EDDY-CURRENT DYNAMOMETERS (WB)

Magtrol Eddy-current Dynamometers carry the designation of "WB" which stands for "Wirbelstrom-Bremse" in German (Wirbelstrom = Eddy-current, bremse = brake). Eddy-currents are circular currents induced in conductors crossing a magnetic field. These currents generate electromagnetic forces acting against the movement of the rotor.

The magnetic field is created by coils powered by a DC current source. The magnetic flux flows through the rotor teeth—not the air gap—creating magnetized and non-magnetized areas within the stator. At the rotor level the magnetic field is stationary but it is pulsed at the rotor frequency on the stator walls. The effect is, that eddy-currents are induced in the stator which generate electromagnetic forces acting against the movement of the rotor.

Eddy-currents transform the kinetic energy of the rotor into heat which will have to be dissipated.

The braking torque is proportional to the rotor speed. It is therefore inexistent at stand-still.

5. Calibration

Every new Magtrol dynamometer is factory calibrated. Static calibration of the zero and torque is recommended from time to time, especially after having maintenance performed. Two calibration beams and a 1 N weight are therefore supplied with the dynamometer.

CAUTION:	PRIOR TO ANY RE-CALIBRATION, THE SYSTEM UNDER TEST MUST BE SEPARATED FROM THE DYNAMOMETER SO THAT THE DYNAMOMETER SHAFT CAN ROTATE FREELY.

5.1 CALIBRATION WITH THE STANDARD DSP ELECTRONICS

It is recommended to calibrate the dynamometer with the DSP electronics supplied by Magtrol. Of course, this electronics has also to be calibrated. The DSP user's manual is available on the Internet website www.magtrol.com.

5.1.1 PREPARATION

1. Remove the dynamometer's cover.
2. Connect the dynamometer to the DSP electronics as indicated on figure 5–1. Ensure correct earth grounds on equipment.

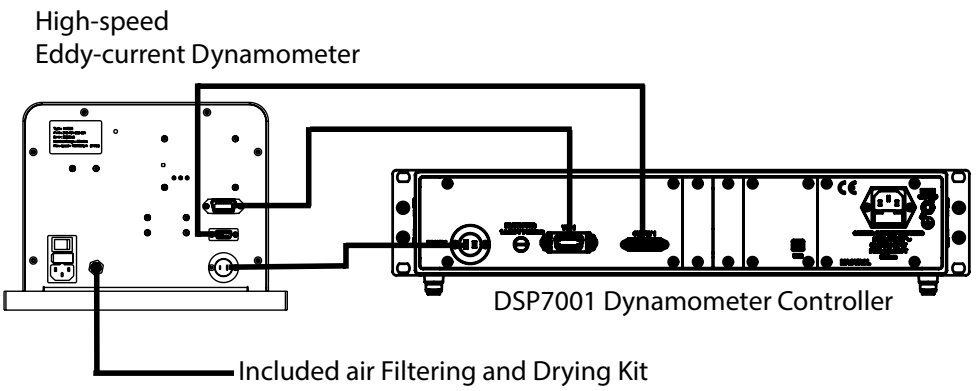


Figure 5–1 Calibration wiring

3. Turn on the controller or readout.
4. Screw the calibration beams in the threaded holes of the matching sleeve *figure 5–3*.

CAUTION:	NO EFFORT MUST BE APPLIED TO THE BEAMS NOT TO FORCE THE LOAD CELL.

The maximal admisible torque variation is ± 8mN·m.

Note:	Do not hang the weight

5. Supply the dynamometer with air pressure (see chapter 3 section 3.3).
6. Allow 20 minutes for warm-up, longer if the equipment is below room temperature.

5.1.2 Calibration Procedure

The calibration procedure is as follows:

1. Use a flathead screwdriver to adjust the ZERO trim pot (located on the rear panel) so that the torque reading is 0.00 ± 0.05 mN·m.

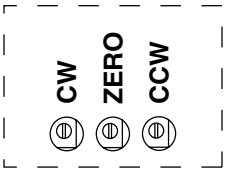


Figure 5–2 Calibration Potentiometers

2. Hang the weight from the clockwise groove (CW).

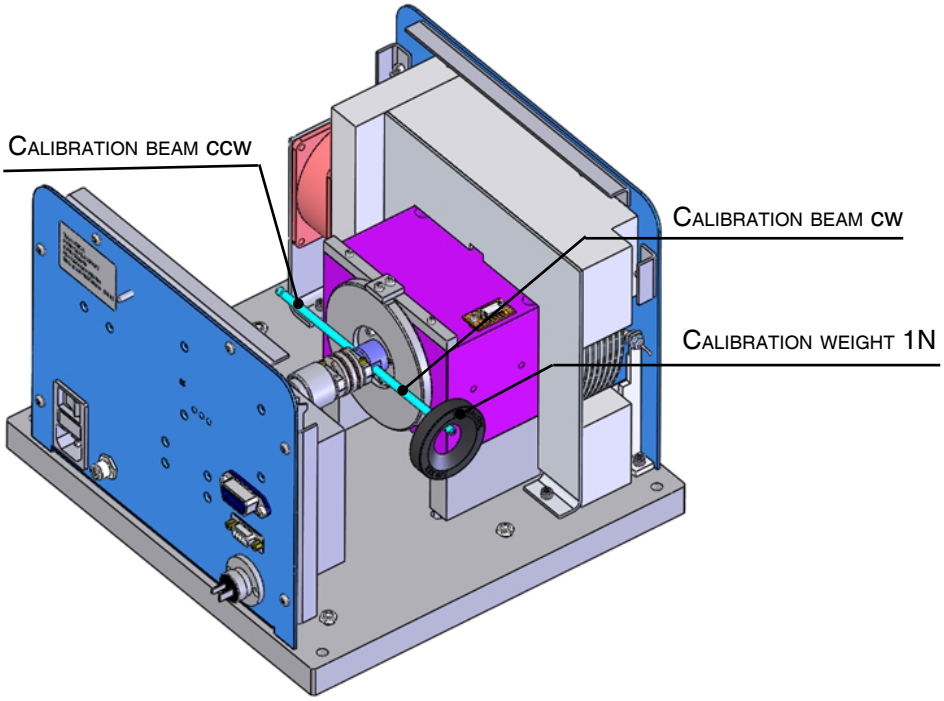


Figure 5–3 Calibration beams (CW side)

3. Adjust the CW Calibration trim pot so that the torque reading equals 80 mN·m ±0.08 mN·m.
4. Transfer the weight to the counterclockwise groove (CCW).
5. Adjust the CCW Calibration trim pot so that the torque reading equals 80 mN·m ±0.08 mN·m.
6. Check the ZERO, CW and CCW values and redo the procedure if values have change.
7. Remove the weight from the calibration beam.
8. Carefully remove the calibration beams.
9. Replace the cover.

5.2 INITIAL CALIBRATION

All Magtrol instruments are calibrated prior to shipment. There is a calibration label on each unit as shown in the following figure.

Figure 5–4 Calibration Label

This label tells the user when the next calibration is required, although Magtrol does recommend that calibration be completed after the dynamometer, readout instrumentation and power supply are set up for the first time.

5.3 CALIBRATION BEAMS AND WEIGHTS

To perform a successful dynamometer calibration, a precision weight heavy enough to apply a torque to the full scale rating is required.

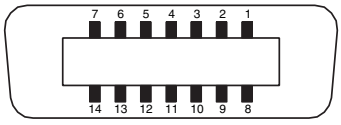
A box containing 2 calibration beams and a precision weight are delivered with WB23 and WB27 dynamometers.

5.4 CALIBRATION FREQUENCY

Magtrol load cells are temperature compensated and designed for stability. It is a good idea to calibrate, frequently at first, maintaining a record until you have established a history. If there appears to be excessive drift, contact Magtrol Technical Assistance.

5.5 CONNECTION FOR TORQUE SIGNAL READING

Other electronics (for example a voltmeter) can be connected to pins 13 and 14 of the Centronic connector to collect the torque signal.



1. N/C
2. N/C
3. N/C
4. SHIELD
5. SHIELD
6. N/C
7. N/C
8. +5.0 VDC COM
9. N/C
10. SPEED SIGNAL
11. N/C
12. N/C
13. TORQUE COM
14. TORQUE SIGNAL

Figure 5–5 14 pin Centronic connector for torque signal measuring

6. Maintenance and Repair

6.1 MAINTENANCE

Just like any rotating equipment, Magtrol dynamometers require periodic maintenance. Higher wear occurs when the dynamometer is operated outside its optimal working conditions. This is especially true when the dynamometer is operated at excessive rotational speeds, which results in the generation of axial and radial forces on the bearings.

Various indicators alert the user as to when maintenance is required:

- The dynamometer can no longer reach its nominal torque
- The residual torque is out of specification.

When the bearings generate noise, it indicates that maintenance is overdue. At this stage, measurements have already been distorted and the entire dynamometer unit is subject to vibrations, reducing its operating life.

6.2 REPAIR

In case of a defect, please refer to both the Warranty and Service Information located at the back of this manual. Whether you are directed to ship your equipment back to Magtrol, Inc. in the United States or Magtrol SA in Switzerland, it is very important to include the following information with your return shipment:

- Model number, part number, serial number, order number and date of purchase
- Description of the defect and the conditions in which it appeared
- Description of the test bench (drawing, photographs, sketches, etc.)
- Description of the tested object (drawing, photographs, sketches, etc.)
- Description of the test cycle

6.3 SENDING EQUIPMENT TO MAGTROL FOR MAINTENANCE/REPAIR

CAUTION: MAINTENANCE MUST BE PERFORMED BY MAGTROL IN ORDER TO GUARANTY FUTURE MEASURING ACCURACY. TO ALLOW MAGTROL TO COMPLETE THE WORK IN THE BEST POSSIBLE TIME, FOLLOW THE PROCEDURE OUTLINED BELOW AS WELL AS THE PROCEDURE OUTLINED IN THE REAR OF THIS MANUAL UNDER SERVICE INFORMATION.

1. Do not dismantle the dynamometer (so that Magtrol can test it prior to performing maintenance).
2. Lock the dynamometer for transport
3. Carefully pack the dynamometer.

Appendix A : Declaration of CE conformity

MAGTROL SA SWITZERLAND	Formulaire - Q **Declaration of conformity CE**	*Document No :* **Do033E** *Date :* 10.11.2009 *Visa :* nbur

DEC No : **038**

We,

MAGTROL SA
Route de Montena 77
CH – 1728 ROSSENS / Fribourg (SWITZERLAND)

Herewith declare that the following products :

family types

Eddy-Current and Powder Dynamometers : Type WB/PB
Electronics : TSC 401, DES 410 / 411, DSP600x / 700x, 6510, 6530

which are mentioned in this declaration, meet all requirements defined in :

2006/42/EC Machinery
2004/108/EC Electromagnetic compatibility (EMC)
2006/95/EC Electrical equipment designed for use within certain voltage limits

Those products have been developed and manufactured according to the processes described in Magtrol's Manual conformity with the ISO 9001 standard.

For the evaluation of these products, following norms have been taken into account :

IEC or EN 61326-1 : 2012-07
Electrical equipment for measurement, control and laboratory use
– EMC requirements – Part 1: General requirements

IEC or EN 61010-1 : 2010-06
Safety requirements for electrical equipment for measurement, control, and laboratory use

Rossens, 06.11.2013

J. Cattin
General Manager

N.Buri
QES System Manager

Page : 1 de 1

Service Information

RETURNING MAGTROL EQUIPMENT FOR REPAIR AND/OR CALIBRATION

Before returning equipment to Magtrol for repair and/or calibration, please visit Magtrol's Web site at http://www.magtrol.com/support/rma.htm to begin the Return Material Authorization (RMA) process. Depending on where the equipment is located and which unit(s) will be returned, you will be directed to either ship your equipment back to Magtrol, Inc. in the United States or Magtrol SA in Switzerland.

Returning Equipment to Magtrol, Inc. (United States)

When returning equipment to Magtrol, Inc.'s factory in the United States for repair and/or calibration, a completed Return Material Authorization (RMA) form is required.

1. Visit Magtrol's Web site at http://www.magtrol.com/support/rma.htm to begin the RMA process.
2. Complete the RMA form online and submit.
3. An RMA number will be issued to you via e-mail. Include this number on all return documentation.
4. Ship your equipment to:
   MAGTROL, INC.
   70 Gardenville Parkway
   Buffalo, NY 14224
   Attn: Repair Department
5. After Magtrol's Repair Department receives and analyzes your equipment, a quotation listing all the necessary parts and labor costs, if any, will be faxed or e-mailed to you.
6. After receiving your repair estimate, provide Magtrol with a P.O. number as soon as possible. A purchase order confirming the cost quoted is required before your equipment can be returned.

Returning Equipment to Magtrol SA (Switzerland)

If you are directed to ship your equipment to Switzerland, no RMA form/number is required. Just send your equipment directly to Magtrol SA in Switzerland and follow these shipment instructions:

1. Ship your equipment to:
   MAGTROL SA
   After Sales Service
   Route de Montena 77
   1728 Rossens / Fribourg
   Switzerland
   VAT No: 485 572
2. Please use our forwarder : TNT • 1-800-558-5555 • Account No 154033
   Only ship ECONOMIC way (3 days max. within Europe)
3. Include the following documents with your equipment:
   - Delivery note with Magtrol SA's address (as listed above)
   - Three pro forma invoices with:
     - Your VAT number
     - Description of returned goods
     - Noticed failures
     - Value - for customs purposes only
     - Origin of the goods (in general, Switzerland)
4. A cost estimate for repair will be sent to you as soon as the goods have been analyzed. If the repair charges do not exceed 25% the price of a new unit, the repair or calibration will be completed without requiring prior customer authorization.

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Worldwide Network
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ISO 9001
BUREAU VERITAS
Certification

WB23/27 - US 09/15