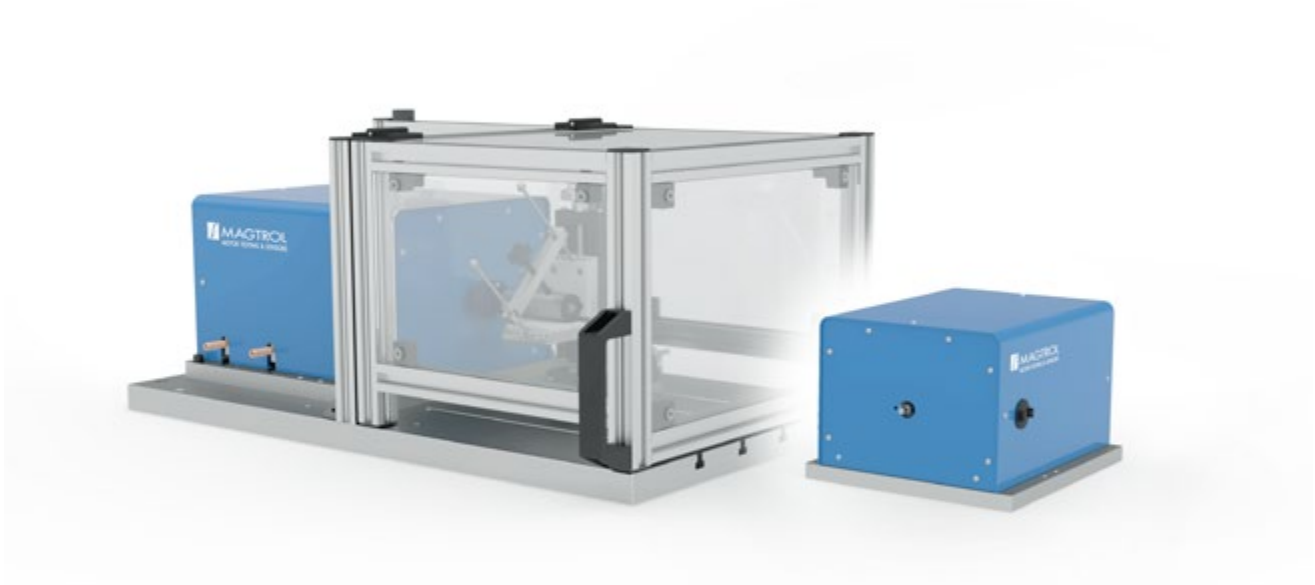
MAGTROL

WB 32 SERIES

HIGH-SPEED EDDY-CURRENT DYNAMOMETERS

USER MANUAL

www.magtrol.com



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PURCHASE RECORD

To ensure continuity of information and to facilitate technical support, Magtrol invites you to note below some essential data about your equipment (model, serial number, date of purchase, etc.). The model number and serial number can be found on the identification plate (aluminum) or on the label (white or metallic) affixed to each unit. Please refer to these numbers when contacting a Magtrol representative about your equipment.

Model Number : _____

Serial Number : _____

Purchase Date : _____

Purchased From : _____

1st English Edition | Revision A | December 2025

SAFETY PRECAUTIONS

WARNING

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 OR THE TORQUE MEASUREMENT DRIVE TRAIN.

ATTENTION

CAUTION: OPERATE THE DYNAMOMETER WB 32 SERIES WITH GREAT CAUTION! THE DYNAMOMETER MAY BE IRREVERSIBLY DAMAGED IF IMPACTED MECHANICALLY (FALL), CHEMICALLY (ACIDS) OR THERMALLY (HOT AIR, VAPOR).

1. Make sure that all Magtrol Dynamometer and electronic products are earth-grounded, to guarantee personal safety and proper operation.
2. Check line voltage before operating electronic equipment.
3. Make sure that all rotating parts (dynamometers, motors under test,...) are equipped with appropriate safety guards.

NOTICE

Detailed information regarding the safety guards or protective systems can be found *see section 2.8 - Protective systems*.

4. Always use couplings that matches the speed and braking torque of the system under tested.
5. Periodically check all connections and attachments.
6. Always wear protective glasses when working close to rotating elements.
7. Never wear a necktie or baggy clothes when standing close to rotating elements.
8. Never stand too close or bend over the rotating drive chain.
9. Electrically insulate the motor terminal block
10. Always connect the motor envelope to earth ground.
11. 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 BE PROPAGATE TO ALL CONNECTED INSTRUMENTS OR TO PERSONS IN CONTACT WITH THE DEVICES.

QUALIFIED PERSONNEL

Persons in charge of installing and operating the WB 32 Series Dynamometers must have read and understood this user manual, paying extra close attention to all safety-related information.

The WB 32 Dynamometer are high-precision products integrating the most recent measurement techniques. The dynamometer or system can give rise to residual dangers if used and manipulated in a non-compliant way by unqualified personnel.

These dyanometers must be handled by qualified personnel according to the technical requirements and the above-mentioned safety instructions. This is also true when using every dynamometer accessories.

RESIDUAL HAZARDS

Dynamometer performances are only one element in the test measurement chain. Safety is of equal importance. There are possible residual hazards when operating rotating test equipment and it is the responsibility of the designer, the manufacturer and the user to minimize these hazards.

In addition to general safety precautions, residual hazards are highlighted in this user manual by using safety symbols and sections (*see section - Conventions used in this manual*).

PROPER USE

The use of WB 32 Series Dynamometer is exclusively restricted to test measuring tasks and directly-related control and regulating tasks. Any further use shall be deemed to be improper.

For safe operation, the WB 32 Series Dynamometer and its accessories may only be used according to the data and specifications given in this User's Manual. Safe operation can be guaranteed only when the dynamometer is correctly transported, stored, installed, mounted and used.

MODIFICATIONS

The WB 32 Series Dynamometer and its accessories may not be modified without the express consent of Magtrol. Magtrol is not be liable for any consequential damages resulting from unauthorized modifications.

TABLE OF CONTENT

PREFACE

PURPOSE OF THIS MANUAL

This manual contains all the information required for the installation, setup, connection and general use of Magtrol's WB 32 Series Series Dynamometer. To achieve maximum capability and ensure proper use, please read this manual in its entirety before operating the unit. 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 test benches operators who are installing or using WB 32 Series Dynamometer in order to determine the torque and power of a motor in relation to its speed. The operator is assumed to have the necessary technical knowledge in electronics and mechanical engineering enabling him to install and operate these WB 32 Series Dynamometers without risk.

MANUAL ORGANIZATION

This section gives an overview of the structure of the manual and the information contained within it. 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 the technical data sheets for Magtrol's WB 32 Series Dynamometers, which describe the units, provide detailed technical characteristics and present a brief overview of their fields of application.

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

Chapter 3: TECHNICAL CURVES - Torque-Speed-Power reference curve for each dynamometer model

Chapter 4: COOLING – Describes the necessary measures to take in order to guaranty an optimal dynamometer operating temperature.

Chapter 5: ELECTRICAL CONNECTIONS – Provides information about the wiring between the dynamometers and the electronic control units, as well as tandem setups of dynamometers.

Chapter 6: OPERATING PRINCIPLES – Describes the physical phenomena on which the Eddycurrent (WB Series) and magnetic powder (PB Series) Dynamometer technology is based.

Chapter 7: CALIBRATION PROCESS – Provides recommended calibration schedules along with step-by-step instructions for the calibration procedure.

Chapter 8: MAINTENANCE, REPAIR & CALIBRATION – Provides information on preventive maintenance and repair operation.

Chapter 9: SERVICES INFORMATION - Information, process, contacts and addresses relative for repair and/or calibration.

SEMANTICS

In this manual, different terminologies may be used to speak about the «WB 32 Series Dynamometers». The primary purpose is to make this user manual useful and easy to read.

Below you will find different terminology used such as: «Dynamometer», «Brake», «Brake Dynamometer», «Dynamometer Brake», «Dyno»,... are all synonyms; «WB XX Series» or «WB Series» are all abreviations for «WB 32 Series Eddy-Current Dynamometer», etc.

The term «Series» stands for all the products of the series (e.g. YY 3XX Series refers to YY 300 ... YY 399).

CONVENTIONS USED IN THIS MANUAL

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

NOTICE

Indicates information considered important but not hazard related.

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 function of the product.

CAUTION

INDICATES A HAZARDOUS SITUATION THAT, IF NOT AVOIDED, COULD RESULT IN MINOR OR MODERATE INJURY.

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

WARNING

INDICATES A HAZARDOUS SITUATION THAT, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.

THIS 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 PARTY MAY BE AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT, BEFORE PROCEEDING FURTHER.

DANGER

INDICATES A HAZARDOUS SITUATION THAT, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY. THE SIGNAL WORD «DANGER» IS TO BE LIMITED TO THE MOST EXTREME SITUATIONS.

THIS 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 PARTY MAY BE AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT, BEFORE PROCEEDING FURTHER.

The safety symbol may subsequently vary depending on the source of the hazard. Below are examples:

Various safety pictograms according to ISO 7010

1. INTRODUCTION

1.1 GENERAL INFORMATION

The WB Series 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 acronym WB comes from the German translation of Eddy-Current Dynamometer (Wirbelstrom-Bremse). Eddy-Currents are circular currents induced in conductors crossing a magnetic field. This technology is implemented in the WB 32 Series Dynamometer to generate electromagnetic forces acting against the movement of the rotor.

1.2 MAGTROL'S DYNAMOMETERS

As a specialist in engine testing equipment, Magtrol also offers other dynamometer models. They have a similar function and differ mainly in the technology chosen in relation to their final application.

- The **HD Series** Dynamometers feature hysteresis technology and behaviors to develop their braking power. There are versatile and ideal for low to medium power ranges
- The **WB Series** Dynamometers feature Eddy-current braking systems and are able to be operated at high speeds. However, as their braking torque is proportional to their speed, they cannot be used at low speeds. Similar to the WB 32, the WB 23/27 models are designed for very high speed applications.
- The **PB Series** Dynamometers feature magnetic powder brakes and are therefore appropriate for low and medium-speed testing. Due to their design, they generate their maximum torque at standstill. However, their maximum speed is limited to avoid the magnetic powder being centrifuged.
- To combine the advantages of both designs, Magtrol offers a **TANDEM Series** which is a combination of both dynamometer types for applications requiring measurements on a wide range of speeds.

Fig.1-1 HD 715 Dynamometer (with Blower BL001)

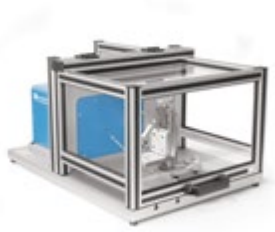


Fig.1-2 WB 23/27 Dynamometer

Fig.1-3 2 WB/PB 43 Dynamometer

Fig.1-4 2 WB/PB 115 Dynamometer

Fig.1-5 4 WB 15 & 4 PB 15 TANDEM Dynamometer (with electromagnetic clutches inbetween)

1.3 PRODUCTS DESCRIPTION

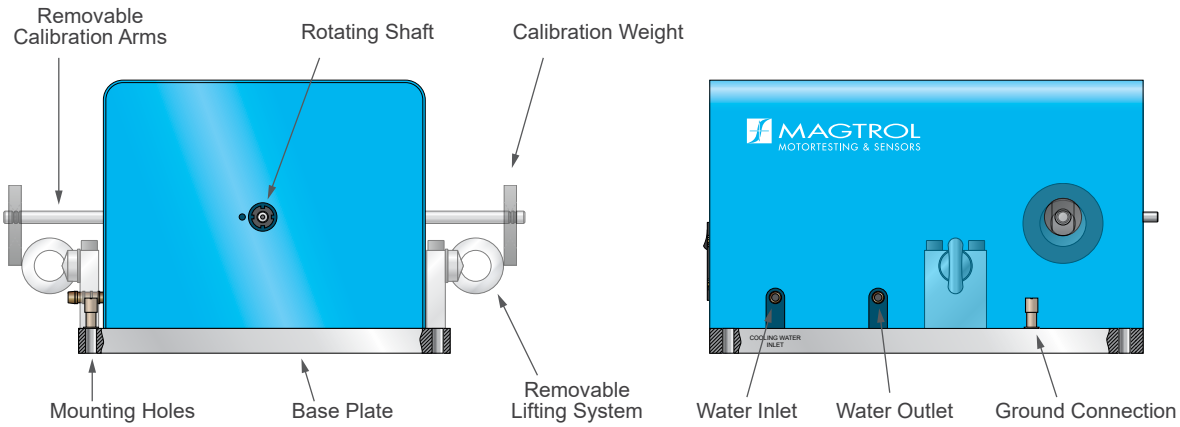


Fig.1-6 Front and left side view

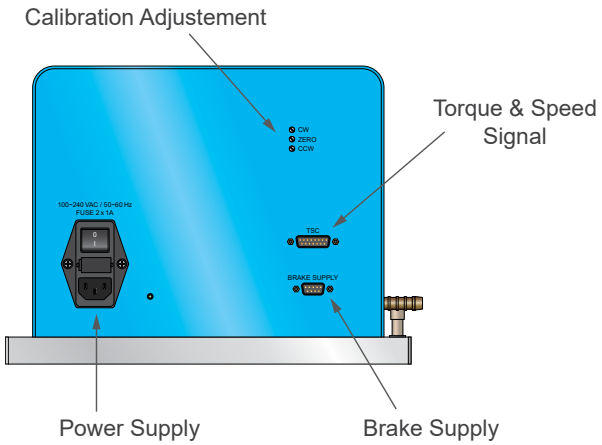


Fig.1-7 Rear view with connection interface

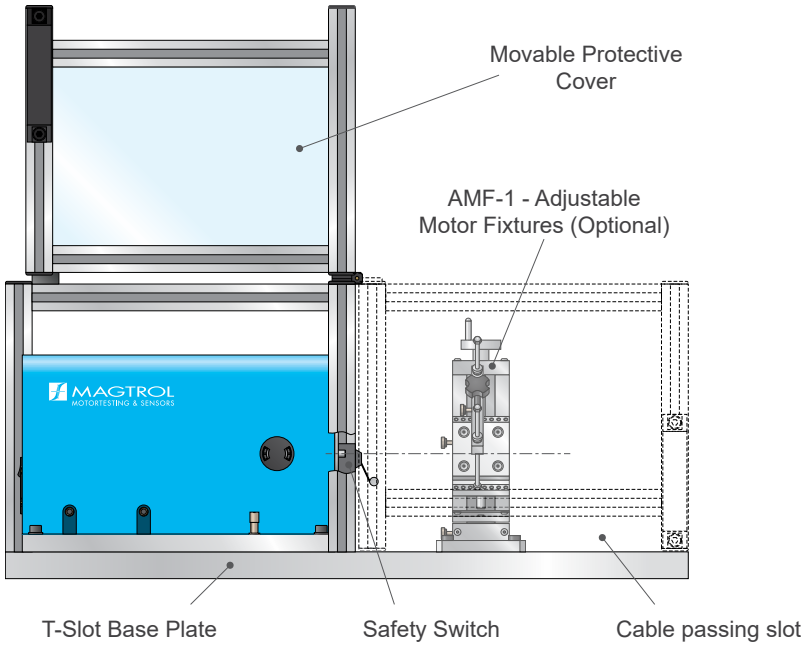


Fig.1-8 "Complete System" version with protective cover

1.4 DATASHEET · WB 32 SERIES

WB 32 SERIES
HIGH-SPEED EDDY-CURRENT DYNAMOMETERS

MAGTROL offers 3 types of dynamometer brakes to absorb load: Hysteresis (**HD Series**), Eddy-Current (**WB Series**) and Magnetic Powder (**PB Series**). 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 standard models to choose from, Magtrol Sales professionals are readily available to assist in selecting the proper Dynamometer to meet your testing needs.

FEATURES

- 2 Models with maximum Torque: 400 mN·m & 800 mN·m
- Speed: up to 80 000 rpm
- Power: 0.5 kW & 1 kW
- Low Moment of Inertia
- Stable & smooth Braking Torque
- Data acquisition via DSP 7010 Series Controller & M-TEST Software
- Built-in Electronics with Torque & Speed Measurement and Excitation Supply

Fig. 1: 1 WB 32 - High-Speed Eddy-Current Dynamometer with calibration arms mounted

DESCRIPTION

Magtrol's WB 32 Series - Eddy-Current Dynamometers are designed for high-speed testing applications. They are ideal for applications requiring high speeds and also when operating in the lower power range (up to 1 kW). By providing a braking torque that is proportional to the rotational speed, rated torque is reached at the rated speed.

The Dynamometers feature a low level of inertia, due to small rotor dimensions. Brake cooling (required) is provided by a water circulation system, which passes inside the stator to dissipate heat generated by braking; this enables higher continuous power ratings.

The stator is mounted on carrier bearings and the torque is measured by the reaction torque sensor protected by overload limiter and transport locking device. The dynamometer has a torque measuring accuracy rating of ±0.5 % full scale. The speed is measured by an optical sensor and a 4 PPR (Pulses Per Revolution) encoder. This sensor measures speeds from 100 ... 80 000 rpm with a full scale accuracy of ±0.06 % by using a Magtrol DSP 7010 Series Dynamometer Controller (due to encoder 4 PPR, the system is not suitable for precise closed-loop control below 1 000 rpm).

A Thermal Switch monitors the brake temperature and alarms the Controller (DSP 7010 Series) to stop the brake excitation current in order to protect the dynamometer from overheating.

OPERATING PRINCIPLES

The WB 32 Eddy-Current Dynamometers provide their full braking power at high speed. This type of brake has been specially designed to test motors rotating at speeds up to 80 000 rpm (100 000 rpm with WB 23/27, see specific datasheet), with the braking torque dependent upon the rotation speed.

APPLICATIONS

Mounted on test benches, the WB 32 Series Dynamometers allow performance and reliability testing on driving elements such as servomotors, micro and small motors, drone motors, fans, drills, hobby tools, small pumps, spindles, motors for domestic appliances, etc.

REVISITED DESIGN

Based on Magtrol's extensive experience in motor testing (over 70 years), the WB 32 Series is the most recent Eddy-Current Dynamometer and will gradually replace the WB 2.7 Dynamometer. Its design has been rethought to be more compact, easier to handle and easier to install on a test bench (due to its large base plate).

A speed signal conditioner, power supply and all the necessary filter electronics are integrated into the housing, making the dynamometer a turn-key unit.

SYSTEM CONFIGURATION

The WB 32 Series Dynamometers should be used with a Magtrol DSP 7010 Series Dynamometer Controller in order to supply the closed-loop control of the test system. In addition, the DSP 7010 Series 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 (MODEL 7500 Series), a required component in a test system measuring motor efficiency, can be integrated into this system as well as Magtrol's Temperature Testing Hardware.

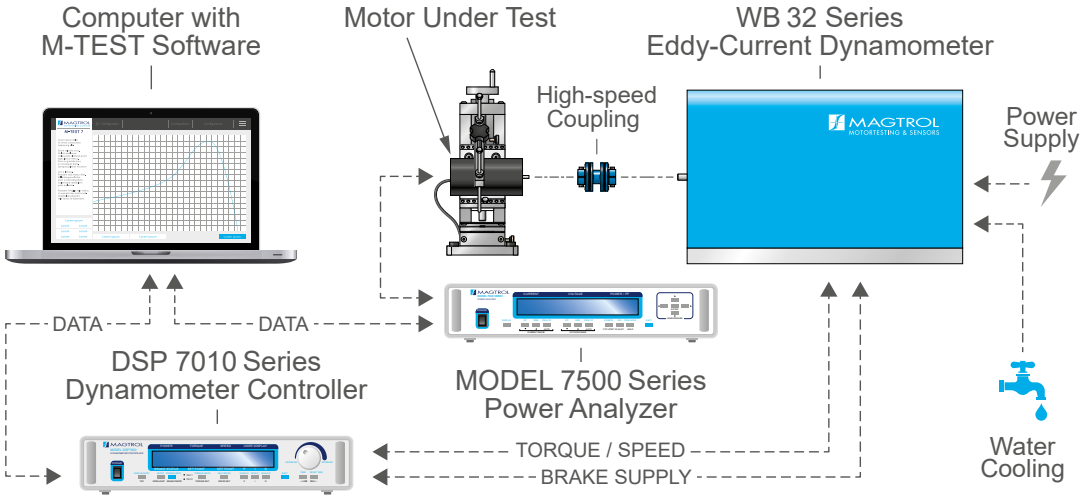


Fig. 2: Configuration of the WB 32 Series Dynamometer with its main accessories

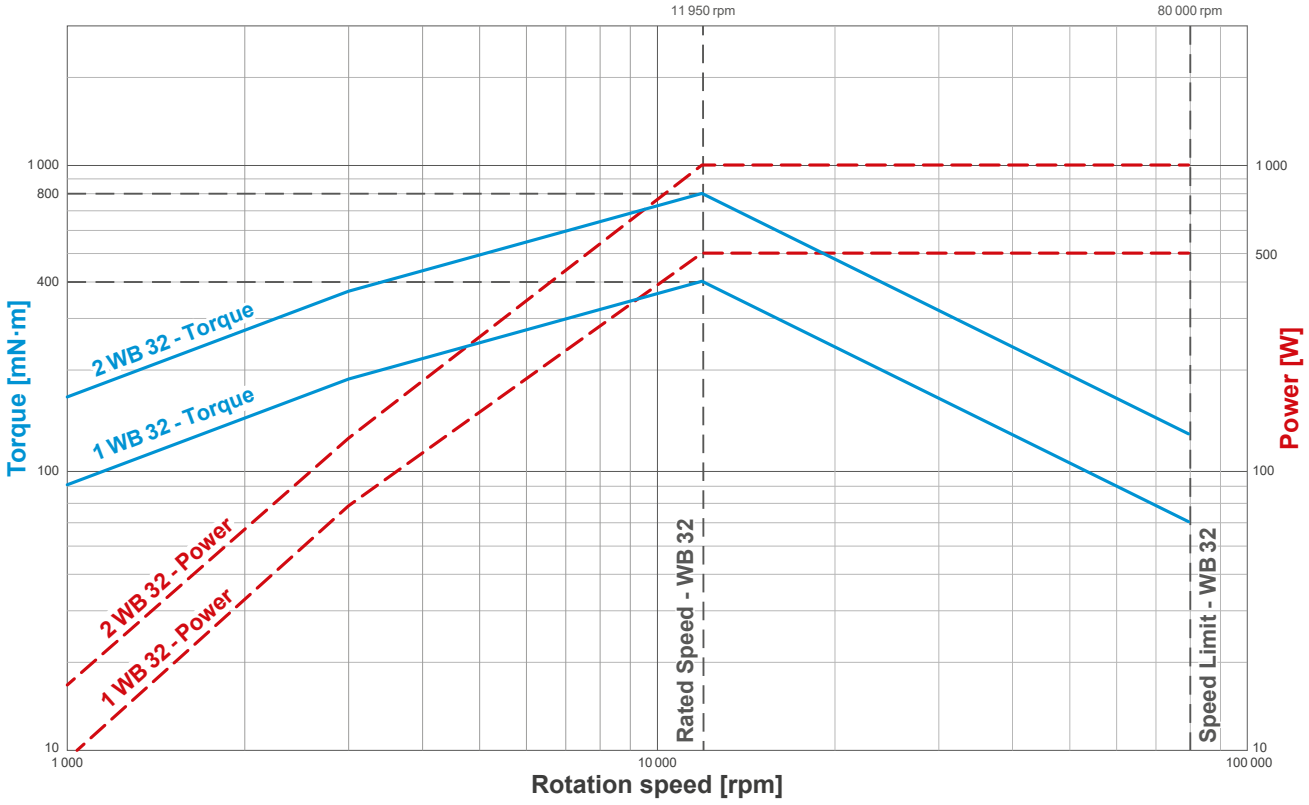
SPECIFICATIONS

NOTE: For continuous operating (≥ 2 hours) at constant torque or power, please consider 20% reserve in both torque & power

MODEL	RATED TORQUE	DRAG TORQUE DE-ENERGIZED	NOMINAL INPUT INERTIA	RATED POWER	RATED SPEED	MAX. SPEED	EXCITATION CURRENT
	N·m	mN·m	kg·m²	W	rpm	rpm	A
1 WB 32	0.4	< 20 (at 80 000 rpm)	2.71×10^{-5}	500	11 950	80 000	0.7
2 WB 32	0.8		5.03×10^{-5}	1000			1.4

MECHANICAL & ELECTRICAL CHARACTERISTICS	
Weight	~ 24 kg
Cooling Water	Water flow: 2.5 l / min | Pressure: 0.5 bar max.
Power Supply	100 - 240 VAC / 50 - 60 Hz
Protection Class	IP 42
Operating Temperature	+10 °C ... +40 °C

TORQUE-SPEED-POWER CURVES



M-TEST MOTOR TESTING SOFTWARE

NATIONAL INSTRUMENTS LabVIEW

Magtrol M-TEST is an advanced motor testing software (Windows® based) for data acquisition. Used with a Magtrol Programmable Dynamometer Controller (i.e. DSP 7010), M-TEST works with any Magtrol Dynamometer or In-Line Torque Transducer to help determine the performance characteristics of a motor under test. Up to 63 parameters are calculated and displayed utilizing M-TEST's feature-rich testing and graphing capabilities.

An integral component of any Magtrol Motor Test System, M-TEST performs ramp, curve, manual, pass/fail, coast and overload to trip tests in a manner best suited to the overall efficiency of the test rig. Written in LabVIEW™, M-TEST has the flexibility to test a variety of motors in a multitude of configurations. The data generated from this user-friendly program can be stored, displayed and printed in tabular or graphical formats, and is easily imported into a spreadsheet.

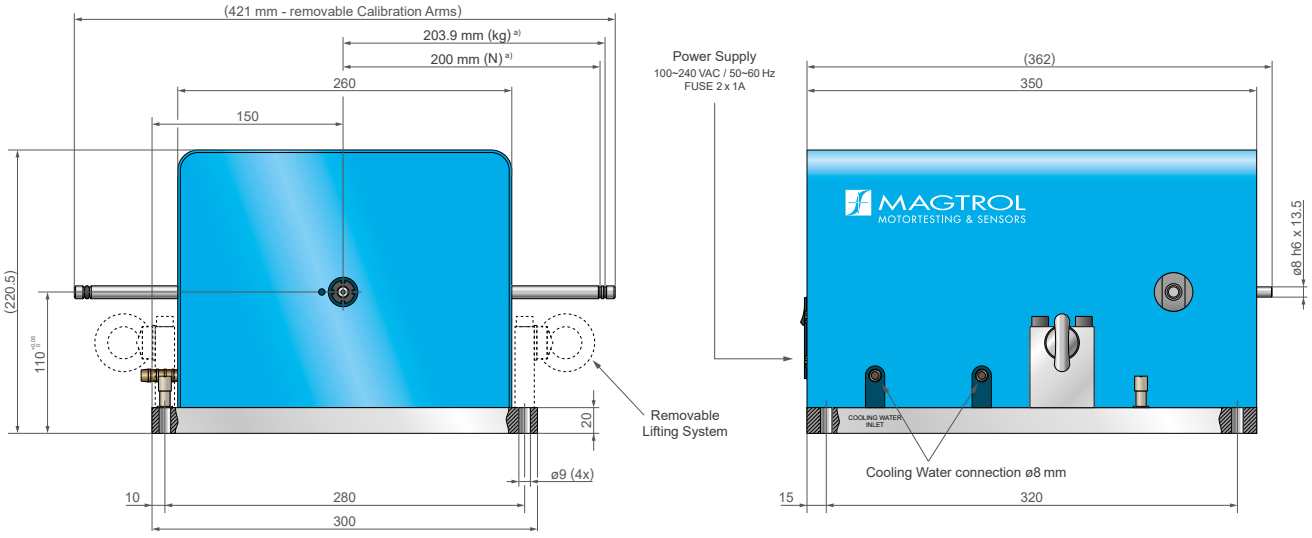
To meet additional engine testing requirements or specific needs, Magtrol can also make custom modifications to the software.

CUSTOM MOTOR TEST SYSTEMS

MAGTROL provides motor testing components to turnkey solutions for all your motor testing needs. Typical test benches may include: various dynamometers, 4-quadrant loading motors, back EMF system, cogging test system, tables, fixtures, control racks, power supplies, power analyzers, ohmmeters, temperature measurment and dedicated M-TEST software. Other sensors, systems and electronics can be integrated upon request.

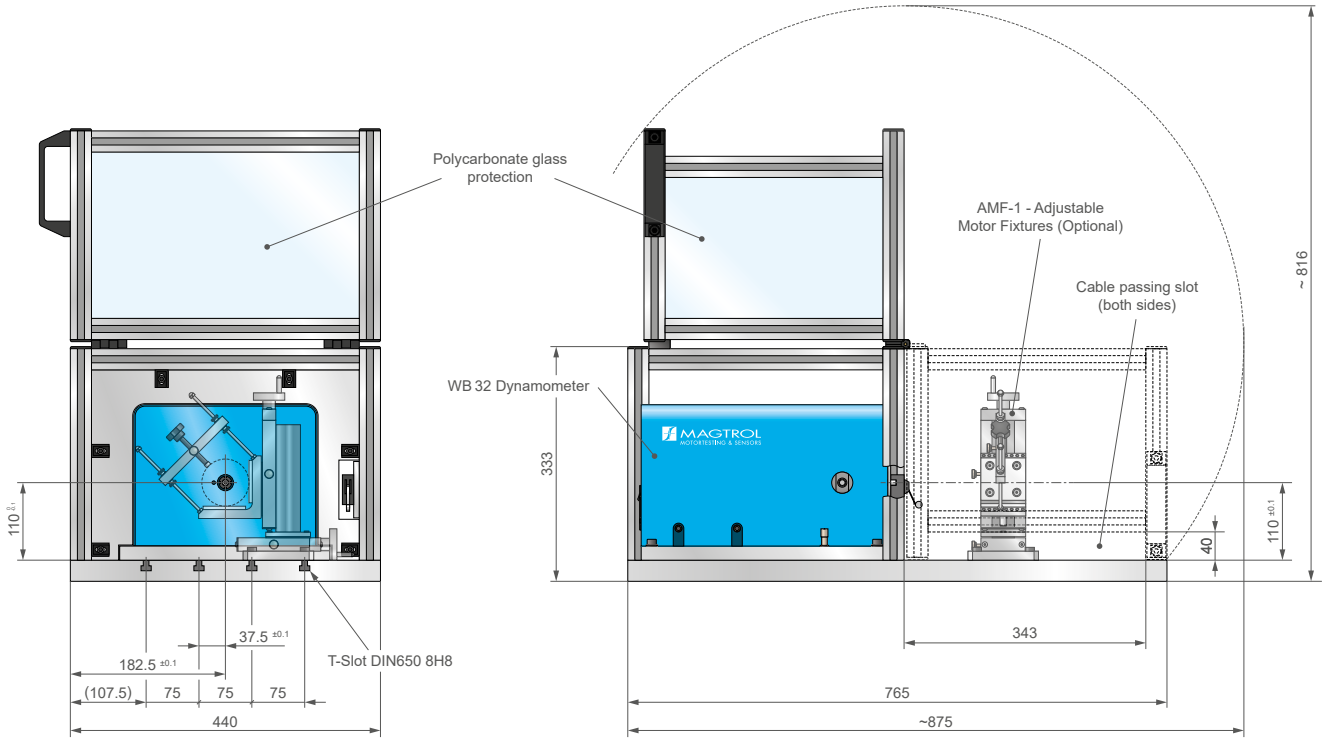
Fig. 3: Custom Motor Test System with WB brake

DIMENSIONS



CAUTION: All WB 32 Series Dynamometers must be water cooled.
NOTE: All values are in metric units. Dimensions are in millimeters.

WB 32 - FULL SYSTEM



The WB32 dynamometer can be integrated as a component of a measurement system.

Magtrol offers a standard version integrating the dynamometer on a base plate. The standard plate has 4 T-Slots to facilitate the attachment of other components and an ergonomic protective cover for the safety of the user.

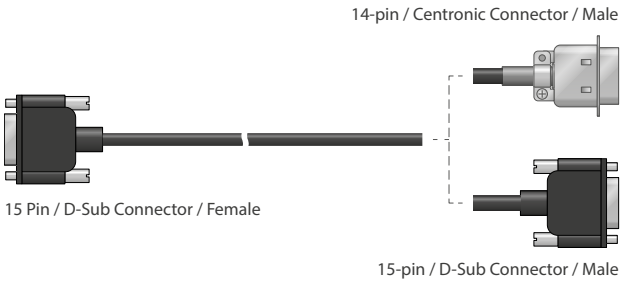
As an option, the system can also be supplied with an AMF-1 Adjustable Motor Fixture. This allows test mounting and alignment of devices with diameters up to 100mm and 4.5kg.

Other designs and mounting systems are available on request. Please, contact our sales department for custom designs. Magtrol is at your service, and has a long experience in providing customized solutions.

CABLE ASSEMBLIES

Cables are required to connect the WB 32 Series to DSP 7010 Series Dynamometer Controller. Since 2020, Magtrol initiated an upgrade of its device connectivity. Depending on the DSP 70XX model, the connectors may not be compatible; for more information please contact our sales department.

TORQUE & SPEED SIGNAL CABLE



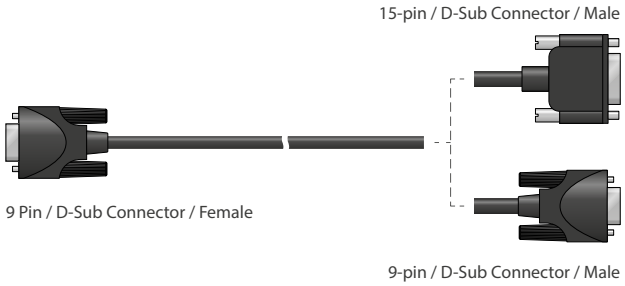
ORDERING NUMBER	88M	_ _ _	/	_ _ _ _

372 : 14 Pin Centronics connector [a)]
368 : 15 Pin D-Sub connector [b)]

0500 : Cable length 5 m
1000 : Cable length 10 m
xxxx : Customized [c)]

a) For use with: DSP70**0X** b) For use with: DSP70**1X**
c) Other cable lenght available on request.

BRAKE POWER CABLE



DESIGNATION	ORDERING NUMBERS
15 Pin D-Sub connector - 5 m [a,c)]	ES 406
9 Pin D-Sub connector - 5 m [b,c)]	957-18-25-0301
9 Pin D-Sub connector - 10 m [b,c)]	957-18-25-0701

a) For use with: DSP70**0X** b) For use with: DSP70**1X**
c) Other cable length available on request.

ORDERING INFORMATION

DYNAMOMETER ONLY

ORDERING NUMBER	317 -	_ _ _	- 000 - 01X

101 : 1 WB 32
102 : 2 WB 32

Example: WB 32 dynamometer only, nominal torque 0.4 N·m, would be ordered as : **317-101-000-01X**.

COMPLETE SYSTEM

ORDERING NUMBER	317 -	_ _ _	- 900 -	_ _ _

101 : 1 WB 32
102 : 2 WB 32

01X : without motor fixture
02X : with AMF-1 motor fixture

Example: WB 32 dynamometer, in complete system, nominal torque 0.8 N·m, with motor fixture AMF-1, would be ordered as : **317-102-900-02X**

SYSTEM OPTIONS AND ACCESSORIES

DSP 7010 - DYNAMOMETER CONTROLLER

Magtrol's DSP 7010 Programmable Dynamometer Controller employs state-of-the-art digital signal processing technology to provide superior motor testing capabilities. Designed for use with any Magtrol Hysteresis, Eddy-Current or Powder Brake Dynamometer, Magtrol In-Line Torque Transducer / Sensor or auxiliary instrument, the DSP 7010 can provide complete PC control via the USB or IEEE-488 interface. With up to 500 readings per second, the DSP 7010 is ideally suited for both the test lab and the production line.

Standard Features:

- **DSP 7011 Single Channel**: Easy to use plug & play solution
- **DSP 7012 Dual Channel**: Enables the support of two testing instruments with independent or tandem configurations and two fully independent control loops
- Built-in Alarm System (power, torque, speed, etc.)
- Speed & Torque closed loop Operating Modes
- Programmable Digital PID Values
- Built-in Current-Regulated Supply
- Selectable Torque Units (imperial, metric).

Fig. 4: DSP 7010 | Dynamometer Controller

AMF SERIES - ADJUSTABLE MOTOR FIXTURE

Magtrol's AMF Series Adjustable Motor Fixtures are used to secure small to medium-sized motors in place while running any test. These extremely versatile fixtures also enable easy motor centering for testing. These accommodate motors up to 101 mm (4") in diameter.

MODEL 7500 SERIES - POWER ANALYZERS

The Magtrol 7500 Series Power Analyzer is an easy-to-use instrument ideal for numerous power measurement applications. From DC to 80 kHz AC, the MODEL 7500 measures volts, amps, watts, volt-amps, frequency, crest factor, Vpeak, Apeak and power factor in one convenient display. They may be used either as stand-alone instruments or in conjunction with any Magtrol Hysteresis, Eddy-Current or Powder Brake Dynamometer; any Magtrol Dynamometer Controller and M-TEST Software for more demanding motor test applications.

Fig. 5: 7500 Series | Power Analyzers

COUPLINGS

When Magtrol WB 32 Series Dynamometers are mounted in a drive train, double-element miniature couplings are ideal, although single-element couplings can be used for low speed applications. The criteria for selecting appropriate couplings for torque measurement is as follows:

- High torsional spring rate (ensures high torsional stiffness and angular precision)
- Clamping quality (should be self-centering and of adequate strength)
- Speed range
- Balancing quality (according to speed range)
- Alignment capability

The higher the speed of the application the more care is required in selecting the coupling and assembling (alignment and balancing) the drive train configuration. Magtrol provides a wide range of couplings suitable for torque measurement applications and can assist you in choosing the right coupling for your transducer.

Fig. 6: MIC Series Miniature coupling

CHILLER

As an option Magtrol can supply a water / air heat exchanger for the WB 32 Series Dynamometer cooling up to 1 kW (available 115 / 230 V AC).

Its power dissipation will however depend on the surrounding room temperature.

2. INSTALLATION / CONFIGURATION

The dynamometer lifespan (before overhauling) 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 increased considerably.

2.1 PACKAGE CONTENTS

- WB 32 Series Dynamometer
- Calibration Certificate
- Arms for calibration (2 parts)
- Weight according on the dynamometer model (2N or 4N)
- Power Cable

NOTICE Connection cables to connect with the DSP 70XX (or other electronic control device) are not included and must be ordered separately.

For more information (*see section 5.3 - Connection Cables*)

2.2 LOCKING THE DYNAMOMETER FOR TRANSPORT

WB 32 dynamometers are equipped with a Reaction Torque Sensor (RT 200 Series). This measures the torque generated by the system being tested on the brake. The Reaction Torque Sensor is a precision instrument which must be protected from shocks during transport in order to guaranty the measurement repeatability. Therefore, all Magtrol WB 32 Dynamometers are fitted with a locking system in order to protect the torque sensor during transport.

The dynamometer can only be used after removing that model's specific locking device. The unlocking procedure is described below (*see section 2.2.1*).

NOTICE The dynamometer have to be mounted on a test bench or in its final location **prior to** the removal of the load cell protection device. This prevents damage to the load cell transducer during dynamometer installation.

CAUTION TO PREVENT DAMAGE TO THE TORQUE SENSOR, THE DYNAMOMETER MUST BE LOCKED BEFORE MOVING OR SHIPPING.

2.2.1 UNLOCKING PROCEDURE

WB 32 Series Dynamometers are fitted with a mechanical stator assembly locking device protecting the load cell during transport. Once the dynamometer is installed in its working position and ready for use, proceed as follows (*see Fig.2-1 & see Fig.2-2*) to unlock the system:

CAUTION WHEN THE COVER IS OPEN AND THE DEVICE IS CONNECTED TO THE POWER SUPPLY, THERE IS A RISK OF ELECTRIC SHOCK. DISCONNECT THE POWER SUPPLY FROM THE DEVICE WHEN PERFORMING ANY WORK INSIDE THE HOUSING.

1. The device must be turned off, disconnected from the power supply, and it is advisable to disconnect any other connection cables to avoid electrical interference.
2. Take off the top cover by removing the 6 screws (1) (2 on each side, 2 on top).

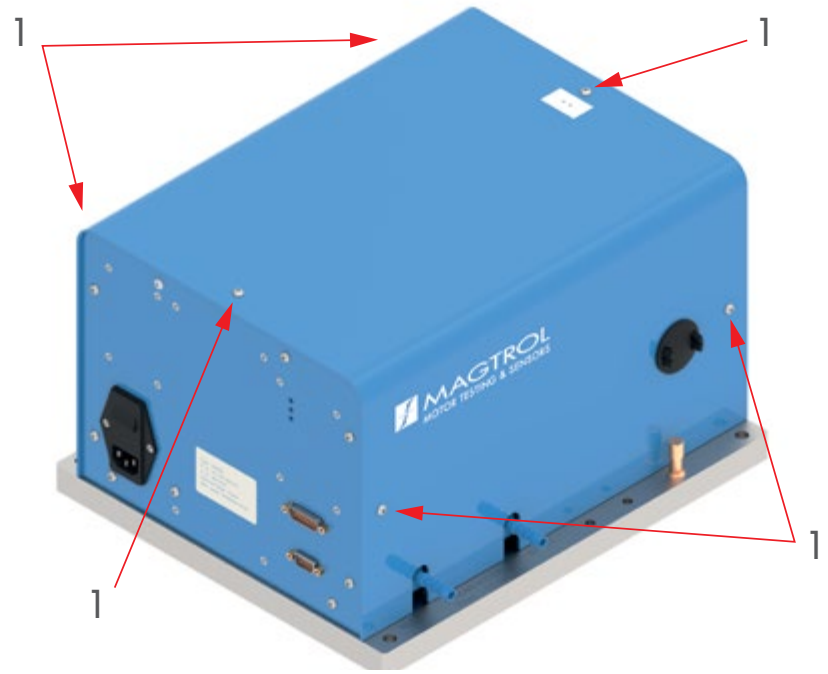


Fig.2-1 Unlocking procedure; remove the top cover.

3. Loosen the two nuts (2).
4. Unscrew the two screws (3) with three turns.
5. Tighten the two nuts (2).
6. Replace the cover and its 6 fixing screws.

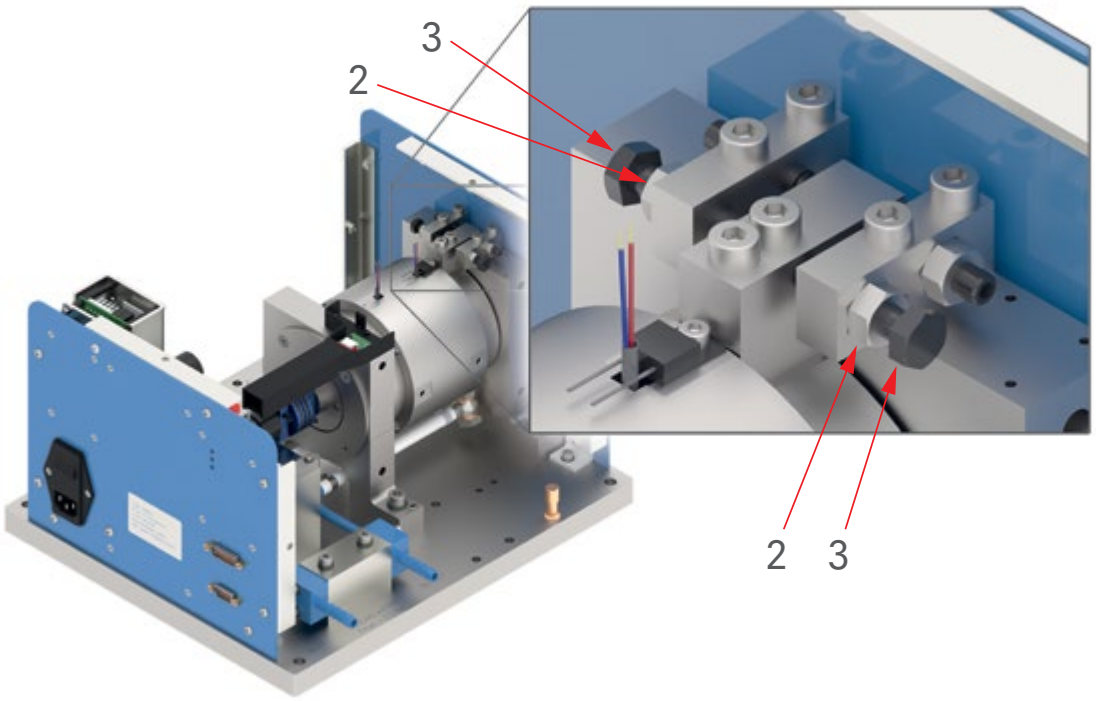


Fig.2-2 Unlocking procedure; release the dynamometer movement

NOTICE Be careful not to change the overload protection screws and nuts. They are adjusted at the factory. More information about overload protection (*see section 7.2*)

CAUTION WHEN THE DYNAMOMETER IS LOCKED DURING TRANSPORT, THE REACTION TORQUE SENSOR SHOULD NOT BE UNDER MECHANICAL STRESS (COMPRESSION, TRACTION OR TORSION).

2.3 MOUNTING THE DYNAMOMETER TO THE TEST BENCH

The dynamometer WB 32 should be placed on a stable horizontal base plate (preferably constructed of cast iron, steel or aluminum) in order to eliminate vibrations to the greatest extend possible. Flatness defects should not exceed 0.05 mm. In addition, the dynamometer frame must withstand the torque transmitted by the dynamometer without deformation.

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

The dynamometer is mounted onto the bench by means of four screws. The size of these screws depends on the dynamometer model. Refer to the data sheet of the corresponding dynamometer (*see section 1.4*) for additional information on the screw type and size.

2.3.1 ALIGNING THE DYNAMOMETERS ON THE TEST BENCH

The proper alignment of the dynamometer with the motor under test 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 high-speed Eddy-current dynamometers (WB 32 or WB 23/27), ≤ 0.01 mm may be tolerated..

2.3.2 VIBRATIONS INDUCED BY THE TEST BENCH

Vibrations will cause premature wear on bearings. Since it is not possible to modify the motor (device) under test to prevent vibrations, precautions must be taken to prevent damage to the dynamometer.

In order to evaluate motors producing vibrations (for instance, combustion engines), the motors must be mounted on a heavyweight base plate equipped with vibration isolators. This may significantly reduces the vibrations transmitted from the motor to the dynamometer. .

Height differences due to varying motor loading must be taken into account. The vibration isolators must not be compressed, as this would cause misalignment between the motor and the dynamometer. This would affect the measurement results and damage the dynamometer.

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

2.4 COUPLINGS

The dynamometer couplings used with the Motor Under Test (MUT) is an important factor to take into consideration. Using a coupling which is not correctly specified for the application will lead to measuring errors and premature wear of the dynamometer. For use with the WB 32 Dynamometer, Magtrol has worked in collaboration with a manufacturer to produce a coupling that ensures that all mechanical parameters do not interfere with the quality of the measurement.

As 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.

The coupling must be dynamically balanced Q2.5, according to ISO 1940-1. This balancing must compensate for maximum tolerated misalignment between the motor under test and the dynamometer.

As with all WB Series dynamometers, Magtrol always use a coupling with two degrees of freedom, as shown in the example below (*see Fig.2-3*). This kind of coupling compensate the misalignment, must dampen axial and radial vibrations and isolate the dynamometer from vibrations generated by the unit under test

Due to the high speed achievable by the WB32 dynamometer, it is crucial that each element in the kinematic chain generates the smallest amount of vibration as possible. For this reason, the coupling must be dynamically balanced.

For use with WB32 dynamometers, Magtrol recommends using a miniature coupling specially designed for this purpose. For more information, contact our technical sales department.

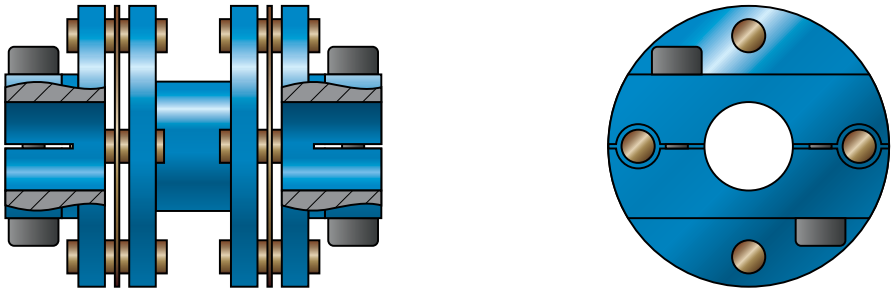


Fig.2-3 Double Element Couplings

CAUTION MAGTROL DOES NOT RECOMMEND USING STANDARD COUPLINGS THAT ARE NOT DESIGNED FOR HIGH-SPEED OR HIGH-PRECISION WORK.

IN ADDITION TO CAUSING IRREGULARITIES OR FALSE MEASUREMENTS, VIBRATIONS (EVEN MINIMAL ONES) CAN DAMAGE THE DYNAMOMETER. THIS MAY RESULT IN REPAIR COSTS OR INVALIDATE THE WARRANTY.

NOTICE With more than 70 years of experience in the field of motor testing, Magtrol is your recommended partner to determine the best suited dynamometer for any given application.

2.5 TORQUE MEASURING RANGE

As with most transducers, dynamometers should be operated in the upper part of their measuring range, between 10 ... 100% of their nominal rating. Measurement accuracy is maximized for the nominal torque value.

2.6 DRAG TORQUE

Drag torque (which is measured by the internal dynamometer cell) is generated by friction originating from the bearings, as well as all other mechanical contacts. 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. More information (*see chapter CALIBRATION PROCESS*).

Please, refer to the corresponding data sheets (*see section 1.4*) for the maximum drag torque values of each model.

2.7 TOLERATED RADIAL AND AXIAL FORCE

NOTICE Any radial or axial force exercised on a dynamometer causes premature wear of the bearings, as well as an increase of the drag torque.

The following table shows the maximum axial and radial forces the WB 32 Series Dynamometer can support without being damaged:

MODEL	F_{axial} max [N]	F_{radial} max [N]
1 WB 32	5	3.5
2 WB 32	5	3.5

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.

The side load of the measuring line is detected by the 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.

By slightly moving the dynamometer stator backwards and forwards when the motor is stopped, the side load disappears. If uncoupling the dynamometer makes the drag torque disappear, either the coupling will have to be changed or it will have to be realigned with the motor.

CAUTION THE DYNAMOMETER MUST BE UNCOUPLED PRIOR TO CALIBRATION (*SEE CHAPTER CALIBRATION PROCESS*).

2.8 CONNECTING THE COOLING SYSTEM

Proper cooling of the dynamometer is essential to ensure a long operating life and accurate measuring results. All Magtrol WB Series Dynamometers are water-cooled to guaranty the best possible heat dissipation.

NOTICE The cooling tubes must have an inside diameter in accordance with the indications on the corresponding dynamometer data sheets (*see section 1.4*). They must be fitted to the dynamometer using a metal ring. Also, check for correct water flow direction.

The cooling water input is marked “Cooling Water Inlet” on the dynamometer housing. The other nipple is used for the water outlet. Check for correct connections.

For more information on the dynamometer’s cooling system (*see chapter COOLING*).

The dynamometers WB 32 are equipped with a temperature sensor that measures the temperature of the water at the outlet. This sensor will trigger an alarm if the cooling water overheats.

2.9 PROTECTIVE SYSTEMS

WARNING **ALL 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 INJURED OR DAMAGED AS A RESULT OF THE DRIVE ELEMENT 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 having become loose.
- Avoid attaching protective elements to rotating parts.
- Keep protective elements at a sufficient distance away from rotating parts.

WARNING **THE ASSEMBLY AND INSTALLATION OF THE SYSTEMS MUST COMPLY WITH MACHINE SAFETY STANDARDS (ISO 12100 OR SIMILAR APPLICABLE STANDARDS).**

2.9.1 FULL SYSTEM (WITH BASE PLATE AND PROTECTIVE COVER)

In addition to the standard version, Magtrol offers an all-in-one version that provides several advantages.

The complete system integrates the WB 32 Dynamometer on a specially dimensioned base plate and offers ergonomic protection. This base plate allows the mounting of motor mounting systems (e.g., AMF-1) and, above all, guarantees the mechanical rigidity required for high-speed motor testing.

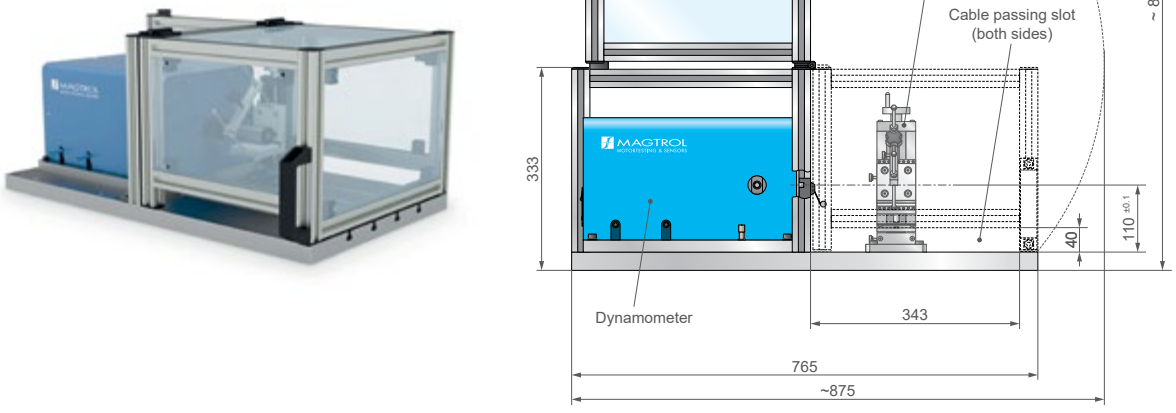


Fig.2-4 WB 32 Series in its complete system configuration with base plate and protective cover

2.9.2 CUSTOMIZED PROTECTION SYSTEM

In the case of a customized system, the protective equipment will be adapted according to the configuration. Our test benches are always designed to protect the operator and are developed in accordance with the safety regulations of the country of destination.

Our R&D department has extensive experience in developing protection systems for test benches. We are available to advise you and help you develop protection systems that are both effective and ergonomic.

Below is an example of a protective system (*see Fig.2-6 to Fig.2-7*). All parts of the bench are accessible, but the covers prevent any risk to the user when closed.

Fig.2-6 Turnkey customized test bench with retractable guard.

Fig.2-5 Test bench with fixed and movable metal guard with safety switch.

Fig.2-7 Custom motor test system with control rack and full safety protection all around the test table.

2.10 POWER / HEAT DISSIPATION

All Magtrol WB Series Dynamometers are instruments which absorb energy. They convert the kinetic energy of the coupled rotating systems into heat.

The quantity of heat which can be dissipated by the dynamometers is not infinite. Additionally, the dynamometers cannot resist excessive temperatures without damage. The most frequent consequence of a too important energy supply is a premature deterioration of the excitation coils of the stator, possibly inducing serious damages to the dynamometer and even to its immediate environment.

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

Converesely, dynamometers should never be loaded at full speed when cold. If a motor must be tested cold, warm up the dynamometer with a different motor first.

CAUTION IT IS IMPORTANT TO FAMILIARIZE YOURSELF WITH THE DYNAMOMETER'S RATINGS. RUNNING THE SYSTEM OUTSIDE OF THE LIMITS SPECIFIED IN THE DATA SHEETS (*SEE SECTION 1.4*) CAN CAUSE IRREVERSIBLE DAMAGE.

3. TECHNICAL CURVES

The diagram below illustrate the performance of WB 32 Dynamometers by means of characteristic curves relating torque, speed and power. The curves are logarithmic; if you require any other type of diagram, please contact Magtrol technical support.

3.1 WB 32 CURVES

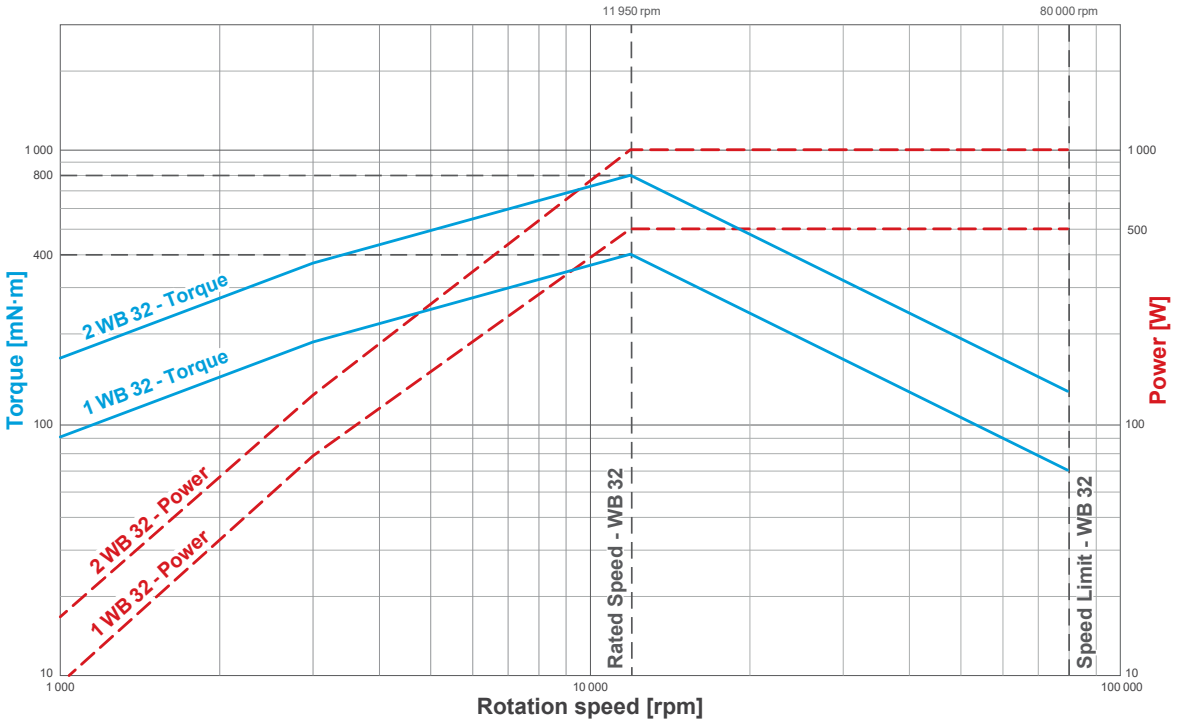


Fig.3-1 WB 32 - Ratings Curves (typical range)

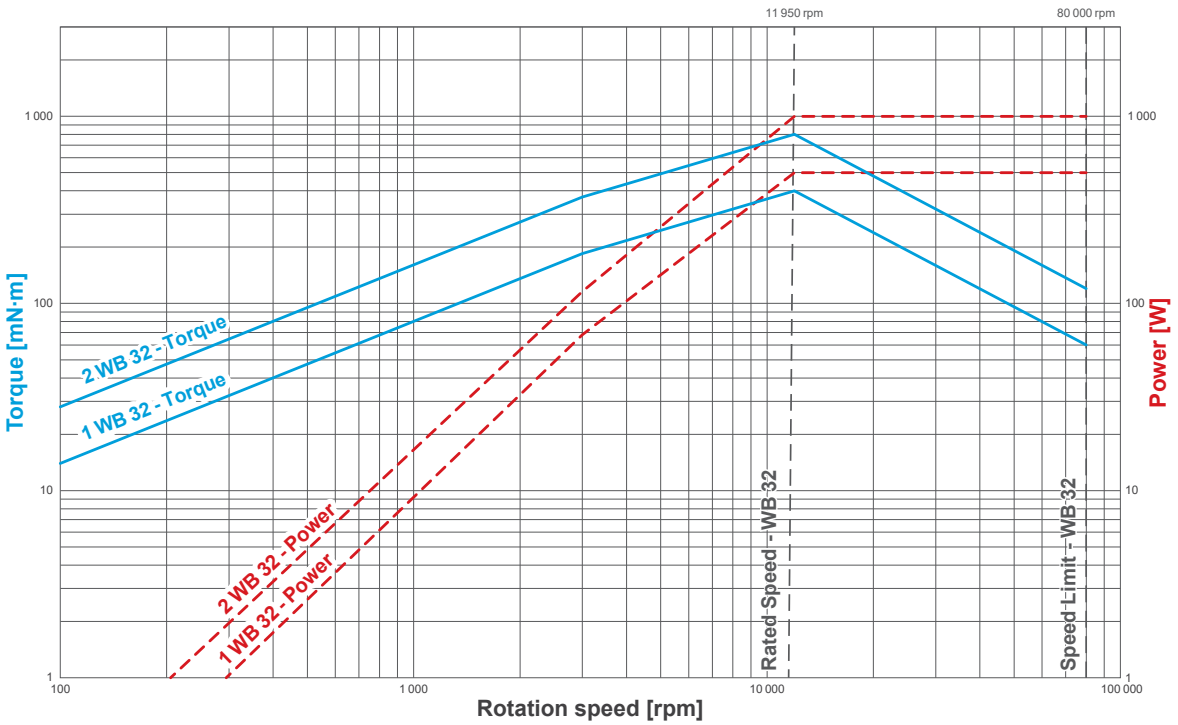


Fig.3-2 WB 32 - Ratings Curves (extended range with low speed)

4. COOLING

4.1 DYNAMOMETER COOLING

Proper cooling of the dynamometer is essential to ensure a long operating life and accurate measuring results. All Magtrol WB Dynamometers are water-cooled to guaranty the best possible heat dissipation.

4.1.1 CONNECTIONS

CAUTION THE COOLING TUBES MUST HAVE AN INSIDE DIAMETER IN ACCORDANCE WITH THE INDICATIONS ON THE CORRESPONDING DYNAMOMETER DATA SHEETS (*SEE SECTION 1.4*). THEY MUST BE FITTED TO THE DYNAMOMETER USING A METAL RING. ALSO, CHECK FOR CORRECT WATER FLOW DIRECTION.

The cooling water input is marked «Cooling Water Inlet» on the dynamometer housing. The other nipple is used for the water outlet. Please ensure that the connections are set up correctly.

4.1.2 WATER FLOW AND PRESSURE

The required cooling water flow rate can be worked out by means of the following formula:

$$\text{Flow rate [l/h]} = \frac{\text{Braking Power [kW]} \cdot 860\ [\text{l}\cdot^\circ\text{C/kWh}]}{\text{Outlet Water Temperature [°C]} - \text{Inlet Water Temperature [°C]}}$$

Fig.4-1 Calculate your water flow rate

NOTICE 1 kWh = 860 kcal = 3600 kJ

The dynamometer cooling system has been designed for an open outflow and freely flowing water without back-pressure.

CAUTION THE MAXIMUM INPUT PRESSURE MUST NOT EXCEED 0.5 BAR FOR MODELS WB 32 SERIES.

MAGTROL STRONGLY RECOMMENDS THE INSTALLATION OF A PRESSURE RELIEF VALVE AT THE COOLING INLET, TO ENSURE CORRECT PRESSURE.

4.1.3 COOLING WATER CONSUMPTION

~ 30 l/kWh at Δt = 30 °C (Metric)
~ 8 gal/kWh at Δt = 86 °F (US)

Fig.4-2 Cooling water consumtion applicable for all WB, PB & TANDEM Dynamometers

4.1.4 TEMPERATURE SENSOR

The dynamometer is fitted with a sensor measuring the outlet water temperature. This sensor generates an alarm in case of overheating.

4.2 OPEN-CIRCUIT COOLING SYSTEMS

Although open-circuit cooling is possible, Magtrol strongly advises against this configuration for environmental consideration. However, if you have a hydraulic configuration in your environment that could justify open-circuit cooling, please contact our Technical Department to find out about the options available.

In all cases, the cooling water must be clean and at a constant flow rate. Ecological aspects regarding water supply and treatment before discharge must be taken into consideration.

4.3 CLOSED-CIRCUIT COOLING SYSTEMS

The closed-circuit cooling system uses water-to-air or water-to-water heat exchangers, or a chiller. This system is used when the water supply is restricted or when the water cannot be used for cooling without prior treatment/filtering.

NOTICE It is recommended to use water specific additives to avoid proliferation of living organisms, and to protect against corrosion and mineral deposits.

A closed-circuit cooling system simply requires a water tank in which the heat exchange will take place. The ideal operating temperature of the dynamometer is maintained by a temperature-regulated valve on the dynamometer cooling water outlet.

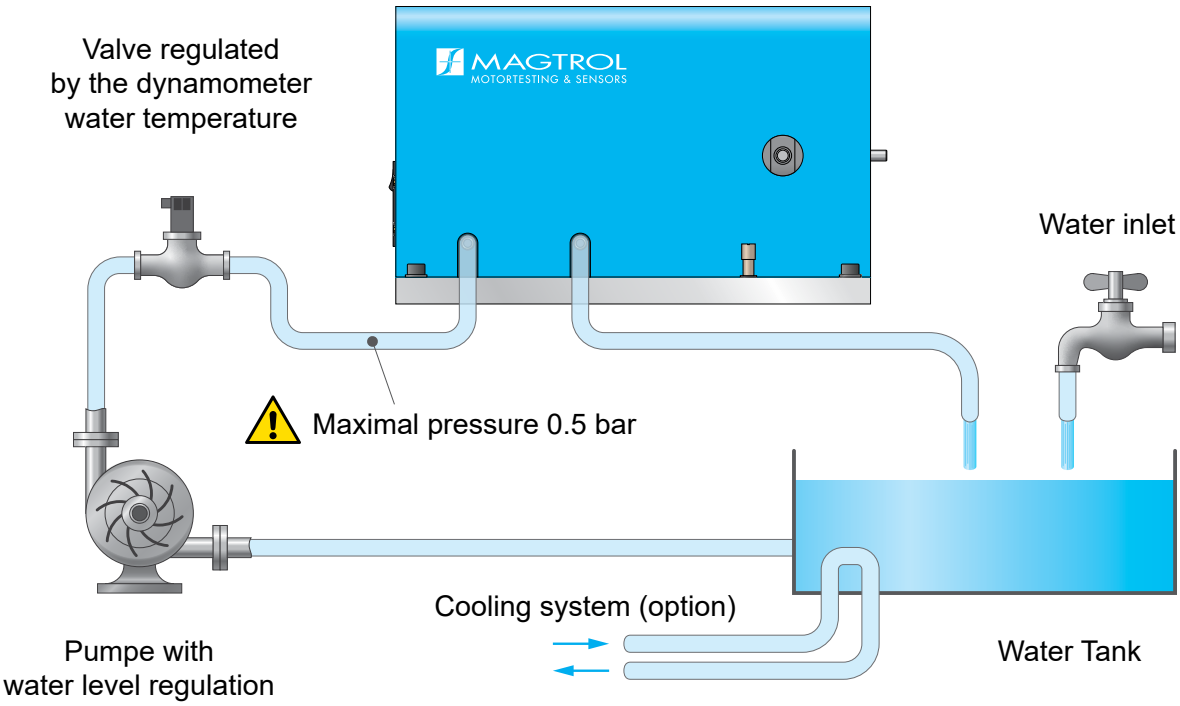


Fig.4-3 Example of a closed-loop cooling system

4.4 COOLING ADDITIVE

In order to optimize the cooling circuit, Magtrol recommends adding an additive to your heat transfer fluid. This will ensures consistent heat transfer, provide protection against corrosion, and increase the service life of the WB32 Dynamometer cooling components.

Magtrol specifically recommends using propylene glycol, such as: Motorex, COOLANT M5.0 Ready to use.

NOTICE In the case of WB 32 Series, it is not necessary or recommended to use the additive in its pure form. It can be diluted in the cooling water.

CAUTION ADDITIVES AND COOLANTS MUST BE DISPOSED OF PROPERLY. ADDITIVES AND COOLANTS MUST BE DISPOSED OF PROPERLY. PLEASE COMPLY WITH THE MANUFACTURER'S INSTRUCTIONS AND RESPECT THE ENVIRONMENTAL STANDARDS IN FORCE IN YOUR COUNTRY.

4.5 EXTERNAL COOLING UNIT (CHILLER)

It is also possible to use an separated cooler. As an option Magtrol can supply a water / air heat exchanger for the WB 32 Series Dynamometer cooling up to 1 kW (available 115 / 230 V AC).

Its power dissipation will however depend on the surrounding room temperature.

Installation and connection will depend on the model, and Magtrol will only provide limited support for external models.

CAUTION PARTS CONTAINING COOLANT (PIPES, CONNECTORS, ETC.) MAY BECOME HOT ENOUGH (> 50°C / 140°F) TO CAUSE MINOR BURNS.

4.6 COOLING WATER ISSUES

Despite the fact that water is necessary for cooling, it also represents a risk. Rust, corrosion, erosion and scale deposits have a negative effect on the functioning of the dynamometer.

4.6.1 IMPURITIES

Tap or running water may contain dust, mud, calcium or magnesium carbonates, calcium or magnesium sulfates, silicates, iron, carbons, sulfides or algae, and other fungi.

If the cooling water is not analyzed and treated, scale may become deposited on the inside surface of the tubing, reducing the heat transfer and the water flow rate. A 0.5 mm thick scale deposit reduces the cooling system tubing diameter by 30 %.

The higher water temperature increases the speed of scale depositing. Also, the warmer the water, the faster the corrosion and erosion. A water temperature increase of 10 °C (50 °F) multiplies the corrosion effect by a factor of two or even four.

4.6.2 HARDNESS

The following table indicates the water hardness in German degrees [°dH]. The total hardness is defined as the sum of the temporary and the permanent hardness. The temporary hardness can be removed by boiling the water, which only takes the calcium and magnesium carbonates and bicarbonates into account. The permanent hardness is caused by the presence of calcium and magnesium sulfates in the water and cannot be removed by boiling. Soft water has a hardness between 3 and 6 °dH, whereas hard water may have a hardness of more than 16 °dH.

	OPEN-CIRCUIT COOLING	CLOSED-CIRCUIT COOLING
pH value	6 - 8	6 - 8
Total hardness	< 20 °dH	< 15 °dH
Temporary hardness	< 10 °dH	< 6 °dH
Permanent hardness	< 10 °dH	< 9 °dH
Free carbon dioxide (CO_2)	< 10 mg/l	< 3 mg/l
Organic substances	< 10 mg/l	< 10 mg/l
Algae and fungal attacks	not acceptable	
Sand and mud	0 mg/l	0 mg/l
Sulfates (SO_4^{2-})	< 50 mg/l	< 50 mg/l
Chlorides (Cl-)	< 30 mg/l	< 30 mg/l
Solute iron (Fe_2+ and Fe_3+)	< 1 mg/l	< 1 mg/l
Phosphates (PO_4^{3-})	0 mg/l	0 mg/l
Total salt content (NaCl)	< 3000 mg/l	< 3000 mg/l
Manganese (Mn)	< 0,1 mg/l	< 0,1 mg/l

Fig.4-4 Water hardness table in German degrees [°dH]

°dH	=	German hardness degree	= 10 mg CaO/liter
°fH	=	French hardness degree	= 10 mg CaCO3/liter
°e	=	English hardness degree	= 1 grain CaCO3/gallon
ppm	=	American hardness degree	= 1 mg CaCO3/liter

1 °dH = 1.79 °fH = 1.25 °e = 17.9 ppm

Fig.4-5 Correspondence table

CAUTION NEVER USE DEMINERALIZED WATER FOR THE COOLING OF DYNAMOMETERS AS THIS WATER IS AGGRESSIVE AND LEADS TO CORROSION DUE TO A HIGH CONTENT OF FREE CARBON DIOXIDE.

4.6.3 FILTERING

In order to avoid clogging of the cooling system due to sand, mud, rust or other substances, the installation of a filter at the water inlet is recommended.

Solid substances conveyed by the cooling water should not exceed 250 µm. As a rule, the filter should remove approximately 98% of the substances above 250 µm of diameter.

4.6.4 CONTROLLING THE WATER FLOW RATE

An excessive deposit of minerals may be avoided by limiting consumption to the absolute minimum necessary for the dynamometer braking power dissipation. This may be performed by installing a thermostatic valve on the water outlet and by adjusting it just below the cutoff temperature of the dynamometer safety thermostat (approximate setting ~60 °C or 140 °F). This valve must constantly guaranty a flow rate in order to get enough water flowing to the dynamometer safety thermostat.

4.6.5 WATER INHIBITORS

In order to prevent scale from forming in closed-circuit cooling circuit systems, it is sometimes necessary to use water inhibitors which must be effective against rust, corrosion and mineral deposits.

The use of strong alkaline substances or certain acids may be risky and dangerous during manipulations. These substances can attack the different metals of the dynamometer, and may even be toxic to the operator.

- **Chromates**: should not be used as they cannot avoid mineral deposits and do not protect aluminum. Furthermore, they are acid-based, dangerous and toxic.
- **Borates**: should not be used as they cannot prevent deposits from forming.
- **Phosphates**: should not be used as they will cause algae growth.
- **Chlorides, nitrates** and **sulfates**: should not be used as they will cause corrosion.

If the available water proves to be of questionable quality, the user should contact the local authorities to be informed about an adequate form of water treatment. Special attention should be paid to water found in industrial areas where contained polluting substances may represent a source of potential dangers for the dynamometer cooling system. Furthermore, water inhibitors improperly used can have a negative impact on the environment.

4.6.6 CONDENSATION

As a general rule, condensation occurs in the dynamometer when the outlet temperature of the cooling water is lower than the ambient temperature in the room. When using a PB Series Magnetic Powder Dynamometer, the condensation oxidizes the powder which leads to a decrease of the braking torque. This happens very quickly and forces the user to send the dynamometer back to Magtrol for replacement of the magnetic powder. On WB Series Eddy-current Dynamometers, the condensation generates rust on the internal components which rapidly reduces the operating life of the dynamometer.

CAUTION WHEN THE DYNAMOMETER IS AT A STANDSTILL, THE COOLING WATER MUST BE TURNED OFF. THIS REDUCES THE LEVEL OF SCALE DEPOSITS AND, EVEN MORE IMPORTANT, AVOIDS CONDENSATION.

4.7 COOLING CIRCUIT PURGING

Prior to storing the dynamometer for a long period of time, the water remaining in the cooling circuit must be blown out with (preferably lubricated) compressed air.

CAUTION DURING THE PURGING PROCESS, PLEASE PROCEED WITH CAUTION TO NOT DAMAGE THE INTERNAL TUBING OF THE DYNAMOMETER.

AT THE BEGINNING OF THE PROCEDURE, LIMIT THE AIR PRESSURE TO 0.5 BAR UNTIL ALL OF THE COOLANT HAS BEEN PURGED. THEN, IT IS POSSIBLE TO USE A SLIGHTLY HIGHER PRESSURE (MAX. 1 BAR) TO DRY THE COOLING SYSTEM.

5. ELECTRICAL CONNECTIONS

NOTICE For information on cable assemblies: please refer to the datasheet (*see section 1.4*).

Connecting the WB 32 Series Eddy-Current Dynamometer is easy !

Once your dynamometer is physically installed in your test system, use the 3 cables provided to connect your device to make it operational. Use the 100 - 240 V AC / 50 - 60 Hz supply cable to power your dynamometer and the other 2 cables to connect the device to Magtrol's Dynamometer Controller (DSP 70XX) or to your own electronic system.

5.1 GROUNDING

CAUTION BEFORE CONNECTING THE WB 32 DYNAMOMETER TO THE SIGNAL PROCESSING UNIT, THE SENSOR'S HOUSING MUST BE EARTH-GROUNDED.

The dynamomter, test bench, table, ..., and driven machine must be commonly grounded (*see Fig.5-1*).

A dedicated grounding terminal is mounted on the brake base plate; use this terminal (*see Fig.5-1*).

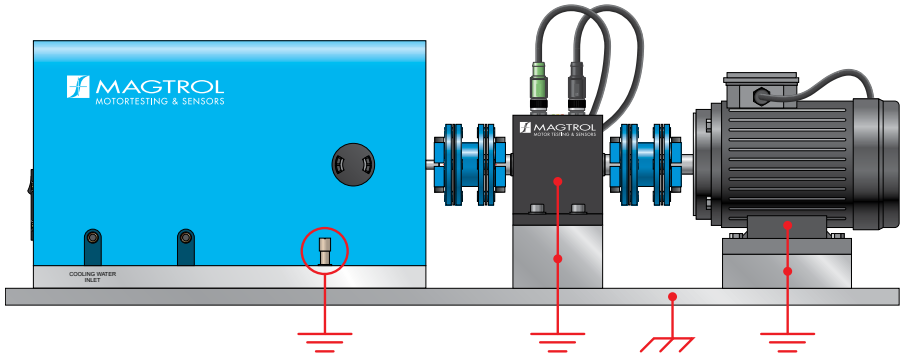


Fig.5-1 Common Earth-grounding

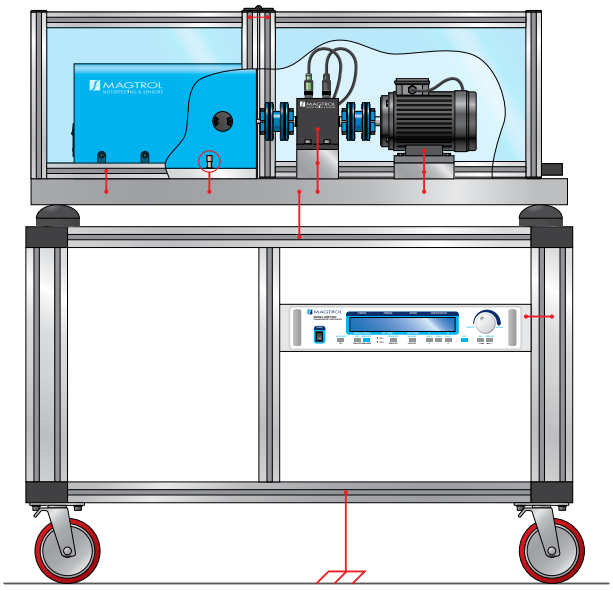


Fig.5-2 Common Earth-grounding also include frame, electronics and any related devices

5.2 ELECTRONIC DEVICE COMMONLY USED IN COMBINATION

NOTICE For more system configuration options and detailed information about the following device, please refer to the corresponding user manual (available online at www.magtrol.com).

5.2.1 DSP 7010 - DYNAMOMETER CONTROLLER

Magtrol's DSP 7010 Programmable Dynamometer Controller employs state-of-the-art Digital Signal Processing technology to provide superior testing capabilities. The DSP 7010 is designed to work with any Magtrol Dynamometer and is also compatible with all TM Series (In-Line Torque Transducers) and TS Series (Torque Sensors). Any Magtrol Dynamometers can be used with any Magtrol Torque Sensors; both are controlled by the same unit.

Complete computer control of the test system can be attained via USB interface, (optionally GPIB IEEE-488), and Magtrol's M-TEST Software. This LabVIEW™-based program is equipped with ramp, curve and manual testing capabilities to help determine the performance characteristics of a motor under test, and also provides pass/fail testing for production line and inspection applications. The data generated can be easily saved, displayed, printed and exported.

5.2.1.1 CONNECTION WITH DSP 701X

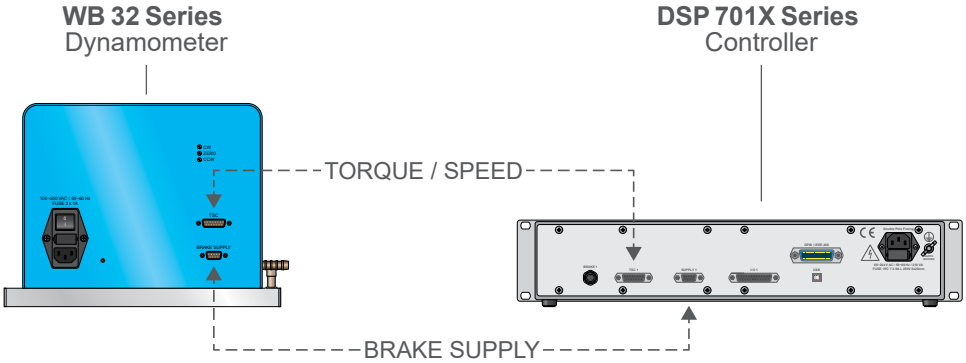


Fig.5-3 Connection of the WB 32 dynamometer with the DSP 701X Controller

5.2.1.2 CONNECTION WITH DPS 700X (LEGACY)

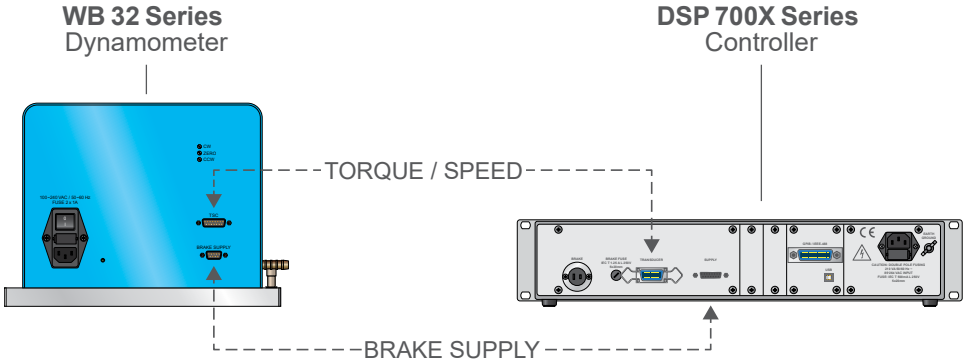


Fig.5-4 Connection of the WB 32 Dynamometer with the DSP 700X Controller

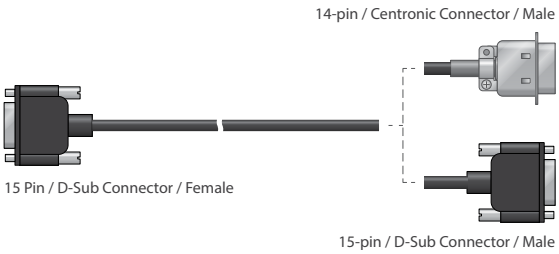
5.3 CONNECTION CABLES

The Dynamometer requires two cables to connect the WB 32 Series to DSP 70XX Series Dynamometer Controller. The first cable allows the torque signal to be transmitted; the second is used to control the brake excitation.

NOTICE

Since 2020, Magtrol initiated an upgrade of its device connectivity. Depending on the DSP 70XX model, the connectors may not be compatible; for more information please contact our sales department (Or find out more on our website: www.magtrol.com).

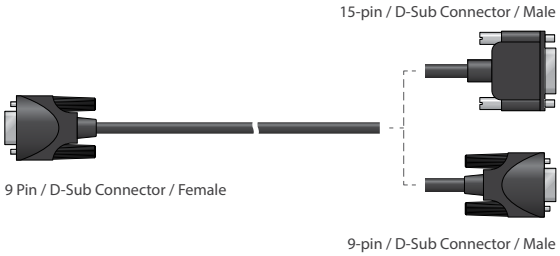
TORQUE & SPEED SIGNAL CABLE



ORDERING NUMBER	88M ___ / ____
372 : 14 Pin Centronics connector [a] **368** : 15 Pin D-Sub connector [b]	
0500 : Cable length 5 m **1000** : Cable length 10 m **xxxx** : Customized [c]	

g) For use with: DSP70**0X** h) For use with: DSP70**1X**
i) Other cable lenght available on request.

BRAKE POWER CABLE



DESIGNATION	PART NUMBERS
15 Pin D-Sub connector - 5 m [a,c]	317-101-950-011
9 Pin D-Sub connector - 5 m [b,c]	957-18-25-0301
9 Pin D-Sub connector - 10 m [b,c]	957-18-25-0701

a) For use with: DSP70**0X** b) For use with: DSP70**1X**
c) Other cable length available on request.

5.3.1 CONNECT DYNAMOMETER TO DSP 701X

5.3.1.1 TORQUE & SPEED SIGNAL CABLE

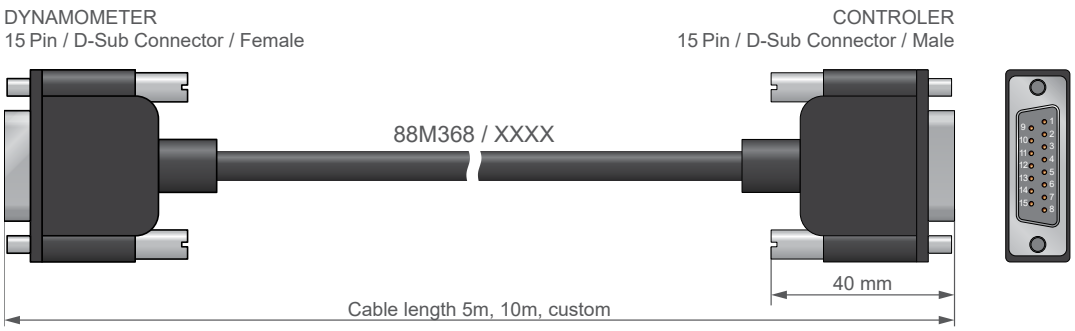


Fig.5-5 Cable 88M368/XXXX - Configuration

For use with DSP 7011 or DPS 7012. The connecting cable to the signal processing unit is fitted both side with a 15 pin D-Sub connector; female on the dynamometer side and a male on the side of the signal processing unit.

5.3.1.2 BRAKE SUPPLY CABLE

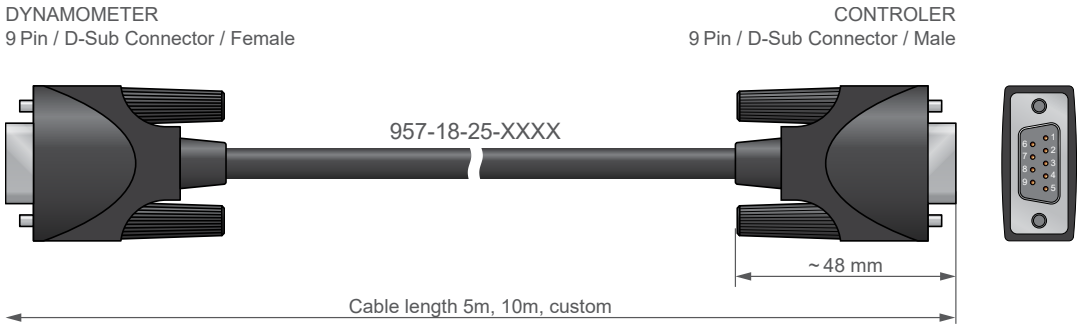


Fig.5-6 Cable 957-18-25-XXXX - Configuration

For use with DSP 7011 or DPS 7012. The connecting cable to the signal processing unit is fitted both side with a 9 pin D-Sub connector; female on the dynamometer side and male on the side of the signal processing unit

5.3.2 CONNECT DYNAMOMETER TO DSP 700X

5.3.2.1 TORQUE & SPEED SIGNAL CABLE

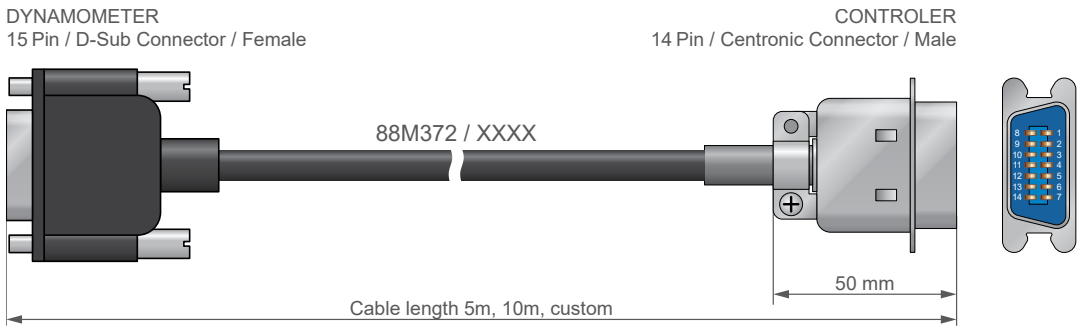


Fig.5-7 Cable 88M372/XXXX - Configuration

For use with DSP 7001 or DPS 7002. The connecting cable to the signal processing unit is fitted with a 15 pin D-Sub connector on the dynamometer side and a 14 pin Centronics connector on the side of the signal processing unit

5.3.2.2 BRAKE SUPPLY CABLE

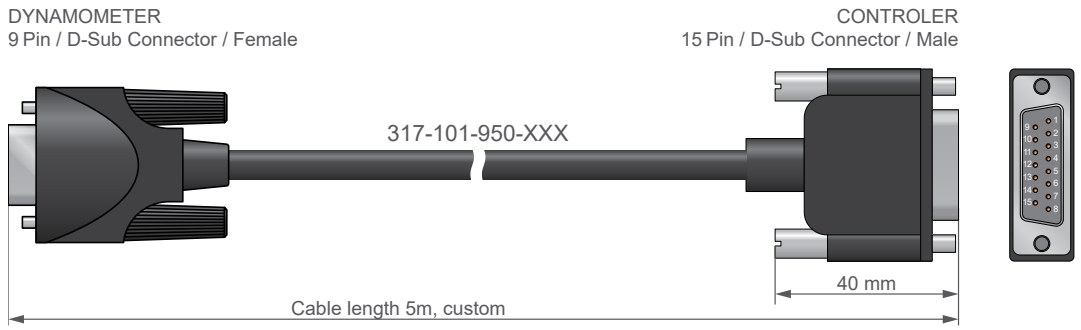
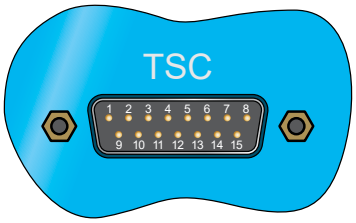


Fig.5-8 Cable 317-101-950-XXX - Configuration

For use with DSP 7001 or DPS 7002. The connecting cable to the signal processing unit is fitted with a 9 pin, D-Sub connector on the dynamometer side and a 15 pin, D-Sub connector on the side of the signal processing unit.

5.4 CONNECTION INTERFACE

5.4.1 TORQUE & SPEED SIGNAL CONNECTION (TSC)



1 N/C	9 +5 V DC COM
2 N/C	10 N/C
3 +24 V DC	11 Tach A
4 +24 V DC COM	12 N/C
5 -24 V DC COM	13 N/C
6 -24 V DC	14 TORQUE COM
7 +5 V DC	15 TORQUE SIGNAL
8 N/C	

Fig.5-9 Connection socket for the torque and speed signal.

The torque signal is provided by a torque meter equipped with a strain gauge bridge. This amplified signal (± 5 V DC) is available at terminals 14 and 15 of the connector.

The speed measurement is delivered in the form of PPR signal (PPR - Pulse Per Revolution). Each turn, the signal returns 4 PPR. Pin 11 (Tach A) of the 15-pin D-Sub connector (*see Fig.5-9*) provides this signal in the form of an open-collector output. The signal reference is provided via pin 9.

This type of output requires the use of a pull-up resistor and an external power supply for pulse shaping (*see Fig.5-10*).

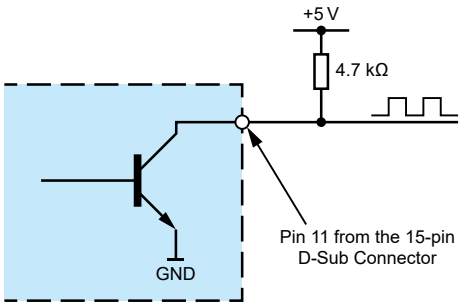


Fig.5-10 Tach A signal output structure

NOTICE The use of shielded cable is mandatory. Connect cable shielding to the connector housing.

5.4.2 BRAKE SUPPLY CONNECTION (EXCITATION)

This connection allows the transmission of all brake control signals as well as various alarm signals.

1 Current Set-point (Signal 0-10 V DC)	6 Current Set-point (Analog 0 V DC)
2 Electrical Alarm	7 N/C
3 Temperature Alarm	8 N/C
4 N/C	9 +24 V DC COM
5 N/C	

Fig.5-11 Connection socket for the dynamometer brake supply

NOTICE The use of shielded cable is mandatory. Connect cable shielding to the connector housing.

5.5 CONNECTION TO MAGTROL MOTOR TESTING ELECTRONICS

The connection and configuration of the Magtrol DSP 7010 Series Dynamometer Controller is described in the corresponding User's Manual. You can access this manual via the Magtrol website: www.magtrol.com. Refer to these documents for additional information on connecting the WB 32 Series Dynamometer to Magtrol motor testing electronics.

5.5.1 MANUAL TEST CONFIGURATION

In a manual test configuration, all test parameters must be manually entered into the DSP 70XX Dynamometer Controller. Data acquisition is then carried out manually.

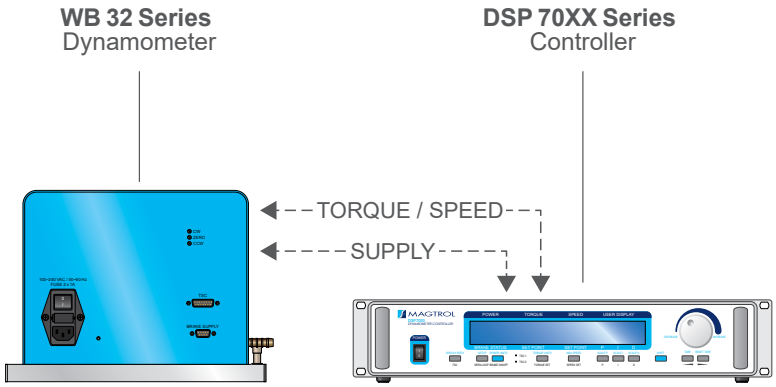


Fig.5-1 Manual Test Configuration with DSP 70XX

5.5.2 PC-BASED TEST CONFIGURATION

For enhanced motor testing capabilities and full data acquisition, Magtrol offers a complete system which includes a DSP 70XX - Dynamometer Controller and M-TEST - Motor Testing Software. Communication between the DSP Controller and PC running the M-TEST Software is carried out by USB or GPIB IEEE-488 interface board and corresponding connection cable.

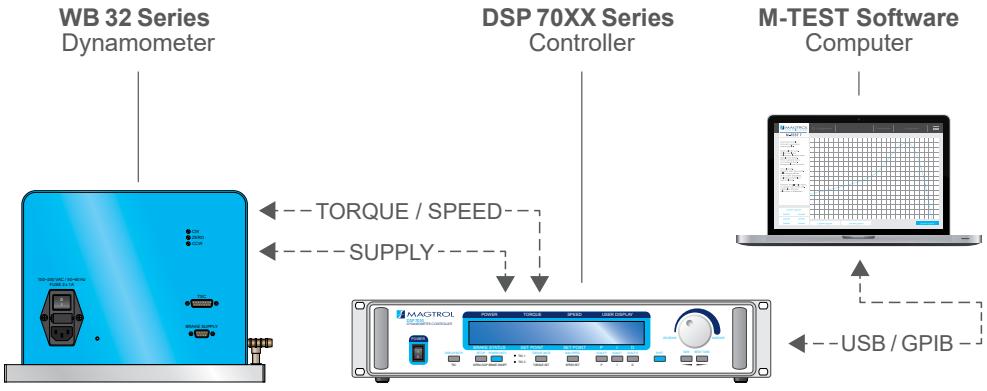


Fig.5-2 PC-Based Test Configuration with M-TEST Software

NOTICE

Magtrol's M-TEST Software is a state-of-the-art motor testing program for Windows®-based data acquisition. Used with the Magtrol DSP 7010 Controller, Magtrol M-TEST Software provides the control of any Magtrol Dynamometer and runs test sequences in a manner best suited to the overall accuracy and efficiency of the Magtrol Motor Test System. This complete 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.

5.6 CONNECTION TO NON-MAGTROL ELECTRONIC CONTROL UNITS

CAUTION USE ELECTRONIC CONTROL UNITS NOT SUPPLIED BY MAGTROL WITH EXTREME CAUTION.

MAGTROL MOTOR TESTING ELECTRONICS ARE FITTED WITH SAFETY DEVICES SUCH AS FUSES, CURRENT LIMITERS, THERMOSTATS, ETC. PREVENTING THE DYNAMOMETERS FROM OPERATING OUTSIDE OF THEIR LIMITS.

Magtrol dynamometers are high-precision products designed for defined uses. Everything from their overall design, mechanical components, choice of electrical components, and the nature of the signals measured is optimized for a precise use. In this sense, the Magtrol electronics device that surround our products are also specially designed to optimize the functionality of our products.

For this reason, and without wishing to impose the use of Magtrol electronics, we reasonably advise against the use of third-party electronics. However, if your project specifically requires the use of third-party electronics, our technical team is available to provide you with compatibility information and advice.

6. OPERATING PRINCIPLES

6.1 EDDY-CURRENT DYNAMOMETERS (WB SERIES)

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.

In the WB Eddy-current Dynamometer, the moving part is a toothed cylindrical 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. During rotation, the rotor teeth generate Eddy-currents in the stator which create a braking force. The kinetic heat generated in this process is absorbed by the stator cooling circuit.

The braking torque depends upon the rotational speed and increases with increasing speed. At a standstill, the torque is zero. To be able to measure a starting torque with this dynamometer, it is necessary to block both the stator and the rotor. In this case, the dynamometer ceases to rotate and the tested motor's torque is integrally transmitted to the dynamometer measuring cell.

6.2 OTHER TYPES OF DYNAMOMETERS:

Magtrol's product range also includes other families of dynamometers, notably:

- Hysteresis Dynamometer (HD Series), versatile and ideal for low to medium power ranges
- Magnetic Powder Dynamometers (PB Serie), which offer maximum torque from 0 rpm:
- Combined Dynamometers (TANDEM Series), which combine the characteristics of a WB Series Dynamometer with those of a PB Series Dynamometer;
- Very High Speed Dynamometers (WB 23 & WB 27), designed for speeds up to 100 000 rpm;
- Very High Speed Dynamometers (MSD - Mega Speed Dynamometer), designed for speeds up to 300 000 rpm and above.

NOTICE Each model meets a specific need. Our technical department is available to advise you in choosing your dynamometer according to your specifications and your project.

7. CALIBRATION PROCESS

Each new Magtrol WB 32 Dynamometer is calibrated at our factories. It is recommended that static calibration of Zero and Torque be performed regularly, especially after maintenance.

To carry out this operation, WB32 dynamometers are supplied with two calibration arms as well as a weight of 2 N (1 WB 32) or 4 N (2 WB 32).

NOTICE Do not forget to unlock the dynamometer following transport (after it returns from overhaul) in accordance with *see section 2.2 - Locking the Dynamometer for Transport*.

PREREQUISITES FOR CALIBRATION

Before the calibration, the motor or any other devices must be disconnected from the dynamometer; this allows the dynamometer shaft to rotate freely.

Magtrol recommends calibrating the dynamometer using a DSP 70XX Series - Dynamometer Controller. For more information about the controller, please refer to the corresponding technical documentation on our website www. magtrol.com

NOTICE As a part of the measurement chain, the DSP 70XX Controller is a high-precision device. They must also be calibrated to ensure the accuracy of measurements or operations.

CAUTION CALIBRATION MUST BE PERFORMED ON A DYNAMOMETER THAT IS DISCONNECTED FROM ALL EXTERNAL ELEMENTS (I.E. COUPLING, TORQUE SENSOR, MOTOR UNDER TEST, ETC)

7.1 TORQUE MEASUREMENT CALIBRATION

7.1.1 CALIBRATION ARMS AND WEIGHTS

To perform the calibration, you will need the two calibration arms and the calibration weight. These are supplied with your dynamometer.

You will notice that the calibration arms have two grooves at their ends. The inner groove (the one closest to the brake) is for calibration in N (Newton). The outer groove (the one furthest from the brake) is for calibration in kg (Kilograms). An engraved inscription next to each groove allows you to identify it.

Your dynamometer is delivered with a certified calibration weight specific to your model. The engraved inscription identifies the model: «2 N» (1 WB 32 dynamometer); «4 N» (2 WB 32 dynamometer).

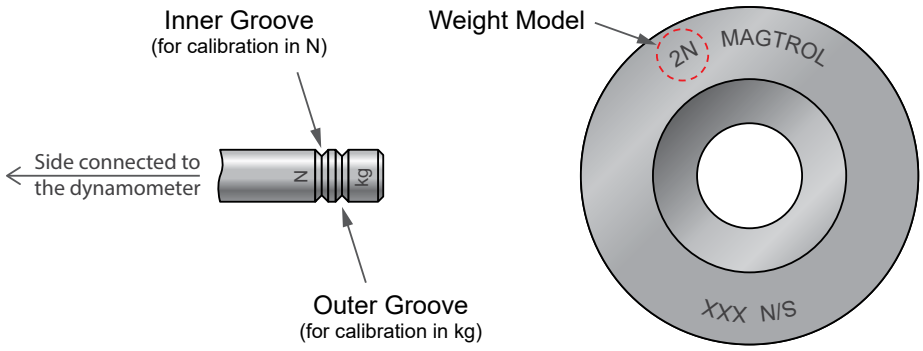


Fig.7-1 Identification of calibration components; calibration arm (left); weights (right)

NOTICE The reference weights provided by Magtrol are calibrated in Newtons. It is also possible to perform calibration using reference weights in kilograms. In this case, you will need to use the outer groove of the calibration arm (*see Fig.7-1*).

7.1.2 PREPARATION FOR CALIBRATION

1. Disconnect the dynamometer from all external elements.
2. Connect the WB 32 dynamometer to the DSP 70XX electronic device as for normal operation (*see section 5.2.1.1 or 5.2.1.2*).
3. Check that all relevant elements are properly grounded (*see section 5.1*).
4. Turn on the DSP 70XX Controller and wait 20 minutes before proceeding with calibration. This delay is necessary to allow all electronic components to stabilize completely.
5. Remove the two black caps on each side of the dynamometer (*see Fig.7-2*).
6. On each side, carefully insert the calibration arms into the opening and screw them in tightly (*see Fig.7-3*).

Fig.7-2 Remove the protective caps

Fig.7-3 Mount the calibration arms

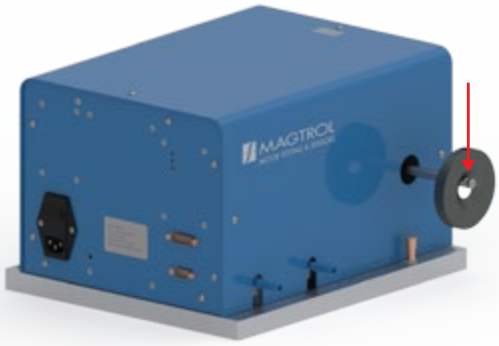


Fig.7-4 Place the calibration weight

7.1.3 CALIBRATION PROCESS WITH DSP 70XX

Calibration is performed by adjusting the three potentiometers on the back of the WB 32 Dynamometer (*see Fig.7-5*). You will need a small flat screwdriver (No. 1) to make the adjustment.

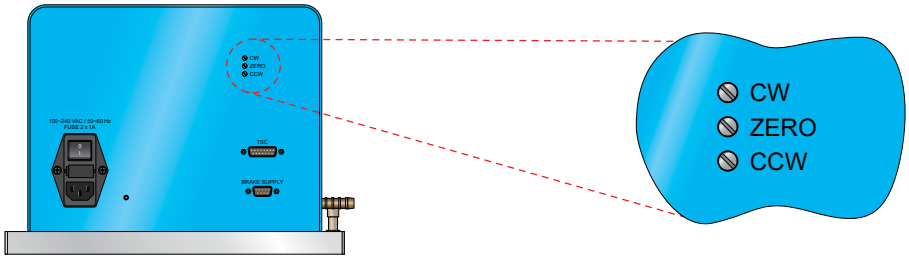


Fig.7-5 Calibration potentiometers located at the rear of the dynamometer

On your WB 32 dynamometer, identify the clockwise and counterclockwise sides (*see Fig.7-6*).

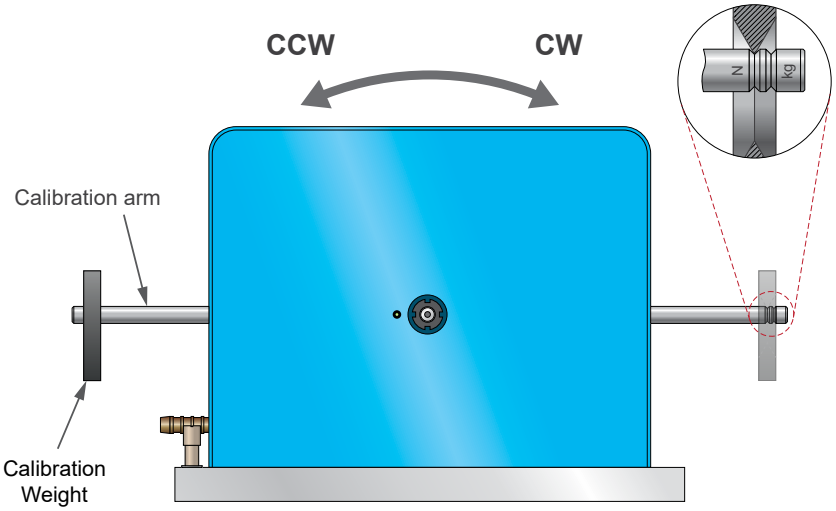


Fig.7-6 Identify the calibration direction

1. Using the flat screwdriver, adjust the ZERO potentiometer so that the torque displayed is equal to 0.00 $^{\pm 0.05}$ mN·m.
2. Use the weight corresponding to your dynamometer model (2 N for 1 WB 32 and 4 N for 2 WB 32).
3. Place the weight on the calibration arm located on the clockwise (CW) side.
4. Adjust the CW potentiometer until the torque display reads 400 $^{\pm 0.4}$ mN·m (1 WB 32) or 800 $^{\pm 0.8}$ mN·m (2 WB 32).
5. Move the weight to the calibration arm on the counterclockwise (CCW) side.
6. Adjust the CCW potentiometer until the torque display reads 400 $^{\pm 0.4}$ mN·m (1 WB 32) or 800 $^{\pm 0.8}$ mN·m (2 WB 32)
7. Remove the weight from the calibration arm
8. Dismantle the two calibration arms and replace the black cap

CAUTION After calibration, **do not forget to remove the calibration arms** from the dynamometer.

7.2 CALIBRATION OF OVERLOAD PROTECTION

Calibration of the overload protection for WB 32 Series Dynamometers is performed at the factory. However, it may be necessary to periodically check or confirm the protection of the measuring cell by following the procedures below.

This procedure requires an electronic device able of displaying torque measurements. Magtrol recommends using a DSP 70XX, which is the instrument used in this example.

CAUTION WHEN THE COVER IS OPEN AND THE DEVICE IS CONNECTED TO THE POWER SUPPLY, THERE IS A RISK OF ELECTRIC SHOCK.

DURING THIS PROCEDURE, PAY ATTENTION TO NOT TOUCH THE ELECTRICAL COMPONENTS (230 V AC) OR ANY ELECTRONIC PARTS, TO AVOID DAMAGING THEM BY CAUSING A SHORT CIRCUIT.

7.2.1 PREPARATION

1. Disconnect the dynamometer from all external elements.
2. Take off the top cover by removing the 6 screws (1) (*see section 2.2*).
3. Connect the WB 32 dynamometer to the DSP 70XX electronic device as for normal operation (*see section 5.2.1.1 or 5.2.1.2*).
4. Check that all relevant elements are properly grounded (*see section 5.1*).
5. Turn on the DSP 70XX Controller.
6. Mount the calibration arms and screw them in tightly(*see Fig.7-2 to Fig.7-3*).
7. Slightly unscrew the two nuts (2) while holding the screw (3) in position (*see Fig.7-7*).

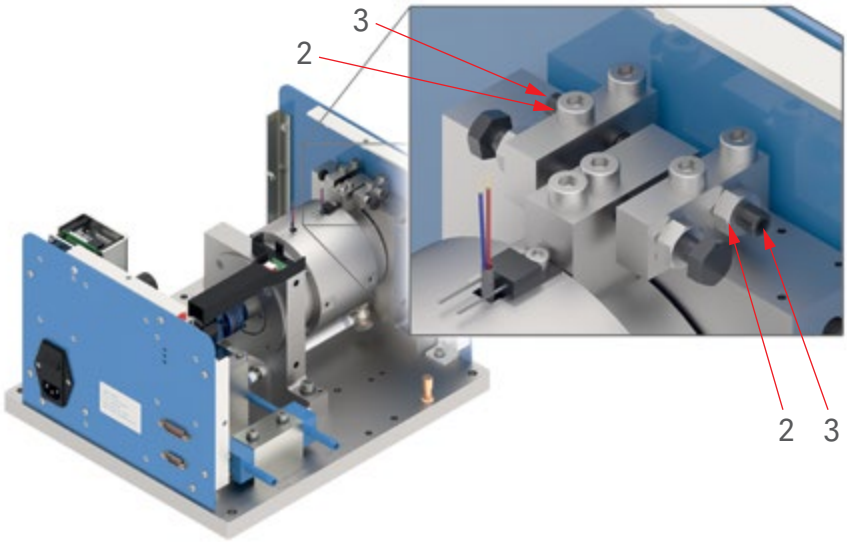


Fig.7-7 Unlocking procedure; release the dynamometer movement

7.2.2 PROCEED WITH OVERLOAD CALIBRATION

8. Identify the clockwise and counterclockwise sides (*see Fig.7.6*)
1. Place the 100 % weight on the calibration arm located on the clockwise (CW) side.
2. Adjust the screw (3) to decrease the torque slightly.
3. Place 200 % of weight on the same arm (CW).
4. Adjust the screw (3) so that the DSP display indicates 150% of the nominal torque.
5. Tighten the nut (2) to secure the adjustment.
6. Remove all the weight of the calibration arms.
7. Repeat the same process (step 1 ...6) for the counter clockwise (CCW) side.
8. Remove the calibration weight and arms. Replace the cover and its 6 fixing screws.

7.3 ADDITIONAL INFORMATION

7.3.1 FINAL INSPECTION

Magtrol performs a final inspection before delivery. A calibration sticker (*see Fig. 7.8*) certifies this inspection. A test report is supplied with the brake.

Fig.7-8 Calibration Sticker

7.3.2 CALIBRATION FREQUENCY

Magtrol reaction torque sensors are temperature compensated and of stable design. Frequent adjustment at the start of use is recommended. If excessive drift in the brake values is observed, contact Magtrol's technical service department. For more information, please read (chapter 8).

8. MAINTENANCE, REPAIR & CALIBRATION

8.1 MAINTENANCE

Like any rotating equipment, Magtrol Dynamometers require periodic maintenance. It is recommended that maintenance be performed every **2000 hours** of normal operation.

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

- When an unusual noise can be heard and it persists over time.
- The dynamometer can no longer reach its nominal torque.
- The water tubing is clogged causing a temperature rise
- The residual torque is out of specification

8.1.1 MECHANICAL MAINTENANCE

2000 hours of normal operation corresponds to the theoretical life of the bearings and the time after which Magtrol recommends an inspection or their replacement. (Bearings should be replaced as soon as they start showing signs of wear.) 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. To use the brake at full speed, it must first be warmed up.

CAUTION WHEN THE BEARINGS GENERATE NOISES, 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.

CAUTION THE USER MUST NOT ATTEMPT TO CHANGE OR REPAIR THE BEARINGS OR ANY OTHER COMPONENTS HIMSELF. FOR ALL MAINTENANCE OR REPAIR OPERATIONS, PLEASE RETURN THE DYNAMOMETER TO MAGTROL.

8.1.2 WATER COOLING SYSTEM

It is mostly important to ensure that there is sufficient coolant to guarantee adequate cooling.

The cooling circuit must be maintained regularly. With regard to the internal cooling circuit of the WB32 dynamometer, Magtrol recommends changing the fluid **every 24 months**. The maintenance intervals for the internal circuit of the WB32 dynamometer are independent of the maintenance cycle for the cooling system (refer to the cooling system documentation).

In the event of a prolonged shutdown, it is necessary to purge the cooling circuit (see). If you notice any problems with the cooling system (loss of flow, abnormal brake heating, etc.), refer to the section on cooling (see) or contact our after-sales service.

NOTICE If the coolant does not contain any additives (see), Magtrol recommends flushing the cooling circuit after each use.

8.1.3 WARRANTY

The user should not attempt to carry out revisions or repairs of any kind on the mechanical or electronic components making up the Dynamometer. if a problem is suspected, magtrol should be contacted so that arrangements can be made to perform any repairs in the factory.

Failure to comply may result in serious damage to the Dynamometer or may invalidate the warranty.

NOTICE **Some of the WB 32 Series Dynamometer parts are sealed**. If evidence indicates that these parts have been disassembled or that unauthorized modifications have been attempted, **the warranty will be invalidated.**

8.2 REPAIR

In case of a defect, please see chapter *see chapter SERVICES INFORMATION* of this manual. Whether you are directed to ship your equipment back to MAGTROL INC. in the United States or MAGTROL S.A. in Switzerland, it is very important to include the following information with your return shipment:

1. Model number, part number, serial number, order number and date of acquisition
2. Description of the defect and the conditions in which it appeared
3. Description of the test system (drawing, photographs, sketches, etc.)
4. Description of the tested device (drawing, photographs, sketches, etc.)
5. Description of the test cycle

CAUTION MAINTENANCE MUST BE PERFORMED BY MAGTROL IN ORDER TO GUARANTEE FUTURE MEASURING ACCURACY.

To allow MAGTROL to complete the operation in the best possible time, please follow the procedure below as well as the standard procedure for returing equipment to Magtrol *see chapter SERVICES INFORMATION*.

1. Do not dismantle the dynamometer (so that Magtrol can test it prior to performing maintenance).
2. Lock the dynamometer for transport (*see section 2.2 - Locking the Dynamometer for Transport*).
3. Carefully pack the dynamometer.

8.3 CALIBRATION INTERVAL

To ensure correct operation of the dynamometer and long-term measurement consistency, it is recommended to calibrate the dynamometer regularly. Magtrol strongly recommends at least **one calibration every 12 months**.

You can perform this operation yourself (*see chapter CALIBRATION PROCESS*) or return the dynamometer to Magtrol so that we can perform this operation for you, **in our ISO/IEC 17025:2017 accredited calibration laboratory**.

Returning the dynamometer directly to the Magtrol factory is both advantageous and economical. We can guarantee a dedicated calibration for the dynamometer performed by one of our specialists.

In addition, any wear and tear requiring maintenance will be immediately taken care of by our after-sales service team.

SERVICES INFORMATION

RETURNING MAGTROL EQUIPMENT FOR REPAIR AND/OR CALIBRATION

When returning equipment to MAGTROL INC. (United States) or MAGTROL S.A. (Switzerland) for repair and/or calibration, a completed **Return Material Authorization (RMA) form is required.**

Please consult the «Services/Return and Calibration» section on our web site www.magtrol.com, in order to choose the most appropriate recipient for your needs.

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 S.A. in Switzerland.

RETURNING EQUIPMENT TO MAGTROL INC. (UNITED STATES)

1. Visit the «Services/Return and Calibration» section of Magtrol's web site www.magtrol.com to initiate an RMA procedure. Complete the RMA form online and submit.
2. An RMA number will be issued to you via e-mail. Include this number on all return documentation.
3. Ship your equipment to: **MAGTROL, INC.**
   70 Gardenville Parkway
   Buffalo, NY 14224 | USA
   Attn: Repair Department
4. 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.
5. 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.

CONTACT FOR AFTER SALES SERVICE AT MAGTROL INC.

After Sales, Repair & Calibration Services

phone +1 716 668 5555 ext. 115
e-mail service@magtrol.com

RETURNING EQUIPMENT TO MAGTROL S.A. (SWITZERLAND)

1. Visit the «Services/Return and Calibration» section of Magtrol's web site www.magtrol.com to initiate an RMA procedure; complete the RMA form online and submit.
2. After your request has been reviewed, you will receive an email containing an RMA number and dedicated return instructions including specifics about shipping details. The RMA number will be a Magtrol SA internal repair order (SR-xxxx) reference.

   Any **shipment sent without an RMA risks delays and possible rejection,** so please wait until you receive the email with the details you will need to properly return your equipment.

   Any **equipment returned for credit must be approved** prior to return and is subject to a re-stocking fee.

CONTACT FOR AFTER SALES SERVICE AT MAGTROL S.A.

After Sales, Repair & Calibration Services

phone +41 26 407 30 00
e-mail repair@magtrol.ch

REVISIONS TO THIS MANUAL

The contents of this manual are subject to change without prior notice. The latest updated versions of our manuals are available and downloadable at any time on Magtrol's website www.magtrol.com in the « SUPPORT » section.

To ensure that you have the latest version, compare the issue date (on the back of this manual) with the last updated document available on our website.

The table of revisions below lists the significant updates that have been made.

REVISION DATES

DATE	EDITION	CHANGES	SECTION(S)
Dec. 2025	1st Edition - rev. A	Creation and first publication	All

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Subsidiaries & Sales Offices

Germany, France & India
Worldwide Network of Sales Agents

Calibration Laboratory

Torque Sensor & Dynamometer
ISO / IEC 17025:2017 Accredited
Swiss Accreditation Service (NIST equivalent)
Calibration according to Euramet cg14

From 100 mN·m ... 50 000 N·m
Best Measurement Uncertainty of 0.01 %

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