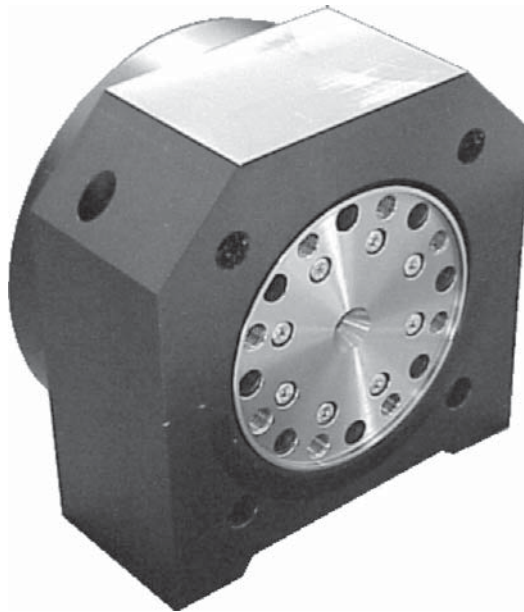


MAGTROL

Model TMF 401-403

Torque Flange Transducer



User's Manual

While every precaution has been exercised in the compilation of this document to ensure the accuracy of its contents, Magtrol, Inc. assumes no responsibility for errors or omissions. Additionally, no liability is assumed for any damages that may result from the use of the information contained within this publication.

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Safety Precautions



OPERATOR'S DUE CARE OBLIGATIONS

The TMF 400 Series The Torque Measuring Flange was designed and built under consideration of a hazard analysis and upon careful selection of the harmonized standards as well as of other technical specifications to be adhered to. Thus, the system meets the state-of-the-art requirements and guarantees the highest safety standards. But such safety can in practice be reached only, if all the necessary measures will have been taken. It is the machine operator's obligation of due care, to plan such measures and to control their execution.

Above all, the operator must assure, that:

- The system is used in accordance with the provisions as intended only (*see Section 1.1*)
- The system is operated under perfect and well-functioning conditions and that specifically the safety equipment is checked regularly for its functional integrity
- The required personal protective equipment for the operation, maintenance, and repair personnel is available and is in fact being used
- The Operating Manual is always in a readable condition, and completely available at the service location of the measuring equipment. In addition to the Operating Manual, further operating instructions must be made available regarding occupational legislation and legal provisions on the use of technical work aids.
- Sufficiently qualified and authorized personnel only is executing the operation, service and repair of the machine
- Such personnel is trained regularly regarding all applicable questions of occupational safety and environ-mental protection, and that such personnel is aware of the provisions of the Operating Manual, specifically the safety instructions included
- All safety and warning instructions attached on the machine must not be removed and shall remain in a readable condition

SYSTEM MODIFICATIONS

For reasons of safety, no unauthorized modifications must be conducted on the measuring equipment. Any intended modifications, mechanical or electrical must be authorized in writing by the corresponding department of Magtrol. The given warranty expires before its regular term, if the ordering party or any third party conducts unauthorized modifications or repairs on the delivered systems, without the prior written approval from Magtrol.

Please use original spare parts only, because they were specifically designed for this system.



SPECIAL TYPES OF HAZARDS

If the system is operated without shaft protection device and with the top cover in the open position, there will be the hazard of particles being thrown out after having fallen inside, or of such particles being jammed between stator and rotor. The consequences resulting thereof may, in extreme cases, lead to a destruction of the shaft system or to considerable personal injuries.

Revisions To This Manual

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

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

REVISION DATE

First Edition – August 2003

TABLE OF REVISIONS

First Edition – no revisions made to date.

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Preface

PURPOSE OF THIS MANUAL

This manual contains all the information required for the setup TMF 400 Series Torque Flange Transducers. To achieve maximum capability and ensure proper use of the transducers, 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 User's Manual was compiled for those individuals concerned with the planning, assembly and the taking into service of torque measurement equipment and systems with torque measuring shafts.

General knowledge of mechanical and electrical engineering is required as a prerequisite for the installation and the operation of the system. The torque measurement system should be operated by those individuals only, who have been trained, instructed, and authorized on the system. Such personnel must be familiar with the User's Manual and must be acting accordingly. The individual authorizations of the operating personnel must be clearly defined.

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 - Describes the composition and functions of the TMF 400 Series Torque Flange Transducers and contains the technical data sheet which provides the mechanical and electrical characteristics.

- Chapter 2: INSTALLATION/CONFIGURATION - Provides information needed for setup of the TMF Transducers including mounting options, electrical connections and step-by-step instructions for mechanical installation.

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! 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 PUT AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT, BEFORE PROCEEDING FURTHER.

1. Introduction

1.1 INTENDED USE

The TMF 400 Series Torque Measuring Flange has been intended exclusively for the measurement of the mechanical performance parameters torque and speed. Any use in an explosive hazard environment is not permitted.

Due to the high accuracy of measurement of the system, a multiple installation on one drive shaft system is possible, e.g. for efficiency measurements. The telemetric transmission procedure has been designed in such a way, that there is no mutual interference when systems are placed in a close arrangement next to each other.

Since the system has been set up without bearings, the specified distances between rotor and stator must be maintained under all operating conditions.

For the utilization of the full measuring accuracy it must be observed, that the acting radial forces and torsional vibrations will not exceed the permissible load limit values.

1.2 COMPOSITION

The TMF 400 Series Torque Measuring Flange represents a torque measuring system which can be used in multiple applications and in many different ways, based on its connecting flanges on both sides. Since this measuring system is equipped with a contactless functioning telemetric system and without roller bearings, it is completely maintenance-free, and therefore specifically suited for permanent-operation applications. The extremely high overload capacity, despite its high measurement accuracy of typically 0.1% of the scale end value, will enable this system to be used as a clutch element even under critical operating conditions. The new series, which includes four different sizes is covering a measuring range from 50 to 6,000 Nm.

One functional unit is composed of the measuring flange itself (rotor), one housing with upper and lower stator part, one main cable and one signal box.

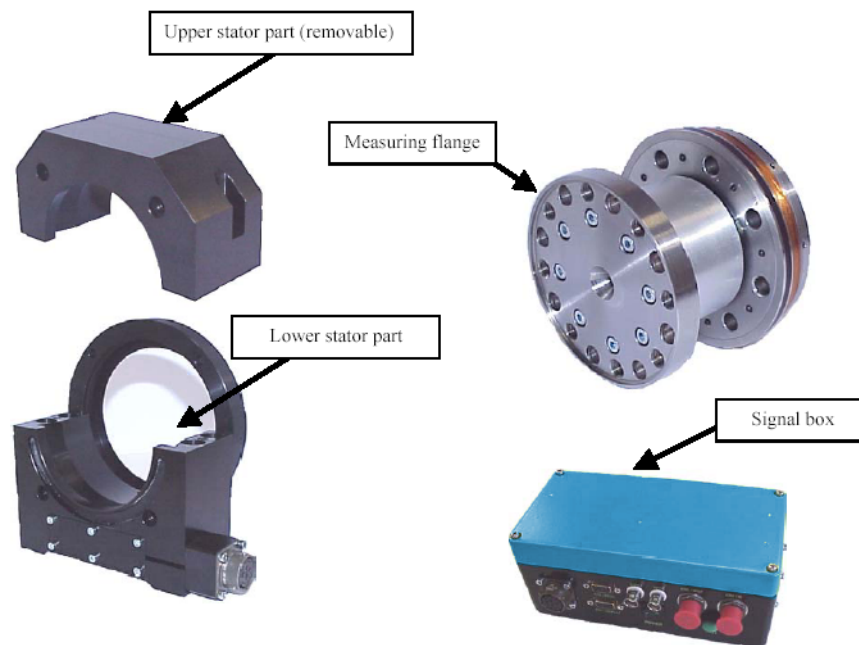


Figure 1-1 Torque Measuring System Configuration

1.3 FUNCTIONAL DESCRIPTION

Each TM 400 Series torque transducer registers the elongation of the shaft body generated by the acting torque by means of strain gauges and transmits these signals to the stator side in the form of frequency-modulated infrared light. An optional second infrared data link can be utilized for the transmission of a second, considerably smaller torque measuring range. A shifting of the zero signal that can be possibly caused by temperature effects will be suppressed on site as much as possible by a μ -controlled compensation circuit.

A standard-type integrated speed registration system will, at the same time, provide a high-resolution speed signal featuring two 90°-displacement speed tracks. Upon utilization of the magneto-resistive effect, stable square-wave, speed-proportional signals are available beginning with zero speed.

The relevant measuring units can be tapped off the signal box in an analog form or as frequency signals.

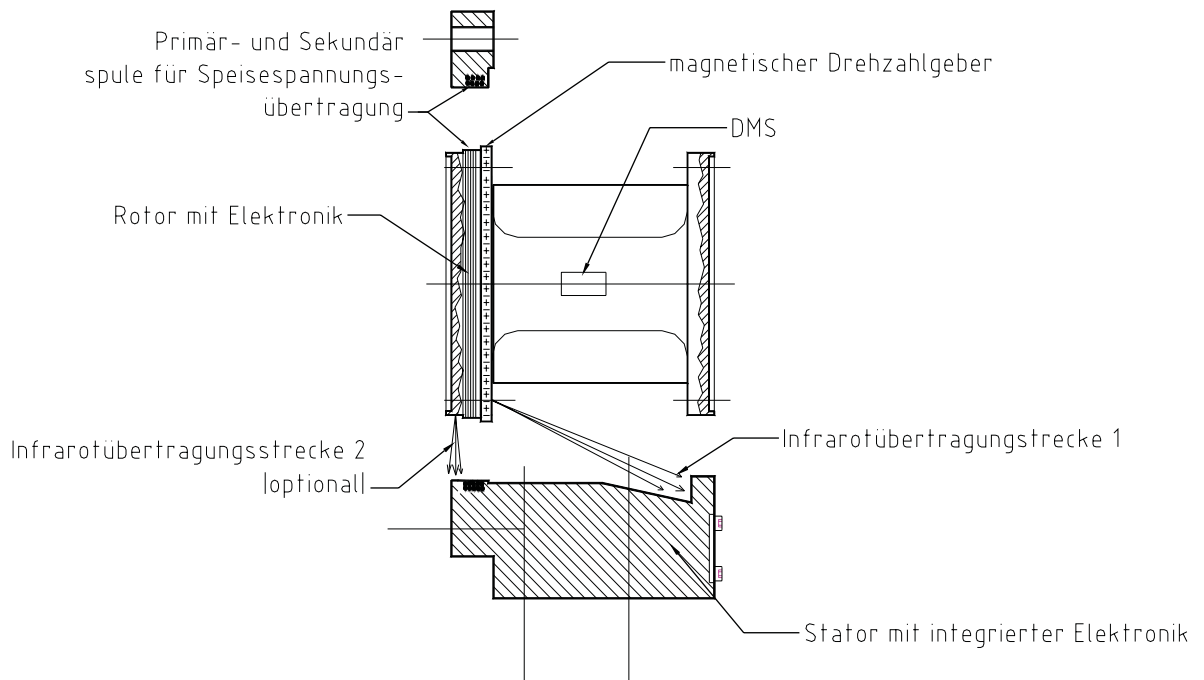


Figure 1-2 Composition of Measuring Flange

1.3.1 TEMPERATURE COMPENSATION

Since the torque transducer itself and the first subsequent steps of electronic processing are functioning on an analog basis, a temperature-dependent shifting of the operating points cannot be excluded. The shaft material elongation due to temperature effects will become noticeable at the output side of the measuring system as an undesired measuring value in the form of a temperature-dependent zero point drifting, although the strain gauges have been arranged in a so-called Wheatstone bridge connection.

An active switching compensation circuit has been established in order to assure stable operating characteristics of the torque transducer over a wide temperature range. With the support of a μ -Controller integrated at the rotating side, temperature data which was determined in an expensive way during the manufacture of the system is picked up and stored in a so-called Lock-Up Table. If during operation of the integrated temperature sensor a change in temperature is determined, then the value which had been stored from the Table in advance will be added to the momentarily available measuring value.

This system has the major advantage that even non-linear temperature characteristics can be compensated. Furthermore, the values determined by means available at Magtrol can be edited at any time. The functional diagram shown below presents an overview of the basic structure of the circuit.

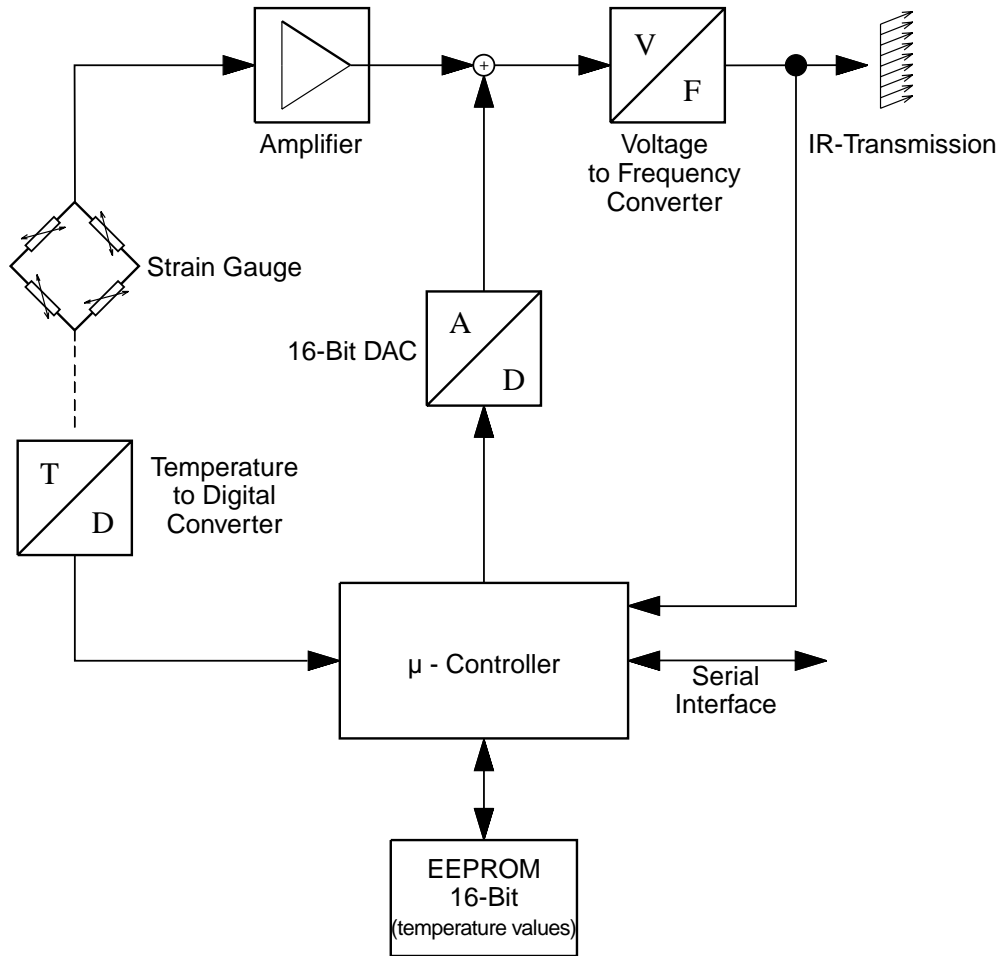


Figure 1-3 Basic Structure of Temperature Compensation

1.3.2 OPTIONAL MEASURING RANGE

The entire system was designed in such a way, that the optional second measuring amplifier and a second infrared transmission data link can be integrated together with the manufacture of the transducer.

This second amplifier is able to increase the signals originating from the joint measuring bridge circuit in such a way, that a second high-resolution measuring range can be used for the registration of much smaller torque values. Thus, the often necessary exchange of the torque transducer for the precise measurement of smaller torque values can be deleted. This partial measuring circuit is equipped with the temperature compensation described above and with the SHUNT calibration (see Figure 1–3).



Note: It must be observed, when utilizing the full accuracy of measurement of the smaller measuring range, that the shaft assembly should be stopped and released from the load, after having conducted a measuring cycle with a high torque load. Then, the zero push button must be pressed, unless otherwise the hysteresis values “stored” before in the spring body would, by principle, superimpose itself on the second, more sensitive measuring channel.

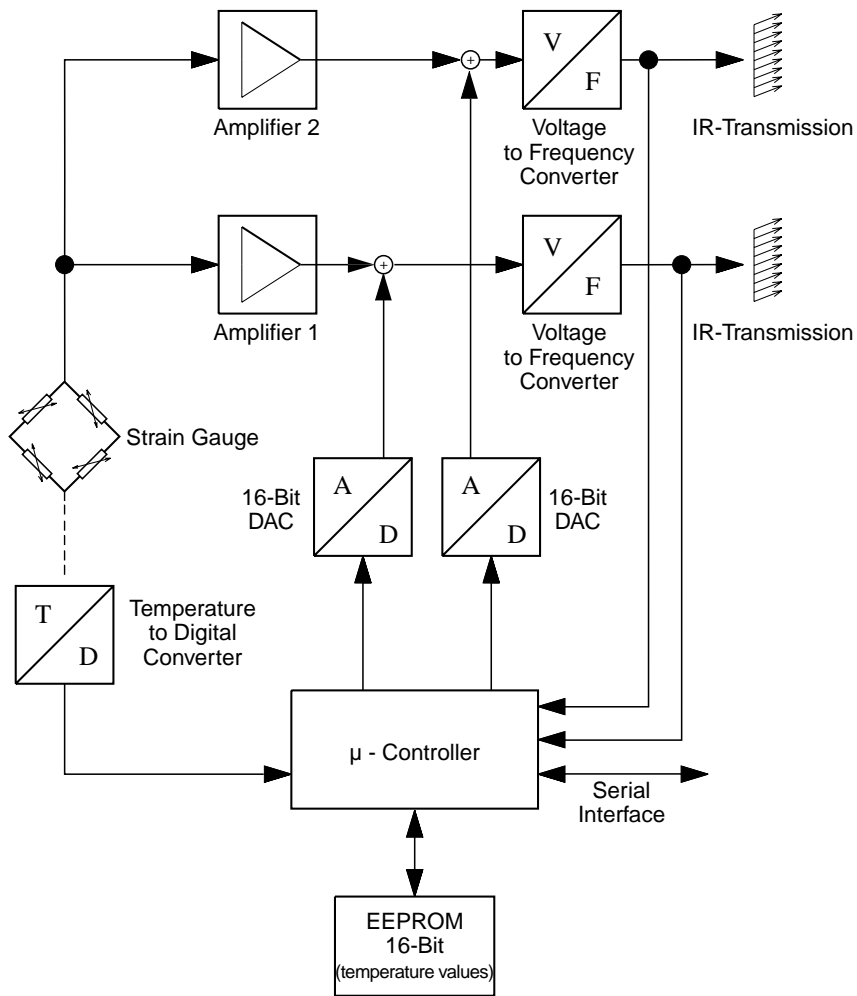


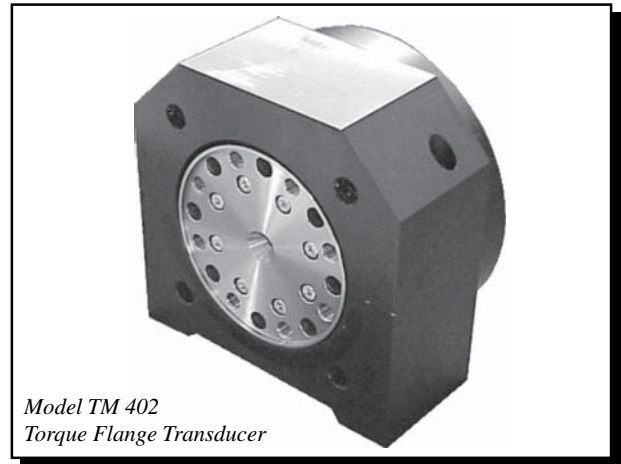
Figure 1–4 Basic Structure of the Second Torque Measuring Range

1.4 DATA SHEET

TMF 401 – TMF 403 Torque Flange Transducers

FEATURES

- Flat, Bearingless Torque Transducer with Infrared Signal Transmission
- Torque Range: 50 N·m to 4200 N·m (36 lb-ft to 3097 lb-ft)
- Accuracy: 0.1% (0.05% on request)
- Overload Capacity: 150%
- Stator Mounting on Test Bench or Housing
- Active Microprocessor-controlled Temperature Zero Point Compensation
- EMC Susceptibility Conforms to European Standards
- Integrated Detection of Speed and Sense of Rotation (as an option)
- Optional Second Measuring Scale



DESCRIPTION

With its three available sizes, the flat TMF Torque Transducer covers a wide torque range between 50 and 4200 N·m. The mechanical installation of the system can be carried out either by attaching the transducer onto the baseplate of the test bench (stand mounting), or by fixing it directly on to the housing of the driving or driven machine. BSD-MODUFLEX® Model 920 torsion-proof couplings can also be fitted on each side of the transducer for torque transmission.

Two magnetic strips providing a signal with a 90° offset and an incremental magnetic transducer are used to determine the rotating speed by generating up to 150 pulses per revolution. It is possible to double, and to even quadruple, the number

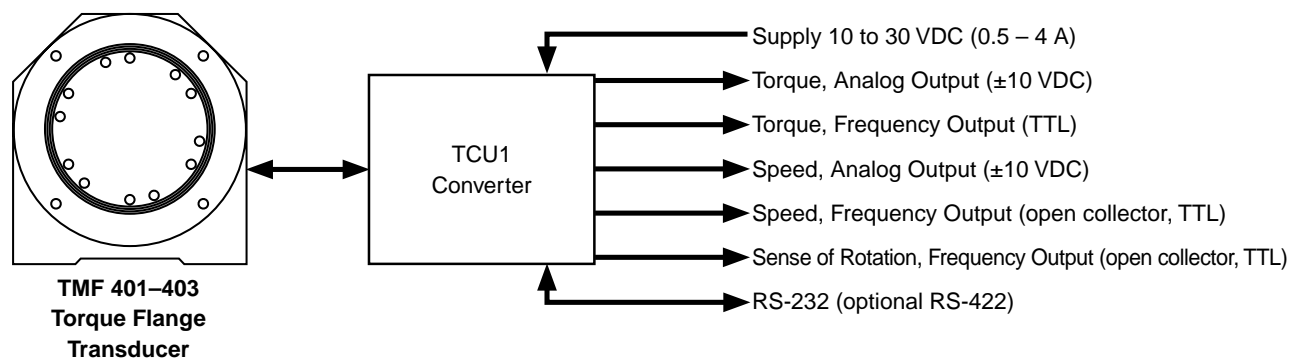
of pulses. The TCU1, a separate measuring signal converter (included), is placed in immediate proximity to the torque transducer and provides all important signals, either as pulses or as analog voltages.

APPLICATIONS

TMF Torque Flange Transducers provide dynamic torque and speed measurement of:

- Automotive engines and transmissions
- Propellers - aerospace, marine and helicopter
- Reduction gears and gearboxes

SYSTEM CONFIGURATION



f Specifications

TMF 401–403

OPERATING PRINCIPLE

The signal processing unit is integrated in an aluminum housing generating frequency and analog voltage output signals. The sense of rotation (option) is indicated by a logical signal.

While being manufactured, the flat torque transducer is brought to its specified maximum working temperature. A microprocessor which is integrated in the transducer flange measures the offset caused by temperature variations and

automatically stores the corresponding correction values in a configuration table.

The optional second measuring scale is achieved by means of a second, independent electronic-amplifying circuit transmitting the measuring signal. Both amplifiers use the same strain gauge measuring bridge but utilize different amplification factors. The active temperature compensation guarantees an excellent zero point stability of the second measuring scale.

RATINGS	TMF 401	TMF 402	TMF 403
TORQUE MEASUREMENT			
Nominal Rated Torque (RT1)*	450 N·m	1100 N·m	2800 N·m
Maximum Dynamic Torque Peak Value (Overload Capacity)	150% of RT		
Optional 2nd Measuring Scale (RT2)**	10% min. to 140% max. of RT		
Maximum Dynamic Torque Without Damage (Overload Limit)***	>500% of RT		
Combined Error of Linearity and Hysteresis	< ±0.1% of FSD (0.05% on request)		
Temperature Influence on the Zero Point	< ±0.1% of FSD/10 K		
Nominal Temperature Range	+10°C to +70°C		
SPEED MEASUREMENT			
Nominal Rotating Speed (n_{max}) - Higher speeds available upon request.	12,000 rpm	10,000 rpm	8,000 rpm
Pulses Per Revolution (standard)	90	120	150
Output Signal (RS-422 Option, Open Collector, TTL)	2 signals with a 90° offset		
Minimum Rotating Speed Guaranteeing a Sufficient Pulse Quality	> 0 rpm		
ENVIRONMENT			
Storage Temperature Range	-23°C to +80°C		
Operating Temperature Range	-10°C to +70°C		
Mechanical Shock	according to IEC 68.2.27/Class D3		
Vibration	according to IEC 68.2.6/Class D3		
Protection Class	IP 44		
MECHANICAL CHARACTERISTICS			
Torsional Stiffness	400 kN·m/rad 295,000 lb·ft/rad	880 kN·m/rad 649,000 lb·ft/rad	2300 kN·m/rad 1,696,000 lb·ft/rad
Moment of Inertia	1.3 g·m ² 0.957 lb·ft·s ²	9.7 g·m ² 7.150 lb·ft·s ²	33.6 g·m ² 24.760 lb·ft·s ²
Weight of Rotor	1.5 kg / 3.3 lb	5 kg / 11 lb	11 kg / 24 lb
Balancing Quality	G2.5 according to ISO 1940		
INPUT AND OUTPUT SIGNALS			
Power Supply (max. voltage / current)	10 to 30 VDC / 0.5 to 4 A		
Torque Frequency Response (RS-422 Option, TTL)	60 ±20 kHz		
Analog Torque Output Signal	±10 V / 0 to 5 V / 0 to 10 V DC		
Dynamics of the Frequency Response	> 1.5 kHz		
Dynamics of the Analog Output	800 readings/second		
Filter Cutoff Frequency (adjustable)	2, 20, 50, 100, 200, 400, 1000 Hz		
Rotating Speed Frequency Response (RS-422 Option, Open Collector, TTL)	0 to 20 kHz		
Analog Rotating Speed Output Signal****	±10 VDC		
Dynamics of the Rotating Speed Output Signal	800 readings/second		
Sense of Rotation Signal (optional)	Open Collector, TTL (high / low)		
Serial Interface (RS-232)	9600 Baud		

* Different calibration of RT1 available on request (max 1.4 × RT nominal).

** Upon request, with a longer delivery time.

*** Without taking into account the torque which can be transmitted by the assembly.

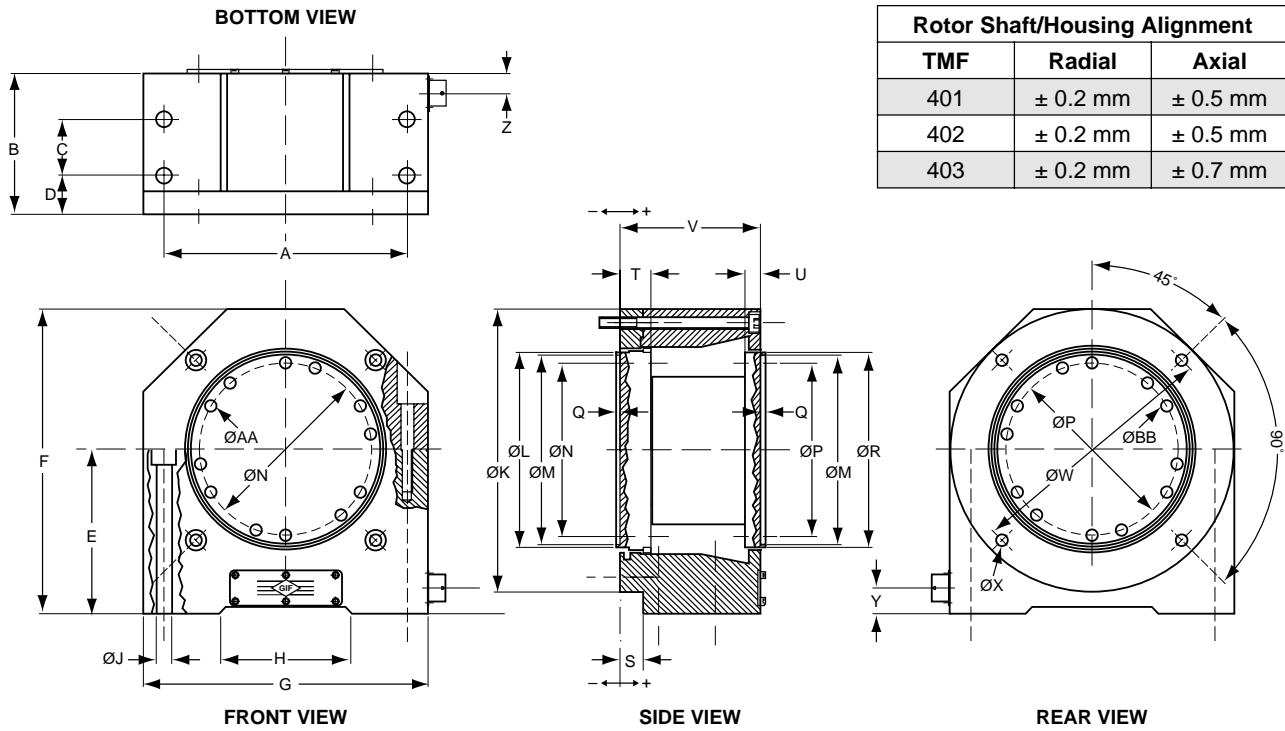
**** Not available with optional 2nd measuring range RT.

Specifications

TMF 401–403

GENERAL INFORMATION

DIMENSIONS



TMF	Radial	Axial
401	± 0.2 mm	± 0.5 mm
402	± 0.2 mm	± 0.5 mm
403	± 0.2 mm	± 0.7 mm

NOTE:

Original dimensions are in Metric units. Dimensions converted to English units have been rounded up to 2 or 3 decimal places.

MODEL	Units	A	B	C	D	E	F	G	H	J	K	L	M	N
TMF 401	mm	121	74	23	27	90	160	140	94	Ø 9	Ø 140h6	Ø 92	Ø 88H6	Ø 77
	in	4.76	2.91	0.91	1.06	3.54	6.30	5.51	3.70	Ø 0.35	Ø 5.5118/ 5.5108	Ø 3.62	Ø 3.4654/ 3.4646	Ø 3.03
TMF 402	mm	178	103	41	26.5	120	224	208	97	Ø 11	Ø 208h6	Ø 143	Ø 139H6	Ø 127
	in	7.01	4.06	1.61	1.04	4.72	8.82	8.19	3.82	Ø 0.43	Ø 8.1890/ 8.1878	Ø 5.63	Ø 5.4734/ 5.4724	Ø 5.00
TMF 403	mm	226	122	65	35	135	260	250	115	Ø 11	Ø 250h6	Ø 180	Ø 170H6	Ø 154
	in	8.90	4.80	2.56	1.38	5.31	10.24	9.84	4.53	Ø 0.43	Ø 9.8425/ 9.8414	Ø 7.09	Ø 6.6939/ 6.6929	Ø 6.18

MODEL	Units	P	Q	R	S	T	U	V	W	X	Y	Z	AA*	BB*
TMF 401	mm	Ø 77	2	Ø 91.5	17	22.5	10	74	Ø 126	Ø 6.6	19	14.5	(8) Ø 8.5	(8) Ø 8.5 and (8) Ø M8
	in	Ø 3.03	0.08	Ø 3.602	0.67	0.89	0.39	2.91	Ø 4.96	Ø 0.26	0.75	0.571	(8) 0.33	(8) 0.33
TMF 402	mm	Ø 127	3	Ø 142.9	16.5	22.5	12	103	Ø 187	Ø 9	19	14.5	(12) Ø 9	(12) Ø 9
	in	Ø 5.00	0.12	Ø 5.626	0.65	0.89	0.47	4.06	Ø 7.36	Ø 0.35	0.75	0.571	(12) 0.35	(12) 0.35
TMF 403	mm	Ø 154	3	Ø 173.5	19	26	14	122	Ø 226	Ø 11	22	14.5	(16) Ø 11	(16) Ø 11
	in	Ø 6.18	0.12	Ø 6.83	0.75	1.02	0.55	4.80	Ø 8.90	Ø 0.43	0.87	0.571	(16) 0.43	(16) 0.43

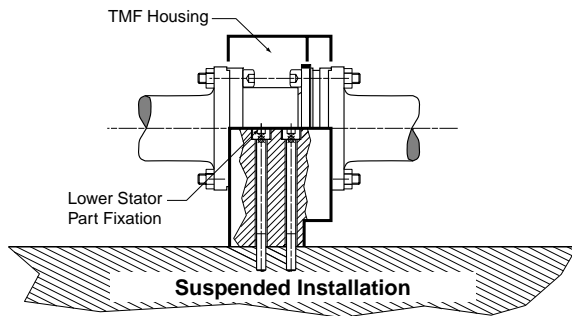
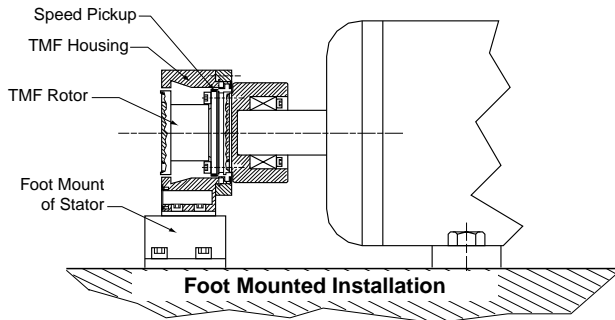
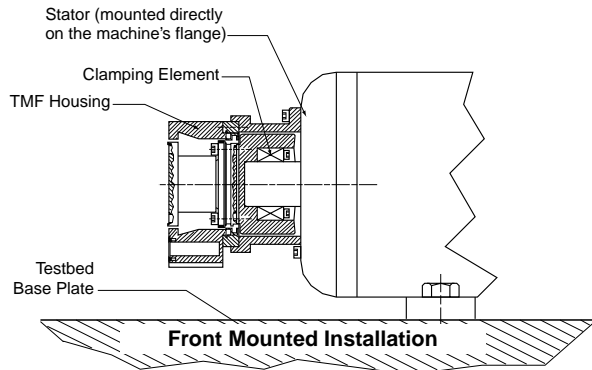
* Number in parenthesis denotes number of mounting holes.

Mounting & Accessories

TMF 401-403

GENERAL INFORMATION

MOUNTING EXAMPLES

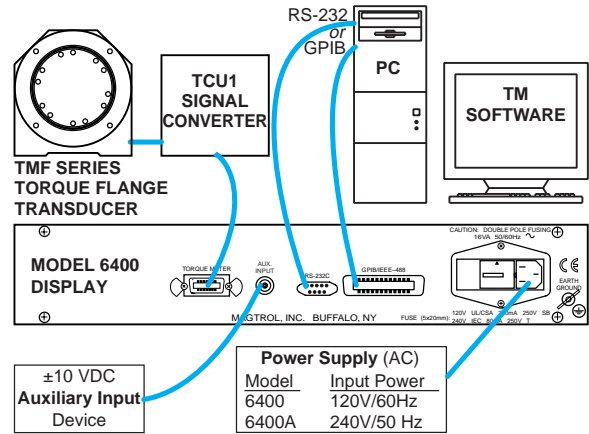


Couplings

When Magtrol TMF Series Torque Flange Transducers are to be mounted in a drive train, the rotor is directly mounted on the output flange on one side and a double-element coupling must be used on the other side. The TMF Torque Flange is designed to directly fit Rexnord's Model 920 BSD-MODUFLEX® coupling series.

Due to the continual development of our products, we reserve the right to modify specifications without forewarning.

SYSTEM OPTIONS



PC-Based System Configuration

Torque Flange Transducer with 6400 Display and TM Software

Model 6400 Display

Magtrol's Model 6400 Torque Transducer Display is designed specifically for use with all TMF, TM, TMHS and TMB Torque Transducers. This easy-to-use device powers the transducer and utilizes high speed Digital Signal Processing (DSP) to display torque, speed, mechanical power (watts or horsepower) and direction of rotation. The 6400 comes with numerous standard features, including: English, Metric and SI settings; tare function; analog input and RS-232/IEEE-488 interfaces. The 6400 can be used as a basic display, as an interface with Magtrol TM Software or on the production line using its pass/fail feature.

TM Software

Magtrol's TM Software is an easy-to-use Windows® executable program, used to automatically collect torque, speed and mechanical power data. The data can be printed, displayed graphically or quickly saved as a Microsoft® Excel spreadsheet. Standard features of Magtrol's TM Software include: peak torque capture, direction of rotation, multi-axes graphing, measured parameter vs. time, adjustable sampling rates and polynomial curve fitting.

DESCRIPTION	MODEL
Torque Transducer Display, 120 volts	6400
Torque Transducer Display, 240 volts	6400A
TM Torque Transducer Software	SW-TM-WE
TM Torque Transducer Software with Source Codes	SW-TM-WS
Torque Transducer Connector Cable, 5 m	ER 113/011
Torque Transducer Connector Cable, 10 m	ER 113/021
Torque Transducer Connector Cable, 20 m	ER 113/031

2. Installation/Configuration

2.1 INSTALLATION SAFETY



WARNING! THE FOLLOWING ITEMS MUST STRICTLY BE OBSERVED IN ORDER TO AVOID SYSTEM DAMAGE OR PERSONAL INJURIES DURING THE INSTALLATION OF THE MEASURING SYSTEM.

- Any installation work must be conducted by qualified personnel only and under consideration of all safety instructions.
- Before beginning with installation work, measuring equipment must be checked for transport damage.
- The attachment bolts for the flange connections and the stator attachment must be selected for their strength and length in accordance with requirements.
- The stator attachment must be executed in such a way that no major relative movements can occur between rotor and stator during operation.
- The distances indicated on the Data Sheet (*Section 1.4*) must be observed, specifically during operation with installed speed recording device.
- Please secure components against loosening, if subjected to vibration loads.
- Please observe the specified torque values.
- The design of the entire shaft system must be conducted in such a way that no detrimental torsional or bending vibrations can occur at any of the operating points.
- Please read the section entitled “Safety Precautions”, found at the beginning of this manual.



Note: It must be observed that the torque measuring flange should, above all, be considered a precision measuring instrument, and not so much as a component for torque transfer. The clutch selection and the quality of the mechanical alignment have a major effect on the accuracy of measurement and the service life of the transducer and the clutches used.

2.1 MECHANICAL INSTALLATION OF MEASURING FLANGE AND STATOR

The following possibilities are available for connecting the torque transducer with the shaft system:

2.1.1 SUSPENDED INSTALLATION

The measuring flange is mounted to the shaft system without any additional bearing element. The stator is bolted to the test bench plate either directly or through a suitable interim element. Possible alignment or angular deviations must be compensated within the drive system by suitable clutch elements.



CAUTION: THIS TYPE OF STATOR ATTACHMENT GENERALLY INCLUDES THE RISK THAT DURING HIGH VIBRATION LOADS, RELATIVE MOVEMENTS OF AN IMPERMISSIBLY HIGH LEVEL MAY OCCUR.

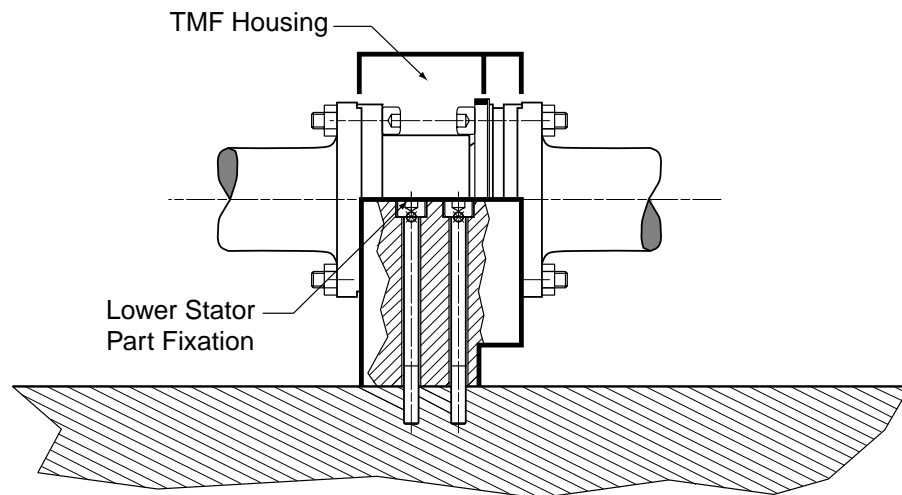


Figure 2–1 Suspended Installation

2.1.2 FRONT-MOUNTING OF STATOR AND FLANGE CLOSE TO A BEARING

The measuring flange is directly coupled with an input or output flange of a power drive or a power take-off machine. The housing must be centered at the face of the bearing plate of the machine and bolted to it.

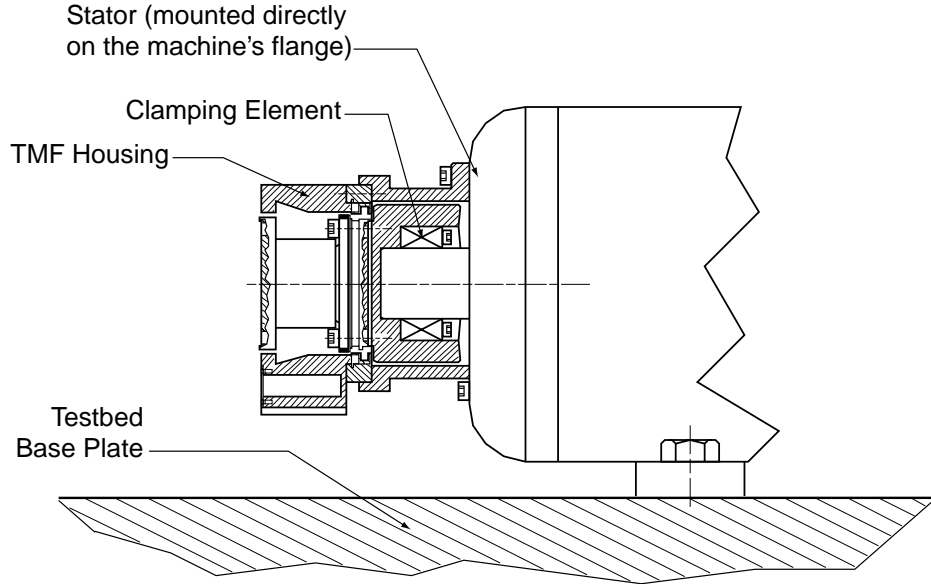


Figure 2-2 Front Mounted Installation

2.1.3 BASE-MOUNTED STATOR DIRECTLY AT THE MACHINE POWER TAKE-OFF

Alternatively, the stator can be centered through the test bench plate with the measuring flange.



CAUTION: AGAIN, THIS INCLUDES THE RISK OF POSSIBLE RELATIVE MOVEMENTS DURING OPERATION BETWEEN ROTOR AND STATOR.

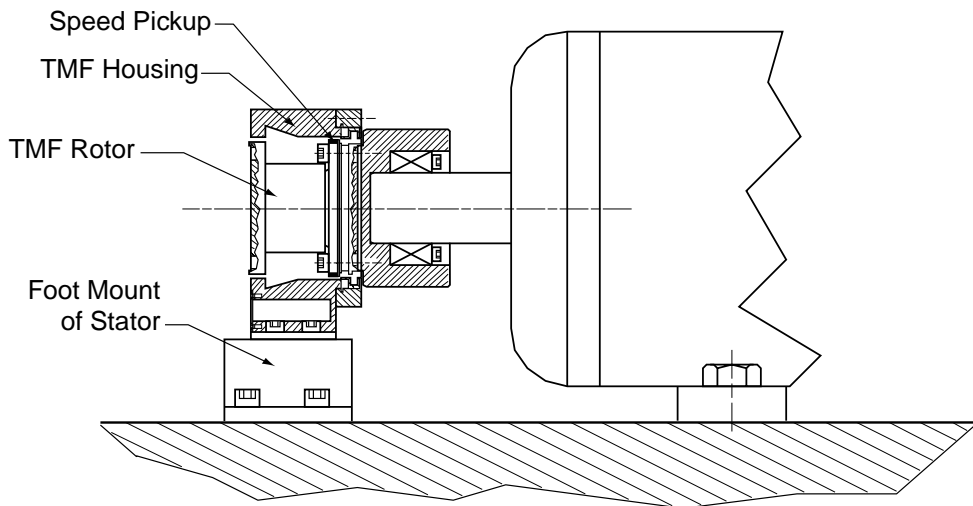


Figure 2-3 Base (or Foot) Mounted Installation

SETUP

In all cases, the power drive, or the power take-off too, can be implemented through an existing standard clutch element featuring torsional vibration resistance according to the figure below.



Figure 2–4 Torsion-resistant Shaft Clutch Element, Type 920



Note: This torsion-resistant clutch element equipped with a medium lamellar package is suited for the compensation of axial and angular deviations, when connecting two shaft ends with each other. If a radial shaft deviation must in addition be compensated too, then the installation of a second lamellar clutch will be required.

The following shaft clutch elements are available as standard equipment:

Torsion-Resistant Shaft Clutch, Type 920				
Size	4.5	11	28	64
Nominal Torque [Nm]	450	1100	2800	6400
Maximum Torque [Nm]	800	2000	5000	12500

Since the accuracy of measurement is not affected by a roller bearing between rotor and stator, it does not matter onto which side of the measuring flange the test specimen will be coupled.



Note: The positive direction of the torque has been defined by the factory in such a way that a moment which rotates clockwise when looking at the measuring flange will lead to a positive output signal, either in the form of a frequency increase or of a positive voltage signal.

2.2 TMF WITH SIGNAL BOX

The torque transducer can be operated only together with a signal-processing electronic system (in the form of a signal box) along with the corresponding connecting cables.

Since the torque as well as the speed signals are available as frequency signals, and at the same time as analog voltages that are freely programmable over a wide range, no further requirements are specified for the user electronic system. This can be freely selected depending on the existing tasks. In view of uninterrupted signal processing, it has been recommended to select the type of continued signal transfer so that the transfer path must not be affected by interruptions.

The actual measuring values can be read through an additional display module, that was designed for switchboard installation, and a system parametrization can be conducted.

2.3 MECHANICAL INSTALLATION STEP BY STEP

1. Remove top cover of housing.

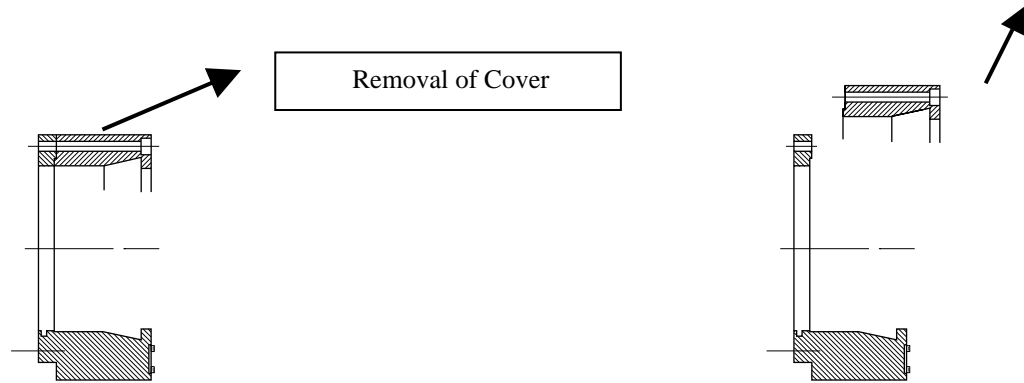


Figure 2-5 Removal of Cover

2. Bolt lower housing part with stator ring to flange plate by using the two lower bolts.

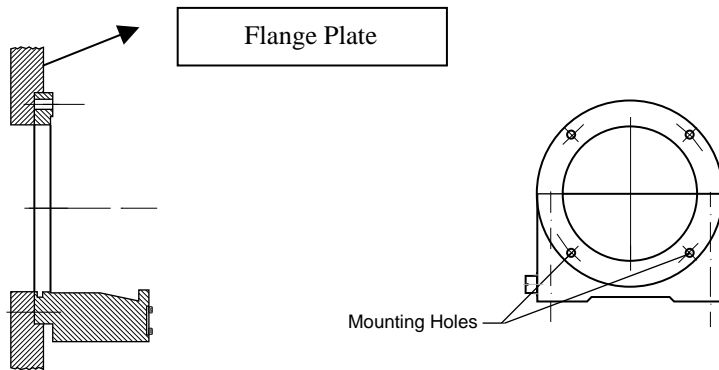


Figure 2-6 Flange Plate

3. Carefully insert measuring shaft, center to connecting shaft, and tighten bolts. Tighten all bolts with identical torque.



CAUTION: WHEN PLACING THE SHAFT ON A HARD SURFACE, IT MUST ABSOLUTELY BE OBSERVED THAT THE PROJECTING SPEED RING IS NOT DAMAGED.

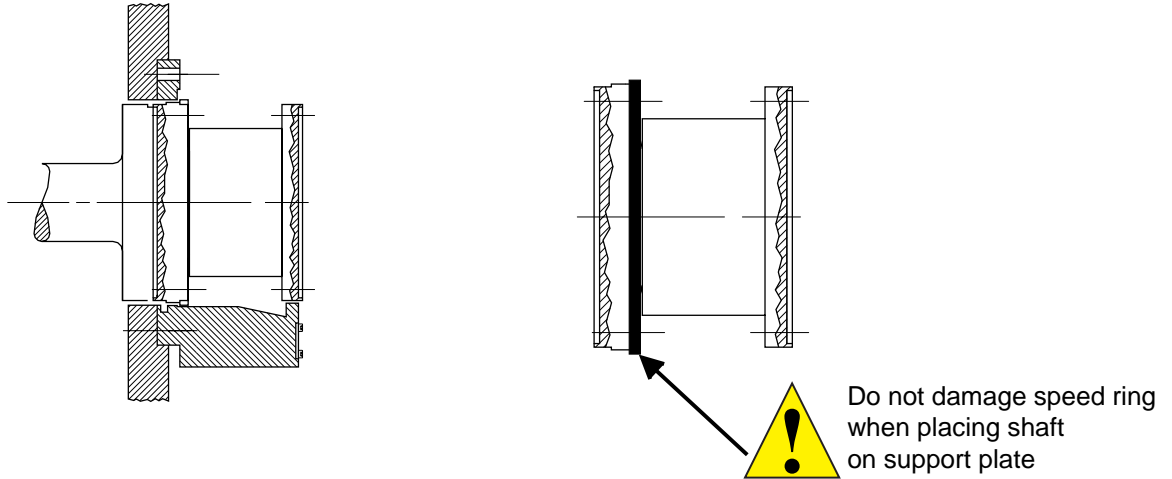


Figure 2–7 Insertion of Measuring Shaft

4. Rotate measuring shaft by hand and determine if unobstructed rotation is possible and if there is no contact with the stator housing.
5. Connect main cable between measuring flange and signal box. Further observe perfect ground connection of stator housing with common. Otherwise use separate cable.
6. Complete other electric connections according to the Operating Manual pertaining to the signal box.

2.3.1 INSTALLTION DIMENSIONS

Please refer to the Data Sheet in *Section 1.4* for dimensions and rotor shaft/housing alignment.

2.4 ELECTRIC CONNECTIONS

The electric connections of the individual components with each other are conducted by using the main cable. This cable can be used for connecting a signal box. The maximum length of the main cable of 50 m should not be exceeded.

The voltage supply of the entire system depends on the order specifications, and may basically be 230 VAC, 115 VAC or 12 – 35 VDC also. For the main voltage supply, the value indicated on the signal box applies exclusively.



CAUTION: PROBLEM-FREE OPERATION CAN BE ASSURED ONLY IF THE STATOR HOUSING, INCLUDING THE INTEGRATED RECEIVING ELECTRONIC UNIT, HAS A PERFECT GROUND CONNECTION. NORMALLY, THIS IS AUTOMATICALLY DONE BY BOLTING THE HOUSING TO THE METAL PARTS OF THE ENTIRE STRUCTURE. IF THE ABOVE CANNOT BE GUARANTEED, THEN A SEPARATE LOW-RESISTANCE CONNECTION SHOULD THEREAFTER BE INSTALLED TO A COMMON.

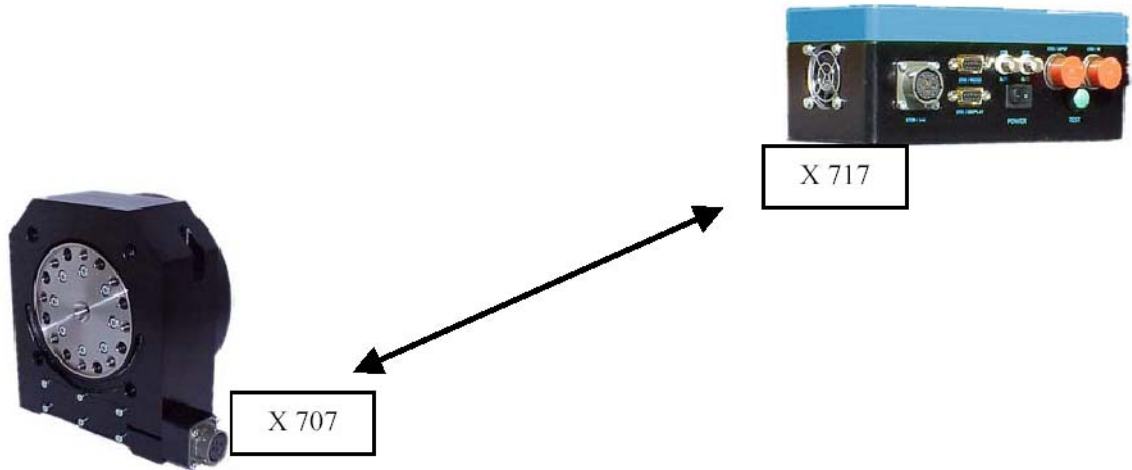


Figure 2–8 Connecting TMF Measuring Flange with Signal Box

SETUP

3. Signal Box



Figure 3-1 TCU1-SB1 Signal Box

3.1 INTRODUCTION

The following paragraphs of this manual describe all steps required of the taking into service and the installation of a Magtrol TCU1-SB1 Signal Box.

Each torque flange transducer from Magtrol can be operated with the TCU1-SB1.

The TCU1 has a power supply output for the TMF transducer and makes a condition of the received signals for the analog outputs and the display.

3.1.1 FEATURES

- Power supply output 0–48 V_{SS} ; 10–50 kHz
- Input 2 × Torque (RS422) and 2 × Speed (RS422)
- 2 × analog Output for Torque / Speed, selectable ±10 V, ±5 V, 0–10 V
- Serial I/O (RS232) with terminal function
- I/O for Touch-Screen Display
- Zero switch
- Diagnostic plug with all signals (TTL-Outputs)

3.2 INSTALLATION

3.2.1 COMPONENT CONTROL

The following components are required for the fully operational setup of a measuring system:

- TMF Torque Flange Transducer
- TCU1–SB1
- Adapter cable for the serial I/O or the display
- External power supply 10–30 VDC (electric connector ...)
- This manual

3.2.2 COMPONENT CONNECTION

The housing must be grounded with the test bench base by a low resistance connection. At the back wall of the housing is a M3 thread. A pole shoe can be installed here.

1. Connect the TCU1 with the TMF transducer via a central cable (12-pin).
2. Connect the power supply of the TCU1 with an external power supply unit.
3. For configuration, connect the Output X722 with the serial I/O of your PC using the cable that was shipped with the signal box.
4. If all parts are connected you can switch on the unit.

3.3 CONFIGURATION

Before delivery, each Magtrol instrument is carefully checked for its technical functions. The technical specifications must be adhered to, in order to successfully comply with the requirements of this check. The instrument should be in perfect condition when received, and this condition should then be checked again.

In the event the instrument is not in proper condition, please compile a damage status report together with the forwarding agent. Also, please compare the information on the delivery note with the actually delivered units.

3.3.1 EXTERNAL POWER SUPPLY

The Magtrol TCU1-SB1 Signal Box has been designed for the connection to a DC voltage power supply with an output voltage in the range of 10–30 VDC. The current input is 0.5–4 A, depending on the torque flange transducer model which is connected.

3.3.2 GROUNDING



WARNING! THE HOUSING AND THE INTERNAL SIGNAL COMMON OF THE TCU1 ARE CONNECTED TOGETHER. THE SHIELDING OF THE INPUT AND OUTPUT LINES MUST BE CONNECTED TO THE HOUSING OF THE CONNECTORS AT THE TCU1 SIDE. BY FASTENING THE TCU1 TO THE TEST BENCH, THE SHIELDING IS CONNECTED WITH THE TEST BENCH GROUND.

3.3.3 ACCIDENT PREVENTION

The use of this instrument requires that the generally applicable accident prevention regulations are adhered to.

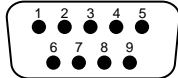
3.3.4 PIN ASSIGNMENT

X730 12-pole MIL N1 Speed1 RS422 N2 Speed2 RS422 Md Torque RS422	A	Input EI+
	B	Input EI-
	C	Input N1+
	D	Input N1-
	E	Input N2+
	F	Input N2-
	G	Input Md+
	H	Input Md-
	J	Output SpSp
	K	Output 15V
	L	Ground
	M	Ground
	X705 4-pole MIL Output N1 Speed1 analog Output ±10V max. 800 readings/s MD1 Torque analog Output ±10V max. 800 readings/s	A
B		N1
C		N.C.
D		Ground
X704* 6-pole MIL Output N1OC Speed1 x Imp. / Umdr. open Collector NDOC speed direction open Collector MD1 Torque analog Output ±10V max. 800 readings/s	A	INPUT 24V
	B	MD1
	C	NDOC
	D	Ground
	E	N.C.
	F	N1OC

* For connection to 6400 Display Unit.

3 pole power supply:

1. VCC (9–30 VDC)
2. GND
3. ON/OFF (0 / 9–30 VDC) switches the torque flange transducer power supply on/off

X736 15-pole Sub-D male Service	1	N1 TTL
	2	ND TTL
	3	EI TTL
	4	N.C.
	5	N.C.
	6	N.C.
	7	CANL
	8	Ground
	9	N2 TTL
	10	MD TTL
	11	Ground
	12	N.C.
	13	N.C.
	14	N.C.
	15	CANH
X737 15-pole Sub-D male Service	1	N1 TTL
	2	ND TTL
	3	EI TTL
	4	Md+ RS422
	5	N1+ RS422
	6	N2+ RS422
	7	EI+ RS422
	8	Ground
	9	N2 TTL
	10	MD TTL
	11	Ground
	12	Md- RS422
	13	N1- RS422
	14	N2- RS422
	15	EI- RS422
X722 9 pole Sub-D female  RS232 Serial Com. Port	1	N.C.
	2	TxD
	3	RxD
	4	N.C.
	5	SIGNAL GROUND
	6	N.C.
	7	N.C.
	8	N.C.
	9	N.C.
X708 BNC	Torque1 analog output ± 10V max. 800 readings/s 8 cut-off frequencies	
X722 BNC	Speed1 analog output ± 10V max readings/s 8 cut-off frequencies	
X731	Display con.	
9 pole Sub-D		

SETUP

3.3.5 CONNECTING THE RS422 I/O (OPTIONAL)

The following wiring diagram is an example how to connect the RS422 output signals.

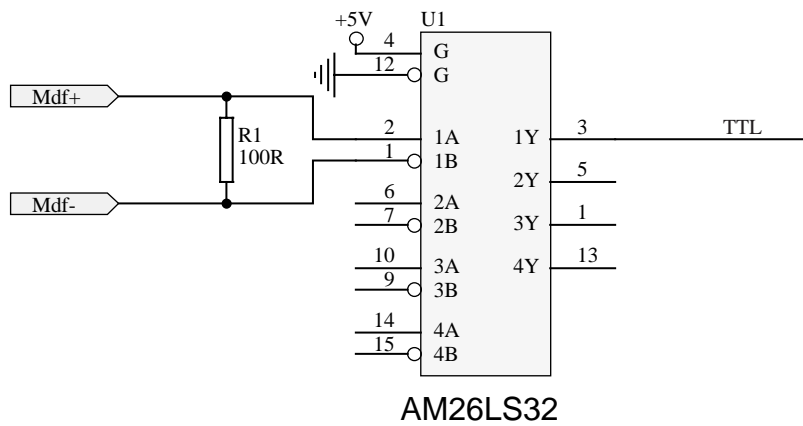


Figure 3–2 RS422 Output Signal Connection

3.3.6 CONNECTING THE TCU1 WITH A PC

The TCU1 Signal Box can be connected to the serial I/O (RS232) of a PC via a 1:1 serial cable. The parameters of the serial I/O must be set to 9600 Baud, 8 data bits, 1 stop bit, no protocol and no parity.

SETUP

3.4 SETTINGS

After all components are connected, the unit can be started up. If the entire measuring system (TMF and TCU1) is ordered together, all settings are done by Magtrol. If only a TCU1 was ordered, or a TMF transducer, the system must be adapted.

3.4.1 OPERATING PRINCIPLE

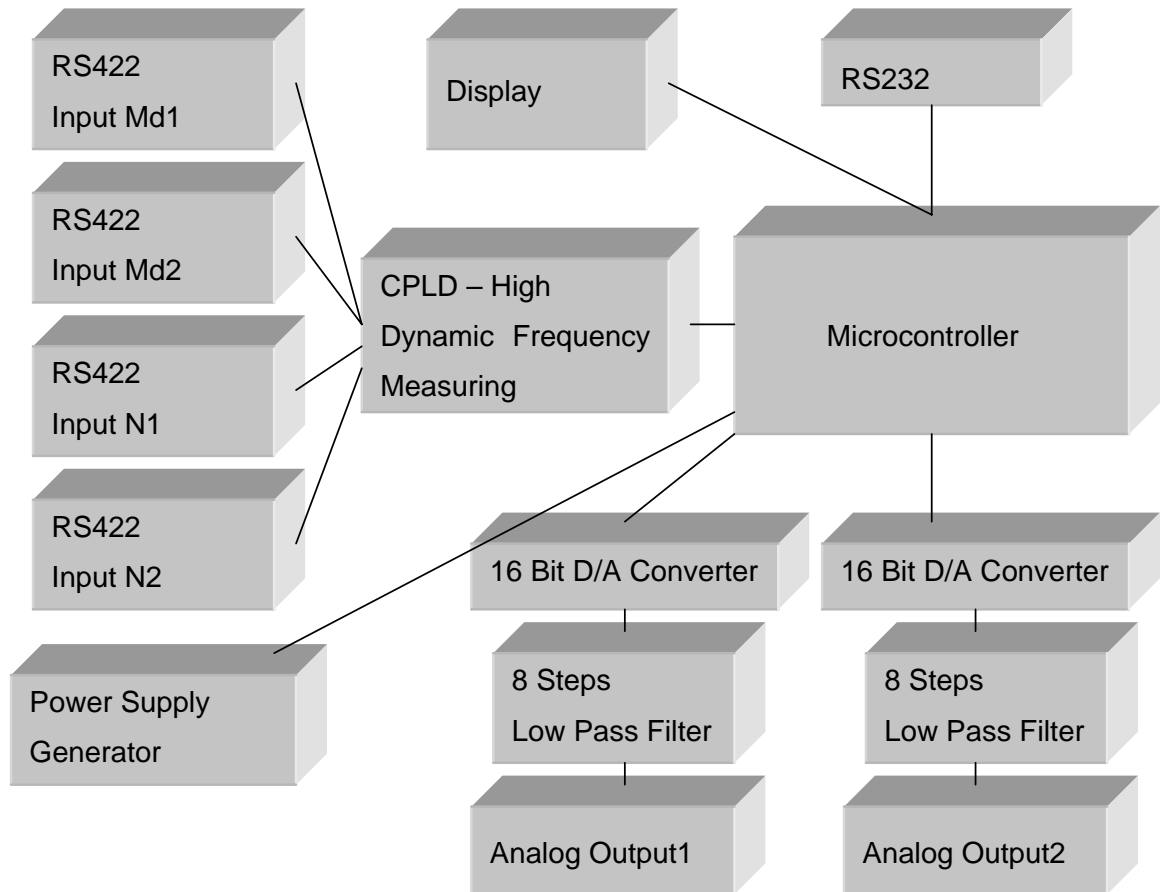


Figure 3–3 Operation Flowchart

The TCU1-SB1 Signal Box generates a voltage in order to supply power to the connected torque flange transducer. The voltage amplitude can be up to 60 V (peak to peak), with a frequency from 10– 40 kHz.

Four RS422 interfaces serve to receive the signals from the sensing element. The microcontroller converts the received signals into analog outputs by using CPLDs and 16-Bit D/A converters. The microcontroller calculates the physical quantity, such as torque and speed, out of the received frequencies. These values can be shown in the terminal program or on the display.

Each signal box works together with each TMF torque flange transducer. For that, several characteristic data must be input via a terminal program or the touch screen display.

Magtrol Limited Warranty

Magtrol, Inc. warrants its products to be free from defects in material and workmanship under normal use and service for a period of one (1) year from the date of shipment. Software is warranted to operate in accordance with its programmed instructions on appropriate Magtrol instruments. This warranty extends only to the original purchaser and shall not apply to fuses, computer media, or any other product which, in Magtrol's sole opinion, has been subject to misuse, alteration, abuse or abnormal conditions of operation or shipping.

Magtrol's obligation under this warranty is limited to repair or replacement of a product which is returned to the factory within the warranty period and is determined, upon examination by Magtrol, to be defective. If Magtrol determines that the defect or malfunction has been caused by misuse, alteration, abuse or abnormal conditions of operation or shipping, Magtrol will repair the product and bill the purchaser for the reasonable cost of repair. If the product is not covered by this warranty, Magtrol will, if requested by purchaser, submit an estimate of the repair costs before work is started.

To obtain repair service under this warranty, purchaser must forward the product (transportation prepaid) and a description of the malfunction to the factory. The instrument shall be repaired at the factory and returned to purchaser, transportation prepaid. **MAGTROL ASSUMES NO RISK FOR IN-TRANSIT DAMAGE.**

THE FOREGOING WARRANTY IS PURCHASER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, OR FITNESS FOR ANY PARTICULAR PURPOSE OR USE. MAGTROL SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR LOSS WHETHER IN CONTRACT, TORT, OR OTHERWISE.

CLAIMS

Immediately upon arrival, purchaser shall check the packing container against the enclosed packing list and shall, within thirty (30) days of arrival, give Magtrol notice of shortages or any nonconformity with the terms of the order. If purchaser fails to give notice, the delivery shall be deemed to conform with the terms of the order.

The purchaser assumes all risk of loss or damage to products upon delivery by Magtrol to the carrier. If a product is damaged in transit, **PURCHASER MUST FILE ALL CLAIMS FOR DAMAGE WITH THE CARRIER** to obtain compensation. Upon request by purchaser, Magtrol will submit an estimate of the cost to repair shipment damage.



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www.magtrol.com

MAGTROL INC

70 Gardenville Parkway
Buffalo, New York 14224 USA
Phone: +1 716 668 5555
Fax: +1 716 668 8705
E-mail: magtrol@magtrol.com

MAGTROL SA

Route de Moncor 4B
1701 Fribourg, Switzerland
Phone: +41 (0)26 407 3000
Fax: +41 (0)26 407 3001
E-mail: magtrol@magtrol.ch

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