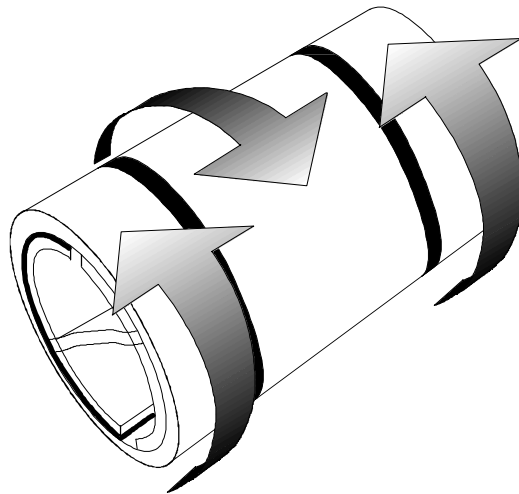


# TORQUE SPEED MEASURING SYSTEM



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The Speed-Torque-Measurement System has been designed especially for measurements in the field of high precision instruments and allows to determine very small torques. The flexural pivots are the core of the torque transducers and replace the measuring shafts of traditional transducers. The angular displacement caused by the effecting torque is taken up by differential transformers.

Together with an incremental Measuring System for rotary speed motor test set ups can be combined which allow most exact measurement of torques at highest rotary speed

A data interface facilitates the valuation of high numbers of tests.

## System Components:

### 1. Transducers

#### Speed Probes

The noncontact speed scanning of rotating objects is possible with photoelectric and magnetic inductive speed probes within a range of  $10 \text{ min}^{-1}$  up to

Field of application:

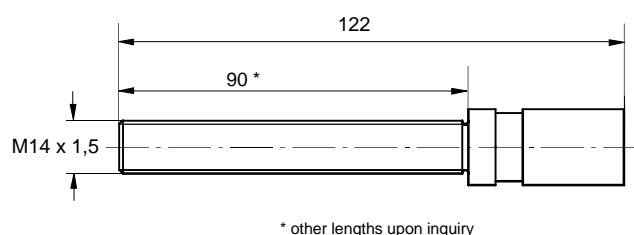
- Product examination
- Random tests of goods received
- Control in series production

Examples of specimen

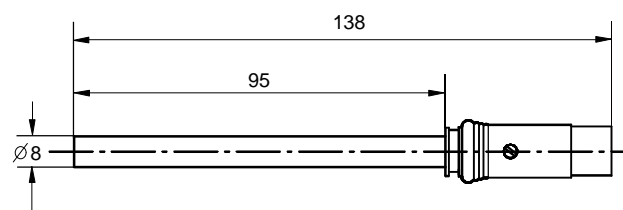
- Electric motors
- Magnetic clutches, friction clutches
- Ball bearings, slide bearings, brakes and gear trains
- Rotary switches, potentiometers, variable capacitors
- Helical and torsion springs, viscosimeters
- Fuel injection pumps, rotary magnets, small turbines
- contact sensors

$999.999 \text{ min}^{-1}$ . The speed probes are robust and resistant to soiling, oil and grease.

Magnetic Inductiv Speed Probe A 5S 01 E



Photoelectric Speed Probe A 1S 30 P



#### Torque Transducers

Five Torque Transducer types are available to cover the total measuring range of 0.1 - 10.000 Ncm. The torque to be measured rotates the rotor of the torque transducer against the restoring force of the rotor's flexural pivot. The angular displacement of max.  $\pm 2^\circ$  proportional to the torque is sensed by an inductive pickoff and displayed by the meter.

Due to the rigid design of the torque transducer, the housing (stator) of small electric motors may be fixed directly to the shaft of the transducer. Thus, the transducer measures the reaction torque acting upon the stator of the motor. This results in a very simple test setup which allows unlimited high rotary speed of the unloaded motor shaft but also load simulations on the easily accessible shaft.

Transducer type		DG 1-1	DG 1-2	DG 1-3	DG 1-4	DG 1-6
Max torque-	Nm	0,001	0,01	0,10	1	100
Max. axial load	N	8	60	150	500	1.000
Max. radial load	N	1	10	70	200	500
Max. hysteresis	% of selected range	$\pm 0,15$	$\pm 0,15$	$\pm 0,15$	$\pm 0,15$	$\pm 0,20$
Accuracy	% of selected range	$\pm 1$	$\pm 1$	$\pm 1$	$\pm 1$	$\pm 1$
Max. zero shift by radial load	mNm/N	0,035	0,035	0,035	0,9	1
Moment of inertia	mNms <sup>2</sup>	$12 \cdot 10^{-5}$	$15 \cdot 10^{-5}$	$90 \cdot 10^{-5}$	$1,3 \cdot 10^{-2}$	1
Spring rate	Nm/rad	$3,4 \cdot 10^{-2}$	0,34	2,9	34	3500
Weight	kg	0,2	0,2	0,2	3	4
Factor M		1	10	100	1.000	100.000

Table 1: Technical Data of Speed-Torque Meters

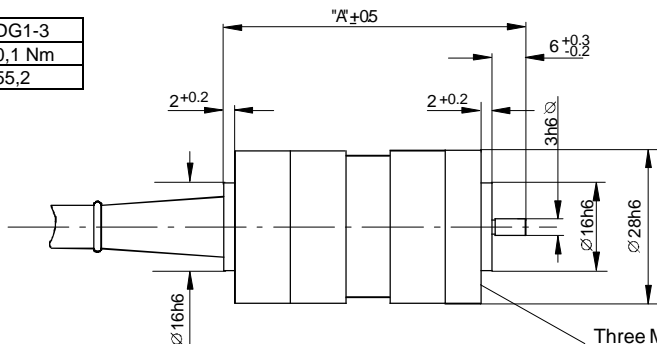
# Torque Transducers



Characteristics, common to all transducers:

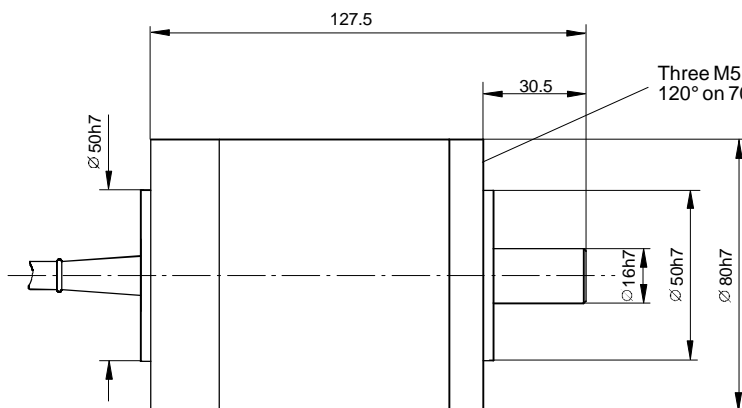
- Flexural pivots protected against overload by mechanical stops
- Cable length 5 feet approx.
- Mounting of transducer at its outer diameter or at its face by three thread holes equally spaced at 120°
- All transducers can be mounted to the measuring stand M 2 and P 2 (DG 1-1 to DG 1-3 with adapter plate)  
Transducers DG 1-1 to DG 1-3 can additionally be mounted to the small measuring stand M2 and P2

	DG 1-1	DG 1-2	DG1-3
Measuring Range	1 mNm	10 mNm	0,1 Nm
Dimension "A"	52,5	52,5	55,2



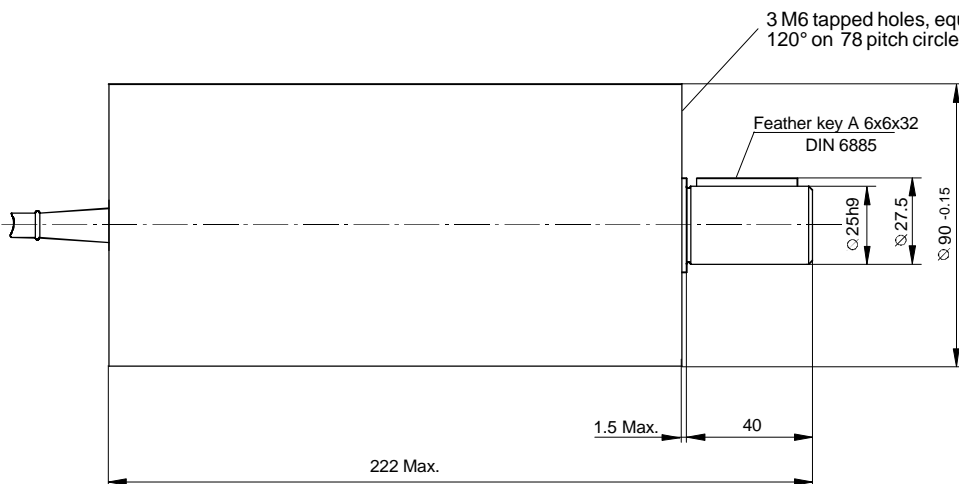
Three M3 tapped holes, equally spaced at 120° on 23,6 pitch circle diameter

	DG 1-4
Measuring range	1 Nm



Three M5 tapped holes, equally spaced at 120° on 70 pitch circle diameter

Type	DG 1-6
Measuring range	100 Nm



3 M6 tapped holes, equally spaced at 120° on 78 pitch circle diameter

Feather key A 6x6x32  
DIN 6885

## Display Units

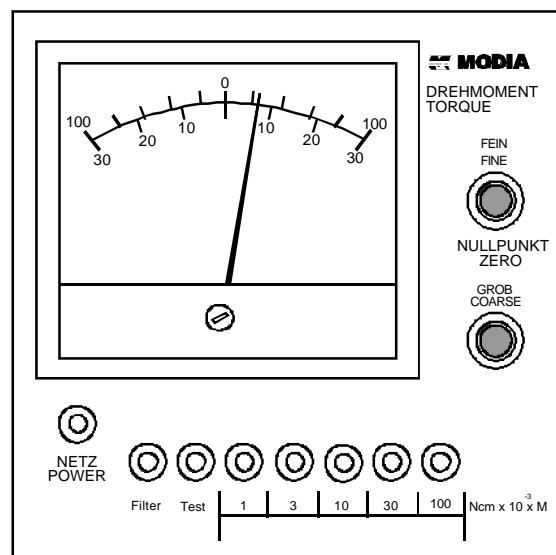
### Base Modules

The base modules (M321.10 to 323.03) can be delivered for use in 19"-inch racks or in different combinations as table mounting systems (M621.10 to M621.6)

#### Base Module MM for Torque Measurement

##### Analog

- Analogue display
- Analogue output  $\pm 1$  V
- Zero point with rough and fine adjustment (with the analogue device zero in the centre of the display)
- Selection of the measuring range between 1,3,10,30,100% of the transducer range (1 mNm - 100 Nm)
- switchable filter with a boundary frequency of  $f_b = 10$  Hz
- For use with Teldix/Modia torque transducers DG1-1/2/3/4 and /6
- All connections at the backside of the device
- As table mounting system or for use in 19 inch rack
- Accuracy of the display device: 1% of the end value of each measur.range.

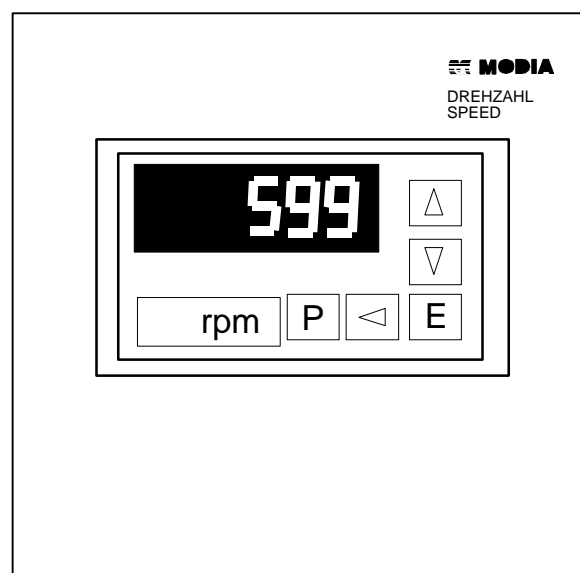


**M 321.10**

#### Base Module MS for Speed Measurement

##### Digital

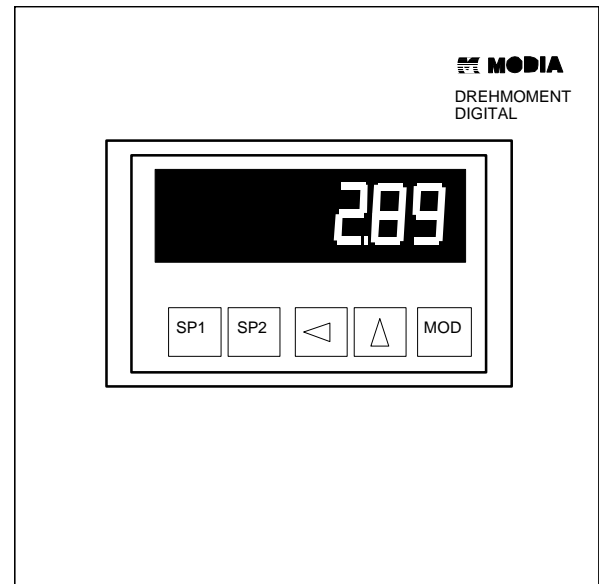
- Display with 5 positions
- Measuring range  $100 \text{ min}^{-1}$  to  $999.999 \text{ min}^{-1}$
- Analogue output + 1 V; with adaptable range
- Single pulse output TTL
- Programmable measuring range
- Programmable number of pulses per revolution
- For use with Photoelectric Speed Probe A1S30P and others



**M323.02/C124**

## Module DM 3 for Torque Measurement Digital

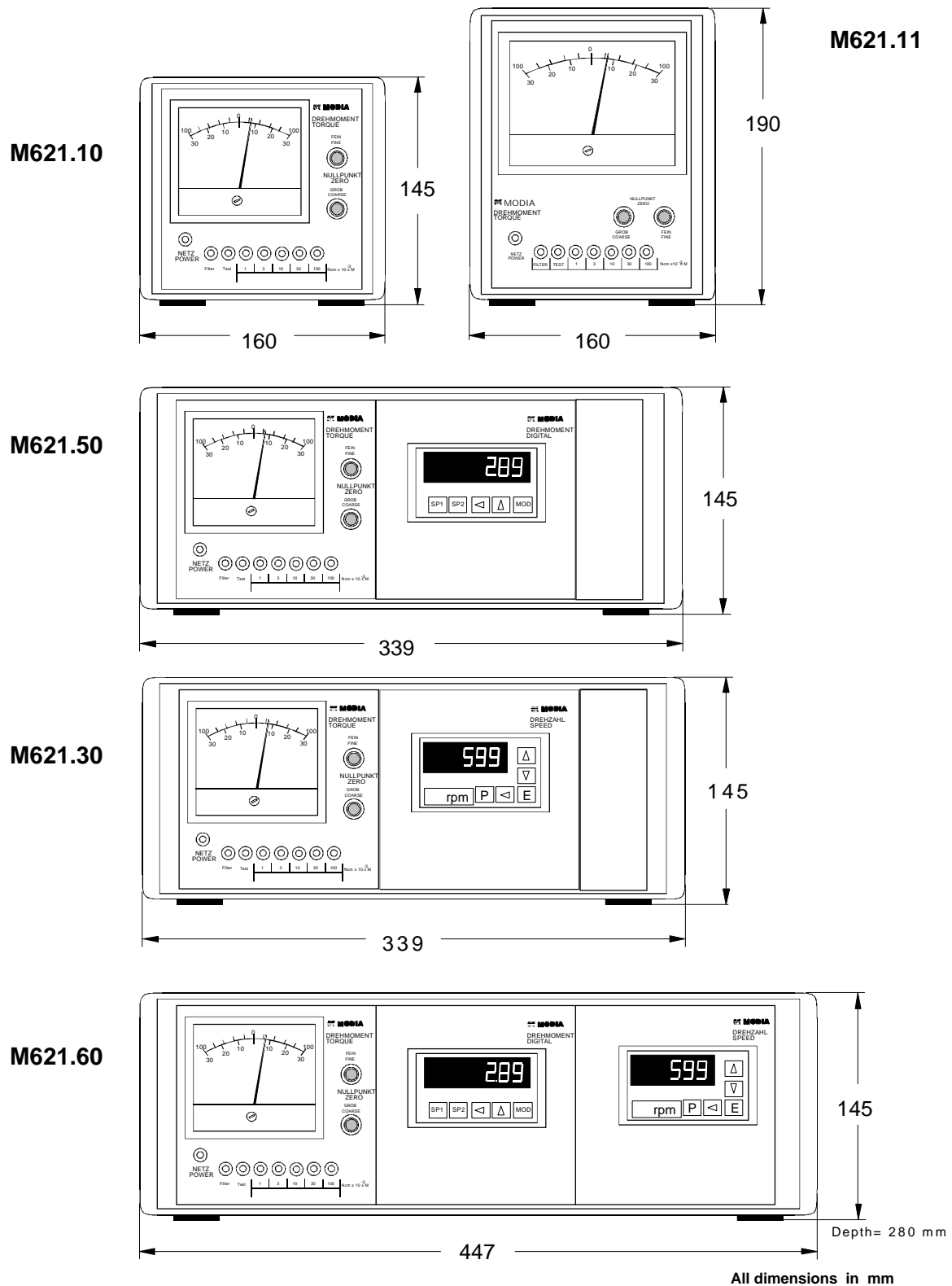
- Digital display  $\pm 1,000$  at full scale value
- Adjustment of 2 limits with relay control (Displayed by LED SP1/SP2)
- Storage and Reset of Max./Min torque values
- Signal output via interface RS-232
- Module DM3 can only be used in connection with base module MM



**M323.03**

## Display Units

### Combinations possible as Table Mounting Systems



## Accessories - Torque Speed Measuring System

For a variety of applications there are available:

### Test stands

- for the examination of micro motors (active)
- for friction measuring (of slip clutches, ball bearings, slide bearings, for determining the cogging torque of motors, ....)
- available in two dimensions
- adapted to each transducer type or to be used universally for all transducers.
- upon choice, provided with auxiliary and driving motors for the examination of passive and active components
- provided with fixtures and joints for speed sensors and mechanical stops.
- to be combined with other components such as brakes and coupling units.

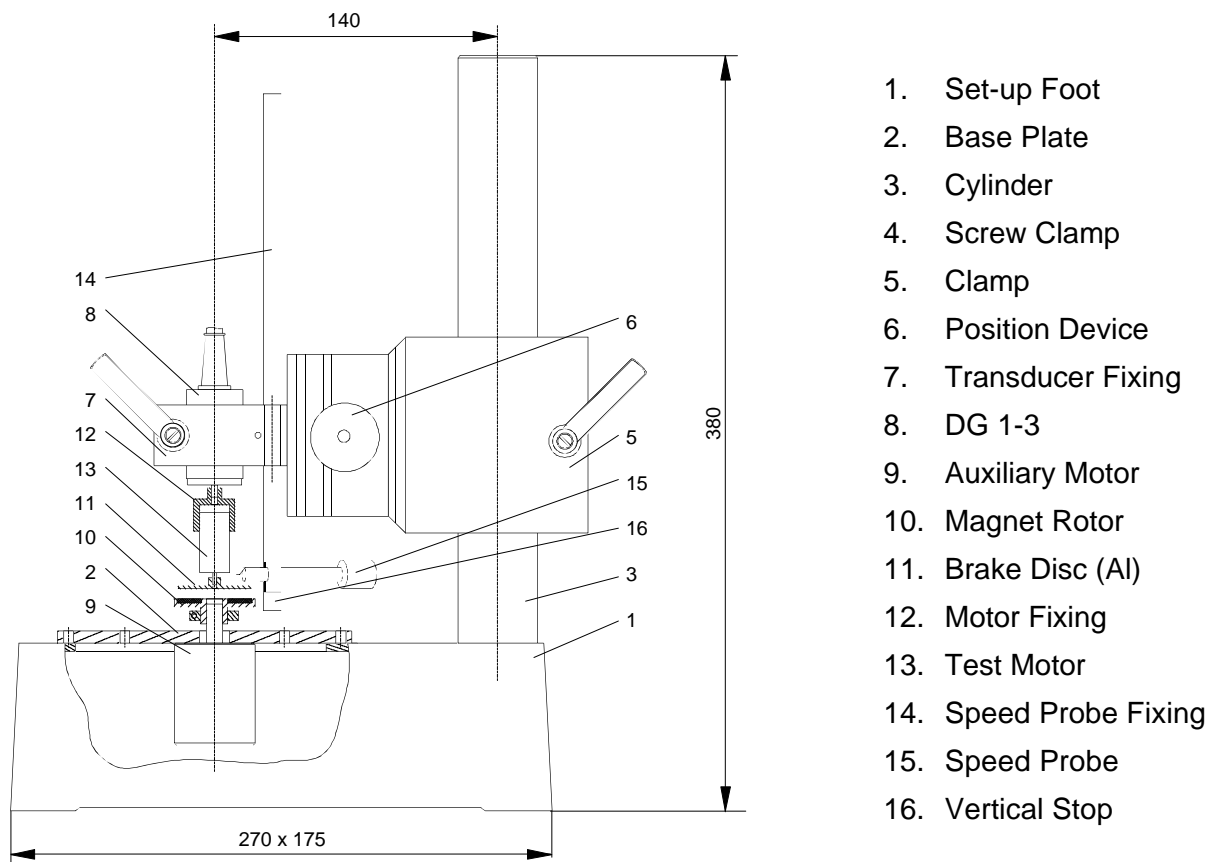
### Brakes

- for the test of active components, especially of electric motors, but also of small pneumatic turbines, etc.
- available for different loads
- designed as Eddy Current Brakes
- operating as non-contact brakes, i.e. without friction
- adjustable load intensity by varying the distance between brake disc and brake magnet, or by imposing a brake magnet speed by means of an auxiliary motor available with measured drawings (Maßbilder) of the brake components and for this reason easily adaptable to the specimen to be measured by the customer.

### Coupling Units

- designed for the measurement of active and passive test specimen.
- protecting the transducer from overload in axial and radial direction.
- designed with clearance in the transmission of torque, in order to avoid disturbing influences of axial and radial forces occurring during measurement.
- with axially movable coupling flange, which allows coupling without axial shift of the transducer.

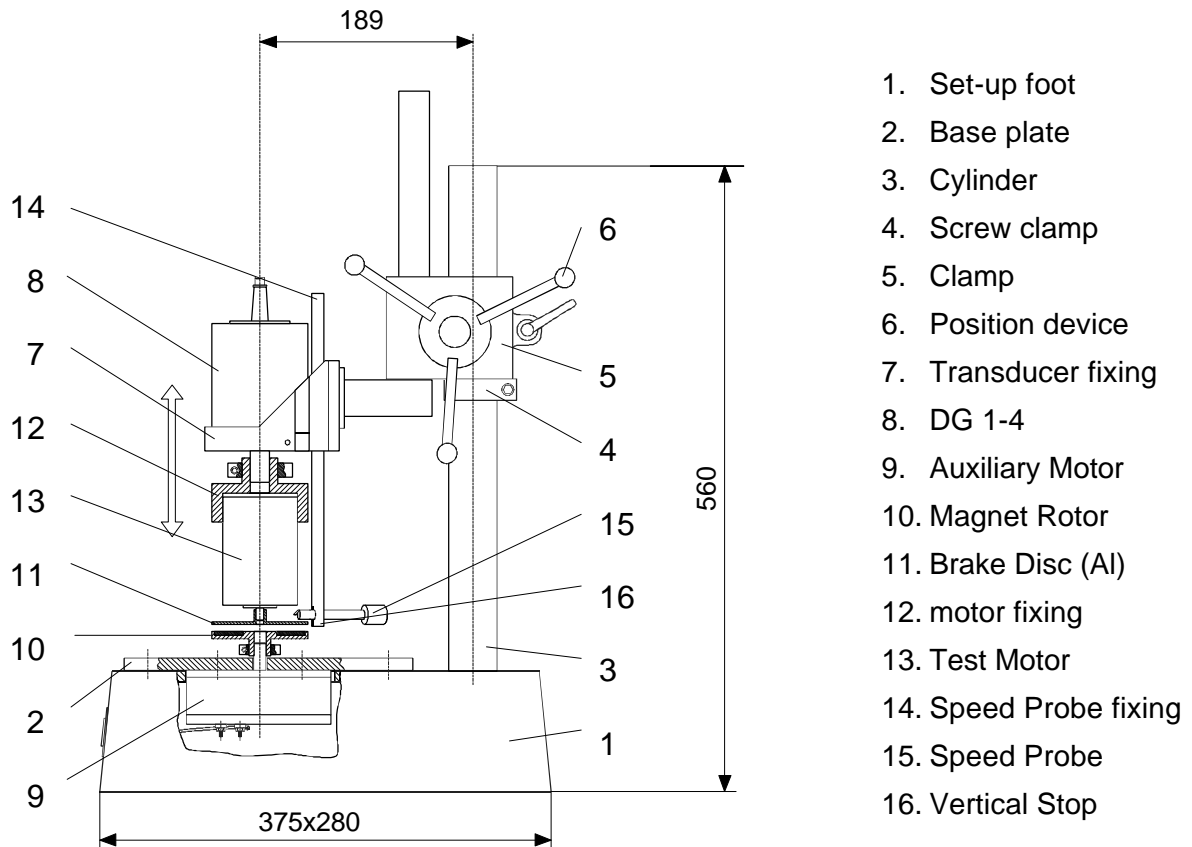
## Motor Test Set-up M1



The Motor Test Set-up M1 serves to examine working conditions of small motors at a variable load. The motor to be tested is fixed with its housing on the transducer shaft and is loaded by an Eddy Current Brake (10/11). The Torque Transducer (DG1-3) senses the reaction torque of the motor while a photoelectric speed probe (15) picks up the speed of the motor. The load of the Eddy Current Brake can be varied by adapting the distance between the aluminium disc driven by the motor and the magnetic brake driven by an auxiliary motor (9) against the sense of rotation of the test motor. A second possibility to vary the load is to change the rotation speed of the auxiliary motor. So test conditions from free run up to locked rotor can be realised.

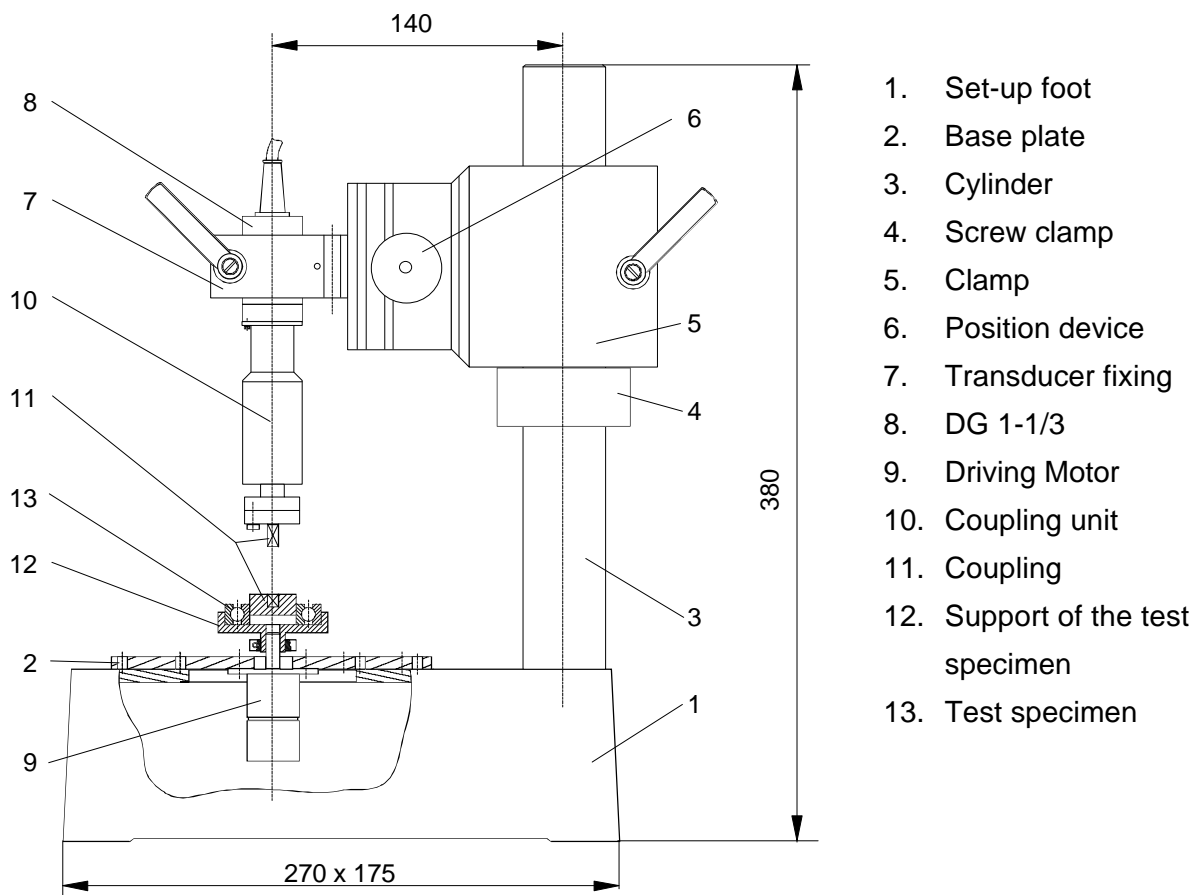


## Motor Test Set-up M2



The Motor Test Set-up M2 serves to examine working conditions of small motors at a variable load. The motor to be tested is fixed with its housing on the transducer shaft and is loaded by an Eddy Current Brake (10/11). The Torque Transducer (DG1-4) senses the reaction torque of the motor while a photoelectric speed probe (15) picks up the speed of the motor. The Load of the Eddy Current Brake can be varied by adapting the distance between the aluminium disc driven by the motor and the magnetic Brake driven by an auxiliary motor (9) against the sense of rotation of the test motor. A second possibility to vary the load is to change the rotation speed of the auxiliary motor. So test conditions from free run up to locked rotor can be realised.

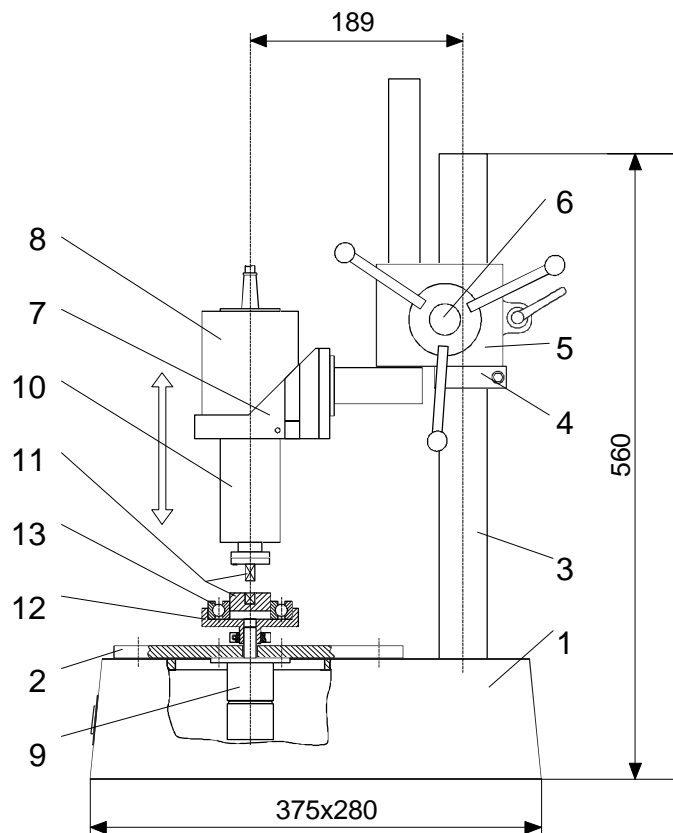
## Passive Test Set-up P1



The Test set-up P1 serves to examine small passive structural components, such as ball bearings, slide bearings, potentiometers, gear trains or stepper motors with resp. without static current. For this purpose the test specimen(13) is arranged between transducer DG 1-1/3 and the driving motor(9). By means of a coupling(11) and a coupling unit(10), creating an axial- und radial load free connection between the test specimen and the DG 1/1-3, the friction torque occurring at the test specimen is transmitted to and measured by the transducer.

The kind of support of the test specimen(12) and the couplings together with the position device(6) make it possible to change the test specimen very quickly and easily. The driving motor can be chosen with different speeds and driving powers according to the customer's wishes. Equipment of the driving motor with angular and speed sensors is also possible.

## Passive Test Set-up P2



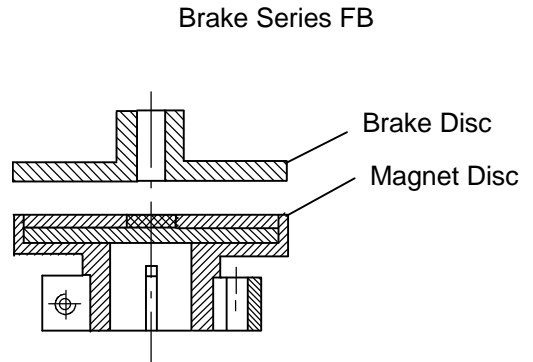
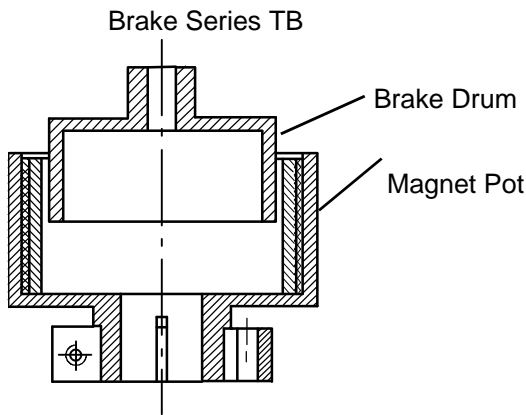
1. Set-up foot
2. Base plate
3. Cylinder
4. Screw clamp
5. Clamp
6. Position device
7. Transducer fixing
8. Transducer DG 1-4
9. Driving motor
10. Coupling unit
11. Coupling
12. Support of the test specimen
13. Test specimen

The Test set-up P2 serves to examine small passive structural components, such as ball bearings, slide bearings, potentiometers, gear trains or stepper motors with resp. without static current. For this purpose the test specimen(13) is arranged between transducer DG 1-4 and the driving motor(9). By means of a coupling(11) and a coupling unit(10), creating an axial- und radial load free connection between the test specimen and the DG 1-4, the friction torque occurring at the test specimen is transmitted to and measured by the transducer.

The kind of support of the test specimen(12) and the couplings together with the position device(6) make it possible to change the test specimen very quickly and easily. The driving motor can be chosen with different speeds and driving powers according to the customer's wishes. Equipment of the driving motor with angular and speed sensors is also possible.

# Brakes

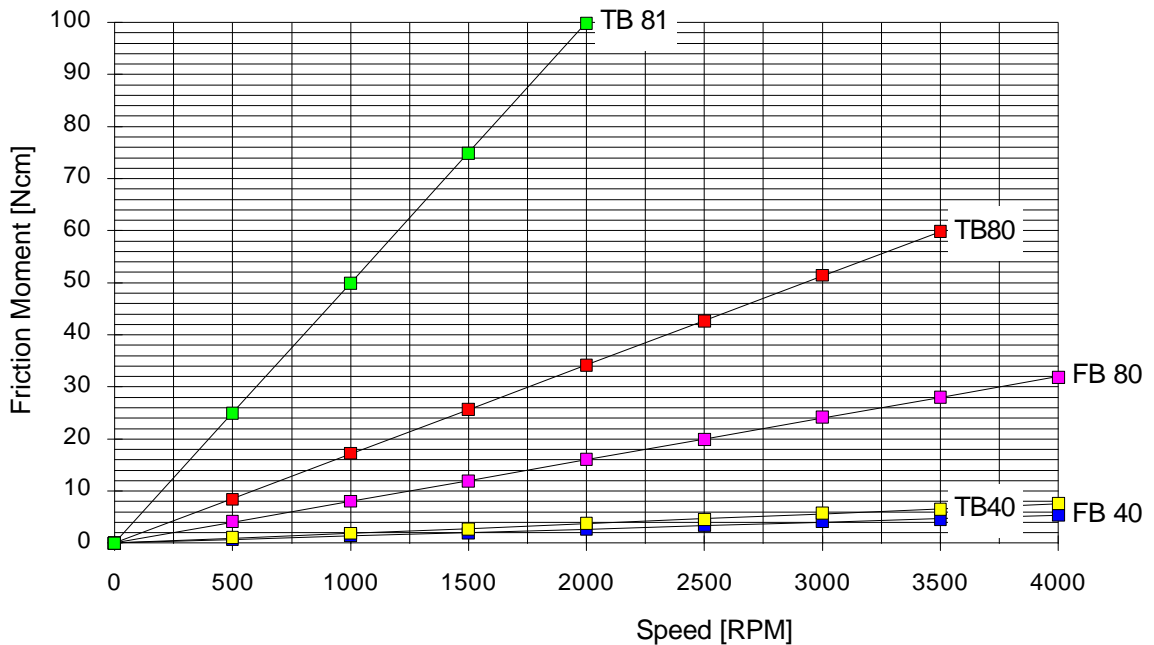
The Eddy Current Brakes serve for testing driving units, such as small electric motors, stepper motors, turbines etc. By means of this brakes variable loads can be simulated on the actors to be examined. Two types of brakes are available:



- Brakes of the series TB allow for higher load than brakes of the FB series.
- Errors of alignment are not to exceed  $\approx 1-3$  mm ( according to the design of the brake drum).

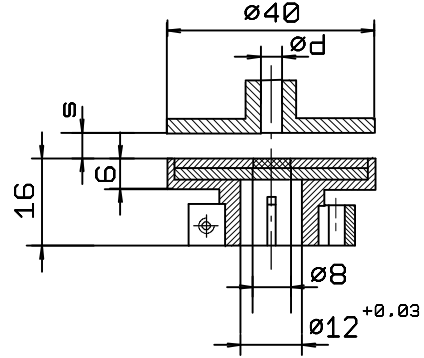
- Easier handling in comparison with the TB brakes
- Errors of alignment are tolerable.
- Test specimen can be changed more quickly than in case of TB brakes because no axial adjustment is necessary.
- FB brakes allow for less load than TB brakes.

**Characteristics of the Eddy Current Brakes**

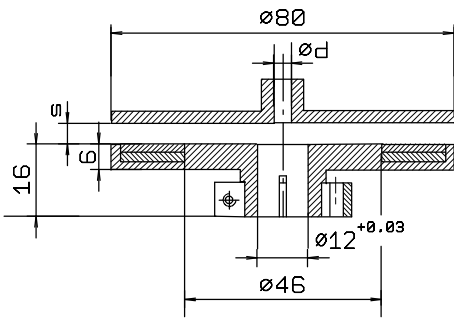


**Measured drawings of the Eddy Current Brakes:**

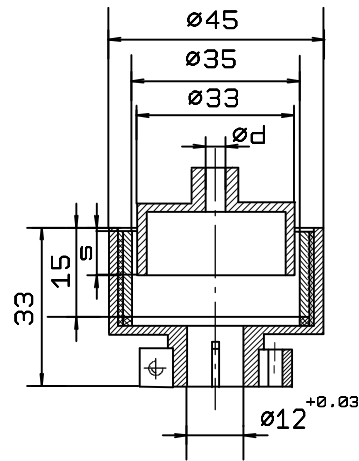
Data sheets of the single brakes are available upon demand



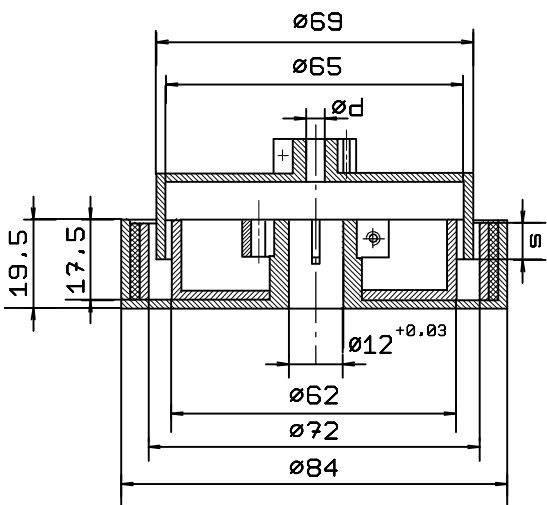
FB40



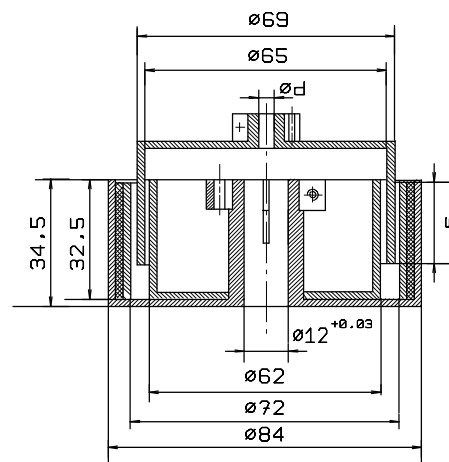
FB80/FB81



TB40



TB80



TB81

## Coupling Units KE 3 and KE 4

The coupling units have been designed to protect the sensible flexural pivots of the transducer and to facilitate the test of passive test specimen (friction measurement).

The coupling flange can be moved in axial direction and admits a slight excentricity between the transducer axis and the rotation axis of the test specimen. Therefore the coupling unit is especially suited in measurement series where test specimen have to be changed in high sequence.

