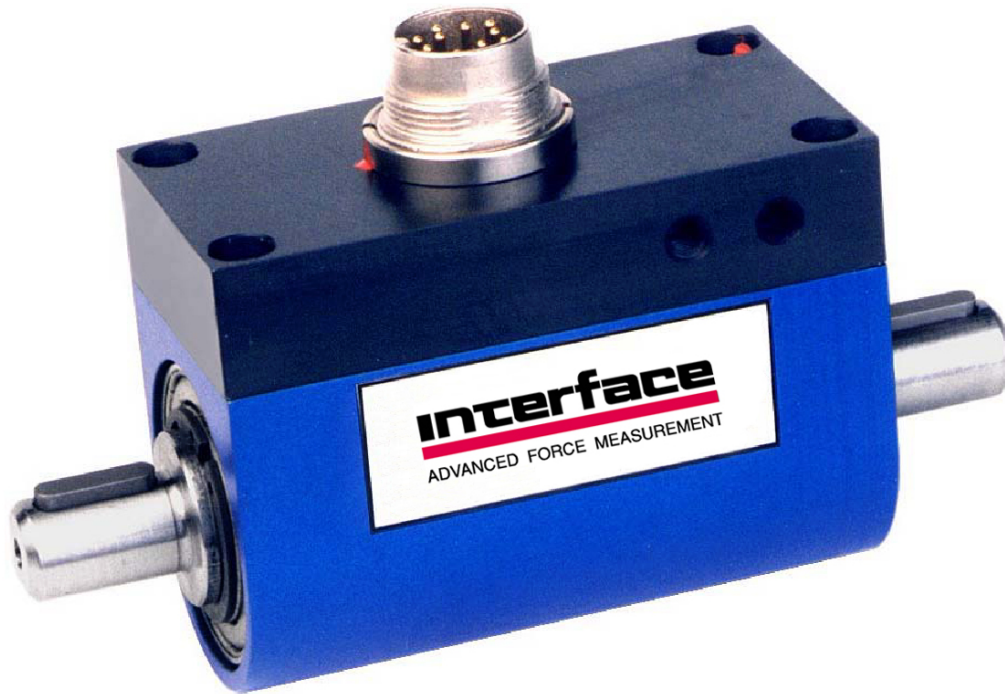


# T14 Slip-Ring Rotary Torque Transducer

*Operation Manual*



## Contents

1	Safety .....	3
1.1	Operation .....	3
1.2	Hazards .....	3
1.2.1	Non-observing of the safety instructions .....	3
1.2.2	Remaining hazards .....	3
1.3	Reconstruction and changes .....	3
1.4	Personnel .....	3
1.5	Warning notes .....	3
2	Product description.....	4
2.1	Transducer with slip-ring transducer and rotating shaft.....	4
2.1.1	Mechanical construction .....	4
2.1.2	Electrical construction .....	4
3	Mechanical assembly .....	5
3.1	Assembly of slip-ring transducers .....	5
3.1.1	Shaft-shaft.....	5
3.1.2	Hex or square drive sensors.....	6
3.2	Couplings .....	6
4	Electrical connection .....	7
4.1	Pin assignment.....	7
4.2	Cable.....	7
4.3	Shield connection.....	7
4.4	Extension cable.....	7
4.4.1	Transducer without integrated electronics.....	7
4.5	Installation of the measuring cables.....	8
4.6	Control (option) .....	8
4.7	Angle (option).....	8
5	Static and dynamic operation.....	9
5.1	Direction of torque.....	9
5.2	Static/Quasistatic torques .....	9
5.3	Dynamic torques .....	9
5.4	Speed limits.....	9
6	Maintenance .....	10
7	Set out of operation .....	11
8	Transportation and storage .....	11
8.1	Transportation .....	11
8.2	Storage.....	11

## 1 Safety

### 1.1 Operation

Torque transducers are intended for measuring torques. With additionally integrated speed transducer or angle of rotation transducer, these measured variables within the area intended can be measured as well. These measured variables in addition are further suitable as control and regulation functions.

The valid safety regulations should absolutely be considered. The torque transducers are not safety components in the sense of the intended use. The transducers are to be transported and stored appropriately. The assembly, putting into operation and disassembly must take place professionally.

### 1.2 Hazards

The torque transducer corresponds to the state of the techniques and it is reliable in service.

#### 1.2.1 Non-observing of the safety instructions

Remainder dangers can develop with inappropriate application (e.g. by untrained personnel). The operating instruction must be read and understood by each person, which is entrusted with assembly, putting into operation, maintenance, repair, operation and disassembly of the torque transducer.

#### 1.2.2 Remaining Hazards

The system planner, provider and operator must plan, implement and answer for safety-relevant interests for the receiver. Remaining dangers must be minimized. It must be referred to the remainder dangers of the torque measuring technique.

### 1.3 Reconstruction and changes

Each modification of the transducer without our written agreement excludes an adhesion on our part.

### 1.4 Personnel

The installation, assembly, commissioning, operation and the disassembly must be carried out by qualified personnel only. The personnel must have the knowledge and make use of the legal regulations and safety instructions.

### 1.5 Warning notes

The rules for the prevention of accidents of the professional associations must be considered.

Necessary are covers and linings before the operation of the transducer.

Task of the covers and linings are:

- ⇒ Protection from solvent parts
- ⇒ Protection from pinches and shears
- ⇒ Avoiding of reaching rotating parts

Covers may

- ⇒ not grind
- ⇒ not rotate along

Covers are necessary also outside of the work and motion travel of persons.

It can be deviated from these demands, if other sufficient safety devices are available.

## 2 Product description

Measurement of following static and dynamic measured variables:

- Torque
- Speed of transducers with rate of revolution measurement
- Angle of rotation on transducers with angle of rotation measurement

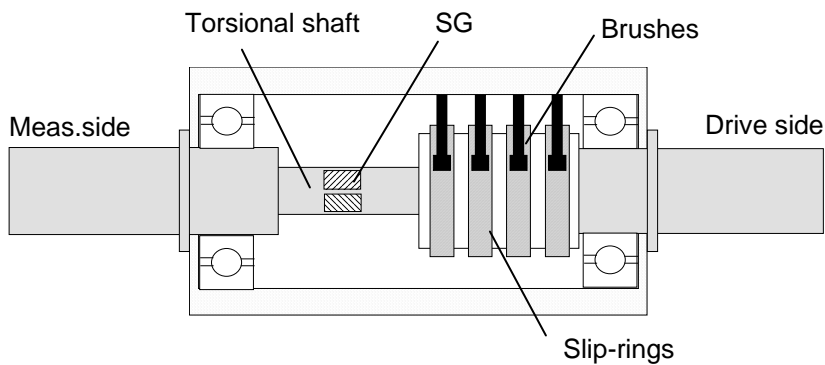
The mounting position of torque transducers is random.

Caution: It is differentiated between measuring side and driving side. Consult factory for details.  
(800) 947-5598 | (480) 948-5555 | www.interfaceforce.com

### 2.1 Transducer with slip-ring transducer and rotating shaft

#### 2.1.1 Mechanical construction

The transducer is equipped with slip-rings for the transfer of supply voltage and the measuring signal.

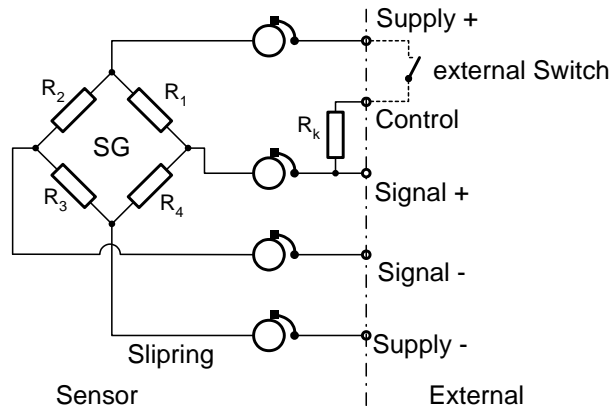


Sectional view of torque transducer.

Slip-ring transducers consist, depending upon execution form, of a torque shaft with different connection possibilities (shafts, square, hexagonal etc.). The torque shaft applied with strain gauges is stored in a housing with ball bearings. For signal transmission or for the supply of the SG fullbridge a slip-ring rotating transformer is arranged in the transducer. It consists of 4 slip-rings on the shaft and fastened brushes at the stator. At the housing a plug or a cable connection is attached.

#### 2.1.2 Electrical construction

The strain gauge full bridge is directly led out over the slip-rings on the plug, or on the connection cable.



*Slip-ring transducers with strain gauge full bridge and option control.*

### 3 Mechanical assembly

#### 3.1 Assembly of slip-ring transducers

With these transducers it is differentiated between measuring side and drive side. On the drive side is the slip-ring rotating transformer, whose inevitable friction enters with exchanged installation position (measuring side mistaken with drive side) into measurement also.

For the position of the measuring side consult factory for details.

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Thus no abrasive dust falls into the brush connections it is recommended to align the cable connection upward.

##### Caution with permutation of measuring with drive side:

- Friction of the slip-rings will enter into the measuring signal.
- At dynamic measurements take note that through the higher slow-acting mass and the absorbing effect of the slip-rings a reduced measuring accuracy will be achieved.

Therefore always consider measuring and drive side.

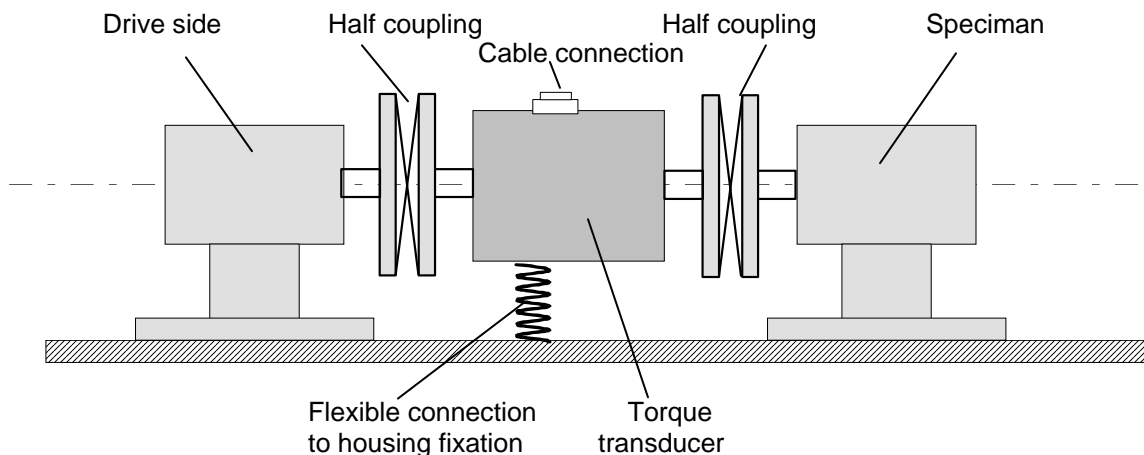
#### 3.1.1 Shaft-shaft

With small torques (< 50Nm) connect transducer electrically during the assembly and observe signal, measuring signal may not exceed limit values.

##### 3.1.1.1 Free-floating assembly

The transducer is installed between two half coupling's and contributes to balance an inevitable misalignment between the two mechanical connections.

When not using couplings very large transverse forces can affect the transducer. Additionally still large forces occur on the bearings in drive and specimen, which limit their life span very strongly.



Shafts and hubs must be cleaned before the assembly with solvent (e.g. acetone). No foreign bodies may stick to them.

##### Connection with clamping unit

Here, the indications from the manufacturer of this unit must be considered. The clamping unit must be suitable in order to safely transfer the occurring torques.

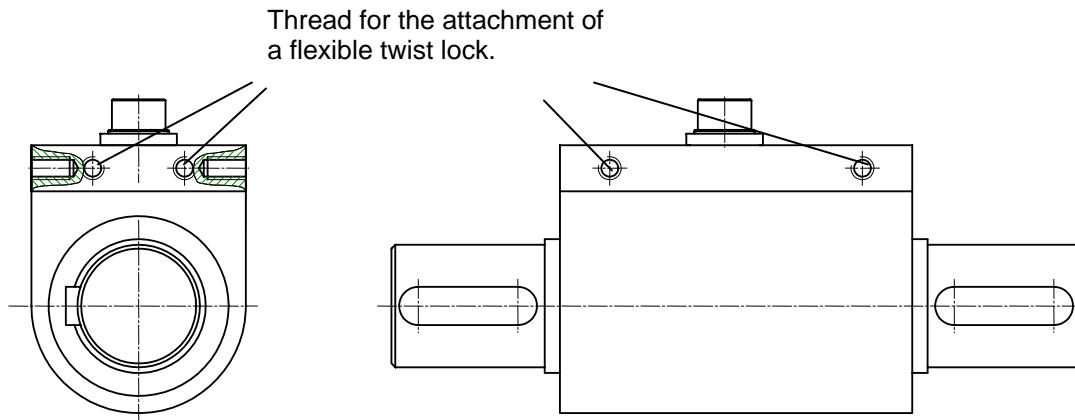
## Connection with key joints

The hub must be secured against slipping out (e.g. safety screw on spline, or axial screw).

**Caution:** When assembling no illegally large forces may affect the transducer or the clutches.

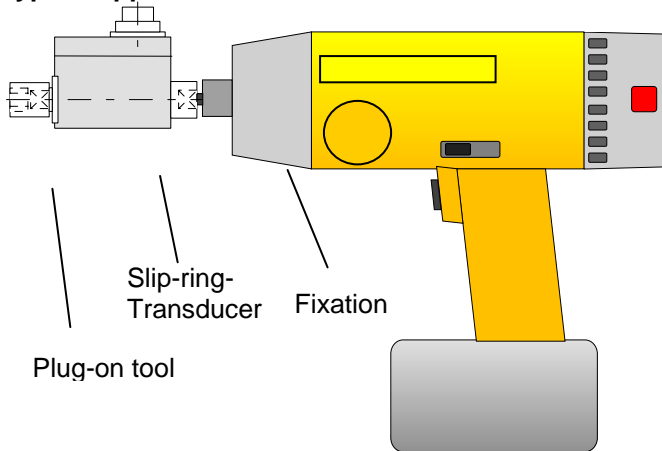
The housing must be protected from twisting (e.g. by a flexible connection). The cable connection may not be used for this.

The cable connection must be loosely shifted (form of goose neck), so that it can follow the easy movements of the stator.



## 3.1.2 Hex or square drive sensors

### Typical application



**Caution: Do not use impulse or impact screwdrivers!**

## 3.2 Couplings

We recommend multiple disc-couplings for our torque transducers.

Couplings must be able to adjust an axial, a radial or angle misalignment of the shafts and not let large forces affect the transducer.

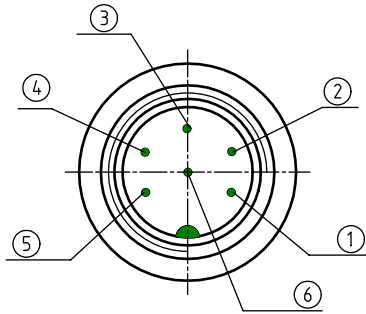
The assembly instructions indicated by the manufacturer are to be considered.

Shift couplings on shaft (use full grip of the coupling) and align shaft.

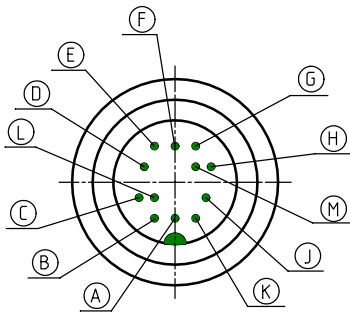
Take note absolutely that the data of the couplings (misalignment, angular misalignment, tension, pressure) are not exceeded.

## 4 Electrical connection

### 4.1 Pin assignment



Socket 6-pin (X6A)		Function	Type
1	green	SG-supply (-)	T14
2	brown	SG-supply (+)	
3	shield	Shielding	
4	yellow	SG- Signal (+)	
5	white	SG- Signal (-)	
6	grey	Control	



Socket 12-pin (X12A)		Function	Type
A	green	SG-supply -	T14
B	brown	SG-supply +	
C	yellow	Signal (+)	
D	white	Signal (-)	
E	grey	Angle (dev. 0V)	
F	red	Angle (dev. +5V)	
G	pink	Angle A	
H	blue	Angle B	
J	black	0V	
K	red/blue	Control	
L	violet	-	
M	shield	Shield	

### 4.2 Cable

Use only shielded cable with the shortest length possible. We recommend Interface brand cables as they are tested together with our transducers.

### 4.3 Shield connection

The shield forms a Faraday's cage together with transducer and external electronics. Thus electromagnetic disturbances do not have influence on the measuring signal.

For problems with potential differences we recommend to ground the transducer at the designated thread for the pick-up of a grounding screw.

### 4.4 Extension cable

#### 4.4.1 Transducer without integrated electronics

Caution: The measuring cable length enters depending upon bridge resistance and conductor wire gauge into the characteristic value of the transducer. Therefore order from Interface, Inc. and have the transducer together with the extension cable calibrated by Interface, Inc.

Dependency of the cable length on characteristic value:

Conductor-wire gauge	Cable resistance per m	Deviation per m Cable length at bridge resistance <b>350 Ω</b>	Deviation per m Cable length at bridge resistance <b>700 Ω</b>	Deviation per m Cable length at bridge resistance <b>1000 Ω</b>
0.14 mm <sup>2</sup>	0.28 Ω	0.08%	0.04%	0.028%
0.25 mm <sup>2</sup>	0.16 Ω	0.046%	0.023%	0.016%
0.34 mm <sup>2</sup>	0.12 Ω	0.034%	0.017%	0.012%

Cable resistance = 2x resistance of the cable length (both feeders of the transducer)

The transducers with the ordered cable length are calibrated at Interface, Inc. Therefore the cable length does not need to be considered in this case.

### 4.5 Installation of the measuring cables

Do not install test leads together with control lines or high voltage cables. Always take note on large distances to engines, transformers and contactors, because their scattering fields can lead to disturbances of the measuring signals.

If disturbances occur over the test lead we recommend a transfer of the cable in a grounded steel conduit.

### 4.6 Control (option)

By a control resistance a signal is produced in the transducer, which corresponds to the nominal value of the transducer.

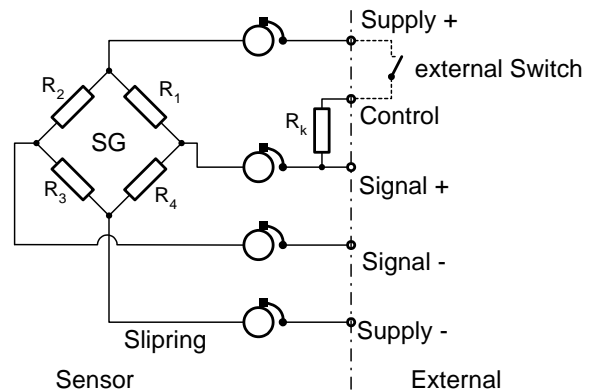
*Advantage:*

Re-Calibrations are reduced. Before each measurement the zero point and the nominal value can be checked.

*Function:*

The measuring bridge is electrically detuned by creation of positive SG supply voltage, so that at the output a measuring signal of 100% of the nominal value is available.

Optionally 50%, 80% possible.



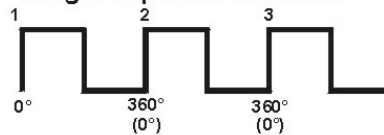
### 4.7 Angle (option)

The impulses/revolution is detected during the angle or speed measurement. By a second channel, which is arranged around 90° shifted, flank analysis n the impulses/revolution can be quadrupled. The trace shifted by 90° can be used also for the direction of rotation recognition.

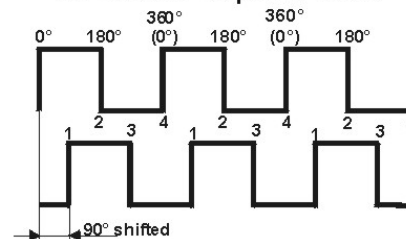
Supply for angle transducer

stabilized supply voltage	5V± 25mV
current consumption max.	20mA

Single Impulse Evaluation



Impulse Evaluation with a second 90°-shifted Impulse Track





## 5 Static and dynamic operation

### 5.1 Direction of torque

A torque means right-rotating or right turn torque, if with view of the shaft end the torque works in clockwise direction. In this case you will receive a positive electrical signal at the output. With Interface, Inc. torque transducers both - the right or the left turn torques can be measured.

### 5.2 Static/Quasistatic torques

A statically or quasistatic torque means a slowly changing of torques. The calibration of the transducers effects statically on a calibration device. The adjacent torque may take any value up to the nominal moment.

### 5.3 Dynamic torques

The statically executed calibration of the torque transducers is valid also for dynamic case of application. Remark: The frequency of the torques must be smaller than the natural frequency of the mechanical measurement setup.

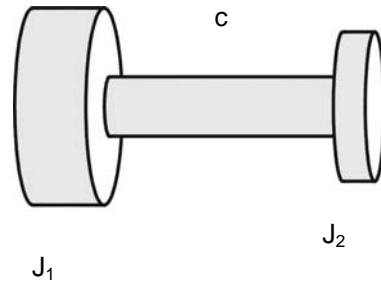
The oscillatory width is to be limited on 70% of the nominal moment.

Periodic resonances

Appraisal of the mechanical periodic resonances:

$$f_0 = \frac{1}{2 \cdot \pi} \cdot \sqrt{c \cdot \left( \frac{1}{J_1} + \frac{1}{J_2} \right)}$$

$f_0$  = Natural frequency in Hz  
 $J_1, J_2$  = Moment of inertia in kg\*m<sup>2</sup>  
 $c$  = Springrate in Nm/rad



Further procedures for the calculation of the periodic resonances are e.g. the “Holzer-Method” (Dubbel pa-perback for mechanical engineering, Springer publishing house) or appropriate available programs.

Note: An operation of the mechanism in the periodic resonance can lead to permanent damage.

### 5.4 Speed limits

The maximum number of revolutions indicated in the data sheet may not be exceeded in any operating condition.

## 6 Maintenance

A check-up of cable, plugs and attachment of the transducer should be executed annually at least. The transducer should be calibrated new after 24 months, at the latest however after 26 months (DIN 51309). The life span of the brushes is limited; it depends on the speed, number of revolutions and on the design. We recommend having the brushes renewed with Interface, Inc. according to following table. On this occasion also the slip-rings are controlled and the transducer is calibrated new.

To prevent measuring signal fluctuations depending on number of revolutions, the carbon dust should be removed from the housing of the transducer.

During the life span we recommend to clean the transducer 5 times as indicated below.

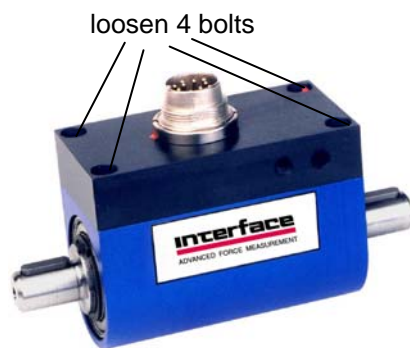
Examination of the slip-rings in the factory:

Speed 1/min	Small design < 35 mm width no of rev.	Medium design < 45 mm width no of rev.	Large design < 60mm width no of rev.	X-large design < 120mm width no of rev.
10	$5 \cdot 10^7$	$4 \cdot 10^7$	$3 \cdot 10^7$	$1.5 \cdot 10^7$
100	$2 \cdot 10^7$	$9 \cdot 10^6$	$8 \cdot 10^6$	$4 \cdot 10^6$
500	$7 \cdot 10^6$	$5 \cdot 10^6$	$3 \cdot 10^6$	$1.5 \cdot 10^6$
1000	$5 \cdot 10^6$	$3 \cdot 10^6$	$2 \cdot 10^6$	-
1500	$4 \cdot 10^6$	$2.4 \cdot 10^6$	-	-
2000	$3 \cdot 10^6$	-	-	-

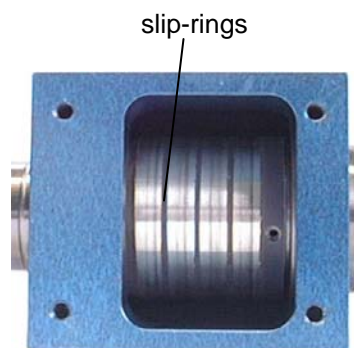
### Cleaning procedure:

- Open transducer: loosen the 4 screws and remove cover with brushes carefully.
- Remove the coal dust from the transducer carefully with fine long-haired brush in dry, oil-free air. Then clean the slip-rings with a fine cloth or q-tips which should be dampened with spirit.
- Carefully clean brush unit likewise with a brush and if necessary with dry air.
- Assemble the transducer and tighten the four fixing bolts.
- After assembly exercise a function test.

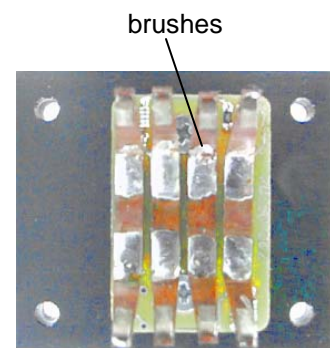
**Caution: Brushes may not be bent at cleaning procedure!**



Open the slip-ring transducer



View of slip-rings in transducer



View of carbon brushes

## **7 Set out of operation**

All transducers must be removed professionally.

Clutches may not be damaged.

Do not exert impacts with tools on the housing of the transducer.

Do not exert bending moments e.g. by levers on the transducer.

The torque transducer must be supported, so that it cannot fall down with the disassembly.

## **8 Transportation and storage**

The transportation of the transducers must take place in suitable packing.

For smaller transducers strong cardboard boxes which are well padded (e.g. air cushion foil, plastic chip, chad) are sufficient. The transducer should be packed up cleanly in foil so no packing material can come into the transducer (ball bearing). Larger transducers should be packed in crates.

### **8.1 Transportation**

Release only well packed transducers to transportation. Transducer may not move back and forth in the packing. Transducers must be protected against humidity.

### **8.2 Storage**

The storage of the transducers may take place only in dry, dust free spaces.

Slightly oil the flanges before storing (rust).