

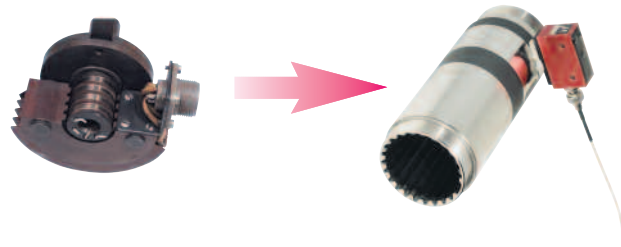
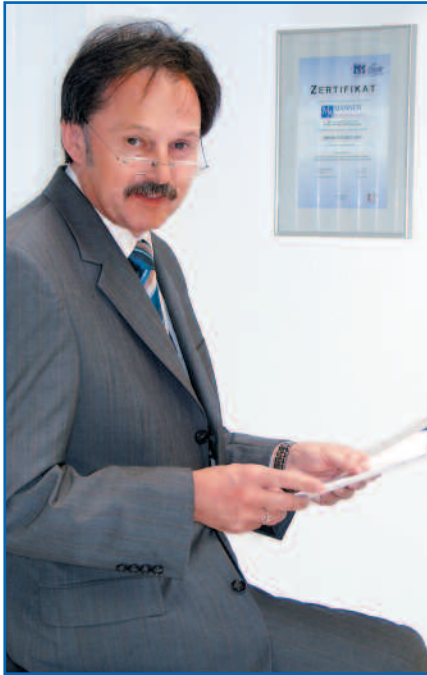


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Preface	4
MANNER corporate history	5
MANNER Sensortelemetrie	6
MANNER corporate philosophy	7
APPLICATIONS for the automotive industry	8-9
APPLICATIONS related to engine	10-11
APPLICATIONS aviation/rotor test standard/turbines	12
APPLICATIONS navigation / geological bores	13
Industrial APPLICATIONS	14-15
APPLICATIONS railroad / wind energy	16
Sensor signal amplifier	17
Multi-channel technology	18-19
Transmission possibilities	20
Evaluation units & interfaces	21
RMC technology	22-23
Sensortelemetry with radio transmission	24-25
Services	26
References	27
MANNER international	28





Welcome to MANNER Sensortelemetrie!

Driven by the firm resolution to replace the inconsistent slip ring technology, and with a good idea leading to the patent for the principle of sensortelemetry, the company **MANNER** was formed in 1991. Our new transmission technique offered significant advantages over the state-of-the-art technology and, particularly, the conventional slip ring technology. Outstanding features of this technique were (and still are) the simplicity and the reliability of transmission involving rotating parts, even under the most difficult ambient conditions. This proved to be very successful in solving problems, especially in the automotive industry.

Customer requirements, the demand for standard products and the rapidly increasing volume of orders made the foundation of the company **MANNER Sensortelemetrie** in 1995 unavoidable. Based on existing technology, a wide range of products was developed over the years, all of which relate closely to the subject of non-contact measuring signal transmission and non-contact data and energy transmission. This range of products has been expanded over the years to include rotating torque transducers.

By combining customer requirements, the currently available latest technology and with a feeling for what is technically possible, we find solutions for problems at the highest level. We do not shy away from virtually unsolvable problems. Where others give up, we move forward.

Customer benefit was and continues to be an important factor for us. With the innovative pioneering spirit of an entrepreneur and Swabian precision, we developed a large number of products for performing measurements on rotating parts. In this process, quality and reliability have always been our foremost priorities. It is not a co-incidence that today **MANNER Sensortelemetrie** is a series production supplier for mast torque monitoring systems in helicopters.

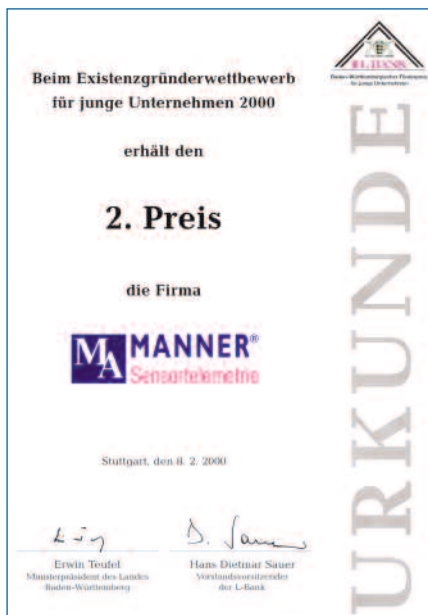
Since 1995, **MANNER Sensortelemetrie** has grown into a healthy medium-sized enterprise. Being an innovative leader in the industry has its price, which is reflected in high development costs. Today, our company has about 50 highly qualified employees. Specialists with several years of experience and a broad knowledge of physics and electronics work for us.

In our role as your partner, we don't see ourselves as a mere supplier of products. We take care of your telemetry-related needs, so that you can focus on your core business. We provide assistance in solving problems, work out concepts for solutions, perform assembly, support you during commissioning and guarantee support after delivery. All this using our long-standing experience, sometimes outside the usual working hours.

Dr. Ernst Manner

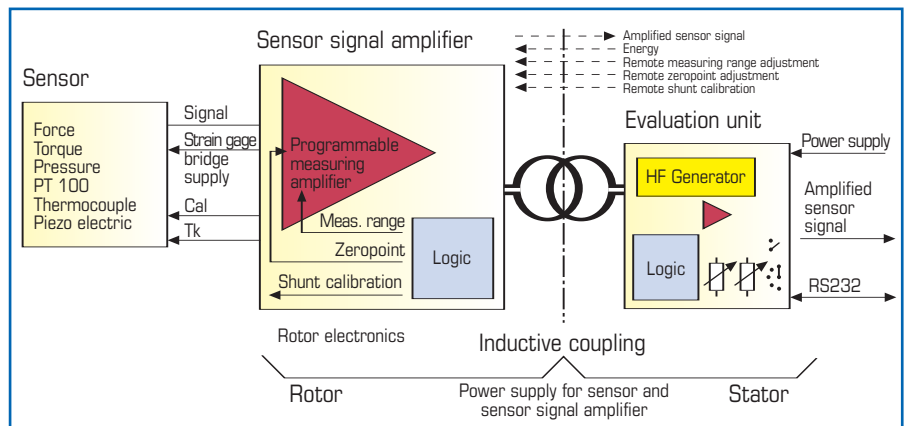
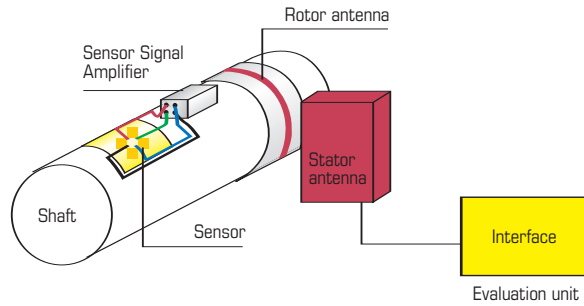
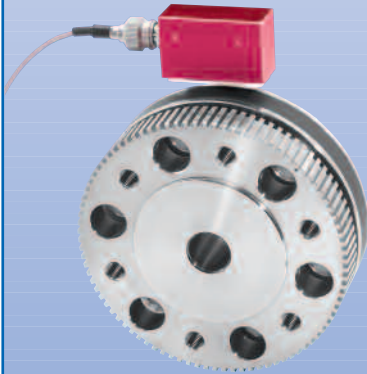
1991

- 01.01.1991 Foundation of the company "**MANNER** Ingenieurbüro"
- 01.04.1991 Development of **MANNER** first products for non-contact measurement data transmission
- 01.09.1993 Qualification as Daimler Chrysler sub-supplier
- 01.11.1993 Beginning of the development of the distribution network in Germany
- 01.01.1996 Company moves into the new office building. Development of the standard sensortelemetry production line (measurement telemetry)
- 01.01.1997 Qualification as series supplier for the aviation industry
- 01.06.1997 Development of the overseas distribution network (sales partners)
- 01.01.1998 Series delivery of customized models with piece quantities of 1000/year/customer (nut running technology)
- 01.04.1998 Development of the patented torque measuring flanges especially for test stand operation
- 01.07.1999 Development of high-frequency digital telemetry systems
- 01.11.2000 Enlargement of the production area by extending the company building
- 01.01.2002 Development of an energy transmission system with integrated data modem for online balancing systems
- 2004 ISO 9001 certification
- 2005 Development of digital RMC telemetry components
- 2006 Introduction of Flex technology



WHAT IS SENSORTELEMETRY?

Sensortelemetry is the non-contact bi-directional transmission between a moving part (especially a shaft) and a stationary point via a modem, with simultaneous energy transmission.

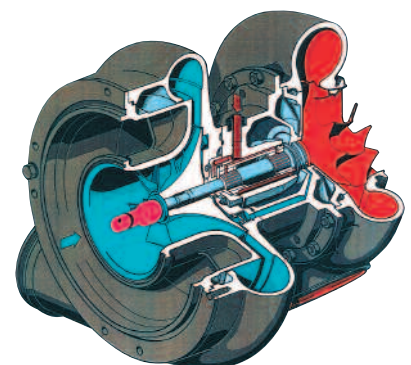
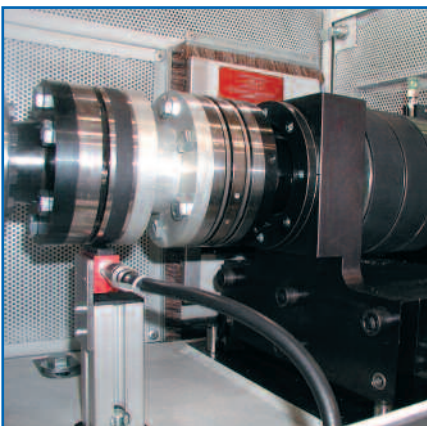


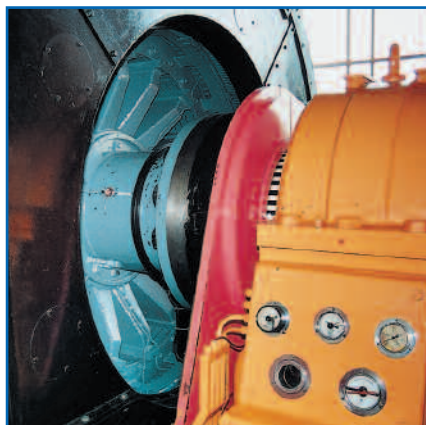
WHAT CAN MANNER SENSORTELEMETRIE DO FOR YOU?

At **MANNER Sensortelemetrie**, we specialize in non-contact sensor signal data transmission for industrial applications. We offer solutions for problems related to non-contact, bi-directional sensor data transmission involving rotating or moving parts.

For such solutions, we develop, manufacture and supply the following:

- Single and multi-channel telemetry systems with the highest sample rates (>400 kSample) and a modular design
- Customized telemetry systems for customer-specific applications
- Customized rotating torque transducers for test stand and industrial applications
- OEM-based, low-cost torque transducers.
- Low-cost, customized transmission systems for series production





OUR CORPORATE PHILOSOPHY

- Focusing on the business area of "non-contact sensor data transmission" in the near field range (near field telemetry), which has resulted in our expertise in this area.
- Continuously applying the knowledge and experience acquired from previous projects in order to refine our expertise for solving problems in the future.
- We want to be the best in the area of single and multi-channel telemetry systems.
- We continuously strive to further strengthen our innovative leadership in the area of near field telemetry.
- We solve problems for our customers and, in this process, customer benefit is always our top priority (solving the problem with the currently available technologies at the highest level with the goal of creating a new product).

**Where others give up,
we at MANNER help you
to be successful!**



ADVANTAGES OF MANNER SYSTEMS

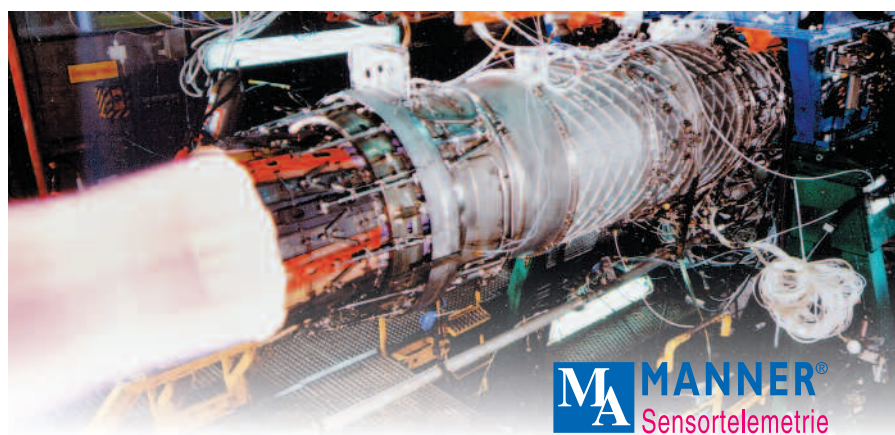
Due to the special patented transmission technique of absorption modulation, our systems can be used **under the highest EMC load**. Even if they are installed in GTO-controlled large-sized motors with a power of 50 Megawatt or more, there is **no interference in the signals**.

The consistent monitoring of signal transmission allows you to achieve **a high degree of reliability**: incorrect assembly of antennas, faulty sensors, insufficient energy supply or defective cables are detected immediately and displayed.

Our systems were developed for use under the toughest ambient conditions and are characterized by **sturdy solder pins, casing** (which ensures oil-tightness) and **extreme acceleration stability** (up to 120,000 g). They can be supplied according to the requirements of the IP67 protection class.

Technological features at a glance

- Temperature-stable rotor electronics (sensor signal amplifier) up to an ambient temperature of 180°C
- Miniature rotor electronics with very small dimensions (7 x 25 x 6 mm) and low weight (2 g)
- Extremely high interference immunity due to the use of the patented sensortelemetry technique
- Acceleration stability up to 120,000 g and speed stability up to 100,000 rev./min
- RMC technology (remote-controlled online conditioning of measuring amplifiers, amplification and zero point with 16 bit resolution), autozero in the rotor
- Frequency modulated (FM) and pulse-code modulated (PCM) transmission technique
- Digitization in the rotor
- Highest sample rate of up to 400 kSample/channel (simultaneous transmission of 52 measuring channels)
- With Flex technology, the sensor signal amplifier can have any geometrical shape and can therefore be installed even if the installation space is not ideal



APPLICATIONS FOR THE AUTOMOTIVE INDUSTRY

DRIVE TRAIN

Today, sensortelemetry has become an indispensable tool for automobile developers in order to design and optimize the drive train.

Flexible stator antenna, particularly for prop and half shafts; any shape is possible, not sensitive to approach towards the vehicle frame or gaging due to integrated shielding and automatic balancing

PLUG AND PLAY



UNIVERSAL SHAFTS

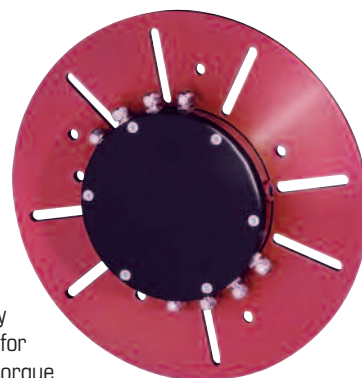
Torque measurement in prop and half shafts with strain gage measuring bridge, sensor signal amplifier and rotor induction loop with radially inductive transmission encapsulated for operation under the toughest conditions (IP67)

Divisible inductive transmitters with integrated sensor signal amplifier in prop and half shafts for simple assembly.



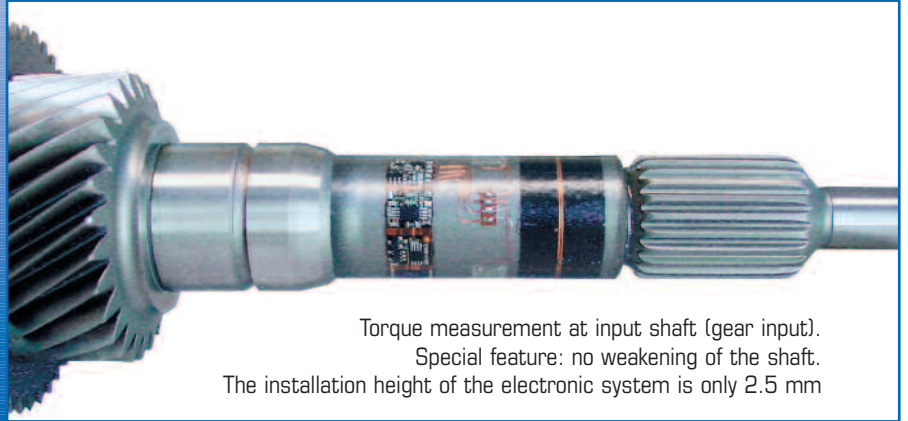
RADIO WHEEL SIGNAL TRANSMITTER

Wheel torque transducers for the most demanding requirements, based on sensortelemetry with radio transmission with integrated overload protection



Wheel telemetry
Single/multi-channel radio transmitter for temperature measurement of brake disks or torque measurement in half shafts

INPUT SHAFT



Torque measurement at input shaft (gear input).
Special feature: no weakening of the shaft.
The installation height of the electronic system is only 2.5 mm



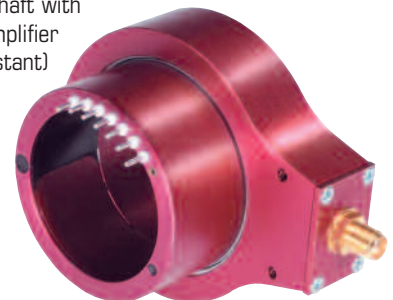
Highly precise measurement of the dynamic torque between the engine and the gear via modified flexplate with 0.1% accuracy.
Temperature range -30 to 160°C

CLUTCH



Temperature measurement at the multi-disk clutch in the automatic gearbox

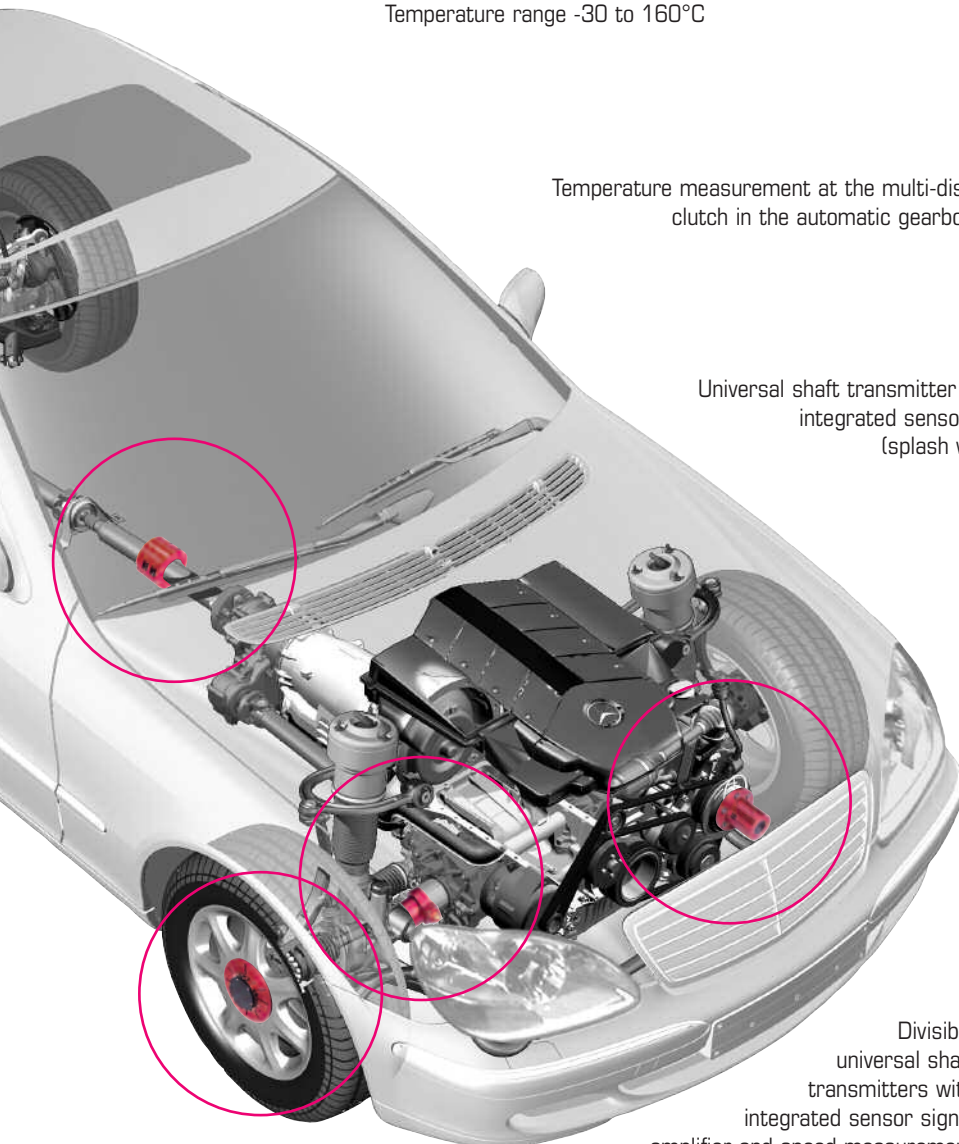
Universal shaft transmitter for prop shaft with integrated sensor signal amplifier (splash water resistant)



UNIVERSAL SHAFT TRANSMITTER

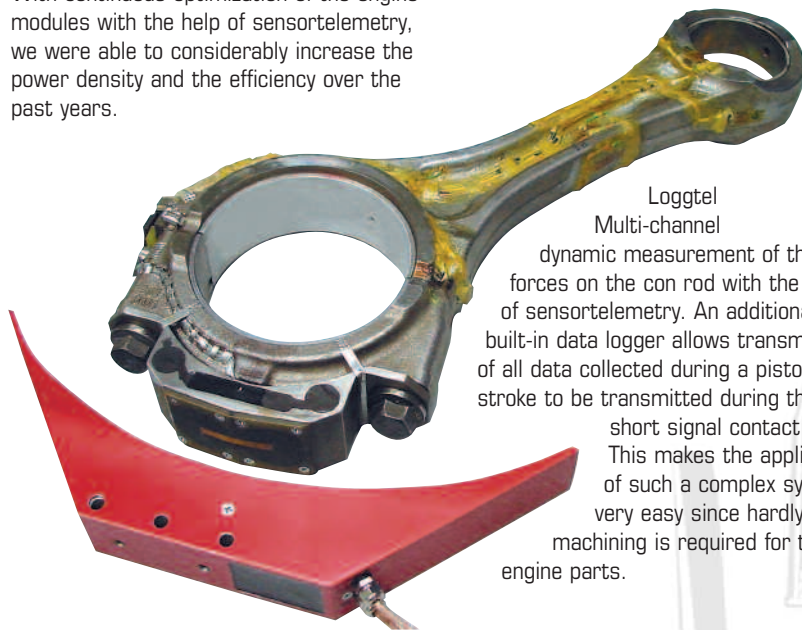


Divisible universal shaft transmitters with integrated sensor signal amplifier and speed measurement (characterized by quick installation, particularly for examination of third party vehicles)

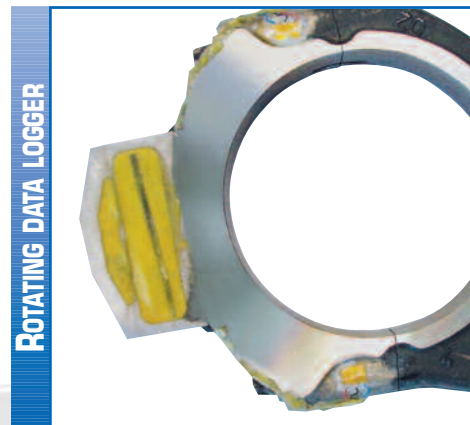


APPLICATIONS RELATED TO ENGINE

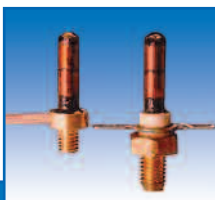
At the heart of every vehicle is the engine. With continuous optimization of the engine modules with the help of sensortelemetry, we were able to considerably increase the power density and the efficiency over the past years.



Loggtel
Multi-channel
dynamic measurement of the forces on the con rod with the help of sensortelemetry. An additional built-in data logger allows transmission of all data collected during a piston stroke to be transmitted during the short signal contact time. This makes the application of such a complex system very easy since hardly any machining is required for the engine parts.



Dynamic multi-channel measurement of the acceleration force (g) on the vehicle con rod during different operating states.



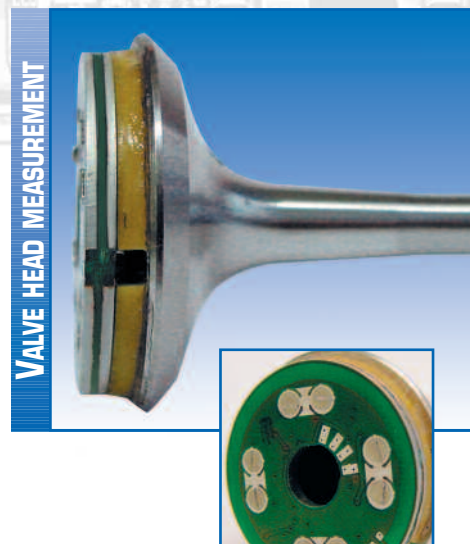
PISTON TEMPERATURE MEASUREMENT

With our high temperature technology, today it is possible to measure the temperature at the piston online for all operating states when the engine is fired. The measuring amplifiers, which are temperature-stable up to 180°C receive a signal from robust thermocouples. The measured temperature values are transmitted once per piston stroke. The transmission elements are extremely compact and can be easily mounted on the piston with minimal mechanical modifications.



Real time measurement of the contact forces of the high-frequency torsion and bending vibration at the fired racing motor F1.

Valve telemetry for unfired operation in order to measure the dynamic forces in the shaft during various engine operating states.

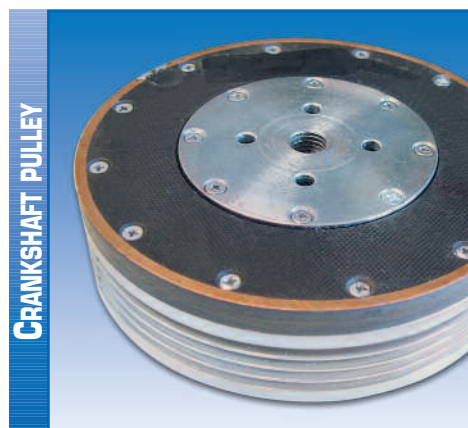
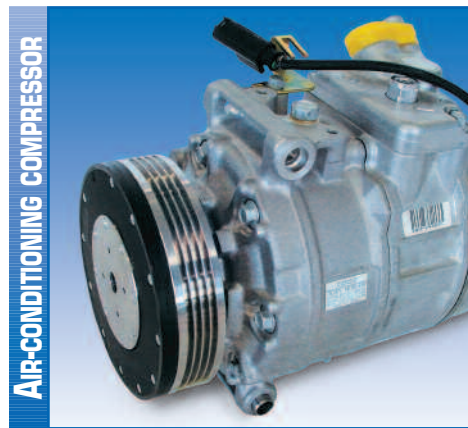


VALVE HEAD MEASUREMENT

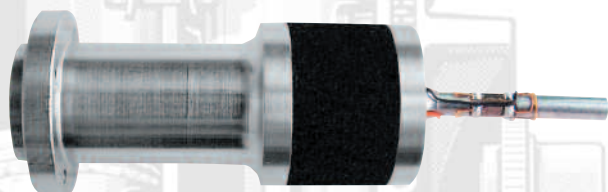


The measurement of dynamic chain forces during circulation in various operating states of the engine provides help in designing the chain tensioners and reducing noise and wear. Signal bandwidth 0 to 40 kHz at an ambient temperature of 150°C.

Torque measurement at the air-conditioning compressor for determining the energy requirement and the reaction on the engine.

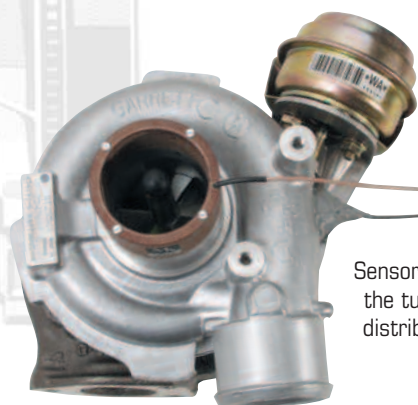


Torque measurement at crankshaft pulley for determining the energy requirement of the auxiliary units and reaction of the auxiliary units on engine operation.



Torque measuring shaft for turbo charger (max. 100,000 rev./min)

8-channel sensortelemetry with axial coupling, real time measurement of the dynamic bending moment/torque development and axial movement of the con rod.



Sensortelemetry is indispensable for optimizing the turbo charger (blade vibrations, temperature distribution).

APPLICATIONS

AVIATION

ROTOR TEST STAND

TURBINES

There are a number of applications in the area of aviation. This does not only apply to tests.

We equip a number of test stands for helicopters and components for measuring torques, temperature and other load parameters with the help of sensortelemetry.

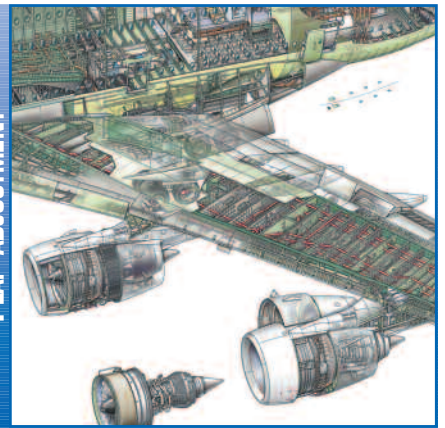
We also offer a mast monitoring system for helicopters which is based on sensortelemetry for series production. Almost every German helicopter has a **MANNER** system on board. It was possible for us to achieve this qualification only because of the high quality of our products.

Today, sensortelemetry is an important tool also for Airbus. Sensortelemetry is used for component testing in several Airbus models (A380, A350, A400 etc.). In these applications, a large number of systems are used in a very limited space without any interference problems.

A special highlight is the **MANNER** turbine telemetry system. Unlike other systems, it works absolutely simultaneously. All measuring points (up to 100 dynamic channels (bandwidth 5 to 50 kHz) and up to 300 temperature measuring channels) are covered simultaneously - a significant advantage compared to the multiplex technique.



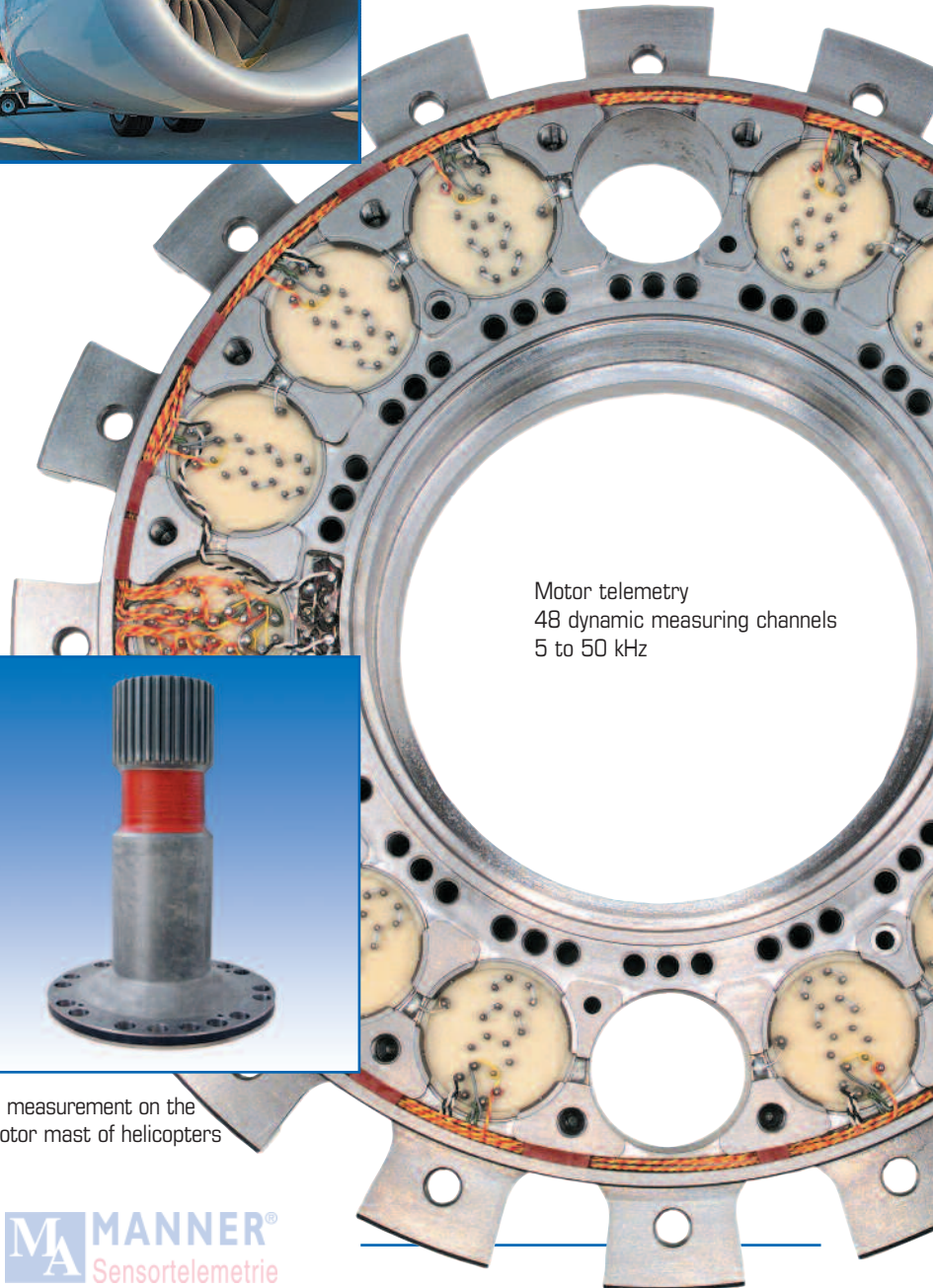
MAST TORQUE MONITORING



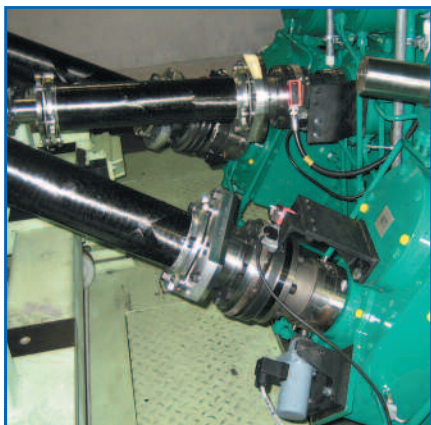
FLAP ADJUSTMENT



VIBRATION MEASUREMENT



Motor telemetry
48 dynamic measuring channels
5 to 50 kHz



ROTOR TEST STAND



Test stand for helicopters with the **MANNER** torque measuring technology

Torque measurement on the main rotor mast of helicopters

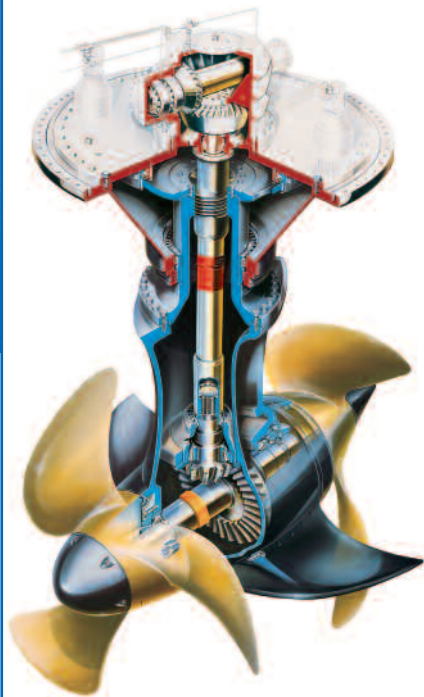
NAVIGATION GEOLOGICAL BORES

Online torque measurement at the propeller shaft

POWER MEASUREMENT

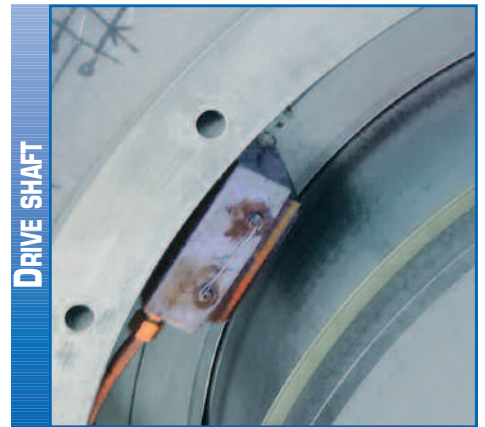


UNDERWATER GEAR



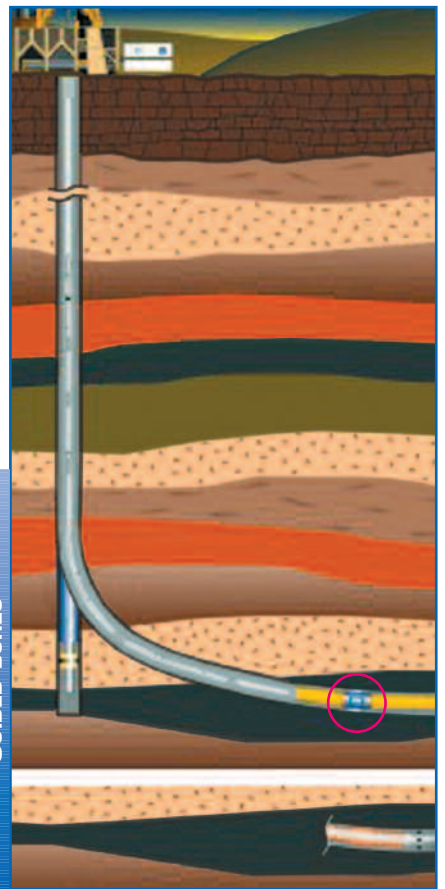
SCHOTTEL twin propeller STP

DRIVE SHAFT



In the area of drilling technology, too, sensortelemetry is used under the roughest conditions (ex) and offers significant advantages for online measurement of the drilling moment, the feed force and the deflection forces which act during drilling. Even the high continuous temperatures of 150°C at a depth of 5000 m are no problem.

GUIDED BORES

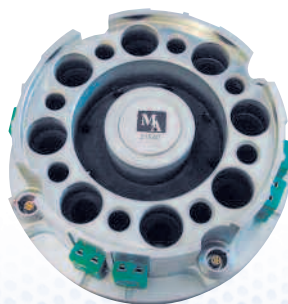


Today, it has become indispensable to measure the mechanical power at the propeller shaft. This measurement not only indicates the power, but is also used for optimizing efficiency and for monitoring purposes. In this process, torque is measured with a strain gage and transmitted in a maintenance-free manner via sensortelemetry.

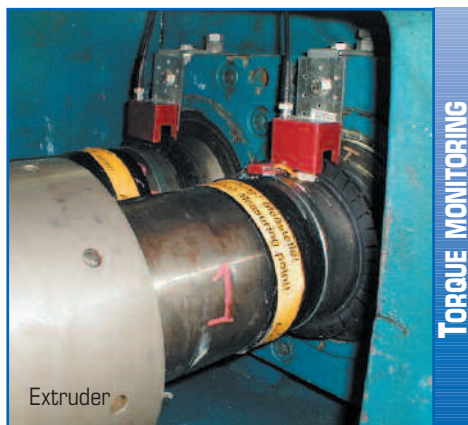
There are a number of applications in the industry. Wherever mechanical power flows, there are rotating shafts. An increasingly important factor in this context is maintenance-free machine monitoring - a task that can be dealt with in the best possible way with Manner **Sensortelemetrie** sensortelemetry systems.

Typical Applications:

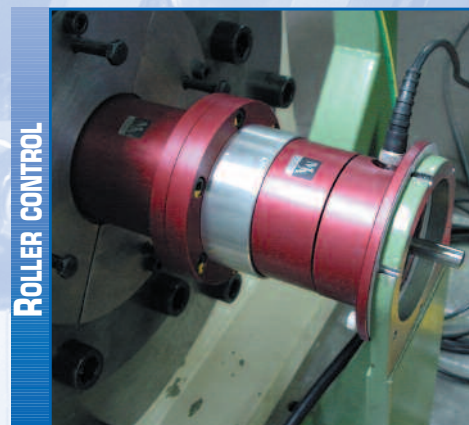
- Torque monitoring
- Early detection of damage of automatic door closures
- Monitoring of the load on gears (estimation of remaining life)
- Rotor temperature monitoring in large-sized motors/generators
- Shaft power measurement in turbo compressors
- Nut torque monitoring in robot running spindles



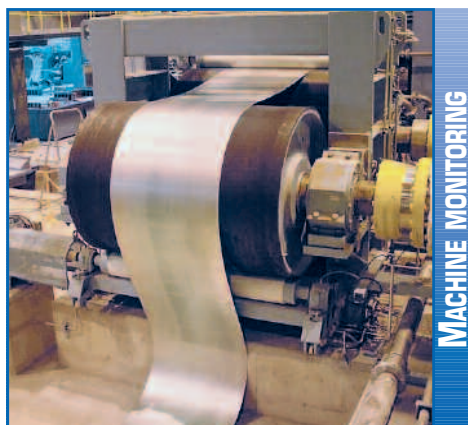
Telemetry measuring flange for test stand applications with thermocouple and strain gage



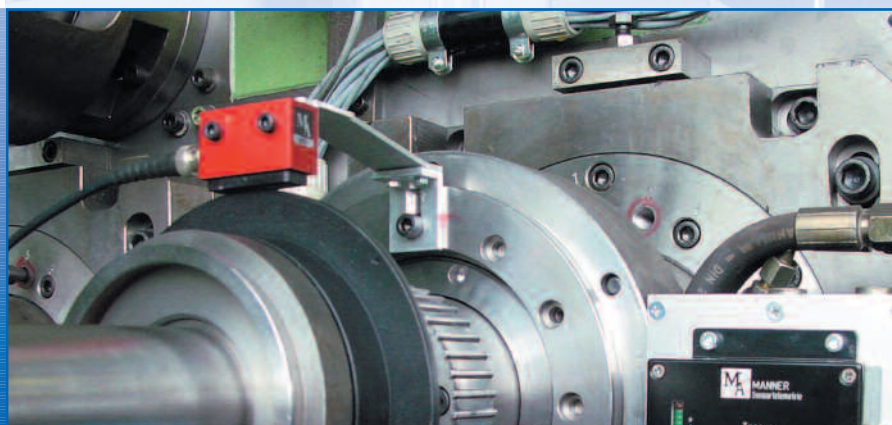
TORQUE MONITORING



ROLLER CONTROL



MACHINE MONITORING



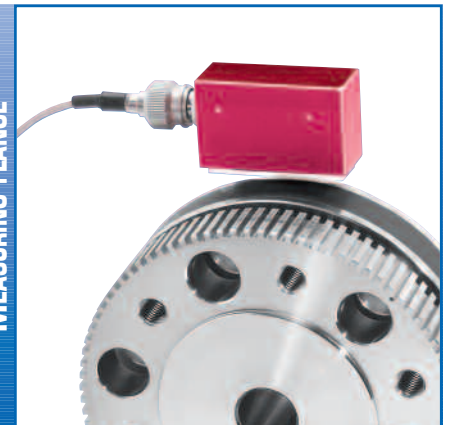


Typical applications:

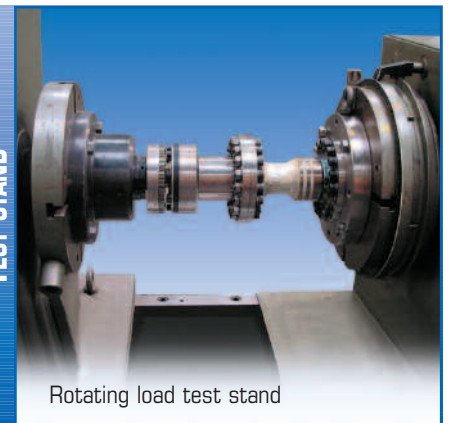
- Viscosity measurement
- Agitator monitoring
- Data transmission from high/low pressure areas
- Polishing devices with inflammable materials
- Feed rate measurement (torque, pressure, temperature)

Automation is becoming more and more common in the chemical and mining sectors too. In this context, a special characteristic is the necessity for explosion-protected components. Sensortelemetry is available according to the Atex standard with the **II 2G EEx ib IIC T4** classification for the chemical industry and with the **II 3D IP67 T125°C** classification for the mining industry.

MEASURING FLANGE



TEST STAND

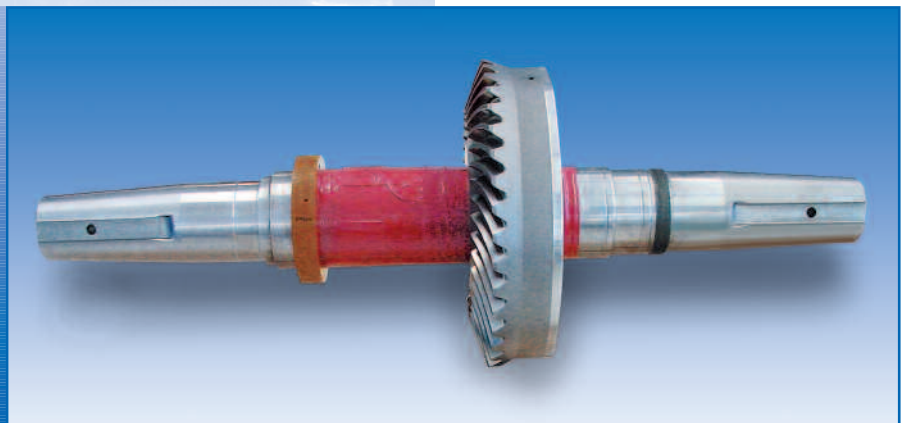
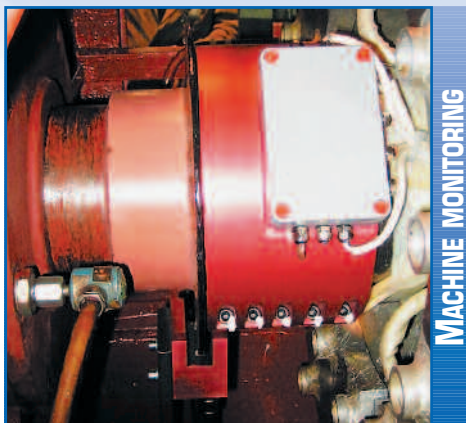


Rotating load test stand

TEST STAND

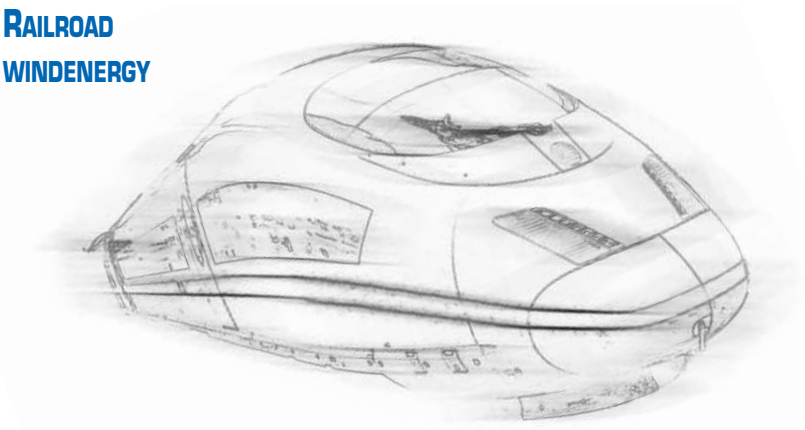


MACHINE MONITORING



APPLICATIONS

RAILROAD
WINDENERGY



POWER MEASUREMENT



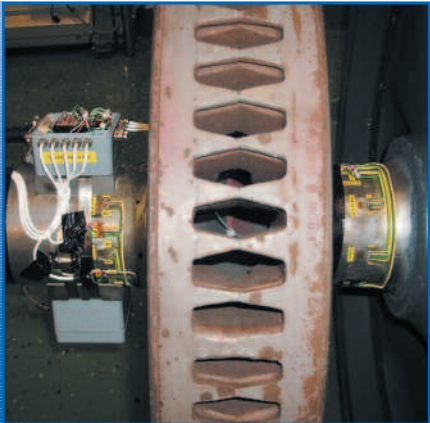
Brake test stand - test stand for train brakes with sensortelemetry (24 measuring channels, strain gage and temperature)

BRAKE TEST STAND

Due to the increase in speed in the railroad sector, it has become necessary to optimize a large number of components. Here, too, sensortelemetry provides dynamic load data at the shafts in real time during travel. The load scenarios are simulated at test stands.



POWER MEASUREMENT



POWER MEASUREMENT



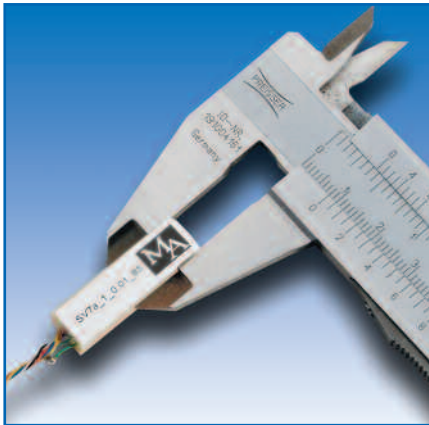
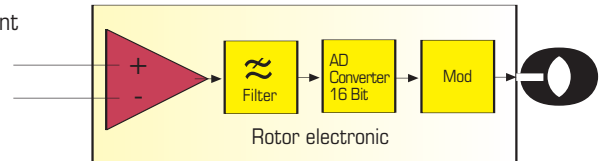
With its single and multi-channel systems, sensortelemetry is an indispensable tool for optimization and continuous monitoring of wind power plants.



The quality of measurement data acquisition depends on the sensor signal amplifier of a sensortelemetry system.

In this context, the following characteristics play an important role:

- Size
- Weight
- Stability with regard to ambient conditions (oil, water, etc.)
- Acceleration stability
- Robustness
- Temperature stability
- Drift characteristics
- Measuring accuracy and resolution



Standard models

Due to the different shapes and sizes of the housing, it can be adapted to most applications. Thanks to the use of sturdy solder pins, a reliable connection to the sensors is ensured even under severe ambient conditions.

Miniature models

Space requirement is a deciding factor for the use of telemetry. That is why Manner started focusing on the development of miniature sensor signal amplifiers at a very early stage.

As a result of our consistent miniaturization efforts, today we can provide single channel sensor signal amplifiers with a size of only 7 x 25 x 6 mm and a weight of 2 g!



Flex technology

Thanks to a specially developed flex substrate (installation height <2.5 mm), the sensor signal amplifier is flexible and can be wound around the shaft and then encapsulated. The smallest bending radius is 8 mm.

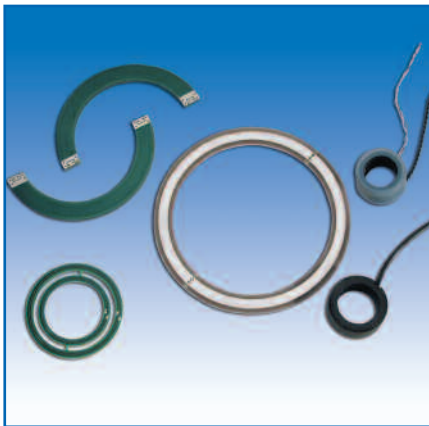
This technology opens the door to previously unimaginable applications involving input shafts, toothed wheels, universal shaft transmitters, injection pumps etc.

THE RIGHT TRANSMISSION TECHNOLOGY WITH DIGITAL TRANSMISSION

Although the time-tested analog technique with FM modulation is still used, today we mainly use digital transmission techniques for inductive as well as radio transmission.

This offers the following advantages

- High resolution of the measuring signals (16 bit)
- Minimum temperature drift < 0.002 %/°C in the measuring range 1 mV/V
- High temperature stability up to an ambient temperature of 180°C
- High transmission speed under EMC conditions
- Additional increase in transmission safety through CRC (checksum) data storage
- No cross-talk with multi-channel technology
- High data rates and number of channels (200 kSample/sec/channel) with simultaneous use of 48 channels

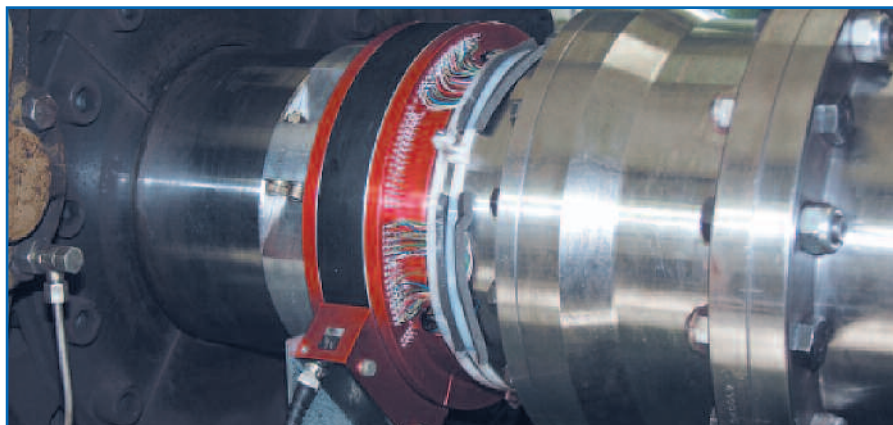
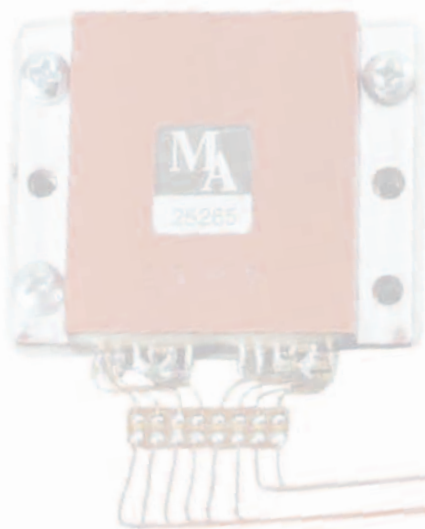
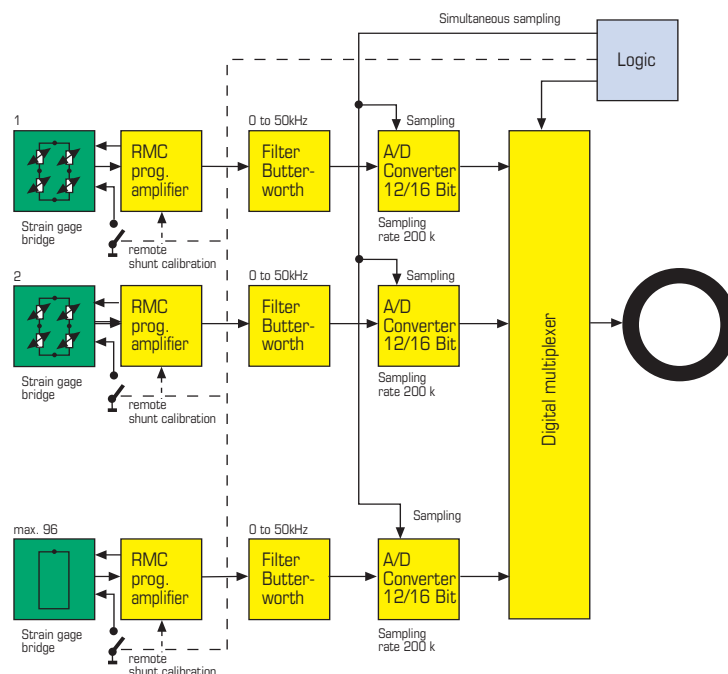
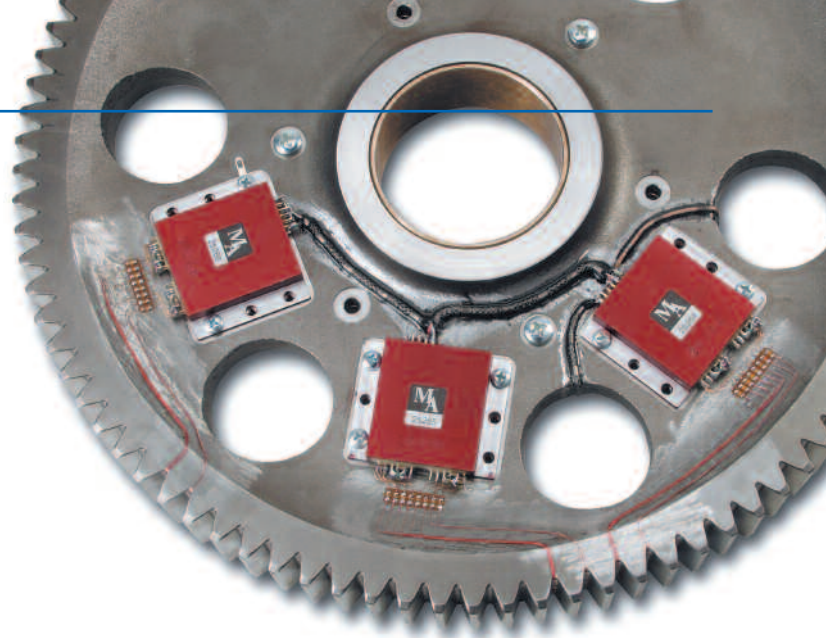


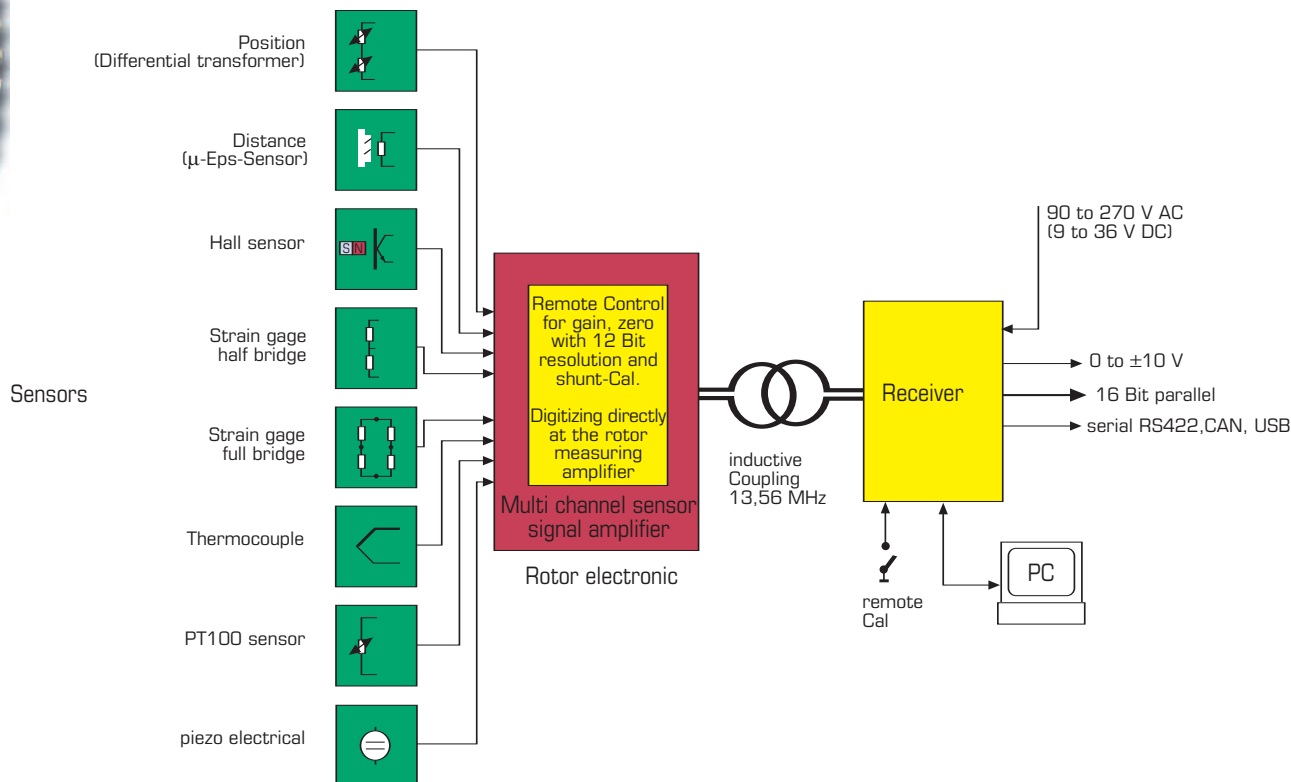
MULTI-CHANNEL TECHNOLOGY

Sensortelemetry is also available with several channels.

Key data:

- FM or digital technology
- High resolution (max. 16 bit)
- Simultaneous transmission of up to 100 measuring channels (sample rate of 200 kSample/channel/sec)
- Sample rates up to 400 kSample/channel/sec
- Max. total data rate 200 Mbit/sec
- Externally synchronized sampling
- No cross-talk due to digital multiplexing
- Separate supply voltage for individual sensors
- Optional scanner operation - up to 1000 measuring channels
- High temperature stability up to 180°C
- Acceleration stability up to 100,000 g
- Integrated data storage CRC
- Remote conditioning of measuring ranges
- Modular design (distributed arrangement, bus technology)





SENSOR

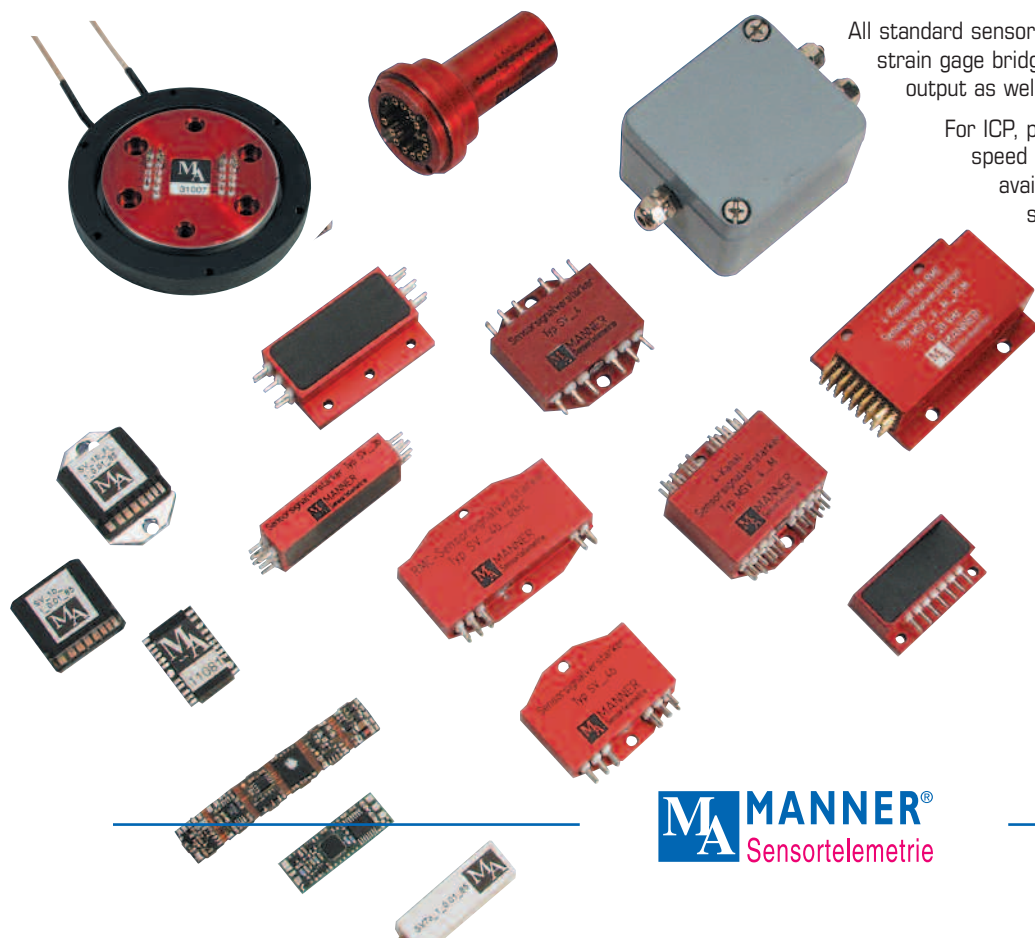
A major advantage of **MANNER** sensortelemetry systems is that they are equipped with high-quality sensor signal amplifiers. With these amplifiers, even the smallest sensor signals in microvolt range (0.05 mV/V) can be processed correctly. With regard to amplification and zero point, the input measuring amplifiers can be almost freely conditioned electronically - you do not need additional pre-amplifiers.

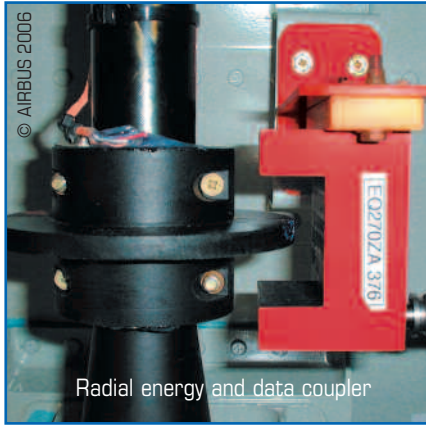
All sensor cells without integrated measuring amplifier available in the market can be directly switched on. This saves power in the rotating system and, therefore, reduces costs.

All standard sensor signal amplifiers can directly process all strain gage bridge models or sensors with voltage or current output as well as PT100 and thermocouples.

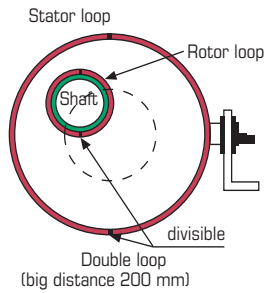
For ICP, piezo-electric, μ - ϵ -, and LVDT sensors, special speed and temperature stable input modules are available which are usually integrated in the sensor signal amplifier.

Naturally, supply to active sensors is also taken care of via sensortelemetry.

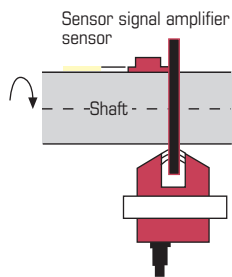
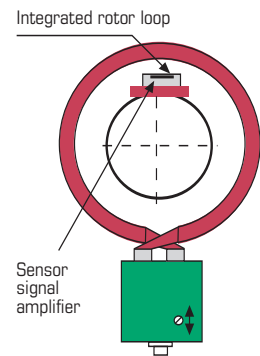




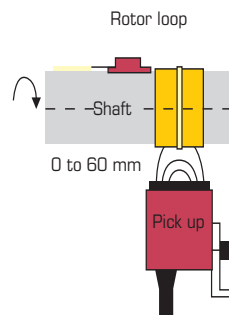
RADIAL CONNECTION



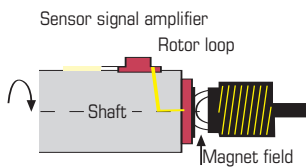
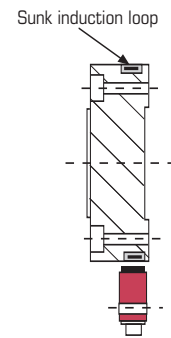
RADIAL CONNECTION



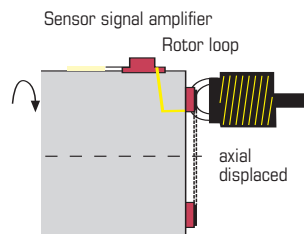
RADIAL CONNECTION



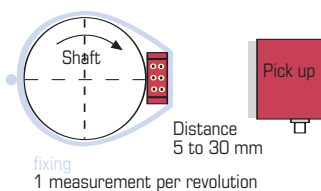
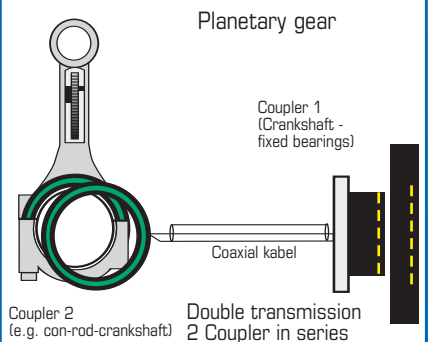
RADIAL CONNECTION



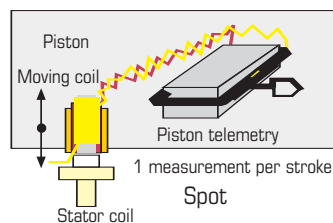
AXIAL CONNECTION



DOUBLE COUPLING



Spot



TRANSMISSION POSSIBILITIES OF INDUCTIVE SENSORETELEMETRY

Since sensortelemetry offers various ways of signal transmission, it is possible to find solutions for even the most difficult installation conditions in units.



EVALUATION UNITS

Various evaluation unit models are available for your applications. 19" models are generally used for switch cabinet applications with 230 Volt AC supply, whereas compact models with 9 ... 36 V DC supply are preferably used for vehicle applications.

INTERFACES

Since telemetry normally constitutes only a part of the entire measurement recording system, it is very important to integrate it seamlessly.

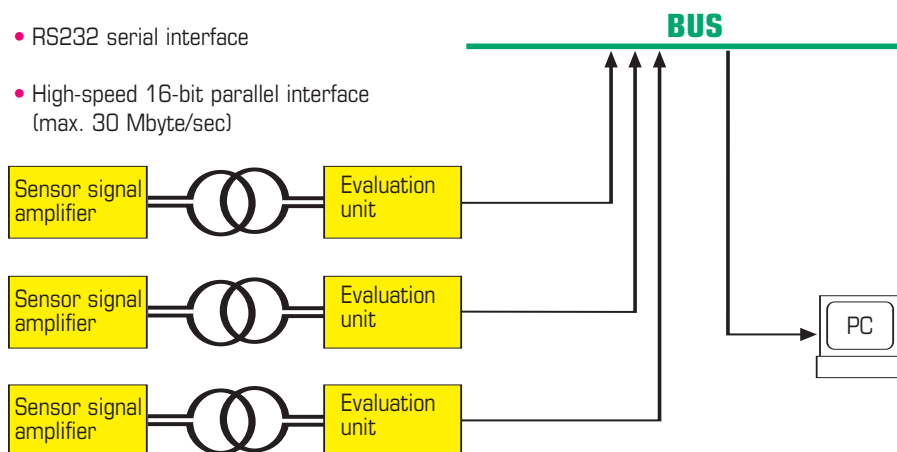
Our systems are equipped as standard with the following features:

- Analog voltage interface (0 to ± 10 V or 0 to ± 5 V), or with a 0(4) to 20 mA current interface
- With FM systems, optionally with a 10 kHz ± 5 kHz frequency interface, TLL level

With digital telemetry systems, it doesn't make sense to convert digital telemetry values into analog values and then re-convert them into digital values again in the measuring system. This is why digital interfaces are becoming more and more important.

The following interfaces are available:

- USB serial interface
- CAN serial interface
- RS232 serial interface
- High-speed 16-bit parallel interface (max. 30 Mbyte/sec)



PLUG-IN CARD FOR MGC

For single channel systems, a plug-in card is available for the Hottinger MGC. It allows you to directly connect telemetry channels to Hottinger detection systems.

REMOTE CONTROL

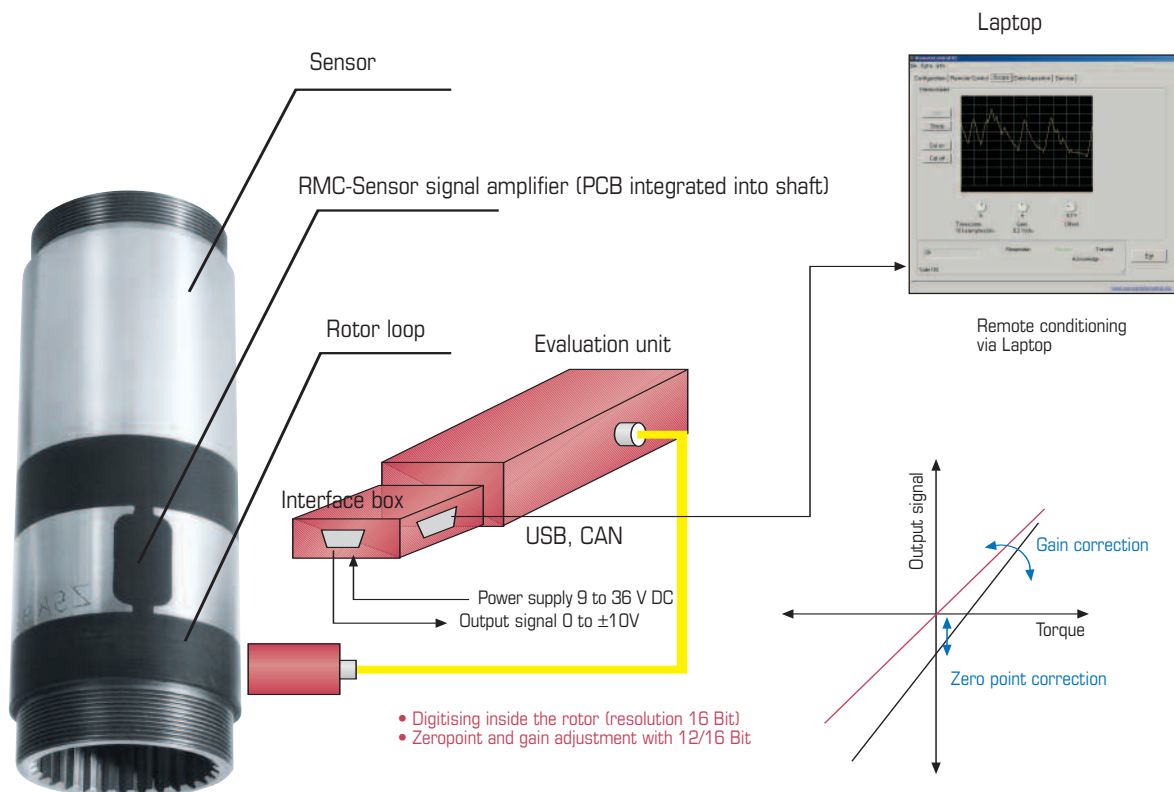
MANNER Sensortelemetrie was the first to introduce remote-controlled measuring range selection, which is available for both single and multiple channel systems. Due to consistent further development, today it is possible to set digital systems with 16 bit resolution, zero point and amplification almost infinitely on the sensor signal amplifier. In other words, the entire adjustment is performed online in the rotor on the input amplifier. The setting range for sensitivity is between 0.05 mV/V and 20 mV/V and for zero point between 0 and 2.5 mV/V. Data transmission occurs via the bi-directional telemetry line.

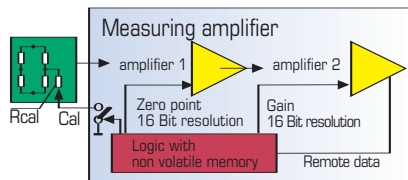
Significant advantages:

- Short commissioning times
- No solder resistors
- Infinite measuring range selection and zero point adjustment online during the measurement without mechanical access to the rotor
- With a standardized output signal at the sensor signal amplifier, various sensor signal amplifiers can be operated with an evaluation unit without loss of calibration.
- Error-free measurement through direct input of the physical parameter (torque, force...)
- Electronic amplifier detection with serial number identification

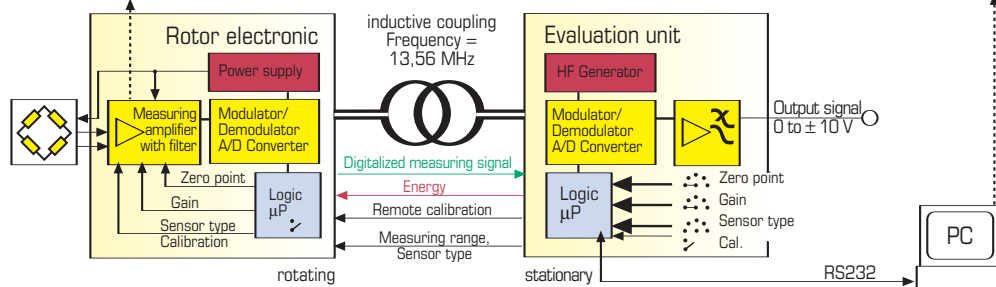
RMC-Technology - (not only) a matter of comfort

In many cases, the expected signal values can be estimated only to a limited extent. For example, installation in a gear involves a lot of assembly work and high test stand costs. Without the RMC function, an incorrectly selected measuring range means the gear and the sealed amplifier must be opened again, the rotor electronics must be readjusted - a task requiring a lot of effort - and then the units must be assembled again.





Remote controlled adjustment of the measuring amplifier



How does the RMC technique work?

The sensor signal amplifier has a programmable amplifier whose input offset and amplification are digitally adjustable. An integrated processor supplies the necessary data to the amplifier and decodes the data transmitted via the telemetry line. This data is saved in a permanent storage and is therefore immediately available even if there is a power failure or if commissioning must be performed again. The conditioning data is stored in the sensor signal amplifier until new data is entered; the new data is generated at the stationary end. With a program, the measuring range and the zero point (in mV/V) can be set in a user-friendly manner via a PDA or laptop. Display of the current measured values and automatic zero point setting are standard features..

Adjustment in the rotor with RMC technology

In order to optimize accuracy and resolution, it is necessary to use the entire control range of the telemetry channel. This is possible only with optimized adjustment of the measuring range and the zero point. Since the sensor signal values at trial parts vary to a large extent (20 µV to 100 mV), the conventional method of adjusting the amplification and the zero point with resistors is extremely time-consuming, especially in case of small signals. Another problem is the speed-stable installation of resistors.

RMC technology in half shafts

Due to the rough testing conditions, half shafts in passenger cars must be enclosed, which is a very complex task. In the course of production, calibration is the last step. With RMC technology, settings for enclosed shafts can be performed during the calibration process. Incorrect calculations of balancing resistances are a thing of the past; later corrections can be performed without opening the enclosure. A zero point offset caused due to plastic deformation of the shaft during a start-off maneuver can also be easily corrected.

Multi-channel system and RMC technology

With a 25-channel sensor signal amplifier, every channel must be separately adjusted. Due to the frequent demand for compact design and the large number of connected sensor wires, soldering of measuring range and zero point resistors is a real challenge. Even if only one channel has to be changed, this usually necessitates a time-consuming re-instrumentation, which is further complicated by the speed-stable enclosure. You don't have these problems with RMC technology since every channel can be conditioned at any time - even during the measurement - from the laptop.

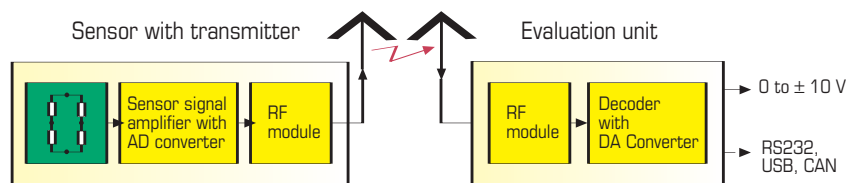




For certain applications, it is advantageous to use sensortelemetry with radio transmission since this does not require the use of a rotor induction loop (system supply with a battery) and the receiving antenna can be shifted by up to 50 m, depending on the requirements. Another advantage is that the unit can be mounted quickly.

Preferred applications:

- Short-term measurements in the test range (< 1 day)
- Wheel measurements on the vehicle with the goal of avoiding disturbing supply lines
- Measurements on large shafts (< 1 m; cement mills, wind power mills)
- Shafts with large movements under load (> 50 mm; train drives)
- Force measurement at conveyor chains



How does sensortelemetry with radio transmission work?

Whereas inductive sensortelemetry works with an inductive interface, sensortelemetry with radio transmission works with a radio interface. The time-tested PCM technique, which is characterized by the highest interference immunity, is used as the modulation technique. The transmission is purely digital (PCM technology) with 12 or 16 bit resolution. The highly accurate measuring amplifier cells are identical to inductive systems; handling, measurement accuracy and adjustment of the sensor signal amplifier are as usual. RMC technology (programmable measuring range setting) is also available. **MANNER** sensortelemetry with radio transmission was specially developed for severe condition use in measurements with demanding ambient conditions.

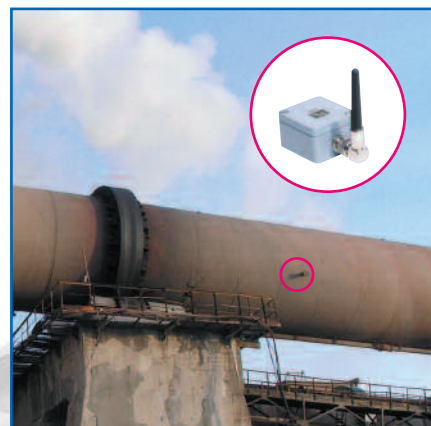
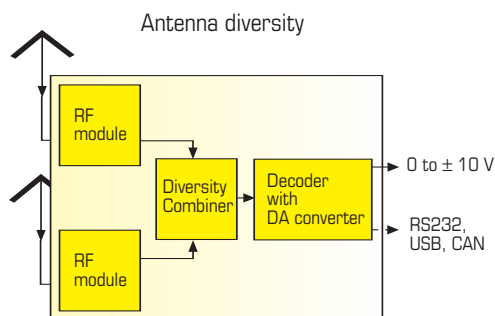
Radio interferences?

A radio transmission line is susceptible to interferences, multiple-path reception, fading, EMC and location-dependent signal zeroizing. With the special **MANNER** data transmission safety protocol (CRC), transmission errors are detected and suppressed 100 % so that it is not necessary to correct the measured values later.

Antenna diversity

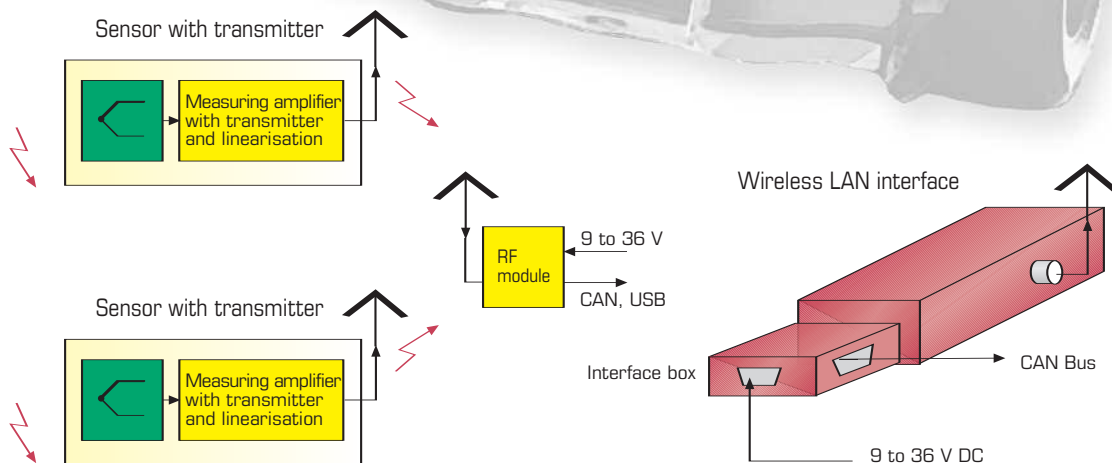
Due to the use of 2 receivers with antennas at various locations and a downstream diversity combiner, the reception in a high interference environment can be improved by a factor of up to 1000. The diversity combiner selects the error-free data signal from the two receiver signals. Especially in case of large shafts with rotation angle dependent shading, interferences, multi-path reception and fading, the measurement signal transmission can take place with almost no loss of data.

Sensortelemetry with radio transmission is particularly advantageous for short-term measurement on rolling roads, rotary furnaces and cement mills. Unlike conventional radio technology, antenna diversity ensures that there is neither any disturbance nor loss of data even in case of shading and fading.



Radio LAN technology

With radio LAN technology, measurement signals of locally distributed sensor signal amplifiers (e.g. vehicle with 4 test rims) can be detected with one receiver and digitally transferred to the measurement recording system via CAN. All LAN sensor signal amplifiers



At **MANNER Sensortelemetrie**, we do not see ourselves as a mere supplier of telemetry components. We advise customers on how to solve specific problems in the best way, which sensors to use and how the transmission should be designed in order to achieve good results. This also includes project planning for problem solving with a fixed price quote.

Naturally, we mount the telemetry system as well as the necessary sensors, put the systems into operation, and train the users.

MANNER is a specialist for solving customer-specific problems at a very high level.

One of our main areas of expertise is the development of customized torque transducers.

We solve even those problems which others shy away from.

We don't consider our job done until you are satisfied.

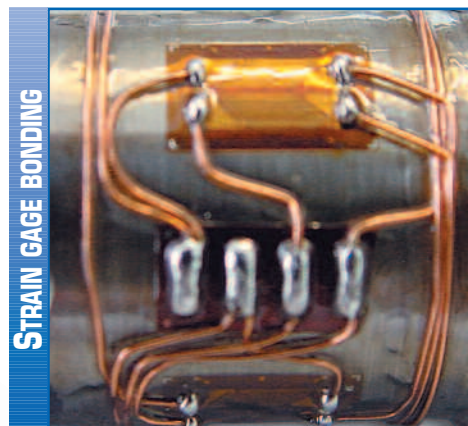
An excellent team of engineers and our experience of many years ensure your success.

Our assets include:

- Our electronics development team
- Our design engineering group with finite element calculation and calculations related to shaft dynamics
- Our strain gage application group
- Four on-site force calibration stands for torques
- Two centrifugal devices for speeds up to 27,000 rev./min.
- Several climatic test cabinets
- A shaker



STRAIN GAGE BONDING



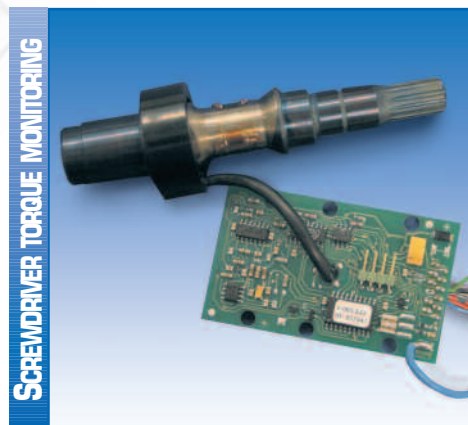
STRAIN GAGE BONDING



CENTRIFUGE TEST STAND



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Turbine applications

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DLR
Mannesmann Turbomachines
Universität Karlsruhe

Wind power plants

Eickhoff
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Winergy

Test stand construction

ESEM Grünau GmbH, Markdorf
GIM
LUK
Strama, Straubing
TU München, Lehrst. für Maschinenelemente

Chemical industry

BASF (Drehofen)
Bayer Leverkusen
BP Köln
Degussa
Dow Chemical
Ekato (Mischmaschinen)
Linde



SIEMENS

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Steel industry

BFI Düsseldorf
Thyssen Steel
VAW Aluminium
Voest Alpine

Mining, underground work

Baker Hughes
Deutsche Montantechnologie, Bochum
Eickhoff, Bochum
Ruhrkohle Niederrhein AG
Schleicher

Railroad applications

Alstom
Deutsche Bahn, Minden
Italianische Staatsbahn
Lucchini

Series applications

Coperion (Kunststoffextruder)
Eurocopter (Hubschrauber EC135/145)

Institutes/colleges

Uni Bradford
Uni Hannover
Uni Stuttgart
TU Dresden
TU München

EXTRACT FROM OUR LIST OF REFERENCES

Motor vehicle industry

BMW
Daimler Chrysler AG, Stuttgart
Fiat, Italien
Honda, Japan
Hyundai Motors, Korea
Opel AG, Rüsselsheim
Porsche AG, Stuttgart
Toyota, Köln
Volvo, Belgien

General machine construction

Caterpillar, Kiel
Deutz AG
Heidelberger Druck, Heidelberg
Hilti
MAN
Mannesmann-Demag Fördertechnik
Renk, Augsburg
Schottel
Stihl, Waiblingen
Thyssen Rothe Erde
Wärtsilä

Motor vehicle sub-suppliers

Bosch
Goodyear
LUK, Bühl
Mannesmann Sachs, Schweinfurt
Spicer



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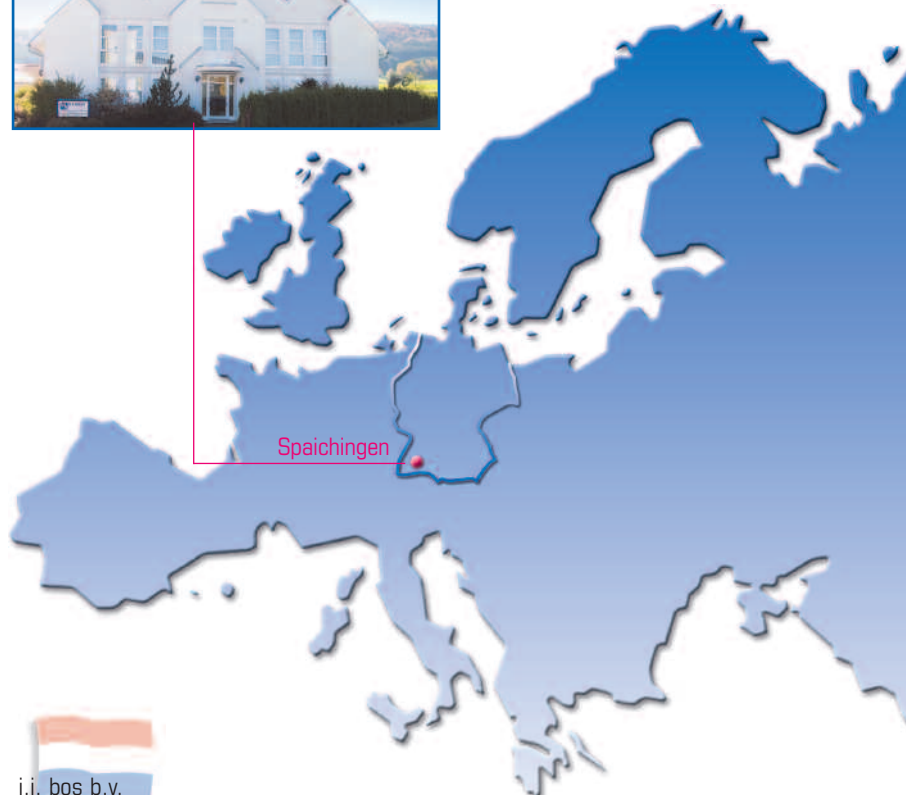
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