# Operating manual

## Sensor Signal Amplifier SV_2Lg

1-Channel, PCM

Shaft Transmitter, Divisible

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**Disclaimer Documentation**

The texts and examples were prepared with care. Mistakes can not be excluded. The enterprise Manner Sensortelemetrie will assume no liability for missing or incorrect information and resulting consequences, neither judicial nor otherwise.

**Modifications**

The enterprise Manner Sensortelemetrie GmbH may change or upgrade hardware and software – or parts of them - as well as the provided documents (operation instructions, start-up instructions, spare parts lists) – or parts of them – without notification.

We would be pleased for suggestion for improvement and notes about mistakes.

# Table of contents


**1 Safety** ..... **4**
1.1 Definition of Warnings ..... 4
1.2 General Warnings ..... 4
**2 Conventional Usage** ..... **6**
**3 Technical Data** ..... **7**
3.1 Measuring System ..... 7
3.2 Shaft Transmitter, Divisible ..... 8
3.2.1 Gain Bandwidth Characteristic ..... 10
3.2.2 Operation Mode Strain Gauge Bridge ..... 10
3.2.3 Remote Shunt Calibration Function ..... 12
3.2.4 List for Shunt Calibration Resistor ..... 13
3.2.5 Operation Mode PT100 ..... 14
**4 Mounting / Starting** ..... **15**
4.1 Coupling / Installation ..... 15
4.2 Mounting Instructions ..... 17
4.3 Starting / Adjustment ..... 17
**5 Options** ..... **19**
**6 Maintenance** ..... **20**
**7 Contact** ..... **21**

# 1 Safety

## 1.1 Definition of Warnings

**DANGER!**
Hint for possible dangerous situation. Ignoring the security terms may cause death or serious injury.

**WARNING!**
Hint for possible dangerous situation.

Ignoring the security terms may cause injury.

**CAUTION!**
Hint for possible damage of property, if the corresponding protective measure were disregarded.

Further information

## 1.2 General Warnings

The system startup has to be carried out by trained qualified personnel, who is able to evaluate the potential risks. All chapters of this instruction manual had to be read and fully understood before startup.

On non-observance it's not possible to assert a claim for the incurred losses from the manufacturer. Any changes to the system, except those described in the instruction manual and customer documentation, will invalidate any warranty.

**DANGER!**
**Risk of Injury by Incorrect Installation**
*Incorrect installation can cause injury to persons directly while the installation or during the subsequent startup*

**Note the Mounting Hint (see chapter 4, installation instruction)**

The system startup has to be carried out by instructed qualified personnel that's familiar with

- the professional handling of security relevant components,
- the valid regulations for operational safety und rules for accident prevention.

**DANGER!**
**Risk of Injury by Unintentional Startup**
*Rotating or moving of parts by inadvertent startup of the machine can cause injury .*

During all mounting, demounting or repairing the system has to be powered-off. Note the mounting instructions.

**DANGER!**

**Risk of Injury by Movable Parts**

*While normal operation, as well as inadvertent loosening of parts of the telemetry system during operation, present persons may be injured if protective equipment is absent.*

Check the safety function of the protective equipment particularly

- before each startup
- after each replacement of a component
- after a longer standstill
- after each defect

Independent thereof the safety function of the protective equipment must be checked in suitable time intervals as part of the maintenance work!

**WARNING!**

**Risk of Burn Injury**

*While operation the sensor signal amplifier and the stator antenna may become warm.*

Avoid contact.

**CAUTION!**

**Risk of Property Damage**

***If the connectors disconnected / connected while the system is powered on the telemetry system as well as the connected devices can be damaged.***

**Plug connectors must not be disconnected / connected when the system is powered on.**

# 2 Conventional Usage

Sensor telemetry systems are used for contact-free data and power transfer from passive and active sensors (e.g. on rotating shafts).

**DANGER!**

**Risk of Subsequent Damages caused by Malfunctions**

*If the telemetry system is used for controlling or regulating functions it is not conceive for, subsequent damages up to injury to persons can be caused.*

**The delivered system has to be used exclusively used for the purpose for which it was ordered.**

The operator must take care of his health and safety.

The operator of the equipment must prevent subsequent errors following faulty measuring results. This is particularly necessary if the telemetry system is used in controlling or regulating functions.

**The customer, as the builder of a system with an integrated sensor telemetry system, is responsible for the correct and conform operation and also assumes the responsibility for ensuring that the system at start-up complies with all provisions of Directives 2014/53/EU and 2014/35/EU.**

**Scope of Delivery**

A telemetry system normally contains:

- Evaluation unit
- Stator antenna
- Rotor antenna
- Sensor signal amplifier
- HF cable

For the detailed purchased parts package of the delivered telemetry system mind the corresponding shipping ticket.

# 3 Technical Data

## 3.1 Measuring System

**Technical Data Telemetry System**

| Term | Value |
|---|---|
| HF frequency | 13.56 MHz |
| Number of channels | 1 |
| Bandwidth | 0 to 1 kHz (-3dB) |
| Linearity | <0.1% |

**General Measuring Configuration**

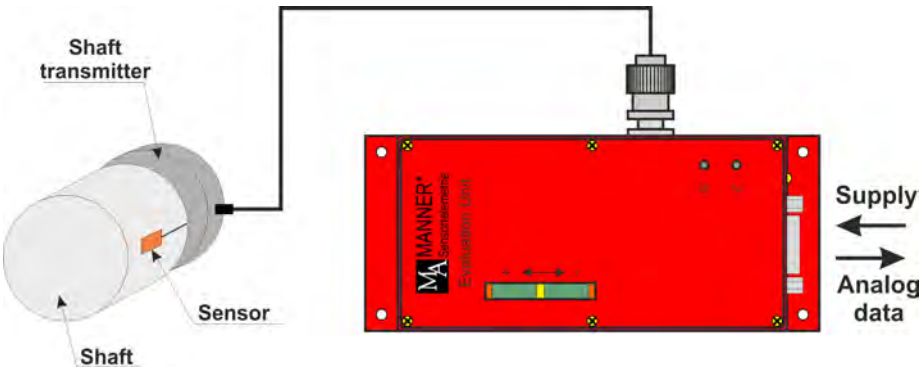


*Fig. 1: General measuring configuration*

**Block Diagram**

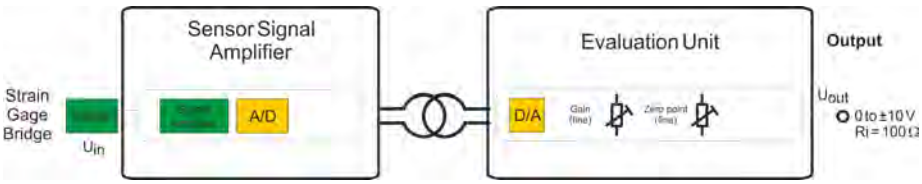


*Fig. 2: Blockdiagramm*

**Energy and Data Flow**

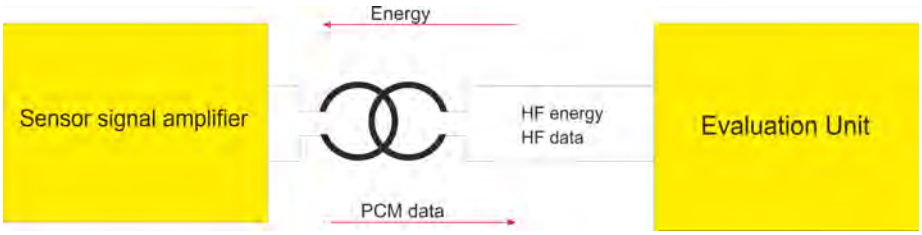


*Fig. 3: Energy and data flow*

## 3.2 Shaft Transmitter, Divisible

**Technical Data Shaft Transmitter**

| Term | Value |
|---|---|
| Type shaft transmitter | **SV_2Lg_PCM16** |
| Sensor | Strain gauge<br>(strain gauge resistor ≥350 Ω) |
| Type of modulation | PCM |
| HF frequency | 13.56 MHz |
| Sample rate | 6.62 kS/s |
| Bridge supply voltage | 3.3 V |
| Zeropoint and gain drift | 0.02% / °C |
| Linearity | 0.1% typ. |
| Amplification (adjustable by solder resistor) | 0.1 to 20 mV/V |
| Bandwidth | 0 to 1 kHz |
| Resolution | 16 Bit mit 16 Bit CRC |
| Maximum RPM | 3000 rpm |
| Coaxial cable | RG316, 4 m, Fischer to BNC |
| Protection class | IP65 |
| Temperature range | -10 to +85°C |

**Scale Drawing Shaft Transmitter**

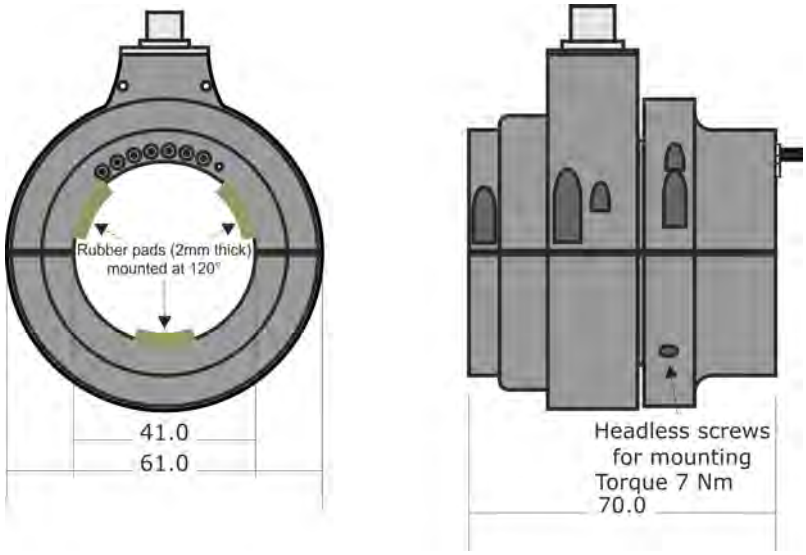


*Fig. 4: SV_2Lg_PCM16, mechanic*

**Pin Assignment Shaft Transmitter**

**NOTICE!**

**Possible Damage to the Rotor Electronics while soldering**

A soldering that is too long or too hot can damage the sensor signal amplifier. Keep soldering as short as possible. If necessary, allow to cool.

**NOTICE!**

**Damaging of Electronic**

*Condensation may cause unwanted contact between the pins*

To prevent any effects of condensation the pin connections must be waterproofed!

The sensor signal amplifier must be grounded by connecting the GND pin to the rotor .

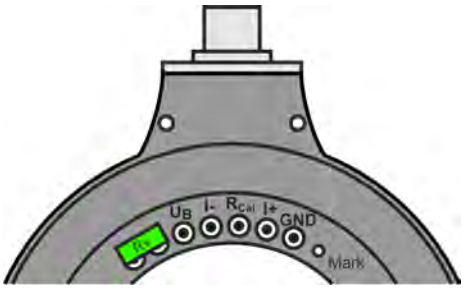


*Fig. 5: SV_2Lg_PCM16, pin assignment*

**Shaft Transmitter, Rotor Antenna Connection**

**Solder all connections while assembly**

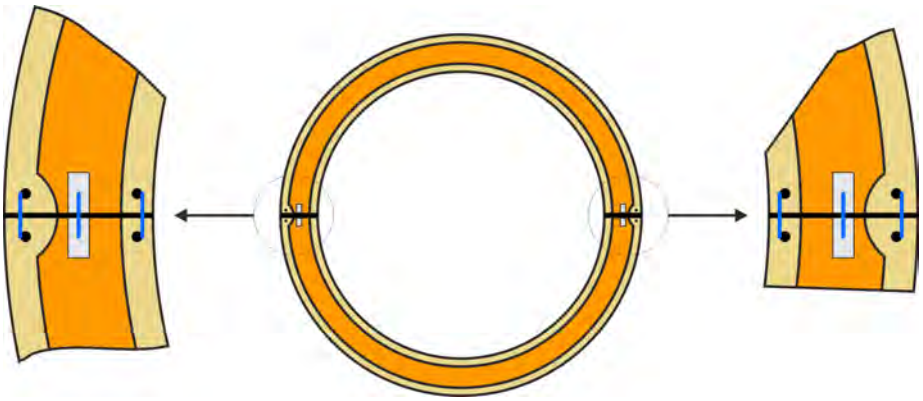

*Fig. 6: Shaft transmitter, closure the rotor antenna*

## 3.2.1 Gain Bandwidth Characteristic

**Gain Bandwidth Characteristic**


*Fig. 7: Gain bandwidth characteristic*

The output signal bandwidth ranges from 0 to 1 kHz.

## 3.2.2 Operation Mode Strain Gauge Bridge

**Operation Mode Strain Gauge (Full Bridge)**

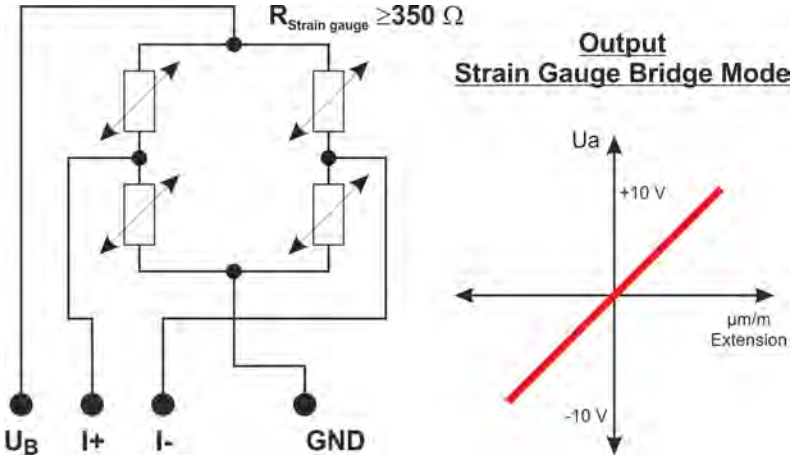


*Fig. 8: Operation mode strain gauge (full bridge)*

| Resistor Rv [kΩ] | Sensitivity [mV/V] |
|---|---|
| 24.8 | 4 |
| 12.4 | 2 |
| **6.2** | **1** |
| 3.1 | 0.5 |
| 1.55 | 0.25 |
| 0.775 | 0.125 |

**Operation Mode Strain Gauge (Half Bridge)**

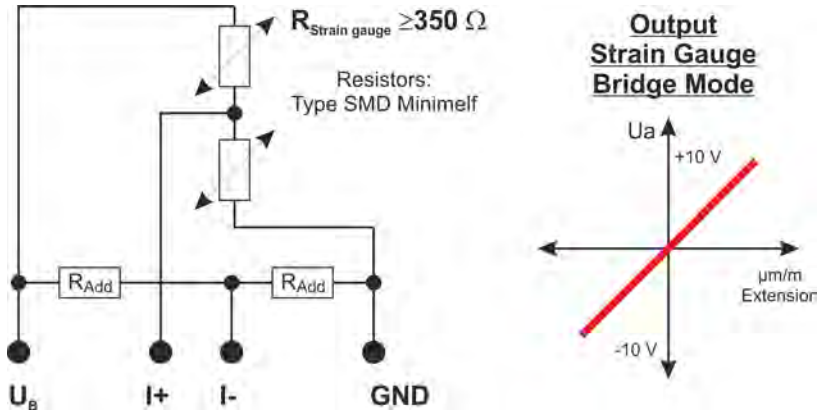


*Fig. 9: Operation mode strain gauge (half bridge)*

Additional resistors $R_{Add}$ = 1 kΩ, 0.1 %, Tk 15

**Operation Mode Strain Gauge (Quarter Bridge)**

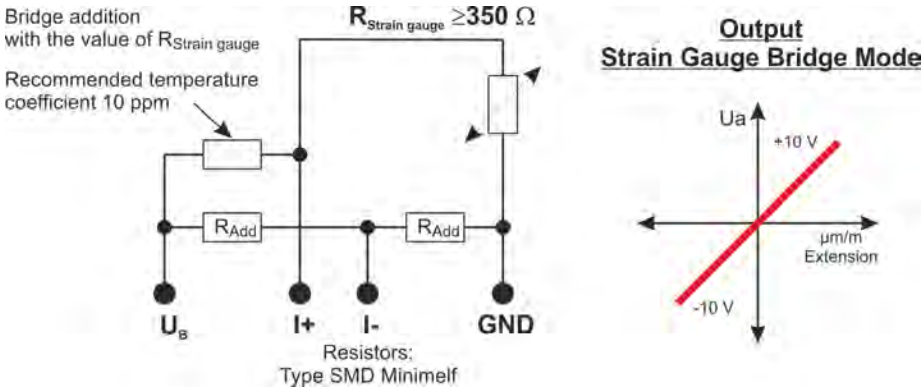


*Fig. 10: Operation mode strain gauge (quarter bridge)*

Additional resistors $R_{Add}$ = 1 kΩ, 0.1 %, Tk 15

### 3.2.3 Remote Shunt Calibration Function

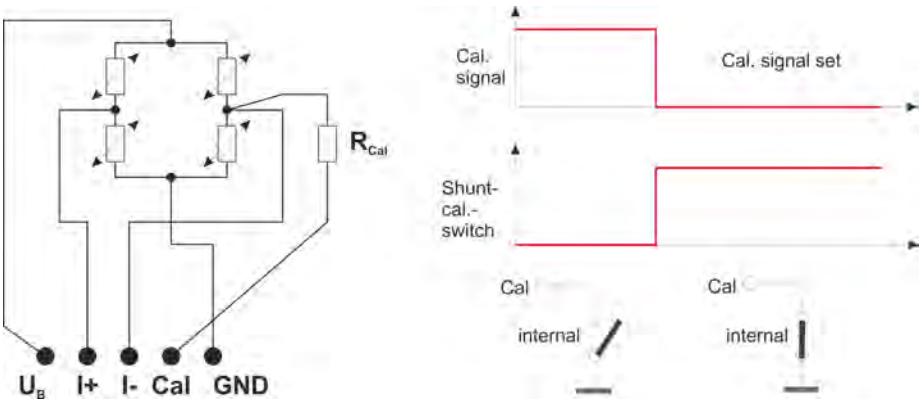


*Fig. 11: Remote shunt calibration function*

$R_{Cal}$ see "List for Shunt Calibration Resistor"

## 3.2.4 List for Shunt Calibration Resistor

$E = dL * k_{Factor}$

$R_{shunt} = 1 / (-1+ 1 / (-1+1 / (0.5+E / 1000))) * R_{strain} = (500-E) / (2*E) * R_{strain}$

The system is based on a 350 Ω **full** strain gauge bridge !!!

| List for the Shunt Resistor (Strain Gauge Full Bridge) | | | | | |
|---|---|---|---|---|---|
| $k_{Factor}$ 2.05 | | | | | |
| Expansion dL (µm/m) | Electrical signal E (mV/V) | Rshunt (kΩ) for a 350Ω $R_{Strain\ gauge}$ (100% adjustment) | Rshunt (kΩ) for a 350Ω $R_{Strain\ gauge}$ (80% adjustment) | Rshunt (kΩ) for a 1000Ω $R_{Strain\ gauge}$ (100% adjustment) | Rshunt (kΩ) for a 120Ω $R_{Strain\ gauge}$ (100% adjustment) |
| 3902.4390 | 8 | 10.76 | 13.45 | 30.75 | 3.69 |
| 3414.6341 | 7 | 12.33 | 15.41 | 35.21 | 4.23 |
| 2926.8293 | 6 | 14.41 | 18.01 | 41.17 | 4.94 |
| 2439.0244 | 5 | 17.33 | 21.66 | 49.50 | 5.94 |
| 1951.2195 | 4 | 21.70 | 27.13 | 62.00 | 7.44 |
| 1463.4146 | 3 | 28.99 | 36.24 | 82.83 | 9.94 |
| 975.6098 | 2 | 43.57 | 54.47 | 124.50 | 14.94 |
| 487.8049 | 1 | 87.32 | 109.16 | 249.50 | 29.94 |
| 439.0244 | 0.9 | 97.05 | 121.31 | 277.28 | 33.27 |
| 390.2439 | 0.8 | 109.20 | 136.50 | 312.00 | 37.44 |
| 341.4634 | 0.7 | 124.82 | 156.03 | 356.64 | 42.80 |
| 292.6829 | 0.6 | 145.66 | 182.07 | 416.17 | 49.94 |
| 243.9024 | 0.5 | 174.83 | 218.53 | 499.50 | 59.94 |
| 195.1220 | 0.4 | 218.58 | 273.22 | 624.50 | 74.94 |
| 146.3415 | 0.3 | 291.49 | 364.36 | 832.83 | 99.94 |
| 121.9512 | 0.25 | 349.83 | 437.28 | 999.50 | 119.94 |
| 97.5610 | 0.2 | 437.32 | 546.66 | 1249.50 | 149.94 |
| 60.9756 | 0.125 | 699.82 | 874.78 | 1999.50 | 239.94 |
| 48.7805 | 0.1 | 874.83 | 1093.53 | 2499.50 | 299.94 |
| 43.9024 | 0.09 | 972.05 | 1215.06 | 2777.28 | 333.27 |
| 39.0244 | 0.08 | 1093.57 | 1366.97 | 3124.50 | 374.94 |
| 34.1463 | 0.07 | 1249.82 | 1562.28 | 3570.93 | 428.51 |
| 30.4878 | 0.0625 | 1399.83 | 1749.78 | 3999.50 | 479.94 |
| 29.2683 | 0.06 | 1458.16 | 1822.70 | 4166.17 | 499.94 |
| 24.3902 | 0.05 | 1749.82 | 2187.28 | 4999.50 | 599.94 |
| 19.5122 | 0.04 | 2187.32 | 2734.16 | 6249.50 | 749.94 |
| 14.6341 | 0.03 | 2916.49 | 3645.61 | 8332.83 | 999.94 |
| 9.7561 | 0.02 | 4374,82 | 5468.53 | 12499.50 | 1499.94 |

**Note:**

When using a **half** strain gauge bridge the same mechanical expansion [dL] results in a **half** of the electrical signal [E] shown in the table above.

e.g. dL = 487.8049 µm/m → E = 0.5 mV/V → $R_{Shunt}$ = 174.84 kΩ ...

When using a **quarter** strain gauge bridge the same mechanical expansion [dL] results in a **quarter** of the electrical signal [E] shown in the table above.

e.g. dL = 487.8049 µm/m → E = 0.25 mV/V →$R_{Shunt}$ 349.83 kΩ ...

**Usage of a strain gauge bridge resistor deviating from the standard resistor**

Deviation of sensor signal **gain** [mV/V] when using strain gauge bridge resistor other than 350 Ω.

| Applied bridge resistor $R_{strain\ gauge}$ [Ω] fullbridge | Deviation of the sensor signal gain to the reference value $R_{strain\ gauge}$ = 350 Ω fullbridge |
|---|---|
| 120 | +1.0% |
| 350 | 0.0% |
| 700 | -1.8% |
| 1,000 | -3.1% |
| 1,400 | -5.0% |
| 2,000 | -7.5% |
| 3,000 | -11.5% |
| 4,400 | -16.6% |
| 5,000 | -18.6% |

## 3.2.5 Operation Mode PT100

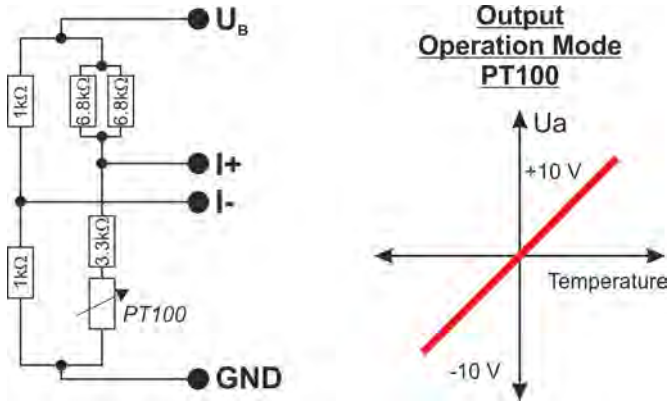


*Fig. 12: Operation mode PT100*

| Resistor Rv kΩ | Temperature °C |
|---|---|
| 72 | 500 |
| 36 | 250 |
| 18 | 125 |
| 8 | 62.5 |

# 4 Mounting / Starting

## 4.1 Coupling / Installation

**Antenna Coupling**

**DANGER!**

**Risk of Faulty Measuring Data and Resulting Subsequent Errors, up to Injury to Persons**

*Damaging, modifications or disturbance of the coaxial cable(s) may falsify the measuring results and optionally cause subsequent errors according to operation purpose.*

Do not buckle the coaxial cable!

Do not modify the coaxial cable!

Do not keep data cable and the coaxial cable together with energy- / high-power current cables!

The connectors of the HF energy and / or HF data coaxial cable must not have connection to the grounding of the machine!

Permissible bending radii for coaxial cables:

- RG58 → $R_B$ = 25 mm
- RG400 → $R_B$ = 30 mm static / 50 mm dynamic
- RG178 → $R_B$ = 15 mm
- RG213 → $R_B$ = 50 mm
- RG316 → $R_B$ = 15 mm

The bending radii of the used coaxial cables must not be undercut

**CAUTION!**

**Risk of Damaging of Electronic, Faulty Measuring Data**

*While overheating of the evaluation unit the built-in electronics may be damaged*

*An overheated evaluation unit may cause faulty measuring values and respectively subsequent errors*

The evaluation unit must be mounted onto a heat conductive base.

**CAUTION!**

**Damaging of Evaluation Unit Caused by High Vibrancy**

*High Vibrancy of the evaluation unit may cause damaging*

While mounting in environments with high vibrancy (e.g. in vehicles) the evaluation unit must be mounted vibration damped, e.g. by rubber buffer.

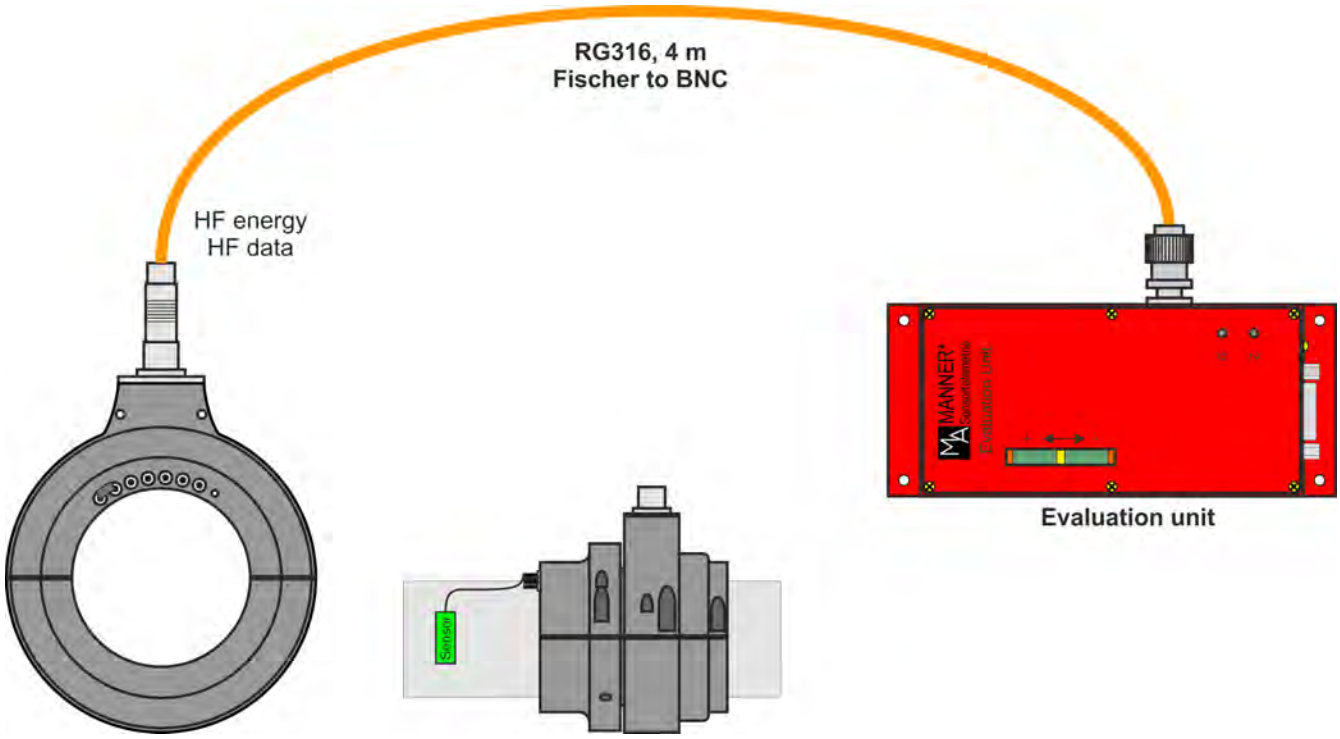


*Fig. 13: Coupling*

**Mounting to Body**

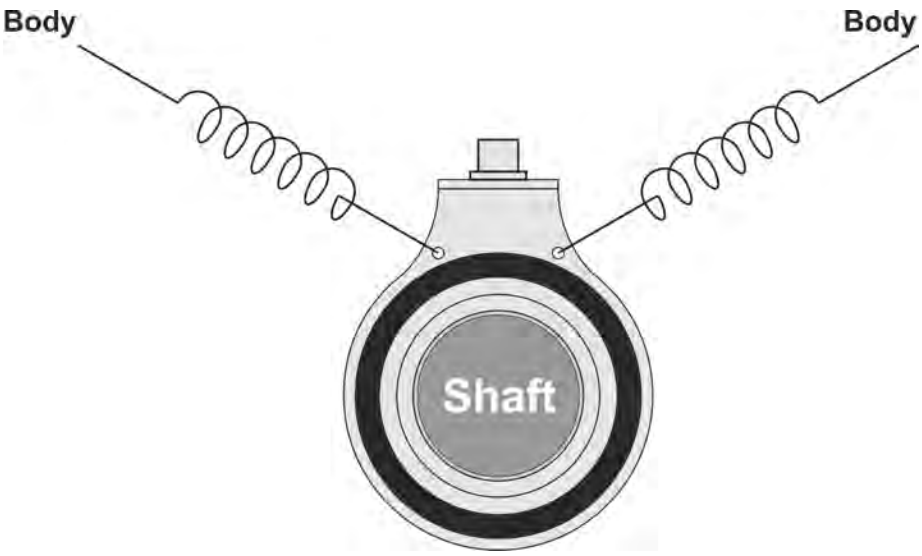


*Fig. 14: Mechanical assembly of shaft transmitters*

## 4.2 Mounting Instructions

1. Unscrew stator housing
2. Pull apart the stator housing (Attention: dowel pins)
3. Desolder rotor antenna
4. Unscrew rotor housing.
5. Pull apart the rotor housing (Attention: dowel pins).
6. Set the rotor half with the sensor signal amplifier and the rubber mate onto the shaft.
7. Close the rotor with the other rotor half and tighten screws. Optionally secure the screws.
8. Solder rotor antenna at both sides.

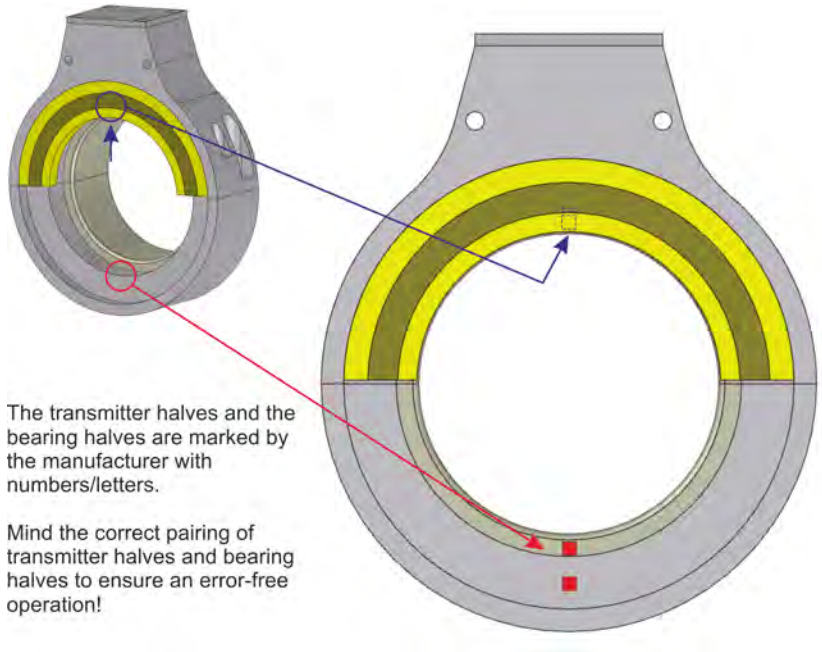


*Fig. 15: SV_2Lg, pairing of halves*

9. Mount the upper part of the stator housing over the sliding bearing.

   The two antennas must face each other.
10. Mount the lower part of the stator housing over the sliding bearing and tighten screws. Optionally secure the screws.
11. Fix stator housing to a non-rotating part of the machine.
12. Run the coaxial cable.
13. Connect the universal shaft transmitter with the evaluation unit.

## 4.3 Starting / Adjustment

**Starting**

**DANGER!**

**Risk of Injury**

*Incorrect installation can cause injury to persons directly while the installation or during the subsequent startup*

Follow mandatory the rules for accident prevention!

1. Connect the shaft transmitter to the evaluation unit
2. Switch the system on

3. Release the measuring position completely
4. Adjust the output signal to 0.000 V by using the screw ‘Zero’
5. Load the measuring position with nominal load or set the Cal.signal permanently
6. Adjust the output signal to +10.000 V by using the screw 'Gain' and measuring the "Analog output signal' or adjust to the value noted in the calibration protocol.
7. Release the measuring position complete or remove Cal.signal
8. Check the output signal to zero. Repeat step 4 to 9, if necessary.

# 5 Options

**Optionally available**

- Temperature measurement (PT100, Thermocouple)
- Remote Control
- waterproof
- ATF oilproof

If you have any questions regarding customer-specific solutions, please contact our sales department.

# 6 Maintenance

The systems of Manner Sensortelemetrie are low-maintenance.

**DANGER!**

**Risk of Injury Caused by Defects on System Built-Up**

*Particularly loose or damaged parts may endanger present persons*

Carry out the maintenance regularly and assiduously.

**Within a periodical repeating maintenance following operations have to be done:**

- Check the antenna system for scrub marks or mechanical damages
- Check the fastening of the system for a fix seat and tighten of the screwed fastenings where necessary.
- Check the plug connections and cables

Document the completed annual maintenance

# 7 Contact

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