TEL1-PCM

Operating Instructions

Digital Telemetry System for Strain Gage Applications on Rotating Shafts

“Gain and Auto Zero setting direct from Receiver Side!”

INSTRUCTIONS FOR QUALIFIED PERSONNEL ONLY!
**Attention**

- Use only shielded sensor cable
- When used on rotating shafts, all connections must be soldered.
- Mounting of the modules on a shaft must be first fixed with mounting tape (only for prefixing) and then with a **hose clamps!!!**
- **The manufacturer doesn't accept liability for damages, which results from insufficient attachment of the individual components.**

**Safety Notes**

- The device should only applied by instructed personnel.
- The power head emits strong magnetic radiation at 30-60 kHz to a distance of 20 cm. Therefore persons with cardiac pacemakers should **not work** with this device!
- Magnetic data storage media should be kept in a distance of at least 3m from the power head to avoid data loss. The same is valid for electromagnetic sensitive parts, devices and systems.
- Do **not place** the power head in the switched-on state on metallic objects, because this results in eddy currents, which could overload the device and strongly heat up small objects. In addition, the probe could be destroyed!
- No metallic objects, other than the disc-type coil, should be located in the air gap of the power head. The same applies to metallic parts within a radius of up to 50 mm in all directions.
- Do not use damaged or faulty cables!
- Never touch in the area between shaft and inductive head, the rotating shaft itself or rotor electronic contacts during operation!
- This is a “Class A” system suitable for operation in a laboratory or industrial environment. The system can cause electromagnetic interference when used in residential areas or environments. In this case the operator is responsible for establishing protective procedures.
General Description

The TEL1-PCM single-channel telemetry system offers the easiest handling for the wireless transmission of strain gage signals from rotating shafts. The very small encoder 35 x 18 x 12 mm with a weight of 13g. The transmitter (encoder) part is simply mounted on the rotating shaft with a special fiber reinforced tape.

Powering of the transmission part and the digital data transfer between transmitter and receiver is realized inductively.

Functional Description

The TEL1-PCM transmitter provides a pulse code modulated signal (PCM) to an induction winding around the shaft (max. diameter 500mm, other on request!). The magnetic field of this winding enables the inductive transmission of the signal to the pickup coil. From there the signal is transferred by cable (5m) to the receiver. The maximum distance between the transmitter coil and the pickup is 25mm with standard head, optional 35mm.

The receiver unit offers a BNC connector at the front panel with analog outputs ±10 V and an optional a digital output for PCM-LAN IP-Interface or a output 4-20mA. An LED bar indicator shows the actual level and a successful Auto Zero calibration. Overload is indicated by the last LED’s in pos. or neg. direction of the bar graph. These OVL-LED’s operate in peak-hold mode and are reset by pressing the overload switch.

Strain gage sensors (≥350 Ohm) in full- and half- bridge configuration can be directly connected to the transmitter. The excitation is fixed to 4 Volt DC and the gain is set by the gain switch on the receiver side. An auto-zero (AZ) adjustment is executed by pressing the AZ button on the front side of the receiver. The successful AZ operation is indicated by a yellow LED in the middle of the LED bar indicator. When the AZ completes the LED continuously illuminates. The AZ setting is stored in a Flash-RAM and thus is not lost during power-off. Use only shielded sensor cable.

TEL1-PCM Set Contains:

- Inductive Powerhead / Pickup with 5m cable
- TEL1-PCM-DEC
- Mounting tape 2x 25mm Length 50m
- Ferrite tape 30mm x 3 meter (Isolate magnetic field between shaft and coil)
- CUL wire 0.5mm for coil (Enamelled copper wire)
- DC power cable
- TEL1-PCM-STG (Housing H2)
- Allen key to press the OLV and AZ button
- Screw driver to select the gain
### Technical Data Transmitting Part:

**TEL1-PCM-STG**
- Strain gage: Full and 1/2 bridge \( \geq 350 \) Ohm,
- Excitation: 4 VDC (fixed)
- Gain: 250; 500; 1000; 2000; 4000; 8000 (selectable from receiver side)

<table>
<thead>
<tr>
<th>Gain</th>
<th>Resolution</th>
<th>Autozero range</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>12 bit</td>
<td>100%</td>
</tr>
<tr>
<td>500</td>
<td>12 bit</td>
<td>200%</td>
</tr>
<tr>
<td>1000</td>
<td>12 bit</td>
<td>400%</td>
</tr>
<tr>
<td>2000</td>
<td>12 bit</td>
<td>400%</td>
</tr>
<tr>
<td>4000</td>
<td>12 bit</td>
<td>400%</td>
</tr>
<tr>
<td>8000</td>
<td>11 bit</td>
<td>400%</td>
</tr>
</tbody>
</table>

AZ: Auto Zero calibration (selectable from receiver side)
- Analog signal bandwidth: 0 - 1200 Hz (-3 dB)
- Operating temperature: -40 to +85 °C
- Sampling rate 6.944kHz
- Dimensions: 35 x 18 x 12mm (without connectors)
- Weight: each module 13 grams (with epoxy resin)
- Static acceleration: up to 3000g (housing not filled with epoxy resin and without solder pins and external capacitor)
- Static acceleration: up to 10000g (housing filled with epoxy resin and without solder pins and external capacitor)
- Powering: Inductive (optional Battery, see TEL1-PCM-BATT)
- Housing: splash-water resistant IP65 (except the connector pins)

**TEL1-PCM-TH-K - Select Gain 250!**
- At Gain 500 multiply the values x2, Gain 1000 with x4
- Max. Voltage output at receiver is +10V!

<table>
<thead>
<tr>
<th>°C</th>
<th>Normal (V)</th>
<th>Min. (V)</th>
<th>Max. (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td>-0.508</td>
<td>-0.450</td>
<td>-0.550</td>
</tr>
<tr>
<td>0</td>
<td>-0.005</td>
<td>-0.050</td>
<td>0.050</td>
</tr>
<tr>
<td>50</td>
<td>0.508</td>
<td>0.450</td>
<td>0.550</td>
</tr>
<tr>
<td>100</td>
<td>1.012</td>
<td>0.950</td>
<td>1.050</td>
</tr>
<tr>
<td>150</td>
<td>1.505</td>
<td>1.450</td>
<td>1.550</td>
</tr>
<tr>
<td>200</td>
<td>2.000</td>
<td>1.950</td>
<td>2.050</td>
</tr>
<tr>
<td>250</td>
<td>2.505</td>
<td>2.450</td>
<td>2.550</td>
</tr>
<tr>
<td>300</td>
<td>3.010</td>
<td>2.950</td>
<td>3.050</td>
</tr>
<tr>
<td>350</td>
<td>3.511</td>
<td>3.450</td>
<td>3.550</td>
</tr>
<tr>
<td>400</td>
<td>4.014</td>
<td>3.950</td>
<td>4.050</td>
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<td>4.511</td>
<td>4.450</td>
<td>4.550</td>
</tr>
<tr>
<td>500</td>
<td>5.011</td>
<td>4.950</td>
<td>5.050</td>
</tr>
<tr>
<td>550</td>
<td>5.511</td>
<td>5.450</td>
<td>5.550</td>
</tr>
<tr>
<td>600</td>
<td>6.010</td>
<td>5.950</td>
<td>6.050</td>
</tr>
<tr>
<td>650</td>
<td>6.507</td>
<td>6.450</td>
<td>6.550</td>
</tr>
<tr>
<td>700</td>
<td>7.007</td>
<td>6.950</td>
<td>7.050</td>
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<tr>
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<td>7.507</td>
<td>7.450</td>
<td>7.550</td>
</tr>
<tr>
<td>800</td>
<td>8.007</td>
<td>7.950</td>
<td>8.050</td>
</tr>
<tr>
<td>850</td>
<td>8.505</td>
<td>8.450</td>
<td>8.550</td>
</tr>
<tr>
<td>900</td>
<td>9.003</td>
<td>8.950</td>
<td>9.050</td>
</tr>
<tr>
<td>1000</td>
<td>9.999</td>
<td>9.950</td>
<td>10.050</td>
</tr>
</tbody>
</table>

If no thermocouple is connected, output is \(-1000°C = -10V\)

- Analog signal bandwidth: 0 - 10 Hz (-3 dB)
- Accuracy: +/-0.5 % (without sensor)
- Operating temperature: -40 to +85 °C
- Dimensions: 35 x 18 x 12mm (without th-connector)
- Weight: each module 13 grams (with epoxy resin)
- Static acceleration: up to 3000g (housing not filled with epoxy resin)
- Static acceleration: up to 10000g (housing filled with epoxy resin and without solder pins and external capacitor)
- Powering: Inductive (optional Battery, see TEL1-PCM-BATT)
- Housing: splash-water resistant IP65 (except the connector pins)
**Technical Data Receiving Part**

**TEL1-PCM-DEC**

*Front side:*
- Analogue output: +/-10V via BNC
  *(delay between analog IN/OUT 15mS constant!!)*
- Digital output for **PCM-LAN-IP-Interface** OPTION or
  Current output 4-20mA output **OPTION**
- Gain setting: via screw switch
- Auto Zero setting: via micro switch
- Overload LED's (Red ON) reset: via micro switch
- Green LED's: Bargraph +/-
- Autozero LED:
  - Yellow ON: successful AZ
  - Yellow OFF: not successful AZ
  - If flashing, call support of KMT, error in EPROM
- Green LED's: Bargraph +/-
- SL LED: Red ON = if error of data transmitting
- SL LED: Red Flashing = distance to far
- Power ON LED: Red ON = if power switch on

*Rear side:*
- Output to Powerhead: via 6pol. Tuchel
- Fuse LED: Flashing if fuse is defective
- Powering: 10-30V DC (min. 24Watt), Input via 7pol. Tuchel
- Switch: ON/OFF
- Operating temperature: -40 to +70 °C
- Dimensions: 200 x 105 x 44 (without connectors!)
- Weight 950 grams
- Static acceleration: up to 200g
- System accuracy*: +/- 0.2%
  *< measure with gain 1000, 35ohm (0.1%) full bridge - test bridge!!>

**TEL1-PCM-Powerhead/Pickup (standard version):**

Function: Inductive powering of the TEL1-PCM-STG unit and receiving PCM magnetic field in PCM modulated code
Inductive frequency is 60kHz

Distance between the transmitter coil and the pickup is 25mm (25mm at diameter <300mm with 5m cable, 15mm with 10m cable)
(Optional 35mm at diameter <300mm - see table)
Output to TEL1-PCM-Decoder: Via 6pol. Tuchel Plug incl. 5m cable
Operating temperature: -40 to +80 °C
Dimensions: 53x66x30mm (without cable)
Weight: 200 grams (without cable!)
Housing: splash-water resistant IP65 (except connector).
Cable length standard 5m! 10m optional!
Transmitting Part:

- Strain gage connection
- Coil connection

This pins are only for **external** capacitor version. E.g. 100nF for larger shaft >400mm! Specify at order!

Coil, depends of shaft diameter 5-18 parallel windings of 0.5mm CUL (Enamelled copper wire) wire, see table for help.

Receiving Part:

- Positive Bar-graph LED
  - With overload indicator
  - Yellow ON - successful AZ
  - Yellow OFF - not successful AZ
  - If flashing, call support of KMT, error in EPROM

- Negative Bar-graph LED
  - With overload indicator

- Reset button of overload indicator

LED ON = Error data transmission
LED Flashing = Distance between Coil and Pickup is too far away

- Analog output +/-10V
- Gain switch
- AZ button
- Power ON LED
Technical Data are subject to change without notice!

Rear Powerhead / Pickup
Standard version for distance of 5-25mm
(Optional 5-35mm)

Data input from Pickup and output to Powerhead

Power ON/OFF switch

Optional
PCM OUT for Interface
or
4-20mA output
Pin 1 = wire grey = 4-20mA
Pin 4 = wire black = GND
+10V = 20mA
0V = 12mA
-10V = 4mA

Power IN DC 10 – 30V

Powerhead / Pickup
Standard version for distance of 5-25mm
(Optional 5-35mm)

DC-Power cable
Caution:
The Powerhead must be fixed in the middle of the coil in a distance from 5 to 25 (35)mm. Don’t introduce any metal parts between or near the Powerhead and the shaft.

Don’t mix T1-PCM and Tel1-PCM parts together! There are not compatible!
Mounting example of power head / pickup:

Right installation

Ideal distance 10mm

Wrong installation, head position is 90° wrong to the coil and will not work!
Version 4.0

Draw about 1:1

Weight 13gram
Shaft Installation

**2 layers** (each separately) of the special ferrite tape around the shaft

Fix with 2 layers of mounting tape around the shaft

Coil, depends of shaft diameter 5-18 parallel windings of 0.5mm CUL (Enamelled copper wire) wire, see table for help.

Strip the isolation from the end of the wire with a skinning tool or head up your soldering iron over 450°C to burn off the insulation from the wire!

Solder the wires of the coil on the input pins of TEL1-PCM-STG "COIL". The pins for capacitor are used only for larger diameter >400mm!
Caution:

Fix TEL1-PCM module with at least 10 layers of the special mounting tape (only for up to 1000g!) around the shaft. Depending on the shafts RPM and diameter particular attention needs to be paid to the safe mounting of the components. The manufacturer doesn’t accept liability for damages, which results from insufficient attachment of the individual components.

The tape is only for test purposes, in order to test the electrical function of the units in the idle state of the shaft.

During the rotation test appropriate safety precautions should be taken.

The entire installation may be used only by authorized persons. By using tape for the attachment, it has to be used in the direction of rotation of the shaft and the end has to be secured. Only non-elastic tapes (Fiberglas Tape) with high tensile strength (100kg/25mm) should be used for pre-fixing. Additionally, use hose clamps for final fixing!! The individual components are to be distributed in such a way on the shaft that imbalances are avoided.
Finding the Correct Number of Windings

The number of windings depends on several factors. The most important influential factors are the diameter, the material of the shaft and the environment around the shaft. The table standing below will help you to find the right number windings for steel shafts. The table below is a help to estimate the number of windings fast. To optimize your results you can try one winding more or less.

Coil, depends of shaft diameter, 5-18 parallel windings of 0.5 or 0.63mm

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Windings ±1</th>
<th>max. distance with XL (35mm) Powerhead</th>
<th>Ferrite tape no. of layers</th>
<th>recommend capacitor (Type MKT or MKS 250V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>4-5</td>
<td>12mm</td>
<td>2</td>
<td>without built-in 220nF, only with external 68nF (specify at order)</td>
</tr>
<tr>
<td>500</td>
<td>5-6</td>
<td>20mm</td>
<td>2</td>
<td>without built-in 220nF, only with external 100nF (specify at order)</td>
</tr>
<tr>
<td>500</td>
<td>3</td>
<td>8mm</td>
<td>2</td>
<td>with built-in 220nF (is standard in housing) Not recommend for large diameters!</td>
</tr>
<tr>
<td>300</td>
<td>5</td>
<td>27mm</td>
<td>2</td>
<td>with built-in 220nF (is standard in housing)</td>
</tr>
<tr>
<td>210</td>
<td>6</td>
<td>28mm</td>
<td>2</td>
<td>with built-in 220nF (is standard in housing)</td>
</tr>
<tr>
<td>160</td>
<td>7</td>
<td>28mm</td>
<td>2</td>
<td>with built-in 220nF (is standard in housing)</td>
</tr>
<tr>
<td>130</td>
<td>8</td>
<td>35mm</td>
<td>2</td>
<td>with built-in 220nF (is standard in housing)</td>
</tr>
<tr>
<td>90</td>
<td>11</td>
<td>35mm</td>
<td>2</td>
<td>with built-in 220nF (is standard in housing)</td>
</tr>
<tr>
<td>60</td>
<td>13</td>
<td>35mm</td>
<td>2</td>
<td>with built-in 220nF (is standard in housing)</td>
</tr>
<tr>
<td>30</td>
<td>14</td>
<td>35mm</td>
<td>2</td>
<td>with built-in 220nF (is standard in housing)</td>
</tr>
<tr>
<td>20</td>
<td>18</td>
<td>35mm</td>
<td>2</td>
<td>with built-in 220nF (is standard in housing)</td>
</tr>
</tbody>
</table>

With built-in 220nF capacitor for shaft up to 400mm recommend! Standard version!

With external capacitor for varies diameters!
220nF for shaft diameter 10-400mm
100nF for shaft diameter 400-800mm
68nF for shaft diameter 800-1200mm
Specify at order!
Following must be considered at the mounting of the inductive power head at TEL1-PCM

Don’t use for mounting any kind metal in this area (25-30mm)! Otherwise flow magnetic energy in the metal also and decrease the distance between power head and coil (on shaft)!

Wrong!!! Mounting plate cover the active area of inductive head

Example of mounting plate,
Powerhead / Pickup - distances (coil / head)

PH-PU-Standard & XL

All distances are only "up to" and can change a little, depending on diameters!
(typical shaft diameter 20-50mm)
Dimensions Powerhead / Pickup (Standard and XL)

- Height 33mm
- Drill d = 4.1mm
- Cable length 5m
- Optional 10...20m

Technical Data are subject to change without notice!
Dimensions Powerhead / Pickup (CRS at standard and XL) draw

CRS = cable rear side out!
Konformitätserklärung

Declaration of Conformity

Declaration de Conformité

Wir
We
Nous

KMT - Kraus Messtechnik GmbH

Anschrift
Address
Adresse

Gewerbering 9, D-83624 Otterfing, Germany

erklären in alleiniger Verantwortung, daß das Produkt
declare under our sole responsibility, that the product
declarons sous notre seule responsabilité, que le produit

mit den Anforderungen der Normen und Richtlinien
fulfills the requirements of the standard and regulations of the Directive
satisfait aux exigences des normes et directives

108/2004/EG
Elektromagnetische Verträglichkeit EMV / EMC

DIN EN 61000-6-3 Ausgabe 2002-8 Elektromagnetische
Verträglichkeit EMV Teil 6-3 Fachgrundnorm Störaussendung

DIN EN 61000-6-1 Ausgabe 2002-8 Elektromagnetische
Verträglichkeit EMV Teil 6-1 Fachgrundnorm Störfestigkeit

Otterfing, 27.04.2006

Martin Kraus

Ort und Datum der Ausstellung
Place and Date of Issue
Lieu et date d'établissement

Name und Unterschrift des Befugten
Name and Signature of authorized person
Nom et signature de la personne autorisée