TEL1-PCM-HS-BATT

User Manual

Digital High Data Rate Telemetry System for Strain Gage and ICP Applications on Rotating Shafts

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

- Easy to assemble and operate
- ICP current 4mA, Gain selectable to: 2-4-8-16
- For strain gages or IPC sensors
- Digital transmission realized inductively
- Strain gage sensors (>350 Ohm)
- Distance up to 50mm
- Full- and half bridge configuration
- No influence through radio frequency
- Excitation fixed 4 Volt DC
- Many systems can operated at the same time
- Auto-Zero adjustment - Setting receiver side
- Signal bandwidth 0…50kHz (Scanning rate 104kHz)
- Gain: 250-8000 - Setting receiver side
- Output +/-10V and digital for interface (Option)
- External shunt calibration
- System accuracy <0.2%
General Description

The TEL1-PCM-HS-BATT single-channel high data rate telemetry system offers the easiest handling for the wireless transmission of strain gage signals from rotating shafts. The encoder 62x27x13mm with a weight of 30g. The transmitter (encoder) part is simply mounted on the rotating shaft with a special fiber reinforced tape.

Powering of the transmission part is via battery 6-9V or optional inductive power supply. The digital data transfer between transmitter and receiver is realized inductively.

Functional Description

The TEL1-PCM-HS-BATT 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 (5 m) to the receiver. The maximum distance between the transmitter coil and the pickup is 50mm. (with standard head)

The receiver unit offers a BNC connector at the front panel with analog outputs ±10 V and a optional a digital output for PCM interface ECIA100 (for notebooks) or IF16 (PCI Desktop). 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. A continued flashing of the yellow LED indicates some error in the AZ electronics. In this case please contact the support of KMT. Additional to the AZ you have the possibility to calibrate the bridge by external shunt. (+ and -). The AZ setting is stored in a Flash-RAM and thus is not lost during power-off. Use only shielded sensor cable.

TEL1-PCM-HS-BATT set contains:

- Inductive Pickup with 5m cable
- TEL1-PCM-HS-BATT-DEC (Decoder)
- Mounting tape 25mm and 50mm Length 50meter
- Ferrite tape 30mm x 3 meter (isolate magnetic field between shaft and coil)
- CU wire, 0.5mm for coil (insulated with lacquer)
- DC-Power cable
- TEL1-PCM-HS-STG-(BATT) (Encoder for strain gages)
- 6V Lithium battery
- Hexagon key to activate the OLV and AZ switch
- Screw driver to set the gain
Technical Data - rotating part

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

<table>
<thead>
<tr>
<th>Gain and STG-Sensitivity (output +/-10V at decoder)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain 250 = +/-5mV/V</td>
</tr>
<tr>
<td>Gain 500 = +/-2.5mV/V</td>
</tr>
<tr>
<td>Gain 1000 = +/-1.250mV/V</td>
</tr>
</tbody>
</table>

Shunt Cal: Via external resistor for positive and negative calibration
AZ: Auto Zero calibration (selectable from receiver side)
Analog signal bandwidth: 0 - 50 kHz (-3 dB)
Scanning rate 104 kHz
Operating temperature: -10 to +80 °C
Dimensions: 62 x 27 x 13mm (without connectors)
Weight: each module 30 grams
Static acceleration: up to 3000g
Powering: Battery 6-9V, Power consumption 70mA at 6V
Optional additional inductive powering

TEL1-PCM-HS-BATT-ICP
For all ICP sensors
Current: 4mA (fixed)
Gain: 1; 2; 4; 8; 16; 32 (selectable from receiver side)

<table>
<thead>
<tr>
<th>Gain</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 = 1 at ICP</td>
<td>12 bit</td>
</tr>
<tr>
<td>500 = 2 at ICP</td>
<td>12 bit</td>
</tr>
<tr>
<td>1000 = 4 at ICP</td>
<td>12 bit</td>
</tr>
<tr>
<td>2000 = 8 at ICP</td>
<td>12 bit</td>
</tr>
<tr>
<td>4000 = 16 at ICP</td>
<td>12 bit</td>
</tr>
<tr>
<td>8000 = 32 at ICP</td>
<td>11 bit</td>
</tr>
</tbody>
</table>

Analog signal bandwidth: 3 - 50000 (-3 dB)
Scanning rate 104 kHz
Operating temperature: -10 to +80 °C
Dimensions: 62 x 27 x 13mm (without connectors)
Weight: each module 30 grams
Static acceleration: up to 3000g
Powering: Battery 6-9V, current consumption 80mA at 6V
Optional additional inductive powering
Technical Data - static part

**TEL1-PCM-HS-BATT-DEC**

**Front side:**
- Analogue output: +/-10V via BNC
- Digital output for PCM Interface IF16 (ECIA100) 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 = if distance to far
- Power ON LED: Red ON = if power switch on

**Rear side:**
- Output to Powerhead: via 5pol. Tuchel
- Fuse LED: Flashing if fuse is defect
- Powering: 10-30V DC, Input via 7pol. Tuchel
- Switch: ON/OFF
- Operating temperature: -10 to +70 °C
- Dimensions: 200 x 105 x 44 (without connectors!)
- Weight 950 grams
- Static acceleration: up to 200g
- System accuracy (without sensor): +/- 0.2 %

**TEL1-PCM-HS-Pickup**

Function: Receiving inductive magnetic field in PCM modulated code
- Distance between the transmitter coil and the pickup is 50mm
- Output to TEL1-PCM-HS-BATT Decoder via 5pol. Tuchel plug incl. 5m cable. *Cable length standard 5m, optional 20m*
- Operating temperature: -10 to +80 °C
- Dimensions: 45x60x25mm (without cable)
- Weight: 400 grams (with 5m cable!)
- Housing: splash-water resistant IP65 (except connector).
Transmitting Part:

- Strain gage connection
- The pins for battery +6-9V and GND
- Coil connection

At half bridge must be a solder bridge between pin IN-- and 1/2!

Tel1-PCM-HS-BATT Encoder

- EXC 4V
- IN--
- IN+
- GND

Full-Bridge

- EXC 4V
- IN--
- IN+
- GND

Half-Bridge

COIL
GND
+6-9V
COIL

Battery 6-9Volt
Note: The Powerhead must be fixed in the middle of the coil in a distance from 5 up to 50 mm.
Receiving Part:

**Front**
- Positive Bargraph LED: With overload indicator
- Auto Zero LED: ON = successful, OFF = Not successful
- Negative Bargraph LED: With overload indicator
- Reset button of overload indicator
- LED ON = Error data transmission
- LED Flashing = Battery voltage lower 6V
- Analog output +/-10V
- Gain switch
- AZ button
- Power On LED

**Rear**
- Flashing if fuse damage
- PCM OUT for Interface (Option!)
- Power ON/OFF switch
- Data input from Pickup head
- Power In DC 10 – 30V

Technical Data are subject to change without notice!
**Pin connection cable:**

**Pickup**
Distance of 5-100mm

![Pickup Diagram](image)

**DC-Power cable**

![DC-Power Cable Diagram](image)
Shaft Installation

1.) Mount 2 layers of the special ferrite tape around the shaft. (each layer separately, without overlap!)

2.) Fix with 2 layers of mounting tape around the shaft

3.)

4.) Coil, depends on shaft diameter 4-25 parallel windings of 0.5 CUL wires (see table for help)

5.)

6.) Fix with 3-4 layers of mounting tape around the shaft
Caution:
Fix TEL1-PCM-HS-STG-BATT module with at least 10 layers (width 50mm) of the special mounting tape 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 with high tensile strength should be used for pre-fixing. Additionally, use a steel hose clamp for final fixing!! The individual components are to be distributed in such a way on the shaft that imbalances are avoided.
Find the correct amount 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.

<table>
<thead>
<tr>
<th>Windings</th>
<th>Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>600</td>
</tr>
<tr>
<td>8</td>
<td>500</td>
</tr>
<tr>
<td>9</td>
<td>250</td>
</tr>
<tr>
<td>10</td>
<td>125</td>
</tr>
<tr>
<td>11</td>
<td>80</td>
</tr>
<tr>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td>13</td>
<td>20</td>
</tr>
</tbody>
</table>

Coil, depends of shaft diameter 4-25 parallel windings of 0.5 CUL wire
Konformitätserklärung

Declaration of Conformity
Declaration de Conformité

Wir
We
Nous

KMT - Kraus Messtechnik GmbH

Gewerbering 9, D-83624 Otterfing, Germany

Anschrift
Address
Adress

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

Bezeichnung
Name
Nom

Messdatenübertragungssystem

Typ, Modell, Artikel-Nr., Größe
Type, Model, Article No., Taille
Type, Modèle, Mo. d'Article, Taille

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

und den angezogenen Prüfberichten übereinstimmt und damit den Bestimmungen entspricht.
and the taken test reports and therefore corresponds to the regulations of the Directive
et les rapports d'essais notifiés et, ainsi, correspond aux règlement de la Directive.

Otterfing, 27.04.2006

Martin Kraus

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

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

Assembling instructions for TEL1-PCM-HS-BATT
Inductive power supply set

Picture shows standard Inductive Power Supply for diameter up to 300mm

- Power supply for power head
- 25 and 50mm mounting tape to fix coil on shaft
- Ferrite tape 30mmx3m
- CU wire 0.5mm
- DC Power cable
- IND-PWR AC/DC module
  - Input: AC from coil
  - Output 6.5VDC 100mA
- Power Head with cable

Mounted on shaft

Caution: No kind of metal objects close to this area!
<table>
<thead>
<tr>
<th><strong>Installation of coil for inductive powering on shaft</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Attach for electromagnetic insulation “Ferrite Tape”</td>
</tr>
<tr>
<td>- 2 x layers <strong>Ferrite-Tape</strong> around the shaft</td>
</tr>
<tr>
<td>- Fixed with 2 layers mounting tape</td>
</tr>
<tr>
<td>Wind the 0.5 mm enameled copper wire around the shaft</td>
</tr>
<tr>
<td>- 4-25 windings for 500-20mm diameter</td>
</tr>
<tr>
<td>Other diameter on request!</td>
</tr>
<tr>
<td><strong>Note:</strong> “The inductive load of the IND-PWR AC/DC</td>
</tr>
<tr>
<td>module and the capacitor in the Power Head must be in</td>
</tr>
<tr>
<td>resonance to get the optimal transmission. The</td>
</tr>
<tr>
<td>inductive load of the shaft depends of diameters,</td>
</tr>
<tr>
<td>material and number of windings.”</td>
</tr>
<tr>
<td>To find the optimal transmission try one winding more</td>
</tr>
<tr>
<td>or less. The LED on the Inductive Power module will</td>
</tr>
<tr>
<td>help to find the best configuration. The distance</td>
</tr>
<tr>
<td>between powerhead and the coil is 3-10mm.</td>
</tr>
<tr>
<td>Control the output voltage and move the powerhead in</td>
</tr>
<tr>
<td>the max distance to the coil.</td>
</tr>
<tr>
<td>The minimum Output voltage must be 6,5 V!</td>
</tr>
<tr>
<td>Fix all with 2-3 layers around the coil with mounting</td>
</tr>
<tr>
<td>tape.</td>
</tr>
</tbody>
</table>
Optimum windings for steel shafts

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Windings</th>
<th>Fine adjustment capacitor ( \parallel ) coil</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>4-5</td>
<td>100-200nF (Type MKT or MKS 250V)</td>
</tr>
<tr>
<td>490</td>
<td>4-5</td>
<td>100-200nF (Type MKT or MKS 250V)</td>
</tr>
<tr>
<td>290</td>
<td>5</td>
<td>100-200nF (Type MKT or MKS 250V)</td>
</tr>
<tr>
<td>190</td>
<td>7</td>
<td>100-200nF (Type MKT or MKS 250V)</td>
</tr>
<tr>
<td>150</td>
<td>9</td>
<td>100-200nF (Type MKT or MKS 250V)</td>
</tr>
<tr>
<td>120</td>
<td>10</td>
<td>100-200nF (Type MKT or MKS 250V)</td>
</tr>
<tr>
<td>80</td>
<td>12</td>
<td>100-200nF (Type MKT or MKS 250V)</td>
</tr>
<tr>
<td>45</td>
<td>16</td>
<td>100-200nF (Type MKT or MKS 250V)</td>
</tr>
<tr>
<td>20</td>
<td>25</td>
<td>100-200nF (Type MKT or MKS 250V)</td>
</tr>
</tbody>
</table>

We recommend a capacitor decade e.g. 100pF ... 11,111 µF
The pins “AC IN” are the AC power input from the coil. On the pins “+6.5” and “GND” you get a stabilized output voltage of 6.5V DC. The control LED will lights up, as soon as the power head is switched on and at the right position - close enough to the coil on the shaft. The max. load current on the DC output is 100mA. The AC/DC converter will use instead battery pack!

**Never use any battery together with the IndPwr!**

### Installation of the power head for inductive powering

Connect the power head on the “AC Out” socket of the power box and then the DC power cable on the “DC In 10-30V” socket. The two banana plugs have to be connected to a DC power source with red on +10-30V DC and black on 0V.

You should mount the power head at a fixed location that it’s as free as possible from vibration influences.

The center of the coil should be in the same horizontal position as the center of the power head. The distance is optimal in the range between 3 and 10mm. (depends of shaft and current consumption)

If the red LED of the AC/DC converter lights up, the position of the power head is OK.
Fixing of IND-PWR AC/DC module and TEL1-PCM-HS-BATT

Fix all modules with at least 10 layers of the special mounting tape around the shaft.
According to the shafts RPM and diameter it’s particularly paid attention to safe mounting of the components. **Add. use hose clamps for final fixing!!**

The manufacturer doesn’t accept liability for damages, which results from not sufficiently attachment of the individual components. The provided cable harness and the tape are 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 tools are to be attached.

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 against removing. Only non-elastic tapes with high tensile strength have to be used for pre-fixing. **Add. use hose clamps for final fixing!!**

The individual components are to be distributed in such a way on the shaft that imbalances will avoid.

Connection IND-PWR AC/DC module and TEL1-PCM-HS-BATT

To avoid transmitting error, the **mounting distance** between Inductive Power Head and Inductive Pickup Head must be at least 100mm.
Following must be considered at the mounting of the inductive power head

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

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

- **Drill d= 4.3mm**
- **Cable length 5m**
- **Optional 10...20m**
- **33mm**
- **66**
- **30**
- **33**
- **43**
- **53**
- **10**

Caution: No kind of metal objects close to this area!
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!!!

Safety Notes for Inductive Powering

- The device should only be applied by instructed personnel.
- The power head emits strong magnetic radiation at 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 15–20 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.