MT1-PCM
Digital Radio Telemetry System for Strain Gage Applications on Rotating Shafts

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

Operating Instructions

- Easy to assemble and operate
- Strain gage sensors (>350 Ohm)
- Full- and half bridge configuration
- Excitation fixed 4 Volt DC
- Auto-Zero adjustment - Setting receiver side
- Gain: 250-8000 - Setting receiver side
- Powering through Lithium battery, >12h work time
- Distance 1-10 meter (rotating application)
- Up to 8 system can work in different radio freq.
- Signal bandwidth 0…500Hz (-3dB)
- Output +/-10V
- System accuracy <0.2%

INSTRUCTIONS FOR QUALIFIED PERSONNEL ONLY!
General Description

The MT1-PCM single-channel telemetry system offers the easiest handling for the wireless radio transmission of strain gage signals from rotating shafts.

The encoder has dimensions (MT1-PCM-STG) of 62x27x11mm (without connectors) and transmitter (40k-Tx) of 62x27x11mm (without connectors). Each module has a weight of about 30g. The encoder/transmitter parts are simply mounted on the rotating shaft with a special fiber reinforced tape and add steel trip.

Powering of the transmission part is with battery 6-9V, power consumption 90mA. The digital data transfer between transmitter and receiver is realized by radio frequency 433MHz or 868MHz, transmitting power 10mW

Functional Description

The MT1-PCM transmitter transmits a digital radio frequency signal to the receiver. The distance between transmitter and receiver (depends of application) is 1-10 meter. "Not rotating Point to Point application upto 100m at free view"

The receiver unit offers a BNC connector at the front panel with analog outputs ± 10 V. 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. The AZ setting is stored in a Flash-RAM and thus is not lost during power-off. Use only shielded sensor cable.

MT1-PCM Set Contains:

- Receiving Antenna With Cable (4m)
- MT1-PCM-DEC (Receiver Unit)
- DC Power Cable
- Mounting Tape 25mm
- Mounting Tape 50mm
- Wire for Cable loom
- 6V Lithium Battery CR-P2 (1600 mAh) >12h operating time
- 1x Hexagon key (for AZ & OVR switch setting)
- 1x Screw driver (for gain setting)
- MT1-PCM-STG (encoder) and 40k-Tx (transmitter) with Wire Antenna

Technical Data are subject to change without notice!
## MT1-PCM-STG

**Strainage:** Full and 1/2 bridge >350 Ohm, 
**Excitation:** 4 VDC (fixed) 
**Gain:** 250, 500, 1000, 2000, 4000, 8000 

Gain table:

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

**Shunt Cal:** Via external resistor for positive and negative calibration 
**Analog bandwidth:** 0 - 500 Hz (-3 dB) 
**Operating temperature:** - 10 to + 80 °C 
**Scanning rate:** 2000 Hz 
**Resolution:** 12bit (ADC) 

**40k-Tx transmitter:**
- Carrier frequency: 433MHz or 868MHz, 10mW transmitting power 
- Dimensions: MT1-PCM-STG = 62x27x11mm (without connectors) 
- Weight: each about 30 gram (without cables) 
- Static acceleration: up to 3000g (only with inductive power!) with lithium battery about 1000g 
- Powering: MT1-PCM-STG By battery 6-9V (powering 40k-Tx trough MT1-PCM-STG, +5V/GND) 
- Power consumption: 90mA 
- Operating time: with CR-P2 Lithium 1600mAh battery about >12h 

**Optional:** Inductive powering

## MT1-PCM-VOLT

**High level inputs:** +/- 20, 10V, 5V, 2.5V, 1.25V or 0.625V 
**Range:** 250, 500, 1000, 2000, 4000, 8000 

Gain table:

<table>
<thead>
<tr>
<th>INPUT range</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>+/- 20V</td>
<td>250</td>
</tr>
<tr>
<td>+/- 10V</td>
<td>500</td>
</tr>
<tr>
<td>+/- 5V</td>
<td>1000</td>
</tr>
<tr>
<td>+/- 2.50V</td>
<td>2000</td>
</tr>
<tr>
<td>+/- 1.250V</td>
<td>4000</td>
</tr>
<tr>
<td>+/- 0.625.V</td>
<td>8000</td>
</tr>
</tbody>
</table>

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- Operating time: with CR-P2 Lithium 1600mAh battery about >12h 

**Optional:** Inductive powering
### Technical Data - Receiver

#### Front Side:
- **Analogue output:** +/-10V via BNC
- **Resolution:** 12bit (DAC)
- **Gain setting:** via screw switch
- **Auto Zero setting:** via micro switch
- **Overload LED’s:** (Red ON) reset: via micro switch
- **Autozero LED:**
  - Yellow ON: successful AZ (output signal <+/-30mV)
  - Yellow OFF: not successful AZ (output sign. >+/-30mV)
  - 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 the battery is empty
- **Power ON LED:** Red ON = if power switch on

#### Rear Side:
- **Antenna:** Input for receiving antenna
- **RF Level:** LED indicator for radio frequency
- **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 %
Transmitting Part:

- **Powering - 6-9V DC**: 6-9V is reverse polarity protected!
- **Recommended lithium battery CR-P2**: 6V 1600mAh (operating time up to >12h)
- **Sensor Connection**: 3 Pins =
  - PCM GND from MT1-PCM-STG
  - PCM IN from MT1-PCM-STG
  - 5VDC IN from MT1-PCM-STG
- **Strain gage**: 3 Pins =
  - PCM GND to 40k transmitter
  - PCM OUT to 40k transmitter
  - 5VDC OUT to 40k transmitter
- **Wire Antenna**
- **PCM IN from MT1-PCM-STG**
- **5VDC IN from MT1-PCM-STG**
- **PCM OUT to 40k transmitter**
- **Take care with 5V connection! It is not reverse polarity protected**

We recommend to solder all wires!
Receiving Part:

**Front**

- **Positive Baragraph LED** With overload indicator
- Yellow ON- successful AZ (output signal +/-30mV)
- Yellow OFF- not successful AZ (output signal >+/-.30mV)
- If flashing, call support of KMT, error in EPROM

**Negative Baragraph LED** With overload indicator

**Reset button of overload indicator**

**Red ON** = if error of data transmitting
**Red Flashing** = if the battery is empty

**Rear**

- **LED Flashing if fuse damage**
- **IN - Receiving Antenna**
- **RF Level**: LED indicator for Radio Frequency
- **Fuse**
- **ON DC 10...30V**
- **Power ON/OFF switch**
- **Power In DC 10 – 30V**

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Version 2012-10

Technical Data are subject to change without notice!
Receiving Part:

MT1-PCM-DEC
Receiver and Decoder

Receiving Antenna with 4m Cable (RG58) (Optional 12m)
Block Diagram:

Transmitting (Tx) wire antenna

Battery 6 - 9V

MT1-PCM STG

KMT 40k-Tx

Caution: +5V IN is not reverse polarity protected!

Distance 1-10m between Tx and Rx antenna (depend of application!)

MT1-PCM Decoder

OVL

AZ

Gain

OVL

OVR

AZ

SL

Power

Technical Data are subject to change without notice!
## Mounting on Shaft:

**Caution:**
Fix MT1-PCM-STG and Tx-40k module with at least 10 layers 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 *(Fiberglas Tape)* with high tensile strength should be used for pre-fixing. Additionally, use **steel strip for final fixing**!! The individual components are to be distributed in such a way on the shaft that imbalances are avoided.

All cable connections should be soldered.

10 layers of the special mounting tape around the shaft. We recommend add. use a steel strip for final fixing!!

Fix with 3 layers of mounting tape around the antenna and cables.

Steel strip
Attention

- Use only special lithium batteries for rotating applications
- 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 steel strip!!!
**MT - Inductive power supply set:**

(Picture shows standard Inductive power supply for diameter up to 300mm)

- Power supply power head
- CU wire 0.5mm
- Ferrite tape 30mmx3m
- 25 and 50mm mounting tape to fix coil on shaft
- AC/DC converter
  - Input: AC from coil
  - Output 6.5VDC 100mA
- DC Power cable
- Power Head with cable 5m

**Mounted on shaft:**

- 3-10mm
Installation of coil for inductive powering on shaft

Attach for electromagnetic insulation “Ferrite Tape” **2 x one** layer around the shaft.
Fixed with 2 layers mounting tape

Wind the 0.50…0.63 mm enameled (CUL) copper wire around the shaft:
10-30 windings for 1000-20mm diameter
Other diameter on request!

**Note:** “The inductive load of the MT1- IND-PWR and the capacitor in the Power Head must be in resonance to get the optimal transmission. The inductive load of the shaft depends of diameters, material and number of windings. ”

To find the optimal transmission try one winding more or less. The LED on the Inductive Power module will help to find the best configuration. The distance between Powerhead and the coil is 3-10mm.

Control the output voltage and move the powerhead in the max distance to the coil.
The minimum Output voltage must be 6,5 V!

Fix all with 2-3 layers around the coil with mounting tape.
Find the correct amount of windings of inductive power coil

**Optimum windings for steel shafts**

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Windings</th>
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<tbody>
<tr>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>490</td>
<td>13</td>
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<tr>
<td>290</td>
<td>15</td>
</tr>
<tr>
<td>190</td>
<td>18</td>
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<td>80</td>
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<tr>
<td>45</td>
<td>27</td>
</tr>
<tr>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

Distance deepened of current consumption

*E.g. 200mA 3-5mm, 100mA 5-10mm*
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 MT-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 MT1 Modules

Fix all MT1 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. 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.

Steel strip

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 steel strip for final fixing!!

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

Safety notes for inductive powering

- The device should only applied by instructed personnel.
- The power head emits strong magnetic radiation at 40-60 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 strong heat up small objects. Also 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 interferences when used in residential areas or environments. In this case the operator is responsible for establishing protective procedures.
 declaring under our sole responsibility, that the product

<table>
<thead>
<tr>
<th>Bezeichnung</th>
<th>Messdatenübertragungssystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Nom</td>
</tr>
<tr>
<td>Typ, Modell, Artikel-Nr., Größe</td>
<td>MT1-PCM</td>
</tr>
<tr>
<td>Type, Modèle, Mo.d'Article, Taille</td>
<td>MT1-PCM</td>
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 fulfilling the requirements of the standard and regulations of the Directive

<table>
<thead>
<tr>
<th>108/2004/EG</th>
<th>Elektromagnetische Verträglichkeit EMV / EMC</th>
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<td>DIN EN 61000-6-3 Ausgabe 2002-8 Elektromagnetische Verträglichkeit EMV Teil 6-3 Fachgrundnorm Störaussendung</td>
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 and the taken test reports und therefore corresponds to the regulations of the Directive

<table>
<thead>
<tr>
<th>Otterfing, 02.05.2006</th>
<th>Martin Kraus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ort und Datum der Ausstellung</td>
<td>Name und Unterschrift des Befugten</td>
</tr>
<tr>
<td>Place and Date of Issuance</td>
<td>Name and Signature of authorized person</td>
</tr>
<tr>
<td>Lieu et date d'établissement</td>
<td>Nom et signature de la personne autorisée</td>
</tr>
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