Inductive Sensor Telemetry
1 Channel Sensor Signal Amplifiers and Receivers

Page 2 ................................................................. Configuration
Page 3 ... 28 ............................................................ Sensor signal amplifier
Page 29 ... 51 ............................................................ Receiver
Configuration (modular inductive Telemetry)

- Single Channel Sensor Signal Amplifier
- Remote control (option)
- Contactless distance (µ-transducer)
- Hall sensor
- Strain gage half bridge
- Strain gage full bridge
- Thermocouple
- PT100 RTD
- Piezo electric

Inductive supply and transmission 13.56 MHz

- Single Channel Receiver
- Digital interface (option)
- Incremental/ Absolut converter (option)

Coupling

- Trace A
- Trace B
- Trace 0
- Speed Pickup

- Shaft encoder (option)

- Remote shunt calibration
- Ethernet CAN USB

- 90 to 270V AC (9 to 36 V DC)
- 0 to ±10V

Configuration (modular inductive Telemetry)
Sensor Signal Amplifier Type 2a

1 Channel FM/PCM Transmitter

For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 14 Bits, 16 Bits*
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 150°C)
Max load: 5 000 g (depending on fixing)
Type: SV_2a_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>

* PCM version
Sensor Signal Amplifier Type 2b (End of shaft, Cartridge, Turbine)

Integrated Rotor Coil

Weight: about 10 g

With integrated axial antenna

End of shaft

Sensor signal amplifier

Stator antenna (Pick up)

1 Channel FM/PCM Transmitter

For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 14 Bits, 16 Bits*
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Enviroemntal temperature range: -25 to +85°C (125°C, 150°C)
Max load: 50 000 g (depending on fixing)
Type: SV_2b_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_TC

* PCM version
Sensor Signal Amplifier Type 2bx (End of shaft, Cartridge, Turbine)

Integrated Rotor Coil

Weight: about 10 g

1 Channel FM/PCM Transmitter
For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 14 Bits, 16 Bits*
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 150°C)
Max load: 50 000 g (depending on fixing)
Type: SV_2bx_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_TC

* PCM version

Weight: 15 g
Torque of inertia: 4.2E-7 kgm²
Sensor Signal Amplifier Type 2c (End of shaft, Miniatur Cartridge, Turbine)

+U_B  
\( R_{\text{Cal}} \)  
I-  
I+  
GND  
HF

2 golden enamelled wires twisted

HF

U_a

I+

I-

GND

1 Channel PCM Transmitter

For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 14 Bits, 16 Bits*
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Enviromental temperature range: -25 to +85°C (125°C, 150°C)
Max load: 50 000 g (depending on fixing)
Type: SV_2b_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Frequency</th>
<th>Modulation</th>
<th>Max Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.02</td>
<td>85</td>
<td>FM</td>
<td>-</td>
</tr>
<tr>
<td>0.01</td>
<td>125</td>
<td>PCM16</td>
<td>10 kHz</td>
</tr>
<tr>
<td>0.003</td>
<td>150</td>
<td></td>
<td>40 kHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>160</td>
</tr>
</tbody>
</table>
Sensor Signal Amplifier Type 2d (End of shaft, Micro Cartridge, Turbine)

Integrated Rotor Coil

1 Channel FM/PCM Transmitter

For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensortelemetry FM, PCM
Integrated filter
Resolution: 16 Bits
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50 000 g (depending on fixing)
Type: SV_2d_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>

<table>
<thead>
<tr>
<th>Type</th>
<th>0.02</th>
<th>0.01</th>
<th>0.003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>85</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>FM</td>
<td>PCM16</td>
<td>PCM16</td>
</tr>
<tr>
<td>Resolution</td>
<td>1 kHz</td>
<td>10 kHz</td>
<td>40 kHz</td>
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<tr>
<td>TC</td>
<td>160</td>
<td>160</td>
<td>160</td>
</tr>
</tbody>
</table>
**Sensor Signal Amplifier Type 2e (Disk, End of shaft, Small space)**

1 Channel FM/PCM Transmitter

- For strain gage, PT100, thermocouple
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 (10 Hz to 50 kHz
- Strain gage bridge supply: 2.5 V (3.3 V*)
- Strain gage bridge resistance: 350 (120, 1000) Ω
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
- Resolution: 14 Bits, 16 Bits*
- Zero point drift: 0.02, (0.01, 0.003 option)
- Remote shunt calibration
- Remote gain, zero, auto zero with 16 Bit resolution (option)
- Additional temperature channel (option)
- Environmental temperature range: -25 to +85°C (125°C, 160°C)
- Max load: 50 000 g (max. speed: 30 0000 RPM)
- Type: SV_2e_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>

* PCM version
Wheel Transmitter with integrated Signal Amplifier  Type 2f

Stator
Rotor
Transducer connection
Range conditioning

For more information see section: Universal shaft transmitter

1 Channel FM/PCM Transmitter
- Bearded wheel transmitter
- For strain gage, PT100, thermocouple
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 (10) Hz to 50 kHz
- Strain gage bridge supply: 6 V (3.3 V*)
- Strain gage bridge resistance: 120, 350, 1000 Ω
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
  - Resolution: 14 Bits, 16 Bits*
  - Zero point drift: 0.02, (0.01, 0.003* option)
  - Remote shunt calibration
  - Speed detection: 360 pulses/turn
  - Environmental temperature range: -25 to +85°C (125°C, 160°C)
  - Max load: 5 000 g (max. speed:10 000 RPM)
- Type: SV_2f_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>_<RPM>

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>Temp</th>
<th>Mod</th>
<th>Bandwidth</th>
<th>Rmc</th>
<th>TC</th>
<th>RPM</th>
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<tbody>
<tr>
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<td></td>
<td></td>
<td>1 kHz</td>
<td></td>
<td></td>
<td>90</td>
</tr>
<tr>
<td>0.01</td>
<td></td>
<td></td>
<td>10 kHz</td>
<td>R</td>
<td>TC</td>
<td>180</td>
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<tr>
<td>0.003</td>
<td></td>
<td></td>
<td>40 kHz</td>
<td></td>
<td></td>
<td>360</td>
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</table>
Universal Shaft Transmitter with Sensor Signal Amplifier Type 2La

(non divisible, 1 channel, with/without RMC, without rpm sensor)

<table>
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<tr>
<th>Dimensions</th>
<th>( \Phi A ) [mm]</th>
<th>( \Phi B ) [mm]</th>
<th>C [mm]</th>
<th>( \Phi D ) [mm]</th>
<th>E [mm]</th>
<th>F [mm]</th>
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<td>70</td>
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<td>37</td>
<td>65</td>
<td>76</td>
<td>17</td>
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<td>46</td>
<td>55</td>
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<td>83</td>
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<tr>
<td>51</td>
<td>60</td>
<td>39</td>
<td>75</td>
<td>90</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

1 Channel FM/PCM Transmitter

- Beared wheel transmitter
- For strain gage, PT100, thermocouple
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 (10) Hz to 10 kHz
- Strain gage bridge supply: 6 V (3.3 V*)
- Strain gage bridge resistance: 120, 350, 1000 Ω
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
- Resolution: 16 Bits
- Zero point drift: 0.02, (0.01, 0.003* option)
- Remote shunt calibration
- Type: SV_2La_<Di>_<Da>_<temp>_<mod>_<bandwidth>_<rmc>_TC_<RPM>

For more information see section: Universal shaft transmitter
Universal Shaft Transmitter with Sensor Signal Amplifier Type 2Lg
(divisible, 1 channel, with/without RMC, without rpm sensor)

**Dimensions**

<table>
<thead>
<tr>
<th>Ø A [mm]</th>
<th>Ø B [mm]</th>
<th>C [mm]</th>
<th>Ø D [mm]</th>
<th>E [mm]</th>
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<tbody>
<tr>
<td>36</td>
<td>50</td>
<td>70</td>
<td>66</td>
<td>80</td>
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<tr>
<td>41</td>
<td>55</td>
<td>73</td>
<td>71</td>
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</tr>
<tr>
<td>46</td>
<td>60</td>
<td>75</td>
<td>78</td>
<td>90</td>
</tr>
</tbody>
</table>

**1 Channel PCM Transmitter**

Beared wheel transmitter
For strain gage, PT100, Thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 Hz to 10 kHz
Strain gage bridge supply: 6 V (3.3 V*)
Strain gage bridge resistance: 120, 350, 1000 Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 16 Bits
Zero point drift: 0.02, (0.01, 0.003* option)
Remote shunt calibration
Type: SV_2Lg_<Di>_dT<Da>_temp<mod>_bandwidth_rmc_TC_RPM

For more information see section: Universal shaft transmitter
Sensor Signal Amplifier Type 3a

Weight: about 10 g

1 Channel FM/PCM Transmitter

- For strain gage, PT100, thermocouple
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 (10) Hz to 50 kHz
- Strain gage bridge supply: 2.5 V (3.3 V*)
- Strain gage bridge resistance: 350 (120, 1000) Ω
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
- Resolution: 14 Bits, 16 Bits*
- Zero point drift: 0.02, (0.01, 0.003 option)
- Remote shunt calibration
- Remote gain, zero, auto zero with 16 Bit resolution (option)
- Additional temperature channel (option)
- Environmental temperature range: -25 to +85°C (125°C, 160°C)
- Max load: 50 000 g (depending on fixing)
- Type: SV_3a_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_TC

* PCM version
Sensor Signal Amplifier Type 3b

1 Channel FM/PCM Transmitter

For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 14 Bits, 16 Bits*
Zero point drift: 0.02, (0.,01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Enviromental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50 000 g (depending on fixing)

Type: SV_3b_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_TC

* PCM version

| 0,02 | 85 | FM | 1 kHz |
| 0,01 | 125 | PCM16 | 10 kHz |
| 0,003 | 150 | 40 kHz |
| 38,0 |
Sensor Signal Amplifier Type 3c

**Weight:** about 12 g

---

**1 Channel FM/PCM Transmitter**

- For strain gage, PT100, thermocouple
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 (10) Hz to 50 kHz
- Strain gage bridge supply: 2.5 V (3.3 V*)
- Strain gage bridge resistance: 350 (120, 1000) Ω
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
- Resolution: 14 Bits, 16 Bits*
- Zero point drift: 0.02, (0.01, 0.003 option)
- Remote shunt calibration
- Remote gain, zero, auto zero with 16 Bit resolution (option)
- Additional temperature channel (option)
- Environmental temperature range: -25 to +85°C (125°C, 160°C)
- Max load: 50 000 g (depending on fixing)

**Type:** SV_3c_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_TC

---

<table>
<thead>
<tr>
<th><strong>Parameter</strong></th>
<th><strong>Value</strong></th>
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</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>0.02 mV/V to 20 mV/V</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>0 (10) Hz to 50 kHz</td>
</tr>
<tr>
<td>Bridge Supply</td>
<td>2.5 V (3.3 V*)</td>
</tr>
<tr>
<td>Bridge Resistance</td>
<td>350 (120, 1000) Ω</td>
</tr>
<tr>
<td>Transmission</td>
<td>FM, PCM</td>
</tr>
<tr>
<td>Integrated Filter</td>
<td>Yes</td>
</tr>
<tr>
<td>Resolution</td>
<td>14 Bits, 16 Bits*</td>
</tr>
<tr>
<td>Zero Point Drift</td>
<td>0.02, (0.01, 0.003 option)</td>
</tr>
<tr>
<td>Remote Shunt Calibration</td>
<td>Yes</td>
</tr>
<tr>
<td>Remote Gain, Zero, Auto Zero</td>
<td>Yes</td>
</tr>
<tr>
<td>Additional Temperature Channel</td>
<td>Yes</td>
</tr>
<tr>
<td>Environmental Temperature Range</td>
<td>-25 to +85°C (125°C, 160°C)</td>
</tr>
<tr>
<td>Max Load</td>
<td>50 000 g (depending on fixing)</td>
</tr>
</tbody>
</table>

---

* PCM version
Sensor Signal Amplifier with auto turning Type 3c_/#Ag

no manual resonant adjustment necessary

Weight: about 12 g

1(2) Channel PCM Transmitter
For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Transmission: inductive sensor telemetry PCM
auto tuning circuit for rotor resonance (range 20..625pF)
Resolution: 16 Bits (Integrated filters)
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 150°C)
Max load: 50 000 g (depending on fixing)
Type: SV_3c_/#Ag625pF_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>

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<th>0,02</th>
<th>0,01</th>
<th>0,003</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>FM</td>
<td>1 kHz</td>
<td>R</td>
</tr>
<tr>
<td>125</td>
<td>PCM16</td>
<td>2 kHz</td>
<td>TC</td>
</tr>
<tr>
<td>150</td>
<td></td>
<td>10 kHz</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sensor Signal Amplifier Type 4a

Weight: about 15 g

---

1 Channel FM/PCM Transmitter

For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 14 Bits, 16 Bits*
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50 000 g (depending on fixing)
Type: SV_4a_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_TC

* PCM version
Sensor Signal Amplifier Type 4b

Weight: about 12 g

1 Channel FM/PCM Transmitter

For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 14 Bits, 16 Bits*
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50 000 g (depending on fixing)

Type: SV_4b_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_TC

* PCM version
Sensor Signal Amplifier Type 4c
integrated Rotor Antenna (radial)

1 Channel FM/PCM Transmitter
For strain gage, PT100, thermocouple
integrated rotor antenna
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 14 Bits, 16 Bits*
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Enviromental temperature range: -25 to +85°C (125°C, 150°C)
Max load: 50 000 g (depending on fixing)
Type: SV_4c_<accuracy>_ <temp>_ <mod> _<bandwidth> _<rmc> _<TC> _<spot>

* PCM version

Weight: about 12 g

Shaft

1 kHz 10 kHz 40 kHz

0.02 85 FM 1 kHz - - -
0.01 125 PCM16 10 kHz R TC spot
0.003 150 40 kHz

Page 17
Sensor Signal Amplifier Type 4d
integrated Rotor Antenna (axial)

Weight: about 12g

1 Channel FM/PCM Transmitter
For strain gage, PT100, thermocouple
integrated rotor antenna
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 14 Bits, 16 Bits*
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50,000 g (depending on fixing)
Type: SV_4d_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>

* PCM version
Sensor Signal Amplifier Type 5a
(Standard)
Weight: about 8g

1 Channel FM/PCM Transmitter
For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 14 Bits, 16 Bits*
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50 000 g (depending on fixing)
Type: SV_5a_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_TC

* PCM version
Sensor Signal Amplifier Type 5b

(Standard)

Weight: about 8g

1 Channel FM/PCM Transmitter

For strain gage, PT100, thermocouple

Sensitivity: 0.02 mV/V to 20 mV/V

Bandwidth: 0 (10) Hz to 50 kHz

Strain gage bridge supply: 2.5 V (3.3 V*)

Strain gage bridge resistance: 350 (120, 1000) Ω

Transmission: inductive sensor telemetry FM, PCM

Integrated filter

Resolution: 14 Bits, 16 Bits*

Zero point drift: 0.02, (0.01, 0.003 option)

Remote shunt calibration

Remote gain, zero, auto zero with 16 Bit resolution (option)

Additional temperature channel (option)

Environmental temperature range: -25 to +85°C (125°C, 160°C)

Max load: 50 000 g (depending on fixing)

Type: SV_5b_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_TC

* PCM version
Sensor Signal Amplifier Type 5c (Miniature Patrone)

Weight: 5 g
Torque of inertia: 1.5E-8 kgm²

1 Channel FM/PCM Transmitter
- For strain gage, PT100, thermocouple
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 (10) Hz to 50 kHz
- Strain gage bridge supply: 2.5 V (3.3 V*)
- Strain gage bridge resistance: 350 (120, 1000) Ω
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
  - Resolution: 14 Bits, 16 Bits*
  - Zero point drift: 0.02, (0.01, 0.003 option)
  - Remote shunt calibration
  - Remote gain, zero, auto zero with 16 Bit resolution (option)
  - Additional temperature channel (option)
  - Environmental temperature range: -25 to +85°C (125°C, 150°C)
- Max load: 50 000 g (depending on fixing)
- Type: SV_5c_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>

PCM version
Sensor Signal Amplifier Type 5d (Super Miniature Patrone)

- **Weight:** 5 g
- **Torque of inertia:** 1.5E-8 kgm²

**1 Channel FM/PCM Transmitter**
- For strain gage, PT100, thermocouple
- Sensitivity: 0.1 mV/V to 20 mV/V
- Bandwidth: 0 (10) Hz to 1 kHz
- Strain gage bridge supply: 3.3 V
- Strain gage bridge resistance: 350 (120, 1000) Ω
- Transmission: inductive sensor telemetry PCM
- Integrated filter
- Resolution: 16 Bits
- Zero point drift: 0.02, (0.01 option)
- Environmental temperature range: -25 to +85°C (125°C, 150°C)
- Max load: 50 000 g (depending on fixing)
- Type: SV_5d_<accuracy>_<temp>_<mod>_<bandwidth>_<TC>

* PCM version
Miniatur Sensor Signal Amplifier Type 7a (Flatchip)

Weight:
Epoxy: about 5g

1 Channel FM/PCM Transmitter
For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 16 Bits
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50 000 g (depending on fixing)
Type: SV_7a_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>

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<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Gain Bandwidth</th>
<th>RMC</th>
<th>TC</th>
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<tr>
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<td>1 kHz</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>0.01</td>
<td>125</td>
<td>10 kHz</td>
<td>R</td>
<td>TC</td>
</tr>
<tr>
<td>0.003</td>
<td>150</td>
<td>40 (50) kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>160</td>
<td></td>
</tr>
</tbody>
</table>
Super Miniatur Sensor Signal Amplifier Type 7b Micro (Flatchip)

Weight:
Epoxy: about 3g

1 Channel FM/PCM Transmitter
For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 10 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry PCM
Integrated filter
Resolution: 16 Bits
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
fixed gain
Environmental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50 000 g (depending on fixing)
Type: SV_7b_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>

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<td>-</td>
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<td>0.01</td>
<td>125</td>
<td>PCM16</td>
<td>10 kHz</td>
<td>TC</td>
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</table>
Miniatur Sensor Signal Amplifier Type 7ke (Flatchip) with integrated Antenna (special for Chain Application)

Weight: Epoxy: about 8g

- 2 golden enamelled wires twisted
- 3 golden enamelled wires twisted

1 Channel FM/PCM Transmitter with Antenna

- For strain gage, PT100, thermocouple
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 (10) Hz to 50 kHz
- Strain gage bridge supply: 2.5 V (3.3 V*)
- Strain gage bridge resistance: 350 (120, 1000) Ω
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
- Resolution: 16 Bits
- Zero point drift: 0.02, (0.01, 0.003 option)
- Remote shunt calibration
- Remote gain, zero, auto zero with 16 Bit resolution (option)
- Additional temperature channel (option)
- Environmental temperature range: -25 to +85°C (125°C, 160°C)
- Max load: 50 000 g (depending on fixing)
- Type: SV_Ke_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>

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<thead>
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<th>Type</th>
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<tr>
<td></td>
<td>1 kHz</td>
<td>10 kHz</td>
<td>40 kHz</td>
</tr>
<tr>
<td>FM</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PCM16</td>
<td>TC</td>
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<td></td>
</tr>
</tbody>
</table>

Page 25
Waterproof Sensor Signal Amplifier Type 8a

1 Channel FM/PCM Transmitter
- For strain gage, PT100, thermocouple
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 (10) Hz to 50 kHz
- Strain gage bridge supply: 2.5 V (3.3 V*)
- Strain gage bridge resistance: 350 (120, 1000) Ω
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
  - Resolution: 16 Bits
  - Zero point drift: 0.02, (0.01, 0.003 option)
  - Remote shunt calibration
  - Remote gain, zero, auto zero with 16 Bit resolution (option)
- Additional temperature channel (option)
- Environmental temperature range: -25 to +85°C (125°C, 160°C)
- Max load: 50 000 g (depending on fixing)
- Type: SV_8a_<accuracy>_<temp>_<sys>_<mod>_<bandwidth>_<rmc>_<TC>_wa

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<th>Temp</th>
<th>Sys</th>
<th>Mod</th>
<th>Bandwidth</th>
<th>RMC</th>
<th>TC</th>
<th>Load (g)</th>
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<td>1</td>
<td>kHz</td>
<td></td>
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<td>10</td>
<td>kHz</td>
<td>R</td>
<td>TC</td>
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</tr>
<tr>
<td>0.003</td>
<td>150</td>
<td>PCM16</td>
<td>40</td>
<td>kHz</td>
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</table>
Waterproof Sensor Signal Amplifier Type 8b

For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 16 Bits
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Environmental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50 000 g (depending on fixing)

Type: SV_8b_<accuracy>_<temp>_<sys>_<mod>_<bandwidth>_<rmc>_<TC>_wa

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<th>&lt;sys&gt;</th>
<th>&lt;mod&gt;</th>
<th>&lt;bandwidth&gt;</th>
<th>&lt;rmc&gt;</th>
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<tbody>
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<td>FM</td>
<td>1 kHz</td>
<td>-</td>
<td>-</td>
<td></td>
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<tr>
<td>0.01</td>
<td>125</td>
<td>Fu</td>
<td>PCM16</td>
<td>10 kHz</td>
<td>R</td>
<td>TC</td>
<td></td>
</tr>
<tr>
<td>0.003</td>
<td>150</td>
<td></td>
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<td>40 kHz</td>
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</table>
Sensor Signal Amplifier Type 9
especially for Driveshafts

Through hole
Ø = 7 mm for weight reduction
Inner diameter: 17 to 50 mm
Outer diameter = Inner diameter + 20 mm

1 Channel FM/PCM Transmitter
For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 16 Bits
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50 000 g (depending on fixing)
Type: SV_9_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>

* PCM version

<table>
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<tr>
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<th>FM</th>
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<th>PCM16</th>
<th>10 kHz</th>
<th>R</th>
<th>TC</th>
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<tbody>
<tr>
<td>0.02</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0.01</td>
<td>125</td>
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<td></td>
<td>160</td>
<td></td>
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<td></td>
<td></td>
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Sensor Signal Amplifier Type SV-Flex

1(2) Channel PCM Transmitter

- For strain gage, PT100, Thermocouple
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 (10) Hz to 50 kHz
- Strain gage bridge supply: 2.5 V (3.3 V*)
- Strain gage bridge resistance: 350 (120, 1000) Ω
- Transmission: inductive sensortelemetry PCM
- Integrated filter
- Resolution: 16 Bits
- Zero point drift: 0.02, (0.01, 0.003 option)
- Remote shunt calibration
- Remote gain, zero, auto zero with 16 Bit resolution (option)
- Additional temperature channel (option)
- Environmental temperature range: -25 to +85°C (125°C, 160°C)
- Max load: 50 000 g (depending on fixing)
- Type: SV_Flex_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Bandwidth</th>
<th>Strain gage bridge supply</th>
<th>Strain gage bridge resistance</th>
<th>Transmission</th>
<th>Resolution</th>
<th>Zero point drift</th>
<th>Remote shunt calibration</th>
<th>Remote gain, zero, auto zero</th>
<th>Additional temperature channel</th>
<th>Environmental temperature range</th>
<th>Max load</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.02</td>
<td>85</td>
<td>FM</td>
<td>1 kHz</td>
<td>PCM</td>
<td>16 Bits</td>
<td>0.02</td>
<td>(0.01, 0.003 option)</td>
<td></td>
<td></td>
<td>-25 to +85°C</td>
<td>50 000 g</td>
<td>SV_Flex_&lt;accuracy&gt;<em>&lt;temp&gt;</em>&lt;mod&gt;<em>&lt;bandwidth&gt;</em>&lt;rmc&gt;_&lt;TC&gt;</td>
</tr>
<tr>
<td>0.01</td>
<td>125</td>
<td>PCM16</td>
<td>2kHz</td>
<td>R</td>
<td>TC</td>
<td>0.01</td>
<td>(0.003 option)</td>
<td></td>
<td></td>
<td>-25 to +125°C</td>
<td>150</td>
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</tr>
<tr>
<td>0.003</td>
<td>150</td>
<td></td>
<td>10 kHz</td>
<td>TC</td>
<td></td>
<td>0.003</td>
<td>(option)</td>
<td></td>
<td></td>
<td>-25 to +160°C</td>
<td>160</td>
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</tbody>
</table>
Sensor Signal Amplifier with auto turning Type SV-Flex /#Ag

no manual resonant adjustment necessary

1(2) Channel PCM Transmitter

For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 (10) Hz to 50 kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry PCM
auto tuning circuit for rotor resonance (range 20..625pF)
Resolution: 16 Bits (Integrated filters)
Zero point drift: 0.02, (0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 150°C)
Max load: 50 000 g (depending on fixing)
Type: SV_Flex_//#Ag625pF_<accuracy>_ <temp>_<mod> _<bandwidth> _<rmc> _<TC>

| 0.02  | 85  | PCM16 | 1 kHz | -    | -    |
| 0.01  | 125 |       | 2 kHz | R    | TC   |
| 0.003 | 150 |       | 10 kHz |     |      |
|       |     |       |       |     |      |

auto turning circuit
self adapting to different shaft diameters
(no extra extra capacity necessary)

Very low inertia
Evaluation Unit (84TE)

1 Channel FM/PCM Receiver
- Bandwidth: 0 to 1 kHz (10 kHz, 50 kHz)
- Output: 0 to ±10 V, ±(0 to 20 mA), frequency, binary, USB, CAN, TCP/IP
- RF power: 1 W, 3 W, 5 W
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
- Resolution: 12 Bits, 16 Bits*
- Remote shunt calibration
- Environmental temperature range: -25 to +70°C
- Supply: 9 to 36 V DC (board supply), 90 to 270 V AC 50/60 Hz

Type: MAV_84TE_<Sys>_<Freq>_<mod>_<bandw>_<supply>_<RF-power>_<outA>_<Dint>_<temp>_<Dz>

<table>
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<tr>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>1W</td>
<td>70</td>
</tr>
<tr>
<td>InBa</td>
<td>PC12</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>3W</td>
<td>U</td>
</tr>
<tr>
<td>Fu</td>
<td>kHz</td>
</tr>
<tr>
<td>3,2</td>
<td>24B</td>
</tr>
<tr>
<td>5W</td>
<td>I</td>
</tr>
<tr>
<td>InFu</td>
<td>kHz</td>
</tr>
<tr>
<td>PCM24</td>
<td>230</td>
</tr>
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<td>10W</td>
<td>USB</td>
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<td>CAN</td>
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<td>TCP/IP</td>
</tr>
<tr>
<td></td>
<td>EtherCAT</td>
</tr>
</tbody>
</table>
Evaluation Unit (42TE)

Depth = 260 mm

Front side

1 Channel FM/PCM Receiver

Bandwidth: 0 to 1 kHz (10 kHz, 40 kHz)
Output: 0 to ±10 V, (0 to 20 mA, frequency, binary, USB, CAN, TCP/IP)
RF power: 1 W, 3 W, 5 W
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 12 Bits, 16 Bits*
Remote shunt calibration
Environmental temperature range: -25 to +70°C
Supply: 9 to 36 V DC (board supply), 90 to 270 V AC 50/60 Hz

Type: AW_42TE_<Sys>_<_Freq>_<_mod>_<_bandw>_<_supply>_<_RF-power>_<_outA>_<_Dint>_<_temp>_<_Dz>

<table>
<thead>
<tr>
<th>F</th>
<th>1 kHz</th>
<th>15</th>
<th>1W</th>
<th>70</th>
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<tbody>
<tr>
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<td>6</td>
<td>PCM12</td>
<td>2 kHz</td>
<td>24</td>
</tr>
<tr>
<td>Fu</td>
<td>3,2</td>
<td>PCM16</td>
<td>5 kHz</td>
<td>24B</td>
</tr>
<tr>
<td>InFu</td>
<td>PCM24</td>
<td>10 kHz</td>
<td>230</td>
<td>10W</td>
</tr>
</tbody>
</table>
Evaluation Unit (22TE)

Front side

1 Channel FM/PCM Receiver
- Bandwidth: 0 to 1 kHz (10 kHz, 40 kHz)
- Output: 0 to ±10 V, (0 (4) to 20 mA, frequency, binary, USB, CAN, TCP/IP)
- RF power: 1 W, 3 W, 5 W
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
- Resolution: 12 Bits, 16 Bits, 24 Bits
- Remote shunt calibration
- Environmental temperature range: -25 to +70°C
- Supply: 9 to 36 V DC (board supply), 90 to 270 V AC 50/60 Hz

Type: AW_22TE_<Sys>_<Freq>_<mod>_<bandw>_<supply>_<RF-power>_<outA>_<Dint>_<temp>_<Dz>

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<th></th>
<th>F</th>
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<th>15</th>
<th>1W</th>
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<th>70</th>
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<tbody>
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<td>6</td>
<td>PCM12</td>
<td>2 k</td>
<td>24</td>
<td>3W</td>
<td>U</td>
<td>F</td>
<td>-45/85 Dz</td>
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<td>PCM16</td>
<td>5 k</td>
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<td>5W</td>
<td>I</td>
<td>B</td>
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<td>10 k</td>
<td>230</td>
<td>10W</td>
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<td>EtherCAT</td>
</tr>
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</table>

90 to 270 volts

Antenna

90 to 270 volts

Digital interface (option)

Incremental/ Absolute converter (option)

Ethernet (TCP/IP) CAN USB

Remote Calibration

Shaft encoder interface (option)

Speed Pickup
Evaluation Unit (AW_D)

1 Channel FM/PCM Receiver
- Bandwidth: 0 to 1 kHz (10 kHz, 40 kHz)
- Output: 0 to ±10 V, (0 (4) to 20 mA, frequency, binary
- RF power: 1 W, 3 W, 5 W
- Transmission: inductive sensor telemetry FM, PCM
- Integrated filter
- Resolution: 12 Bits, 16 Bits, 24 Bit
- Remote shunt calibration
- Environmental temperature range: -25 to +70°C
- Supply: 24/15V

Pin Assignment of the D-Sub connector
- Pin 1: Output -10V to +10V
- Pin 2: GND Output
- Pin 3: Remote Calibration Signal
- Pin 4: do not connect
- Pin 5: GND Power Supply
- Pin 6: do not connect
- Pin 7: Power Supply 9 to 36 VDC
- Pin 8: do not connect
- Pin 9: do not connect

Type: AW_D_<Sys>_<Freq>_<mod>_<bandw>_<supply>_<RF-power>_<outA>_<Dint>_<temp>_<Dz>_<Mo>

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<th>24</th>
<th>3W</th>
<th>U</th>
<th>F</th>
<th>-45/-85</th>
<th>Dz</th>
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<td>I</td>
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<td></td>
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<td></td>
<td>USB</td>
<td></td>
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</tr>
</tbody>
</table>
Evaluation Unit (AW_M)

Pin Assignment of the D-Sub connector

- Pin 1: Output -10V to +10V
- Pin 2: GND Output
- Pin 3: Remote Calibration Signal
- Pin 4: do not connect
- Pin 5: GND Power Supply
- Pin 6: do not connect
- Pin 7: Power Supply 10 to 36 VDC
- Pin 8: do not connect
- Pin 9: do not connect

1 Channel FM/PCM Receiver

- Bandwidth: 0 to 1 kHz (10 kHz)
- Output: 0 to ±10 V, 0 (4) to 20 mA, frequency, binary
- RF power: 1 W, 3 W
- Transmission: inductive sensor telemetry FM, PCM, Radio
- Integrated filter
- Resolution: 14 Bits, 16 Bits
- Remote shunt calibration
- Environmental temperature range: -10 to +70°C (-45 to +85°C)
- Supply: 24 (±5%) VDC (0.4 A/3W), 10 to 36 V DC (board supply)
- Type: AW_M_<Sys>_<Freq>_<mod>_<bandw>_<supply>_<RF-power>_<outA>_<Dint>_<temp>_<Dz>_<Mo>

<p>| | | | | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>InBa</td>
<td>6,8</td>
<td>PCM12</td>
<td>2 kHz</td>
<td>24</td>
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<tr>
<td>Fu</td>
<td>3,4</td>
<td>PCM16</td>
<td>5 kHz</td>
<td>3W</td>
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<tr>
<td>InFu</td>
<td>PCM24</td>
<td>10 kHz</td>
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<td></td>
</tr>
</tbody>
</table>
Evaluation Unit (AW_P)

With CAN-Bus Option available

1 Channel FM/PCM Receiver

- Bandwidth: 0 to 1 kHz (10 kHz)
- Output: 0 to ±10 V, (0 (4) to 20 mA, frequency, binary, USB, CAN)
- RF power: 1 W, 3 W, 5 W
- Transmission: inductive sensor telemetry FM, PCM, Radio
- Integrated filter
- Resolution: 14 Bits, 16 Bits, 24 Bits
- Remote shunt calibration
- Environmetal temperature range: -10 to +70°C (-45 to +85°C)
- Supply: 24 (±5%) V DC, 10 to 36 V DC (board supply)

Type: AW_P_<Sys>_<Freq>_<mod>_<bandw>_<supply>_<RF-power>_<outA>_<Dint>_<wa>_<temp>_<Dz>_<Mo>

Cover ‘Zero’ and ‘Gain’ screws after adjustment if necessary
Evaluation Unit (AW_Ph)

Pin Assignment of the D-Sub connector

- Pin 1: Output -10V to +10V
- Pin 2: Ground Output
- Pin 3: Shunt Cal. (active low)
- Pin 4: do not connect
- Pin 5: Ground Power Supply
- Pin 6: do not connect
- Pin 7: Power Supply 10 to 36 VDC
- Pin 8: do not connect
- Pin 9: do not connect

Cover 'Zero' and 'Gain' screws after adjustment if necessary

With CAN-Bus Option available

1 Channel FM/PCM Receiver

- Bandwidth: 0 to 1 kHz (10 kHz)
- Output: 0 to ±10 V, (0 (4) to 20 mA, frequency, binary, USB, CAN)
- RF power: 1 W, 3 W, 5 W
- Transmission: inductive sensor telemetry FM, PCM, Radio
- Integrated filter
- Resolution: 14 Bits, 16 Bits, 24 Bits
- Remote shunt calibration
- Environmental temperature range: -10 to +70°C (-45 to +85°C)
- Supply: 24 (±5%) V DC, 10 to 36 V DC (board supply)
- Type: AW_G_<Sys>_<Freq>_<mod>_<bandw>_<supply>_<RF-power>_<outA>_<Dint>_<wa>_<temp>_<Dz>_<Mo>

Digital interface (option)
Configuration
(direct signal data acquisition, torque, no analog output)

Sensor signal amplifier

Coupling

Data stream

Torque
Speed
Power
Temperature

Inductive supply and transmitting 13.56 MHz

Speed channel

Speed Pickup

CAN-Bus
TCP/IP
USB

Supply 9 to 36 V DC
0 to ±10 V

Adjustment zero, gain, auto zero

Datei Info
Werte erneut senden
Zusatzfunktionen

Transmit/Receive
Status

Initialisieren

Exit

MA MANNER®
Sensortelemetrie
Evaluation Unit (AW_F)

Pin Assignment of the D-Sub connector

- Pin 1: Output -10V to +10V
- Pin 2: GND Output
- Pin 3: Shunt Cal. (active low)
- Pin 4: do not connect
- Pin 5: GND Power Supply
- Pin 6: do not connect
- Pin 7: Power Supply 10 to 36 VDC
- Pin 8: do not connect
- Pin 9: do not connect

Cover 'Zero' and 'Gain' screws after adjustment if necessary.

1 Channel PCM Receiver
- Bandwidth: 0 to 1 kHz (10 kHz)
- Output: 0 to ±10 V, (0 (4) to 20 mA, frequency, binary, USB, CAN, TCP/IP, EtherCAT)
- RF power: 1 W, 3 W, 5 W
- Transmission: inductive sensor telemetry FM, PCM, Radio
- Integrated filter
- Resolution: 14 Bits, 16 Bits, 24 Bits
- Remote shunt calibration
- Environmental temperature range: -10 to +70°C (-45 to +85°C)
- Supply: 24 (±5%) V DC, 10 to 36 V DC (board supply)

Type: AW_F_<Sys>_<Freq>_<mod>_<bandw>_<supply>_<RF-power>_<outA>_<Dint>_<temp>_<Dz>_<Mo>

- InBa 6 PCM12 2 kHz 24W 1U F -45/85 Dz Hu
- Fu 3.2 PCM16 5 kHz 5W 1B
- InFu PCM24 10 kHz 10W USB

With CAN-Bus or TCP/IP or USB Option available.
Pin Assignment of the D-Sub connector

- Pin 1: Output -10V to +10V
- Pin 2: GND Output
- Pin 3: Shunt Cal. (active low)
- Pin 4: do not connect
- Pin 5: GND Power Supply
- Pin 6: do not connect
- Pin 7: Power Supply 9 to 36 VDC
- Pin 8: do not connect
- Pin 9: do not connect

Cover ‘Zero’ and ‘Gain’ screws after adjustment if necessary

With CAN-Bus or TCP/IP or USB Option available

1 Channel PCM Receiver mit MiniDisplay

Bandwidth: 0 to 1 kHz (10 kHz)
Output: 0 to ±10 V, (0 (4) to 20 mA, frequency, binary, USB, CAN, TCP/IP)
RF power: 1 W, 3 W, 5 W
Transmission: inductive sensor telemetry FM, PCM, Radio
Integrated filter
Resolution: 14 Bits, 16 Bits, 24 Bits
Remote shunt calibration
Environmental temperature range: -10 to +70°C (-45 to +85°C)
Supply: 24 (±5%) V DC, 15 (±2%) V DC, 9 to 36 V DC (board supply)

Type: AW_F_<Sys>_<Freq>_<mod>_<bandw>_<supply>_<RF-power>_<outA>_<Dint>_<temp>_<Dz>_<Mo>

- - - 1 kHz 15 1W - - 70 - -
InBa 6 PCM12 2 kHz 24 3W U F -45/85 Dz Hu
Fu 3,2 PCM16 5 kHz 24B 5W L B La
InFu PCM24 10 kHz 10W USB

Antenna
Speed Pickup
Trace A
Trace B
Shaft encoder interface (option)
Incremental/ Absolut converter (option)
Evaluation MGC Plugin Unit (AW_ES_MGC)

1 Channel MGC-Plugin Unit FM/PCM Receiver

- Bandwidth: 0 to 1 kHz
- Output: 5 to 15 kHz
- RF power: 3 W
- Transmission: inductive sensor telemetry FM, PCM, Radio
- Integrated filter
- Resolution: 16 Bits
- Remote shunt calibration
- Environmental temperature range: -10 to +70°C
- Supply: 17 (±5%) V DC, 15 (±2%) V

Type: AW_EG_<Sys>_<Freq>_<mod>_<bandw>_<supply>_<RF-power>_<outA>

<table>
<thead>
<tr>
<th>Type</th>
<th>F</th>
<th>1 kHz</th>
<th>17V</th>
<th>2W</th>
<th>Fu</th>
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<tbody>
<tr>
<td>InBa</td>
<td>6,8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fu</td>
<td>3,4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InFu</td>
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</tr>
<tr>
<td>PCM16</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
Digital combi Data acquisition (Sensortelemetery + stationary Channels)
(direct signal data acquisition)

Configuration
Digital combi Data Acquisition (Sensor telemetry + stationary Channels)
(direct signal data acquisition)

Advantages:
* data acquisition system for rotor and stator signal in 1 unit
* very compact and light weight data acquisition system
* Isochronious sampling of rotor and stator signals
* digital interface direct to PC with software
* additional speed acquisition channel (option)
* easy handling - ideal for mobil application

1 Channel PCM Receiver with additional stationary Channels

<table>
<thead>
<tr>
<th>Type</th>
<th>AW_F_&lt;Sys&gt;<em>&lt;Freq&gt;</em>&lt;mod&gt;<em>&lt;bandw&gt;</em>&lt;supply&gt;<em>&lt;RF-power&gt;</em>&lt;Dint&gt;<em>&lt;temp&gt;</em>&lt;Dz&gt;<em>&lt;Mo&gt;</em>&lt;sta&gt;&lt;x&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td></td>
</tr>
<tr>
<td>InBa</td>
<td>6.8, 24 kHz, 2 W, USB, -45/85, Hu, Sta4</td>
</tr>
<tr>
<td>Fu</td>
<td>3.4, 5 kHz, 5 W, CAN, Ba, 8</td>
</tr>
<tr>
<td>InFu</td>
<td>10 kHz, 10 W, EtherCAT</td>
</tr>
</tbody>
</table>

Bandwidth: 0 to 1 kHz (10 kHz)
Output: 0 to ±10 V, (0 to 20 mA, frequency, binary, USB, CAN, TCP/IP)
RF power: 1 W, 3 W, 5 W
Transmission: inductive sensor telemetry FM, PCM, Radio
Integrated filter
Resolution: 14 Bits, 16 Bits*
Remote shunt calibration
Additional 4/8 static configurable signal inputs (strain gauge, voltage, etc.) with remote conditioning
Digital Interface USB oder Ethernet
Environmental temperature range: -10 to +70°C (-45 to +85°C)
Supply: 90 to 270 volts AC, 24 (±5%) V DC, 15 (±2%) V DC, 9 to 36 V DC (board supply)
Online remote programmable Sensor Telemetry

High resolution (16 Bit) initial remote setup of the of strain gage application at installation, calibration

Remote programmable samplerate (opt.)
Storage for calibration data and characteristic curve or user specific data
Separate address for each amplifier
Acquisition of internal temperature or alternative external sensor (opt.)

RMC-Sensortelemetry

Optional temperature channel

Address
Programmable sample rate
User spec. storage
Monitoring of supply
Internal/ext. temperature

Sensor Signal amplifier
Electronically programmable amplifier
µP

Gain (remote)
Autozero, Zero (remote)

Evaluation unit

0 to ±10V
USB
CAN
Ethernet
Digital data

Remote controlled range (online via telemetry channel)
Display Software and special Configurations
(Software Package Remote Control)

When using the software for the first time the hardware must be configured
select menu -> Setup -> Hardware configuration' to configure

Not all functions are available in every hardware configuration
Remote Control for rotor electronic (range/autozero/shunt calibration)

(Software Package Remote Control)

- Input field for the sensitivity
- Input for the zero point
- Remote calibration on/off
- Read actual active values

Transmission of the settings - temporary storage:
The settings keep actual as long as the measuring amplifier is powered. If the power supply breaks the previous stored settings will get active. This function is useful for tests or alternative settings because it allows a quick update of the measured value. After a successful adjustment the settings can be stored permanently into the EEPROM of the rotor with ‘Send and store’.

Automatic range set
Allows to automatic range set during applied load

Automatic zero point
Calculates the offset on the basis of the actual measured value and the actual gain to correct the output voltage to Zero. If necessary do this function repetitive. To save this offset permanently store it with ‘Send and store’.

Selection of the used temperaturesensor:
internal sensor (standard) or external temperature-diode (2nd channel)

This function allows the readback of the saved (EEPROM on rotor) settings of the rotor measuring amplifier. It is useful to read back these values at start parameters before starting the adjustment.

Transmission of the settings - permanent storage:
Zero point and gain are sent to the measuring amplifier and stored permanently in the EEPROM of the rotor.
Data Recording Software
(Software Package data acquisition - optional)

Start recording into a file
Stop recording into a file
Shunt calibration on/off
Show data with additional external viewer PVIEW - if installed
Display file operation activity
Number of saved samples

Input field for path and file name
Readed value channel 1
Additional information, which is saved in the description files
Temperature channel recording (option)
Readed value channel 2 (temperature)
Speed channel recording (option)

Option for RPM-systems save calculated rpm or save rpm-pulses to datafile
On menu setup, there is the possibility to activate an averaging for the calculated rpm.
For option ‘Calculated RPM’ take care of the correct setting at configuration (Samplerate).

No other program must be active at the PC while recording data into a file. This can effect a loss of data.
Data Display Software Pview

(Software Package data acquisition - optional)

Visualisation of recorded datas
Data Interface

Realtime recorded Data File

Format of the binary file (.DAT) or ASCII file (.CSV)

Definition:
LB = low byte,
HB = high byte
First the low byte and then the high byte of a channel is recorded.
The range of a 12 and 16 bit system is from 0 to 65535.
For 12 bit-systems, the lowest 4 bits are set to 0.

Pview visualisation program
(part of software package data acquisition)

User specific analysis program

Excel or other analysis programs
Data file format

(Software package Data acquisition modul - optional)

Data Format
The data are recorded in a binary format. The file has the ending ‘.DAT’. The data can be imported in every analysing software, which can handle with binary data.

Additionally there are generated two description files:

- MDF-description-file: This file is used to descript the structure of the binary file. The description file is necessary for the data viewing software PVIEW from Stiegele Datensysteme GmbH.

- Text-description-file: Description information in plain text

Format of the Binary File (.DAT)
Definition: LB= Low Byte, HB=High-Byte
First the Low-Byte and then the High-Byte of a channel is recorded.
The range of a 12 and 16 bit system is from 0 to 65535
For 12 bit-systems, the lowest 4 bits are set to 0

Assignment to the analog values:
Excitation 100% (correspond to analog output +10V) digital value 62259 for 16 Bit-Systems
Excitation 0% (correspond to analog output 0V) digital value 32768 for 16 Bit-Systems
Excitation -100% (correspond to analog output - 10V) digital value 3277 for 16 Bit-Systems

Exciation [%] = (Digital-Value - 32768) / 294.91 for 16 Bit-Systems

Values, which exceed this range are not within the measuring range.
The time between two meavalues in the .DAT-file corresponds to the reciprocal value of the sample rate of the system (see page technical data)

A optional calculated power-value is saved as 4-Byte float.
Data File-Structure
(Software package Data acquisition modul - optional)

Structure of the Binary File with extension .DAT: Sample file shown with a Hex Viewer

First measvalue
FF=Low Byte
7F=High Byte

Second measvalue

Structure of the Text Description File with extension .txt (structure shown for a system with two channels)

[Data-Description file]
Version: 1.0
Binary-Filename: dataset1.dat
Time of Record: 24.01.2008 17:15:39
Samples per Frame: 2
Bytes per Sample 4
Samplerate [1/s] 6511,48

[ChannelDescription]
Channelnumber: 1
Name: Ch1
Label: Channel 1
Unit: V
Factor: 0,000339086500966397
Constant: -11,1111864636669

Channelnumber: 2
Name: Ch2-RPM
Label: RPM
Unit: 1/s
Factor: 1
Constant: 0

Factor and offsetconstant to calculate the physical value from the binary value
Example: Binary Value 62259 * (0,00033908..)+ (-11,1111..) = 10 V [Unit]

Dataformat: 4 for 2-Byte Integer, 9 for 4-Byte Floatingpoint
Signal test function via Scope function

(Software package Data acquisition modul - optional)
**Automatic zero drift correction function**

(Software package RMC modul - optional)

- Torque shaft → acquisition of zero drift
- result
- calculation correction parameters
- programming of online correction parameters inside sensor signal amplifier

**Result: fully compensation of the zeropoint drift**

**High precision torque measurement**
Software für Zero Drift Adjustment

Umwandlung der RMC-Werte in Parameter
Dauerhaftes speichern der Werte im Rotor-EEPROM
Temperaturschranksteuerung
IP-Adresse
Verbindung Start/Stop
Einstellungen zur automatischen Steuerung/Meßwerterfassung
Einstellungen zur manuellen Steuerung/Meßwerterfassung
Anzeige der Soll/Ist Einstellung und des Temperaturschrankes
Anzeige der Meßwerte des Prüflinges
Anzeige ob Kompensations-Modus aktiviert oder deaktiviert ist. Die Aktivierung erfolgt im Hauptfenster bei der Einstellung Konfiguration

Eingabe der Kennlinien-Parameter
Speicher/Ladefunktion der Kennlinien-Parameter
Graphische Darstellung der Kennlinien-Parameter und der Meßwerte mit Skalierungsfunktion
Umwandlung der Parameter in RMC-Werte

MaManner Sensortelemetrie
Torque/Power acquisition on shaft

- high precise torque acquisition based on strain gauge
- integrated power supply (no batteries)
- no maintainance, easy mounting
- special for longterm use
- digital interface
- environment temperature range -45..160°C

**Diagram:**
- Integrated sensor signal amplifier
- Drehmoment-aufnehmer
- divisible rotor antenna
- Pickup
- Shaft
- Bahrgraph
- Receiver
- Antenna cable: Type RG316
- Sensor signal amplifier
- Torque transducer
- Receiver
- Drehzahl
- Speed acquisition
- Output (U,I, USB, CAN, Ethernet)
LVDT - Interface Modul

For displacement sensor, position sensors differential, inductive full bridges.

Number of channels: 1

Transducer types: displacement sensor, differential transformers, fullbridge

Sensitivity: 80 mV/V (1 mV/V to 200 mV/V)

Bandwidth: 0 to 1 kHz

Transducer Supply differential (Vs+ - Vs-) = 3.5 volts pp

Frequency of supply transducer: 10 kHz

min. Transducer resistor at f = 10 kHz: 350 Ω

output signal differential to M 0 to ±1.25 volts

Supply Vss > 5.3 volts

Current consumption 40 mA

Zero point drift: 0.02 %/°Centigrade

Environmental temperature range: -25 to +85°C (125°C, 150°C)

Max load: 20 000 g (depending on fixing)

Housing (external Modul): 36 x 34 x 13 mm, or integration in SV

External Interface Modul

Type displacement external: KondLV#xxxmm# #ext

Type displacement internal: KondLV#xxxmm# #F
external uEps Sensor- Interface Modul

Transfer Characteristic

Vout

+1.25 volts

non linear

0

S

typical

0.4 mm

max.

U-Eps - Interface Modul

For displacement sensors Ueps S05 and U05
Number of channels: 1
Sensitivity: adapted to total range: 0 to 0.4 mm
Bandwidth: 0 to 1 kHz
Frequency of supply transducer: 2 Mhz +/- shift output signal differential to M 0 to ±1.25 volts
Supply Vss > 5.3 volts
Current consumption 40 mA
Temperature shift compensated by measuring transducer temperature
Zero point drift: 0.1 %/° centigrade (-0 to +85°C)
Environmental temperature range: -25 to +85°C (125°C, 150°C)
Max load: 20 000 g (depending on fixing)
Housing (external Modul): 36 x 34 x 13 mm, or integration in SV
External Interface Modul
Type displacement external: KondEp#xx#mm# #ext
Type displacement internal: KondEp#xx#mm# #F
Sensor Signal Amplifier Type SV-Flex
with integrated torque strain gauge sensor

Very low inertia

1(2) Channel FM/PCM Torque Transmitter
For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 to 1 Hz to 2 kHz
Strain gage bridge supply: 3.3 V
Sensor SG Foil Full bridg (resistance 1000 Ω)
range: 0,050 um/m to 8000 um/m
Transmission: inductive sensor telemetry PCM
Integrated filter
Resolution: 16 Bits
Zero point drift: 0.01, 0.003 option)
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Envirnomental temperature range: -25 to +85°C (125°C, 160°C)
Type: SV_Flex_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>_<TC>

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>FM</th>
<th>Bandwidth</th>
<th>Remote Gain</th>
<th>Remote Zero</th>
<th>16 Bit Resolution</th>
<th>Temp Range</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.02</td>
<td>85</td>
<td>1 kHz</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>0.01</td>
<td>125</td>
<td>2 kHz</td>
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<td></td>
<td></td>
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<td>SV_Flex_001_02_125_PCM16_2KHZ_RC_TC</td>
</tr>
<tr>
<td>0.003</td>
<td>150</td>
<td>10 kHz</td>
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<td>SV_Flex_003_001_150_PCM16_10KHZ_RC_TC</td>
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<tr>
<td></td>
<td>160</td>
<td>40 kHz</td>
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<td>SV_Flex_0003_PCM16_40KHZ_RC_TC</td>
</tr>
</tbody>
</table>
Evaluation Unit (AW_DAnt)

1 Channel FM/PCM Receiver with integrated Pick UP

- Bandwidth: 0 to 1 kHz (10 kHz)
- Output: 0 to ±10 V, (0 to 20 mA) binary
- RF power: 1 W, 3 W
- Transmission: inductive sensor telemetry PCM, integrated Pick UP
- Integrated filter
- Resolution: 12 Bits, 16 Bits
- Remote shunt calibration
- Environmental temperature range: -25°C to +70°C
- Supply: 24V

Pin Assignment of the D-Sub connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Type/Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 1</td>
<td>Output -10V to +10V</td>
<td>PCM12, 1 kHz</td>
</tr>
<tr>
<td>Pin 2</td>
<td>GND Output</td>
<td>1W</td>
</tr>
<tr>
<td>Pin 3</td>
<td>Remote Calibration Signal</td>
<td>U</td>
</tr>
<tr>
<td>Pin 4</td>
<td>do not connect</td>
<td>70</td>
</tr>
<tr>
<td>Pin 5</td>
<td>GND Power Supply</td>
<td>Dz</td>
</tr>
<tr>
<td>Pin 6</td>
<td>do not connect</td>
<td>Hu</td>
</tr>
<tr>
<td>Pin 7</td>
<td>Power Supply 24 VDC</td>
<td></td>
</tr>
<tr>
<td>Pin 8</td>
<td>do not connect</td>
<td></td>
</tr>
<tr>
<td>Pin 9</td>
<td>do not connect</td>
<td></td>
</tr>
</tbody>
</table>
Monitoring Temperature/Pressure on rotating Shaft with operating mode Spot (1 sample/turn)

radial

or axial

1(4) Channel- PCM Transmitter

For strain gage, PT100, thermocouple Typ K
Mode: 1 sample/turn
Input Sensitivity: 0.2 mV/V to 20 mV/V
min. signal contact time: 1.3 ms
Strain gage bridge supply: 3.3 V
Pressure sensor SG Foil full bridged (resistance 1000 Ω)
Transmission: inductive sensor telemetry PCM
Integrated filter
Resolution: 16 Bits
Zero point drift: 0.01, 0.003 option)
Environmental temperature range: -25 to +85°C (125°C, 160°C)
1 Channel Temperature Sensor Signal Amplifier Type Sc
(Screw Terminal Block)

1 Channel FM/PCM Transmitter
For strain gage, PT100, thermocouple
Sensitivity: 0.02 mV/V to 20 mV/V
Bandwidth: 0 to 1kHz
Strain gage bridge supply: 2.5 V (3.3 V*)
Strain gage bridge resistance: 350 (120, 1000) Ω
Transmission: inductive sensor telemetry FM, PCM
Integrated filter
Resolution: 16 Bits*
Zero point drift: 0.02
Remote shunt calibration
Remote gain, zero, auto zero with 16 Bit resolution (option)
Additional temperature channel (option)
Environmental temperature range: -25 to +85°C (125°C, 160°C)
Max load: 50 000 g (depending on fixing)
Type: SV_Sc_<accuracy>_temp_<mod>_<bandwidth>_TC

<table>
<thead>
<tr>
<th>0,02</th>
<th>85</th>
<th>FM</th>
<th>1 kHz</th>
<th>TC</th>
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</thead>
<tbody>
<tr>
<td>125</td>
<td>PCM</td>
<td>150</td>
<td>160</td>
<td></td>
</tr>
</tbody>
</table>

Torsionssensor Kit
(SG based in combination with stator loop antenna)

Feature
- For dynamic measurement of torque on rotating shafts
- Integrated strain gauge full bridge
- Integrated rotor antenna
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 Hz to 1(2) kHz
- Strain gauge bridge supply: 3.3 V (bridge resistance: 1000 ohms)
- Transmission: inductive sensor telemetry PCM
- Resolution: 16 Bits
- Zero point drift: 0.02
- Remote shunt calibration, gain, zero, auto zero with 16 Bit resolution (option)
- Additional temperature channel (option)
- Environmental temperature range: -25 to +85°C (125°C, 160°C)
- Max load: 10 000 g (depending on fixing)
- Weight: 3.5 grams
- Type: SV_Tors_<accuracy>_ <temp>_<mod>_<bandwidth>_<rmc>

55

Very low inertia
**Torsionssensor Kit**

(simple/rapid mounting without soldering, SG based)

**Feature**

- For dynamic measurement of torque on rotating shafts (power train)
- Integrated strain gauge full bridge
- Integrated loop rotor antenna (variable shaft diameter)
- Kit solution simple/rapid mounting (with instructions, clue kit)
- Direct mounting on shaft without soldering
- Sensitivity: 0.02 mV/V to 20 mV/V
- Bandwidth: 0 Hz to 1(2) kHz
- Strain gauge bridge supply: 3.3 V (bridge resistance: 1000 ohms)
- Transmission: inductive sensor telemetry PCM
- Resolution: 16 Bits
- Zero point drift: 0.02
- Remote shunt calibration, gain, zero, auto zero with 16 Bit resolution (option)
- Additional temperature channel (option)
- Environmental temperature range: -25 to +85°C (125°C, 160°C)
- Max load: 10 000 g (depending on fixing)
- Weight: 5 grams (depending on shaft diameter)

**Type:** SV_Tors_x/y_<accuracy>_<temp>_<mod>_<bandwidth>_<rmc>

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>Temp</th>
<th>Mod</th>
<th>Bandwidth</th>
<th>R/MC</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/40</td>
<td>0.02</td>
<td>85</td>
<td>PCM16</td>
<td>1 kHz</td>
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<tr>
<td>60/80</td>
<td>125</td>
<td>2kHz</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>80/120</td>
<td>150</td>
<td>160</td>
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<td></td>
</tr>
</tbody>
</table>
### Product Key One Channel System

**Type:** AW_84H6_<VFreq>_<_sys>_<_mod>_<_bandwith>_<_power>_<_supply>_<_outpA>_<_DInt>_<_Temp>_<_RPM>_<_wa>_<_sta>

- additional stationar channels (stat4/stat8..)
- option: protection class (IP52, IP65, IP67)
- speed option
- extended temperature range
- digital Interface (USB, CAN, TCP, CAT)
- output signal (U, I, F)
- supply
- RF-power
- samplerate/channel/sec
- Coding (PCM/F)
- Type of system (inductive, Radio, UHF)
- supply frequency
- housing type
- multi channel receiver

**Type:** SV_Rad_<size>_<_speed>_<_accuracy>_<_temp>_<_VFreq>_<_sys>_<_mod>_<_sample>_<_bandwidth>_<_mc>_<_wa>_<_TC>_<_range>

- range
- sensor type (SG,TC, PT,..)
- waterproof/oilproof
- Remote Control
- sample rate (opt.)
- band width
- type of signal transmission
- type of system (inductive, radio, UHF)
- supply frequency
- temperature range
- accuracy
- size
- max. speed (opt.)
- housing type
- single channel signal amplifier

*not all items always used*