Curve Detector CoriSENS

Railway application

GENERAL CHARACTERISTICS

Curve detection by analysing the rotation rate with electronics conform to railway standards.
A micro mechanical spring-mass-system continuously measures the rotation rate and converts the measured value to a standard 4-20mA and 0-10V analog output.
Rotation rate sensor according to railway safety standards DIN EN 50155 and ready to use with the voltage supply directly from the trainset.

- *Measurement range ±12°/s*
- *Current output 4-20mA*
- *Voltage output 0-10V*
- *Offset compensation*
- *Resistant housing*
- *Protection class IP42*
- *Compliant to DIN EN 50155*
- *Operating temperature -40°C ... +85°C*
- *Wide supply voltage range*
- *Self-Test function*

MICRO-SENSOR

TECHNICAL PARAMETERS

Physical parameters	
Rotation axis	1 (z-axis)
Measurement range	±12°/s*
Sensitivity (current)	0.67 mA/°/s
Sensitivity (voltage)	416.7 mV/°/s
Sensitivity error	±2%
Noise	0,2% RMS of fullscale
Cutt off frequency (-3dB)	4 Hz
Current output	4 ... 20 mA
Zero signal	12 mA
Voltage output	0 ... 10 V
Zero signal	5 V
Temperature offset error (Delta T_{max} = 0.5K/min)	±3%**
Maximum error	±5%**
Output impedance (current)	100Ω ±30Ω
Charge impedance	min. 2500Ω
Housing	Die-cast aluminum
Applied standard	DIN EN 50155
Operating temperature range	-40°C ... +85°C
Sealing	IP42

* Customizable
** Depends on the settings of the offset-compensation

Electrical parameters	Min.	Typ.	Max.	Unit
Supply voltage	70	110	160	V
Supply current		0.02		A
Consumption	1	2	3	W
Insulation		>200M		Ω

All specifications at +25°C, unless otherwise defined.

MICRO-SENSOR

CURRENT AND VOLTAGE OUTPUT

Curve Detector			
Rotation rate [°/s]	–12	0	+12
Output current [mA]	4	12	20
Output voltage [V]	0	5	10

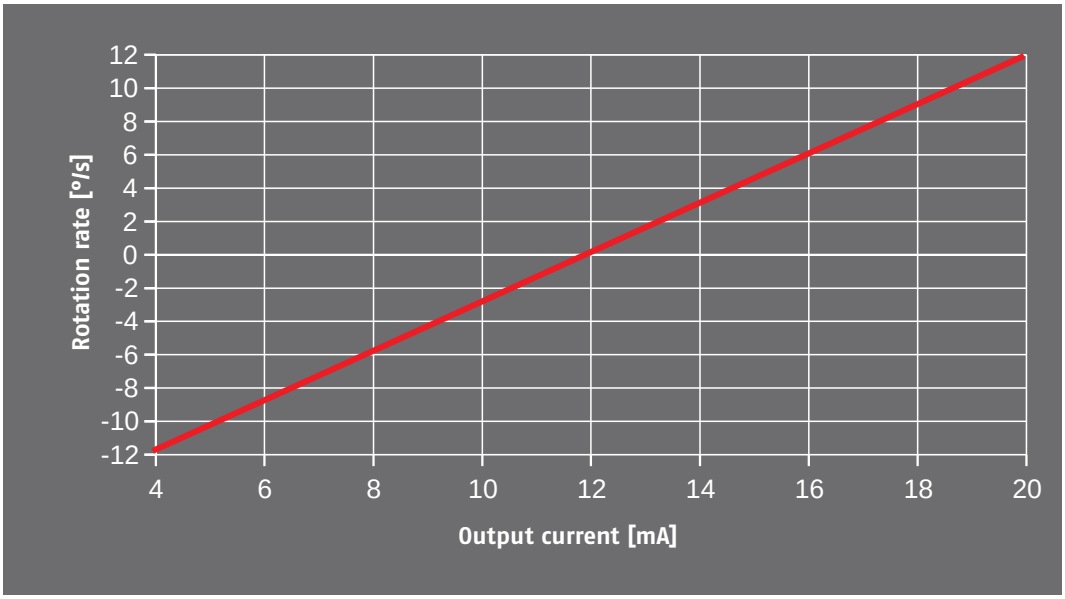


Figure 1: Output current

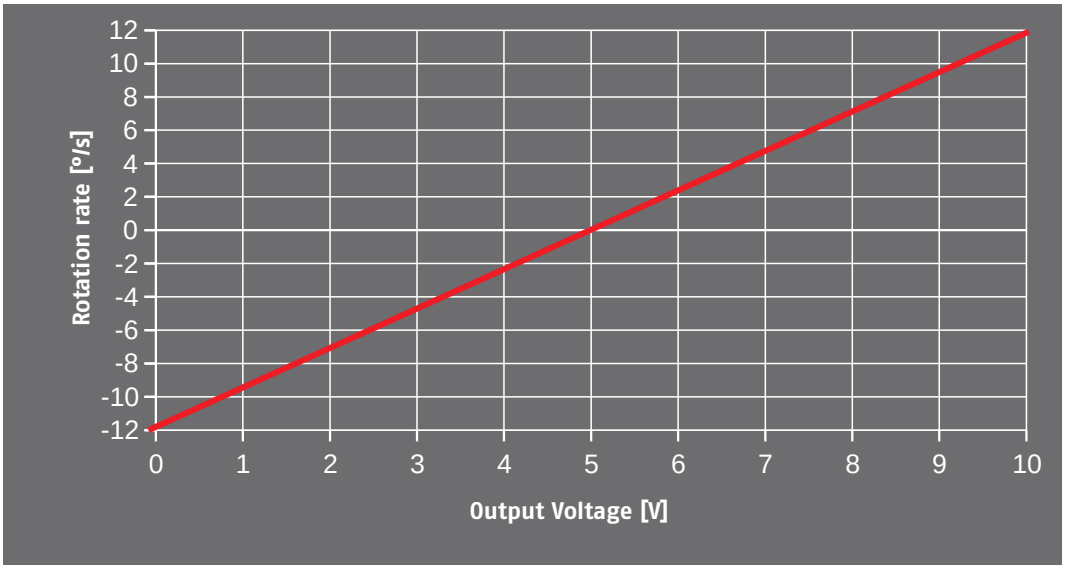


Figure 2: Output voltage

CURRENT OUTPUT CONNECTION

Load resistance: 100Ω ± 30Ω

Connect a resistor to the signal output and signal ground of the current output as shown in figure 3.

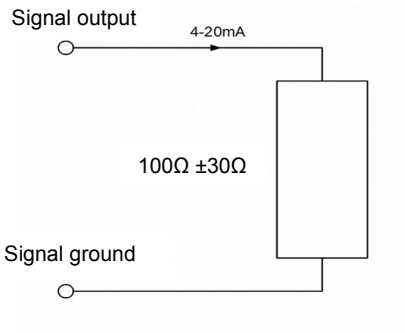


Figure 3: Current output connection

SHIELDING CONCEPT

Connect the housing to train earth potential.

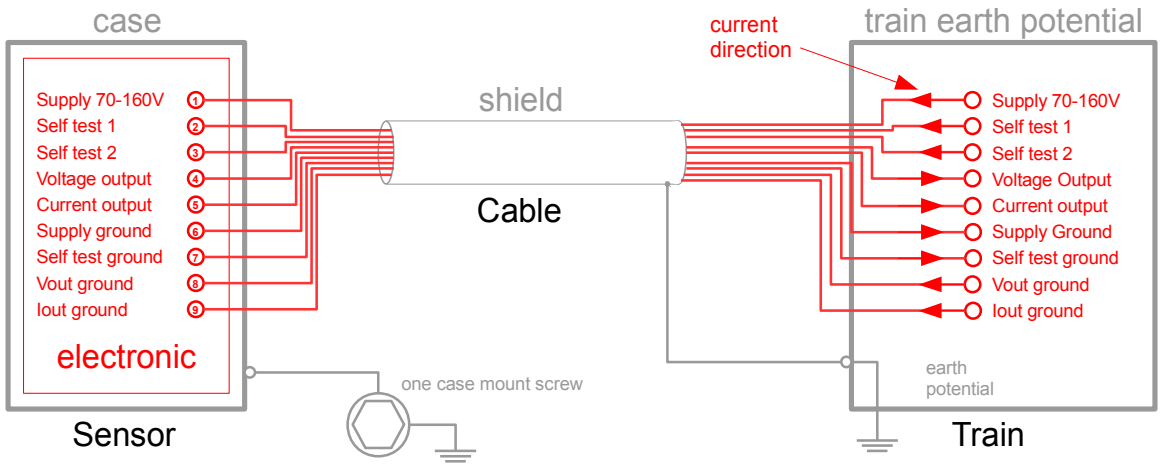


Figure 4: Shielding concept

CONNECTOR AND HOUSING

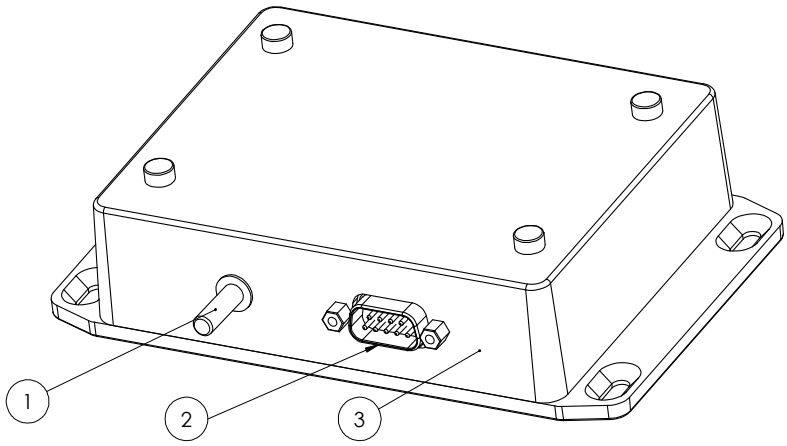


Figure 5: Curve Detector with D-Sub connector

No.	Component
1	M5 screw for grounding
2	D-Sub connector (CONEC No.15-000573)
3	Housing

PINOUT

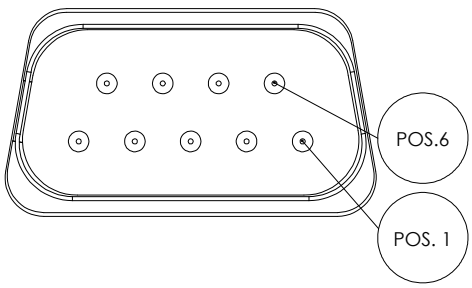


Figure 6: Pinout

Pin	Signal
1	Supply voltage
2	Self-Test 1
3	Self-Test 2
4	Voltage output
5	Current output
6	Supply ground
7	Self-test ground
8	Voltage output ground
9	Current output ground

MECHANICAL DIMENSIONS

Weight: ~ 0,7kg

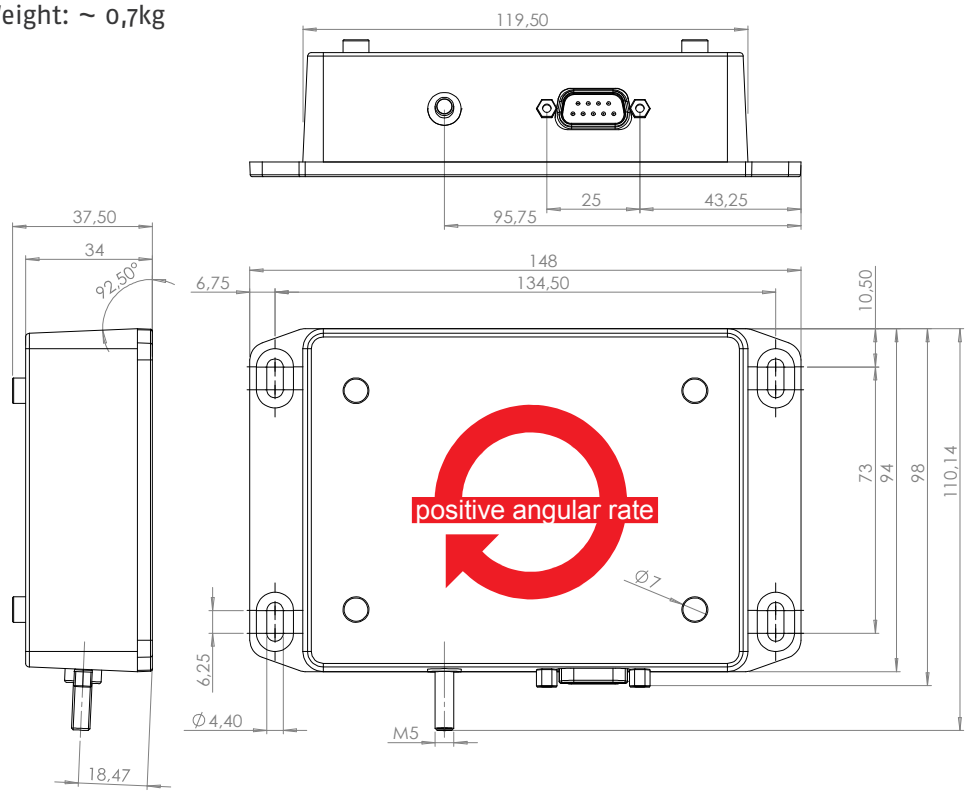


Figure 7: Mechanical dimensions [mm]

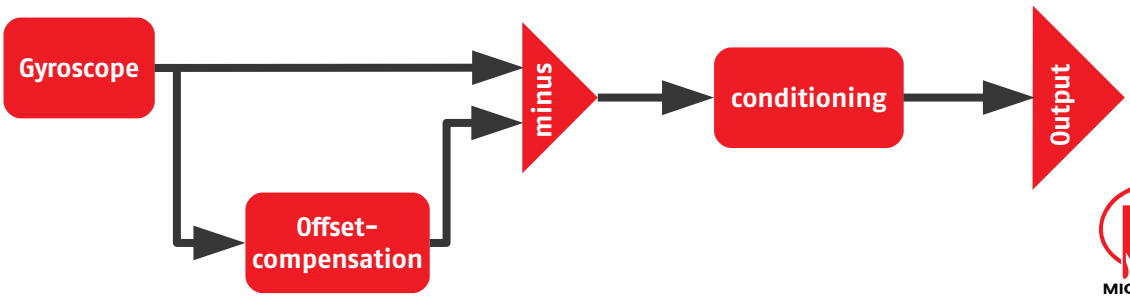
FUNCTIONAL BLOCK DIAGRAMM

Gyroscope: A micromechanical spring-mass-system uses the coriolis force to detect a rotation. It is highly insensitive against transversal forces which are caused by disturbing vibrations or mechanical noise.

Offset-compensation: It minimizes the natural drift-effect of the gyroscope with a lowpass filter with a very long time-constant (10 minutes). The output of the lowpass filter is subtracted from the output of the gyroscope which eliminates the temperature drift and other static offsets of the gyroscope signal.

Faster changes of the gyroscope output, e.g. a rotation by curve movement, are fed directly to the sensor output and form the curve detection signal. This sensor architecture comes along with some special rules which are described on page 8.

Conditioning: Analog signal conditioning to provide the standard output range of the current or voltage output.



SELF-TEST FUNCTION

The sensor includes a self-test feature. Self-test is activated by appliying a logic high level to ST1 (pin2) or ST2 (pin3) related to self-test GND (pin7).
Applying logic high to pin ST1 sets the output to the end value of the right rotation. Applying logic high to pin ST2 sets the output to the end value of the left rotation (figure 8: Self-test function shown at voltage output).

The self-test function is available at the current and voltage output simultaneously.

Because of the compensating low pass filter it is recommended to use both test signals only in succession and both no longer than 2 seconds.
Do not use the self-test during the power-on time in the first 20 seconds.

ST Input	
Low (V_{IL})	High (V_{IH})
0V	24V ±10%

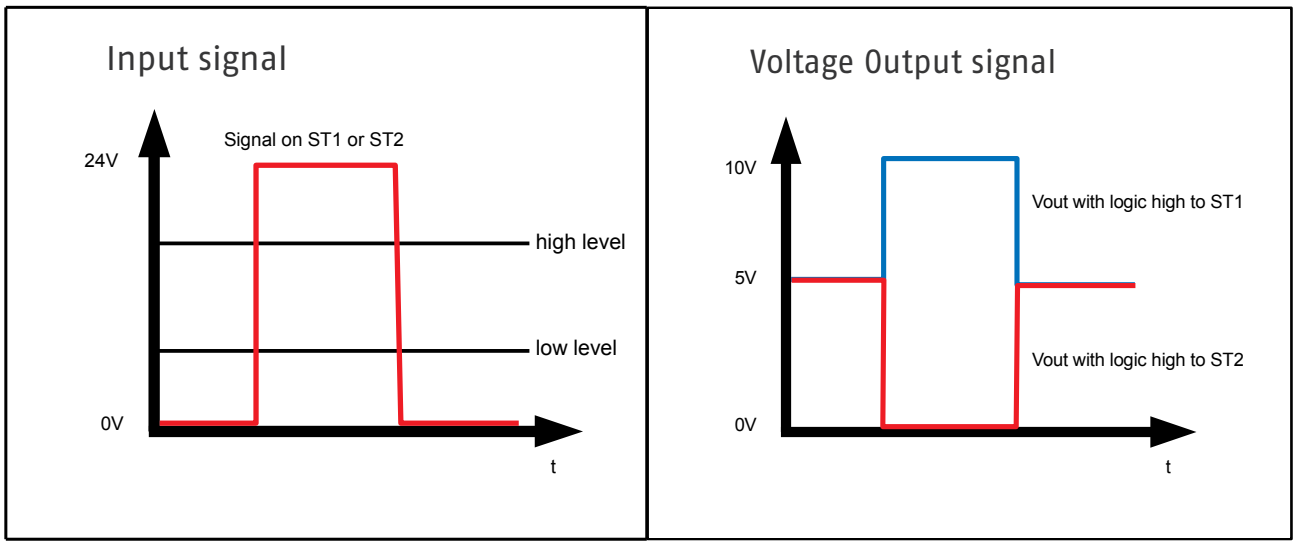


Figure 8: Self-test function at voltage output

RULES OF OPERATION

For a regular operation of the curve detector the following rules are mandatory:

- *Do not rotate the device in the first 20 seconds after power on.*
- *Do not use the Self-Test in the first 20 seconds after power on.*
- *The maximum duration of a rotation at maximum rotation rate is 20 seconds.*
- *The ambient temperature must not change faster than 0.5K/min to assure an operation within the failure tolerances*

These rules can be adapted to meet customer requirements.

APPLIED STANDARDS

Applied standards according to DIN EN 50155	
DIN EN 55011	Conducted emission
DIN EN 55011	Radiated emission e-field
DIN EN 61000-4-3	Immunity to electromagnetic field
DIN EN 61000-4-4	Immunity to electrical fast transient/burst
DIN EN 61000-4-5	Immunity to electrical slow transient/surge
DIN EN 61000-4-6	Immunity to conducted RF voltage
DIN EN 61373	Shock and vibration tests
DIN EN 60068-2-11 (Ka)	Salt mist test
IEC60068-2-1 (Bd)	Dry heat test
IEC60068-2-30 (Db)	Damp heat, cyclic (24+24 cycle)
IEC60068-2-1 (Ad)	Cold test