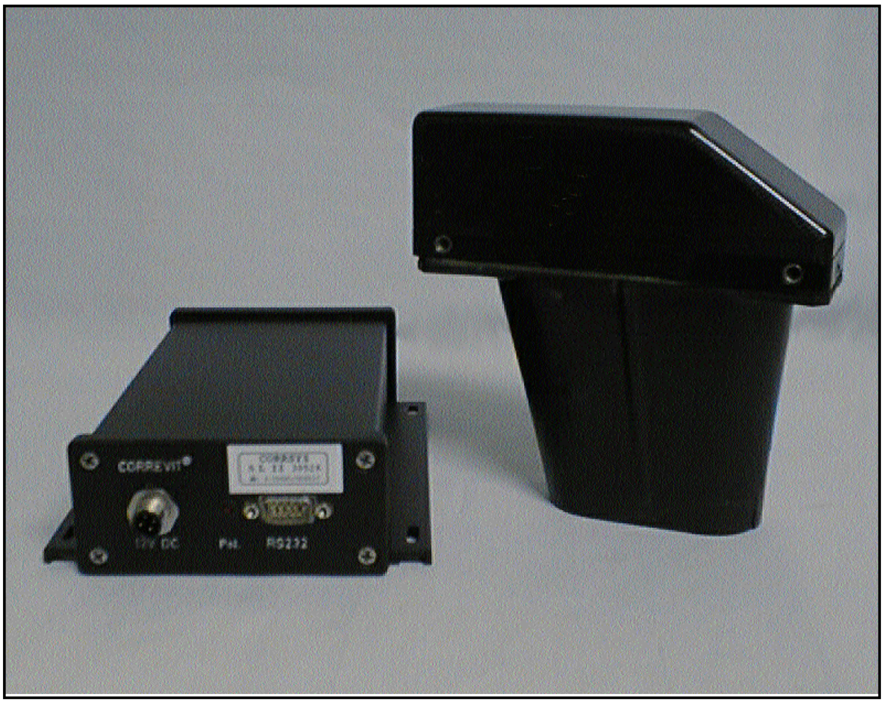

CORREVIT® SL

Non-Contact Optical Sensor

for

slip-free measurement of longitudinal and transversal dynamics

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USER MANUAL

CORRSYS DATRON Sensorsysteme GmbH

1. Overview

CORREVIT® SL

Non-Contact
Optical Sensor

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Art-No.: 1.022.50

Optimizing the dynamics of vehicle movement is a primary focus of development within the automotive industry. In this process, the accurate measurement of longitudinal distance and speed, as well as transversal speed, plays an important role.

The CORREVIT® SL Sensor is especially developed for the measurement of tire slip angle. The low weight and compact design of the sensor have negligible affect on tire slip angle, providing more accurate results.

The CORREVIT® SL Sensor uses proven optical correlation technology to ensure the most accurate possible signal presentation. This technology incorporates a high-intensity light source that illuminates the test surface, which is optically projected by the sensor onto an optical grating system. Fast, easy mounting and universal applicability distinguish this proven non-contact, optical sensor.

Features

- Developed for measurement of tire slip angle at speeds up to 400 kph.
- Smaller and lighter version of the proven CORREVIT® S-CE Sensor.
- Has exactly the same performance characteristics as the CORREVIT® S-CE Sensor.
- Extremely high measuring accuracy – better than 0.1% (or better than 0.1° angle resolution).
- Any required measurement quantity available.
- Easy operation, mounting angle correction and direct connection to PC or other evaluation system.
- Negligible service and maintenance requirements as a result of durable technology.
- Tested and used under extreme climatic conditions.
- New even lighter version under 500g in weight.

Applications

The compact, ultra-lightweight CORRSYS-DATRON SL Sensor is designed for use in dynamic vehicle testing applications that require highly accurate measurement of the following variables:

- Distance
- Speed
- Acceleration
- Longitudinal and transversal speed
- Tire slip angle
- Drift angle

2. Extent of delivery

Standard delivery

1. (1) SL Sensor #1.022.00 + PC connection cable *
2. (1) SL Signal Conditioning Unit + 4 x output signal #K.022.1C.31 *
3. (1) Sensor/Signal Conditioning Power Cable #K001.40.42
4. (1) Sensor to Signal Conditioning Box Communication Cable #K0022.CC.52
5. (1) Halogen Lamp, 35 watt, 12V, 8°
6. (2) Bolts (for mounting hardware)
7. (2) Thumb Screws (for mounting hardware)

* 4 Digital / Analog output cables, BNC to Lemo #K022.1C.31

Options/Accessories

8. (1) CD-ROM with CeCalWin Software and User Manual
9. Calibration certificate ISO 9000 ++
- Suction Mounting Hardware
- Transport Case
- Replacement Halogen Lamp 35 watt, 12V, 8°
- Signal cable #K00182.41 for connection to DAS 2A

About replacement halogen lamps
It is recommended that only halogen lamps supplied by CORRSYS-DATRON be used as these have been subjected to a special treatment. Optimal sensor function can only be assured when using original-equipment lamps.

3. Installation and connection

1. Connect the Sensor to Sensor Electronic Box Communication Cable (#K0022.CC.52) to the Data Port of the SL Sensor and to the Sensor Input of the Interface Box.

2. Connect the Sensor/Sensor Electronic Power Cable (#K001.40.42) to the 12 V DC Power Input of the SL Sensor.

3. Plug Lemo connectors of one Digital/Analog Output Cable, BNC to Lemo (#K022.1C.31), into digital outputs D1 and D2 on Sensor Electronic Box and then connect BNC connectors to corresponding digital inputs on data acquisition system.

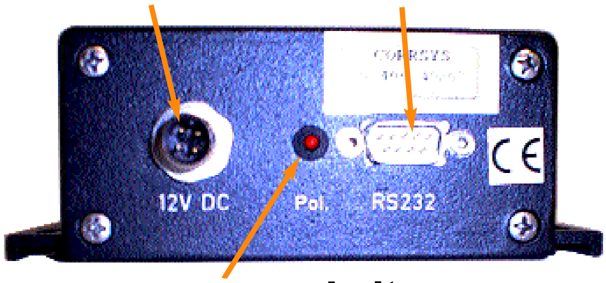
4. Plug Lemo connectors of one Digital/Analog Output Cable, BNC to Lemo (#K022.1C.31), into analog outputs A1 andA2 on Sensor Electronic Box and then connect BNC connectors to corresponding analog inputs on data acquisition system.

5. Connect Signal Box Power Cable (4-pin to banana plug) to 4-pin input on Sensor Electronic Box.

6. Connect Power Cable from Sensor Electronic Box to 12 V DC power supply.

7. Connect Power Cable from SL Sensor to12 V DC power supply.

NOTE:
To calibrate the SL Sensor using CeCalWin Software, also connect the Sensor Electronic Box to PC or laptop using the RS 232 Serial Communication Cable to connect between the 9-pin D-SUB serial connectors on the Sensor Electronic Box and the computer.

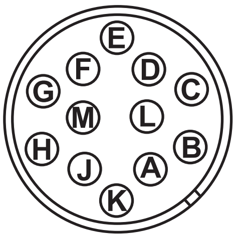


NOTE:
Also included in the standard extent to delivery is the Signal Cable, 12-pin to 10-pin Lemo (#K001.82.41). This cable is included specifically for application with the CORRSYS-DATRON data acquisition system DAS-1. Connection is made by attaching the 12-pin Lemo connector to the Sensor Electronic Box and the 10-pin Lemo connector to the DAS-2.

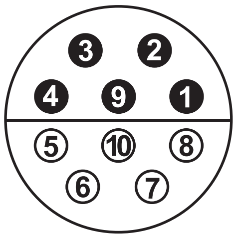
3.1 Pin assignments

3.1.1 Pin assignments: signal

Binder	Lemosa	Assignment	Signal	Signal Type & Description
A	1	shield (white)	GND ANA1	
B	2	white	ANA1	Speed - analog
C	3	brown	ANA2	Slip angle - analog / Transversal speed - analog
D	4	shield (brown)	GND ANA2	
E	5	green	TTL1	Longitudinal distance - digital
F	6	yellow	/TTL1	
G	7	gray		
H		pink		
J	9	blue	/TTL2	
K	10	red	TTL2	Slip angle - digital / Transversal speed - frequency modulation
L	7	gray	GND TTL	
M				



Binder



Lemosa

(view: soldering side)

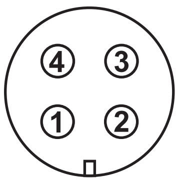
3.1.2 Pin assignments: BNC distributor

Signal	Label
Analog 1 (ANA1)	Speed - analog
Analog 2 (ANA2)	Slip angle - analog / Transversal speed - analog
Digital 1 (TTL1)	Longitudinal distance - digital
Digital 2 (TTL2)	Slip angle - digital / Transversal speed - frequency modulation

3.1.3 Pin assignments: 12 V DC power supply

Plug	Socket	Assignment	Signal
1 & 2	1 & 2	white / brown	GND
3 & 4	3 & 4	blue / black	+12 V

10.5 V minimum required at the sensor

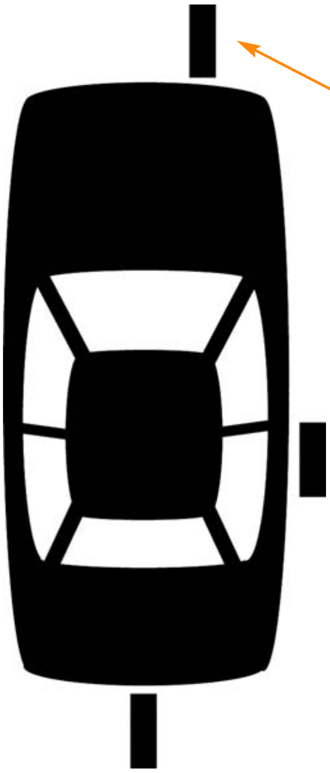


Power Supply

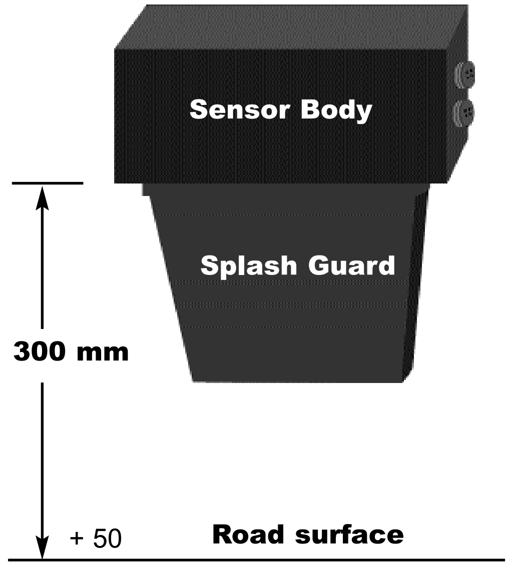
Reverse polarity protection

The SL Signal Conditioning Unit is equipped with reverse polarity protection. In the event that polarity is inverted (9 V - 14.5 V DC), the unit will not be damaged but the red reverse polarity indicator LED will be illuminated! If this happens, disconnect power from the unit immediately and correct the power supply connection.

3.2 Mounting the sensor on the vehicle



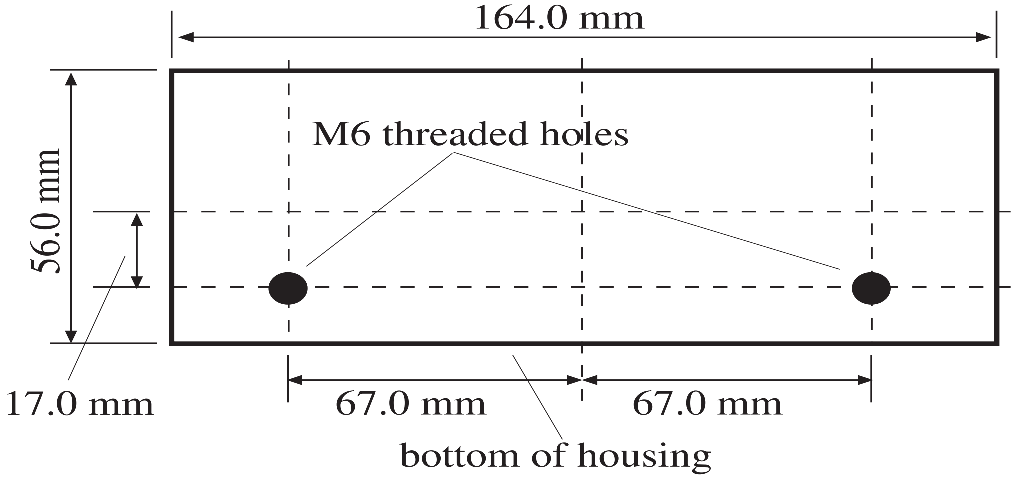
Notice:
When using the sensor in wet or snowy conditions, mount it at the front of the vehicle to avoid spray and/or blowing snow.



Mount the sensor in a longitudinal orientation, parallel to the vehicle

For optimum performance and accuracy, the mounting distance from the lower surface of the sensor body (not including the spray guard) to the road surface must be 300 mm ± 50 mm.

SL mounting jig

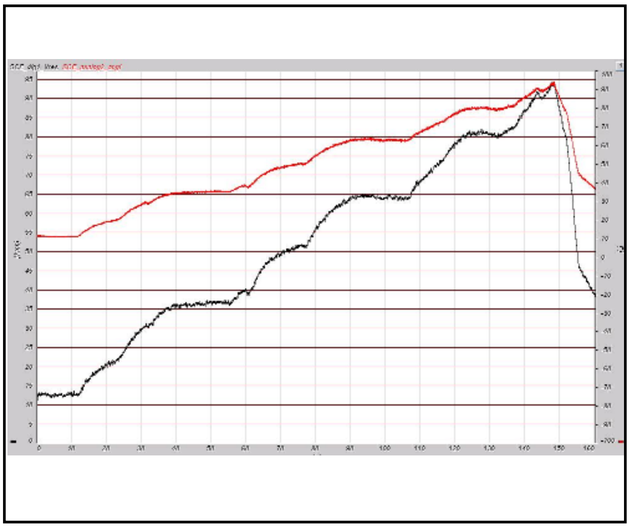


4. Technical data

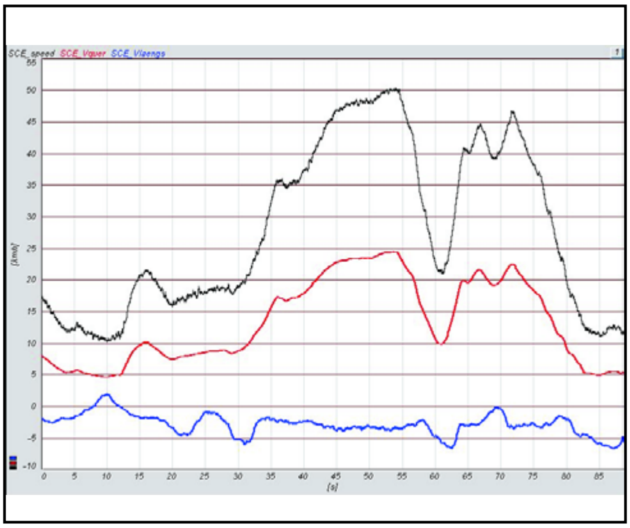
4.1 Specifications

Speed range		0.5 to 400 kph
Braking / Coasting		to 0.2 kph
Distance resolution		1.5 mm
Measurement deviation		±0.1%
Angle range		±40°
Angle range		±40°
Digital output 1 longitudinal distance		160 to 750 pulses/m
Digital output 2 switchable		Output as frequency
- Frequency modulated angle or transversal speed		
Analog output 1 longitudinal direction		0 to 10 V
Analog output 2 switchable		- 5 to 5 V
- Transverse speed or tire slip angle		
Transversal speed or tire slip angle		
Power supply		9 to 14.5 V; 40 W
Working distance		300 ±50 mm
Temperature range	Operation:	- 25 to 50° C
	Storage:	- 40 to 85° C
	Relative Humidity:	5 to 80% not condensing
System protection of the sensor		IP 67
Dimensions of the sensor (l x w x h)		approx. 164 x 52 x 61 mm
Weight		760 g/ new 500 g
Dimensions of the electronics (l x w x h)		approx. 183 x 105 x 49mm
Weight		940 g
Shock		50 g half-sine, 6 ms
Vibration		10 g, 10 to 150Hz
Serial interface for connection to the PC		
automatic sensor identification, function control		

transverse angle



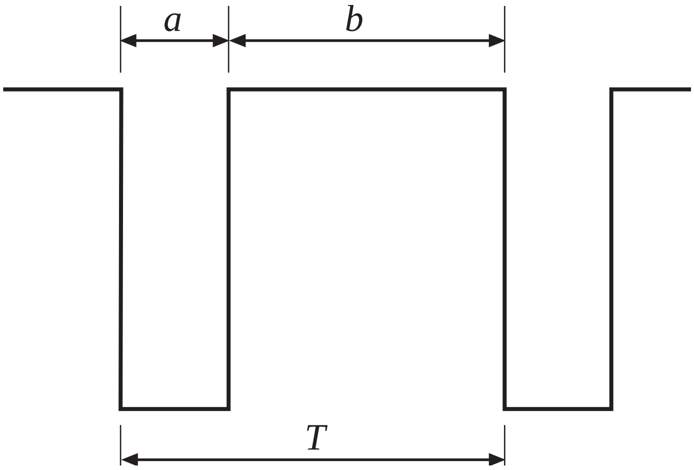
speed / acceleration



4.2 Measured values

Measurement	Output	Output Channel
Longitudinal speed V_L	analog	Analog 1
Magnitude speed $\|V\|$	analog	Analog 1
Angle β	analog	Analog 2
Transversal speed Vq	analog	Analog 2
Pulses/m for longitudinal distance	digital	Digital 1
Pulses/m for magnitude distance	digital	Digital 1
Angle β, frequency modulated	digital	Digital 2
Transversal speed Vq, frequency modulated	digital	Digital 2

4.3 The calibrated CORREVIT® SL sensor (set to 340 pulses/m) supplies the following pulse form at output DIG 1.



***a* = 25% of T**
***b* = 75% of T**

Pulse forms at a rate of 300 kph:

Conversion of the speed factor into m/s $\frac{300\ \text{kph}}{3.6} = 83.33\ \text{m/s}$

Frequency f of the S-400 Sensor 83.33 m/s x 340 P/m = 28.333 kHz

T: period $\frac{1}{28.33\ \text{kHz}} = 35.3\ \mu s$

A period of 35.2 µs requires a = 8.8 µs and b = 24.4 µs

Pulse forms at a rate of 1 kph

Conversion of the speed factor into m/s $\frac{1\ \text{kph}}{3.6} = 0.277\ \text{m/s}$

Frequency of the S-400 Sensor 0.277 m/s x 340 P/m = 94.44 Hz

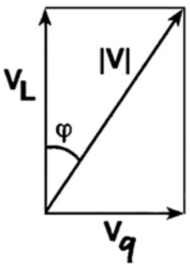
T: period $\frac{1}{94.444\ \text{Hz}} = 10.58\ \text{ms}$

A period of 10.58 ms requires a = 2.64 ms and b = 7.94 ms

4.4 The SL Sensor has been set as follows:

Analog channel 1	25 $\frac{mV}{kph}$	Magnitude speed |V|
Analog chanel 2	100 $\frac{mV}{\circ}$	Angle β
Digital channel 1	340 $\frac{pulses}{m}$	Longitudinal distance (output as pulses)
Digital channel 2	50 $\frac{Hz}{\circ}$	Angle (output as frequency)

4.5 Values to be measured



On digital channel 2, the angle output is frequency modulated (FM).
The carrier frequency used is 10 kHz and has a range of ±2 kHz.

With a setting of 25 mV / kph for longitudinal speed V_L,
a maximum speed of 400 kph can be achieved.

The above settings produce the following values:
100 kph = 2.5 V
200 kph = 5.0 V
300 kph = 7.5 V
400 kph = 10.0 V

All signals can be used as inputs to all common data acquisition systems.
Should any problems arise, please contact CORRSYS-DATRON.

For analog signal representation of speed, the voltage scale may be changed to any of the following:

- 15 mV / kph
- 25 mV / kph
- 50 mV / kph
- 100 mV / kph

A further possibility is to smooth the signal using a moving average filter, which can be adjusted with different times for averaging. Note that signal detail and dynamics will be decreased the signal becomes increasingly smooth.

Filter Values

- 65.5 ms
- 131 ms
- 262 ms
- 524 ms