CORRSYS
DATRON
Sensorsysteme GmbH

CORREVIT® SF™

Non-Contact Optical Sensor

for

slip-free measurement of longitudinal and transversal dynamics

USER MANUAL

Notes:

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General Information

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Safety Instructions

Please read carefully before operating the equipment.

CORRSYS-DATRON is not responsible for damage that may occur when this system is used in any way other than that for which it is intended.

To assure safe and proper operation, all supplied equipment, components and/or accessories must be carefully transported and stored, as well as professionally installed and operated. Careful maintenance and usage in full accordance with operating instructions is imperative.

CORRSYS-DATRON equipment should be installed and operated only by qualified persons who are familiar with devices of this type.

Local regulations may not permit the operation of motor vehicles on public highways while the equipment is mounted on the exterior of the vehicle.

- Use the equipment only for intended applications. Improper application is not advised.
- Do not modify or change the equipment or its accessories in any way.
- Improper use or mounting of the equipment may affect the safety of the vehicle and/or occupants.
- The equipment must not be mounted and/or operated in any way that may compromise vehicle or and/or occupant safety.
- Equipment must be mounted firmly and securely.
- Use only original equipment, components and/or accessories included in the scope of delivery.
- Do not mount equipment, components and/or accessories near heat sources (e.g. exhaust).
- Do not use defective or damaged equipment, components and/or accessories.
- Always note correct pin assignments and operating voltages when connecting equipment to power supplies, data acquisition/evaluation systems, and/or any other system or component. Equipment may be damaged if not properly connected and/or operated.
- For additional information, please call the CORRSYS-DATRON Hotline: ++49 (6441) 9282-82 or: hotline@corrsys-datron.com

Danger

- Invisible Radiation from light emitting diodes!
  Do not observe with optical instruments!
  Laser class 1M in compliance with DIN EN 60825 - 1:2001

Warning

- The sensor and/or sensor components may be damaged if power is applied for extended periods, especially in hot environmental conditions.
- Disconnect power from the sensor if the vehicle is stationary for extended periods.

1. Overview

CORREVIT® SF™

Non-Contact Optical Sensor

for

slip-free measurement of longitudinal and transversal dynamics

Article no.:

SF Sensor	13788

The CORREVIT® SF Sensor marks the next major step in an optimization process that has resulted in a significant miniaturization of the CORREVIT® optical sensor. Even with this significant reduction in size and weight, functionality and measurement accuracy remain comparable with existing CORREVIT® S-Sensors. Miniaturization is made possible via the use of near-infrared light emitting diodes as illumination elements. With an appropriate heatsink, this new LED light source provides an operating life even longer than that of conventional halogen lamps.

Features

- Smallest and lightest of the CORREVIT® S Sensors *
- Sensors weighs only 180 g
- Developed for measurement of tire slip angle
- Accurate at speeds up to 350 kph (optional 400 kph)
- Minimum filter time 4 ms.
- Speed linearity - desired distance < ± 0.5 %
  Distance linearity < ± 0.2 %
- Easy operation
- Mounting angle correction via software
- Direct connection to PC or other evaluation systems
- Illumination by long-life, high-power infrared LEDs
- Signal output via CAN bus
- Negligible service and maintenance requirements as a result of durable technology
- Tested and used under extreme environmental conditions

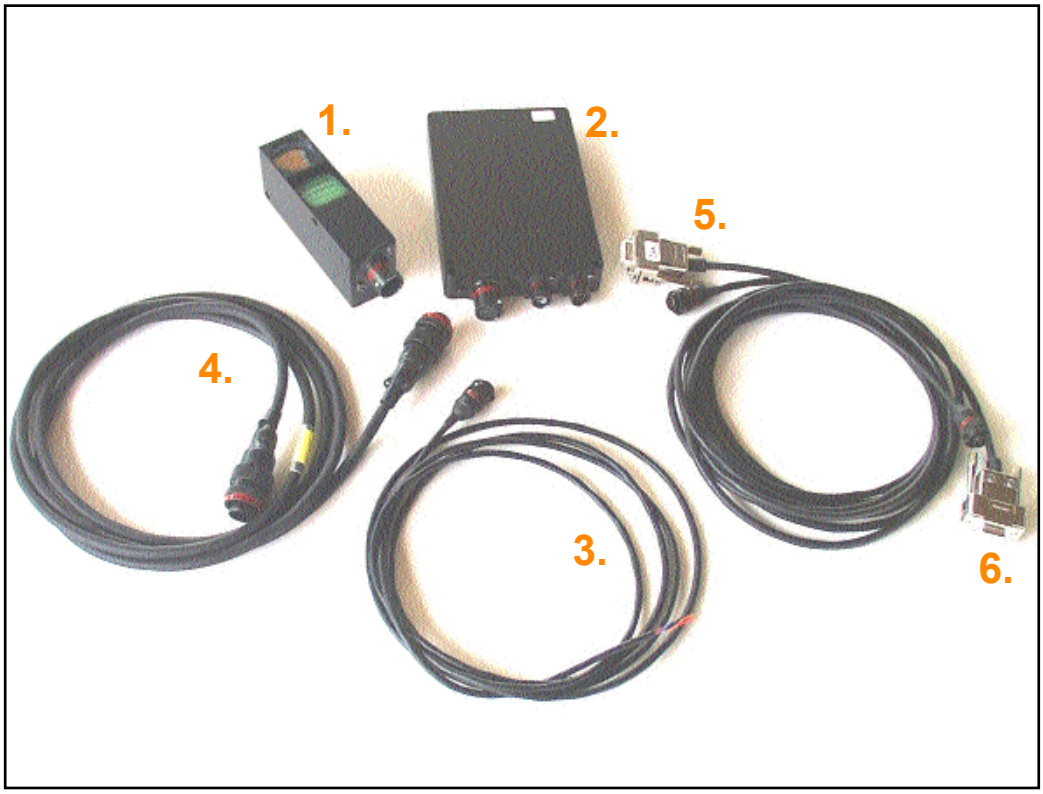
Application

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

- Distance
- Speed
- Angle
- Longitudinal speed
- Transversal speed

*As of 12/04

2. Extent of Delivery



Standard Extent of Delivery Art. No. 13788

1. (1) SF Sensor (Art. No. 13837)
2. (1) SF Electronics Box (Art. No. 13677)
3. (1) Power Cable, 2m MIL Banana (Art. No. 13854)
4. (1) Sensor to Electronics Box Cable, 2m (Art. No.13794)
5. (1) CAN Output Cable, 2m (Art. No. 13683)
6. (1) RS232 Output Cable, 2m (Art. No. 13682)

7. (1) CeCalWin Software (not shown, Art. No. 11343)
8. (1) Cooling element left + right (not shown, Art. No. 14044)
9. (1) Transport Case (not shown, Art. No. 11228)
10. (1) Inlet for transport case (not shown, Art. No. 11127)
11. (1) Inlet for transport case (not shown, Art. No. 11131)

3. Technical Data

3.1 Specifications

Performance Specifications

Speed range:		0.5 ... 350 (optional 400 kph)
Distance resolution		2.08 mm
Uncertainty of measurement*:		< ±0.2%
Speed linearity - desired distance		< ± 0.5 %
Distance linearity		< ± 0.2 %
Working distance and range:		180 +/-50 mm

CAN Bus: CAN V2.0B

System Specifications

Power supply:		12 V ... 14.5 V; 28 W (12 VDC)
Temperature range:	operation:	-25 ... 50°C
	storage:	-40 ... 85°C
	rel. humidity:	5 ... 80%, non condensing
System Protection of the sensor:		IP 67
Illumination wavelength:		850 nm, laser class 1M
Dimensions, sensor head (l x w x h):		100 x 28 x 40 mm (without plug)
Weight, sensor head:		180 g
Dimensions, electronics (L x H x B):		130 x 85 x 20 mm
Weight, electronics:		300 g
Shock:		50 g half-sine, 6 ms
Vibration:		10 g, 10 ... 150 Hz

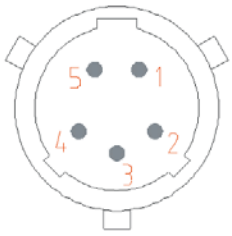
INVISIBLE RADIATION FROM LIGHT EMITTING DIODES!
DO NOT OBSERVE WITH OPTICAL INSTRUMENTS!
LASER CLASS 1M
IN COMPLIANCE WITH DIN EN 60825-1:2001

Serial interface for connection to PC,
automatic sensor identification, function control.

3.2 Pin Assignments

3.2.1 Pin Assignment: PC (RS 232) / CAN Output

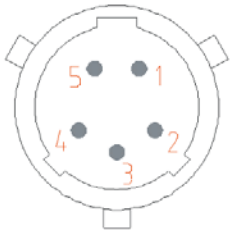
Cable: 5-pin MIL / 9-pin D-SUB



RS232/CAN	
Pin 1:	RXD
Pin 2:	TXD
Pin 3:	Digital GND
Pin 4:	CAN low
Pin 5:	CAN high

3.2.2 Pin Assignment: Power Connector

Cable: 5-pin, female



MIL Connector

Power Connector		
Pin 1 & 2:	+12V	Banana, red
Pin 3:	Shield	
Pin 4 & 5:	Ground	Banana, black

3.3 Internal Signal Filtering

Signals may be smoothed using a moving average filter, which can be set to different time values. Note that signal detail and dynamics will decrease as the signal becomes increasingly smooth.

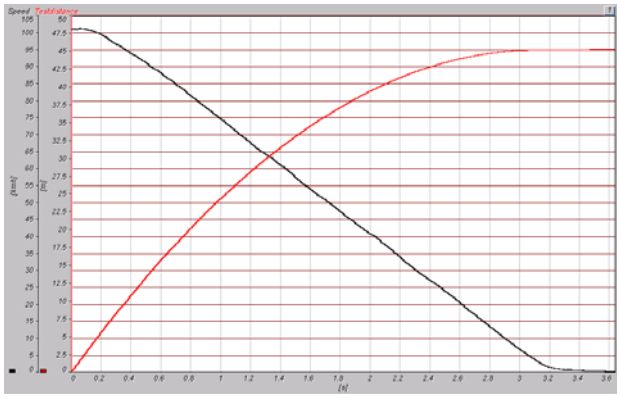
Filter Values for Speed

Filter Value		delay time
• 8 ms	increased signal detail and dynamics (as well as noise) minimum signal delay	2 ms
• 16 ms		6 ms
• 32 ms		14 ms
• 64 ms		30 ms
• 128 ms (default setting)		62 ms
• 256 ms	smoothest signal maximum signal delay	126 ms
• 512 ms		254 ms

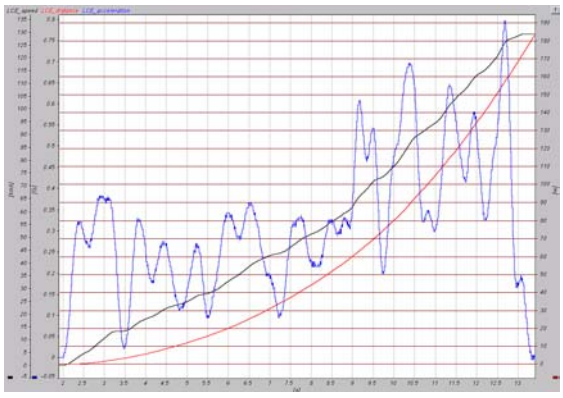
Use CeCalWin Software to change filter settings.

3.4 Typical Data Plots

Brake Test

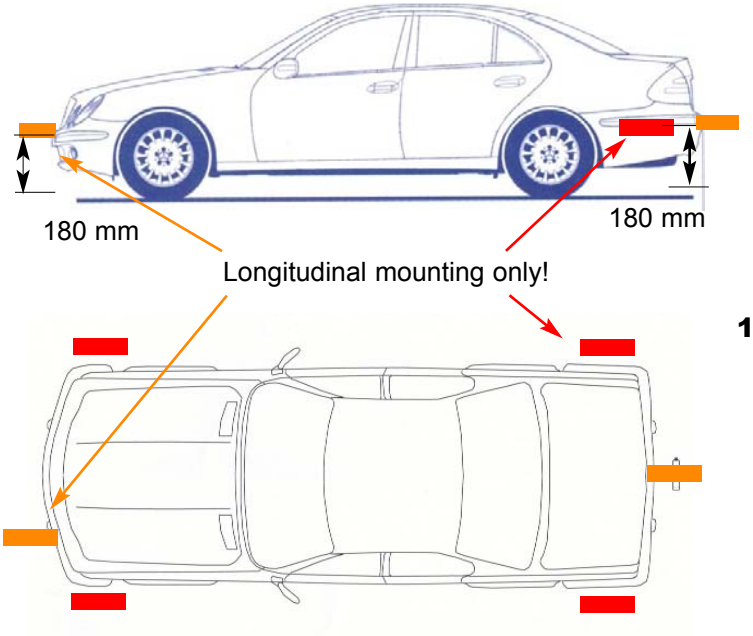


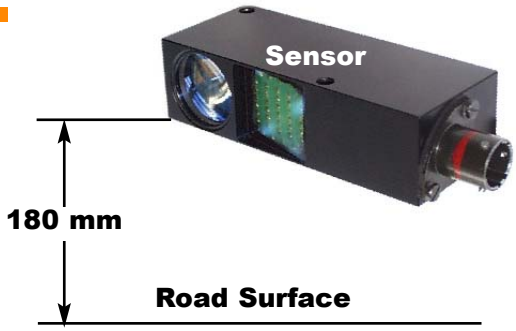
Speed/Acceleration



4. Set-up and Connection

4.1 Mounting Options

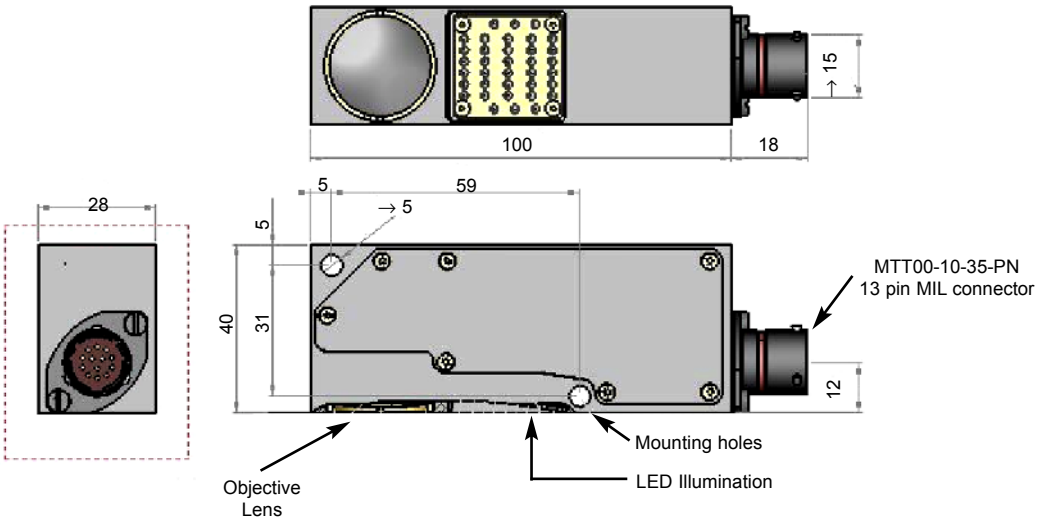




The mounting distance from the lower surface of the sensor body to the road surface must be 180 ±50 mm.

Note:
In wet or snowy conditions, do not mount sensors directly behind the rear wheels. This will help to prevent measurement anomalies that can be caused by spray and/or blowing snow.

4.2 Sensor Mounting Jig



4.3 Mounting Instructions

4.3.1 Suction Mounting Unit

1. Pre-assemble the CORRSYS-DATRON Suction Mounting Unit (Art.No. 13990) as shown in Fig. 1.1.

Fig. 1.1

2. Position the Suction Mounting Unit parallel to the vehicle body (e.g. at the driver-side door), as shown in Fig. 2.1.

   To assure proper function of the suction holders, the mounting area must be free of grease, oil, dust and other contaminants. For this reason it its necessary to clean the painted surface in the mounting area before attaching the suction holders. Do not use cleaning products that leave residue of any kind on the surface.

Fig. 2.1

3. Adjust the Mounting Unit perpendicular to the ground:
   - Loosen the black levers at each suction holder so that the suction holder brackets slide freely.
   - Position the Mounting Unit so that is perpendicular to the ground (vertical).
   - Re-tighten both levers.

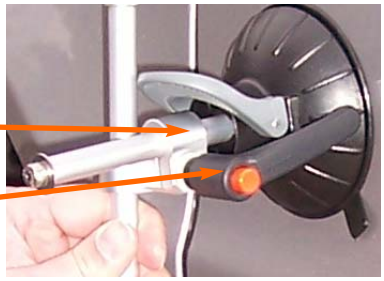


Fig. 3.1b

Fig. 3.1a

4. When the Mounting Unit is correctly positioned, press the suction holders - one after the other - firmly against the vehicle body to flatten the rubber pads against the body surface. Then, fold the grey levers toward suction holders to produce a vacuum, which will secure the suction holders to the vehicle body.

Fig. 4.1

When producing the vacuum, you will feel a distinct resistance. If the suction created is not sufficient to secure the holder(s), check to be certain that the mounting surface is clean.

Always inspect the Suction Mounting Unit before use. Special attention should be paid to the condition of the rubber suction pads, which must be absolutely intact. Replace damaged pads immediately.

Use of a safety line is recommended.

5. Measure the sensor mounting height to be sure that the sensor is within the specified vertical operating range of 180 +/-50 mm (see pages 9 and 11). This distance is measured from the bottom of the sensor body to the road or track surface. **NOTE:** The the bottom of the heat sink/sensor mounting plate will be flush with the bottom surface of the sensor, so the mounting height can be measured from the bottom surface of the heat sink/sensor mounting plate.

   If the sensor is not within the specified vertical operating range, loosen the black levers at each suction holder and slide the the vertical mounting rod up or down, as required, then re-tighten both levers.

   If additional adjustment is required, fold the grey levers on the suction holders down to release suction, then remove the suction holders from the vehicle body by pulling the black tab on each holder. Reposition the Mounting Unit so that the mounting height is correct, then proceed with the mounting procedure described in Step 3 (page 12).

Fig. 5.1

6. Insert the included sensor mounting screws through the mounting holes in the sensor, then into the mounting holes in the heat sink/mounting plate and tighten the screws.

Fig. 6.1

7. Connect the signal cable to the sensor.

Fig. 7.1ba

Fig. 7.1b

8. Route the signal cable trough the side window, into the interior of the vehicle and connect it to data acquisition, then secure the cable to the vertical mounting rod with with a cable tie.

Fig. 8.1

4.3.2 Magnetic Plate Mounting Unit

1. Pre-assemble the CORRSYS-DATRON Magnetic Plate Mounting Unit (Art.No. 14091) as shown in Fig. 1.2.

Fig. 1.2

2. Position the Magnetic Mounting Unit parallel to the vehicle body (e.g. at the driver-side door), as shown in Fig. 2.2. The magnetic plates will automatically hold fast to the (metal) vehicle door/body panel.

Fig. 2.2

3. Adjust the Mounting Unit perpendicular to the ground:
   - Loosen the black levers at each magnetic holder so that the magnetic holder brackets slide freely.
   - Position the Mounting Unit so that is perpendicular to the ground (vertical).
   - Re-tighten both levers.

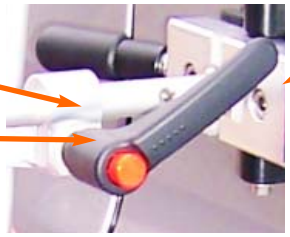


Abb. 3.2b

Fig. 3.2a

Use of a safety line is recommended.

4. Measure the sensor mounting height to be sure that the sensor is within the specified vertical operating range of 180 +/-50 mm (see pages 9 and 11). This distance is measured from the bottom of the sensor body to the road or track surface. **NOTE:** The the bottom of the heat sink/sensor mounting plate will be flush with the bottom surface of the sensor, so the mounting height can be measured from the bottom surface of the heat sink/sensor mounting plate.

   If the sensor is not within the specified vertical operating range, loosen the black levers at each magnetic holder and slide the the vertical mounting rod up or down, as required, then re-tighten both levers.

   If additional adjustment is required, release the magnetic plates by pulling them away from the vehicle with the black handles. Reposition the Mounting Unit so that the mounting height is correct, then proceed with the mounting procedure described above.

Fig. 4.2

6. Insert the included sensor mounting screws through the mounting holes in the sensor, then into the mounting holes in the heat sink/mounting plate and tighten the screws.

Abb. 5.2

7. Connect the signal cable to the sensor.

Abb. 6.2a

Abb. 6.2b

8. Route the signal cable trough the side window, into the interior of the vehicle and connect it to data acquisition, then secure the cable to the vertical mounting rod with with a cable tie.

Abb. 7.2

4.3.3 Wheel Mount

The CORRSYS-DATRON Wheel Mount System for CORREVIT® SF Sensors is designed to enable precision tire-slip measurement.

The following mounting units are recommended.

- Sensor Wheel Mounting Unit (**Art. No. 14178**) consisting of:
  (1) Torsion rod with protective boot
  (1) Suction holder
  (1) Torsion rod mounting clamp
  (1) Mounting disk with mounting hub
  (6) Centering stars (1 each for 3-, 4- and 5-lug hubs (**Art. No 11295, 11293, 11294**)

- Mounting collets for various lug nut sizes:
  Standard dimensions:
  17 mm, #10070
  19 mm, #10071
  21 mm, #10072
  further on request

1. Remove hubcap or any covering over wheel nuts and clean dirt/debris from wheel nuts.

2. Place collets on wheel nuts.

Fig. 1.3

3. Position the mounting disc and attach it loosely to collets with mounting bolts and washers.

   NOTE: The mounting disc has 3 sets of slots for proper alignment with 3-, 4-, and 5-lug configurations. Each set of slots is marked 3x, 4x or 5x, corresponding the number of lugs.

Fig. 2.3

4. Place the centering star tightly against the mounting disk and position the concave edges of the centering star against the washers on the mounting bolts, as shown. Then, turn the centering star until it is tight against all of the washers to ensure that the mounting disk is properly centered on the wheel.

Fig. 3.3

5. Continue to hold the centering star tightly against the mounting washers and mounting disk, then tighten the mounting bolts in a cross pattern, using an allen wrench.

Fig. 4.3

6. Using an allen wrench, loosen the set-screw at the bottom of the torsion rod retainer clamp and place the retainer clamp onto the mounting hub.

   NOTE: The set screw should not be tightened until after the torsion rod is properly positioned, see Step 11. (page 19).

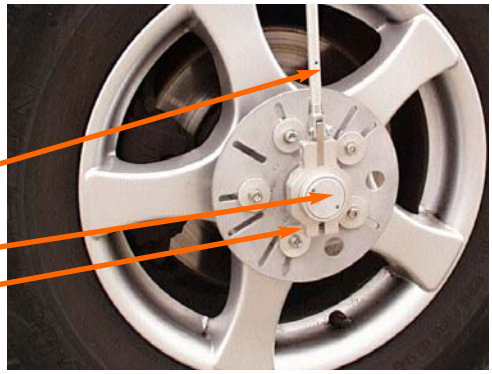


Fig. 5.3

7. Slip the protective boots over the lower and upper sections of the torsion rod. Then, fit the upper section of the torsion rod into the joiner at the top of the lower section of the torsion rod. Check the safety line to be sure it is secured to the torsion rod.

   A safety line should always be used to avoid damage or injury in the event that a suction holder separates from the vehicle body during the test drive.

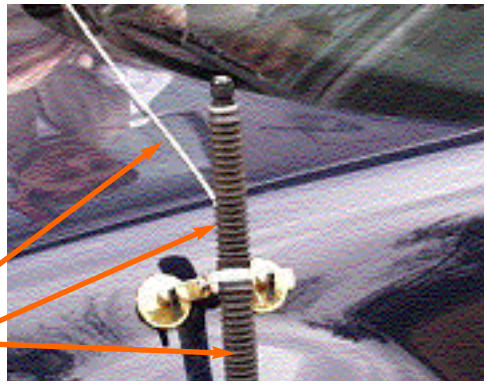


Fig. 6.3

8. To assure proper function of the suction holders, the mounting area must be free of grease, oil, dust and other contaminants. For this reason it its necessary to clean the painted surface in the mounting area before attaching the suction holders. Do not use cleaning products that leave residue of any kind on the surface. Place the suction holders firmly against the vehicle fender and latch the suction holder lock handles (latched position is approximately parallel to vehicle fender surface).

When producing the vacuum, you will feel a distinct resistance

Fig. 7.3

9. Tighten the set screws that secure the upper and lower sections of the torsion rods together, using an allen wrench.

Fig. 8.3

10. If necessary, adjust the torsion rod so that is parallel to the vehicle, then tighten the nut that secures the suction holder mounting to the torsion rod.

Fig. 9.3

11. Tighten the retainer clamp set-screw with a allen wrench.

Fig. 10.3

12. Secure the safety line at a suitable location on the vehicle.

Fig. 11.3

13. Loosen the sensor mounting retainer set screw with an allen wrench.

    Place the mounting plate onto the mounting hub and re-tighten the set-screw.

    Insert the included sensor mounting screws through the mounting holes in the sensor, then into the mounting holes in the mounting plate and tighten the screws.

Fig. 12.3

14. Measure the sensor mounting height to be sure that the sensor is within the specified vertical operating range of 180 +/-50 mm (see pages 9 and 11). This distance is measured from the bottom of the sensor body to the road or track surface. If the sensor is not within the specified vertical operating range, first loosen the screws and move the sensor up or down, as required, in the channels on the mounting plate and measure again. If this adjustment is insufficient, remove the mounting plate from the retainer clamp using an allen wrench. Move the plate up or down as required and re-attach the plate to the mounting plate, then securely re-mount the sensor to the mounting plate.

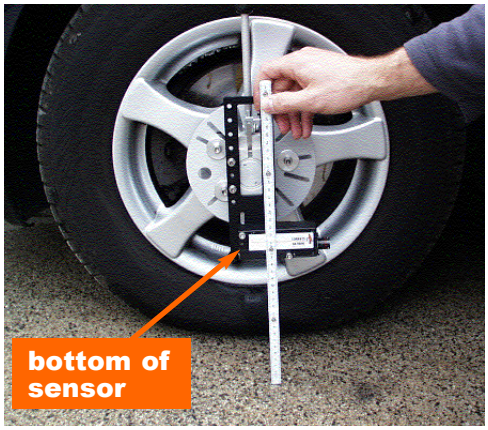


Fig. 13.3

15. Connect the signal cable to the sensor, then wind the cable loosely around the torsion bar.

Danger

WARNING: Be sure to leave enough slack in the cable to allow for full-lock steering changes, but use caution to assure that the cable is not wound too loosely around the torsion bar. Under no circumstances should the cable be loose enough to touch the tire or to be pulled under the fender during testing. Either circumstance would inevitably result in damage to the equipment and could also cause an accident.

Finally, connect the cable to data acquisition.

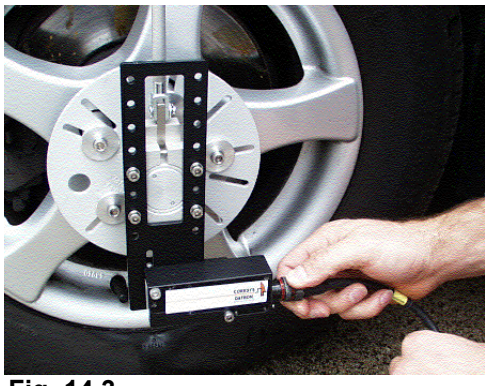


Fig. 14.3

16. If desired, mount the optional heat sink onto the sensor head using an allen wrench.

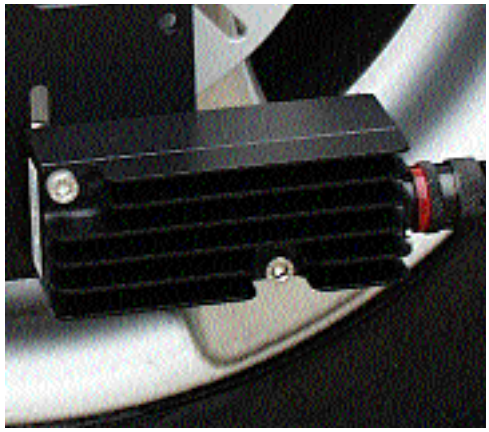
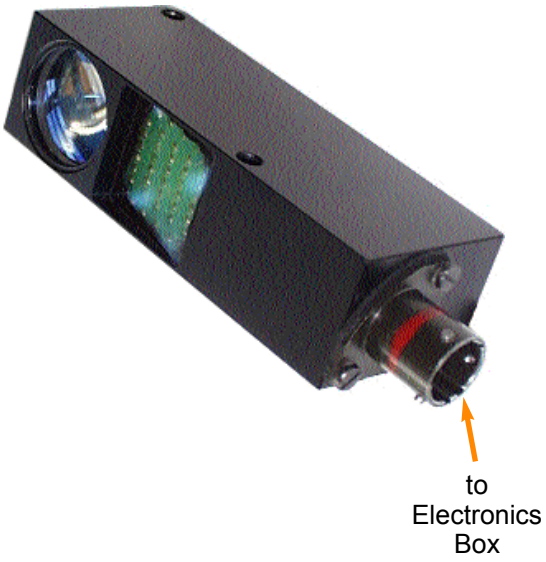


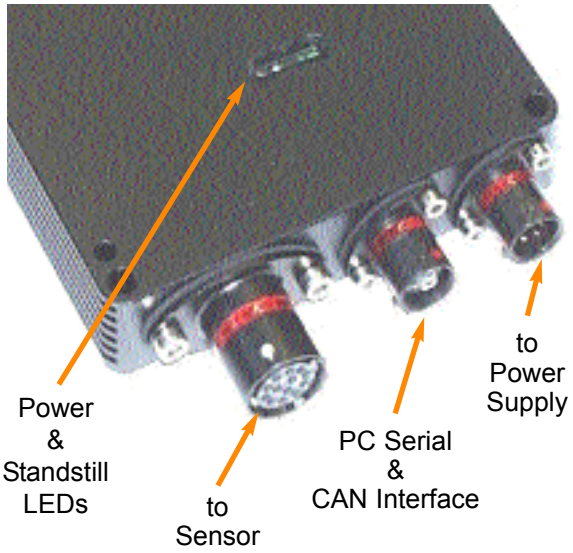
Fig. 15.3

4.4 Connecting the sensor

Sensor Connections



Sensor Electronic Connections



Reverse Polarity Protection
The electronic unit is equipped with reverse polarity protection. In the event that polarity is inverted, the unit will not be damaged but the power LED will illuminate red! Immediately disconnect power from the unit and correct the power supply connection.

To connect the sensor to a PC or laptop for set-up and calibration with CeCalWin Software:

1. Connect the sensor signal output to the signal input on the electronics with the 5m Sensor to Electronics Box Cable (Art. No. 13796).
2. Connect the electronic to a PC operating CeCalWin Software via the RS232 Output Cable, 2m (Art. No. 13682)
3. Be sure that the individual switches on each power output circuit on the power distribution unit are in the "OFF" position.
4. Connect the supply cable from the electronics to a CORRSYS-DATRON power distribution box.
5. Start the vehicle engine and carefully connect the power distribution unit to the vehicle power supply.
6. Switch the distribution box power circuit ON to send power to the sensor electronics box(es).
7. The sensor is now ready for set-up and calibration with CeCalWin Software.
   See **Using the CeCalWin Software Package** for complete details.

To connect the sensor to data acquisition:

If the sensor is currently connected to PC for set-up/calibration:

1. Disconnect the RS232 Output Cable (Art. No. 13682) from the PC/laptop.
   NOTE: It is not necessary to power down the sensor/electronic before disconnecting or connecting the signal cable.
2. Connect the electronic to data acquisition:
   - for Serial connection, simply connect the RS232 Output Cable, 2m (Art. No. 13682) to the data acquisition system.

     or
   - for CAN connection, disconnect the RS232 Output Cable and connect the electronic to data acquisition via CAN Output Cable, 2m (Art. No. 13683).

If the sensor is not already connected to PC for set-up/calibration:

1. Connect the sensor signal output to the signal input on the electronic with the 5m Sensor to Electronics Box Cable (Art. No. 13796).
2. Connect the electronic to data acquisition:
   - for CAN connection, use CAN Output Cable, 2m (Art. No. 13683)
     or
   - for Serial connection, use RS232 Output Cable, 2m (Art. No. 13682)
3. Be sure that the individual switches on each power output circuit on the power distribution unit are in the "OFF" position.
4. Connect the supply cable from the electronics to a CORRSYS-DATRON power distribution box.
5. Start the vehicle engine and carefully connect the power distribution unit to the vehicle power supply.
6. Switch the distribution box power circuit ON to send power to the sensor electronics box(es).

5. Troubleshooting

When troubleshooting the CORREVIT® SF Sensor, begin by checking the following:

Cables and power supply

- Check all connections to determine that each is complete and that the system is connected to a power supply that provides voltage output within the specified range.
- Check to determine that the correct cables have been used for all connections.
- The following problems can be caused by incorrect or incomplete cable connections and/or connection to incorrect power supply voltage:
  - Output signals are not available to data acquisition and/or connected PC.
  - A sensor will not go out of standstill mode with vehicle motion.

Status LED's on sensor electronic boxes

- If all connections are correct and no faults are present, the "PWR" (power) LED on the sensor electronic will be illuminated orange. If the "PWR" LED is red, a fault is indicated. Additionally, the green "ST" (standstill) LED will be illuminated if all connections are correct and no faults are present.
- If the "PWR" LED is red and the green "ST" LED is not illuminated, polarity has been reversed and must be corrected.
- If the "PWR" LED is orange and the green "ST" LED is not illuminated, cables may have been connected incorrectly. Check and reconnect cables as necessary.

Operating range

If a sensor is mounted out of the recommended height range (standoff distance), it may not go out of standstill mode with vehicle motion, and no measurement signals will be output. Check and correct mounting as necessary.

Sensor lens

The sensor lens (located on the underside of the sensor housing) may occasionally become dirty, preventing proper operation. Check and clean the sensor lens regularly.

Software

If one or more output signals appear to be incorrect, the sensor may have been set-up incorrectly via CeCalWin Software. Check all relevant settings in CeCalWin:

- Check calibration factor

Environmental conditions

The sensor may occasionally interpret heavy spray from snow or water as part of the road or track surface, producing unexplained spikes in the output signals and/or other anomalous measurement artifacts. Sensors should be mounted away from the heaviest spray areas, especially directly behind the rear wheels.

EMC interference

If the sensor starts to send output signals without vehicle motion, triggering may have been caused by excessive EMC interference from the test vehicle. To correct this condition, reset the sensor by disconnecting from power and then re-connecting, or by switching power off and then back on at the power distribution box. If the condition persists, disconnect sensor from vehicle ground and isolate it at all mounting points.

If none of the above recommendations provides a solution, you may wish to contact CORRSYS-DATRON. Before doing so, please be ready to supply the following:

- A .ccw file saved from CeCalWin software to serve as an example of the problem or fault condition.
- A list of all which outputs that appear to be problematic, i.e. analog, digital, CAN, RS-232.
- The serial numbers of all relevant components.

Troubleshooting CAN with the CORREVIT® SF Sensor

Problem: There are no messages on the CAN-bus
Check to be sure that:
- the electronic has power
- data acquisition is connected to the SF sensor electronic
- the correct send mode is selected (in CeCalWin Software settings)
- the data acquisition system and all sensor electronics use the same settings for baud rate, CAN identifiers and identifier types (see CeCalWin Software settings)
- if you use CANalyser or a data acquisition system with an acceptance filter, be sure the message from the sensor is not disabled

Problem: Data received via the CAN bus appear to be incorrect
Please be sure that:
- the data acquisition system uses Intel data format for communication via CAN-bus
- the data acquisition system and all sensor electronics use the same settings for the type of measured value (signed or unsigned, number of bits)

For more information about data types and how they apply to this sensor, see the separate **CAN Protocol**.

CORRSYS-DATRON recommends that the .dbc file option be used to avoid problems with false data types or bit lengths. Sensor-specific .dbc files are available for download at www.corrsys-datron.com, or may also be obtained by contacting the CORRSYS-DATRON application department directly.

Appendix: Technical Drawing