

**CORRSYS**

**DATRON**

Sensorsysteme GmbH



# **CORREVIT<sup>®</sup> L-400**

Non-Contact Optical Sensor

*for*

*slip-free measurement*

*of longitudinal dynamics*

*at large operating distances*

# **USER MANUAL**

**Notes:**

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## Appendix: - Technical Drawings

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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 applicable 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 email: [hotline@corrsys-datron.com](mailto:hotline@corrsys-datron.com).



Danger

- Use caution when exchanging sensor lamps – lamps are extremely hot, and may cause injury.
- Do not look into sensor lamps – lamps are extremely bright, and may cause eye injury.
- Sensor head can become very hot and may cause injury if power has been applied to the sensor for extended periods of time. This is especially true if the sensor is used in hot environmental conditions.



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.

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## 1. Overview



## CORREVIT® L-400

### Non-Contact Optical Sensor System

for

*slip-free measurement of longitudinal dynamics at large operating ranges*

#### Art. No.

L400 longitudinal	11303
L400 long. + CAN	11305
L400 transversal	11304
L400 trans. + CAN	12494

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 plays an important role.

With an extended operating range of 400 mm  $\pm$  130 mm, the CORREVIT® L-400 Sensor is ideally suited for application with trucks, busses and off-road vehicles.

The CORREVIT® L-400 Sensor uses proven optical correlation technology to ensure the most accurate possible signal presentation. This technology incorporates two high-intensity light sources that illuminate the test surface, which is imaged by the sensor onto an optical grating system. Fast, easy mounting and universal applicability distinguish this proven non-contact optical sensor.

## Features

- Extended operating range of 400 mm  $\pm$ 130 mm.
- Due to its considerably extended working range, this sensor is ideally suited for application with trucks, busses and off-road vehicles.
- Wide speed range from 0.5 to 250 kph\*.
- Extremely high measuring accuracy – better than  $\pm 0.1\%^{**}$  – as a result of precise optical gratings and digital signal processing.
- Programmable standardized analog and digital signal outputs using the latest processor techniques, fast and easy calibration.
- Any required measurement quantity available.
- Easy operation and direct connection to PC or other evaluation systems.
- Negligible service and maintenance requirements as a result of durable technology.
- Tested and used under extreme environmental conditions.

## Applications

The compact CORRSYS-DATRON L-400 Sensor is designed for use in dynamic vehicle testing applications that require highly accurate measurement of the following variables:

- Distance
- Speed
- Acceleration (optional)

\* optional race version up to 400 kph available

\*\* with calibration on the test surface

## 2. Extent of Delivery



### Standard delivery

1. (1) L-400 Sensor
2. (1) L-400 Electronics Box
3. (1) Power Cable #K003-16N-12-2m
4. (1) Sensor to Electronics Box Cable #K003-1J2-10-5m
5. (1) Signal Output to BNC Adapter Cable #K003-292-11-1m
6. (1) RS 232 Serial Communication Cable, #K003-15N-11-2m
7. (2) Halogen Lamps, 20 watt, 12V, 10°
8. (6) Bolts (for mounting hardware)
9. (2) Thumb Screws (for mounting hardware)
10. (1) CD-ROM with CeCalWin Software and User Manual  
(1) Calibration certificate ISO 9000 ++

### Options/Accessories

11. CAN Bus Interface - Cable #K003-14N-11-2m
  - Suction Mounting Hardware
  - Transport Case
  - German Calibration Service Certificate (Livingston)
  - Replacement Halogen Lamp 20 watt, 12V, 10°

#### 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. Technical Data

### 3.1 Specifications

#### Performance Specifications

Speed range:	0.5 ... 250 kph*
Distance resolution:	1.9 mm
Measurement deviation**:	<±0.1%
Working distance and range:	400 ± 130 mm

#### Electronic Connector Output

Digital output 1 - distance $V_L$ :	1 ... 1000 pulses/m
Analog output 1 - longitudinal speed $V_L$ :	0 ... 10 V
Analog output 2 - acceleration a (optional):	-10 ... +10 V

#### CAN Bus (optional):

CAN V2.0B

#### System Specifications

Power requirement		11.5 ... 14.5 V; 50 W (12 V DC)
Temperature range	Operation:	- 25 ... 50° C
	Storage:	- 40 ... 85° C
	Relative Humidity:	5 ... 80% non condensing
System protection (with mated connector):		IP 67
Dimensions of the sensor (l x w x h):		247 x 52 x 171 mm
Weight:		1350 g
Dimensions of the electronics (l x w x h):		212 x 144 x 53 mm
	Weight:	940 g
	Shock:	50 g half-sine, 6 ms
	Vibration:	10 g, 10 ... 150 Hz

A serial interface on each of the sensor electronics enables connection to PC for automatic sensor identification, set-up and function control.

### 3.2 Pin Assignments

#### 3.2.1 Pin Assignment: Electronic Output

Cable: 9-Pin D-SUB to 3 BNC (#K003-392-11-1m)

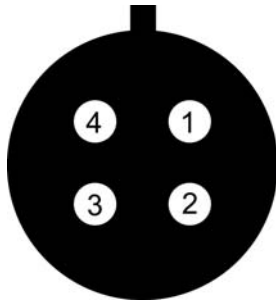
D-SUB	Signal	Measurement Value	BNC
Pin 1	Analog 1	longitudinal speed $V_L$	ANA1
Pin 2**	Analog 2	acceleration a	ANA2
Pin 3	n.c.		
Pin 4	Analog GND		
Pin 5	n.c.		
Pin 6	n.c.		
Pin 7	Digital 1	longitudinal distance $V_L$ (pulses/m)	DIG1
Pin 8	n.c.		
Pin 9	Digital GND		

\* optional race version up to 400 kph available

\*\* with calibration on the test surface

### 3.2.2 CAN Bus Outputs (optional)

Cable: 4-pin CAN to 9-pin D-SUB (#K003-14N-11-2m)



#### CAN connector

Pin 1: CAN High  
 Pin 2: CAN Low  
 Pin 3: n.c. (do not connect to this pin)  
 Pin 4: n.c. (do not connect to this pin)

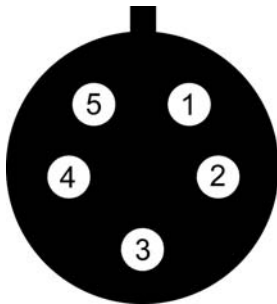
#### D-SUB connector

Pin 7 - CAN High  
 Pin 2 - CAN Low

There is a 120  $\Omega$  termination resistor between Pins 1 and 2.

### 3.2.3 Pin Assignment: PC (RS 232) Outputs

Cable: 5-pin RS-232 to 9-pin D-SUB (#K003-15N-11-2m)



#### RS-232 connector

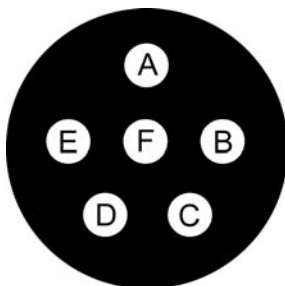
Pin 1: TXD  
 Pin 2: RXD  
 Pin 3: Digital GND  
 Pin 4: n.c. (do not connect to this pin)  
 Pin 5: n.c. (do not connect to this pin)

#### D-SUB connector

Pin 2 - TXD  
 Pin 3 - RXD  
 Pin 5 - Digital GND

### 3.2.4 Pin Assignment: Power Connectors

Cable: 6-pin to 2 banana plugs (#K003-16N-12-2m), electronic to power supply



#### 6-pin MIL connectors

Pins A, B, C: Power (+12 V)  
 Pins D, E, F: GND (0 V)

#### Banana plugs

Red: Power (+12 V)  
 Black: GND (0 V)

#### MIL Connector

06 10 98SN

### 3.3 Default Settings for Analog and Digital Outputs

#### 3.3.1 Analog Output Default Settings

Analog channel 1	25 $\frac{\text{mV}}{\text{kph}}$	Longitudinal speed $V_L$
Analog channel 2 (optional)	100 $\frac{\text{mV}}{\text{m/s}^2}$	Acceleration

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

With a setting of 25 mV/kph for magnitude speed  $|V|$ , a maximum speed of 400 kph\* can be achieved.

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 between 10 and 500 mV/km/h.

Use CeCalWin to change the settings.

#### 3.3.2 Digital Output Default Settings

Digital channel 1	460 $\frac{\text{pulses}}{\text{m}}$	Longitudinal distance (output as pulses)
-------------------	--------------------------------------	--

Use CeCalWin to change the settings.

\* refer to the calibration sheet for maximum calibrated speed

### 3.4 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.

#### 3.4.1 Filter Values for Speed and Slip Angle Output

- 8 ms
  - 16 ms
  - 32 ms
  - 64 ms
  - 128 ms (default setting)
  - 256 ms
  - 508 ms
- ↑

↓

increased signal detail and dynamics (as well as noise)  
minimum signal delay

smoothest signal  
maximum signal delay

Use CeCalWin to change filter settings.

#### 3.4.2 Optional Acceleration Signal

The acceleration signal is calculated internally from the filtered speed signal. A short filter time will give a noisy acceleration signal.

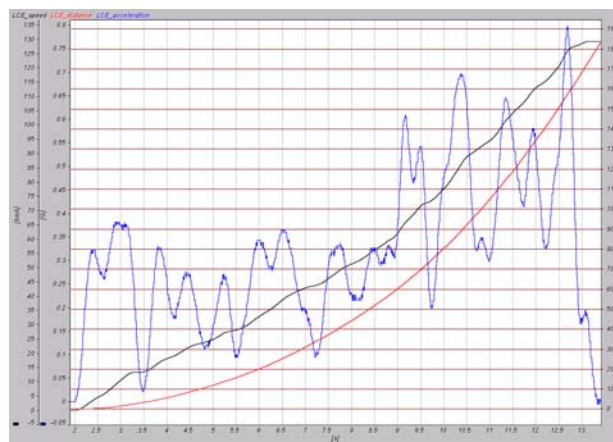
The acceleration signal is additionally filtered with a 2s filter.

### 3.5 Typical Data Plots

**Brake test**

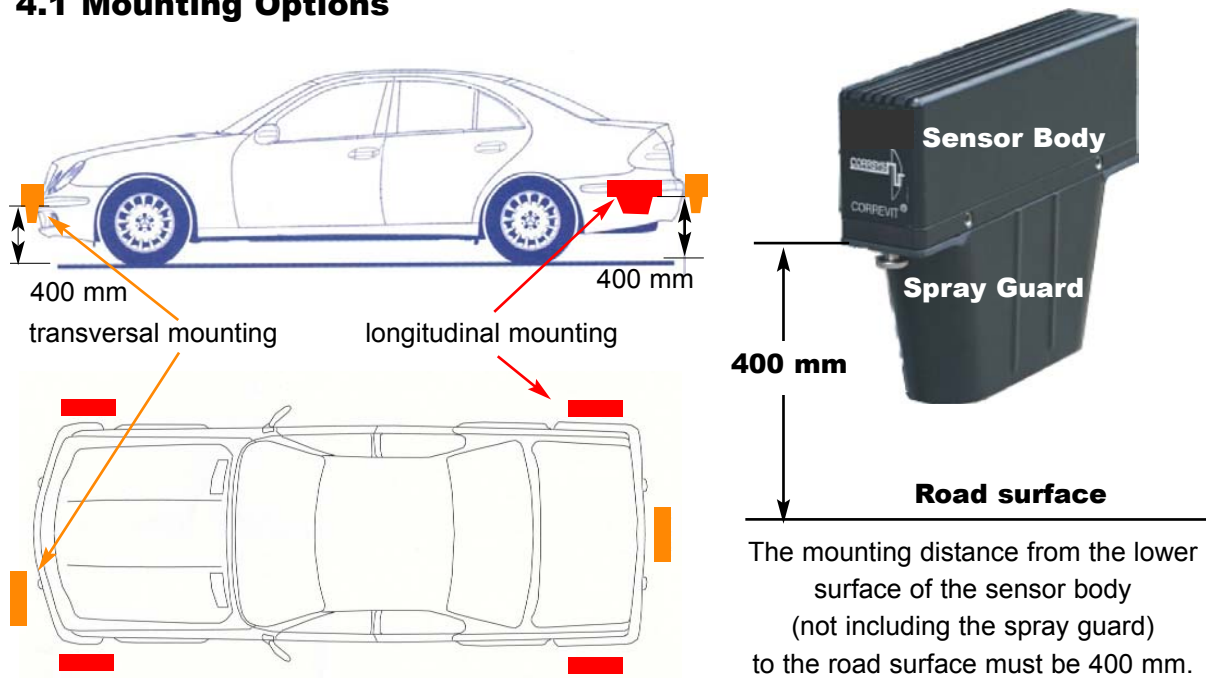


**speed/acceleration**



## 4. Set-up and Connection

### 4.1 Mounting Options



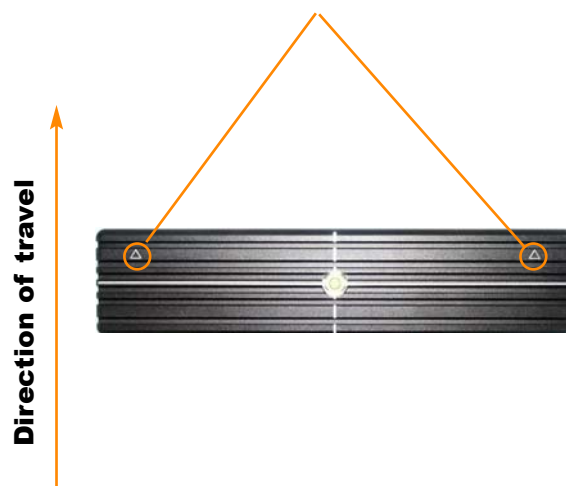
### 4.2 Sensor Orientation

All sensors must be mounted in the orientation indicated by the arrows imprinted on the top of each sensor (sensors may be ordered with either longitudinal or transversal orientation). Care should be taken to assure that the plane of the sensor orientation is closely aligned to the direction of travel.

Arrows indicate direction of travel



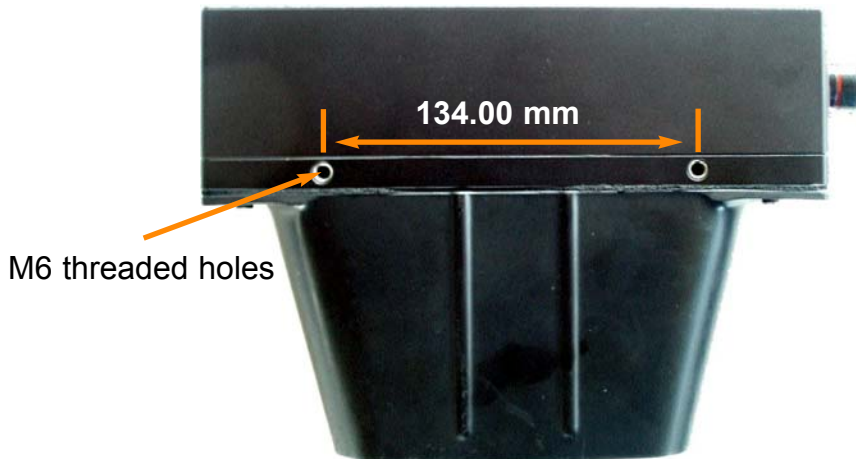
Arrows indicate direction of travel



**Notice:**

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.

### 4.3 Sensor Mounting Jig



**Caution:**

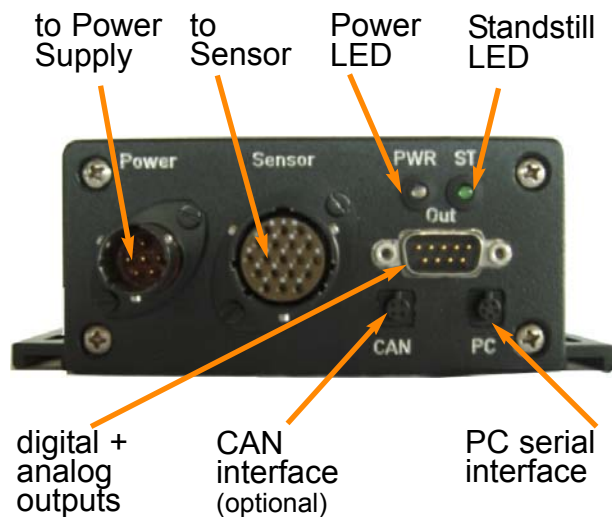
For proper sensor mounting, use only M6 screws with a maximum thread engagement depth of 10 mm. The use of screws with thread engagement depths of greater than 10 mm can damage the sensor housing and will void the warranty!

### 4.4 Connecting the Sensor

#### Sensor Connections



#### Sensor Electronic Connections



**Reverse polari-**

**typrotection**

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.

1. Connect the sensor to the electronic unit:

Connect signal output on the sensor to the signal input on the electronic with cable #K003-1J2-10-5m.

2. Connect the electronic to data acquisition:

a) Connect the data acquisition with 9-Pin D-SUB to 5 BNC cable #K003-392-11-1m.

b) Option: Connect the CAN connector to data acquisition with 4-pin CAN to 9-pin D-SUB cable #K003-14N-11-2m

**NOTE: The L-400 electronics is equipped with a 120  $\Omega$  termination resistor!**

3. Connect the power cable from the electronic to a CORRSYS-DATRON power distribution unit with cable #K003-16N-12-2m (6-pin to 2 banana plugs).
4. Be sure that the individual switches on each power output circuit on the power distribution unit are in the "OFF" position.
5. Start the vehicle engine and carefully connect the power distribution unit to the vehicle power supply.
6. Switch the power circuit on to send power to the sensor electronics boxes.
7. The sensor is now ready for set-up and calibration using CeCalWin Software. Connect the PC output (RS 232) on the electronic to a PC operating CeCalWin (see **Using the CeCalWin Software Package** for complete details). Use the 5-pin RS-232 to 9-pin D-SUB serial communication cable (#K003-15N-11-2m) to make the connection between electronic and PC.

## 5. Troubleshooting

### When troubleshooting the CORREVIT® L-400, 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.

#### Lamps

Check to be sure that all lamps in the sensor are illuminated. Check and replace lamps as necessary. Also be sure that connections and supply voltage are correct.

#### Sensor orientation

- The sensor is delivered with a user-specified operating orientation, which is indicated by arrows located on the top surface of the sensor housing. Sensors must be mounted with the arrows pointing in the direction of travel.
- Incorrect sensor orientation will cause all output signals to be incorrect.

#### Operating range

If the 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:
  - All analog voltage settings must be within range and should be conforme with the data acquisition system settings to which they are connected.
  - All digital pulse and resolution settings must be set within range and should be conforme with the data acquisition system settings to which they are connected.
  - Check all offset values and recalibrate sensor as necessary.
- If no output signals are available and all connections are correct, use the CeCalWin Test Function to determine that all outputs are fully operational. See Section 6, Using the CeCalWin Software Package for complete details.
- CeDapWin, an additional software package available from CORRSYS-DATRON, enables real-time monitoring of height, speed and other relevant signals with a laptop. CeDapWin can be useful for detecting errors in the measurement set-up. Contact your CORRSYS-DATRON sales office for details about obtaining CeDapWin.

## 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® L-400

### **Problem: There are no messages on the CAN-bus**

#### **Check to be sure that:**

- the electronic has power
- data acquisition is connected to the L-400 sensor electronic
- the correct send mode is selected
- the data acquisition system and all sensor electronics use the same settings for baud rate, CAN identifiers and identifier types
- 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 Bus Manual.**

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](http://www.corrsys-datron.com), or may also be obtained by contacting the CORRSYS-DATRON application department directly.

# Appendix

