

# OPERATING INSTRUCTIONS

# CarSense 303™

MAGNETORESISTIVE VEHICLE DETECTOR



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## Cautions and Warnings



**CE REQUIREMENT:** Use CE rated power supply for CE compliance providing suppression as specified by EN61000-4-5.

**Not to be used in personnel safety applications.**

**IMPORTANT:**

This product is an accessory or part of a system. Always read and follow the manufacturer's instructions for the equipment before connecting this product. Comply with all applicable codes and safety regulations. Failure to do so may result in damage, injury or death.

**WARNING:**

**DO NOT INSTALL THE SENSOR DIRECTLY INTO HOT ASPHALT, see installation section**



**WARNING:**

Always use photoelectric protection when using the CS303 as a closing detector on a parking arm operator to prevent accidental closing on a car.

## Product Overview



CS303 Controller



CS303 sensor in probe (top) and flat pack (bottom) configurations



CS303-L Logic Interface

The CarSense 303 features advanced 3-axis, magnetoresistive sensing technology. The sensor measures Earth's magnetic field and responds to disturbances caused by ferrous objects. Three sensing elements provide magnetic field measurement in the X, Y and Z axes, improving detection sensitivity. The CS303's exciting new technology provides a high-sensitivity, compact, and cost-effective solution for reliable vehicle detection.

The small size of the CS303 allows for easy installation in pavement (below grade) with a single saw cut. It provides cost savings on labor and materials when compared to the multiple cuts and corner reliefs required for the installation of inductive loops. The rugged sensor is also suitable for above grade installations, making it ideal for use in confined areas or hidden in non-ferrous architectural components for security purposes.

- Three-dimensional presence detection - select X, Y and/or Z axis independently
- Remote control module for programming and relay contact output
- Stand-alone sensor stores background and settings in a non-volatile memory
- Single cut, low-cost installation
- ULTRAMETER™ sensitivity display for easy set-up
- Fast response for high-speed detection
- Logic Interface available for extended range, directional logic and more
- DETECT-ON-STOP™ feature will allow detection only when a vehicle has come to a complete stop near the sensor. This EMX exclusive technology ignores cross traffic in tight spaces.

NOTE: When power is applied to the CS303-C-1 controller and a CS303-DB or FP sensor is connected, the settings on the controller will be sent to the sensor. The sensor stores these settings.

# Specifications

	Sensor	Remote
<b>Sensing Technology</b>	3-axis magnetoresistive	
<b>ULTRAMETER™ Display</b>	10 levels of sensitivity: 0-9	
<b>Axis Sensitivity</b>	512 counts/Gauss (typical)	
<b>Environmental Tracking</b>	Automatic compensation	
<b>Local Magnetic Field Calibration</b>	Averages local field signature in any sensor orientation	
<b>Detection Range</b>	5ft (1.5m)	
<b>Response Time</b>	125 ms	
<b>Power/Fault Indicator</b>		Green LED
<b>Detect Indicator</b>		Red LED
<b>Detect-On-Stop™ (DOS®)</b>	Requires vehicle to stop for a minimum of 1 second (1-2s typical)	
<b>Outputs</b>	NPN (open collector)	SPDT relay NPN (open collector)
<b>Output Ratings</b>	50 mA	Relay: 1A @ 24 VDC...120 VAC NPN: 50 mA (max)
<b>Connection</b>	5 conductor direct burial	10 position screw terminal
<b>Operating Environment</b>	-40° C...82° C (-40° F...180° F) 0...95% relative humidity	
<b>Housing Material</b>	DB: PVC FP: Polyamide	ABS
<b>Environmental Rating</b>	IP69K	IP30
<b>Power Supply</b>	12-30 VDC	12-30 VDC and 24 VAC
<b>Current Draw</b>	10 mA max	40 mA max
<b>Supply Protection Circuitry</b>	Reverse polarity and fuse protected	
<b>Dimensions</b>	DB: 102mm (4.0") x 27mm (1.0") FP: 108mm (4.3") x 22mm (0.9") x 9mm (0.3")	76mm (3.0") x 22mm (0.9") x 70mm (2.75")
<b>Weight</b>	DB: 43g (0.09 lbs.) FP: 27g (0.06 lbs.)	68g (0.15 lbs.)
<b>Certifications</b>	CE	CE

# Operation

## Power Up

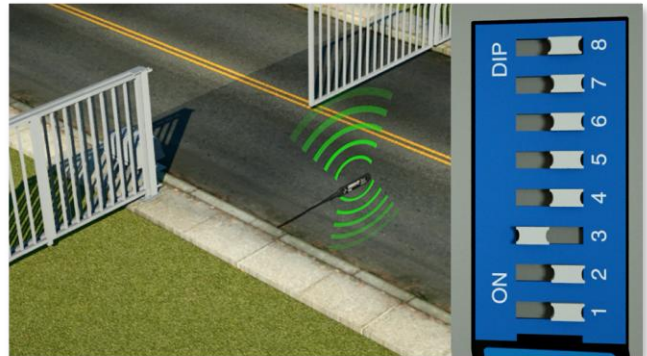
The green LED indicates that the detector is powered and operational. Upon first power-up, the detector will need to be calibrated to the local magnetic field (see [Controls and Indicators](#)).

## Axis Settings

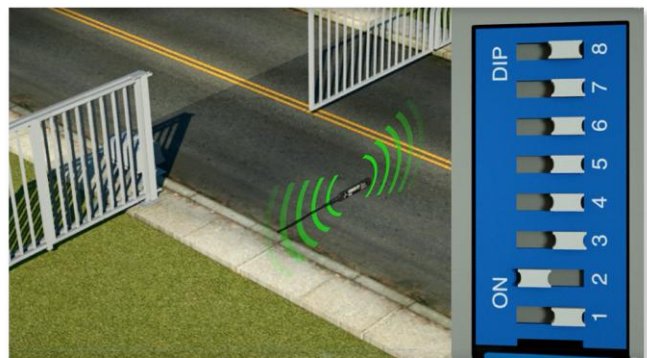
The heart of the CS303 is the 3-axis magnetoresistive sensor. This state-of-the-art technology integrates three separate sensing elements, allowing for individual tailoring of the detector's sensitivity according to its environment.

The sensor can detect disturbances in all 3 axes (X, Y, and Z), and allows you to select any combination required for your unique installation. By "turning off" the axis in the direction of a disturbance, the sensitivity in that direction is reduced, while maintaining the sensitivity of the other two axes.

### X Axis Sensitivity



### Y Axis Sensitivity



### Z Axis Sensitivity



## Operation (continued)

The prior illustrations indicate the areas that each axis will be most sensitive to. For most applications, activate all three axes for the greatest sensitivity and maximum detection distance.

For unique installation challenges, such as moving gates or cross traffic that fall within the sensitive directions shown, turn off that axis to minimize the sensitivity from those disturbances.

Note that the flat pack configuration allows for the best implementation of these settings. The only known axis in the *probe configuration* will be the Y, as its orientation does not change as the sensor is rotated about the cable end (see the [vertical installation](#) diagram).

To find the axis most affected by an unwanted disturbance when using the round probe configuration, perform the following procedure:

1. Calibrate the sensor with the disturbance removed.
2. Move the disturbing object into position
3. Select each axis individually, observing the ULTRAMETER™ display for each.
4. Turn off the axis that causes the *lowest* number to appear due to the disturbance.

### ULTRAMETER™ Sensitivity Display

The [ULTRAMETER™ sensitivity display](#) simplifies the installation process by displaying the sensitivity setting required to detect a vehicle near the sensor. To use this feature, observe the display while a vehicle is moving into position near the sensor module, note the number displayed, then adjust the sensitivity setting (rotary switch) to the displayed position.

During normal operation, when a vehicle is not on near the sensor, the display is blank. The effects of cross-traffic interference can be observed on the display when the sensing area is vacant.

### Sensitivity Setting

The [10-position rotary switch](#) allows for precise adjustment of detection level. The sensitivity level increases from position 0 thru 9 with position 0 being the lowest sensitivity. Typical applications require a setting of 3 or 4. The [ULTRAMETER™ sensitivity display](#) simplifies the installation process by displaying the sensitivity setting required to detect a vehicle near the sensor. To use this feature, observe the display while a vehicle is moving into position near the sensor, note the number displayed, then adjust the sensitivity setting (rotary switch) to the displayed position. This adjustment applies to all axes.

### Sensor Calibration/Reset

[Pressing the reset switch](#) calibrates the sensor to the local magnetic field. This must be used whenever the sensor is moved from its position, and may be necessary if the sensor's local magnetic environment has changed ([see troubleshooting](#)).

## Operation (continued)

### Detect-On-Stop (DOS®)

The [Detect-On-Stop feature](#) requires that a vehicle must come to a complete stop near the sensor for a minimum of 1 second (typical 1-2s) before the output activates.

### Presence Output

The [presence setting](#) provides two selections: the output can be set for Infinite Presence or Normal Presence. Infinite Presence causes the output to remain in detect mode as long as the vehicle remains near the sensor. Normal Presence causes the output to reset after 5 minutes. **DO NOT USE THE NORMAL PRESENCE SETTING UNLESS THE OPENING IS PROTECTED BY A SECONDARY SAFETY DEVICE SUCH AS THE EMX IRB-4X PHOTOEYE.**

### Pulse Output

When the pulse output mode is selected, the output will be activated for approximately 500ms on vehicle entry or exit (depending on status of [switch 5](#)).

### Delay

The delay setting provides a 2 second delay before activating after the sensitivity threshold is met.



# Controls and Indicators

## PRESENCE

DIP switch position 8	
Normal	on
Infinite	off

## DETECT-ON-STOP (DOS®)

DIP switch position 7	
DOS on	on
DOS off	off

## OUTPUT

DIP switch position 6	
Pulse	on
Presence	off

## PULSE ON ENTRY/EXIT

DIP switch position 5	
Pulse on exit	on
Pulse on entry	off

## DELAY

DIP switch position 4	
2 second delay on	on
2 second delay off	off

## AXES SETTINGS

DIP switch position			
Axis	3	2	1
X	on		
Y		on	
Z			on

## SENSITIVITY SETTING

Position 0.....9	
Sensitivity	low.....high

*\*Sensitivity applies to all selected axes*

## DETECT

Red LED	
Presence detected	on
No presence	off

## ULTRAMETER™ SENSITIVITY DISPLAY

Indicates sensitivity setting required to detect vehicle

## SENSOR CALIBRATION/RESET

Press to calibrate and reset error status



# Connections



Terminal	Description	Sensor Shielded Cable
1	Power (12 – 24 VDC/VAC)	-
2	Power (12 – 24 VDC/VAC)	-
3	Relay - NO	-
4	Relay - COM	-
5	Relay - NC	-
6	Open collector through-put	
7	Open collector through-put	WHITE
8	Sensor communications A	RED
9	Sensor communications B	GREEN
10	V+ (to sensor)	BROWN
11	V- (logic common)	BLUE
	Chassis GND	SHIELD

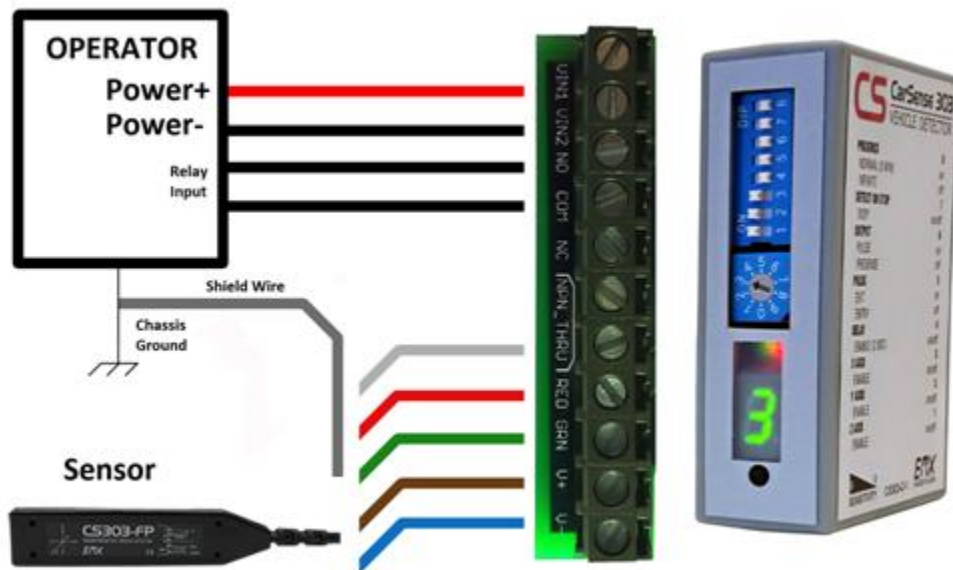
Operator Connections

Sensor Connections



The shield (bare) wire on the sensor cable should be connected to Chassis ground to ensure noise immunity.

Note: Strip wires 1/8" to 1/4", refer to operator instructions for operator connections.



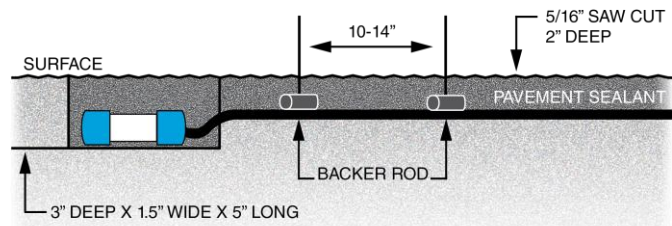
## Troubleshooting

Symptom	Possible cause	Solution
Green LED flashes half second on, half second off “E” “1” flashes on display	Communication failure	<ol style="list-style-type: none"> <li>1. Check communications and power wiring to sensor module</li> <li>2. Cycle power to remote and sensor module</li> </ol>
Green LED flashes, 1 fast	Previous communication failure	Check communications and power wiring to sensor module
No detection	Sensitivity set too low	With vehicle within desired proximity, observe ULTRAMETER™ display to find the minimum sensitivity required for detection
Stuck in detection	Local environmental change	Recalibrate sensor using reset button located underneath ULTRAMETER™ display on CS303-C-1
ULTRAMETER™ Display shows a value when no car is present	Local environmental change	Recalibrate sensor using reset button located underneath ULTRAMETER™ display on CS303-C-1
Green and red LED's flash simultaneously “E” “2” flashes on display	Insufficient supply voltage	<ol style="list-style-type: none"> <li>1. Make sure the power supply is working correctly and properly rated according to connections table (see above)</li> <li>2. Disconnect the sensor module and see if power returns to the controller</li> </ol>
Green LED flashes half second on, half second off “E” “3” flashes on display	Damaged sensor module	<ol style="list-style-type: none"> <li>1. Cycle power to remote and sensor module</li> <li>2. Replace sensor module</li> </ol>

## Probe

### HORIZONTAL INSTALLATION

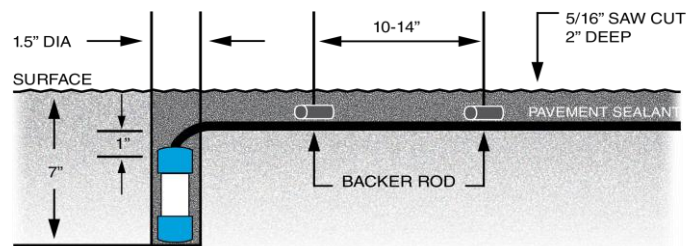
Horizontal installation can be accomplished by cutting out a 3" x 1.5" x 5" area in the pavement, with a 5/16" x 2" deep saw cut exiting the cutout for the communications/power cable. Backer rod should be placed at a minimum of every 10-14". Pavement sealant can then be used to fill the cable and probe cavities.



Horizontal Installation

### VERTICAL INSTALLATION

For vertical installation, drill a 7" x 1.5" hole in the surface with a 5/16" x 2" deep saw cut exiting the cutout for the communications/power cable. Backer rod should be placed at a minimum of every 10-14". Pavement sealant can then be used to fill the cable and probe cavities.



Vertical Installation

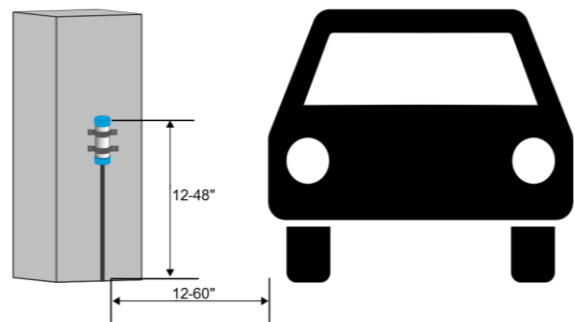
### ABOVE-GRADE MOUNTING

When mounting above-grade, make sure that the sensor is placed at a height to maximize the sensitivity of the detector. This typically means installing it at door level to prevent dropouts. The maximum distance maintained between the sensor and the vehicle should be less than five feet (see [CS303 Sensitivity vs. Distance graph](#) on page 13).

The sensor should be secured to the target object to minimize any movement that might provide false detections or dropouts. Securing the probe may be accomplished with at least one 1" ID pipe/conduit strap, such as Cantex part number 5133736. If plastic straps are not available, steel may be used, but should be placed towards the cable-end of the probe to avoid sensitivity related issues. The flat pack can be secured with cable ties and suitable mounts.

The sensor can be installed inside of any non-ferrous architectural structures, such as fiberglass, plastic, aluminum, etc.

Cabling should be enclosed in conduit to minimize environmental degradation.



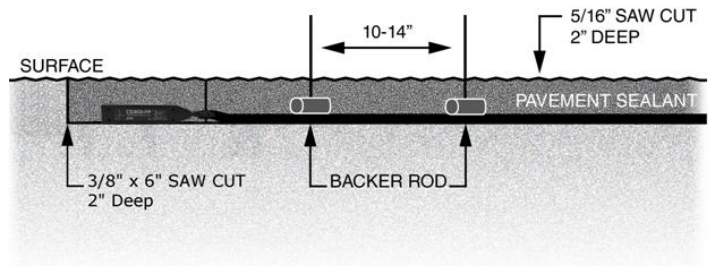
Above-Grade Installation

## Installation (continued)

### Flat Pack

#### HORIZONTAL INSTALLATION

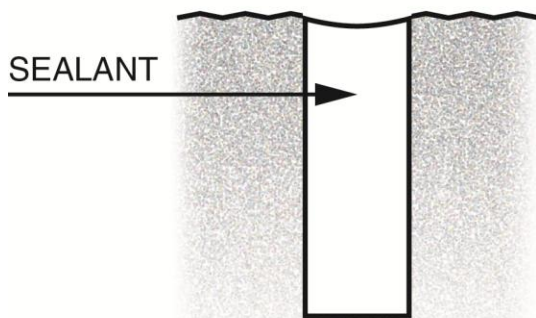
The flat pack requires a 2" x 3/8" x 6" cut in the pavement for the sensor, with a 5/16" x 2" deep saw cut for the cable lead. Backer rod should be placed at a minimum of every 10-14". Pavement sealant can then be used to fill the cable and sensor cavities



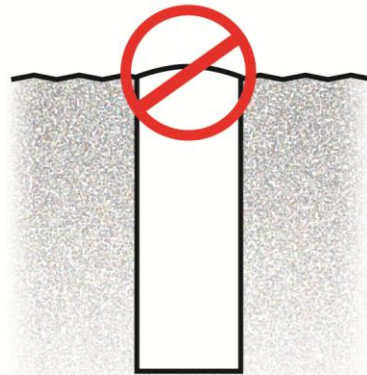
Horizontal Installation

### Sealant (Probe & Flat Pack)

**Correct sealant fill does not extend above the roadway**

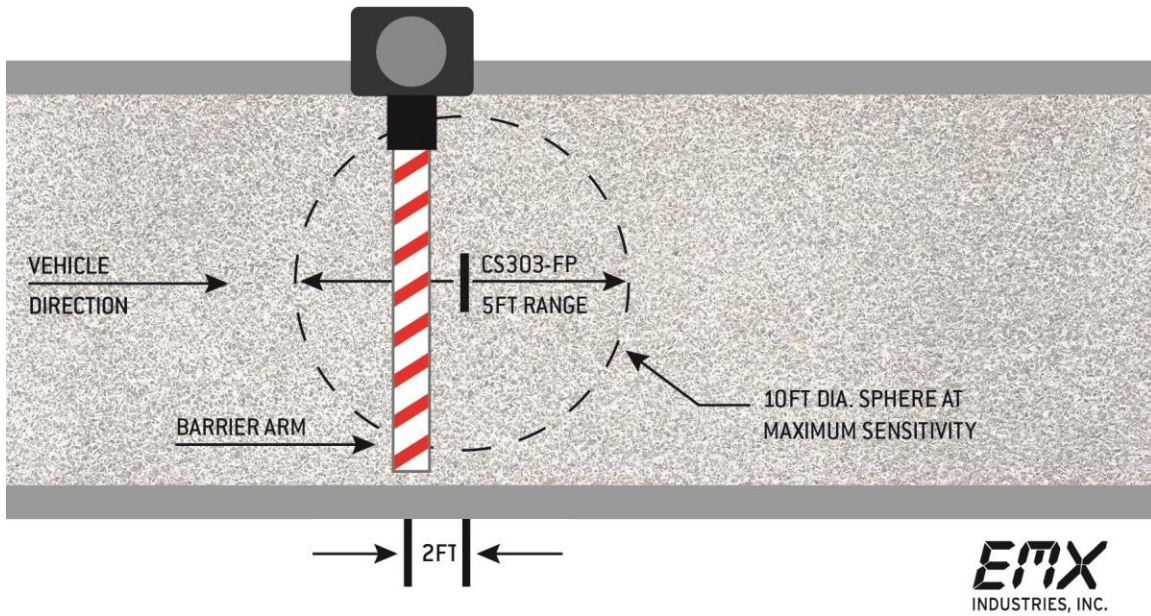


**Incorrect fill allows vehicle weight to press on sensor**

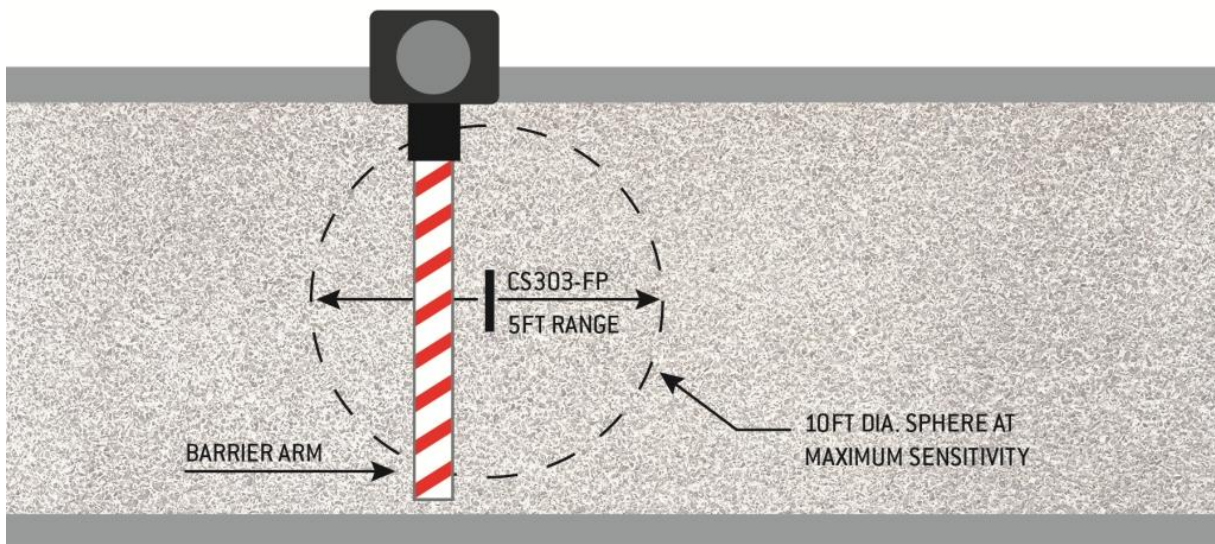


## Installation (continued)

### CS303 VEHICLE SENSOR Barrier Arm Installation



### CS303 VEHICLE SENSOR Loop Detector Replacement



CS303 sensor minimizes the potential of the barrier arm closing when a vehicle is present.  
The number of sensors and their placement is dependent on the application.



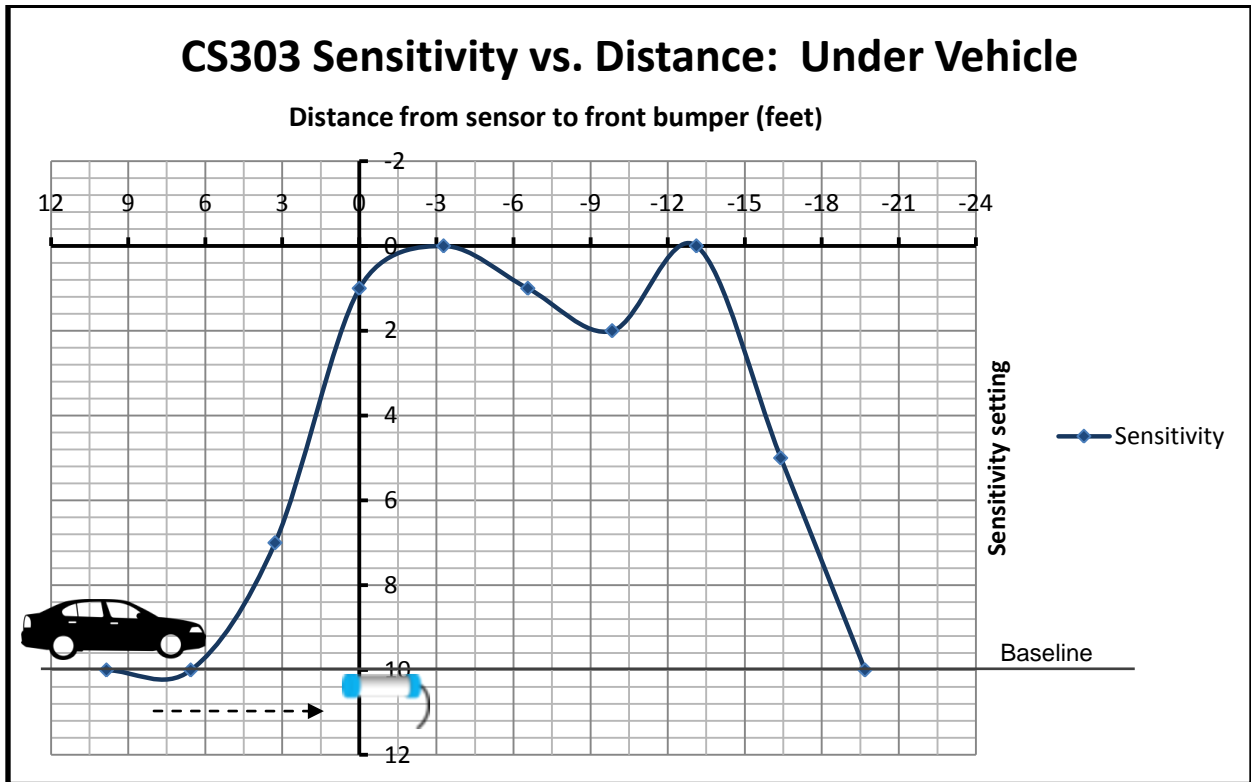


Figure 1 - CS303 Sensitivity Data

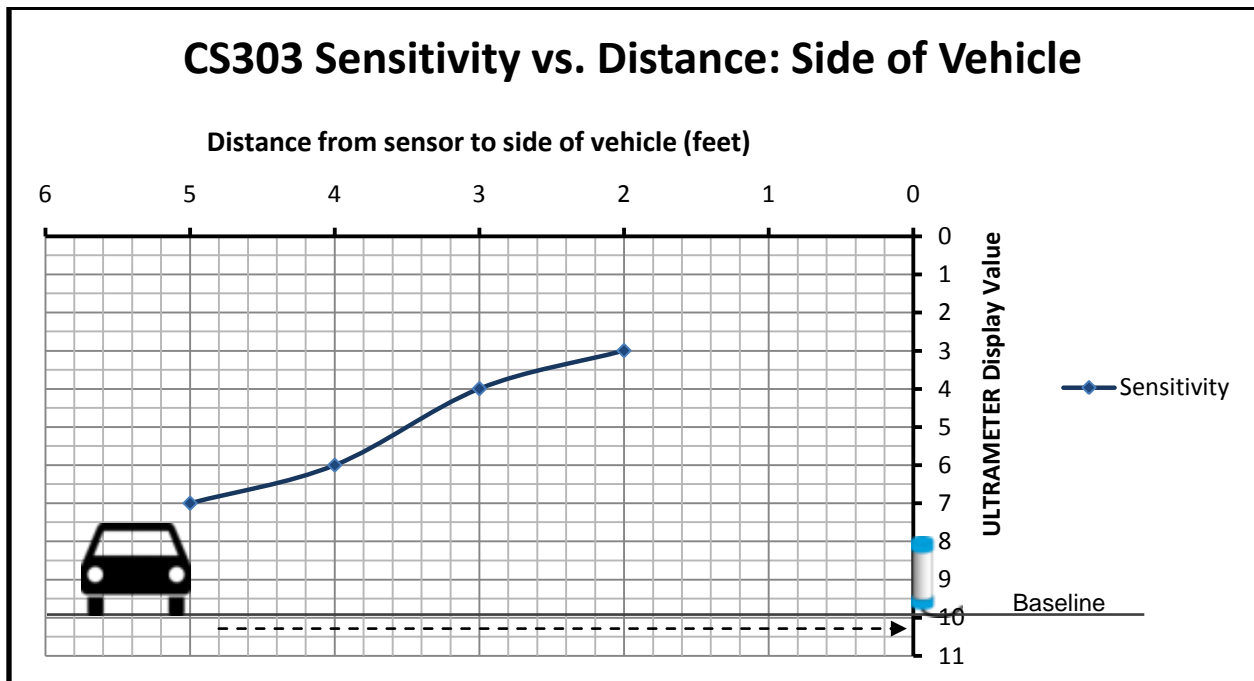


Figure 2 - CS303 Sensitivity Data

## Installation (continued)

### Sensitive area vs. Sensitivity adjustment

Area (ft.)	Height at the center (ft.)	Sensitivity (adjustment setting)
1x1	1	2
2x2	2	3
3x3	3	4
4x4	4	6
5x5	5	7

## Ordering Information

- **CS303-C-1** Control Unit
- **CS303-DB-50** Direct Burial Sensor, Probe, 50'
- **CS303-DB-100** Direct Burial Sensor, Probe, 100'
- **CS303-FP-50** Direct Burial Sensor, Flat Pack, 50'
- **CS303-FP-100** Direct Burial Sensor, Flat Pack, 100'
- **CS303-L** Logic Interface



## Warranty

EMX Industries Incorporated warrants all products to be free of defects in materials and workmanship for a period of two years under normal use and service from the date of sale to our customer. This warranty does not cover normal wear and tear, abuse, misuse, overloading, altered products, damage caused by incorrect connections, lightning damage, or use other than intended design.

There is no warranty of merchantability. There are no warranties expressed or implied or any affirmation of fact or representation except as set forth herein.

EMX Industries Inc. sole responsibility and liability, and the purchaser's exclusive remedy shall be limited to the repair or replacement at EMX Industries option of a part or parts found not conforming to the warranty. In no event shall EMX Industries Inc. be liable for damages, including but not limited to damages resulting from non-conformity, defect in material or workmanship.

Effective date: January 1<sup>st</sup>, 2002





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