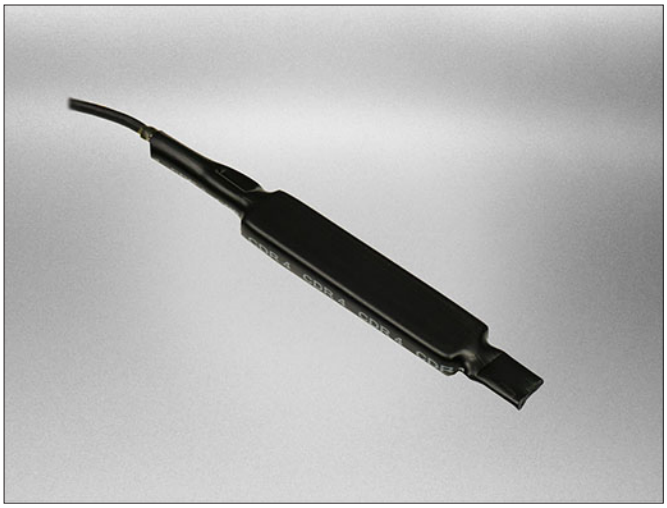
Magneto-resistive Vehicle Detection Sensor

FVD-L-EPX

Features

- **Magneto-resistive sensor PNP+NPN (bipolar)**
- **3-dimensional presence detection for vehicles and large ferrous objects**
- **Substitutes inductive loops and other vehicle detection systems**
- **No need for potentiometer nor external controller**
- **Easy to install and mount in pavement, cement, cobbles, etc.**
- **It can be installed underground or open air**
- **La orientación no afecta a la capacidad de detección**
- **Protection degree IP-69K; NEMA 6P**
- **Protected against short-circuit**
- **Compact design and reduced dimensions: 174 x 24 x 10 mm.**
- **Axes enabling and disabling technology**

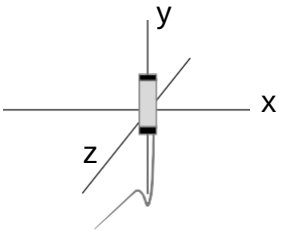


Operation principle

The FVD-L-EPX sensor uses a passive sensing technology to detect large ferrous objects. The sensor measures the change in the Earth's natural magnetic field (ambient magnetic field) caused by the introduction of a ferromagnetic object.

The FVD-L-EPX sensor provides a direct replacement for inductive loop systems, and needs no external frequency box.

For best performance, mount the sensor below-ground, in the center of the traffic lane, but it also may be mounted above-ground.



3-dimension detection: the sensor detects changes in the magnetic properties of the environment along three axis X, Y, Z

The sensor uses three mutually perpendicular magnetoresistive transducers.
Each transducer detects magnetic field changes along one axis. By incorporating three sensing elements, maximum sensor sensitivity is achieved.

A ferrous object will alter the local (ambient) magnetic field surrounding the object. The magnitude of this magnetic field change is dependent both on the object (its size, shape, orientation, and composition) and on the ambient magnetic field (its strength and orientation).

Through a simple programming procedure, the sensor measures the ambient magnetic field. When a large ferrous object (for example, a truck, automobile, or rail car) alters that magnetic field, the sensor detects the magnetic field changes (anomalies). When the degree of magnetic field change reaches the sensor's threshold, the sensor's discrete outputs switch.

The sensor range depends on three variables:

1) The local magnetic environment (including nearby ferrous material).

2) The magnetic properties of the object to be sensed.

3) Sensor settings.

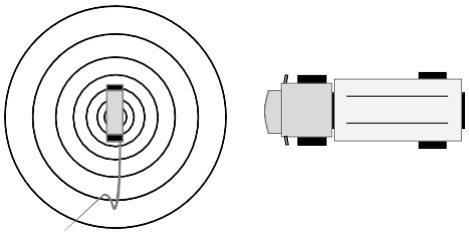
The FVD-L-EPX can detect changes in the ambient magnetic field in all directions. As with other sensors, the range will depend on the target. The strong disturbance of a large ferrous object decreases as distance from the sensor increases, and the magnitude and shape of the disturbance is dependent on the object's shape and content.

The sensor can be programmed to react to magnetic field disturbances of greater or lesser intensity, using two adjustments:

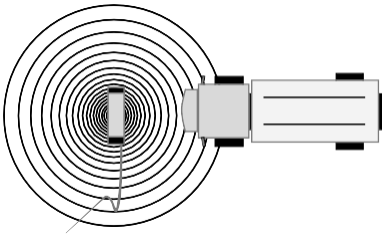
1) Background condition

2) Sensitivity level

Once background condition and sensitivity level are set, and both settings are stored in non-volatile memory, the sensor is ready to detect the target object.



Señal OFF: the FVD-L-EPX sensor is operating. There is no vehicle within its detection area, thus the magnetic properties of the environment remain unaltered and the output is OFF.



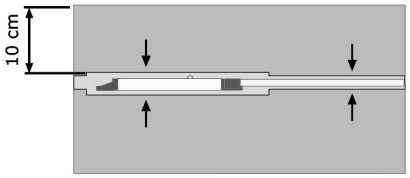
Señal ON: when a vehicle invades the detection area of the sensor, it modifies the magnetic field properties around the sensor. If this modification reaches the sensitivity threshold, the sensor's output triggers.

Below-ground installation

For optimal performance, the FVD-L-EPX should be mounted in the center of the traffic line. The axles of the vehicles provide the most effective and most repeatable magnetic field changes.

When replacing an inductive loop, the geometric center of the failed loop is typically a good location for mounting. For applications at the "side" of the traffic line, consideration must be made for movement of metallic objects within a short distance of the sensor on the side opposite the traffic line, even if the activity is not visible.

The FVD-L-EPX sensor's narrow housing allows it to be mounted in pavement, within a single saw cut 1cm wide. Once the sensor is placed, remove the loose particles from the gap and fill it with loop or pavement sealant. Do not fill the saw cut with heated asphalt. Work the sealant around the sensor and cable with a thin object, to eliminate any trapped gaps. To remove the FVD-L-EPX, simply pull the sensor cable straight up from the control cabinet end. This will pull the cable, the cured sealant and the sensor from the saw cut.

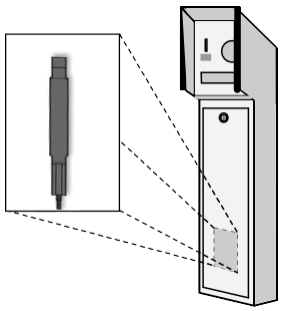


Above-ground installation

The FVD-L-EPX can be mounted in the lateral of the lane which is aimed to detect, for example garages, tolls, self-service lanes, etc. In these cases, it is usually installed in the pole next to the access.

The FVD-L-EPX is a "non-directional" detector, thus the sensor can be mounted in any position without affecting its sensing properties. In case of wanting to use the axes enabling and disabling technology, it is needed to know the position in which the sensor is installed for disabling the correct axes.

Select a location as close as possible to the vehicle(s) to be detected. In applications where the sensor must be mounted to the side of the vehicle traffic lane (e.g., in a kiosk, menu board or gate control box), make sure that no other moving metal objects can affect the FVD-L sensor.

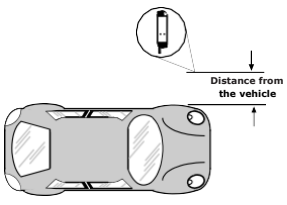


Sensitivity Level and sensitivity gain factor

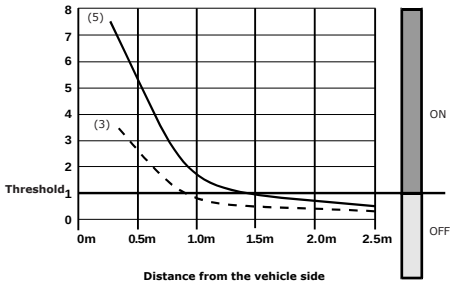
The FVD-L has 6 levels of sensitivity (level 1 being the less sensitive and level 6 the most sensitive). The sensitivity variation from one level to the next is determined by a Gain Factor Multiplier set by default. The ratio of sensitivity gain along the sensitivity scale is described in the table below:

Sensitivity Level	Threshold value
1 (least sensitive)	300
2	250
3	200
4	150
5 (factory default setting)	100
6 (most sensitive)	75

The graphics below explain the behaviour of the FVD-L-EPX for two different levels os sensitivity (level 3 and level 5), whether the sensor is mounted above the ground or below the ground.



Sensor on the side of the lane



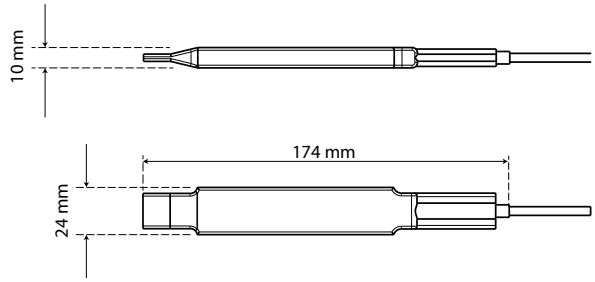
Distance from the vehicle side

Magneto-resistive Vehicle Detection Sensor

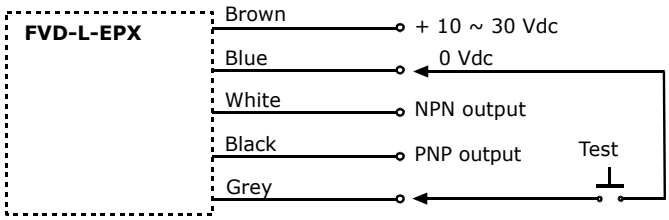
FVD-L-EPX

Características técnicas		
Type of detection		Passive 3-axis magneto-resistive transducer
Detection range		Adjustable range by configuration
Supply voltage		10 to 30 Vdc
Output configuration		NPN y PNP
Output current		100 mA
Saturation	NPN	<400 mV at 10 mA and <2,0 V at 100 mA
	PNP	<1,4 V at 10 mA and <2,5 V at 100 mA
State leakage current	NPN	<200 µA
	PNP	5 µA
Output protection		Short-circuit
Supply protection		Reverse polarity and transient voltages
Operating conditions		-40 ºC to +70 ºC
Temperature effect		<0,5 miligauss/ºC
Relative uhmidity		100 %
Response time		20 ms
Delay at Power-Up		0,5 s
Environmental protection		IP-69K (NEMA 6P)
Connections		Shielded 5-conductor polyethylene jacketed attached cable
Construction		Housing: anodized aluminium, End caps: PVC

Dimensions



Connections



Available types

Model	Cable length	Cable type	Supply voltage	Output type	Detection range
FVD-L-EPX-9	9 m	5-wire shielded cable with 4mm diameter polyethylene jacket	10 ~ 30 Vdc	Bipolar PNP/NPN	Range varies, depending on application and target being sensed

Accessories

Model	Description
FVP	Hand-held portable programming box, used for configuring sensor. Battery-powered.
FVC	Interface cable for RS-232 port on PC.

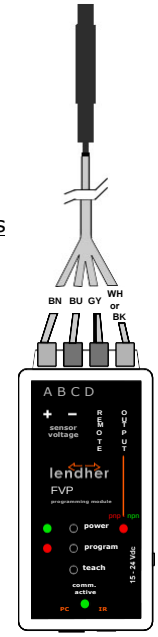
Sensor configuration

The sensor is configured via its grey remote wire. The grey wire is always active and the sensor may be re-taught at any time. For optimum performance, fixture the sensor so that it will not move either during or following configuration. Programming pulses may be executed by connecting the sensor's grey wire to sensor's common (blue wire) with a normally open mechanical button connected between them, or as a low (< 2V dc) signal from a programmable logic controller (PLC). When a PLC is used for configuration, the pulses are acknowledged via the sensor output signal. The sensor has 6 levels of sensitivity, being level 1 the less sensitive and level 6 the most sensitive (the sensitivity level set by default is 5). Once the sensor has been taught, it will keep the configuration settings, even if there is a power cut.

Set background condition (no vehicle presence)

	Configuration	Result
	Remove all temporary metal objects from the sensing area. Single-pulse the remote wire. 	Sensor learns background. Output LED flashes approx. 12 times, while background is taught. Sensor returns to RUN mode.
Set sensitivity level (level 1 least sensitive, level 6 most sensitive)		
Access sensitivity mode	Double-pulse the remote wire. 	Output LED flashes 1 to 6 times every 2 seconds to indicate sensitivity level (e.g., twice indicates level 2). When FVP is used: Sensor always begins at level 1.
Adjust sensitivity	To increase the sensitivity in increments, single-pulse the remote wire again; continue until desired sensitivity level is reached. 	Output LED flashes 1 to 6 times every 2 seconds to indicate sensitivity level (e.g., twice indicates level 2).
	Double-pulse the remote wire to save setting. 	Sensor returns to RUN mode.
Operating test	Drive a vehicle past/over the sensor to trip the output (use a small/lightweight vehicle to ensure larger vehicles will be detected later).	Verify Output LED comes ON as expected.
	Adjust the sensitivity as needed.	

Cable colors
BN: Brown
BU: Blue
GY: Grey
WH: White
BK: Black



FVP portable programming box

Operating preparation	Disconnect FVP or the temporary switch used for configuration and connect sensor to permanent power supply / output device The grey cable must be grounded when the FVP is not being used.

The FVP module is a valuable accessory for easily programming the FVD-L sensor. This tool is specifically designed for programming the FVD-L sensor whether it is installed above or underground. The FVP produces the signal given by the sensor at every moment through its LED indicators and allows to send pulses to the sensor for the setting procedure, when needed.

When the FVP is used, the pulses are accomplished by clicking the "teach" push button. Sensor output status is reflected by the FVP Output indicator LED. For optimum performance, fixture the sensor so that it will not move either during or following configuration. It is important to remark that this tool is not mandatory for using the sensor.

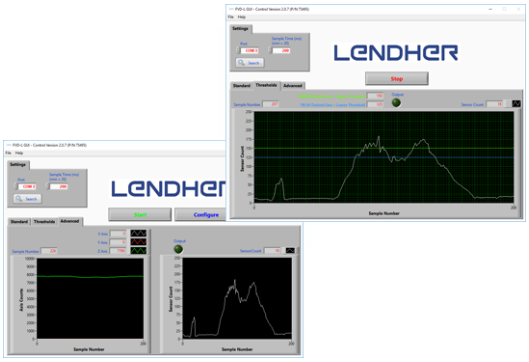
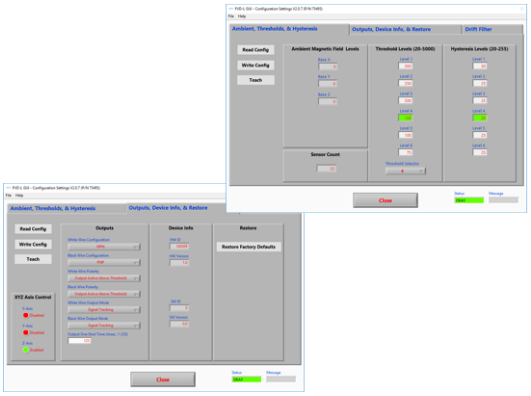
The main advantage os using the FVP for configuring the sensor is the possibility to use the FVD-L-EPX control software, a tool which allows to monitor graphically the FVD-L-EPX functions. This software also allows to modify the parameters of the sensor which are set by default (hysteresis, output status, threshold values, etc.).

To be able to use the FVD-L-EPX software, it is indispensable to have the FVP portable programming box, as this module has the electronics and connections which will act as an the interface between the sensor and the software.

Sensor configuration via software

This parametrization software permits not only to set up the sensor, but also to see in real time the response of the sensor in a screen.
This fact makes this tool very insteresting for its first use. For using this software, having the FVP is essential.

Functions

Visualisation	Standard	Real time response of the sensor is displayed in a X-T graphic where the sensing value is represented in real time	
	Threshold	Real time response of the sensor is displayed in a X-T graphic where the sensing value is represented in real time. In this visualisation, a white grid is included, with two discontinuos lines for the threshold value and the hysteresis value.	
	Advanced	Two graphics are displayed: - On the left side, a X-T graphic with one line per each enabled axis and the count its count value. - On the right side, a X-T graphic represents the overall output value of the sensor (with a standard visualisation).	
Configuration	Ambient, threshold and hysteresis	In this window there are 3 sections: - Ambiental information related to the surrounding field of the X,Y and Z axes. - Personalized threshold value setting for each level. - Personalized hysteresis value setting for each level.	
	Outputs, device info and restore	In this window there are 3 sections: - Configuration of the output type - NPN or PNP - NO or NC - Single pulse or permanent signal while detecting - Environmental teach function (TEACH) - Reset to factory settings	
	Drift filter	Filtering time value can be adjusted to compensate slow variations in the environmental magnetic field.	