



**Connaught  
Electronics Ltd.**

IDA INDUSTRIAL ESTATE,  
DUNMORE ROAD, TUAM, CO.  
GALWAY, IRELAND.

[info@cel.ie](mailto:info@cel.ie)

[www.cel-europe.com](http://www.cel-europe.com)

Telephone: +353 93 25128

Fax: +353 93 25133

A/C Fax: +353 93 24047

TECHNICAL FILE  
  
FOR  
  
VOLVO MMS SENSOR

CEL P/N:        902960  
                     902961  
                     902962

## **1.0 Introduction**

This is a Technical File for VOLVO MMS sensor electronics supplied by CEL to VOLVO.

## **1.1 Theory of Operation**

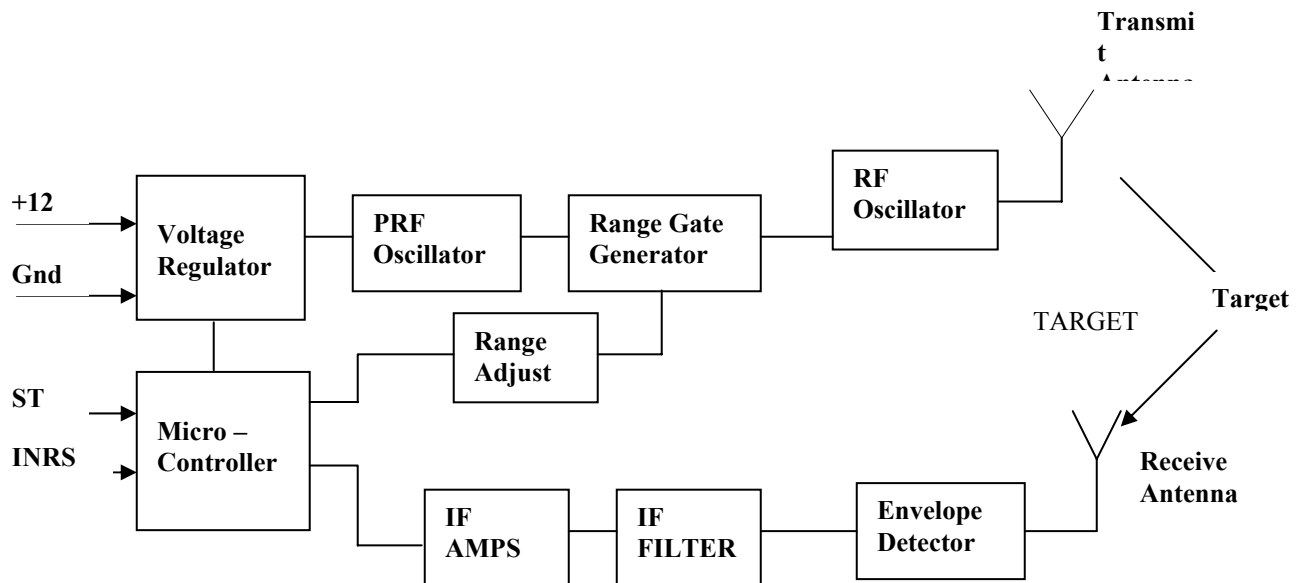
The MDD microwave sensor works on the Doppler principle. The transmit antenna transmits an electromagnetic field into the vehicle. The receive antenna accepts reflections from moving targets and the resulting signals are filtered and amplified before being sent to the microcontroller for evaluation.

The range is adjustable in software. Thus, the range can always be adjusted to fill the vehicle interior, in relation to the shortest distance between the MDD sensor and the windscreen or vehicle roof (the limits of the vehicle passenger compartment). In this way, a hemispherical field is generated within the vehicle as the area to be monitored. If a large enough change in analogue signal amplitude occurs, an analysis of the signal evaluation is started. The microcontroller contains a software algorithm that determines if the signal is a genuine movement or a spurious signal.

If this analysis detects significant characteristics of a movement, an alarm is issued to the PJB via the BUS Interface.

The VCC system uses a combination of sensors comprising a front and rear in order to provide greater cover within the vehicle.

### **MICROWAVE BLOCK DIAGRAM:**



## **1.2 Operating Modes and influencing factors**

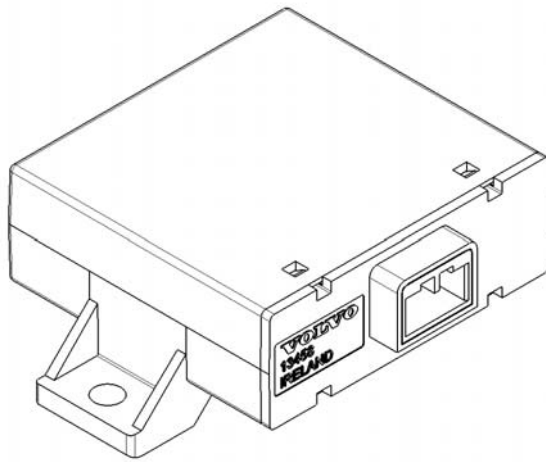
In its non-sensitized condition, the microwave sensor module is set to Sleep-Mode. When sensitized, it is woken by an interrupt on the ST line. The sensitization period for the microwave sensor module, to full functionality, is 30 seconds. The complete alarm system is likewise ready for operation 30 seconds after sensitization of the DWA (anti-theft warning system).

The microwave sensor module operates in impulse mode: that is, like a radar impulse system. An impulse is emitted for a brief period and the reflected signal received is amplified and evaluated. Because the module operates with a very low transmission output, more powerful external frequencies can connect with the receiver side of the device and cause false alarms. The reflected signal is checked in parallel with a suitable EMC protection switching unit and any foreign frequencies are filtered out.

Any real movement in the detection area is recognized by a change in the reflection sample. The module emits a pulsed signal and delays this in accordance with the detection range required. This delayed impulse then controls the receiver section. Only after this delay time is the receiver section opened for a short period, when an associated signal pattern is stored. In reality, the detection range corresponds with a spherical "shell" having a width of ca. 5cm. The signal is stored in terms of amplitude and pattern and is compared with the next signal which is received.

## **1.3 Physical Construction**

Housing:



LENGTH: 65mm, WIDTH: 60mm, HEIGHT: 25mm

## FCC ID: (LQN2960 & LQN2961)

---

**PCB:** Two layer, Board material FR4  
Layer 1: Components and signal tracks  
Layer 2: Ground plane

### Connector Detail:

Front Connector Type : 5 Way JAE Part Number: IL-AG5-5PK-S3LG

Rear Connector Type : 5 Way JAE Part Number: IL-AG5-5PK-S3LB

**Table 1 – Microwave Sensor ECU Connector Pin Detail**

Pin	Name	Function
1	Ubat	Positive power supply
2	NC	No connection
3	BUS	BUS connection
4	NC	No connection
5	GND	Negative power supply

### 1.4 ESC Part Number(s)

CEL Part No.: 902960, 902961 & 902962

### 1.5 ESC Manufacturers:

CEL  
Dunmore Road,  
Tuam, Co. Galway,  
Ireland  
Tel: +353 93 25128

2.0      EMC Requirements Analysis

2.1      Potential Sources of Emissions

Signal Source Description	Voltage/Current Level	Frequency	% Duty Cycle (range)	Other
Resonator	3V	4MHz	50%	

### **3.0 Mode Descriptions**

<b>Mode</b>	<b>UBAT</b>	<b>ST Input</b>	<b>INRS (Output)</b>
<b>Armed</b>	+12V	0V	12V (1 sec 0V on Alarm)
<b>Disarmed</b>	+12V	12V	12V

#### **Mode Armed:**

In this Mode the ST Input to the Microwave sensor is pulled to ground which ‘Arms’ the sensor i.e. if movement is detected then the INRS (alarm) output is activated (by pulling the INRS output to ground for 1 second).

#### **Mode Disarmed:**

In this Mode the ST Input to the Microwave sensor is pulled to UBat which ‘Disarms’ the sensor i.e. the sensor is turned OFF and so should not react to any movements.