

# Lodar Essential Safety Requirements (ESR)

The new **Lodar 90, 91, 92, 93, 94 and 95 Series** has been designed to comply with all the relevant Safety and Machinery Standards, to reduce any potential risk to the lowest possible level. Lodar uses “watchdog” circuits, which will automatically remove power from all the output stages in the event of any malfunction.

## Minimum Relevant Safety and Machinery Standards

BS EN 954-1 (Category 2)	Lodar conforms to the higher (Category 3)
E11	Lodar has E11 approval for use with vehicles
EN BS 60204-1 Part 1	Lodar conforms fully

## Potential Faults & Solutions

### **1. Internal Lodar faults, causing undesired outputs or failure to produce an output.**

*All function outputs are continuously monitored by an independent circuit and checked against the commands at the processor output – any error will result in a shutdown within 0.3 seconds. Lodar cannot be activated until the problem is resolved; nor is it possible to override this status by holding down the Set button.*

*Furthermore, the processor is continuously and independently monitored to ensure that any output command from the processor is the direct result of a coded input. Any non-agreement between input and output commands will automatically operate the safety circuits.*

### **2. Momentary surges or dips in the Lodar supply voltage, causing loss or changes to the processor programmes.**

*All internal supplies are derived via a Buck regulator with a decoupled input against spikes. All outputs have inductive load clamps suitable for the available output current. The processor supply voltage is monitored by the processor itself and an independent circuit, either of which will shut down if problems occur.*

*The independent circuit holds the processor in the RESET condition and will only allow the processor to continue after the correct supply voltage is reached and stabilised at 150ms, preventing corruption of programmes.*

*If a problem has arisen due to supply voltage then the Safety circuit cannot be turned on until the problem is rectified.*

### **3. Processor failure, for any reason, leads to incorrect output conditions.**

*There are numerous reasons why processor software may fail. The internal activity of the processor is continuously and independently monitored and if incorrect operation is detected it is immediately shut down, removing all power from the output stages.*

*Lodar is held in the safe mode until it can be reset after fault correction*

### **4. Short circuits or excessive current drain**

*The output current on all Lodar Receivers is constantly monitored and will be shut down if the limit is exceeded (Not 90 and 91 Series DC relay or 96 and 97 Series AC relay)*

### **5. EMC (Electro-magnetic Compatibility)**

*Lodar, like all other short range devices, can be susceptible to RF interference from high powered transmitters on nearby frequencies. This interference cannot cause unwanted operation due to the safety measures already discussed – at worst, Lodar simply will not operate.*

## **Transmitter Conformation System (T.C.S)**

### **Reason for implementation**

A new legislative requirement deems that radio control systems must “fail-safe” if the transmitter is “out of range” of the receiver. This is most important when Receiver outputs are latched and unsafe situations could arise if the Transmitter failed.

A Transmitter can become “out of range” due to many factors, including, but not limited to, failure of the battery, physical damage to the Transmitter, an operator exceeding the transmission range.

### **Requirements**

On an “out of range” fault condition, the receiver unit must default to a safe condition within a time period not exceeding 550ms (0.55 Seconds).

### **System operation**

Once “Set” has been pressed on the Transmitter and until “Stop” is pressed (or a pre-programmed time-out has occurred), the transmitter will transmit a “Transmitter Conformation Packet (TCP)” to the receiver every 400ms (0.4 Seconds) after release of any valid “Function button”.

If a TCP is not received within 550ms (0.55 Seconds) of the last TCP, the receiver unit will switch all functions off and revert to the safe un-powered output state.