

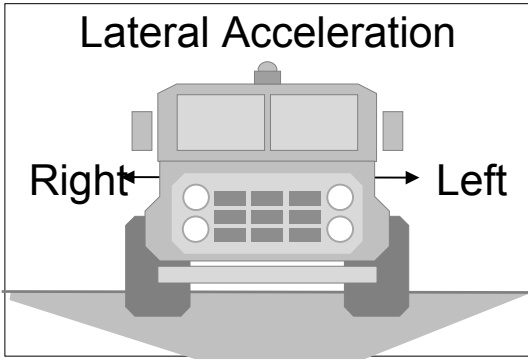
## INTRODUCTION

The LG-Alert™ Lateral Acceleration Indicator is intended for use as an early alert system to assist drivers in recognizing when they are exceeding set maximum maneuvering limits of the vehicle. This device monitors and displays lateral “g” forces perpendicular to the vehicle direction of travel in real time. The lateral sensitivity of the device can be adjusted using the digital push buttons on the front of the base unit. ‘00’ is least sensitive and ‘99’ is most sensitive. An auxiliary horn jack provides an additional signal indicating the full scale of the device has been exceeded. Signal output jacks provide voltages biased at +2.5 VDC proportional to applied ‘g’s for data logging or trip recording applications. Internal filtering reduces the effects of high frequency accelerations associated with bumps and vibration.

## OPERATING PRINCIPLE

The heart of the LG-Alert™ Lateral Acceleration Indicator is a complete acceleration measurement system contained in a hermetically sealed monolithic IC. The signal conditioning circuitry incorporates a force-balance control loop and bias adjustment to center the signal about zero. This provides a bi-polar voltage proportional to the applied “g” force. The absolute value of the lateral signal is determined and outputted to the display module. Internal temperature regulation of sensitive IC’s virtually eliminates error associated with changes in surrounding temperature. The device can be set to display a full scale lateral acceleration range of between 0.17 and 1 “g” force.





LATERAL FORCES ON VEHICLES

Turning a corner causes the vehicle to be thrown outwards. When the force becomes large enough the vehicle will either slide or overturn. Lateral forces on the vehicle can be determined by adding the radial acceleration associated with turning corner with the tilt component related to earth's gravity.

A tilt table can be used to establish a safe setting for the LG-Alert™. The relationship between digital setting and full-scale sensitivity are shown in the setup table. Alternatively the device can be set by an experienced driver and tested under actual vehicle operating conditions to determine a conservative setting for the device.

TURNING A CORNER

$$a = V^2 / R$$

- a = acceleration (m/s<sup>2</sup>)
- R = Radius (m)
- V = Velocity (m/s)
- F = Force (N)
- m = mass (kg)

E.g., R=50m, V=40 km/h

$$a = V^2 / R$$

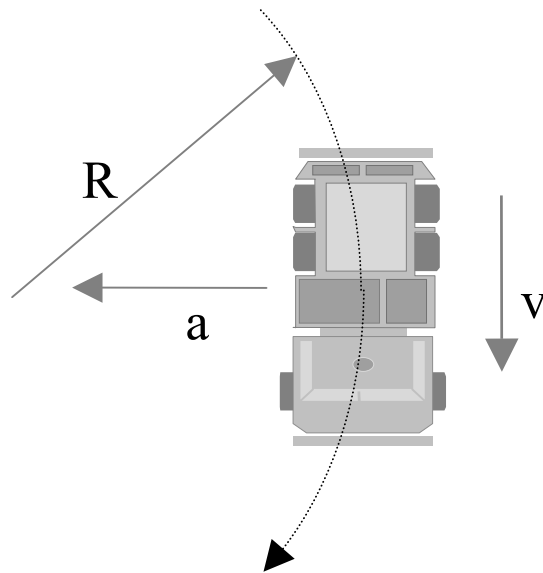
$$= (40 * 1000 / 3600)^2 / 50$$

$$= 2.469 \text{ m/s}^2$$

$$= (2.469 \text{ m/s}^2) / (9.81 \text{ m/s}^2)$$

$$= 0.25 \text{ "g's"}$$

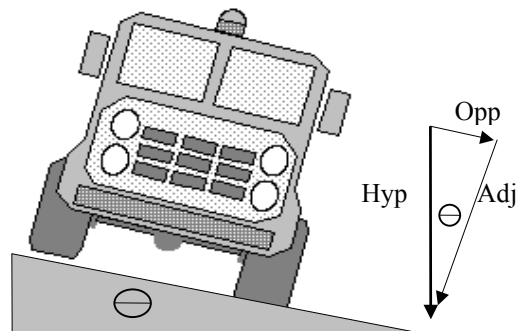
$$= (0.25 \text{ of earth's gravity})$$



FORCES ON AN INCLINED SURFACE

Acceleration = SIN(tilt angle) \* earth's gravity  
 Earth's Gravity = 9.81 (m/s<sup>2</sup>)

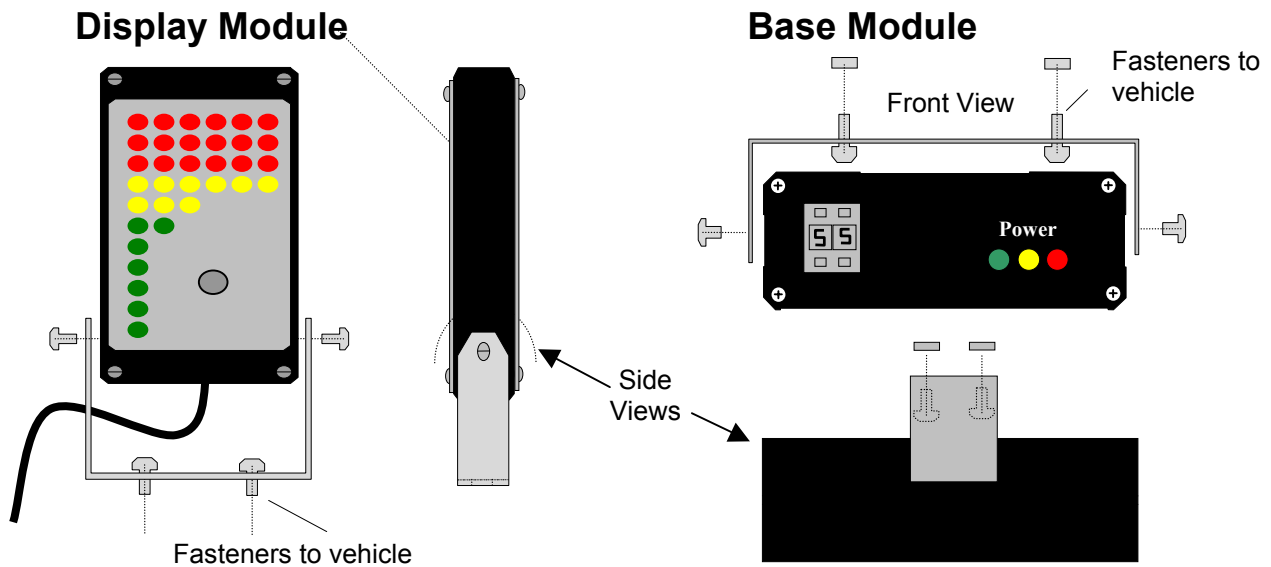
The LG-Alert™ displays the total lateral acceleration on the vehicle which is the sum of the turning acceleration and the component associated with gravity (e.g., from an inclined surface).



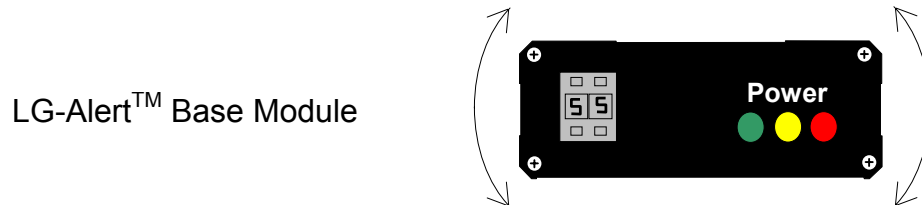
**WHERE TO INSTALL**

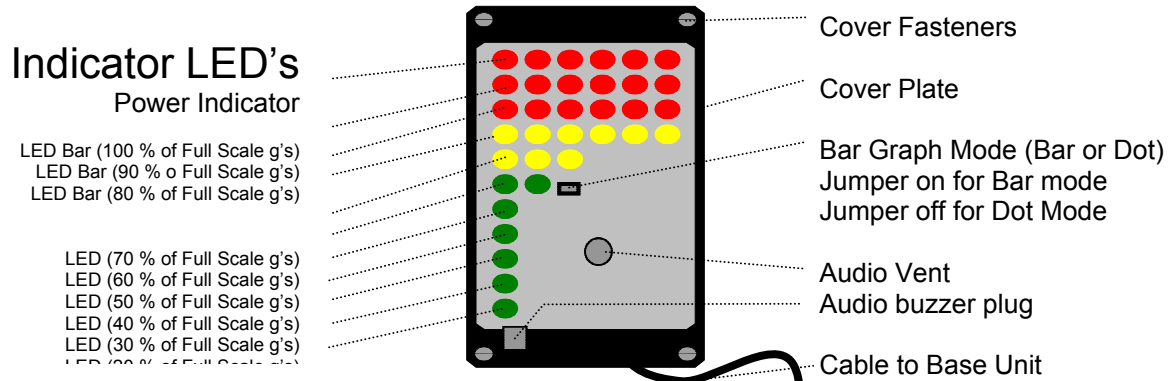
Both base and display modules should be located within the driver compartment. The display module can be positioned anywhere that is convenient for viewing by the vehicle operator. The display can be configured to mount to the dash or frame above the windshield. The SAE suggests instruments should be located 0.71 m (28 in) from the driver's eye, no more than 45 degrees below the horizon, within 30 degrees of straight ahead. The base module should be positioned as low in the cab as possible using the two meter cable provided. It must be firmly attached to the vehicle framework and as close to level as possible. Access to the base units front and rear panels should not be obstructed to allow adjustments to be made. The front and rear panels of the base unit must be aligned with the vehicles forward direction of travel. Cables should be located away from contact by people and equipment and secured to reduce fatigue due to vibration.

**INSTALLATION**

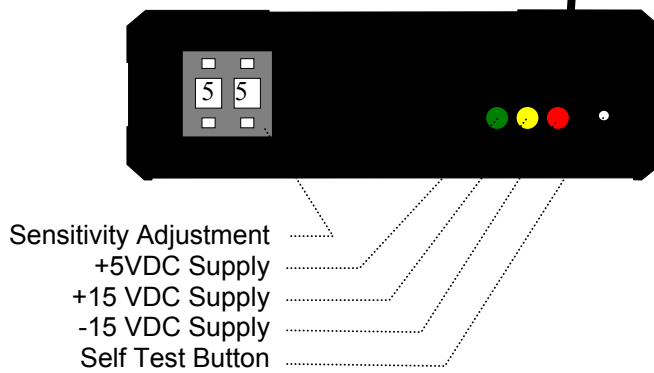


The LG-Alert™ requires only 2 cables to be connected to function. One cable provides 12 VDC from the vehicle fuse panel. The second cable connects the display unit to the base module. A fast blow fuse provides protection for the device. The power lights should illuminate upon powering of the unit. There is a warm-up period of about 10-20 seconds where the device may display an imbalance. During installation the device can be tested for functionality by attaching cables and rotating the base module as shown.

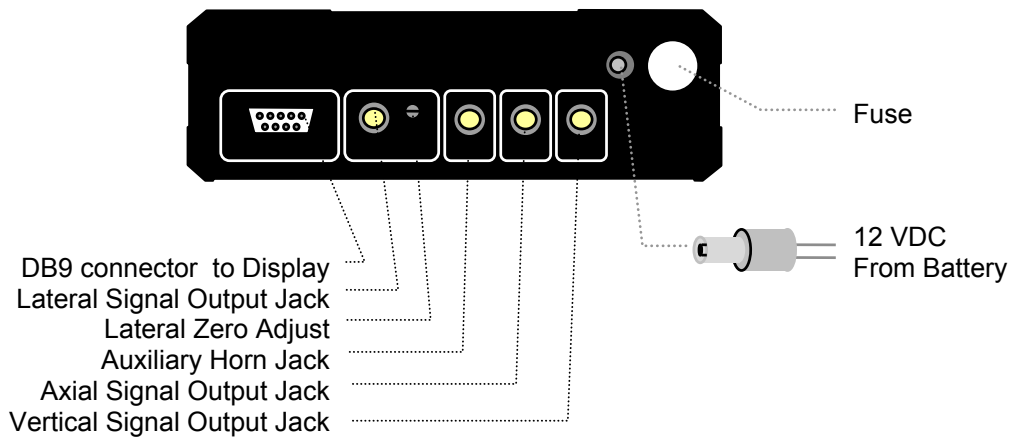




**Front View Base Unit**



**Rear View Base Unit**



## LOCATIONS TO AVOID

The display module can be placed in almost any location, convenient for viewing by the vehicle operator. The device however should not be located where it may obstruct the vehicle operator's visibility.

The base module must be protected from transient conditions and impact.

- ❖ Do not locate the device in an area that may be exposed to the weather.
- ❖ Do not locate in areas of high humidity or temperature extremes (e.g., engine compartment)
- ❖ Do not locate in areas exposed to turbulent air from fans, doors or windows.
- ❖ Do not locate in areas exposed to high electromagnetic interference.
- ❖ Do not locate in areas of extreme mechanical vibration. (E.g., bolted to the engine)
- ❖ Do not locate in areas that may allow impact from people or equipment.
- ❖ Do not route cables through areas of high electrical magnetic interference.

## TROUBLE SHOOTING

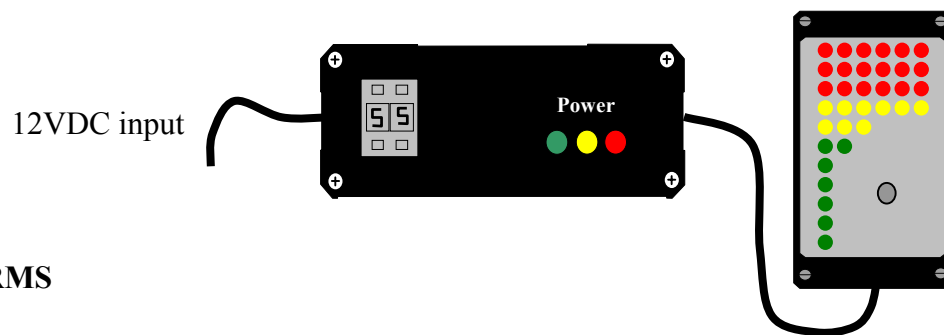
### NO POWER

Check fuse and power connections.

Base and display units should have all power lights illuminated.

If any one of the four power supply lights is not illuminated the device may malfunction.

Green, yellow and red on the base module indicate status of the three power supplies (+5,+15,-15 Volts). The red led on the Display indicates +12VDC to the display module.



### FALSE ALARMS

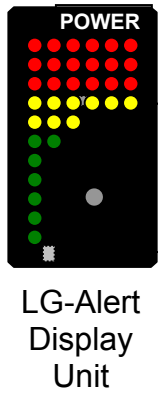
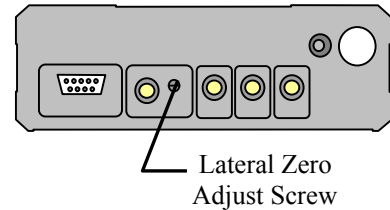
- First check all cables and connections.
- Loose wires may cause the device to behave erratically.
- Check for damaged wire between base and display unit.
- Check the supply voltage to the device. Voltages less than 11 VDC or greater than 18 are outside the device specification range and may cause false readings. Abnormal supply voltage fluctuations caused by faulty equipment or loose wires may cause the highly sensitive amplifier circuits to give a false reading or appear unbalanced.

**UNBALANCED OPERATION**

The device may have shifted during service or the characteristics of the vehicle may change over time causing the device to be out of balance. This error can be removed by zeroing the device. This is accomplished using the adjustment screw on the rear panel of the base unit. If the left and right balance of the device cannot be corrected with the zero adjust the device may require servicing.

**ZEROING THE DEVICE**

The device can be zeroed using a tiny 1/16" flat screw driver to turn the zero adjust screw found on the rear panel of the base module. Make sure the vehicle is on a level surface before starting. Count the rotations of the zero adjustment screw between one indicator light on the display for left and right lateral accelerations. For example turn the zero adjustment screw until only one green light is illuminated on the display module. Count the number of turns required to pass through zero and illuminate one light the other way. Simply divide the number of turns by two and rotate adjustment pot to the middle-point, which should be close to zero. A setting of '99' on the "sensitivity adjust" digital push button will provide the maximum gain to easily visualize the error. Make sure the device is re-set back to its original digital push button setting after zeroing.



**BAR GRAPH MODE**

The BAR GRAPH MODE is selected by the jumper found inside the display module. The faceplate of the unit must be removed to expose the circuit board. The bar graph mode jumper is found in the middle of the circuit board. When the jumper is on the contact pins the display is in full bar mode. When the jumper is removed the display changes to moving dot mode.

**DISABLING THE INTERNAL AUDIO ALARM**

The display's internal audio alarm can be disabled by removing the buzzer plug. The faceplate of the unit must be removed to expose the circuit board. The buzzer plug is found on the bottom left side of the circuit board. When the plug is connected the internal buzzer is enabled. When the plug is removed the buzzer is disabled. The auxiliary horn jack found on the rear of the base unit is not disabled by this procedure. To disable the auxiliary horn it must be unplugged from the base unit.

**SET-UP OF THE LG-Alert™**

The Lateral Acceleration Indicator is factory set at a digital setting of '55' corresponding to first alert occurring at a static tilt angle of approximately 15 degrees (0.26 'g's). The device may be adjusted by removing the base unit front panel and changing the digital setting. Static tilt table specifications from the factory may be different than the "as equipped" configuration of the vehicle. The dynamic response of the vehicle is highly unpredictable and can have a profound effect on stability. Vehicle characteristics and response of the LG-Alert™ define the recommended setting, as described in the NRC report to Transport Canada, "Development of a Training Program for Drivers of High Capacity, High Center of Gravity Airport Rescue and Fire Fighting (ARFF) Vehicles, Dec. 10, 1998". Management may choose a sensitivity that is even more conservative. Once a setting for a vehicle has been established, management must put in place a clear policy that the device is never altered. Any change in device setting must be clearly documented and all personnel informed, especially if the device is rendered less sensitive. A routine inspection of the device setting and operation should be included in the short test drive undertaken at the beginning of each shift. The self-test button can be pressed to ensure the device is fully operational. The relationship between LG-Alert™ digital setting and the associated 'g' forces to activate each of the three warning stages (lights 8,9 and 10) is shown below.

<b>LG-Alert Sensitivity Table</b>						
Digital Push Button Setting 00 - 99	<b>LATERAL TILT ANGLE</b>			<b>LATERAL ACCELERATION</b>		
	light 8 is on at (deg)	light 9 is on at (deg)	light 10 is on at (deg)	light 8 ('g's)	light 9 ('g's)	light 10 ('g's)
99	8.0	9.1	10.0	0.14	0.16	0.17
95	8.5	9.6	10.6	0.15	0.17	0.18
90	9.1	10.3	11.4	0.16	0.18	0.20
85	9.8	11.1	12.3	0.17	0.19	0.21
80	10.5	11.9	13.2	0.18	0.21	0.23
75	11.3	12.8	14.3	0.20	0.22	0.25
70	12.2	13.7	15.4	0.21	0.24	0.27
65	13.1	14.8	16.6	0.23	0.25	0.29
60	14.2	15.9	17.9	0.24	0.27	0.31
55	15.3	17.1	19.4	0.26	0.29	0.33
50	16.5	18.4	20.9	0.28	0.32	0.36
45	17.7	19.8	22.6	0.30	0.34	0.38
40	19.1	21.3	24.4	0.33	0.36	0.41
35	20.6	22.9	26.4	0.35	0.39	0.44
30	21.7	24.7	28.5	0.37	0.42	0.48
25	24.0	26.5	30.8	0.41	0.45	0.51
20	25.9	30.1	33.3	0.44	0.50	0.55
15	30.5	35.3	39.0	0.51	0.58	0.63
10	36.0	42.0	48.0	0.59	0.67	0.74

## LIMITATIONS OF THE LG-Alert™

This device is intended as an early alert system to assist drivers in recognizing when they are approaching maneuvering limits that are potentially unstable. While this device can provide invaluable information to the operator of the vehicle, it must be recognized that the LG-Alert™ has limitations.

There is an associated warm-up time as with many electronic devices in which accuracy and balance of the device may be in error. Extremes in surrounding temperature (<< 20 C >>) will have an adverse effect on the zero bias signal level during the warm up period. If possible the device should be powered at all times to reduce warm-up time. Typical quiescent current is approximately 200 mA, 12VDC supply at 25 Celsius. At colder operating temperatures the device will require more power to maintain the temperature of the sensitive internal accelerometer IC's.

- ❖ The device will not prevent the vehicle from overturning.
- ❖ The device cannot work without a suitable, steady power source (there are no batteries).
- ❖ The device may not work properly if the power supply drops below 11 or rises above 18 VDC.
- ❖ The device can't operate properly if it is not installed properly. The base module must be level when the vehicle is loaded and on level ground. Any error in the device orientation will appear as an error on the display module.
- ❖ The device will not work properly if the base module's orientation is altered by impact from people or equipment. Ensure that a routine is initiated that inspects functionality of the device and orientation of the base module.
- ❖ The audio alarm cannot alert the vehicle operator if it is disabled.
- ❖ The device may function improperly if the cable between the base and display modules is altered or lengthened. Consult manufacturer regarding cable length limitations.
- ❖ The device may malfunction if the cable between the base and display modules is routed through an area of high electromagnetic interference (e.g., through engine compartment). A specially shielded cable may be required if electromagnetic interference disrupts signal reliability.
- ❖ The device power supply must be between 11 and 18 VDC. Extraneous noise or high voltages from the vehicle alternator circuit may cause internal damage to the device. If this is a concern a power conditioning circuit should be installed between the device and the vehicle battery circuit to filter out noise.

The LG-Alert™ is not a substitute for property, disability, life or any other insurance of any kind. Appropriate insurance coverage is your responsibility. Consult your insurance agent. The LG-Alert™ Lateral Acceleration Indicator is **NOT** to be relied on, wholly, or in part, as a substitute for proper driver training, vehicle operation and continued instruction respecting the safe operating parameters within which a vehicle must be operated.

## LIMITED WARRANTY

Stability Dynamics Ltd. warrants that the LG-Alert™ Lateral Acceleration Indicator to be free from defects in materials and workmanship under normal use and service for one year from the date of purchase. This warranty is in lieu of any other warranty, either expressed or implied. No manufacturer, agent, representative, dealer or employee of the company has the authority to increase or alter obligations or limitations of this warranty. This warranty is limited to the repair or replacement of the LG-Alert™ Lateral Acceleration Indicator, at the Company's option, in situations where this unit is found to be defective in materials and/or workmanship in normal vehicle use. This warranty does not cover damage resulting from negligent handling, painting, disassembly, misuse or lack of reasonable care. In no case shall Stability Dynamics Ltd.'s liability under any other remedy prescribed by law exceed purchase price of the Lateral Acceleration Indicator. Your Lateral Acceleration Indicator is not a substitute for property, disability, life or any other insurance of any kind. Appropriate insurance coverage is your responsibility. Consult your insurance agent.

The duration of this warranty, including that of merchantability of fitness for any particular purpose, shall be limited to the period of 1 year from date of purchase. Stability Dynamics Ltd., the manufacturers and their respective officers, directors, agents and employees, or any or all of them, shall have no liability for any personal injury, property damage or any consequential or incidental damage for breach of this or any other warranty, expressed or implied whatsoever, even if the loss or damage is caused by the Company's negligence or fault. Some jurisdictions do not allow exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which may vary from province to province.

For repair within the warranty period, return this product postage prepaid along with proof of purchase date to Stability Dynamics Ltd.. Please enclose a note stating the nature of the difficulty. In the event that you have any questions concerning the use, care and/or service of this product, please write, fax or email:

**Stability Dynamics Ltd.**

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Campbellford, Ontario (Canada)  
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