

INTRODUCTION

**US Pat. No. 6,130,608**

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. The device monitors and displays lateral g-forces perpendicular to the vehicle direction and 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 the least sensitive setting and “99” is the most sensitive setting.

An auxiliary horn jack provides additional signals indicating the full scale of the device has been exceeded, in addition to signal output jacks providing voltages biased at +2.5 VDC proportional to applied g-forces for data logging or trip recording applications. Internal filtering reduces the effects of high frequency accelerations associated with bumps and vibration.

OPERATING PRINCIPLE

The foundation 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 value of the lateral signal is determined and output to the display module, with lateral g-force to the left displayed as an increasing level on the right, and vice versa for a right increasing lateral g-force. 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 between 0.17 and 1 g-force.

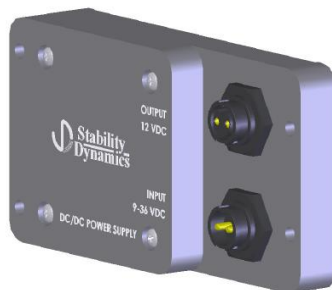


The LG Alert™ includes the following standard components:

- 400001 Display Assembly
- 400004 Base Assembly
- 400009 Mounting Bracket Assembly
- 700010 Display Cable Assembly (13 ft.)
- 700002 Power Cable Assembly (10 ft.)
- 800001 User / Installation Manual
- 800002 Remote Horn Assembly

Note: Units for large fleet orders may be provided with custom cable lengths and mounting brackets.

**LG Alert™ Helping Drivers Operate Safely**



The LG Alert™ requires 12 ± 3 VDC input for standard operation. If the power available is out of the 12 VDC range, an optional power supply is available that will accommodate a 9 to 36 VDC input providing a 12 VDC output to the LG Alert.

OPTIONAL POWER SUPPLY

- 400008 Power Supply
- 700003 Power Supply Input Cable (10ft)
- 700006 Power Supply Output Cable (10ft)

## THEORETICAL PRINCIPLES



## LATERAL FORCES ON A VEHICLE

Turning a corner results in a momentum force perpendicular to the vehicle center line. This is known as a lateral g-force or lateral acceleration.

When these lateral forces become large enough, the vehicle will either slide or overturn. This condition is referred to as a "rollover".

Lateral forces on a vehicle can be determined by the summation of radial acceleration associated with turning a corner and the tilt component related to the force of gravity on the vehicle.

## LATERAL g FORCE CALCULATION WHEN TURNING A CORNER

FORMULA:  $a = V^2/R$   
 Values:  $a =$  acceleration (m/s<sup>2</sup>)  
 $R =$  radius of turn (m)  
 $V =$  velocity (m/s)  
 $F =$  force (N)  
 $m =$  mass (kg)

Constants: Force of gravity = 9.81 m/s<sup>2</sup>

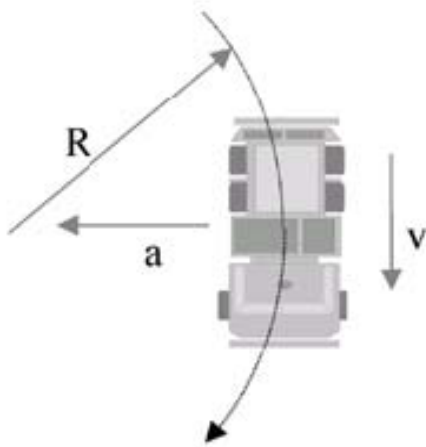
EXAMPLE: Turning Radius (R) = 50m  
 Velocity (V) = 40 km/h

$$a = (40\text{km/hr} \times 1000\text{m} / 3600\text{s})^2 / 50$$

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

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

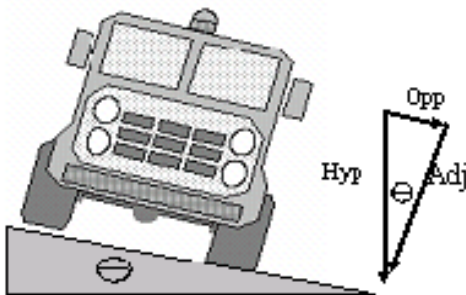
$$g = 0.25$$



## FORCES ON AN INCLINED SURFACE

Acceleration = SIN (tilt angle) x 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)



Lateral g-forces on the right of the vehicle are displayed on the left-hand side, and lateral g-forces on the left of the vehicle are displayed on the right-hand side of the indicator display.

OPERATING PRINCIPLE (contd.)

The relationship between digital setting and full-scale sensitivity is shown in the LG Alert™ Sensitivity table. Alternatively, the device can be set by an experienced driver and tested under actual vehicle operating conditions to determine a setting. For liability reasons, Team Eagle Ltd., cannot recommend a setting, nor can we provide a procedure to determine the settings of the LG Alert™ unit for your vehicle, and installed payload.

If you wish to contact us, we can provide information as to how other users have determined the settings for their particular vehicle.

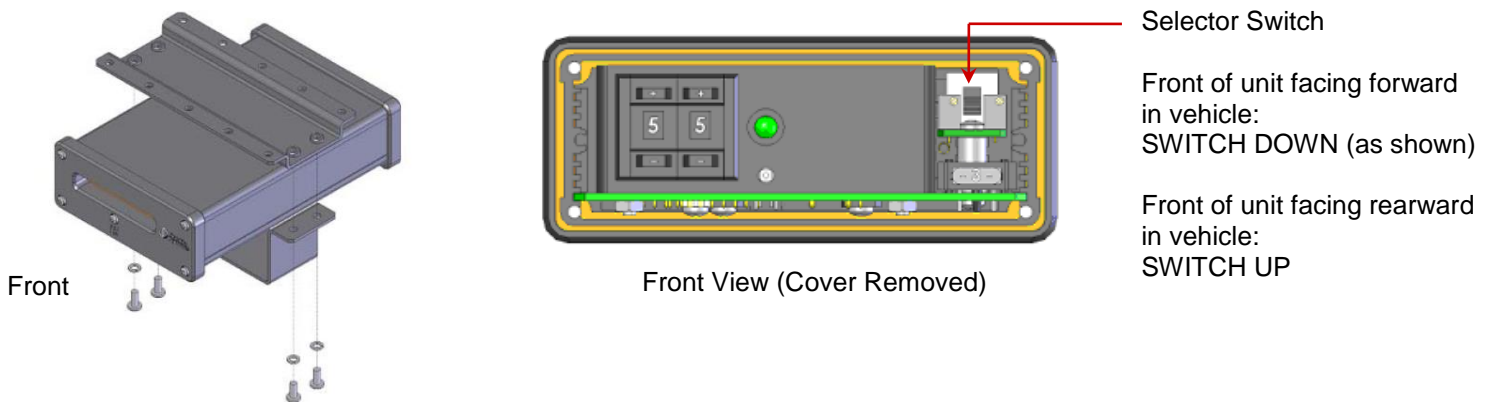
INSTALLATION

LOCATION

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 SAE suggests instruments should be located 0.71 m (28 in) from the driver's eye no more than 45 degrees below the horizon and within 30 degrees from straight-ahead.

The base module should be positioned as low in the cab as possible using the 13ft. cable provided. It must be firmly attached to the vehicle framework and as close to level as possible. Access to the base unit's front panel should not be obstructed to allow access in case of "sensitivity" setting adjustment. The front and rear panels of the base unit must be aligned with the vehicle forward direction of travel. Cables should be located away from contact by people and equipment and secured to reduce fatigue due to vibration.

**ATTENTION:** ORIENTATION OF LG-ALERT™ IN THE CAB OF THE VEHICLE IS CRITICAL TO THE PROPER OPERATION OF THE DEVICE. ENSURE THAT THE SELECTOR SWITCH IS SET AS INDICATED BELOW.



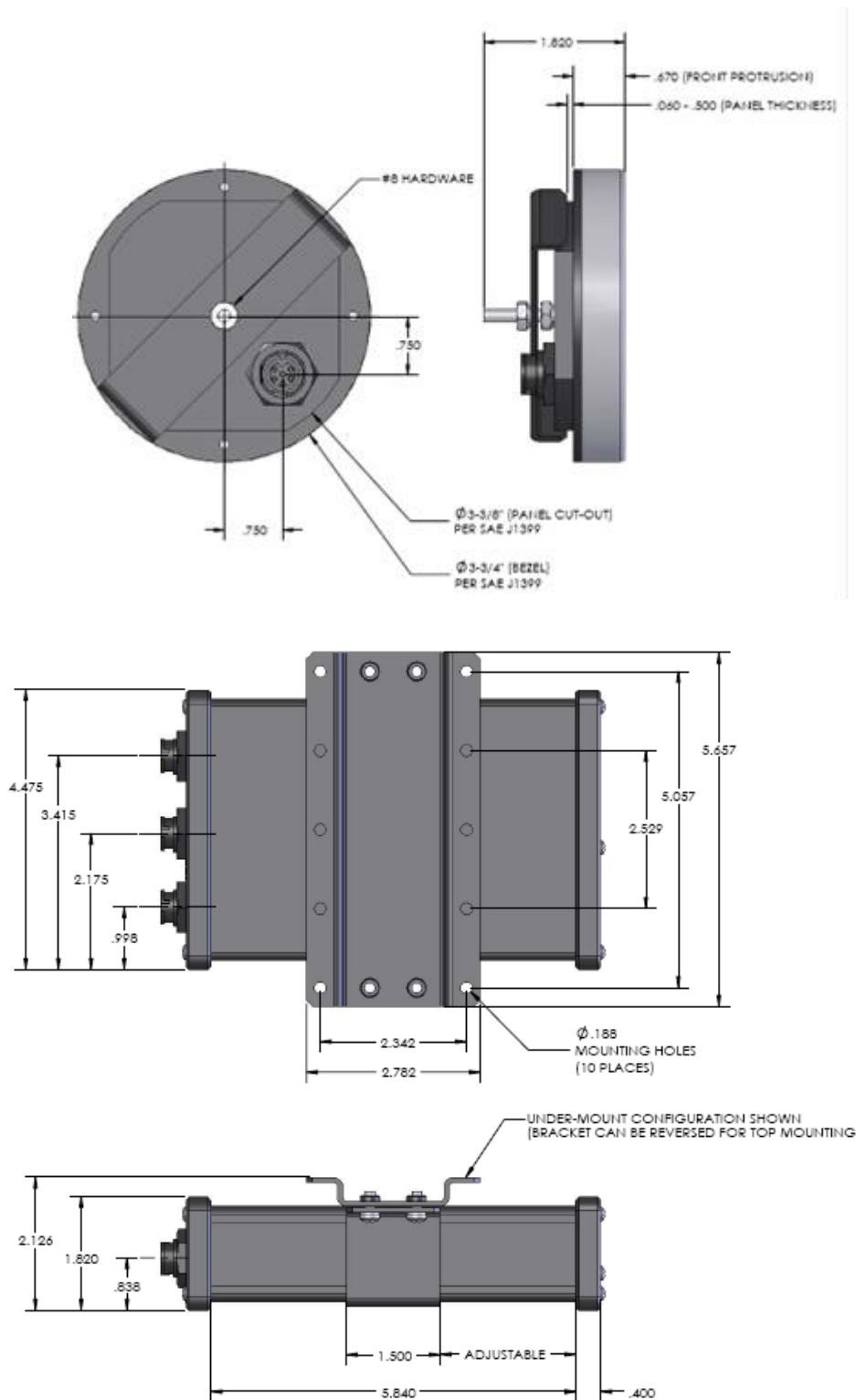
#### LOCATIONS TO AVOID

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.

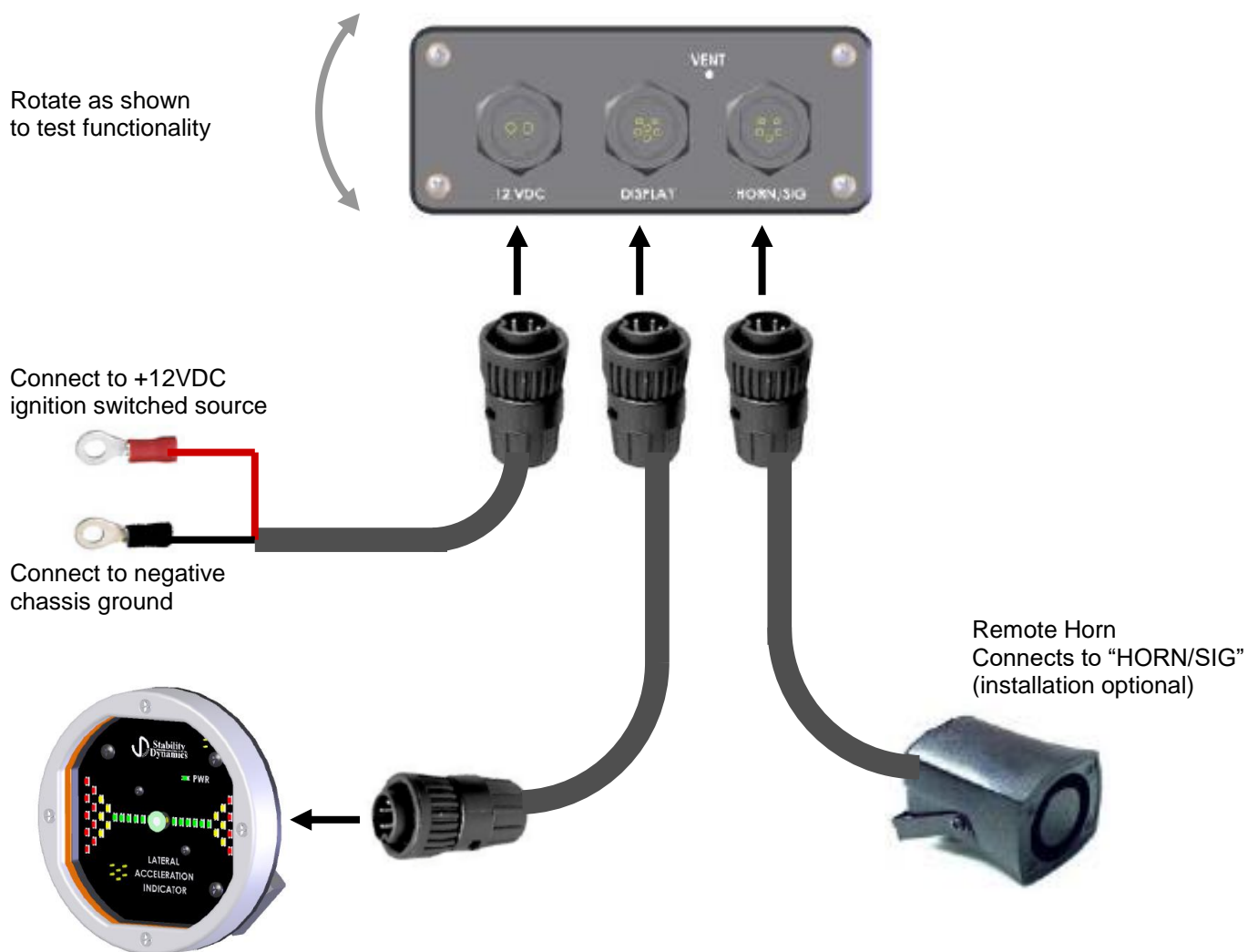
- ✓ Do not locate the device in an area that may be exposed to the weather.
- ✓ Do not locate in areas of high humidity or temperature extremes (E.g. engine compartment)
- ✓ Do not locate in areas exposed to turbulent air from fans, doors or windows
- ✓ Do not locate in areas exposed to high electromagnetic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

DIMENSIONS



## WIRING

The LG-Alert™ requires only two (2) cables to be connected to function. One cable provides 12 VDC from the vehicle fuse panel, and is connected to the Base Assembly rear connector, labeled “ 12 VDC “. The second cable connects the Display Assembly to the Base Assembly. It is connected on one end to the Display Assembly rear connector, and the other end connects to the Base Assembly rear connector, labeled “DISPLAY”. An internal fast blow fuse provides protection for the device. The power lights on both the Base and Display units should illuminate upon powering the unit. There is a warm up period of approximately 120 seconds where the device may display imbalance. During installation, the device can be tested for functionality by attaching cables and rotating the base module as shown.



## TROUBLE SHOOTING

### NO POWER

Check fuse and power connections

Base and Display units should have all power lights illuminated

If the lights are not illuminated, the device may malfunction

Check the supply voltage to the device. Voltages less than 9 VDC or greater than 15 VDC 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.

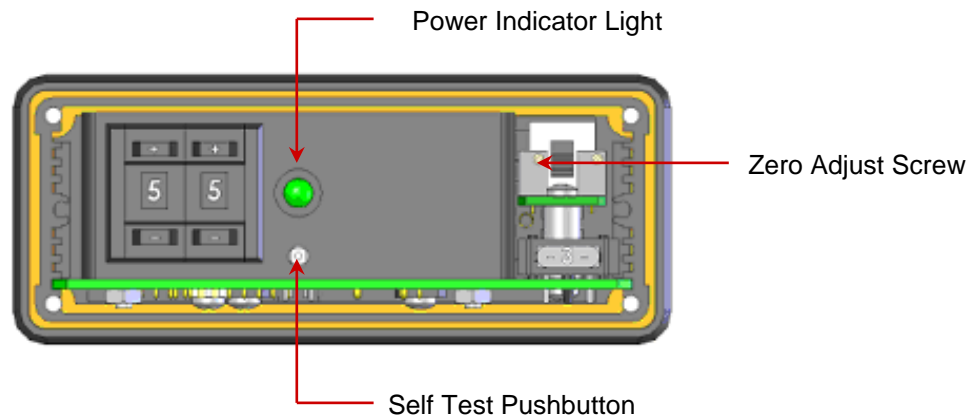
For voltage ranges of 9 to 36 VDC, an optional power supply is available. See information on Page 1.

### 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 lower front panel of the base unit, after removing the front cover. If the left and right balance of the device cannot be corrected with the zero adjust, the device may require servicing.

### ZEROING THE DEVICE

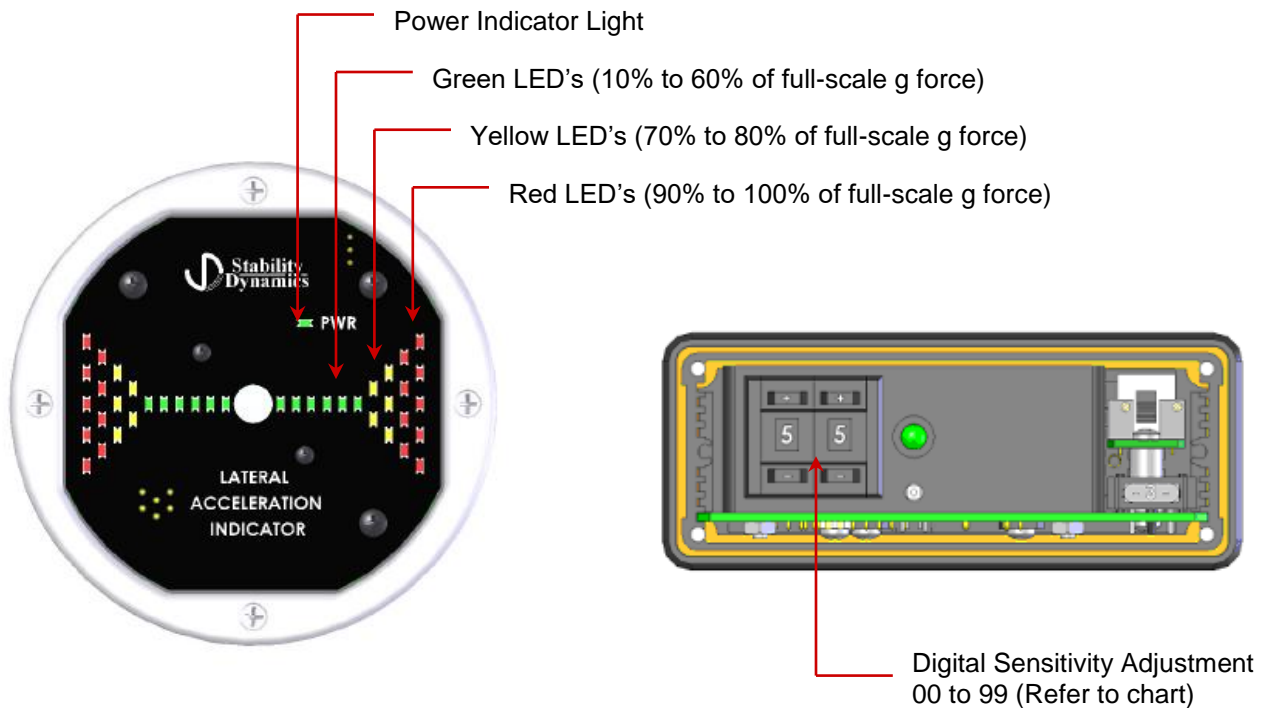
The device can be zeroed using a tiny 1/16" flat screwdriver to turn the zero adjust screw found inside the front panel of the base module. The cover must be removed to obtain access to the zero adjustment screw. Make sure the vehicle is on a level surface before starting. Count the rotations of the 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.**



Front View (Cover Removed)

## SET UP OF THE LG-ALERT™

The lateral acceleration indicator is factory set at a digital setting of '55' corresponding to the 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 by removing the front panel screw, and inserting a small wire to activate the switch. The relationship between LG-Alert™ digital setting and the associated 'g' forces to activate each of the three warning stages (indicator lights 8,9, and 10) is shown below.



**Front View (Cover Removed)**



LG-ALERT™ SENSITIVITY TABLE

Digital Push Button Setting 00-99	Lateral Tilt Angle			Lateral Acceleration		
	indicator light 8 is on at (deg)	indicator light 9 is on at (deg)	indicator light 10 is on at (deg)	indicator light 8 "g" forces	indicator light 9 "g" forces	indicator light 10 "g" forces
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 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.

- ✓ The device will not prevent the vehicle from overturning
- ✓ The device can not work without a suitable, steady power source (there are no batteries)
- ✓ The device may not work properly if the power supply drops below 9 VDC or rises above 15 VDC (unless optional 9-24 VDC converter installed)
- ✓ The device must be properly installed. The base module must be calibrated 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 provide proper readings if the orientation is altered through physical impact or abuse. Ensure a routine inspection is followed to check for functionality and device orientation.
- ✓ The audio alarm will not function if disabled.
- ✓ The device may function improperly if the cable between the base and display modules is lengthened or altered. Consult Stability Dynamics 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 (i.e.: through engine compartment). A specialty shielded cable may be required if electromagnetic interference disrupts signal reliability.
- ✓ The device power supply must be between 9 and 15 VDC (unless optional 9-24 VDC converter is installed). Extraneous noise or high voltages from the vehicle alternator may cause internal damage to the device. If this is a concern, a power-conditioning unit 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**

Team Eagle Ltd. warrants the LG Alert™ Lateral Acceleration Indicator to be free from defects in materials and workmanship under normal use and service conditions for a period of one year from 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 modify or alter the obligations or limitations of this warranty. This warranty is limited to the repair or replacement of the LG Alert™ Lateral Acceleration Indicator. This warranty does not cover damage resulting from negligent handling, painting, disassembly, misuse or lack of reasonable care. In no case shall Team Eagle Ltd.'s liability under any other remedy prescribed by law exceed purchase price of the LG Alert™ Lateral Acceleration Indicator. Your LG Alert 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 one (1) year from the date of purchase. Team Eagle 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 that may vary from jurisdiction to jurisdiction.

For repair within the warranty period, return this product postage prepaid along with proof of purchase date to Stability Dynamics. 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 to the following address;



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