



INTRODUCTION

The R'Over™ Lateral Acceleration Indicator is intended for use as an early alert system to assist drivers in recognizing when they are exceeding certain 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 sensitivity of the device can be adjusted, using the User Settings menus on the Display unit, and indicated directly in g force level. '1.00' is the least sensitive setting, and '0.09' is the most sensitive setting. User defined settings and display control are entered through a touch screen on the Display unit.

Analog signal outputs providing voltages for all 3 axes biased at +2.5 VDC, proportional to applied g-forces, are available for data logging or trip recording applications. Adjustable, (0.1 to 10 Hz), internal filtering reduces the effects of high frequency accelerations associated with bumps, chassis, and engine vibration. Provision for optional recording of time/date stamped lateral g force levels, using the supplied 2GB SD memory card, is also available.

OPERATING PRINCIPLE

The foundation of the R'Over™ 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 outputted to the Display Module (DM), 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 ambient temperature. The device can be set to display a full-scale lateral acceleration between 0.01 and 1 g of lateral force.

The R'Over™ includes the following standard components:



Acceleration Sensor Module (ASM)



Display Module (DM)

R'over™ Driver's Best Friend

THEORETICAL PRINCIPLES

LATERAL FORCES ON A VEHICLE



Turning a corner results in a momentum force perpendicular to the vehicle centerline. 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/s²)
 $R =$ radius of turn (m)
 $V =$ velocity (m/s)
 $F =$ force (N)
 $m =$ mass (kg)

Constants: Force of gravity = 9.81 m/s²

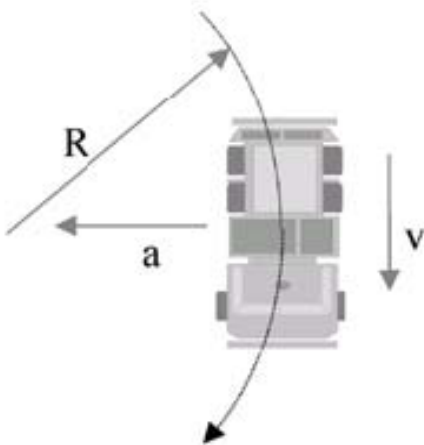
EXAMPLE: Turning Radius (R) = 50 m
 Velocity (V) = 40 km/h

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

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

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

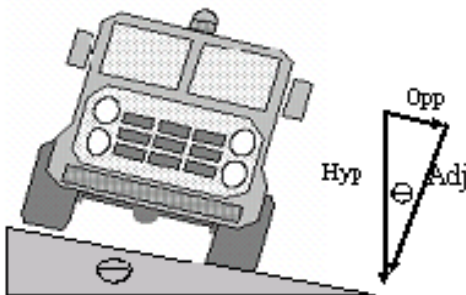
$$g = 0.25$$



FORCES ON AN INCLINED SURFACE

$$\text{Acceleration} = \text{SIN}(\text{tilt angle}) \times 9.81 \text{ m/s}^2$$

The R'Over™ 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)



The device can be set by an experienced driver and tested under actual vehicle operating conditions to determine a setting.

In every situation, the sensitivity setting of the R'Over™ is determined by the owner, or designee.

For liability reasons, Team Eagle Ltd., cannot recommend a setting, nor can we provide a procedure to determine the settings of the R'Over 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 model of vehicle.

INSTALLATION

LOCATION

Both the Acceleration Sensor Module (ASM) and the Display Module (DM) should be located within the driver compartment. The DM can be positioned anywhere that is convenient for viewing by the vehicle operator. The SAE suggests instruments should be located no more than 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.

If placement of the ASM outside the vehicle cab is required, please ensure the ambient temperature of the mounting location does not exceed -20 or + 60 degrees Celsius.

The ASM should be positioned as close to the center of front axle as possible using the 10 ft. cable provided. It must be firmly attached, flush to the vehicle framework using the housing flange and as close to level as possible. Please refer to the diagram below for correct orientation of the sensor module. Cables should be located away from contact by people and equipment and secured to reduce fatigue due to vibration.

ATTENTION: CORRECT ORIENTATION OF R'Over™ ASM ON THE VEHICLE IS CRITICAL TO THE PROPER OPERATION OF THE DEVICE.

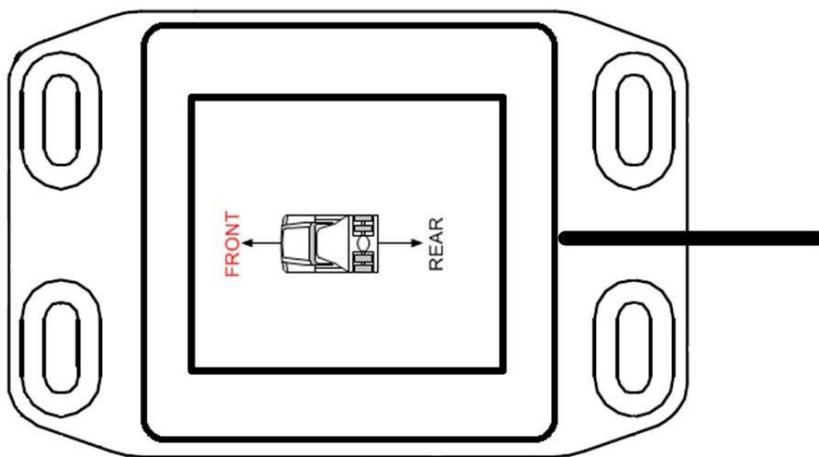
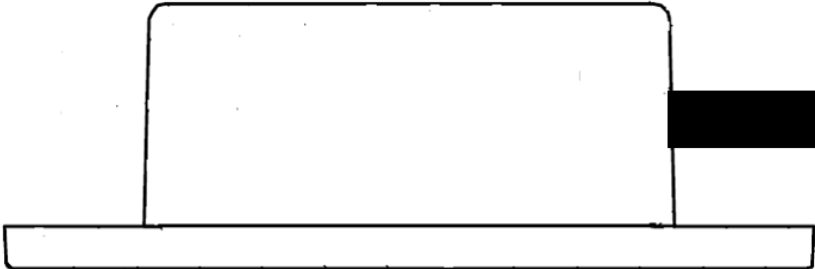


Fig.1 – ASM Top View



Ground

Fig. 2 – ASM Side view in relation to the ground

Front is front of vehicle cab

Rear is rear of vehicle cab

Mount the ASM with the mounting flange up or down, as the device will automatically correct the left to right orientation either way when initially powered up provided that the front back orientation of the device, parallel to the ground, is achieved.

LOCATIONS TO AVOID

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

The DM 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 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.

WIRING

The R'Over™ requires 9 to 30 VDC input for standard operation.

The R'Over™ requires two (2) cables to be connected to function. The power cable provides ignition switched power from the vehicle fuse panel and is connected to the DM 4 pin bottom connector as shown in the wiring picture below. The umbilical cable, integral to the ASM, connects on one end to the DM 8 pin bottom connector. An internal fast blow fuse provides protection for the device.



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The power cable has 2 colored wires and a bare shield at the end. Strip $\frac{1}{4}$ inch of insulation off both insulated wires.

Terminate the Red wire with a suitable connector for connection to a vehicle switched +ve power source.

Terminate the ground and shield with a suitable connector for vehicle power ground, which could be a connector bonded to the vehicle chassis.

Ensure the power source is off.

Connect the ASM umbilical cable and power cable to the DM as shown in Fig. 3 on the next page.

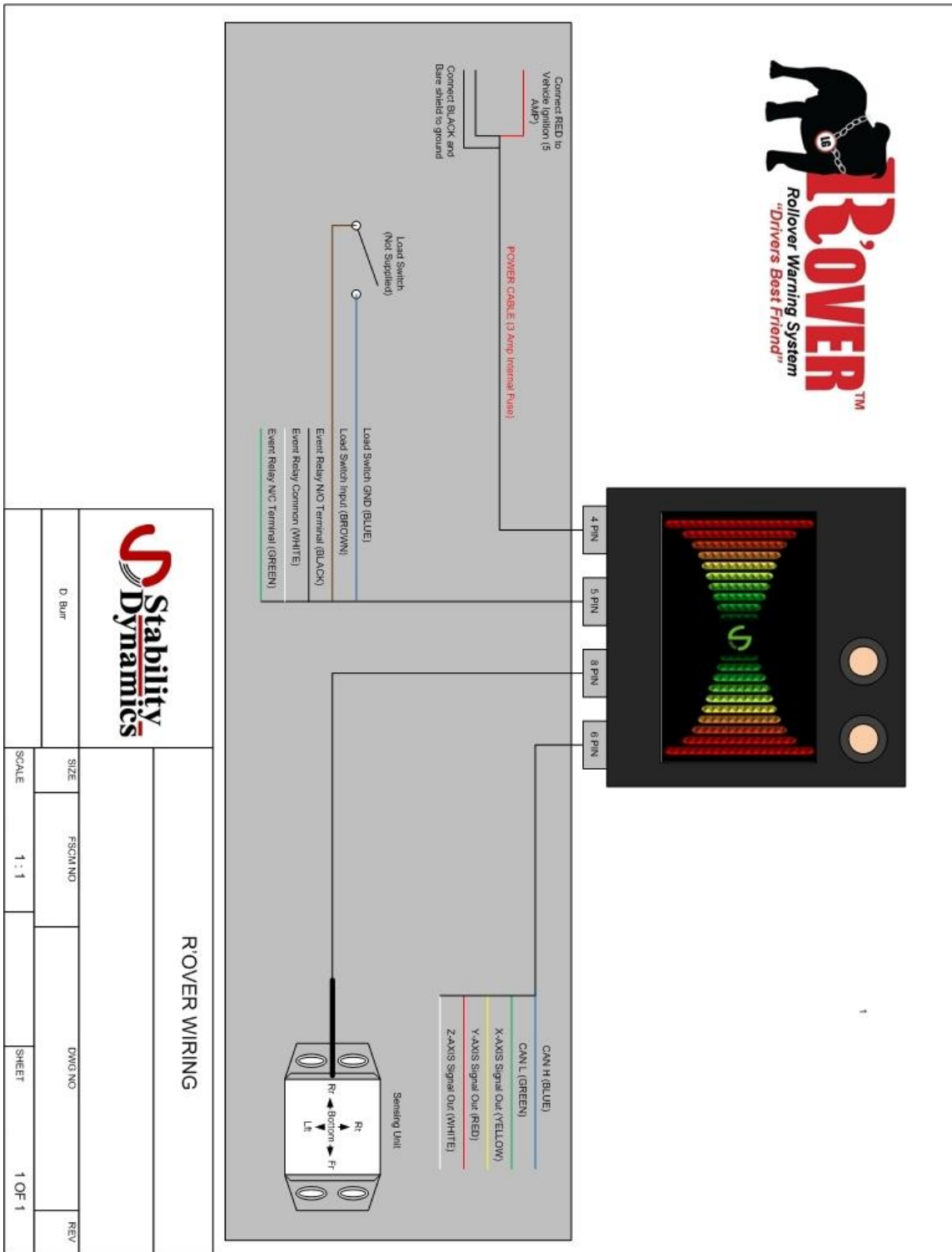


Fig. 3 R'Over Wiring

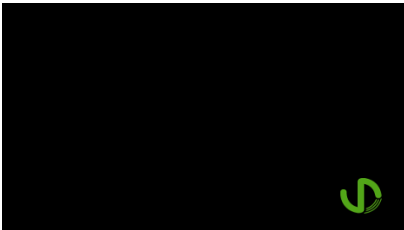


APPLY POWER TO THE UNIT

- 1) The DM should display the R'Over™ startup screen for 10 seconds as per figure 1 below.



- 2) The normal indication screen shown below will appear after the startup screen



- 3) In the event that any additional green, yellow, or red indicators are showing to left or right, a recalibration of the acceleration sensor is required.
Please refer to the User Menu section – Calibration, for instructions on how to calibrate the unit.

Note: The Factory default for the unit is a two-sided display mode.

TROUBLE SHOOTING

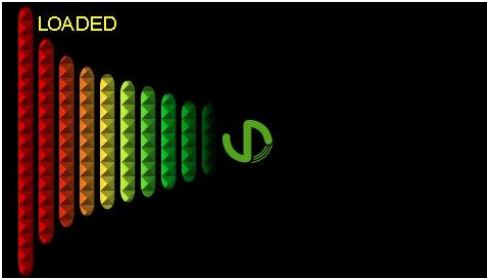
NO POWER

- 1) Check vehicle fuse and power connections
- 2) DM should show the white dot in the center of the screen if working properly.
- 3) Check the supply voltage to the device. Voltages less than 9 VDC or greater than 30 VDC are outside the device specification range and may cause false readings and or system damage. 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

Should the ASM be faulty the DM could show a full-scale alert, as shown below, with audio alarm occurring as well.



Should this occur, immediately remove power from the unit by switching off vehicle ignition power and check the umbilical cable connector is threaded on properly to the 6-pin DM connector. If problem persists then the ASM is faulty and must be replaced.

SET UP OF THE R'Over™

The lateral acceleration indicator is factory set at a setting of '0.33' corresponding to the first alert occurring at a static tilt angle of approximately 70% of full-scale, 13.34 degrees or 0.23 'g's. The device may be adjusted to another value using the Gain setting menu. 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 R'Over™ 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". Users 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 relationship between R'Over™ gain setting and the associated 'g' forces to activate each of the three warning stages shown below in Fig. 4.

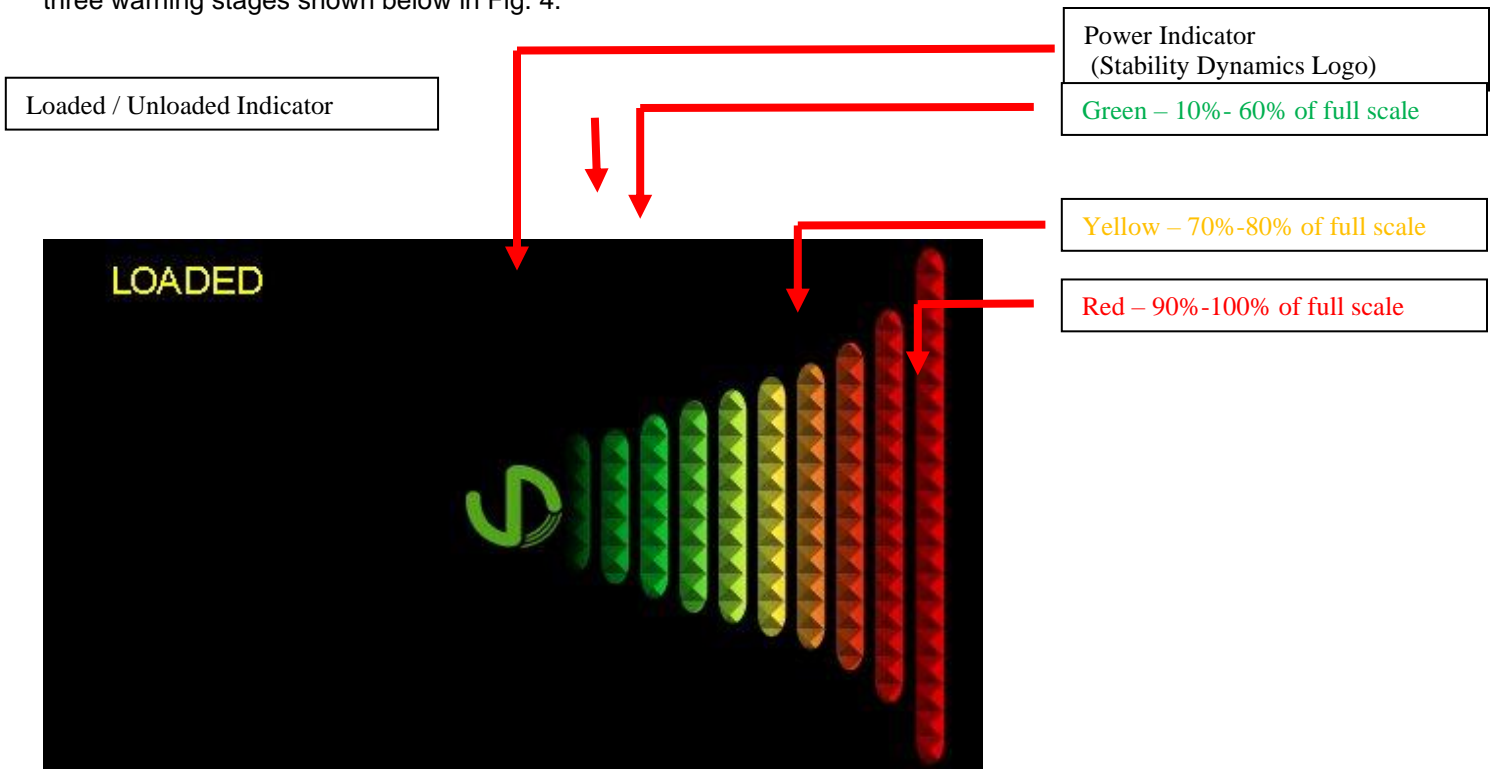


Fig. 4 – R'Over™ Main Display screen



User Settings:

All user settings are password protected to ensure unauthorized changes are not made to the device. To access the login screen tap the upper half of the display screen.



The password in factory set to 33333, which the user can change in the Display Menu. Touch the upper left return button on the display to return the unit to normal operation.

Enter the 5-digit password, and press the lower right return key, and the Main Menu will appear.



The Main Menu and Login screens will return to the normal operating display if a sub-menu selection is not pressed within 10 seconds.

The Main Menu Options:

The Main Menu is divided into different settings options and functions for the unit. Touching any of the 6 sub-menu options brings that menu up on the screen. All sub-menus are displayed indefinitely until the user presses the upper left corner 'return' arrow key. Once a selection is made in each sub-menu, press the upper left return arrow to return the unit to normal operation. All system selections are automatically saved.

Each sub-menu function is explained in detail in the paragraphs below, including the factory default settings.

Lateral Gain Menu



R'Over™ has the capability to provide the same sensitivity (Symmetrical Sensitivity) for left or right lateral acceleration force measurement (default). Select 'YES' for most cases where the vehicle load is evenly distributed from left to right. For applications where the vehicle load inertia is not symmetrical, such as a turning drum on a concrete delivery truck, a different sensitivity for right and left direction acceleration is possible. If asymmetrical sensitivity is desired, select 'NO' to enable this option.

For symmetrical sensitivity (Fig 5) , an adjustment screen will appear with one full-scale adjustment option. For asymmetrical sensitivity (Fig 6) full-scale adjustments are available for right and left acceleration directions

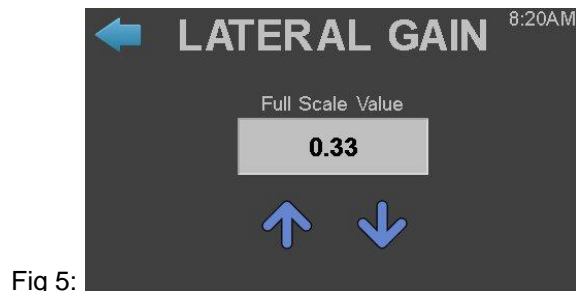


Fig 5:

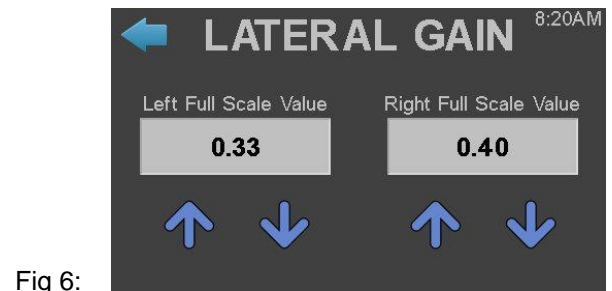


Fig 6:

Touch the up or down arrow(s) indicators to increase or decrease respectively the full-scale setting. The default setting is a '0.33' g level for the default **Unloaded** vehicle condition.

Decreasing the Left Full Scale Value number increases the indicator sensitivity when performing a right turn, while decreasing the Right Full Scale Value number increases the indicator sensitivity when performing a left turn.

The User can set either Full Scale Value number based on how their vehicle handling characteristics differ in either direction.

Selecting the optimum value for your vehicle is best done using an experienced vehicle driver for that type of vehicle and load.

Calibrate Menu



The Calibrate menu allows for corrections in a slight tilt of the vehicle when on level ground due to initial, and over time, suspension tilt. It also is where the User sets the point where alarms first occur relative to the full-scale value set in the Lateral Gain menu.

With the ASM properly installed, and the vehicle on level ground, and the DM correctly left and right orientated, touch the Zero Lateral, Zero Axial, and Zero Vertical to calibrate the zero g position for all 3 axes. The unit will announce calibration completion with a single audio tone.

The initial alarm point where the yellow indicator bars, and audio alerts, first turn on can be set to a different point from the default 70% of the Lateral Gain setting. Adjustment is possible from 30% to 70% of the full-scale g level, by using the up and down arrows to select the required level.

Recording Menu



R'Over™ can optionally continuously record date/time stamped 3 axis g force levels, at one second intervals using the optional SD memory card (supplied) when installed.

To enable recording, make sure the SD card is installed in the unit **prior to powering up the device**, and in the Recording menu touch the 'Enabled' box to see the checkmark appear in the selection box.

Touch option 'Overwrite when full' to have the recording overwrite old data when the memory card is full or select 'Stop when full' to stop recording when the memory card is full (default) to ensure older data is not lost.

The data is stored in a standard format Comma Separated Value (csv) text file, which can be transferred to, and can be viewed on a computer using common spreadsheet applications such as MS-Excel. Data files are labeled by the date of the

recording. The SD card data is transferred to the computer hard drive using an SD card compatible reader device (not supplied).

SD Card Installation

In order to record and view acceleration data, when Recording has been enabled, the user must first install the SD storage card in the Display unit.

Note: The unit is designed to use only standard SD cards, which are limited to a max. storage capacity of 2 GB of data. The use of SD HD (High density) cards is not supported. These HD cards are typically larger than 2GB in storage size.

To insert the SD card in the Display unit

- Locate the SD card door on the Display unit – right hand side



- Slide the card door up all the way



- Orient the SD card properly with front label of card facing the back



- Insert the card into the open slot as shown until it clicks into place



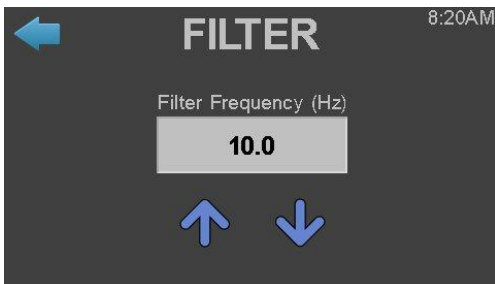
- Card when fully inserted should clear the card door as shown



- Complete SD card installation by closing the sliding door
Reconnect power to the unit, and make sure 'Recording' is enabled in the device settings.

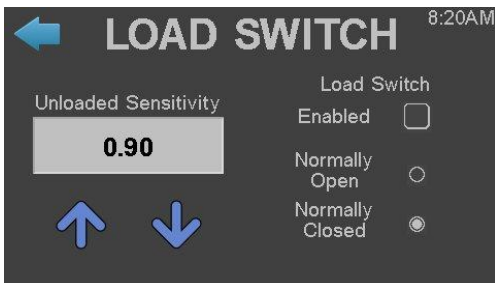
Reverse these steps for removal of the SD card for reading the data.

Filter Menu



The default setting of 1Hz will suit most applications.

Event Menu (manage use of Load Switch)



The Event Menu allows for a different sensitivity to be automatically enabled when the vehicle is unloaded or loaded with cargo. This allows the correct sensitivity for the different load inertia seen under the two conditions. To enable the load switch, touch the box on the screen next to 'Enabled'. The box will be checked when enabled, and empty when disabled.



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When enabled, the Unloaded Sensitivity Multiplier is applied when the Load switch is activated and can be adjusted using the up and down arrows, changing the full-scale lateral G level in "Loaded" state from 0.95 to 0.5 times the 'unloaded' Lateral Sensitivity setting. For example. If the Lateral Gain Full scale setting is 0.66 for the Unloaded Condition and the Sensitivity Multiplier is set to 0.5 then the 'Loaded' condition full scale value changes to 0.33 when the Load switch is ON.

The user has the option to use a Normally Open (NO) or Normally Closed (NC) load detection switching device (not supplied), connected to pins 1 and 2 of the 5-pin connector at the bottom of the Display unit.

Fig. 6 – Load Switch and Relay Output connector pinout diagram



Pin Assignments

Front View

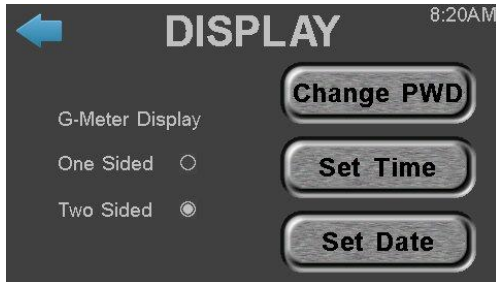
1. Load Switch Input
2. Load Switch Gnd
3. Event Relay N/O terminal
4. Event Relay Common
5. Event Relay N/C terminal

Note: Pins 3, 4, and 5 of the connector are connected an internal relay that closes when a full-scale condition occurs for a device to be controlled, such as a remote siren for high ambient noise conditions. A Max. of 30 Vdc 1 Amp is allowed for the controlled device.

For assistance with setting up a load switch configuration, or an external relay controlled device.

Please contact us using the information listed at the bottom of this page.

Display Menu:



Display Mode:

R'Over™ has two operating alert display modes - one sided (shown below), and two sided (default).



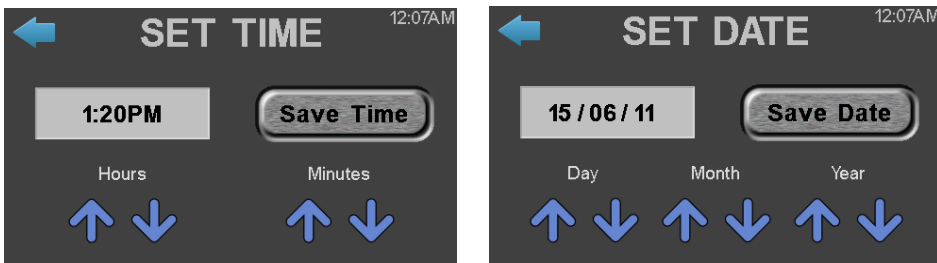
The diagrams above show a lateral zero g, Intermediate Alert, and Full-Scale alert condition. The display will indicate increasing lateral g force to the left or right of the vehicle in the same upward direction. This simpler display allows experienced drivers to use only peripheral vision to see the alert level, and not focus on the actual direction of the force.

To set the Display Mode, on the screen, under the G-Meter Display heading, touch the circle button either for 'One Sided' or 'Two Sided' to set the display preference.

Additional Display features for Time, Date, and Password are set in this menu. These items should be set when the unit is first installed in the vehicle.

Touch the 'Change PWD' button to change the Login password from the current one (Factory Default is 33333), and enter a new 5 digit numeric code. Remember to write down the new password for future reference.

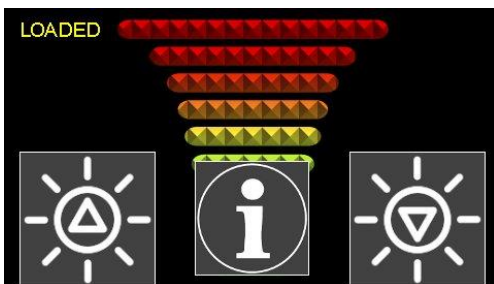
Touch either the 'Set Time' or 'Set Date' button on the screen, and the menus below will appear.



Use the respective up/down arrow buttons under each function heading, to change the displayed value, remembering to press save on reaching the desired date or time setting.

Display Dimming and Settings Summary:

Touching the bottom half of the Display screen during normal unit operation will show the display dimming controls, and an information button to display a Summary of the settings.



Tap the up arrow to brighten the display, or tap the down arrow to dim the display. These buttons will disappear after 10 seconds.

The “i” button when touched will bring up a Settings Summary screen for Administrators to quickly check the current settings of the unit. If any information shown is incorrect the Administrator should return to the Settings Menus to make changes.





LIMITATIONS OF R'Over™:

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 R'Over™ 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 voltage is below 9 VDC or above 30 VDC
- ✓ The device must be properly installed. The Acceleration sensing 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 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 the built-in transducers are tampered with
- ✓ The device may function improperly if the cable between the Acceleration Sensing and Display modules is lengthened or altered. Please consult Stability Dynamics regarding cable length limitations
- ✓ The device may malfunction if the cable between the Accelerometer sensing and Display modules are 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 30 Vdc. 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 R'Over™ 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 R'Over™ Lateral Acceleration Indicator is **NOT** to be relied on, wholly or in part as a substitute for proper driver training, vehicle operation.



SPECIFICATIONS:

Electrical:

- Power input: 9.0 to 30.0 Vdc , negative ground, 30W maximum
- Power Input protection to SAE J1455 specification
- Event relay contact: NO or NC, 30 Vdc , 1 amp max.
- Load Switch: 5 Vdc open voltage through pull-up resistor, max. Current 10 mA. +30Vdc protection
- Accelerometer module output – 0 to 5 Vdc w.r.t vehicle ground, 100 ohm max. Output impedance
- Accelerometer module power - + 5.0 Vdc, +/- 0.1 max. ripple, 25 mA max.
- Accelerometer sensitivity: 1000 mv/g, +/- 0.3% ; -40 to +70 deg. C temp. range
- Accelerometer zero g level – 2.5 +/- 0.1 Vdc, 0.1 mv per deg. C temp co-efficient

Environmental:

- Operating Temperature: -20 to + 60 deg. Celsius
- Storage Temperature: -50 to + 95 deg. Celsius
- Dust and Fluids Ingress: Display Control Unit – IP55; Accelerometer unit- IP67
- EMI Radiated & Conducted Emissions; tested according to CISPR 22 IEC , which complies with FCC part 15 Class B for Unintentional Radiator, and also complies with corresponding Industry Canada specification: ICES-003
- EMI Radiated & Conducted Susceptibility; SAE J1113, sect. -2, -3, -11. -12. -13, -21
- Vibration: 1.0g Sine sweep per Section 4.9.4.1 of SAE J 1455, Random per Section 4.9.4.2 of SAE J 1455
- Shock – 40G, 11ms per MIL-STD-810D, method 516.3
- Humidity – 0 to 95%, non-condensing per SAE J1455

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules, and compliant to Industry Canada specification - ICES-003 as well. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that of the receiver.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications, are expressly forbidden and not approved by Stability Dynamics. Changes or modifications will void the user's warranty.



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LIMITED WARRANTY

Team Eagle Ltd. warrants the R'Over™ 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 R'Over™ Lateral Acceleration Indicator. This warranty does not cover damage resulting from use, negligent handling, painting, disassembly, misuse and 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 R'Over™ Lateral Acceleration Indicator. Your R'Over 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 Stability Dynamics negligence or fault. Where jurisdictions do not allow exclusion or limitation of incidental or consequential damages, 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 Team Eagle 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 to the following address;



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