



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 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 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 done 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.

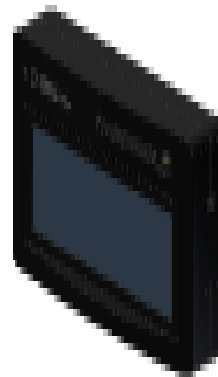
OPERATING PRINCIPLE

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, 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



Display Module

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 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.

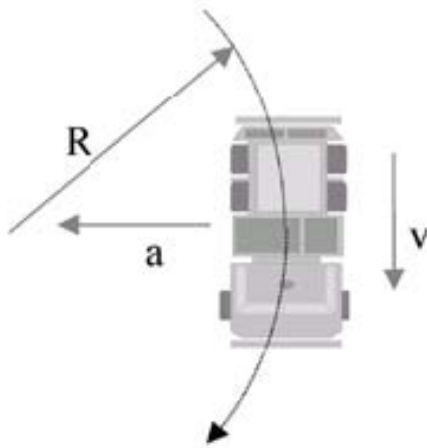
LATERAL g FORCE CALCULATION WHEN TURNING A CORNER

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

Constants: Force of gravity = $9.81 m/s^2$

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

$a = (40km/hr \times 1000m / 3600s)^2 / 50$
 $a = 2.469 m/s^2$
 $g = (2.469 m/s^2) / (9.81 m/s^2)$
 $g = 0.25$



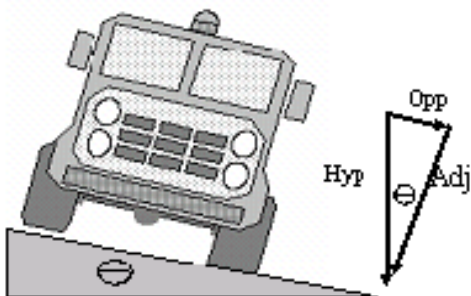
FORCES ON AN INCLINED SURFACE

Acceleration = SIN (tilt angle) x $9.81 m/s^2$

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)

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.

A tilt table can be used to establish a safe setting for the R'Over™. Alternatively, the device can be set by an experienced driver and tested under actual vehicle operating conditions to determine a setting.





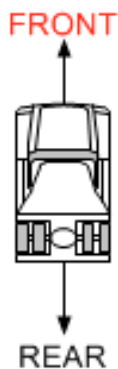
INSTALLATION

LOCATION

Both Acceleration sensor 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 Acceleration Sensor Module should be positioned as low in the cab 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™ Acceleration Sensor IN THE CAB OF THE VEHICLE IS CRITICAL TO THE PROPER OPERATION OF THE DEVICE.



Front is front of vehicle cab

Rear is rear of vehicle cab

Mount the unit with the mounting flange up or down, as it will auto-correct the left to right orientation either way, when initially powered up.

Proper orientation, front to back parallel to the length of the cab, will ensure the correct right, and left position is achieved.



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 Display 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 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 only two (2) cables to be connected to function. The first cable provides ignition switched power from the vehicle fuse panel, and is connected to the Display Assembly bottom connector as shown in the wiring picture below. The second cable, integral to the Acceleration Sensor, connects to the Display Assembly. It is connected on one end to the Display Assembly bottom connector. An internal fast blow fuse provides protection for the device.

The Power cable has 2 colored wires and a bare shield at the end. Strip ¼ 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.

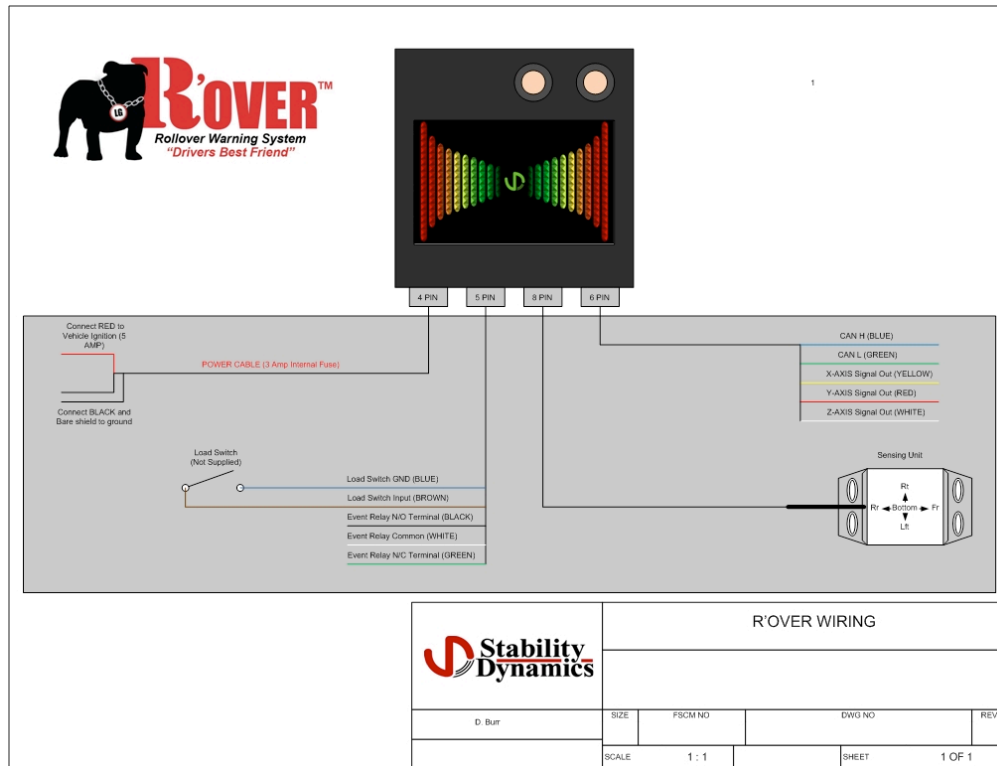
Ensure the power source is off.

Connect the Accelerometer Sensor cable and Power Cable to the Display unit as shown in the picture below.



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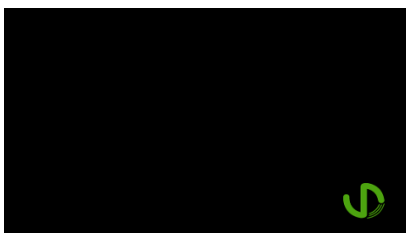


APPLY POWER TO THE UNIT

The Display unit should display the R'Over startup screen for 10 seconds.



The normal indication screen below will follow the startup screen.





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In the event 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, but depending on whether single sided display has been selected, the Stability logo on the screen may be in another position at the bottom right. Please see the Display Menu section later in this manual for a description of the 2 display modes.

TROUBLE SHOOTING

NO POWER

Check vehicle fuse and power connections

Display unit should show the white dot in the center of the screen if working properly.

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. 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.

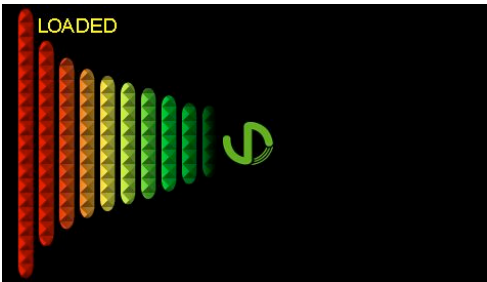
Stability Dynamics, a div. of Team Eagle Ltd.

10 Trent Drive, P.O. Box 670, Campbellford, Ontario, Canada, K0L 1L0
Ph: (705) 653-0775 Fax: (705) 653-4732 Email: info@stabilitydynamics.com
www.stabilitydynamics.com



UNBALANCED OPERATION

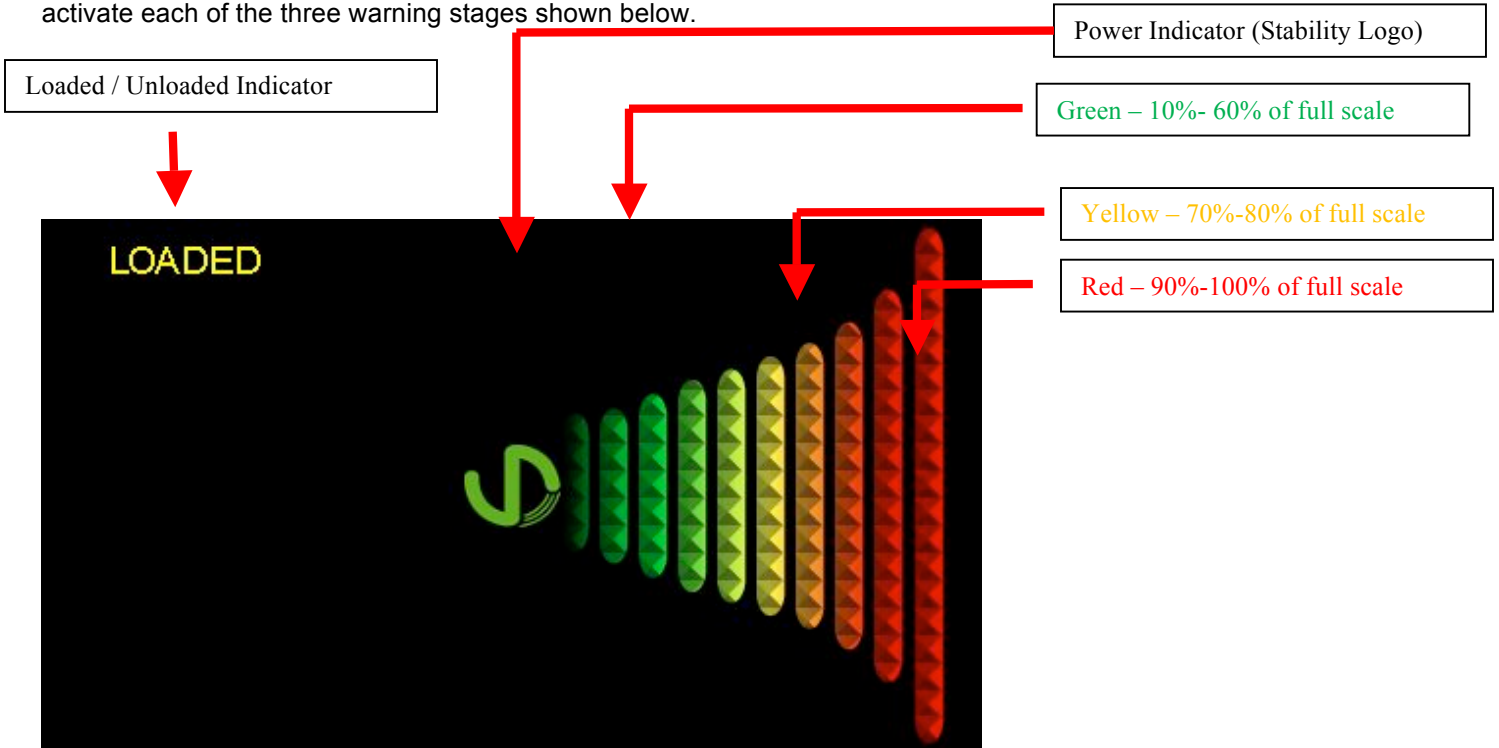
Should the accelerometer unit be faulty the Display unit could show a full scale alert, as shown below, with audio alarm occurring as well.



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

SET UP OF THE R'Over™

The lateral acceleration indicator is factory set at a setting of '0.66' 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 with the 'Loaded' multiplier set to 0.5 times this 'Unloaded' full scale value, please see section titled 'Event Menu' for details. 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.



User Settings:

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



The password in factory set to 3333, 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. It is recommended that an authorized user change the password upon initial installation to prevent unauthorized change of the settings later.



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.

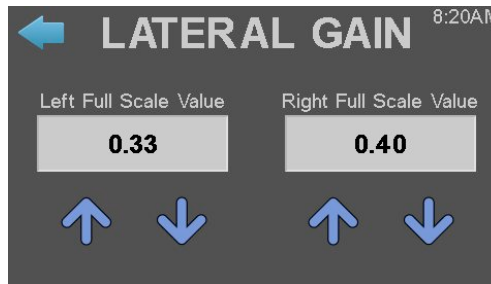
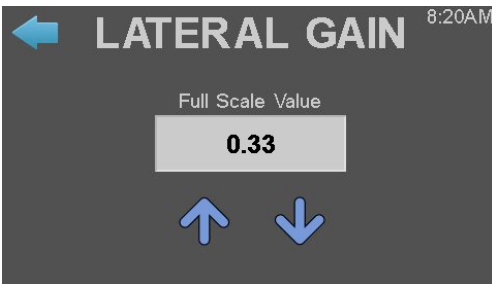
Each sub-menu function is explained in detail in the paragraphs below, including the factory default settings.

Lateral Gain Menu



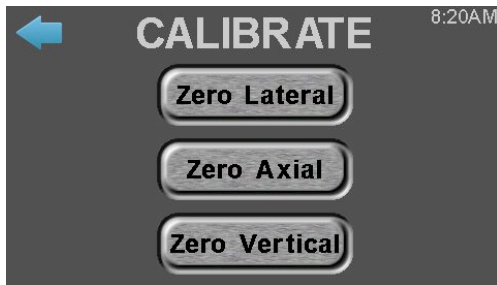
R'Over™ has the capability to provide the same sensitivity (Symmetrical Gain) for left or right lateral acceleration force measurement (default). Select 'YES' for most cases where the vehicle load is evenly distributed from left to right. For applications where the vehicle load inertia is not symmetrical,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

For Symmetrical Gain, an adjustment screen will appear with one full-scale adjustment option, and for non-symmetrical gain 2 full-scale adjustments are available for right and left acceleration directions



Touch the up or down arrow indicators to increase or decrease respectively the full-scale setting. The default setting is a '0.66' g level for the **Unloaded** vehicle condition. The unit is also set to default 'Loaded' condition with a gain multiplier of 0.5. This is equal to a full-scale g force level of 0.33

Calibrate Menu

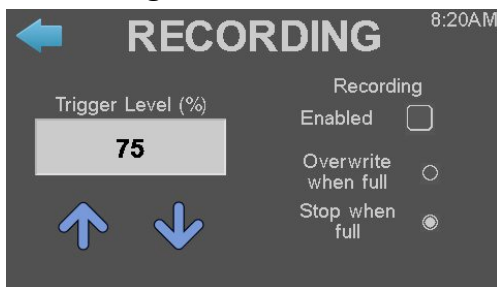


The Calibrate menu allows for corrections in a slight tilt of the vehicle when on level ground due to initial, and over time, suspension tilt. It also is where the User sets the point where alarms first occur relative to the full-scale value set in the Lateral Gain menu.

With the Acceleration Sensing module properly installed, and the vehicle level to the ground and 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. Recording is not enabled by default.

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 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 a 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 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



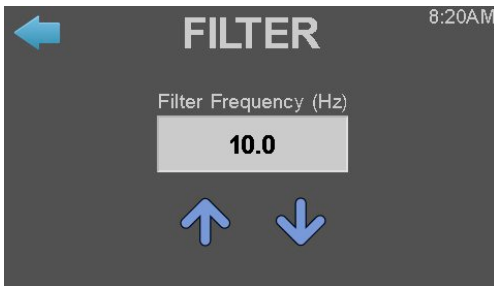
- Card when fully inserted should clear the card door as shown



- 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.

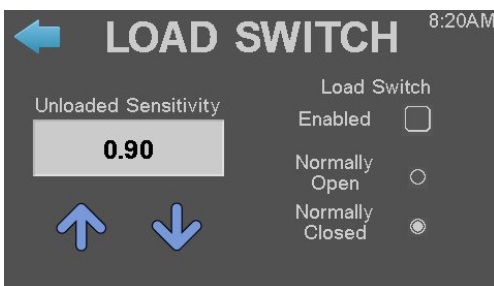
Filter Menu



The response of the acceleration sensing unit can be changed to provide protection against engine or chassis vibration causing false alerts simply by changing settings in the Filter Menu.

The default setting of 1Hz will suit most applications, but if faster response is required to measure a vehicle able to maneuver quicker, increase the filter frequency using the up arrow, or in cases where very low frequency rumble in the vehicle chassis is observed, reduce the frequency by pressing the down arrow. The best setting must be empirically determined using normal driving conditions.

Event Menu



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.

When enabled the Gain 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 from 0.95 to 0.5 of the 'unloaded' Lateral Gain setting.



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Use an either a Normally Open (NO) or Normally Closed (NC) load selection switch (not supplied), connected to pins 1 and 2 of the 5-pin connector at the bottom of the Display unit. Select the proper logic for the switch in the 'unloaded' position, either NO or NC. Connect the switch per the connector diagram below. An open collector logic driver signal may be applied to the Load Switch input as well as a mechanical switch. The input default is high, with no connection applied.

The unit is shipped default in the Load Switch enabled condition (and a Normally Closed Load switch) with a full-scale g force setting of 0.5 times the Gain setting of 0.66. This translates into a setting of 0.33 lateral g level for full-scale indication. Set Loaded and Unloaded conditions for full-scale lateral g forces based on experienced driver feedback, and truck manufacturer supplied data.



Pin Assignments

Front View

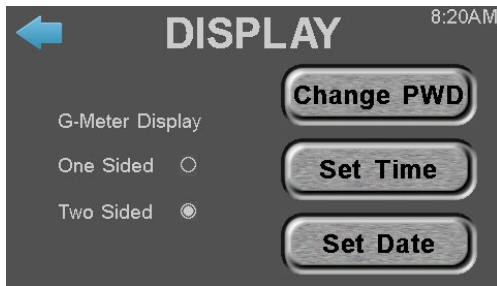
1. Load Switch Input
2. Load Switch Gnd
3. Event Relay N/O terminal
4. Event Relay Common
5. Event Relay N/C terminal

Note: Pins 3, 4, and 5 of the connector are connected an internal relay that closes when a full-scale 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.

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10 Trent Drive, P.O. Box 670, Campbellford, Ontario, Canada, K0L 1L0
Ph: (705) 653-0775 Fax: (705) 653-4732 Email: info@stabilitydynamics.com
www.stabilitydynamics.com

Display Menu:



Display Mode:

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

Two sided mode displays lateral g force either to the left or right of the Display center, intuitively showing the driver to turn the wheel in the opposite direction the increasing indicator bars. This mode works well with inexperienced drivers who require more guidance to correct the excessive g force condition.

Examples of Two sided mode display are shown on pages 6 & 7 of this manual.

One Sided mode is for more experienced drivers, who are experts at correcting steering position during these conditions.



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.

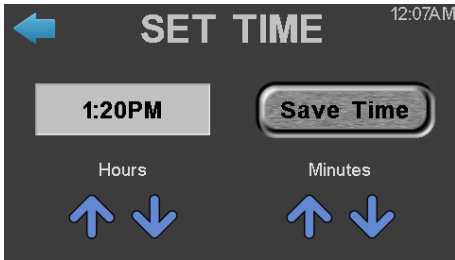
To set the Display Mode, on the screen, under the G-Meter Display heading, touch the circle button either for 'One Sided' or 'Two Sided' to set the display preference.

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.

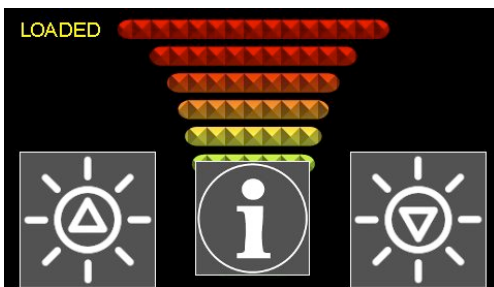
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Use the respective up/down arrow buttons under each function heading, to change the displayed value, remembering to press save on reaching the desired date or time setting.

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 and continued instruction respecting the operating parameters within that a vehicle must be operated.



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.

Any changes or modifications, not expressly approved in writing by Stability Dynamics, could void the user's authority to operate the equipment.



LIMITED WARRANTY

Stability Dynamics 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 negligent handling, painting, disassembly, misuse or lack of reasonable care. In no case shall Stability Dynamics 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. Stability Dynamics, 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 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 to the following address;



Stability Dynamics, a div. of Team Eagle Ltd.
10 Trent Drive, P.O. Box 670
Campbellford, Ontario, K0L 1L0, Canada
Ph: (705) 653-0775 Fax: (705) 653-4732
Email: info@stabilitydynamics.com
Web: www.stabilitydynamics.com