Turnkey Instruments Ltd

Simret 3000
Operating Instructions

KEY-PRESS FUNCTION

to switch on
[R]   to quit current function
to see amount of memory left

to <u>print</u> results
[P]   to insert a <u>pause</u> after a test
to scroll down through a list

to measure <u>slope</u> gradient
to manually <u>start & stop</u> a test
[S]   to enter <u>select</u> a choice or value
to <u>set</u> the pedal force transducer to zero
to scroll up through a list

to <u>arm</u> for test
[A]   to print <u>all</u> results
to <u>accept</u> a choice or value

[R] & [S]   to select the editing mode

[R] & [A]   to change the test number

[S] & [P]   to switch off manually

GETTING STARTED

The **SIMRET** keypad has a tactile feel and the instrument beeps when a button is pressed. Holding a button for more than one second causes the instrument to beep rapidly. This is the ***hold-mode*** in which **[S]** , **[A]** and **[P]** behave differently as described below.

SWITCHING ON: To turn the instrument on, press and release the switched marked **[R]**. After a short self test (see below) the display will show ***"SIMRET ready"***, together with the time and date. If the battery needs re-charging, the display will flash ***"Charge battery"***.

The battery must be fully re-charged as soon the ***"Charge battery"*** warning appears. The instrument will not let you print results with the ***"Charge battery"*** warning on.

SWITCHING OFF: Providing the instrument is not armed for a test or printing, it will switch itself off automatically if no buttons have been pressed for 4 minutes. To manually switch off the instrument press **[S]** and **[P]** together.

DISPLAY CONTRAST: To adjust the contrast of the display press and hold **[R]** as the instrument is switched-on until the display goes its darkest after about 3 seconds. Then use the **[S]** button lighten the display as required. Press **[A]** to accept the new contrast setting. **SIMRET** will automatically remember this setting and use it each time it is switched-on. The contrast can only be adjusted as you switch the instrument on, and once set to suit you it should not normally need re-adjusting.

SELF TEST: As **SIMRET** is switched on it carries out certain self tests to make sure it is working correctly. At the end of the self test the display will show ***"Calibration date"***, this is the time and date when the instrument was last calibrated. If this is more than a year ago, the display will show ***"PLEASE HAVE ME RE-CALIBRATED"*** instead.

If the instrument detects a fault with its memory during the self test the display will show **"MEMORY ERROR"**.

If the instrument has lost its calibration information the display will show **"POOR CALIBRATION"**.

In both of the above cases, the instrument will automatically revert to a default calibration and is therefore still usable – albeit with reduced accuracy. In this case, after the error message, the display will show ***"PLEASE HAVE ME RE-CALIBRATED"***. If the ***"Memory Error"*** warning appears always check that the Trimmable Parameters (see Appendix B) have not been corrupted before using the instrument. Consult the factory regarding service and re-calibration, low cost annual service and calibration contracts are available.

MEMORY: If you press **[R]** while the display shows ***"SIMRET ready"***, the display will switch to indicating the battery voltage and percentage of memory used. Release **[R]** to revert to the normal display.

The fully charged battery voltage is about 6.4 volts. It is suggested that the battery is recharged if its voltage drops below 6 volts.

As the percentage of memory used approaches 100% you should reduce number of tests stored to free up more memory space (see **CHANGING THE TEST NUMBER** below). Doing this erases the tests from memory so remember to first print any stored tests you wish to keep.

If the battery charger is connected the second line of the display will show the recharge current being taken by the battery instead of the percentage memory used. When full charge is reached the current will drop below 30 milli-amperes (mA), and the battery voltage will eventually rise to about 7.25 volts while the charger is connected.

EDITING MODE: The editor allows some of the instrument settings and parameters to be changed. Editing can be password protected. To select the editor press **[R]** and **[S]** together while the display shows ***"SIMRET ready"***, then use **[S]** to select and **[A]** to accept what to edit from the following:

OPERATOR ID: allows the user to change the name identification of the operator. Up to sixteen alphanumeric characters can be entered for each of the 32 ID's that can be stored. Firstly press **[P]** to refresh and to scroll down through the list, use **[S]** to scroll up. Press and release **[A]** to begin editing the ID, use **[S]** and **[P]** to change the character, press **[A]** accept and move on to the next character position. Press and hold **[A]** to save the whole name.

PLANT ID: allows the user to change the plant identification. The characters are edited in the same fashion as Operator ID. The Operator and Plant ID will appear on the printout.

Change Settings: your instrument has various settings which can be turned on or off by the user. The settings you can change are described in **Appendix A** of this manual. Press **[S]** to select NO for a setting (i.e. to turn it off), press and hold **[S]** to select YES (i.e. to turn it on). Then press **[A]** to accept the selection and move on to the next.

Trim Parameters: your instrument is programmed with some adjustable parameters whose values can be changed. They are described in **Appendix B** of this manual. This editing option allows you to change their value. Press **[S]** to change the value of the flashing digit, hold **[S]** to quicken the scan. Press and release **[A]** to accept and move on to the next digit. Press and hold **[A]** to save the whole parameter value and move on to the next.

Trim Zeros: allows the user to periodically check and trim the transducer zero levels. Zeroing can be done on any flat surface by following the prompts on the display. Properly trimmed zeros allow the instrument to be used to make accurate measurements of ground slope. Note that the

zero trimming surface does not have to be exactly horizontal but it must be flat. Make the first measurement with the instrument handle nearest to you, then rotate the instrument through 180 degrees and make the second measurement with the handle away from you.

The vehicle must be stationary while trimming the transducer zero level.

Adjust Clock: allows the time to be changed to compensate for daylight saving. On selection, the minutes value will flash to indicate it can be adjusted, use **[S]** to change then **[A]** to accept the new value, the hours value will then flash and can be adjusted likewise. The date can only be changed at the factory.

Re-calibrate: shows the latest calibration information and allows the factory/distributor to re-calibrate the instrument. Press **[P]** to print a Calibration Report.

CHANGING THE TEST NUMBER: Your **SIMRET** can store the results of up to 50 brake tests in its memory. Each test is identified by a number in the range 1 to 50.

You must **Clear the Memory** when Test 50 is reached or if the memory is full. In either case the instrument will give you the opportunity to print out the stored results first, see **ARMING SIMRET** for details.

If you do **Clear the Memory** all previous stored results will be lost. If you want to keep the results, print them or download them before electing to clear the memory.

You can also create more space in memory by erasing the most recent test results. You do this by pressing **[R]** while the display shows *"SIMRET ready"*, and then pressing **[A]** while still holding **[R]**. The display will then show *"Next Test is N"*, where N will be the test number when the instrument is next armed. You can reduce this number by one each time

[S] is pressed. If you go too far, press and hold **[S]** to start again. Finally press **[A]** to accept the change, or **[R]** to quit without changing.

Remember that, if you change the test number, results from tests with higher test numbers will be lost. Print them out first!

USING YOUR SIMRET

MEASURING SLOPE: To measure the slope gradient press the switch marked **[S]**. The instrument will now continuously measure and display the slope gradient in percent. A negative number means a downward gradient. SIMRET should be levelled so the knob of the levelling screw is flush with the top of the curved stainless steel guide block with the marked yellow disk pointing towards the instrument. If a very accurate measurement is required, first trim the instrument zeros as described in **Trim Zeros**.

If the pedal force/line pressure input option is switched-on, the second line of the display will show the force in Newtons being applied to the Pedal Force Transducer (or pressure in Bar applied to the pressure gauge). If not, the second line will show the gradient as 1 in n.

Note that the instrument assumes that no pedal force is being applied as it enters this *MEASURING SLOPE* mode. It takes the value of pedal force it measures on entry as the zero point and uses this value to compensate for any zero drift of the pedal force transducer. This zero point is automatically saved in the instrument memory. Please make sure that no force is being applied to the transducer at the moment **[S]** is pressed.

Note that the line pressure is not zeroed on entry.

POSITIONING THE INSTRUMENT: To get the most accurate results from your SIMRET 3000Q Brake Tester it should be positioned in the vehicle so that it is parallel to the ground surface. It should also be placed against a forward bulkhead so that it cannot slide forward under severe braking.

The simplest way to align SIMRET is while the vehicle is standing on level ground. In this case, locate SIMRET in the vehicle cab (if possible, against a forward bulkhead) and press the **[S]** button to measure slope. Now adjust the levelling screw until the display indicates a gradient of 0.0%. The SIMRET is now parallel to the ground and ready to be armed. This alignment will remain correct even if the brake tests are done on sloping

ground. The SIMRET printout will show the actual slope of the ground on which a test was done.

If SIMRET cannot be aligned while the vehicle is on level ground, two alternative methods can be used. If the gradient of the ground on which the vehicle is standing is known, then position SIMRET in the cab as before and adjust the levelling screw until the SIMRET display indicates the same gradient as the ground. The gradient is displayed as the sine of the incline angle and as 1 in N, with downward inclines showing negative.

Alternatively, if the gradient is not known, place SIMRET on the ground at a representative point and measure the gradient at that point. Then place SIMRET in the cab and adjust the levelling screw until the display indicates the same gradient. For very accurate measurements trim the zero offset first.

If the trigger pad or pedal force transducer are to be used attach to the brake pedal and connect to the instrument using the cable provided before completing the final adjustment of the levelling screw.

BRAKE TRIGGER PAD: With the SIMRET aligned in the cab as described above, fit the trigger pad accessory to the brake control. When the brake control is operated, the trigger pad will signal to SIMRET that the brakes have been applied and for it to start taking measurements. The signal is latched and the pad can then be released after the first brake application. An extension lead is available for the trigger pad.

If the trigger pad is depressed when the instrument is being **ARMED** (see below) the **DEADMAN BRAKE** trigger is automatically selected. In this mode a *"D"* will appear at the end of the top line of the display when the instrument is armed. In this case the SIMRET will start measuring when the trigger pad is **released**.

PEDAL FORCE TRANSDUCER: The optional pedal force transducer type PFT2 can be used to record the force being applied to the brake control and to trigger the instrument. The PFT trigger level is normally set to 20 Newtons. If used the printout will show the maximum pedal force and the graph will show the variation in pedal force with time in the range up to 1000 Newtons.

Alternatively you can operate the instrument with a manual start and stop using the **[S]** button alone.

ARMING FOR A TEST: Before brake performance can be measured the instrument must be armed. This is done by pressing the switch marked **[A]**. while the vehicle is stationary. You can do this while measuring slope.

Enter a Plant ID, (up to 32 ID's can be stored or download via a PC). Press the **[P]** button first you can then use the **[S] & [P]** button to rotate through your list, once the correct plant is identified press **[A]**.

Enter an Operator ID in the same manner as a Plant ID, press **[A]**.

You can now define the test area, the display should now show UNSPECIFIED AREA, press **[S]** to alter the description that is relative to your test area, if left on unspecified area no reference to the test area will be show on the print out. Press **[A]**.

After a short pause while the display shows *"Please Wait"*, the top line of the display will show *"ARMED TEST N"*, where N is the identification number for the test. This number, which will be between 1 and 50, is used to identify the test results on the printout and in the instrument memory. It increases by 1 after each successful test.

Do not allow the vehicle to start moving while the display shows *"Please Wait"*.

Now start accelerating for the brake test, the second line of the display will show the approximate speed increase since pressing **[A]**.

To disarm the instrument without carrying out a brake test, press **[R]**.

If, when you press **[A]** to arm for a test, the test number exceeds 50 or if there is insufficient memory space left, the display will show *"Clear my Memory?"*. In this case press **[A]** to start again at Test 1, or press **[R]** to quit so that the stored results can be printed. <u>Print the results you want to keep before clearing the memory.</u>

SIMRET will automatically record suspension bounce for about 1.5 seconds at the end of the test.

With the result on the screen press **[P]**, the test will start to print off, alternatively for a quick re- arm press **[A]**.

If you press **[P]** while SIMRET is armed, a *"P"* will appear at the end of the top line of the display. This indicates that the SIMRET will pause at the end of If, when you press **[A]** to arm for a test, the test number exceeds 50 or if there is insufficient memory space left, the display will show *"Clear my Memory?"*. In this case press **[A]** to start again at Test 1, or press **[R]** to quit so that the stored results can be printed. <u>Print the results you want to keep before clearing the memory.</u>

BRAKE TESTING: With **SIMRET** armed as described above, two methods can be used for starting the brake test:

Trigger start-stop: This method uses trigger pad or PFT2 as described. When armed and the brake control operated, SIMRET will automatically starts to measure the deceleration experienced by the vehicle. The display will show *"AUTOMATIC STOP"*. Measurements continue until the instrument senses the vehicle has stopped decelerating, at which time the results are calculated and shown on the display.

Manual start-stop: This method can be used without any external triggering. With the instrument armed as described above, momentarily press and release the **[S]** button as the brakes are applied to start the measurements. The display will show *"MANUAL STOP"*. Press and release **[S]** again to stop the measurements as the vehicle comes to a halt.

With either method, at the end of a successful test the display will show the average result, expressed as a fraction or % of g the acceleration due to gravity, g = 9.81 metres/sec/sec; the **Speed** at braking and the **Stopping Distance**. The **peak pedal force** during braking, expressed in Newtons, is shown on the display if the PFT2 has been used..

If the test was not successful, the display will indicate the possible reason.

The instrument will continue measuring for 1.5 seconds (or longer if the pause facility is used) after the vehicle comes to rest. This records the suspension bounce behaviour for inclusion on the graphical printout. The display shows *"Measuring Bounce"* while this is going on.

The display then shows *"Calculating..."* whilst the results are being calculated. Note that the calculated speed and distance assume the vehicle comes to rest and will be wrong if the vehicle is not brought to a halt during the brake test.

The instrument will automatically measure the track slope at the end of the test. This can be manually adjusted using the pause facility.

Do not allow the vehicle to move off until the results appear on the display.

After a successful brake test, the results are automatically stored in memory. Each set of test results is identified by the test number shown when the instrument was armed for that test.

If immediate printed results are not required press **[R]** in readiness for the next test.

TERMINOLOGY and SET-UP: You may set your SIMRET to measure either average **Brake Effort** or average **Deceleration**. We call the average **Brake Effort** the **Brake Efficiency**. The brake efficiency is virtually independent of ground slope and is the best measure of brake performance. The deceleration on the other hand will vary with ground slope. For example, when going down hill the deceleration will be less because the brakes have to overcome the force of gravity trying to accelerate the vehicle down the hill. Both are expressed as a percentage or fraction of g, the acceleration due to gravity, g = 9.81 metres/sec/sec.

Generally speaking **Brake Effort** *equals* **Deceleration** *minus* **Slope**. On level ground the two are identical.

The average values are normally calculated from when the brakes start to stop the vehicle until it comes to rest. The point when the brakes start to stop the vehicle is determined when the deceleration is sustained above the **braking threshold**. However, if you choose to include the brake delay in the average it will be calculated from when the brakes control was actually operated. This will give a slightly lower result.

The speed at braking and stopping distance are calculated from the measured deceleration of the vehicle. The deceleration is equal to the

brake effort plus the slope on which the brake test was carried out. For example, for upward slopes the force of gravity helps to stop the vehicle, giving a deceleration greater than that due to the brake effort alone. Downward slopes decrease the effective deceleration

To calculate the speed and stopping distance, SIMRET needs to know the ground slope on which the test was carried out. It makes an accurate measurement of this slope three seconds after the brake test (or later if the pause facility is used). This time delay allows the suspension system of the vehicle to settle down after the test. During this time the SIMRET display shows **"Calculating - DON'T MOVE YET"**. Do not allow the driver to move off while the display shows this, otherwise the slope will be measured incorrectly giving errors in the speed and stopping distance.

Note that the Brake Efficiency reading is not affected by any errors in the measurement of the slope of the test course but the speed and stopping distance will be affected.

Note also that the calculation of speed and distance assume an end point speed equal to zero. The calculation will be in error if the vehicle is not brought to a halt during the brake test.

You may set-up you instrument to display results in kph and metres, or mph and yards. Similarly the averages can be shown as either a percentage or fraction of g or metres/sec/sec.

The recommended instrument set-up for heavy quarry vehicle brake testing is:

Miles per hour?	YES/NO
Results in %g?	YES
Delay in Average?	NO
Get Brake Effort?	YES

PRINTING IMMEDIATE RESULTS: To print the results table of the test just carried out, press **[P]** <u>while the results are still shown on the display</u>.

The results table for the test will be printed. This will show the **Brake Efficiency**, the **Time to Stop**, **Brake Delay Time**, **Speed** at braking and **Stopping Distance**, the peak **Pedal Force** in Newtons, the time and date of the test, the test number, the date the next instrument calibration is due, and the instrument serial number. Also printed are the Operator and Plant identifications.

The **Brake Delay Time** is only printed when the triggering facility is used. The **Time to Stop** is the sum of the **Brake Delay Time** and the **Braking Time** (see *Printing Graphs* below).

Note that the instrument will not allow you to print results if the low battery warning is on, or if the battery starts to fail during printing. However, since the results are automatically stored in memory, they can be printed out later on (or duplicate prints obtained) if this happens.

If at any time you wish to terminate a printout press **[R]**.

The printout will show ***"I NEED CALIBRATING"*** if your instrument is due for re-calibration.

PRINTING STORED RESULTS: The instrument will automatically store up to 50 sets of brake test results, each identified by its respective test number. On completion of each successful brake test, the test number will automatically increase by 1.

The results store remains valid even when the instrument is switched off.

To print stored results press **[P]** while the display shows ***"SIMRET ready"***. The display will show ***"Print Test N?"*** (where N is a test number between 1 and 50) and, on the second line, the Plant ID for that test.

To change the test to be printed, press and release **[S]** to move back one test, or press and hold **[S]** to jump to the last test carried out. Then press **[P]** again to start printing the results table for the chosen test. The instrument will remember which test number you reached in the print sequence and carry on printing from there even if a new test was printed in the immediate mode (see above). Changing the test number in this print mode will not erase any results.

You can also print all the stored results from the indicated test number up to the last test carried out. Do this by pressing **[A]** instead of **[P]** while the display shows *"Print Test N"*. This does not apply to the immediate printouts described above.

Remember the print sequence number will be changed (and stored results erased) if the Test Number is changed during Arming.

PRINTING GRAPHS: the instrument can also print graphs of the brake effort as a function of time. After printing a results table, the display will show *"PRINT GRAPH N ?"*. If a graph is required press **[P]**, if not press **[R]**.

The graph will be automatically scaled to suit the results. The graph axis is scaled to give either 0.125 g, 0.25 g, 0.5 g, 1.0 g or 1.5 g full scale (or the equivalent in metres/sec/sec), and the time axis scaled to match the time between the brakes being applied and the vehicle coming to a stop. At the end of the graph, the time axis scale will be printed.

Three solid lines appear on the graph. The first line is at the *external trigger time* when the brake control was operated. The other two are at the points in time when the deceleration first and last crosses the **Braking Threshold** (for the required start and stop window time respectively - see Appendix B). These are the *brake start* and *brake end times* respectively. The time between these latter two lines is the **Braking Time**. The time between the *external trigger time* and the *brake start time* is the brake **Delay Time**. Some pre-braking measurements will be plotted on the graph prior to the *external trigger time*.

Beyond the *brake end time* the graph records the suspension bounce for a further 1.5 seconds. In this portion of the graph negative values are plotted as shaded. Suspension bounce is not recorded in manual start/stop, nor are the brake start and end times recorded on the graph.

The average brake effort or **Brake Efficiency** is calculated over the **Braking Time** unless you set the instrument to include the readings taken during the brake **Delay Time** in the average. The **Time to Stop** is the **Braking Time** plus the brake **Delay Time**.

If at any time you wish to terminate a graph printout press **[R]**.

If you have recorded pedal force or line pressure during a brake test these will also be plotted on the graph.

EXTERNAL INPUTS

With appropriate transducers you can also use your SIMRET to record and plot the brake pedal force or the brake line hydralic/air pressure during a brake test. The PFT2 pedal force transducer has been specifically designed for for use with SIMRET and will withstand pedal forces of up to 2000 Newtons. Consult Turnkey Instruments for suitable pressure transducers to measure line pressure.

PC-LINK

Test results recorded by your **SIMRET** can be downloaded to a Windows computer for more detailed analysis and archive purposes.

A PC-Link interface and software disk are required to download from the instrument.

To install the USB drivers for the PC-link, connect the PC-link to an available USB port and follow the on-screen windows hardware wizard. Further instructions can be found included in the driver folder. WINSIM is software for Microsoft Windows with which you can download from SIMRET to your PC and maintain an interactive database of your brake tests results. You can interrogate the database by plant ID, operator, test date range, or brake performance. You get on screen graphs of the brake effort, which can be manipulated and analysed with the help of "on screen" buttons, and you can produce a full test report. Call the factory for more information.

MAINTENANCE

*The are no user serviceable parts inside the **SIMRET** instrument case.*
The manufacturer's warranty is invalidated if the case seal is broken.

CHARGING THE BATTERY: To re-charge the **SIMRET** battery, connect the charger supplied with the instrument to the DIN connector on the rear panel. Switch on the mains power to the charger. A full charge takes about 12 hours.

With a fully charged battery, the **SIMRET** can be operated for up to 20 hours, depending on how much the printer is used.

Always recharge the battery as soon as possible after the ***"Charge Battery"*** warning appears on the display.

To get the best performance and battery life out of your **SIMRET** it is important that the battery is kept in good condition.

To keep the battery in optimum condition and the instrument ready for use we recommend the following charging schedules:

1   If the instrument is in regular use, re-connect the battery charger after every testing session and leave the instrument permanently on charge.

2   If the instrument is not to be used for a month or so, fully recharge the battery and then disconnect the charger. Then at monthly intervals give the instrument a 24 hour top up charge. In this way, the instrument will always be ready for use.

3   If the battery has gone into deep discharge through neglect or miss-use, it may take up to 72 hours of re-charging to fully recover its capacity.

CHANGING PAPER ROLL AND RIBBON: Remove the printer cover. This is held in place by the two Allen key screws on the top of the instrument. Lift out the paper roll and carrier and tear through the remaining paper strip to leave a short length feeding into the printer.

Remove this strip of paper by carefully pulling it upwards through the printer.

Remove the printer ribbon by pressing on the right hand side near the PUSH marker.

Fit a new roll of paper onto the roll carrier so that the paper will feed upwards into the printer mechanism from the bottom of the roll. Make sure the leading edge of the paper strip is square.

Replace the paper carrier. Feed the leading edge of the paper strip into the bottom of the printer and wind through by turning the knurled plastic screw on the left hand side of the mechanism. Once the paper appears out of the top of the printer, pull through a short length to align it properly.

Pass the ribbon over the leading edge of the paper and then gently press it down onto the printer mechanism until it clicks into position. Tension the ribbon by turning the adjuster on the left hand side in the direction of the arrow.

Replace the printer cover.

CALIBRATION: The **SIMRET** instrument is supplied with a self-printed **Calibration Report** with the instrument identified by its serial number. Additional copies of the Calibration Report can be printed by the instrument.

It is recommended that the be re-calibrated once per year or earlier if the instrument self test warns of a calibration fault.

The manufacturers and distributors can offer a full Re-calibration and
Maintenance Contract for your **SIMRET**.

NOTES

For help and information please contact:

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APPENDIX A – CHANGING SETTINGS

*Use <u>hold</u> **[S]** to choose YES to turn a setting on, or **[S]** and <u>release</u> to choose NO to turn it off. Then press **[A]** to accept and save the setting choice and move on to the next one.*

PASSWORD PROTECT? Choose YES to protect the settings and parameters with the password ***. The password must be entered via the keypad before the **Editing Mode** can be used.

LINE PRESSURE? Choose YES to record the brake line air or hydraulic pressure during the brake test. An external pressure transducer must be connected to the DIN socket. This should give an output of 0.4 volt at 0 bar pressure and 2.0 volt at 100 bar. Consult the wiring diagram in Appendix C for DIN socket pin connections.

PEDAL FORCE? Choose YES to record the force applied to the brake pedal during the brake test. Fix the optional **Pedal Force Transducer** to the brake pedal and connect to the DIN socket.

FAST SAMPLING? Choose YES to record at 400 samples per second instead of the normal 40 per second. Will use up memory 10 times as fast but useful for studying high speed ABS oscillations.

LCD BACKLIGHTING? Choose YES to illuminate the LCD for use at night. The extra current drain will shorten time between battery re-charges.

FINE SLOPE? Choose YES to display the slope gradient to 0.1% in the **SLOPE MEASURING** mode. Otherwise measures to 1%

MILES PER HOUR? Choose YES to show, print and download results in mph and yards, NO for kilometres per hour and metres.

RESULTS IN m/s/s? Choose YES for the results to be displayed and printed in metres/second/second, NO to display and print as % or fraction of g. (where g=9.81 m s-2 the acceleration due to gravity)

RESULTS IN % g? Choose YES for the results to be displayed and printed as a percentage of g, NO to display and print as fraction of g. (where g=9.81 m s-2 the acceleration due to gravity)

DELAY IN AVERAGE? Choose YES to include the measurements during **Brake Delay Time** period in the average g result (will give a lower average reading), NO to start the average after the brake delay.

Get BRAKE EFFORT? Choose YES to measure **Brake Effort**, NO to measure **Deceleration**. The Brake Effort measurement is virtually independent of the ground slope so you obtain consistent results wherever you do the brake tests. Brake Effort equals Deceleration minus Slope

APPENDIX B – TRIMMABLE PARAMETERS

Tilt 5.00 degrees/g - this compensates for the tilt of the vehicle, caused by the movement of its suspension, as it decelerates. The default value of 5.0 degrees per g is suitable for heavy dump trucks. Vehicles with softer suspension require a larger tilt compensation.

Brake at 10.00% - this is the deceleration in %g of the **Braking Threshold** which determines the start and end of braking. It is also the threshold for the end of the **Brake Delay Time** period. It can be adjusted between 00.00% and 99.99% g. The default value is 10.00% g.

Starting 00.50 secs - the time window the deceleration must be sustained at more than **braking threshold** for the braking to be determined to have started (and the Brake Delay to have ended). The *brake start time* is then taken as the beginning of this time window. The time from the **External Trigger** to the *brake start time* is the **Brake Delay Time**. The Starting Time Window can be adjusted between 00.00 sec and 02.55 sec, the default value is 00.50 secs.

Stopping 00.20 secs - the time window (after a valid start) the deceleration must be sustained at less than **braking threshold** for the braking to be determined to have ended (and the vehicle to have stopped). The *brake end time* is then taken as the beginning of this time window. The time between the *brake start* and *brake end times* is the **Braking Time**. The average g reading will be calculated over this interval unless you have specifically included measurements during the Brake Delay Time as well. The Stopping Time Window can be adjusted between 00.00 sec and 02.55 sec, the default value is 00.20 secs.

MAX over 00.20 s - the time window interval in seconds over which the developed or sustained peak reading is determined. The default interval is 0.2 seconds. It follows that the value determined will be greatest lowest value seen as the window is scanned across the data.

PFT Trig 20.00 N - this is the brake pedal force in Newtons required to trigger the instrument when using the pedal force transducer.

APPENDIX C – DIN CONNECTOR

Pin Connections Viewed onto DIN Plug Mating Face
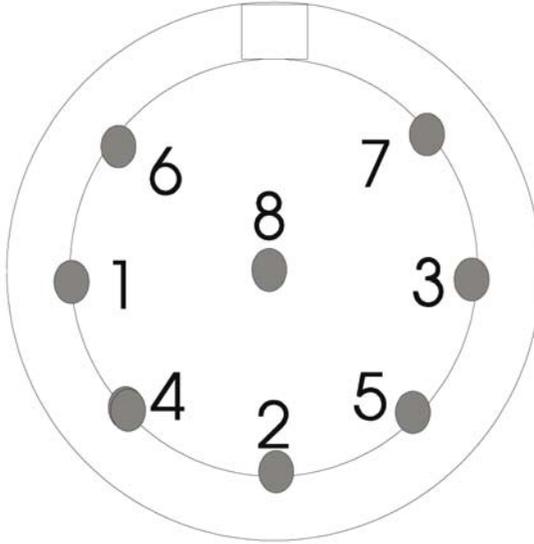
Pin 1   external trigger input, serial data out, barcode input
Pin 2   battery charger -ve and case
Pin 3   digital status input, serial data input
Pin 4   pulse input
Pin 5   signal common
Pin 6   voltage output (5.5 volt approx)
Pin 7   analogue input 0.4 volt to 2.0 volt (pressure)
Pin 8   battery charger +ve

APPENDIX D – TECHNICAL SPECIFICATION

Measurement Accuracy	better than ±2% over full scale, better than ±1.5% from 15% g to 90% g
Measurement Range	0 to 140% g (g=9.81 metre/sec/sec). Resolution 0.1 % g., 40 or 400 measurements per second
SIMRET Printer	40 column dot matrix type with graphics
SIMRET Display	2 line alphanumeric LCD with backlight
Real Time Clock	months and leap years adjust automatically
Bar Code Input	scans plant and operator identification (uses code 39 bar codes)
Start Trigger	from brake pedal air pad or pedal force transducer
Computer Link	serial RS232. The instrument's memory saves results of up to 50 brake tests for transfer into PC database or spreadsheet or **WinSim**
Battery	6 volt rechargeable, operates for over 16 hours from full charge. Display shows battery voltage and warns when re-charge required
Battery Charger	unregulated 12 volt DC 600mA from AC mains. Re-charge current shown on display
Keypad	tactile feel with audio feedback. Full alphanumeric entry for operator and plant identification
Pedal Force Transducer	Detachable type **PFT2** with auto zero, 2000 Newtons FSD, accuracy better than ±2%
Size and Weight	220 x 140 x 110 mm, 4.5 kg nett

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