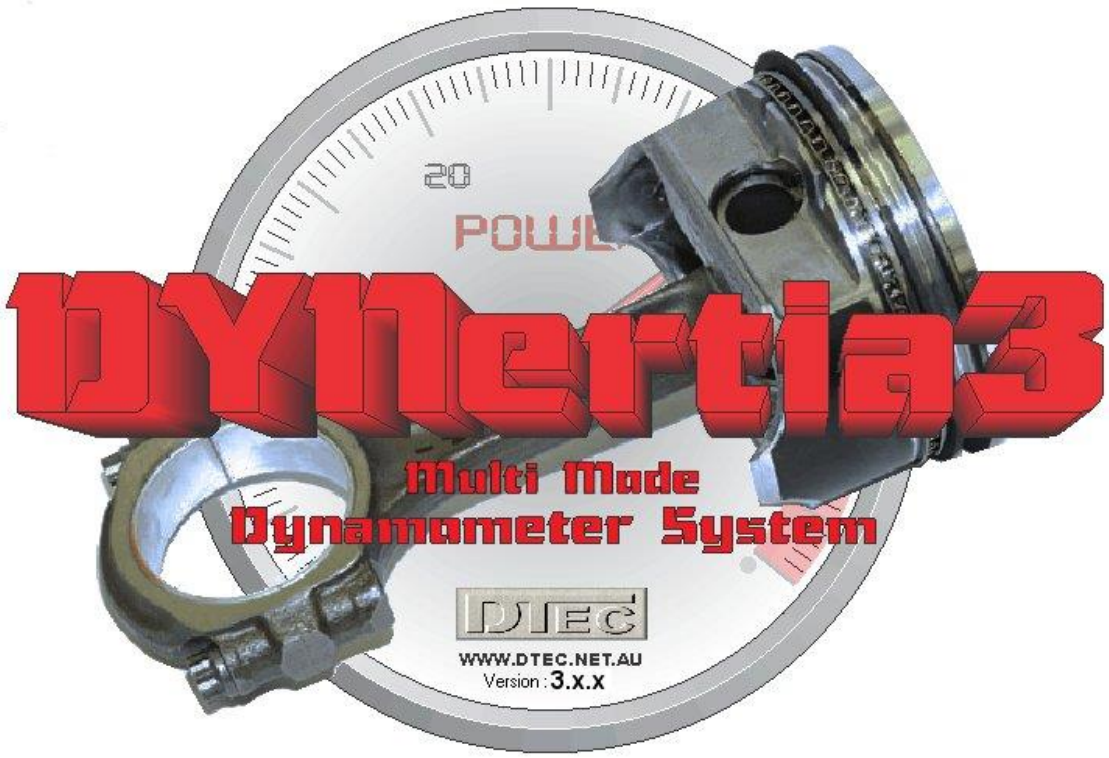


‘Quick Start’ Guide for Inertia Dyno- ‘Engine’ Type

(see www.DTEC.net.au for ‘Quick Start’ guides on other dyno types)

‘Quick Start’ Guide: Version IE 8.3 (≥ V3.3.0 software)

STOP !!!

Important notice
To be read in conjunction with the main DYNertia3 manual!

The following ‘Quick Start’ guide contains basic information for your Inertia dyno (engine type)

This is a brief overview of some main operations, it builds the base that will allow understanding of the features explained in the main DYNertia3 manual (included under the ‘Help’ menu).

Tip- There are sample test Runs installed along with DYNertia3 software so you can learn to use many of the features without needing to perform actual ‘Runs’.

Table of Contents

Concept

An inertia type dyno operates on the principle of calculating the power required to accelerate a known mass, which is basically just an additional 'dyno flywheel' driven by the engine. The controller senses the velocity of this rotating mass, handles the precision timing required and outputs this data to the PC for analysis and storage.

The included 'DYNertia3' software package handles all the functions required for dyno control, setting up, saving runs, correcting for atmospheric conditions, filtering, displaying data, printing, overlaying and analyzing multiple runs.

Hardware Mounting & Basic Wiring for Initial Setup

Mounting the DYNertia Sensor and Magnet

Mount the sensor system to detect the rotation of the roller/shaft.

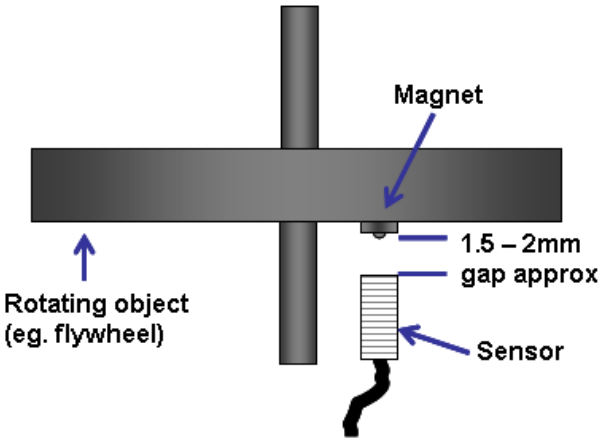
Note: Do not mount the magnet at the outside diameter of the dyno roller/shaft as the centrifugal forces will be highest; choose a location towards the centre area. The magnet is also very fragile and must be handled with care!

Note: The included sensor will only detect the 'South' Pole of a magnet, so the magnet must be have the South Pole (marked with red paint) facing the sensor!!

Mounting by screwing/gluing flat to dyno flywheel-

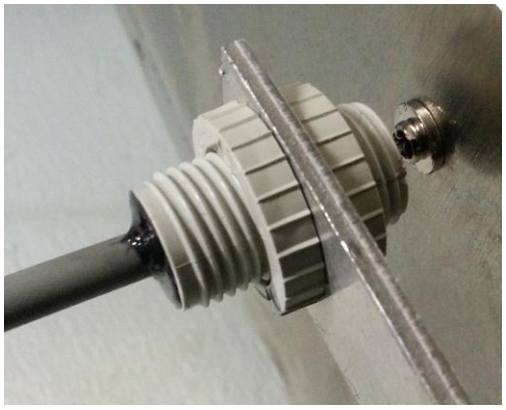
Dyno flywheel is drilled and tapped for 4mm screw (3.3mm drill size is usual for 4mm tapping). Short (min 6mm) screw inserted into magnet. Do not over tighten or magnet may crack!

Magnet epoxy glued and screwed to dyno flywheel with South Pole outwards.

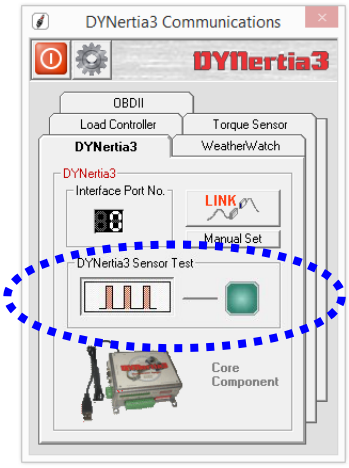


The sensor face **must be positioned 1.5 - 2mm** from the magnets **South Pole** (or the head of the screw if one is used to secure magnet).

A16mm diameter hole is required to mount the sensor. Do not over tighten the lock nuts or they will be damaged. A small 'blob' of silicon sealant or similar is applied to the edge of the nuts to stop them loosening with vibration.

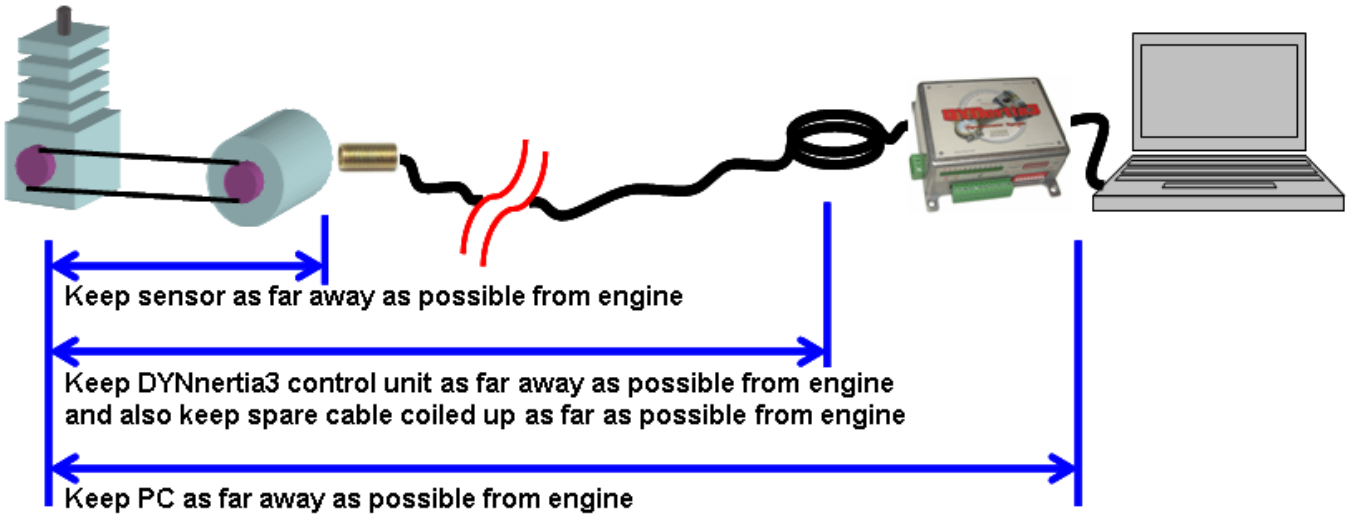


Tip- After the 'Linking' process (discussed later) the sensor operation can be checked via the button "DYNertia3 Sensor Test". The indicator and an audible noise can be used to confirm sensor operation during slow rotation. The indicator lamp/noise triggers for a short time as the magnet approaches the sensor (only on approach).



KEY POINTS- 1.5 – 2mm gap. Safe magnet mounting, South Pole (marked with red paint) of magnet facing towards the sensor!

DYNertia Control Unit Mounting



1) Mount the sensor unit at the furthest distance (**'every inch counts'!**) from the engine as possible. Route all cables as far as possible away from the engine (and any electric motors such as cooling fans) and keep the controller and PC at a distance. Coil any spare cable up neatly at the PC. Keep the sensors lead away from the USB lead or any other wiring.

It's best to route cables inside a protective metal tubing or keep separated from the engine by mounting behind the earthed metal of the dyno frame or shields. Secure at the DYNertia control unit to prevent movement of the cables.

DYNertia3 software can even be operated by remote control if required (wireless keyboard or a PC 'page turner' as one option), tests can be started and stopped and new files even created (names incremented).

2) **Always** use resistive Spark plugs and suppressed Spark plug leads to prevent interference (at least during testing).

Tip- A suppressed spark plug lead from a car can be put in series with the existing spark plug to reduce interference.

This additional spark lead is essential on many go-kart engines as they have particularly 'noisy' ignition systems!

Basic wiring

Dyno only needs the USB and the speed sensor connected for use.

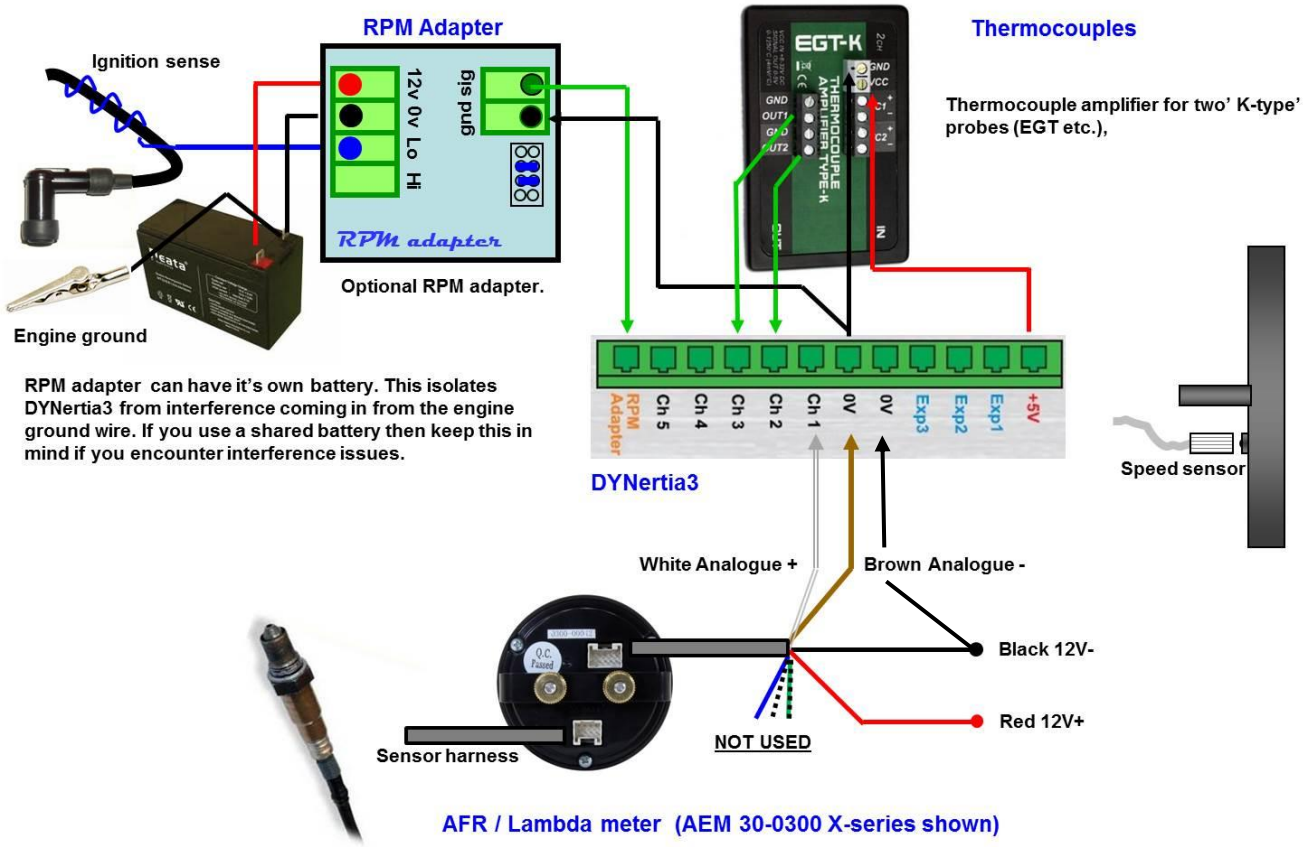
Example of wiring with some additional devices shown

Note: Until correct dyno operation is confirmed and some trial runs have actually been done –

Do not connect any sensors to input terminals

Do not connect anything to the "RPM Adapter" input, including the 'RPM adapter' (if you have one)

Please refer to the main DYNertia3 Manual (found under 'Help' menu) chapter called 'Inputs- Using' for full wiring details on connection of optional data acquisition devices or 'RPM Adapter'.



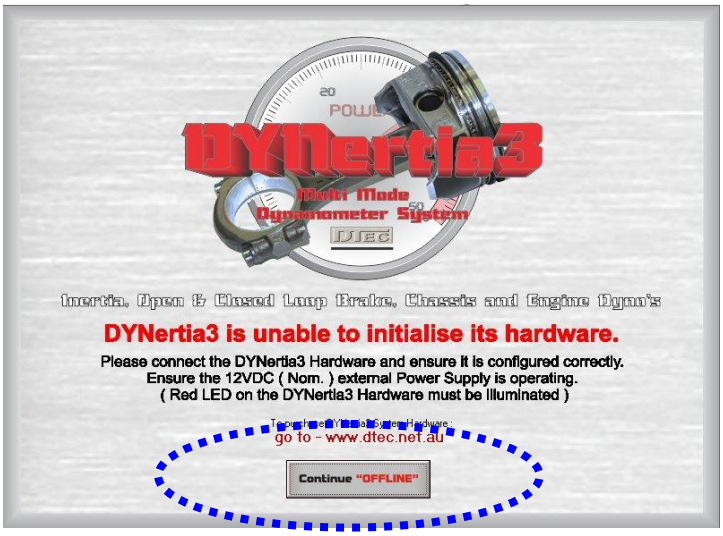
‘Linking’ Hardware to PC

Do not run other programs when using DYNertia3, background processes could interfere.

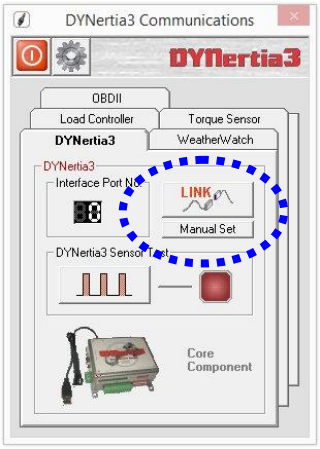
1. When you first run DYNertia3 you will be shown this Window. Press the “Continue OFFLINE” button, this is necessary as DYNertia3 software does not yet know what PC communication port your control units are connected to, it must be first ‘Linked’.

Once ‘Linked’ DYNertia3 will automatically find the hardware in future when it is connected, powered and the software is started. If you plug DYNertia hardware into another USB port you may need to re-link.

This Window will also appear whenever DYNertia3 is started and the control units are not connected, powered or ‘Linked’. Pressing the “Continue OFFLINE” button allows you to continue to use DYNertia3 software to view and analyse data ‘off-line’ (i.e. with no hardware connected to the PC).



2. Plug the USB lead in, start DYNertia3 software, select the menu option “Setup” and then choose “Communication” and then press the “LINK” button to DYNertia3 to automatically configure the port interface. Then repeat for ‘Weather Watch’ if connected.



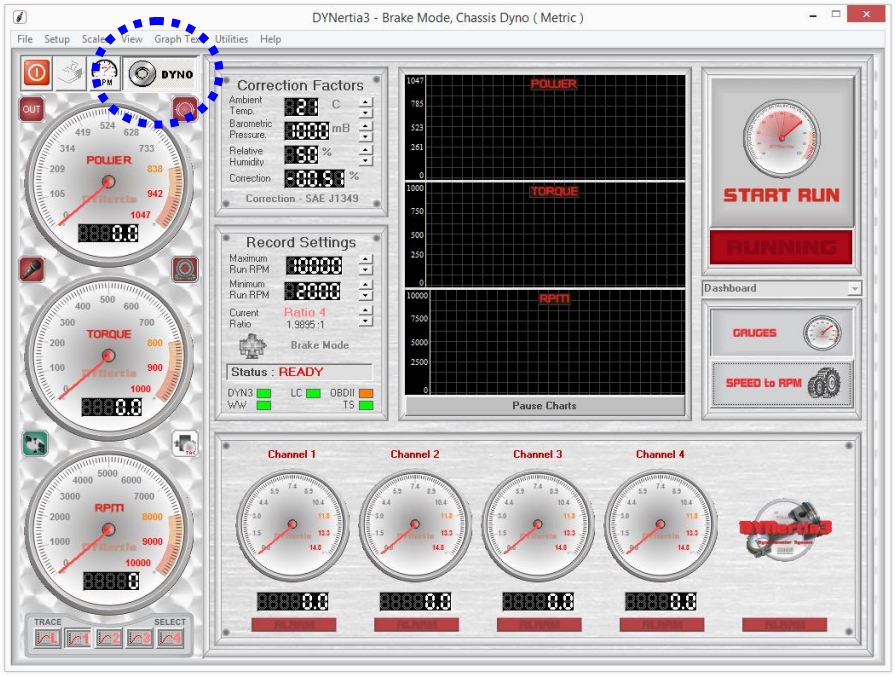
With the USB connected to DYNertia the status LED (next to the sensor connector) will blink twice at first to indicate microprocessor is initialising. After this the LED will illuminate to indicate power.

Two Main DYNertia3 Windows (DYNO / GRAPH)

Press the "**DYNO**" / "**GRAPH**" button to change between the 2 main Windows of DYNertia3.

The '**DYNO**' Window is used to select and create files, enter the weather details, record vehicle test data, 'teach' gear ratios, view RPM/speed and control the testing.

Note: This Window is only visible when the control unit is connected, powered and 'Linked'.



Note: The Row of gauges (input channel data) shown along the bottom of the screen are visible with a single monitor. With duel monitors this data is displayed on the second monitor instead and replaced with the test 'comments' field (also found in 'View' menu).

The '**GRAPH**' Window displays the Power and Torque as traces that can be overlayed and analysed. Traces from a test Run can be selected, loaded from file and compared.

Note: The 'Setup' menus (and most menus) discussed in the following pages are only accessible from this GRAPH screen (they are 'greyed' out in DYNO screen)

Note: The RPM/Speed button makes the software use either units of RPM or speed (e.g. kph) for the controls, displays and graphs.

Note: When test Runs are visible on the graph we refer to them as 'traces'.

Note: The DYNertia3 Window does not size itself to the PC screen, if you wish you can adjust your PC screen resolution to best suit (Program Window size is1024 x 768)

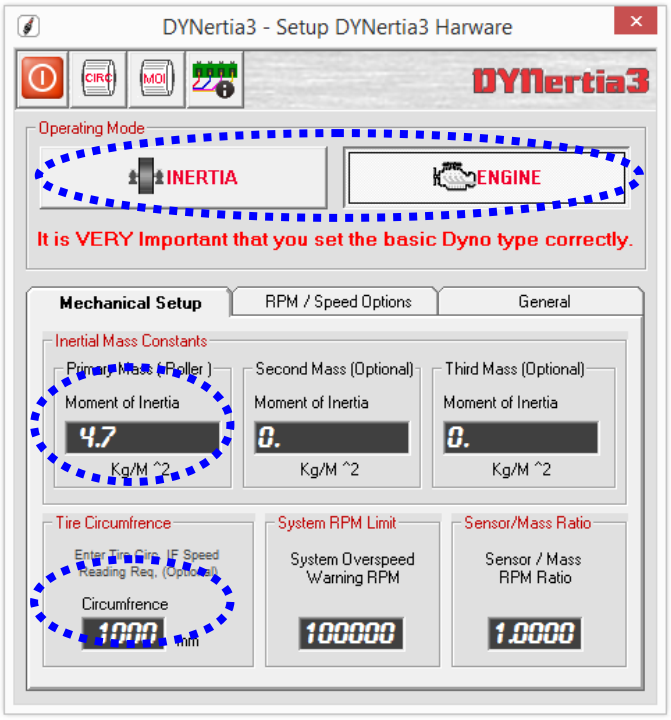
Basic Hardware Settings

As an example of a basic test 'Run' we will test a go-kart engine on the inertia engine dyno and save the results for future reference.

This example the Dyno flywheel inertia factor of 4.7 kg/m² (can be calculated by pressing the 'MOI" button in Setup/Hardware). Dyno flywheel is coupled to the engine by a chain, with a 60 tooth dyno flywheel sprocket and a 10 tooth engine sprocket, for this example we will assume engine has no gearbox. DYNertia sensor is picking dyno RPM up from the dyno flywheel. Leave program settings in their default position.

First time use, Hardware setup

At the top Left of the Window you will find the menu options. Under the menu option "Setup" you will find "Hardware".



Ensure 'INERTIA' mode is selected.

Select 'ENGINE' dyno type.

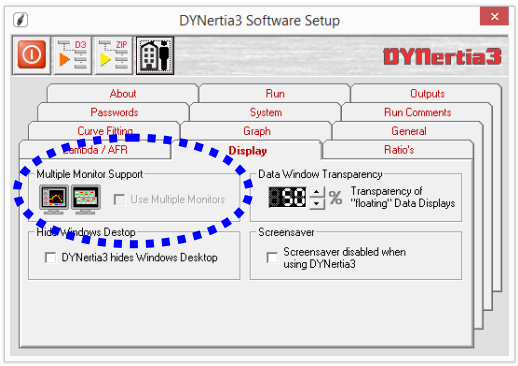
Tire Circumference: For an engine dyno the circumference field is not important, but if you enter a value matching the distance the vehicle would travel in one revolution of the dyno flywheel then this allows accurate display of speed.

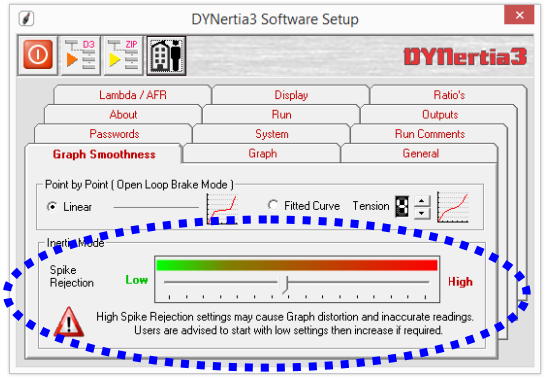
Inertia Mass: Enter the dyno's MOI (Moment Of Inertia) inertial value, 4.7 for this example.
As mentioned above, your dyno's inertia value can be calculated by pressing the 'MOI" button at the top of the window.

Leave other settings in their default position as shown, especially DO NOT choose any alternative RPM source.

Basic Software settings (default)

Shown below are the software settings (menu choice 'Setup/Software'), see the main DYNertia3 manual for any details. Leave the settings at default (except multiple monitor if possible), but take the time to see what options are available–





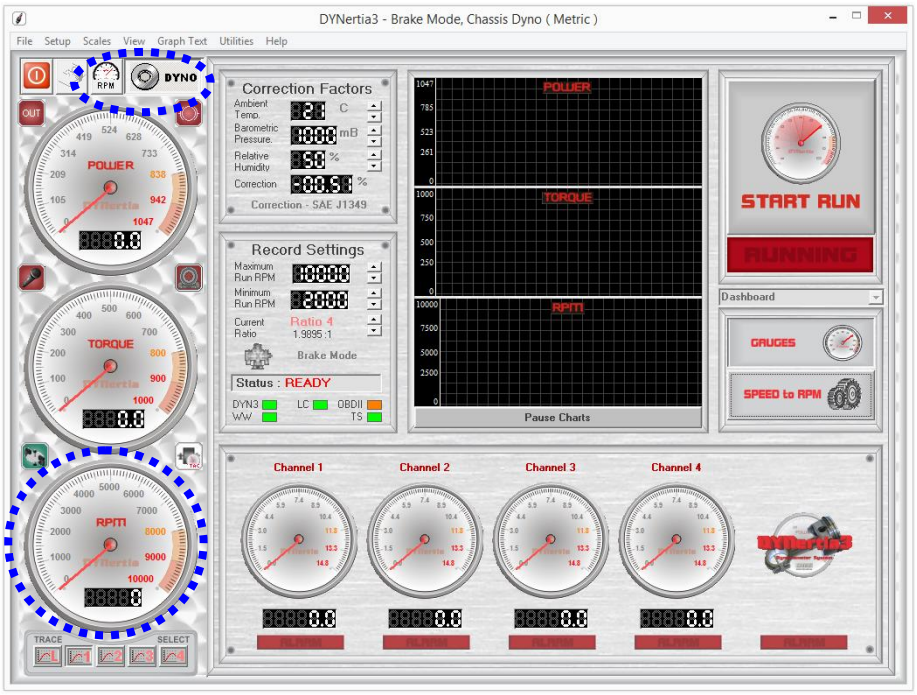
Note: The option "Multiple Monitor Support" is strongly recommended. Having two monitors allows additional functions.

Inertia Mode Graph Smoothness: When testing on an inertia dyno this filtering value determines the level of smoothing applied to the data. This has the effect of displaying data that is not so wildly changing due to small cyclic variations in engine firing and dyno mechanical tolerances.

Quick Test of Dyno Speed Sensor

Before performing testing it is advisable to do a quick function check. Open the main 'DYNO' Window and observe the RPM gauge while vehicle is turning the dyno (at this stage it will show the shaft RPM at the sensor, not engine).

It is often worth a quick look before dyno testing to check for a steady and accurate reading as this will show the RPM ratio setup is correct and the speed sensor is operating.



At this stage of setup the gauge will just be displaying dyno shaft RPM, not engine RPM as no drive ratio has been specified

It may require you to rescale to observe the reading. See 'Note' below.

The software will not display at very low RPM, so drive at reasonable speed.

The RPM/Speed button makes the software use either units of RPM or speed (e.g. kph).

Note: The scales of the gauges used during actual testing can be altered in the menu option 'Scales' (when analysing existing runs they are automatically scaled).

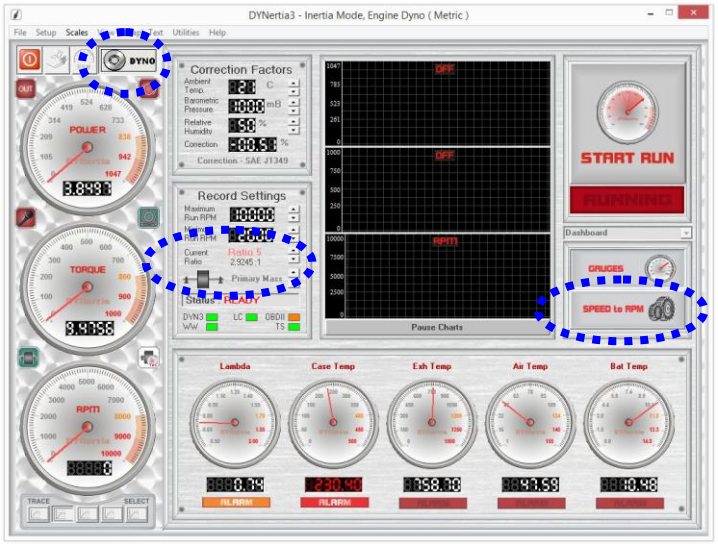
Note: In inertia dyno mode the 'Torque' and 'Power' displays do not show data during a test, these are for analysing data after a test.

Displaying Engine RPM (One Method)

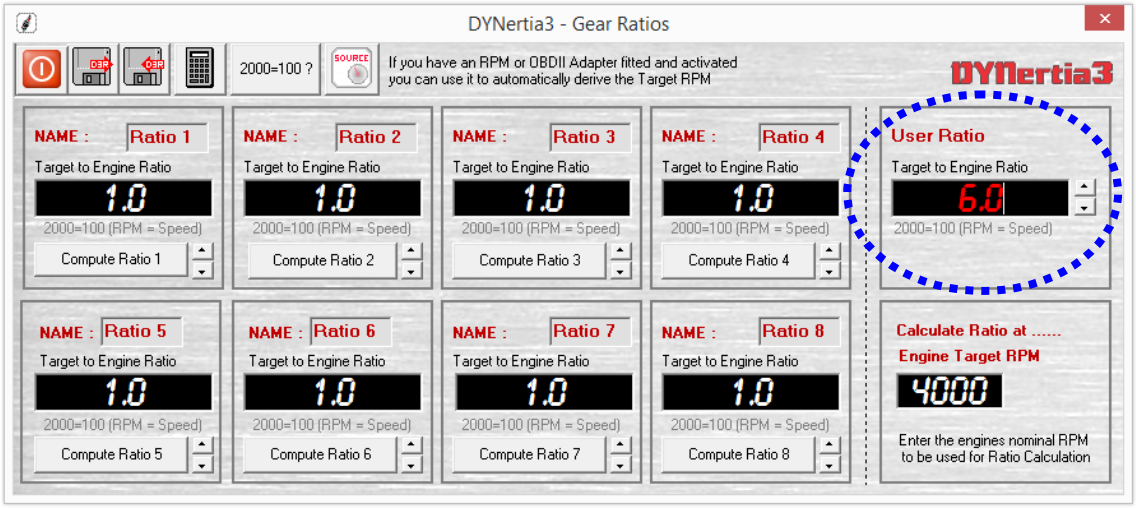
We are going to test for now without a direct engine RPM signal (such as from the optional 'RPM Adapter').

As we do not have direct measurement of engine RPM we have three options for testing. We could 'teach' it a drive ratio (good if we had a gearbox and didn't know the drive ratio), but we will choose another option which we will call 'option 4'. **All other relevant RPM input options are explained in the main manual!**

Option 4- Manual Ratio Entry- If DYNertia3 knows the drive ratio between the engine and the dyno flywheel it can calculate actual engine RPM from the dyno flywheel RPM (as measured by the sensor). This option will require you to know the drive ratio being used, in this example it is 6:1 (engine to dyno flywheel ratio = 60 teeth / 10 teeth = 6).



Press the 'Speed to RPM' button, right hand side on the main 'DYNO' Window to make the Window shown below visible.

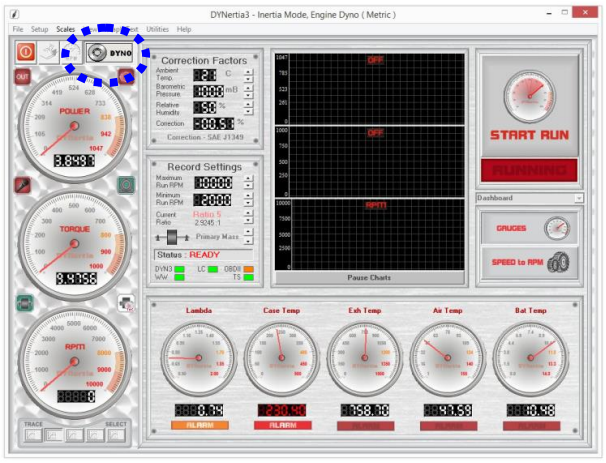


Manually enter the ratio ("6") into the 'User Ratio' field. Press Enter and your setting will be transferred to the 'Record Settings' panel for "Current Ratio" (in the 'DYNO' Window).

That's it! DYNertia3 now knows the engine RPM for any dyno flywheel speed.

Performing a Basic Inertia Test 'Run'

All dyno run setup is done in this main 'DYNO' Window:

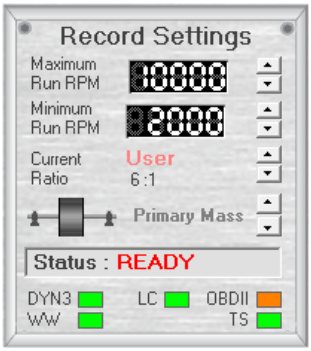


Enter the current Temperature, Barometric pressure and Humidity into the 'Correction Factors' box. If you have no weather data then go to menu option "Setup/Software" and select "No correction" in "DYNO Correction Systems".

If you have the optional 'Weather Watch' hardware all this data is updated automatically, but first you must select the menu option "Setup/Communications", connect the unit and 'Link' the Weather Watch hardware.

It is important to set 'Record Settings' 'Run Minimum & Maximum' to a suitable start and finish RPM for the test. Set the maximum run RPM to just <u>below</u> the RPM you wish to test to, set the minimum RPM to just <u>above</u> the RPM you start testing at.

Check that 'Current Ratio' is set to "User Ratio", as this selects the user ratio value previously entered into the 'User Ratio' field ('6' in this example).



You are now ready to perform a test!

Run the engine and hold the speed below what you have set for a 'Run Minimum'.

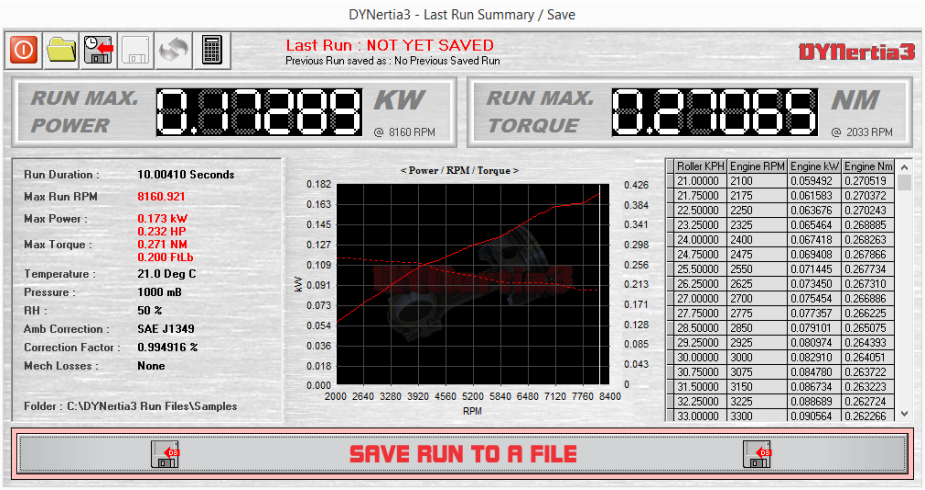
Press 'Start Run' button.

Snap open the throttle (when the 'Minimum Speed' is exceeded recording begins). When the maximum RPM you wish to test to is reached shut off throttle and pull in the clutch simultaneously! (If fitted, else overrunning clutch or start to brake to slow the dyno flywheel)

Press 'Stop Run' button again to end recording.

After the test finishes you will be presented with a test run summary and you can decide now if you wish to save the run.

Tip- You can click on the graph in the summary to see the data highlighted in the table.

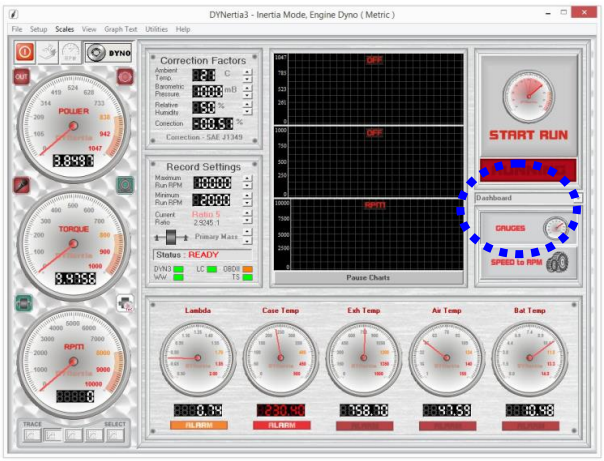


Enter a descriptive run file name for easy future reference. The default folder used is called 'Samples'!

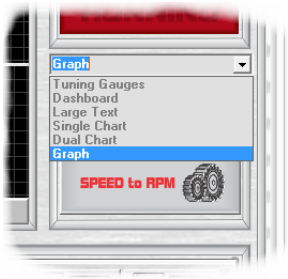
Observing the engine data during a test

The available windows to view data in depend on the fitment of a second monitor.

Note: In inertia dyno mode the 'Torque' and 'Power' displays do not show data during a test, these are for analysing data after a test. Keep this in mind when selecting suitable data to display on secondary screens



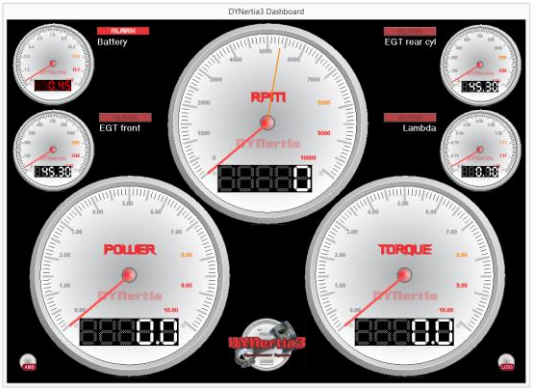
Due to limited screen space, with only a single monitor the data is displayed as shown to the Left. There are chart recorders and gauges for RPM, whilst the 4 data channels are displayed on a second set of gauges with alarm limits.

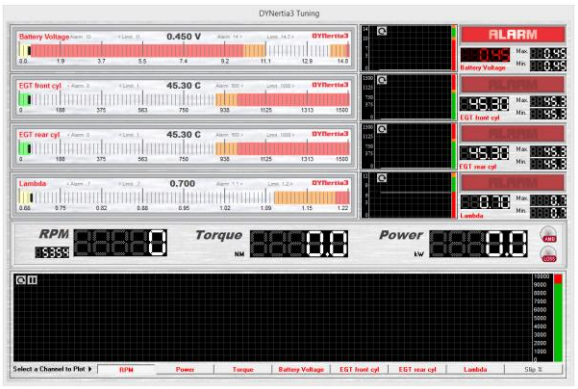


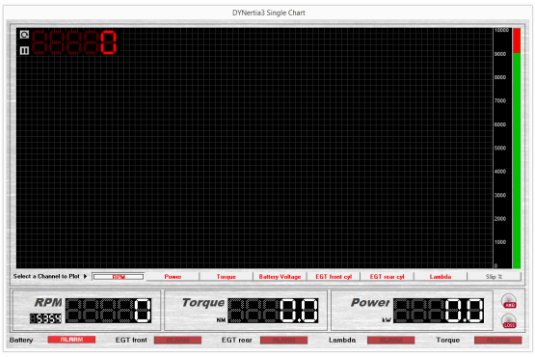
If a multiple monitors are fitted then there will be a dropdown list of possible display Windows for the second monitor.

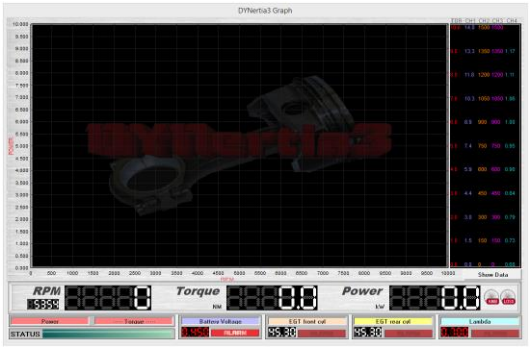
Note: Press the 'GAUGES' button to turn second display on and off.

Below is a preview of the Windows available on a second monitor, not all are relevant for an inertia dyno. Please see main manual for full details.





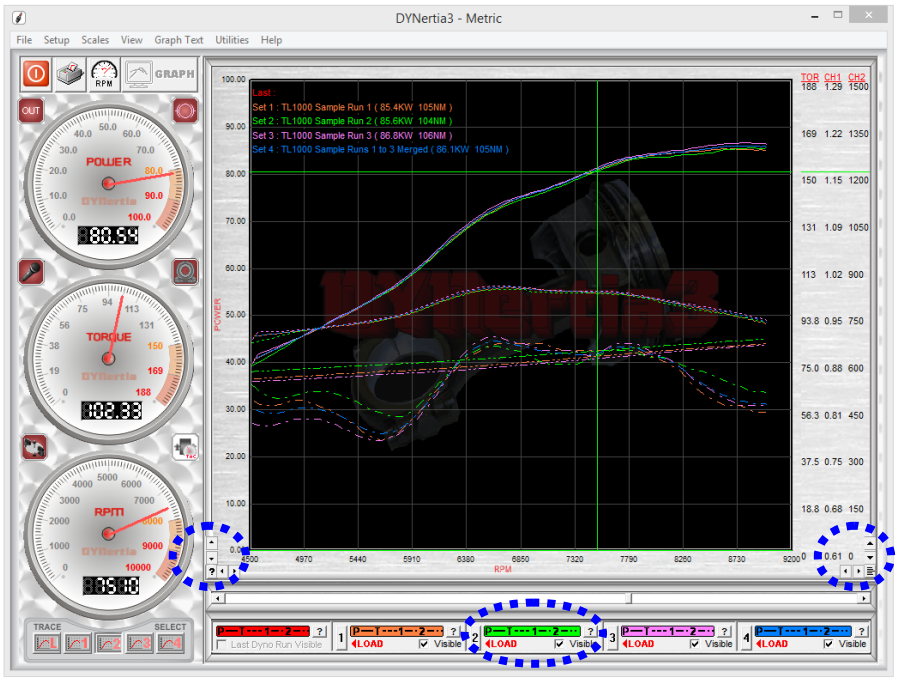




Viewing/Loading of Runs ('Graph' Window)

We will outline the basic functions needed for viewing, selecting and loading data from test Runs.

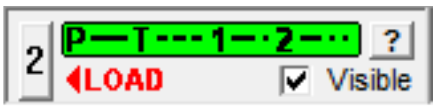
Loading test Runs into the Graph Window to view and analyze



With default software settings, If you have just performed a test then this 'GRAPH' Window will appear automatically.

The last Run you did will appear as a RED trace (not shown here) and any others already 'loaded' will be shown as various alternate coloured traces.

The scales are automatically set to the highest data values. To 'zoom' in or out of areas of interest on the graph use the "◄►▲▼" buttons in the lower graph corners.



When Runs are 'loaded' into the GRAPH Window we use the 'Trace Set Controls' (coloured boxes beneath the graph) to control them, one for each of the 5 traces that can be viewed (actually 10 using secondary screen). To temporarily 'hide' any trace from view 'click' on its Check Box "☑", to view associated data and notes 'click' on the "**?**" button.

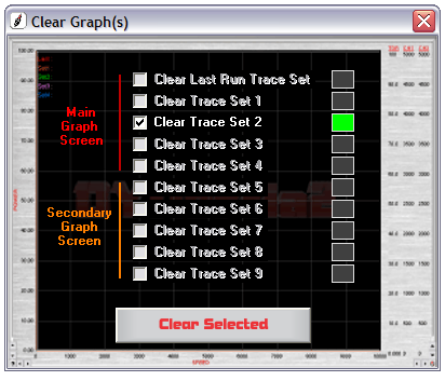
Load runs- To load a new Run into the graph for viewing or to change an existing one 'click' on a trace number (button numbered "2" in this example above), this will open our '**DYNertia File Explorer**' Window (detailed next page) where we can select a test Run to be shown as trace '2'.

In 'DYNertia File Explorer' you can select a Folder of choice and when each Run file is selected (one 'Left Click') its data table, its general notes, key data and preview graph are shown.

Single 'Right Click' on the Run file of interest and it will be loaded as the new 'trace set' back in the main GRAPH Window!

Clear runs- To remove traces from the graph (un-load them) press your keyboards Shift and Delete keys (or menu option "View/Clear Graphs").

Note: Files are not deleted or modified; they are just not selected for viewing.

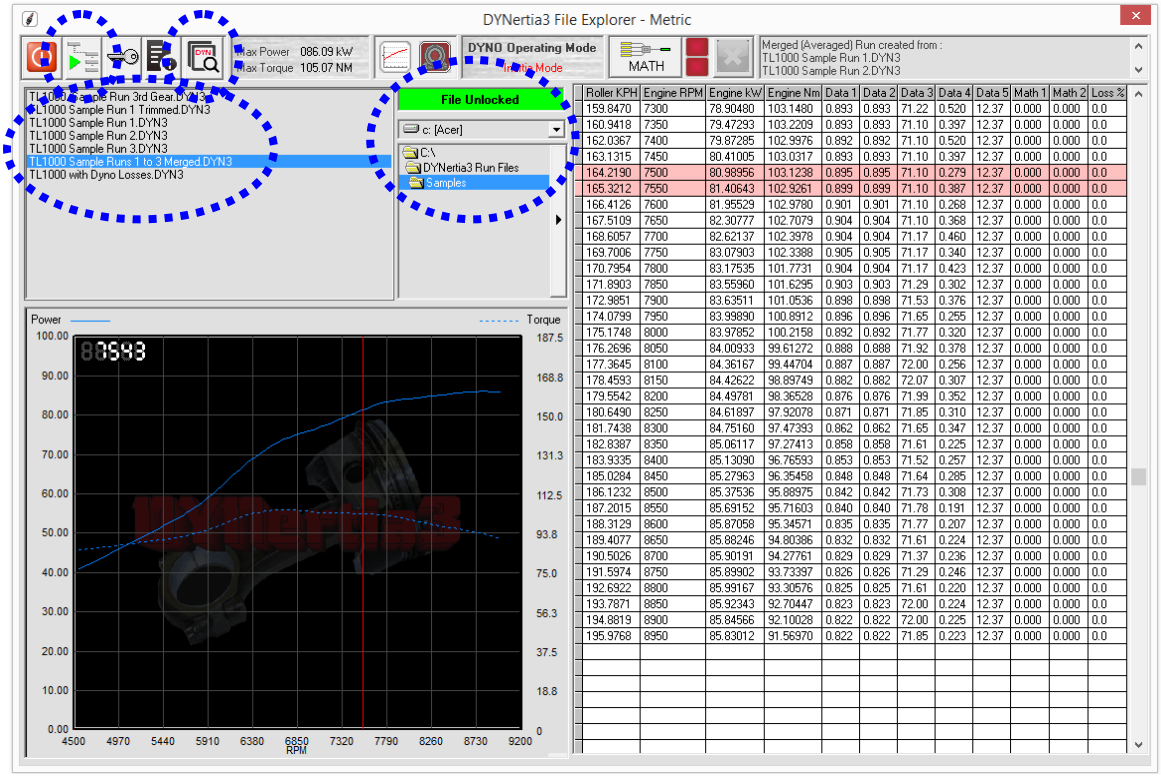


Tip- DYNertia3 already has some test runs in a Folder called 'Samples', use these to learn the software operation.

Finding Folders to view or to save tests into

As mentioned on the previous page, 'DYNertia File Explorer' is used to select a storage Folder of choice and when each Run file within it is selected (one 'Left Click') its data table, general notes, key data and preview graph are shown.

Single 'Right Click' on the Run file of interest and it will be loaded as the new 'trace set' back in the main Graph Window!



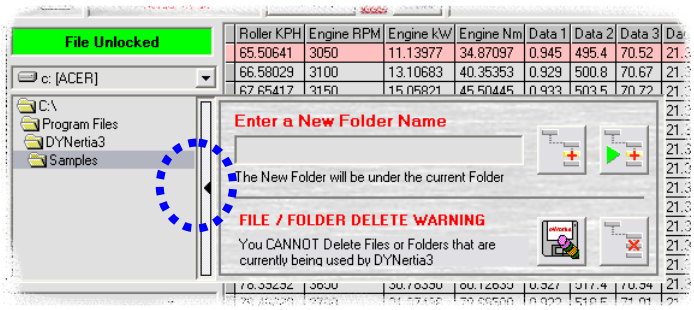
Tip- Clicking on the preview graph image will bring up a cursor line and highlight the corresponding data in the table.

You can browse folders to view the contents of, or to store runs into, by using the 'Folder List' section (shown above, just below the green "File Unlocked" text box). You can also use the search function for finding DYNertia3 files on your PC.

Note: If you are selecting a Folder that you wish to use to save runs into then press the 'File Storage' icon (top LH). It will be this Folders content that is shown when then saving runs in the main Dyno Window!

Tip- 'DYNertia File explorer' can be opened from the menu option 'View/DYNertia File Explorer', by pressing 'ctrl + F' buttons or from the 'Trace Set Controls' (coloured boxes under graph) as discussed previously.

Creating/Deleting new Folders to save tests into



Next to the Folder list is a black arrow "►", 'Clicking' on this will open a menu that allows you to create/delete new Folders easily.

Once you type in a name, press the button shown to create the Folder and also set it as default. It will then be used to save files into and view when explorer is opened.

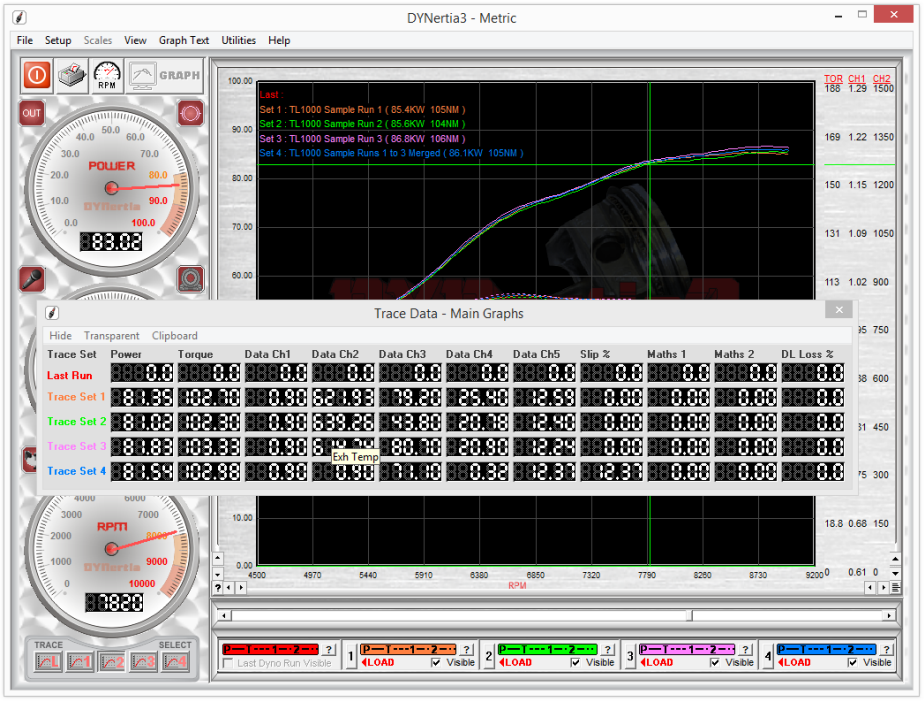
Pressing these buttons will delete a test Run file (disc/eraser icon) or respectively a Folder (cross icon)

Note: Standard 'Windows Explorer' ('My Computer') can also be used to delete, create or move Folders and files!

Basic Analysis of Saved Data

Basic analysis using the main GRAPH Window; refer to the full DYNertia3 manual for details.

The main Graph Window can be used for overlaying and analysing data from test Runs.



To analyse a trace choose the trace of interest by selecting it with the buttons underneath the RPM/speed gauge and then ‘Click’ on the Graph Window. The coloured cursor (matches selected trace) will indicate via the gauges the values present.

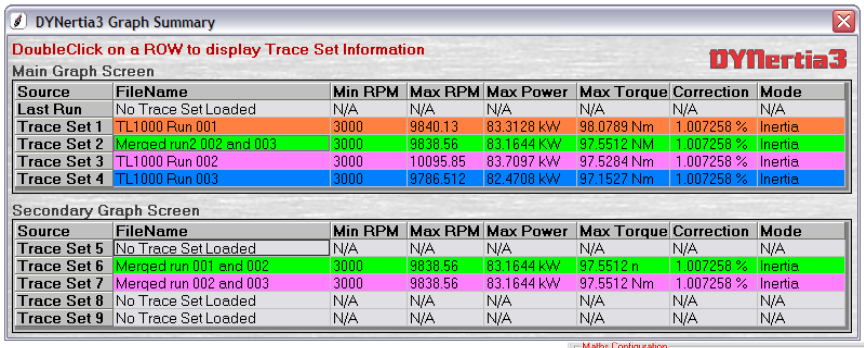
‘Clicking’ in the graphs Right hand side (where the scales are) will display the ‘floating’ data Window as shown to reveal information for all the traces.

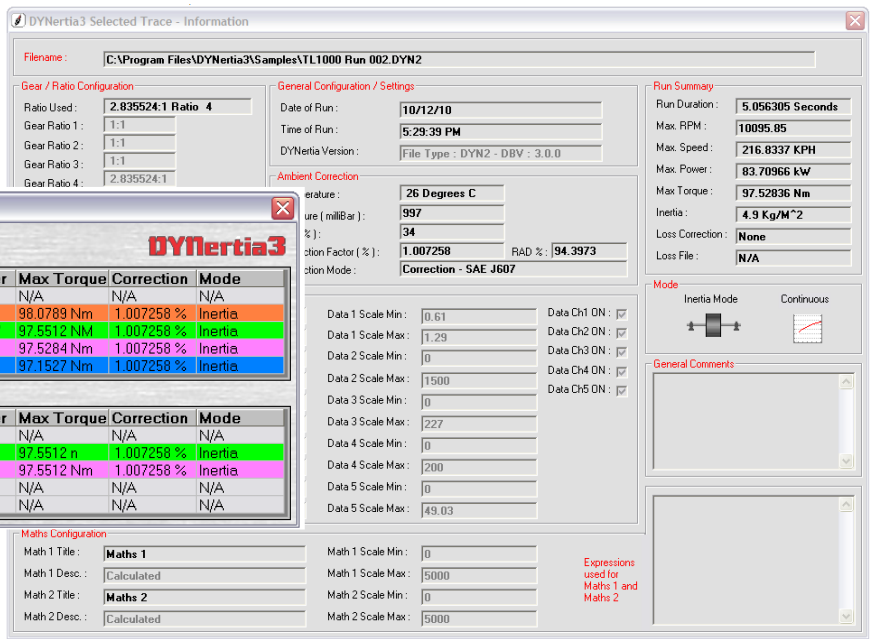
Holding the mouse over a data box will show that data Channels label (e.g. Exh Temp)

Tip- Don’t forget you can ‘zoom’ in or out of the graph, use the “◄►▲▼” buttons in the lower graph corners.

‘Click’ on the “**?**” button in lower Left Hand graph corner displays a graph summary.

‘Double Clicking’ on any row in the graph summary will bring up full information on that trace (shown Right)



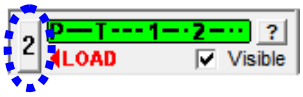


Windows for Further Analysis of Saved Data

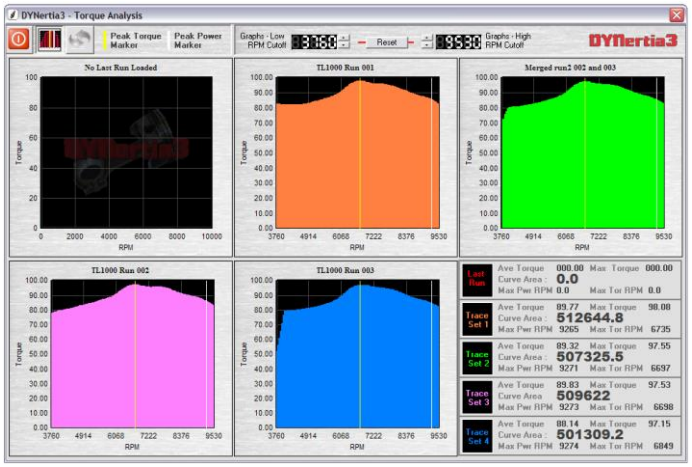
A brief over view of more complex analysis, read the main DYNertia3 manual for many more options and details.

Most Windows used for analysing saved data are in the menu option 'View'

Load the test runs you wish to analyse into the GRAPH Window first using the trace set boxes as already explained.

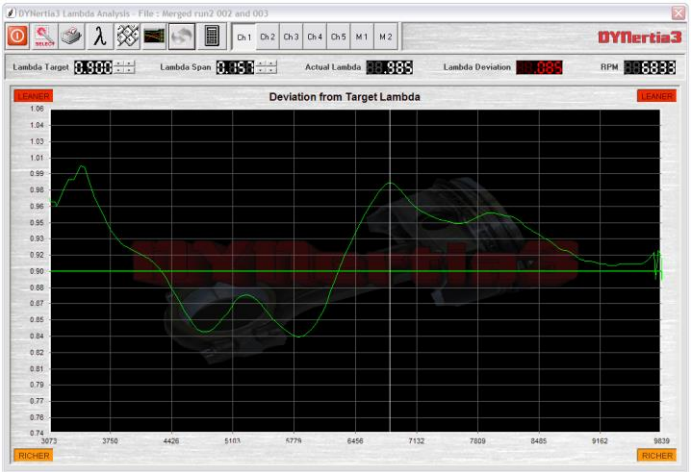


Note: Windows may only be relevant if the required data was collected e.g. Lambda deviation Window is only valid if you are recording Lambda into a data channel.

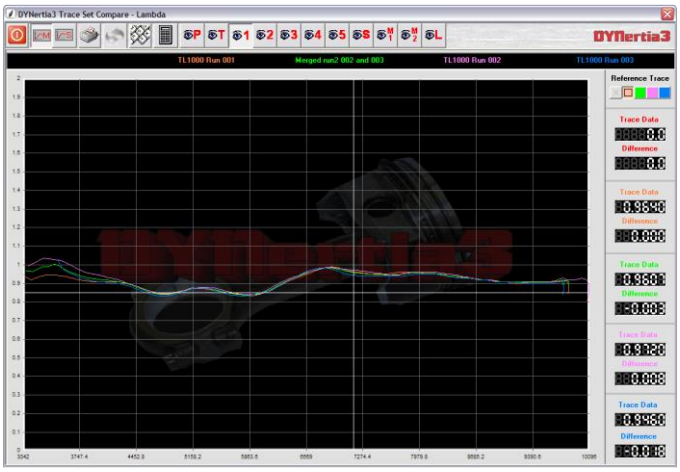


Torque analysis- Area under curve, averages, peaks, stats

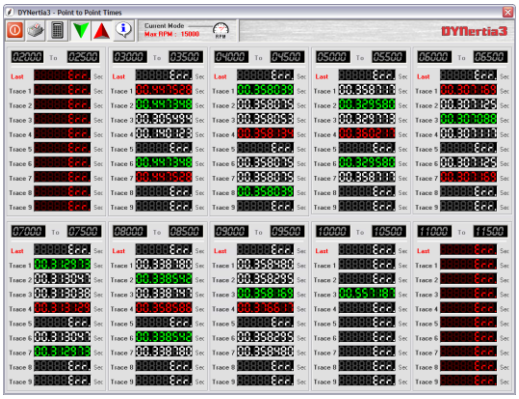
Individual trace set- Detailed study of single Run data



Lambda/AFR deviation- How far from the target air fuel ratio



Compare- Difference between Runs (smoothed)

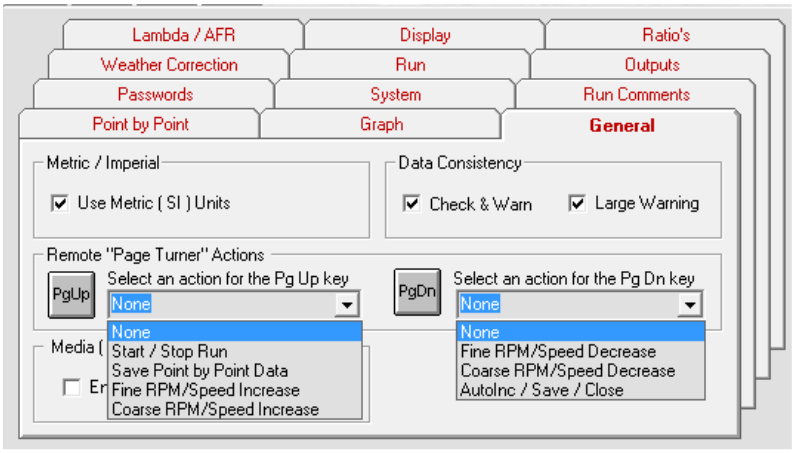


Point to point- time to accelerate between RPM or speed points.

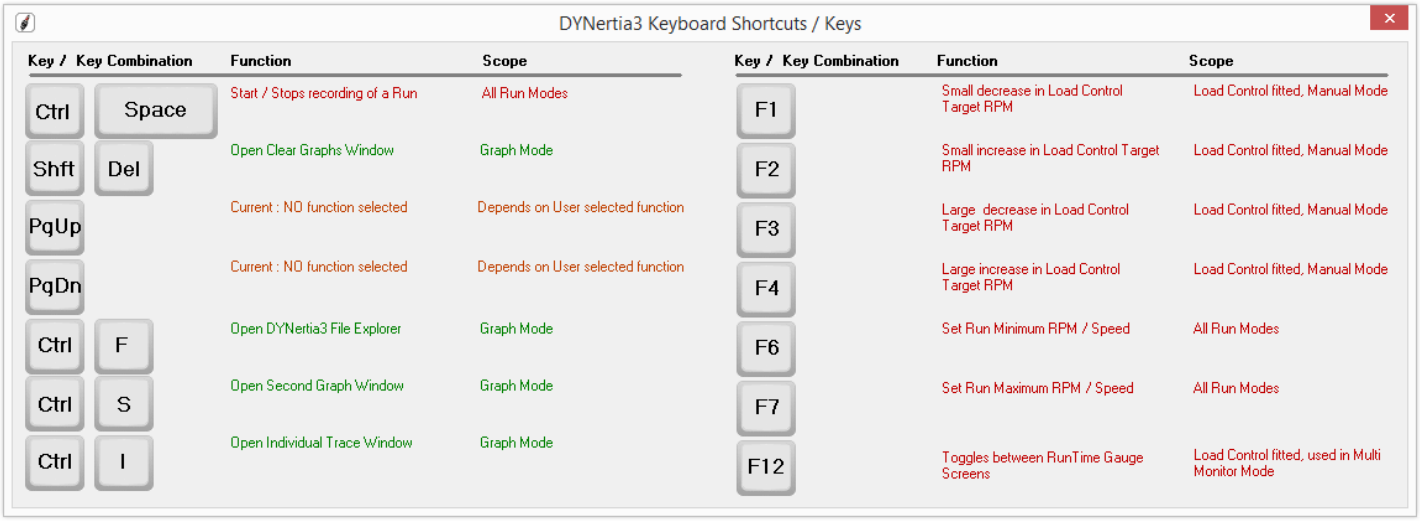
There are many more options for getting the most from your testing. You can even export data directly into Excel to try out your own analysis concepts.

Shortcuts

In the menu ‘Setup/Software/General’ is the ability to allocate some functions to the ‘page up’ and ‘page down’ keys. This allows the opportunity to use wireless ‘presenters’ to control some dyno functions. Of course there are always wireless keyboards available that can be used.



Tip- ‘Page down’ can be set to “AutoInc/Save/Close” end this can greatly speed testing. “AutoInc” is to automatically increment a file name rather than re-typing it in!

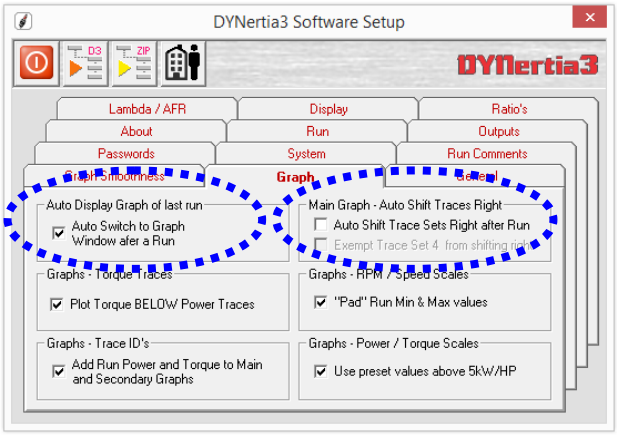


The menu ‘Help/Shortcut Keys’ lists the shortcut keys including those that are user assigned e.g. PgUp & PgDn

Tip- There are settings in the in the menu ‘Setup/Software’ that also effect the speed of testing-

Auto Display Graph of Last run: If you turn off it won’t jump to the GRAPH screen after every test for analysis.

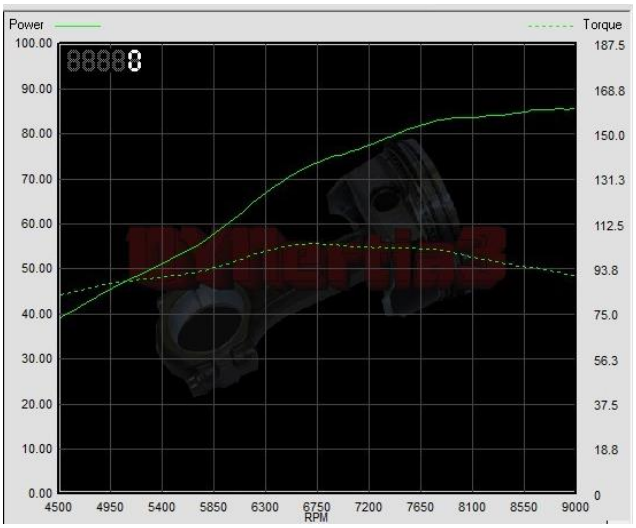
Main Graph-Auto Shift Traces Right: If you want to compare each run as it is done then this allows the previous runs to remain visible (only relevant if the Auto Display above is turned on).



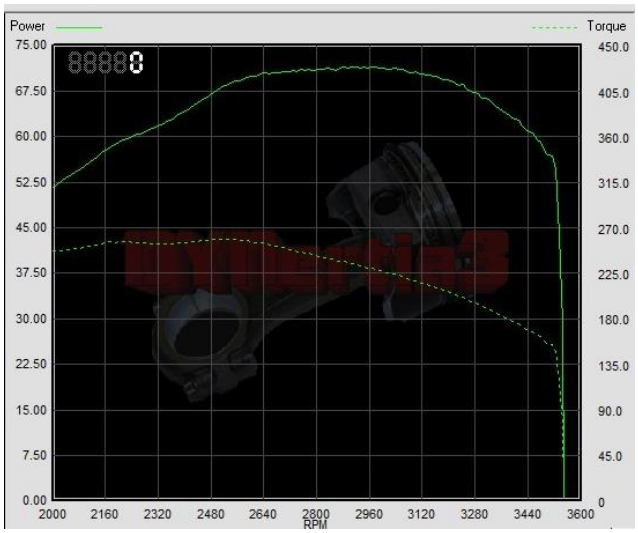
Troubleshooting

Assessing test results- Poor settings

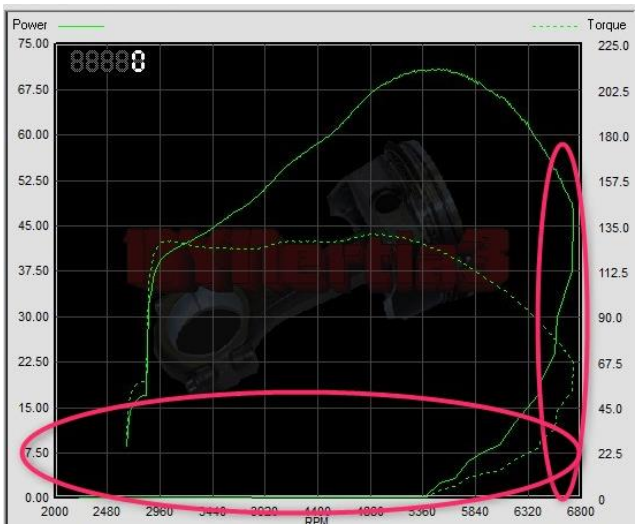
Most poor results are either due to electrical interference (via PC, accessories or DYNertia hardware) or from poor selection of start and end points for the test.



OK- It has a good start point and decisive end



OK- It has a good start point and decisive end.
Note: Personally I would set the max RPM lower to prevent the trace from dropping away and risking doubling back under.



NOT OK- Both these traces are running back under themselves at the test end. The trace should not run back under itself or you effectively end up with 2 power readings for every RPM point and this is confusing to calculations we run.

Both the above files have a poorly set Max RPM (set in “Record Settings” field as below).

There is nothing wrong with the data, just needs a better setup of max and min RPM/speed (start and end) at test time.

Assessing test results- Signal issues

NOT OK- Traces go back and forth.
This can be from ignition interference etc. but the image above is lacking any large 'spikes' that this usually creates.

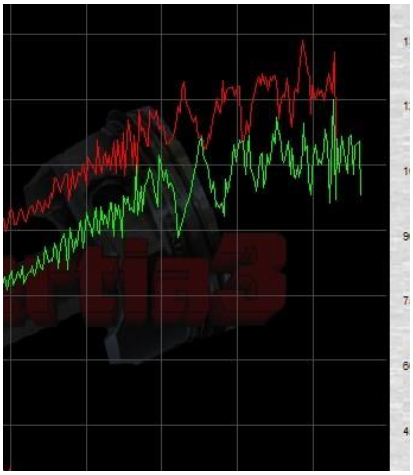
Likely the engine RPM differs to roller RPM in the data so this implies an issue i.e. roller smooth, engine erratic. This could be from 'RPM adapter' (if used) was getting bad signal (poor connection, ignition missfire or even a rev-limiter cutting spark).

It is useful to realise the 'power' is calculated from the roller/flywheel mass speed sensor, not the "TAC" input (RPM adapter) which is used to derive 'torque' from the 'power' and is used for the X axis graph scale (RPM).

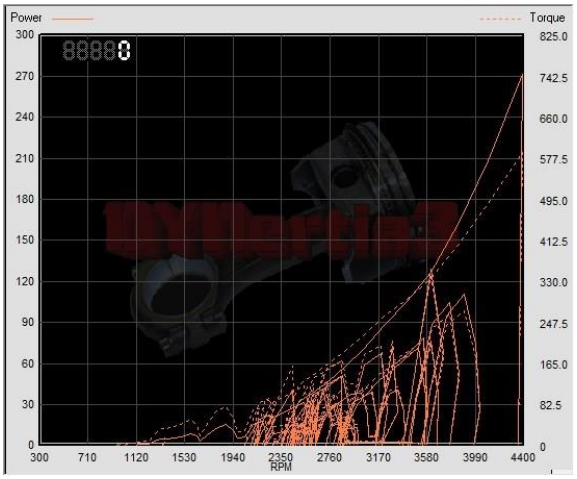
If you display the same data above in 'speed' mode (kph on X axis), and not 'RPM' mode it will remove the impact on the graph X axis scale, however the torque will still be erratic.

Below is same data above displayed in 'Speed' mode (kph is the X-axis), not 'RPM' mode. Nice power trace proves the theory that poor TAC signal was the issue.

Note: Best avoid the optional TAC input use if it's not stable or interference is impacting it, choose another RPM source option.



NOT OK- Power traces getting very erratic as speed rises. Mechanical issue creating variations in shaft speed (vibrations or 'snatch'). Greater filtering will help somewhat but not a fix.



NOT OK- Crazy data due to electrical interference from the ignition system.