EXTERNAL WIRING DIAGRAM

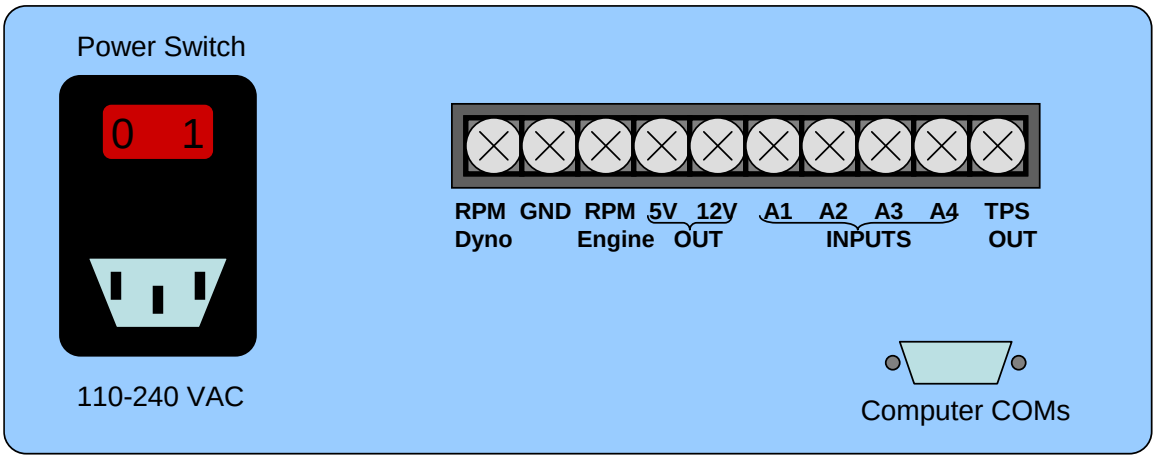
The Controller has 3 main connections:

AC Power Input: 110-240VAC 50-60Hz with a current draw of less than 1A

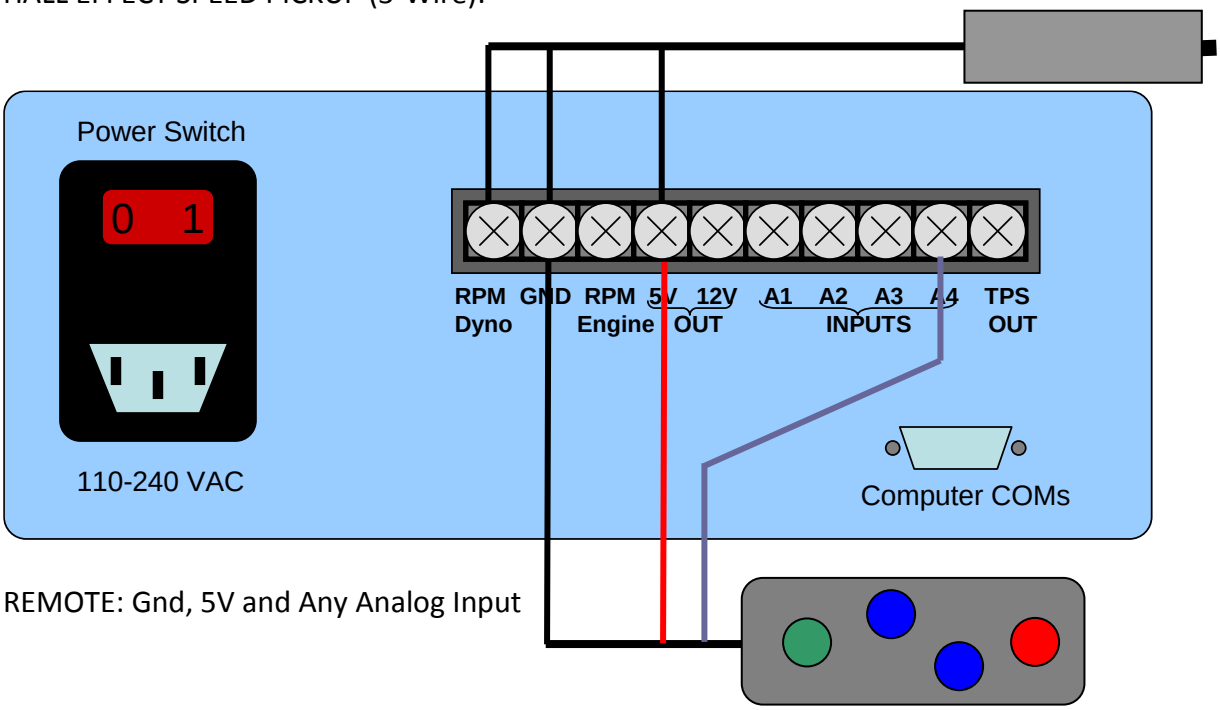
Computer Comunications: RS232 Serial D-9 connector for Serial or Serial to USB connection

Dynamometer Wiring consisting of the following connections:

RPM Dyno	This connects to a speed pickup (Hall Effect or Variable Reluctance type)
Ground	All signals must share a common ground, and should connect to computer chassis
RPM Engine	Input from Speed Clamp (Coil, Injector, Tack or Spark signal)
5V	Output for Hall effect Sensors, Remote or Other Sensors
12V	Output for powering AFR Meters
A1	Analog Channel 1 Input, 0-5V
A2	Analog Channel 2 Input, 0-5V
A3	Analog Channel 3 Input, 0-5V
A4	Analog Channel 4 Input, 0-5V
TTL	Throttle Output (used for controlling various peripherals like fans)

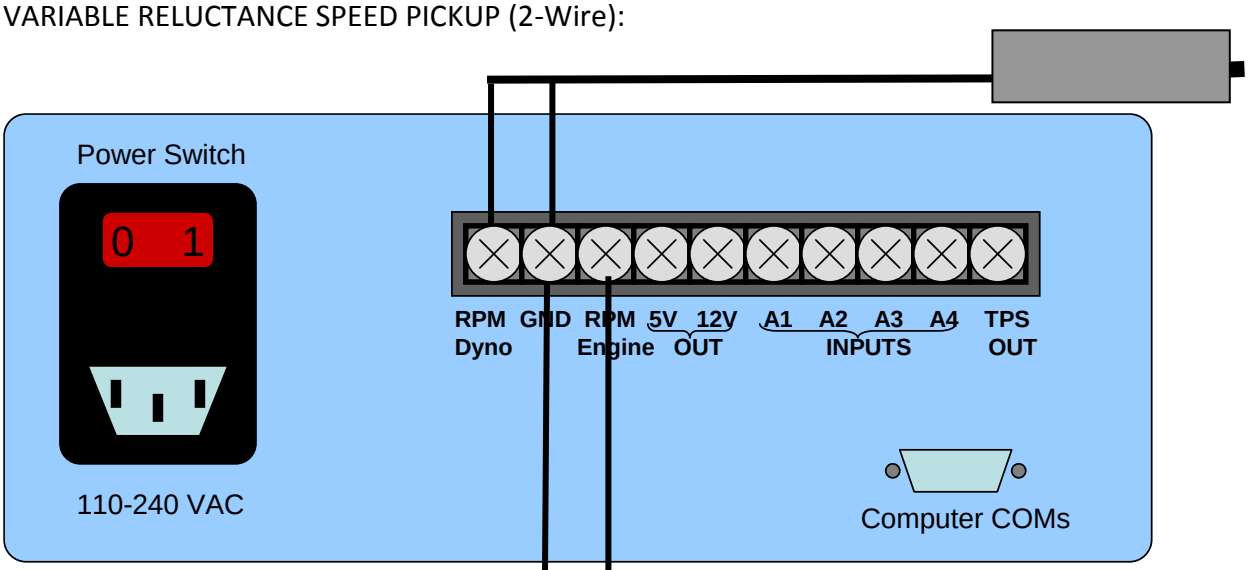


HALL EFFECT SPEED PICKUP (3-Wire):

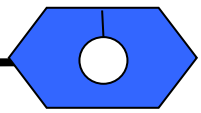


REMOTE: Gnd, 5V and Any Analog Input

VARIABLE RELUCTANCE SPEED PICKUP (2-Wire):



ENGINE SPEED CLAMP: Clamp on low-voltage lead to Spark Coil, or Injector. Clamping the Spark High Voltage line may give “noisy” readings unless Wire is Secured Tightly within clamp. Use Foam or similar to prevent motion of Spark Wire.



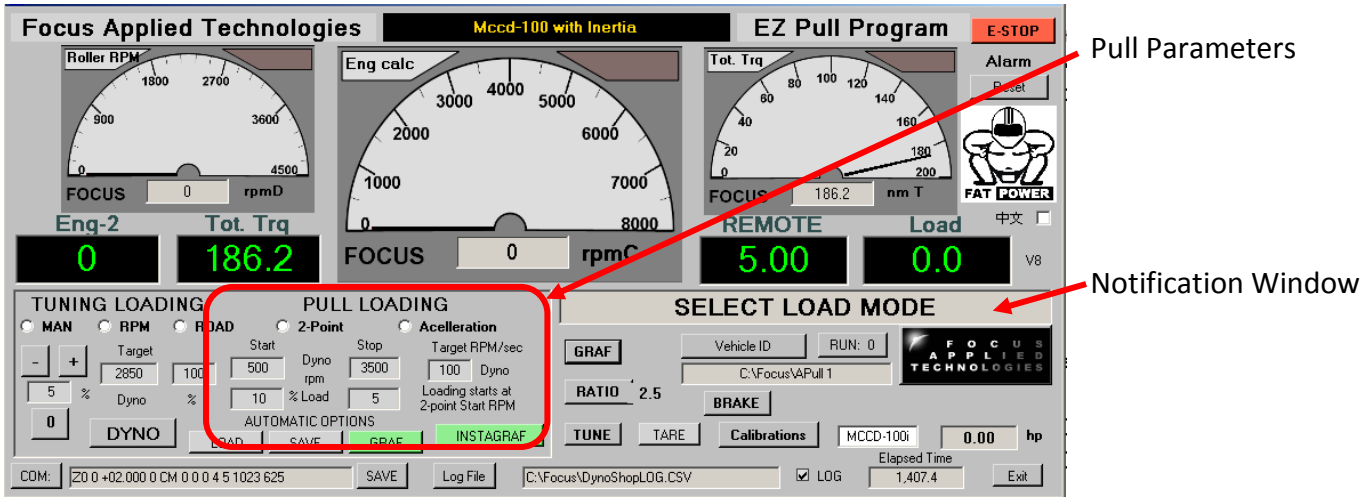
SOFTWARE

EZ pull Dynamometer program is designed to be a simple interface for dynamometer testing and tuning of all types of vehicles. It works with our Motorcycle, Automotive and Heavy Duty Vehicle chassis dynamometers, allowing various ways to control the load, as well as collecting and displaying data from the dyno and vehicle.

An on-line tutorial covering this software is available at “ezDyno Monitor Tutorial”:
https://www.youtube.com/watch?v=iylz2doeOK8

Dyno pulls are “Wide Open Throttle” acceleration tests used to measure power, torque and usually the Air/Fuel Ratio of your engine during hard acceleration. The pull should last for 10 to 20 seconds to get best results. This can be done with no load (an inertia only pull), 2-point loading (has a start rpm and load and stop rpm and load), or acceleration loading (uses start rpm and load, then adjusts load to achieve constant acceleration).

SETTING UP CONTROLLER TO PERFORM PULLS:
“Tare” load cell reading (or double click on the TARE button to automatically TARE)
Select Gear, and spin up roller
Click **“RATIO”** and set gear ratio (if using Calculated Engine RPM)
Return engine to idle
Click **ENGINE/DYNO** button to select RPM reference
Set desired **START** and **STOP** RPMs



PERFORMING PULLS:
Select Vehicle ID (license plate number or other) and File Destination
Slowly open throttle to wide open at the start speed
“Instantaneous” graph will automatically show up if the Instant Pull Graph box is ticked
Hold throttle Wide Open following instructions in the notification window
When at redline, or instructed to close throttle, reduce throttle
To view results and compare/print click on the GRAF button

There are several AUTOMATIC options used when performing pulls:

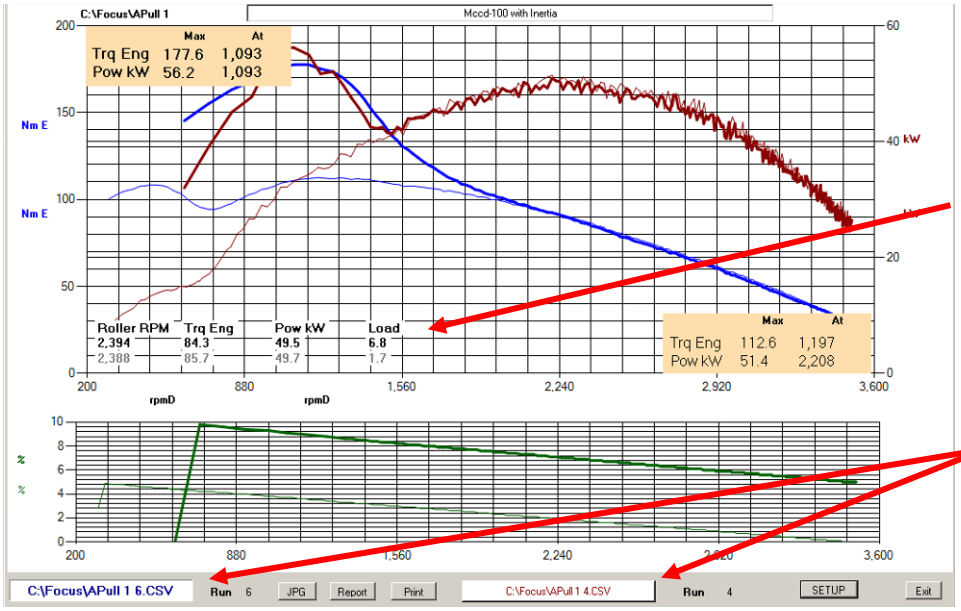
LOAD: Not used for Inertia pulls
SAVE: When this is ON the file will automatically be saved with the given vehicle ID and run number
GRAF: When this is ON the large graf will automatically be opened at the end of the pull.
INSTAGRAF: When this is on an “instantaneous” graf will show up during pulls/.

These options are turned on/off by clicking the button. They are ON when the button is GREEN.

GRAF: Graphic Results Display

To view the large “Pull” graf, click on the GRAF button.

Click on file name buttons to load existing files, and select X and Y axis parameters from the **SETUP** menu.



“Hover” over graph to see individual point numbers

Click on the plot area to get statistics from that point

You can click on the Name buttons to load existing pull files

Saving the Data
You can save the graf the **JPG** button (prints it to a file), **REPORT** (sends it to an Excell spread sheet) or the **PRINT** button (prints to a printer).

Graf setup parameters (what data to plot, 1 or 2 graphs, grid size and etc) can be accessed by hitting the **SETUP** button.

CALIBRATIONS

To properly calculate the vehicles power the calibrations must be set to the correct values. Most problems with power calculations are related to incorrect calibration values. The dynamometer Roller Diameter and Inertia are the most critical. Next is the Friction, however if the inertia is properly set, the friction can be automatically calibrated. You can also set up the calibration for practically any sensor connected to the Analog Inputs, and many other parameters of interest.

Dynamometer Calibrations can be accessed by hitting the **Calibration** button.

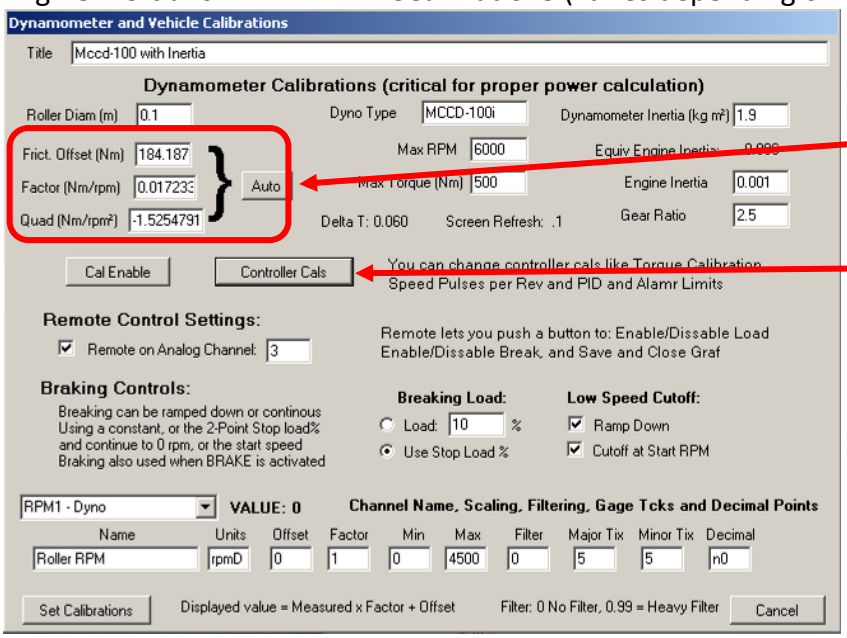
NOTE: Friction can be calibrated only once the Inertia is correctly set.

To calibrate friction:

Tare the load cell
Spin up the dyno to a high speed (typical speed encountered during testing)
Click on the AUTO friction button (and OK on the confirmation box)
Clutch the vehicle (or place in neutral) and allow the roller/wheel so spin freely to a stop
The new friction parameters will be presented in a confirmation box.

TYPICAL CALIBRATION NUMBERS

FRICTION Offset: 4Nm Factor: 0.002 Nm/rpm Quad: 0 Nm/rpm²
Dyno Inertia: 1.3 Roller Diameter: 0.165m Max RPM: 8000 Max Torque: 250Nm
Engine Inertia: 0 Gear Ratio: 3 (varies depending on what gear used on vehicle)



Friction Calibrations

Controller Calibrations Access

Remote Control Settings

Breaking Calibrations

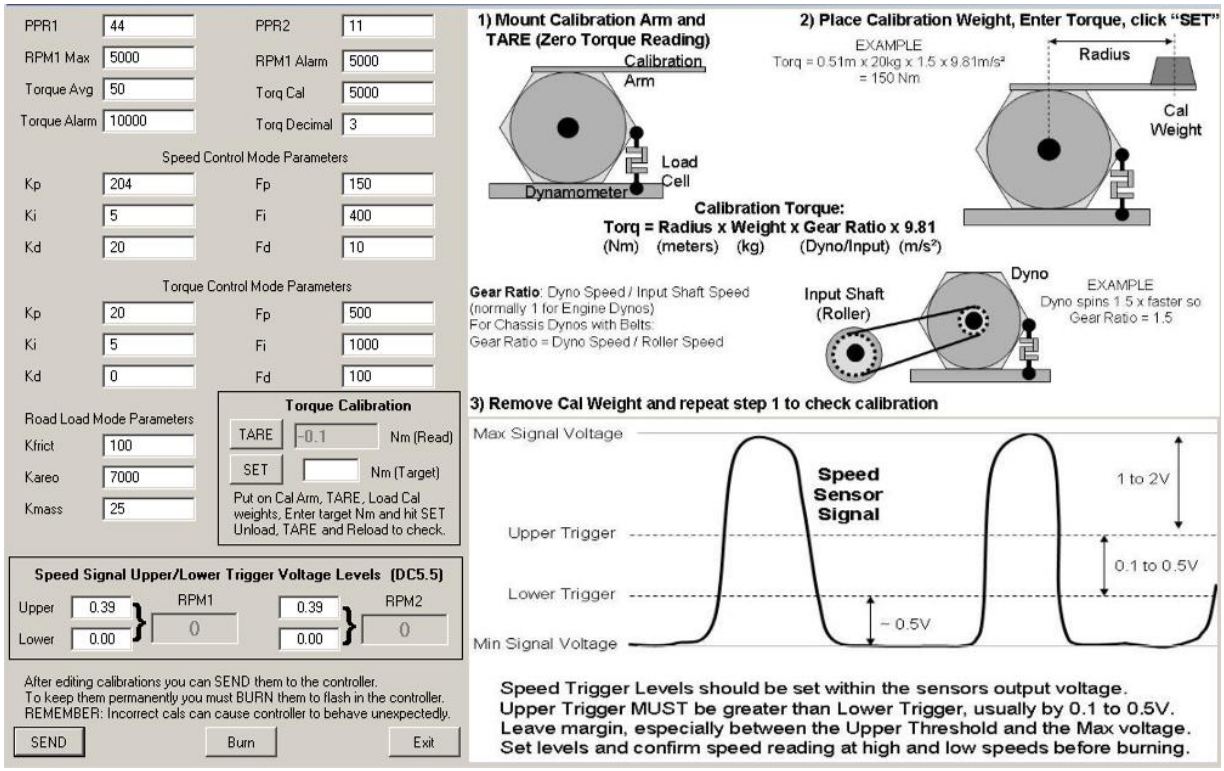
Channel Settings

Each "Channel" has a label, units and linear calibrations (offset and factor). For scaling purposes there is a minimum and maximum value that can be changed, and a filter value for smoothing out the fluctuations. Filter value of 0 gives no filtering, 0.5 is slight filtering, and 0.9 is heavy filtering. Major and Minor number of ticks on the dial gages can be set, and the number of digits to be displayed (for example F2 or N2 for 2 digits to the right of the decimal point).

Common Analog Channel Calibrations

DEVICE NAME	UNITS	OFFSET	FACTOR (U/V)	
INNOVATE Motorsport AFR Meter	AFR	7.35	3.01	
AEM AFR	AFR	7.3125	2.375	
Focus Thermistor	°C	-27.6	135	(approximate)

To change the controllers internal calibrations, you can click the **Controller Cals** button.
PPR are the “pulses per rev” of the dyno, or RPM2
Torque Averaging of 50% is normal. Use ~80 for greater averaging of displayed number (on controller)
Torque Decimal places can be set (0, 1, 2, 3 or 4)



PID Tuning: Not Used for Inertial Dynos

Road Load Tuning: Not Used for Inertial Dynos

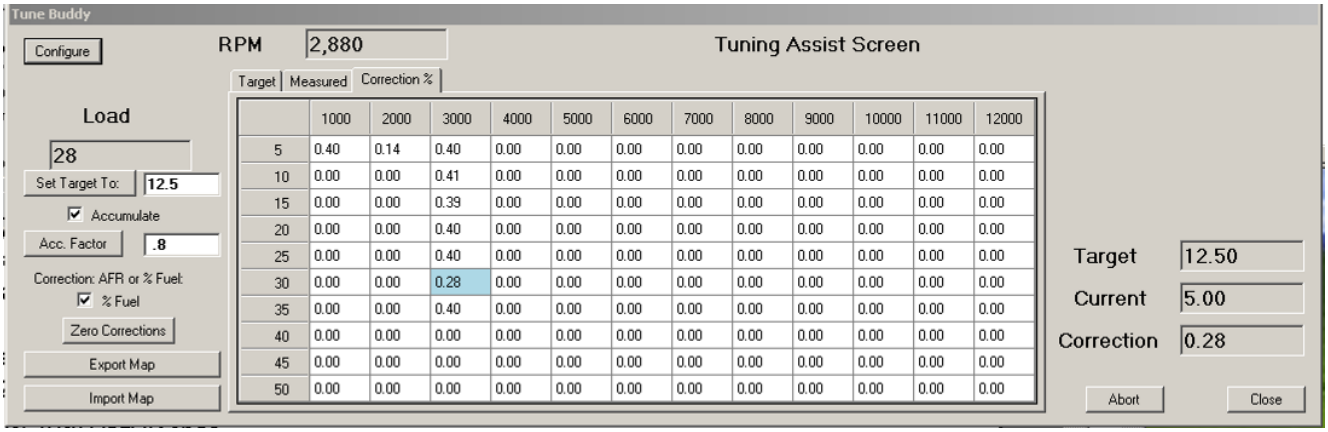
Torque Calibration: Not Used for Inertial Dynos

Speed Signal Trigger Levels: Normally this will by 0.5 for the lower level and 1.0 for the upper level
Upper and Lower levels can be adjusted to give best RPM stability
If a trigger level is too high or low, the RPM will be 0 even with a signal
Spin the rollers or run the engine with speed clamp to view RPM numbers

SEND the parameters to the controller to test out.
BURN them to the controller when you are happy with the results.

ENGINE TUNING WITH THE "TUNE BUDDY" SCREEN:

To get the "Tune Buddy" tuning assist screen, click the TUNE button on the main screen. You will then have a second window open that has 3 grids, each with the same coordinates, usually X = Engine RPM, Y = Throttle (or MAP) and Z (the displayed item) is Air/Fuel ratio:



	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
5	0.40	0.14	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TARGET: This is the target AFR. It can be set by entering a number in the upper left box and hitting "Set Target To" button. If you want different target values in different cells, you can Export, edit and then Import the map.

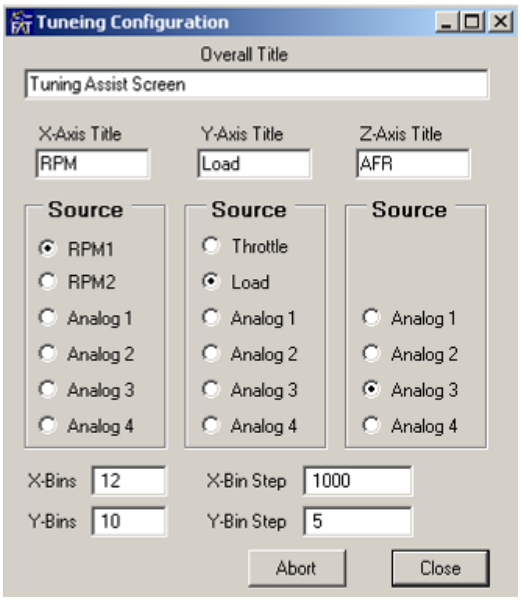
MEASURED: This is the actual measured average AFR for each cell. The averaging exponent is labeled as the Acc. Factor (accumulation factor)

Correction %: This is the relative change required in the fueling map of the engines ECU (Electronic Control Unit)

As you change the operating condition the light blue highlighting indicates what cell you are operating in. You can observe the Measured and Correction values change while you run.

The Current cell value, Target value and Correction value for the current cell are displayed on the right side. Corrections can be reset by hitting the "Zero Corrections" button.

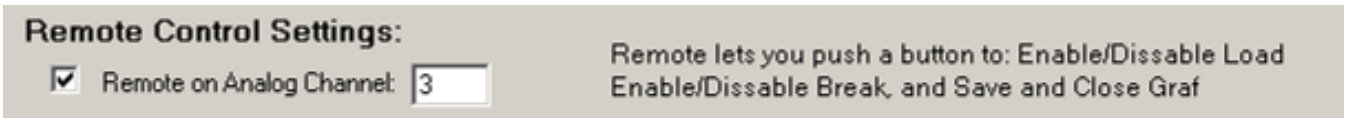
You can edit the Tune display configuration with the Configure button:



You can select the variable for the X axis, Y axis and Z, as well as the number of bins in the X and Y directions, and their step size. These parameters are saved in the Tune Configuration file.

REMOTE

A remote is available which has 3 to 5 buttons. This is connected to any one of the Analog inputs. The Remote functions need to be turned ON via the Calibrations Remote section:



The first button puts the dyno in BREAKING mode, applying a load specified in the Breaking section of the Calibrations. BREAKING mode can be toggled ON/OFF with this button.
The second button is the LOAD button. The Load can be toggled ON/OFF using this button.
The Third button is the CONTINUE button. This is used to SAVE files when the Save file dialog box is open, or to EXIT the Graf when it is open. This allows you to continue testing without having to click the mouse.

For more information contact:
www.FocusAppliedTechnologies.com