

Cam Checker: Quick Start

The Cam Checker will display cam data on it's LCD screen. There are several options which you can select to customize the logger for your particular needs.

The screen features are shown below:



Press the Options button for menu to select features and customize the logger for your needs or engine being tested.

Label for which centerline is displayed either "In" or "Ex".

Press the InExDet button to scroll through the calculated results for the last test you recorded. Displayed are Intake Centerline, Exhaust Centerline and Details (like lift, duration, events, etc.)

Template Name, shown here as the default "Template 1". Templates are combinations of Rocker Arm Ratios and Lash settings to calculate what the cam lobe specs are if you measure what the valve retainer is doing.

Start turning over the engine with the starter and press the Record button to start recording data. The screen will show "Recording Data". Once enough data has been recorded, the screen will show "Calculating". When finished, the screen will show the Intake Centerline, like shown here. Other options are then available as described in this document.

Press the Sleep button to conserve battery power. Press the latching power button on the side to better save battery power, but **you will lose recorded data.**

Battery Indicator. If moving "+", then battery is charging via USB cable. If "[----]" then battery is fully charged. If "[-]" battery very low and may turn off power quickly to maintain battery power and save any recorded data. Typically all data is saved if power is lost except the raw readings for the Profile File.

Setting up your Logger for the First Time

- 1) Press Options, then Reset Defaults to restore all the logger's settings to their standard settings and use right side buttons to choose Yes, then press Select button. (NOTE: Once you have set up your logger, do **NOT** Reset Defaults as you may lose some special settings you like.)
- 2) Press Options, then Calibration. Choose Lift Sensor 1 and Lift Sensor 2 and enter the calibration numbers below. These are typically written on the side of the sensors. Connectors for the Lift Sensor s are marked by colored shrink tubing. The "Dead Band Cts" is for the rotary sensor. The calibration for the Pressure and Rotary sensors are not critical. It is recommend you use the defaults loaded by pressing "Reset Defaults".

_____	Lift Sensor 1 (red) *	_____	Lift Sensor 2 (yellow) *	These calibration numbers are typically already entered by Performance Trends.
_____	Pressure (green)	_____	Rotary (blue)	
_____	Dead Band Cts			

Scroll through the choices, then press the Select button when your selection is being pointed to. Then press Back button (upper left) to return to the list of Options.

* Numbers written on lift sensors will have 3 digits, like 344. When you choose a calibration number in logger, it will put ".000" in front of it, so 344 on lift sensor gets entered as .000344.

- 3) In Options, click on Valve Train, then Edit Template. Here you can set the Rocker Ratio and Lash you want the program to use for calculating what the cam lobe specs are (typical of most cam card specs) when you measure what the valve retainer is doing. That means you have placed the linear sensors on the valve retainer. NOTE: If you place the linear sensors directly on the tappet or pushrod (components which move directly with the cam lobe), you should set 1 for the Rocker Arm Ratio and 0 for the Lash. You would also set 1 for the Rocker Arm Ratio and 0 for the Lash if you want to measure what the valve is doing, instead of the cam lobe. (updated Jan 16, 2020)

- 4) Click on Back 2 times to return to the Main Screen. You have set the most critical parameters to obtain good results.
- 5) To run a test, you must install the 4 sensors on the engine:
 - Screw the pressure sensor connection into the cylinder you will be testing.
 - Install the lift sensors on the retainers (or pushrod or tappet, or some other item which moves with the valve motion). Fig 1, also showing optional disk magnet on steel retainer to make a larger "target".
 - Install the rotary sensor on most any item which turns with the engine crankshaft, like a pulley or belt. Fig 2.
- 6) Crank the engine over with the starter for a few seconds, then press the Record button. The screen will show "Recording Data". Once enough data has been recorded, the screen will show "Calculating". When finished, the screen will show the Intake Centerline. By pressing the "InExDet" button in the lower left you can scroll through Intake Centerline, Exhaust Centerline and Details (like lift, duration, events, etc.),
- 7) You can upload these results to a PC via the USB cable and the free Performance Trends software. Check the program's help screens and documentation for more information on this program.

Notes:

- You will charge your logger battery via the USB cable to any computer's USB port.
- You can upload your recorded data to the free Cam Checker software on Performance Trends website or from CD.
- The logger will shut down automatically if it senses it is not moving and/or the buttons have not been pressed, to save battery power.
- The LCD backlight will shut down automatically if it senses it is not moving and/or the buttons have not been pressed, to save battery power. The time to keep the light on can be modified in the Options menu.
- The logger will mark each recorded data set with date and time. You must set this clock when you first get your logger. The time and data are only available when you upload the records to the PC. These features are available only by the free software.
- If you press power switch on side of logger to turn it off to save battery power (which also reboots the microprocessor), the screen may still stay on if you have USB power plugged in. You will lose the cam profile data (all raw readings) for the last profile measured when you reboot.



Tips on Hardware Installation:

- The most likely reason for data not repeating is the rotary sensor slipping. Be sure it is firmly pressing on the belt or pulley. Performance Trends offers spring loaded brackets which can reduce slipping.
- Just hand tighten the pressure sensor into the spark plug hole. A *minor* leak is not critical.
- You want the bracket holding the lift sensor to be very stiff and secure. If it is bending or moving slightly, that can easily change the lift and readings .030" or more, which also affects duration and events measurements.
- If you are measuring a cam with hydraulic followers, the high force of the valve springs can force the lifters to leak down, changing the effective lash and the measured results. The solution is to measure directly on the pushrod with the rocker arm removed, or replace the followers on the lobes being measured with solid followers. If you go directly to the pushrods, you will likely need additional springs to keep the follower in contact with the cam. If you stay with hydraulics, it helps to crank engine over many revolutions before measuring to get lifters pumped up.
- If you are only interested in cam timing (centerlines), you can place the lift sensors on the rockers (especially if the rocker arms have large flat surfaces like those pictured above).
- You can place large disk magnets on the valve spring retainers (if they are steel) to provide a large flat surface for the lift sensors.

Cam Checker Options Menu Operation

Main Screen Display

Press for Options Menu shown below

Template name for Valve Train (rocker ratio and lash)

To rezero pressure sensor

Press to start recording data

Press to put logger into "sleep" mode and somewhat save battery power (saves data).

Latching power button, to completely save battery, but you will lose the last complete profile you recorded.

Options Menu

Press to return to Main Screen

Cursor Arrow showing current selection

Press this button to select option or value currently selected by the cursor arrow.

This button moves arrow cursor up.

This button moves arrow cursor down

Backlight Time Menu (showing how picking an option works)

Press to return to Options list **WITHOUT** keeping your change

Cursor Arrow showing current selection

Press this button to select option or value currently selected by the cursor arrow and return to Options Screen with your selection saved.

This button moves arrow cursor up in list.

This button moves arrow cursor down in list

Tapping these buttons move cursor 1 step at a time. Holding these buttons move cursor quickly through list.

Playback Mode for Recorded Data

At main screen, press Options, then Data/Power, then Recorded Data, then Record # for saved data.

Data can also be uploaded to a PC via the free Performance Trends software.

Labels for the record data.

Intake results

Exhaust Results

Press these buttons to display Next or Prev (previous) screen of detailed data.

Back	Details		Next
	Int	Exh	
CL	108.54	107.95	
Dur	248.50	246.26	
MxLft	0.391"	0.376"	
RSCal	0.0314		

Cam Checker Options Menu Operation, cont

Explanation of some menu options:

Calibration, Lift Sensor 1, Lift Sensor 2, Pressure, Rotary, Dead Band Cnts This is where you can enter the calibrations for your particular sensors. The Lift Sensor calibrations are critical to enter correctly for all data except cam timing. Pressure and Rotary sensors are not critical at this time; use the default settings. Dead Band Counts (the counts missing in the rotary encoder as the values drop from maximum to minimum when the rotary encoder goes beyond a full revolution) is somewhat critical and is typically 225 (the default).

Valve Train, Current Template Displays the current template name of template being used. A “template” is a combination Intake and Exhaust Rocker Arm Ratio and Lash Options (4 values). These numbers are used to calculate the cam’s actual **lobe** values if you measure what the **valve** is doing. If you place the lift sensors directly on the follower or pushrod which is directly on the lifter, you should use a template where the rocker ratios are 1 and the lash is 0. The Template names can only be changed in the PC software.

Valve Train, Open Template Lets you pick a different template.

Valve Train, Edit Template Lets you change the Rocker Ratios or Lash settings. This can also be easily done with the PC software.

Procedure, Units Lets you change between inches and mm units. Note: The lift sensor calibrations are always in inches.

Procedure, Lift Events Lets you set the lift where duration and events are determined. Note: These are calculated as what is happening on the cam lobe, like most cam grinders report. When you measure the valve motion, you need the correct template settings of rocker ratio and lash.

Procedure, Step Size Lets you set the change in rotary sensor bits to change before a new reading is taken. Depending on the RPM of the rotary sensor, many times the records have much bigger steps than specified here. This minimum step would only be used if the RPM was very slow. (mostly for future options)

Procedure, Test Method Lets you set the change the method by which the engine is being rotated. **Keep it set to “On Stand” (earlier firmware) or “TDC every 360” (v1.61 or later firmware) at this time.** These settings mean the TDC signal (like cylinder pressure) can come every 360 deg of rotation. This is what happens when the rockers are removed and the valves are not opening. Even when the valves are opening, there is typically no advantage to switching to “With starter” or “TDC every 720”. In the future, we may use this setting for more details.

Data/Power, Backlight/Pwr Lets you specify options to save on the battery life.

- Backlit On With lets you specify if motion of the logger or pressing a button will turn on the backlight.
- Backlight Time Lets you specify how long the backlight will stay on after being activated.
- InactivePwrOff lets you specify how long the box can have no motion or button press or USB communications before the box “goes to sleep” to save on power.
- Low Bat PwrOff lets you specify how long before the box goes to sleep when the battery power is very low.

Data/Power, Recorded Data Lets you display the results for the individual records.

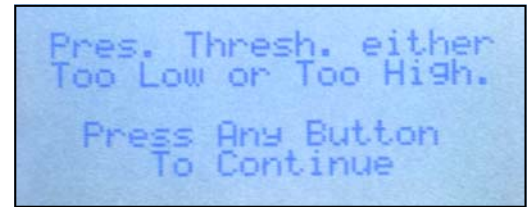
Data/Power, Delete Data Lets you erase all the individual records.

Data/Power, Raw Readings Lets you add the data readings for the 4 sensors to the main screen display. Typically you will only display these readings if you are troubleshooting the system.

Reset Defaults Puts the logger back to all factory settings. This can be very useful if you think you have made mistakes with the settings. NOTE: After this you must reinstall your calibrations. It does give you an option to save Template changes.

Troubleshooting with v1.60 firmware (firmware version appears on start up):

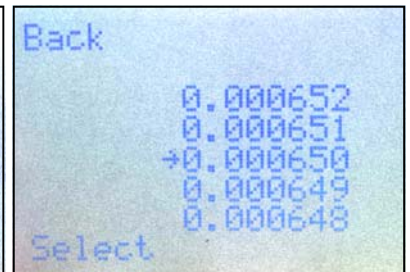
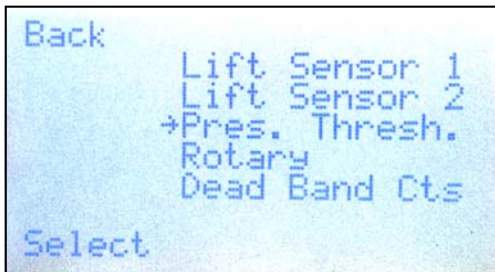
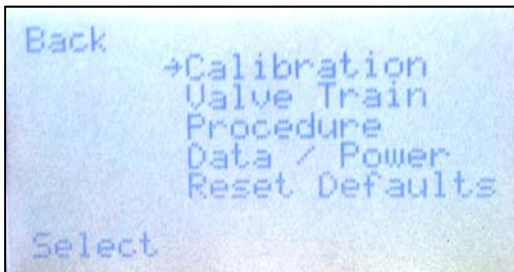
Version 1.60 firmware (June 2018) has added some features to better diagnose problems with Cam Checker accuracy, displaying "Rated Lift too Low" messages, or not producing any results at all. If you have an older versions of firmware, you still can benefit from reading through these tips. Note: Rate Lift Too Low has been replaced by the message "Pres. Thresh. Either Too Low or Too High".



The most likely reason for the logger to just say "Recording" and never get to "Calculating" screen, or getting the new "Pres. Thresh. Either Too Low or Too High" message is the cylinder pressure is not in the range the system is expecting. This problem really started to appear when people wanted to measure valve lift directly on the pushrods, thus disabling the rocker arms. This produced a situation where cylinder pressure could get quite low because the valves were not opening to let air into the cylinder. Air just leaked out by the rings, and never really got back in. Pressures were much lower than we expected.

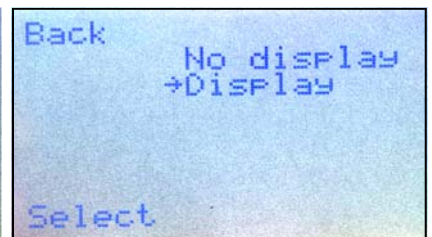
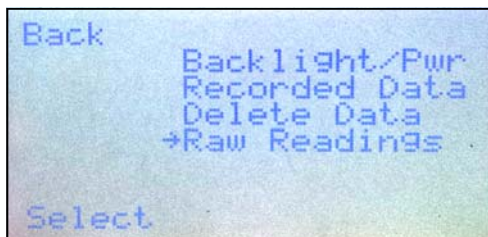
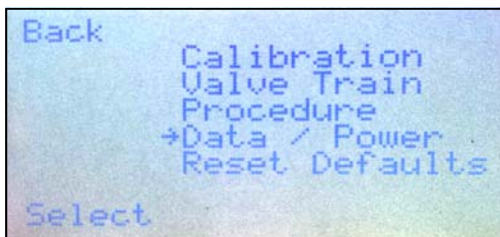
The system needs to see cranking pressure go above and below a certain pressure threshold. If it just stays below this limit, or never gets above this limit, errors would occur. Firmware v1.60 now lets you change this Pressure Threshold. It is available by Options, then Calibrations, then "Pres. Thresh." It is typically set to .00065, which means 650 counts. You take the setting and multiply by 1,000,000 to get the counts, $.00065 \times 1,000,000 = 650$.

You can view the pressure sensor counts during testing by Options, then "Data/Power", then "Raw Readings", then select "Display". Now when you press Record you will see the raw counts for the 4 sensors. Displaying Raw Readings is a helpful troubleshooting feature, as you should see all readings changing significantly as the motor turns over. If one of the readings is not changing, it

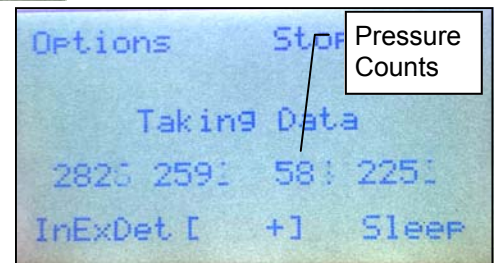


indicates that sensor is not connected, is not installed correctly, or has gone bad.

If you watch the pressure sensor reading (3rd from the left), the lowest number you see should go below 650 and you should see it also go well above 650 for proper operation. Because it cycles so fast, the high number can be difficult to see exactly.



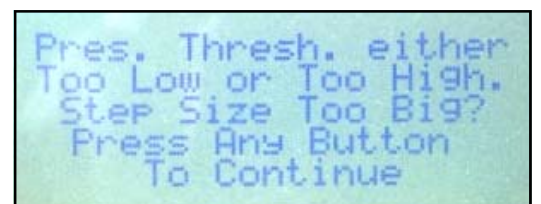
Typically you want the Pres. Thresh. to be about 50-100 counts higher than the lowest Pressure Counts you see when recording data. Pictured to the right we see 584 counts, so 650 is about right. Typically you do NOT adjust this, unless you are getting no results or an error message.



Other Errors:

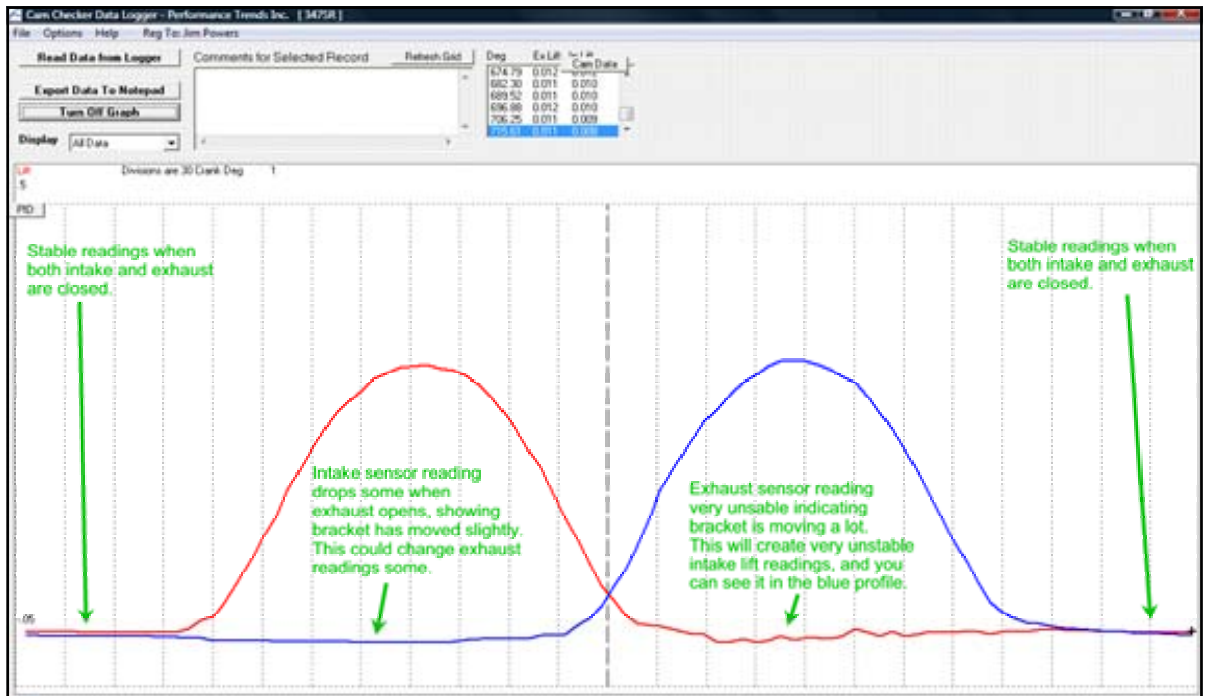
Other sources of errors or inaccuracies include:

- Lift sensor brackets having too much flex.
- Rotary Sensor slipping. Performance Trends offers spring loaded brackets which can reduce slipping.
- Timing seems retarded, but is still accurate due to "slop" in the timing chain or gears putting real retard into the cam.
- The amount of rotary sensor rotation between data points can be too high or too low. If the system senses this, it will show up in the warning message as shown in the lower right. If it does show up, go into the "Procedure" option, then "Step Size" and change it to either a bigger or smaller step size. Just a 5 increment (1 step in this option) change is typically enough. This was added with Firmware v 1.64.



Flex in brackets

The Cam Checker graph to the right shows how the readings of base circle are changing when the other lobe is being measured. That is because the sensor for the other lobe is having force applied to it and that is moving the bracket.



This Cam Checker graph shows how straight the base circle data is, showing that the bracket and lift sensors are not moving around.



The standard lift sensor bracket is “universal”, which means it works for most all situations, but is not designed for any particular engine. We added a simple strap of metal to this universal bracket which made it much stiffer, producing much better results. We are also reading lift off the pushrods with our pushrod “cups” and helper springs, part number QCC-PK.

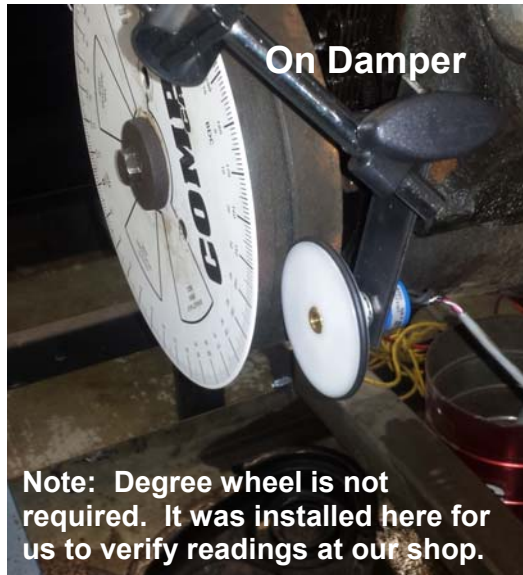
Also, pushrod measurements are typically more accurate because the lift sensor has a much more stable “target”. When placed on a retainer, even with a flat magnet (also shown in picture), the lift sensor can move around on the target.



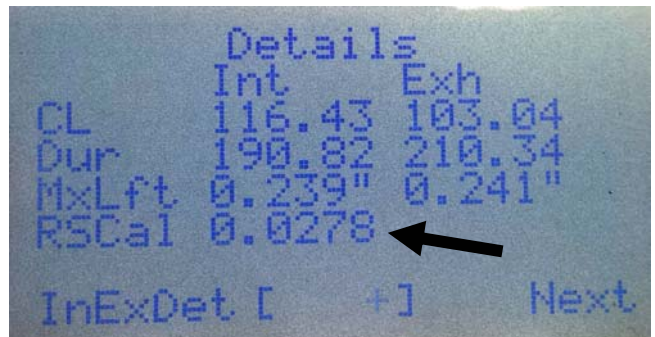
Rotary Sensor Slip

If the rotary sensor is slipping on the belt or pulley, you will get errors in events and centerlines. Typically it is better to put the rubber rotary sensor wheel on a belt, because it has some "give" (compliance) to it, like a spring. If things move a little bit, the wheel is still rubbing on the pulley.

However, if you put the rubber wheel on something solid, like the damper, there is no give. If something moves even slightly it is the difference between turning the sensor wheel, or opening up a slight gap and not turning the sensor wheel.

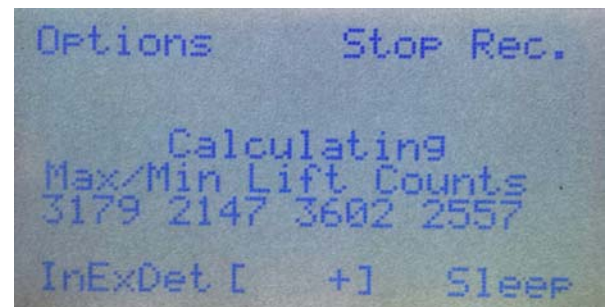


One way to check if this is happening is to watch the "RSCal" number in the results. Is is a measure of how many crank degrees for every count from the sensor. It depends on pulley diameters, wheel diameter, etc. It is difficult for this number to be lower than it should be. However, if it is even slightly higher than normal, it is indicating slip. The figure at the left shows it to be .0278, or .0278 crank degrees for every digital count from the sensor. Let's say you typically get this number how you mount the sensor on your 604 crate motor. If now you are getting .0280, that could be enough to throw off you results like duration and centerlines several degrees. However, with a totally different motor, pulleys, etc, you should expect this RSCal number to be different.



Bad Data

Sometimes the system just gets "confused" and will produce strange results. Firmware 1.60 now produces some "raw data" results, showing the Maximum and Minimum lift counts for the 2 lift sensors when calculating results. For example, in picture to the right, the first lift sensor went from 3179 to 2147 counts, or about a 1000 count **difference**. The count difference is typically in the range from 500 to 2000. If you see one of these numbers of say, 10,000 or -10,000, you know the results will be wrong, so run the test again. Typically this type of problem is from not having the "Pres. Thresh." set correctly.



Cam Timing Seems Retarded

Results, especially cam centerlines, will be retarded from what you expect due to the "slop" in the timing system. Our experience is they can be a couple degrees more retarded than what you would get from careful measuring with a degree wheel and dial indicator. This is true even if you are careful to always rotating the crank in the proper "running" direction. When cranking the motor with the starter, the continuous load of the valve springs on the valve train may put more load (and therefore more stretch) into the timing chain or belt. This stretch may be more when the engine is cranking over faster than what you turn it by hand.

Troubleshooting with v1.66/1.67 firmware (firmware version appears on start up):

Version 1.66 firmware (Aug 2021) has added some features to better diagnose problems with Cam Checker. The problems which can occur is that the logger never finishes recording, or produces the message to the right “Pres. Thresh. too Low or too High”.

The most likely reason for the logger to just say “Recording” and never get to “Calculating” screen, or getting the new “Pres. Thresh. Either Too Low or Too High” message is the cylinder pressure is not in the range the system is expecting. Cylinder pressure can vary significantly depending on whether the valves are working or not working (rocker arms disabled with sensors directly on the pushrods). Another possible problem is the rotary sensor is turning much more quickly or slowly that what we expected.

The system needs to see cranking pressure go above and below a certain pressure threshold. If it just stays always above or below this limit, errors would occur. Firmware v1.60 added the ability to change this Pressure Threshold. It is available by Options, then Calibrations, then “Pres. Thresh.” It is typically set to .00065, which means 650 counts. You take the setting and multiply by 1,000,000 to get the counts, $.00065 \times 1,000,000 = 650$. This is covered on a separate sheet.

What is new in v1.66 is the maximum and minimum pressure the logger is recording is displayed. Another new data point displayed is the number of data points recorded. If the number of data points is close to going above the logger’s limit of 480, there may not be enough data to do the calculations. This can happen if the wheel on the rotary sensor is much smaller or larger in diameter than the the pulley on the crank driving the belt for the sensor, or what ever rotating engine component the sensor is riding on. This can also be affected by cranking RPM, with very fast cranking RPMs producing problems.

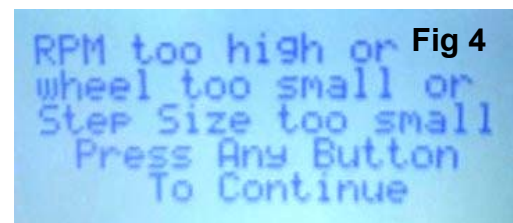
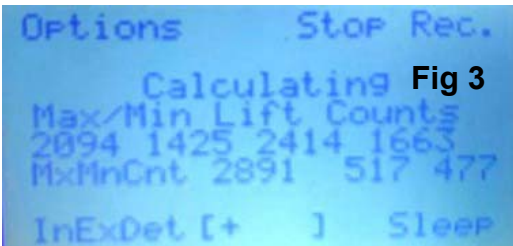
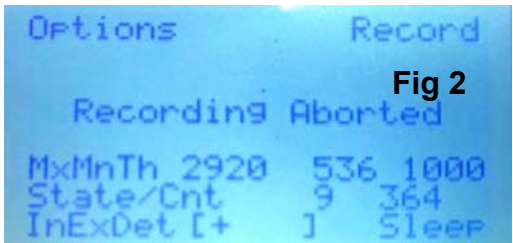
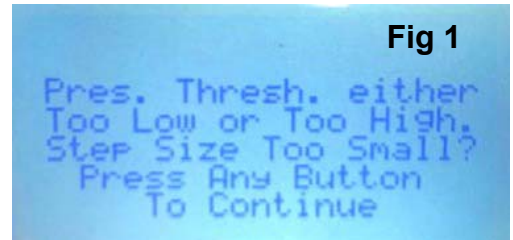
To view these new messages, **you must turn on “Raw Readings”**. This is done by pressing :Options”, then “Data/ Power”, then “Raw Readings”, then select “Display”. Now when you press Record you will see the raw counts for the 4 sensors. Displaying Raw Readings is a helpful troubleshooting feature, as you should see all readings changing significantly as the motor turns over. However, they can change so quickly they may be difficult to read.

If after pressing Record at upper right corner, the logger never switches from Recording to Calculating, press Stop Recording at the upper right. You will get a screen of Fig 2 to the right, where the 2920 is the maximum pressure reading, 536 is the minimum pressure reading, and 1000 is the threshold you have set in the logger. The threshold should be between the max and min and not close to either one. The “State” number of 9 shows which step the logger got to, from 1 to 15 for recording data. The “Cnt” of 364 shows how many data points were recorded. (“Stop Record” was pressed just to get this screen, but a Cnt of 364 is quite high for only being on step 9.)

If the screen does switch to “Calculating”, these readings are also displayed as in Fig 3. The 2891 is the maximum pressure reading, 517 is the minimum pressure reading. (Threshold is not displayed.) The “Cnt” of 477 shows how many data points were recorded, which is typically the maximum you will see. This is indicating that there is likely a problem with the test, that the rotary sensor is spinning too fast. Typically the Cnt will be between 200 and 440.

If Cnt is much less than 200, you can increase the number of data points by reducing the “Step Size” in Options. If Cnt is much greater than 400, you can decrease the number of data points by increasing the “Step Size” in Options. Go into “Options”, then the “Procedure” option, then “Step Size” and change it to either a bigger or smaller step size. This was added with Firmware v 1.64, but was improved in v1.66 to have a larger effect..

Version 1.67 added a new feature for when the cranking RPM is quite fast, or the size of the sensor wheel is quite small compared to the pulley on the engine. In these cases, there can be too much data from the rotary sensor. Version 1.67 can now handle this better and produce results, but it is still more accurate if the RPM was slower or the ratio between the 2 wheels was not so great. You can tell if this less accurate situation exists if the logger shows the display in Fig 4. If you get this message and can not fix the fast RPM or sensor wheel size issue, try increasing Step Size as described above. If issue persists, make several repeat tests and use the most consistent, repeatable results.

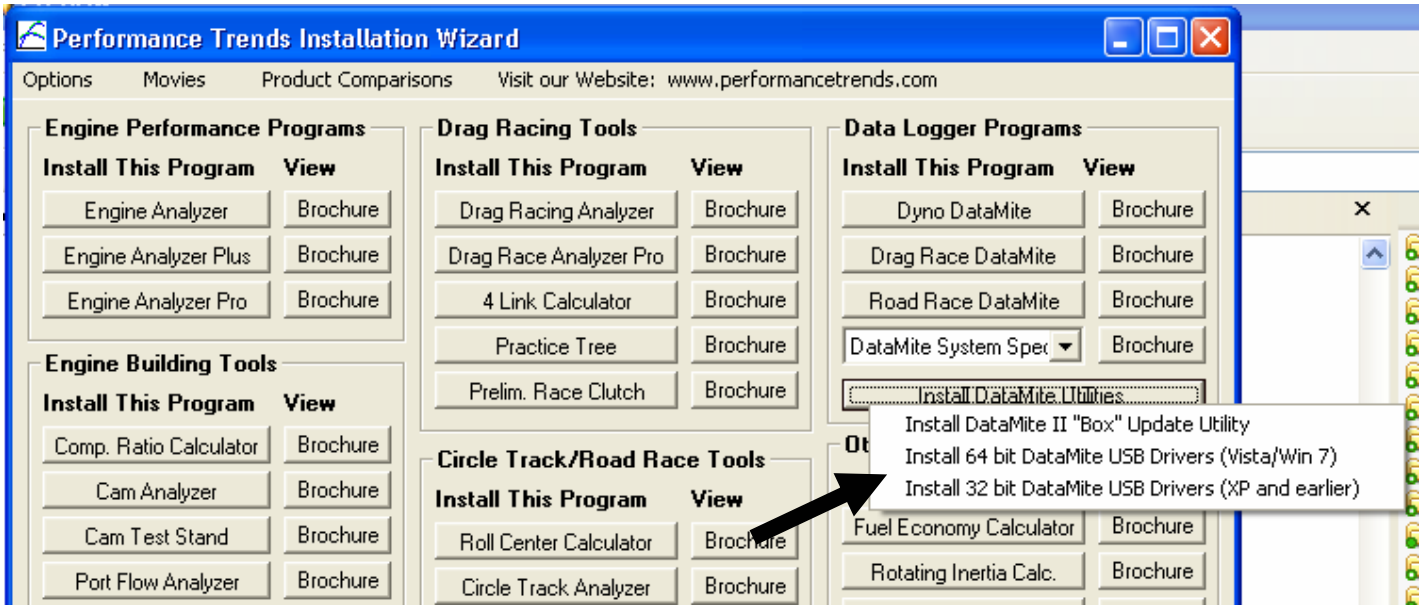


Cam Checker Software - Quick Start

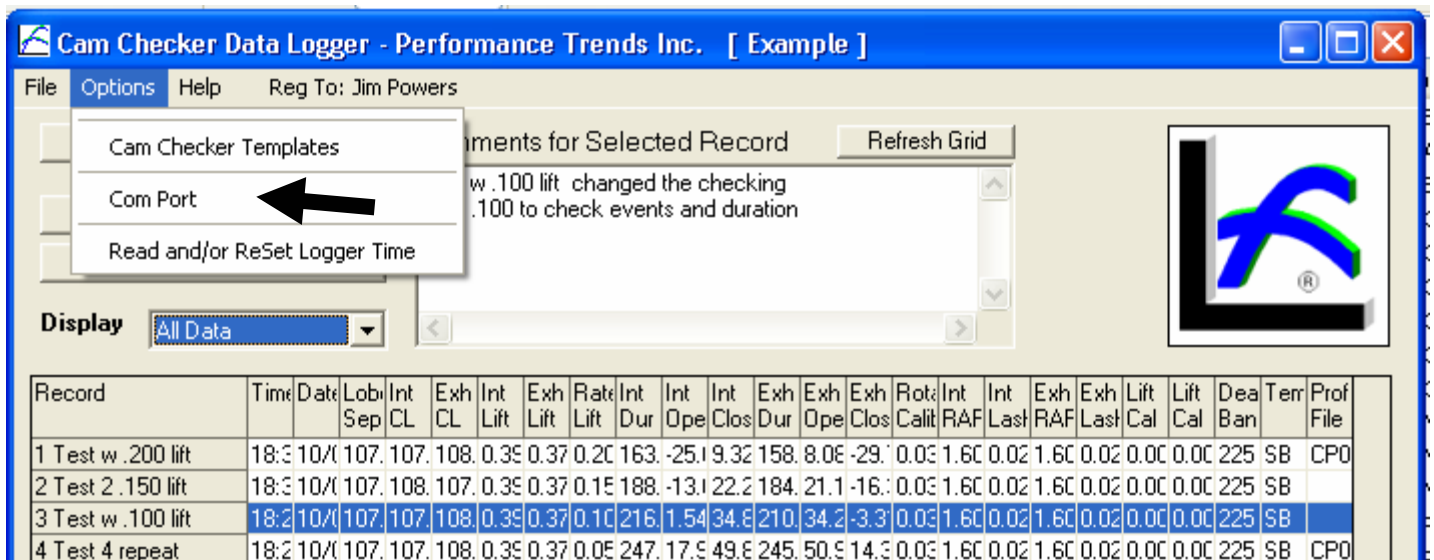
Install the Cam Checker software following the paperwork with the CD.

Then you need to get the Cam Checker to “talk” to your computer. If you already have some Performance Trends USB type loggers, plug in the USB cable to the logger. It will likely say “Found new hardware” at lower right corner of computer screen. Wait 30-60 seconds and see if computer comes back and says your USB Hardware should be working. If it does not say that, unplug the USB cable and wait about 20 seconds. Also check page 15 for more info.

Insert CD which contains the Cam Checker software and it will start up the Installation Wizard. When it starts up, click on the Install DataMite Utilities and then select either “Install 64 bit...” or “Install 32 bit...” to install USB drivers. Unless you know you have a 32 bit system, most all newer computers (Vista, Win 7, Win 8, Win 10) are 64 bit so choose “Install 64 bit...”. Follow program instructions. When finished, plug in the USB cable and see if it says your Hardware should be OK.



Run the Cam Checker software and see if it communicates with the Checker. Click on Options, then Com Port and see what the software finds for possible Com Ports. Typically the Cam Checker will be the highest number in the list, so



choose that one. Then click on the “Read Data from Logger” button, behind the drop down menu in the screen shown above and see if it reads the data in the logger.

If it can, it will read up to 10 records of what is stored in the logger. For only the last record, it will also read the raw data of what the cam profile looked like. This is not very precise data and is mostly used from troubleshooting the results or find bad sensors.

As you click on different rows in the spreadsheet, the comments for that row (record) are displayed at the top. If you have not entered any comments, it will be blank. Any comments you enter or change will have the changes “remembered”, especially if you click the “Refresh Grid” button.

The screenshot shows the 'Cam Checker Data Logger' interface. On the left, there are buttons for 'Read Data from Logger', 'Export Data To Notepad', and 'Graph Profile'. A 'Display' dropdown is set to 'All Data'. The main area contains a table with columns for Record, Time, Date, Lobe Sep, Int CL, Exh CL, Int Lift, Exh Lift, Rate Lift, Int Dur, Int Ope, Int Clos, Exh Dur, Exh Ope, Exh Clos, Rot Calit, Int RAF, Int Last, Exh RAF, Exh Last, Lift Cal, Lift Cal, Dea Ban, Terr, and Prof File. A 'Comments for Selected Record' box is open, showing a comment for record 3: 'Test w .100 lift changed the checking lift to .100 to check events and duration'. A 'Refresh Grid' button is also visible.

Record	Time	Date	Lobe Sep	Int CL	Exh CL	Int Lift	Exh Lift	Rate Lift	Int Dur	Int Ope	Int Clos	Exh Dur	Exh Ope	Exh Clos	Rot Calit	Int RAF	Int Last	Exh RAF	Exh Last	Lift Cal	Lift Cal	Dea Ban	Terr	Prof File
1 Test w .200 lift	18:3	10/1	107.7	107.108	108.039	0.37	0.20	163.25	19.32	158.8	0.06	-29.0	0.03	1.60	0.02	1.60	0.02	0.00	0.00	0.00	0.00	225	SB	CPD
2 Test 2 .150 lift	18:3	10/1	107.7	108.107	107.039	0.37	0.15	188.13	22.2	184.21	1.1	-16.0	0.03	1.60	0.02	1.60	0.02	0.00	0.00	0.00	0.00	225	SB	
3 Test w .100 lift	18:2	10/1	107.7	107.108	108.039	0.37	0.10	216.15	34.8	210.34	2.3	-3.3	0.03	1.60	0.02	1.60	0.02	0.00	0.00	0.00	0.00	225	SB	
4 Test 4 repeat	18:2	10/1	107.7	107.108	108.039	0.37	0.05	247.17	54.8	245.50	5.14	3.0	0.03	1.60	0.02	1.60	0.02	0.00	0.00	0.00	0.00	225	SB	CPD
5 Test 3 repeat	18:2	10/1	108.107	108.039	0.37	0.05	249.18	50.3	245.51	5.13	3.4	0.03	1.60	0.02	1.60	0.02	0.00	0.00	0.00	0.00	225	SB		
6 Test 2 repeat	18:2	10/1	108.107	108.039	0.37	0.05	249.18	50.4	244.51	5.13	3.4	0.03	1.60	0.02	1.60	0.02	0.00	0.00	0.00	0.00	225	SB		
7 Test 1	18:2	10/1	107.7	108.107	108.039	0.37	0.05	248.17	50.5	244.51	5.13	3.3	0.03	1.60	0.02	1.60	0.02	0.00	0.00	0.00	0.00	225	SB	CPD

The screenshot shows the 'Cam Checker Data Logger' interface with the 'Display' dropdown set to 'Basic'. The 'Comments for Selected Record' box shows a comment for record 4: 'Test 4 repeat uploaded this one right after recording so it included the full profile data.' A 'Graph Profile' window is open, showing a graph of the cam profile with two curves (red and blue) over a grid. The data grid below shows columns for Record, Lobe Sep, Int CL, Exh CL, Int Lift, Exh Lift, Rated Lift, Int Dur, and Exh Dur.

Record	Lobe Sep	Int CL	Exh CL	Int Lift	Exh Lift	Rated Lift	Int Dur	Exh Dur
1 Test w .200 lift	107.94	107.56	108.32	0.391"	0.377"	0.200	163.71	158.36
2 Test 2 .150 lift	107.81	108.00	107.61	0.391"	0.378"	0.150	188.56	184.79
3 Test w .100 lift	107.88	107.56	108.20	0.391"	0.377"	0.100	216.43	210.92
4 Test 4 repeat	107.84	107.68	108.00	0.392"	0.377"	0.050	247.85	245.27
5 Test 3 repeat	108.11	107.62	108.59	0.390"	0.377"	0.050	249.29	245.51
6 Test 2 repeat	108.00	107.22	108.78	0.391"	0.377"	0.050	249.25	244.77
7 Test 1	107.96	108.01	107.91	0.391"	0.377"	0.050	248.57	244.95

If a record has a complete file, it will show it in the rightmost column “Profile File”. If you click a row with a Profile File, then click the “Graph Profile” button, the raw profile data will be graphed.

There is lots of data in the spread sheet.

If you want to reduce the number of columns, choose a different “Display” option.

If you want a complete file so you can graph it, you must upload the Checker to your computer after every run. The software tries to remember what is new data and data it has already read in from the logger. It tries to make sure that if you do something unexpected, it will handle the data correctly.

A useful option under “Options” are Read and/or Reset Logger Time so each cam checker record is properly time stamped. Another is Cam Checker Templates, where you can create more templates and template names of various rocker ratios and lashes for checking engines you will commonly test.

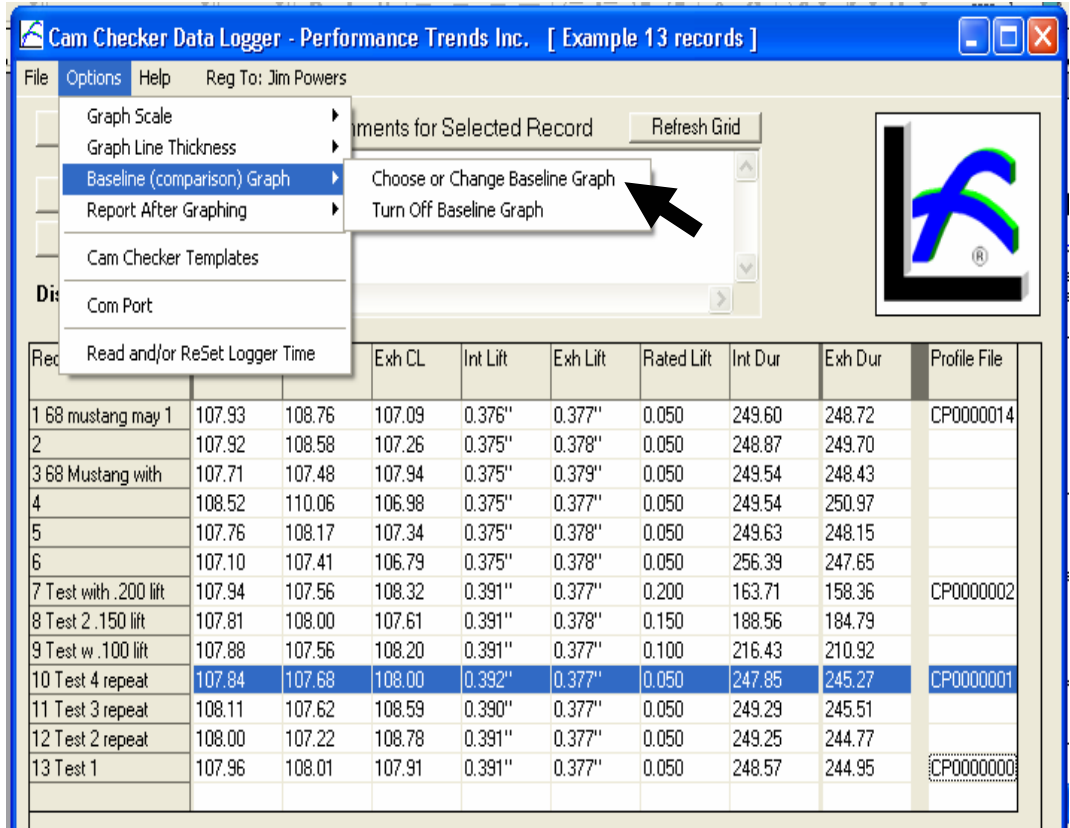
Check the website for latest updates to the software, including assigning one test as a Baseline for comparisons with other tests like overlay graphs and comparison reports, handy for track tech inspectors.

Assigning a Baseline Run so 2 Profiles can be Compared

Recent additions to the software (v1.1 A.012 or later) include the ability to do overlay graphs with a test you have designated as a "baseline" for comparison. This is very handy if you are checking to see if the cam in 1 vehicle is matching the cam in another, like for track inspection.

To compare 2 different profiles, you must upload them from the Cam Checker to the software in a computer. Only the last profile measured can be uploaded. If the software has the 2 profiles loaded, assign one as the baseline as shown to the right.

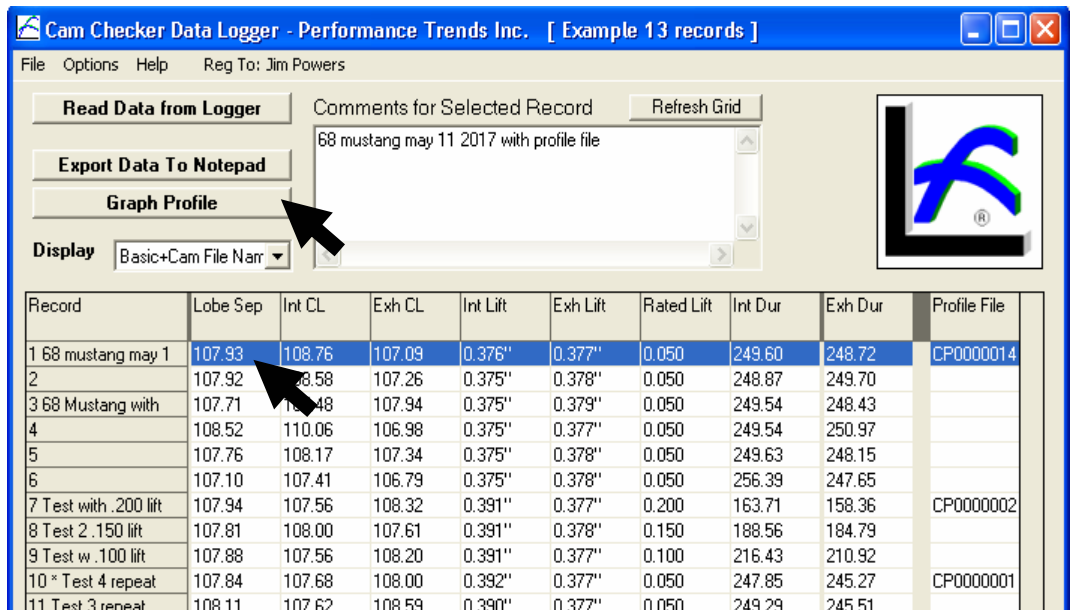
You will get a message shown below. Click on a test with a "Profile File" like row 10 shown below. It will now



show 10 with an asterisk * marking it as the baseline profile. Then go and click on a different test with a Profile File, perhaps the one in row 1 called "68 mustang may 1" to highlight it in blue. Then click on the "Graph Profile" button shown to the right.



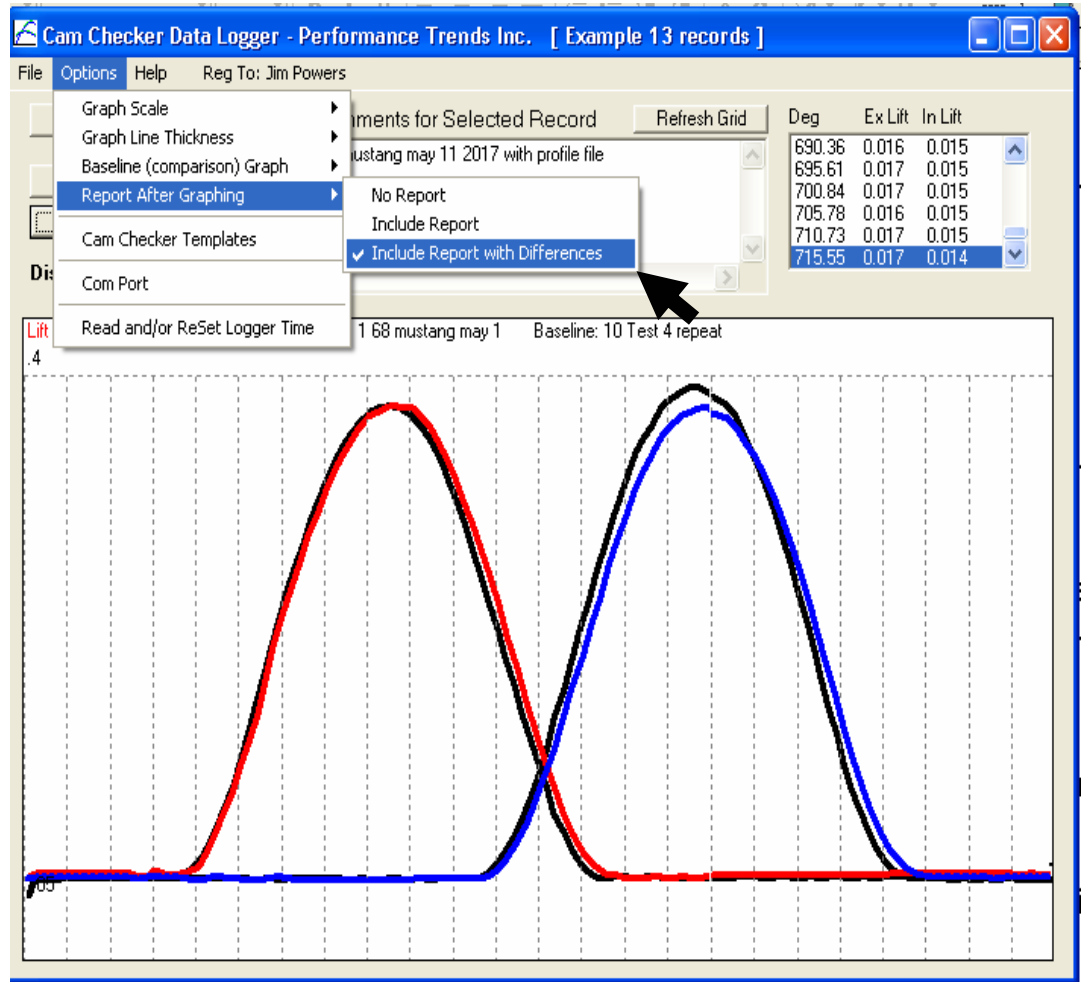
The graph on the next page shows the baseline test graphed in black called "10 Test 4 repeat" with the current test being called "1 68 mustang may 1". You can see that the exhaust profiles are fairly similar (the baseline being a little smaller on the closing profile) and the baseline intake being advanced some and higher



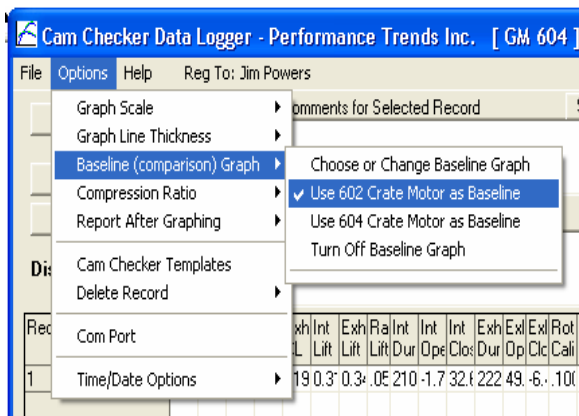
lift. This type of comparison is very useful for track inspection.

Also shown are many new Graph options letting you:

- Change the graph scale. You will notice the scale of screen to the right shows profiles much larger than the standard scale of earlier program, shown in picture above.
- Change the thickness of the graph lines.
- Whether to include a baseline graph or not, and picking a test to designate as the baseline.
- Whether to include a report of the duration and events for 1 or both graphs at .050" lift increments, and include a table showing the differences between these 2 tables (as shown to the right).



A new feature added in 1.1 A.025 in 2020 lets you easily add a GM 602 or GM 604 crate motor cam profile as the baseline in 1 click. See options screen below:



The screenshot shows a Notepad window with a comparison table between a baseline file and a cam file. The table has columns for Lift, Int Open, Int Close, Int Dur, Exh Open, Exh Close, and Exh Dur.

Cam File: 1 68 mustang may 1						
Lift	Int Open	Int Close	Int Dur	Exh Open	Exh Close	Exh Dur
.050	18.0	51.4	249.4	51.9	16.5	248.4
.100	0.0	34.7	214.7	34.5	-0.7	213.8
.150	-14.1	21.9	187.8	20.8	-15.1	185.7
.200	-28.0	9.0	161.0	9.3	-28.0	161.3
.250	-42.0	-4.3	133.7	-4.7	-41.8	133.5
.300	-57.5	-20.4	102.1	-20.6	-56.8	102.6
.350	-79.0	-42.5	58.5	-42.3	-75.9	61.8
.400						
.450						
.500						

Baseline File: 10 Test 4 repeat						
Lift	Int Open	Int Close	Int Dur	Exh Open	Exh Close	Exh Dur
.050	21.3	44.1	245.4	52.3	10.7	243.0
.100	4.1	28.4	212.5	35.5	-5.7	209.8
.150	-9.1	15.8	186.7	23.1	-19.8	183.3
.200	-22.3	3.7	161.4	10.4	-33.0	157.4
.250	-35.1	-8.5	136.4	-3.1	-46.5	130.4
.300	-49.4	-23.1	107.5	-18.7	-61.0	100.3
.350	-67.3	-40.7	72.0	-40.5	-80.7	58.8
.400						
.450						
.500						

Differences: Baseline: 10 Test 4 repeat - Cam File: 1 68 mustang may 1						
Lift	Int Open	Int Close	Int Dur	Exh Open	Exh Close	Exh Dur
.050	3.3	-7.3	-4.0	0.4	-5.8	-5.4
.100	4.1	-6.3	-2.2	1.0	-5.0	-4.0
.150	5.0	-6.1	-1.1	2.3	-4.7	-2.4
.200	5.7	-5.3	0.4	1.1	-5.0	-3.9
.250	6.9	-4.2	2.7	1.6	-4.7	-3.1
.300	8.1	-2.7	5.4	1.9	-4.2	-2.3
.350	11.7	1.8	13.5	1.8	-4.8	-3.0
.400						
.450						
.500						

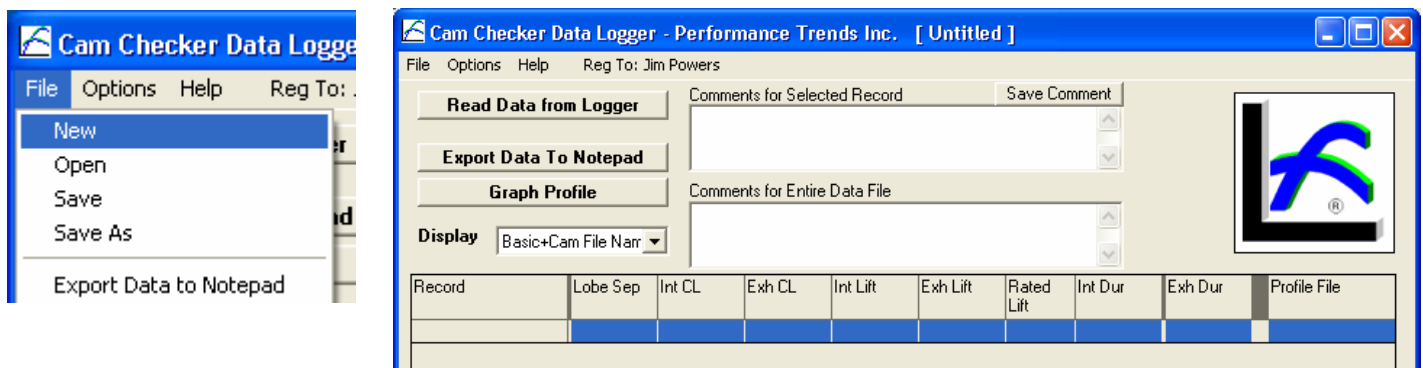
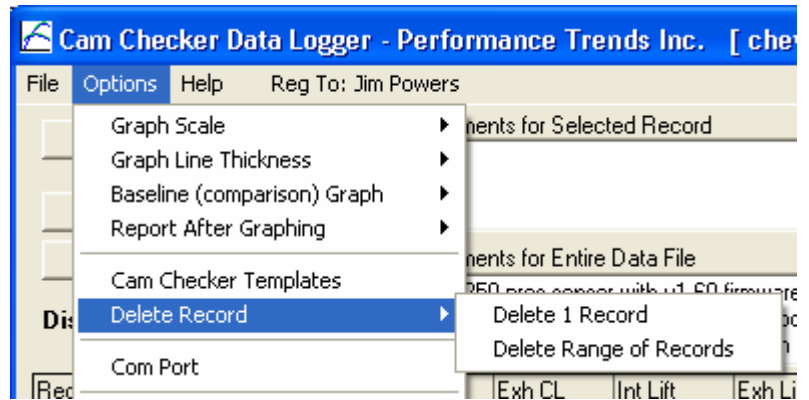
New Software Features in v1.14

In June 2018 we release new features in the Cam Checker software as described below:

Under Options, you can now Delete 1 record, or a range of records for a test file.

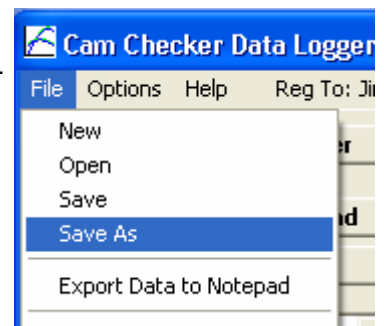
You can now save comments for entire data file, not just individual records. A test file is a group of individual records read from the Cam Checker. You probably want to group records together, like a particular test session at a particular race, or all the records from a particular customer or racer's car.

For example, lets say you are going to tech several cars after a race at Onaway Motor Speedway. You would start with a new file for all these records. You click on File, then New to create a blank file as shown below.



You start doing tests on various cars, and downloading the results to the Cam Checker software. Each test gets added as a Record, or a new line to the table (or grid) of results.

You enter "Comments for Selected Record" like "#54 Devin Jones, motor still warm", and the next record "#54 Devin Jones, motor cooled 30 min". When you are done doing all the tests on different cars at Onaway on July 22, you click on File, then Save As, and enter a file name of "Onaway July 22 2017".



The screenshot shows the main interface of the software with a file titled '[Onaway July 22 2017]'. The 'Comments for Selected Record' box contains "#54 Devin Jones, feature winner, 604 crate motor Motor still quite warm". The 'Comments for Entire Data File' box contains "Onaway Michigan July 22, 2017 Jerry Smith inspector, Josh Peterson assisting". A table with columns like 'Record', 'Lobe Sep', 'Int CL', 'Exh CL', 'Int Lift', 'Exh Lift', 'Rated Lift', 'Int Dur', 'Exh Dur', and 'Profile File' is visible at the bottom. Two callout boxes provide instructions on how to use the comment features.

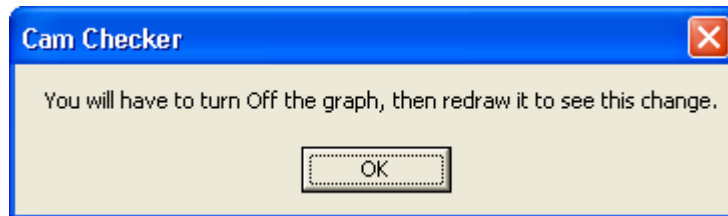
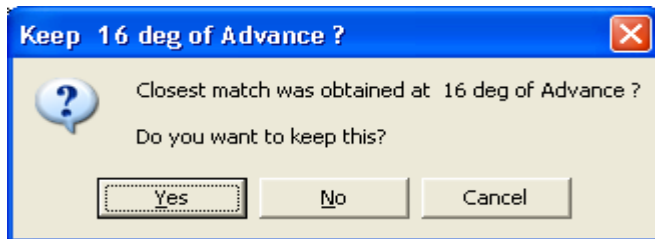
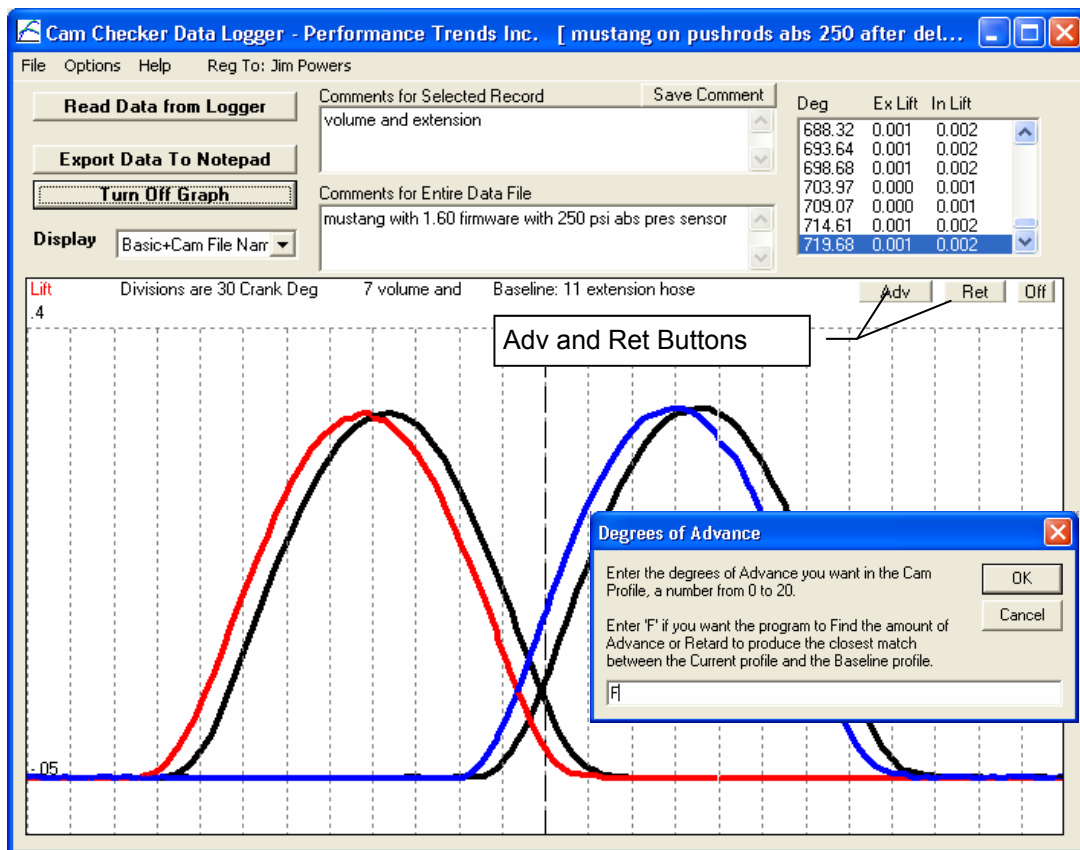
Callout 1: Comment for individual records. Click on Record (in this case Record 5) to highlight it and the comment you have entered for that particular record is shown here. You can also change it to read anything you want. This was also available before this software update.

Callout 2: This new area lets you save comments to describe this entire file, called "Onaway July 22 2017" for this example.

Record	Lobe Sep	Int CL	Exh CL	Int Lift	Exh Lift	Rated Lift	Int Dur	Exh Dur	Profile File
1 #54 Devin Jones,	112.23	121.24	103.21	0.257"	0.267"	0.050	194.74	197.00	CP0000148.txt
2 #54 Devin Jones,	112.06	120.98	103.13	0.253"	0.264"	0.050	195.95	194.67	CP0000147.txt
3 * #97 Dave Johnso	112.09	121.26	102.91	0.258"	0.264"	0.050	194.92	196.14	CP0000146.txt

There are now Adv, Ret, and Off buttons to advance and retard a cam profile. This is handy for getting better agreement between a the current profile you are graphing and the baseline cam profile.

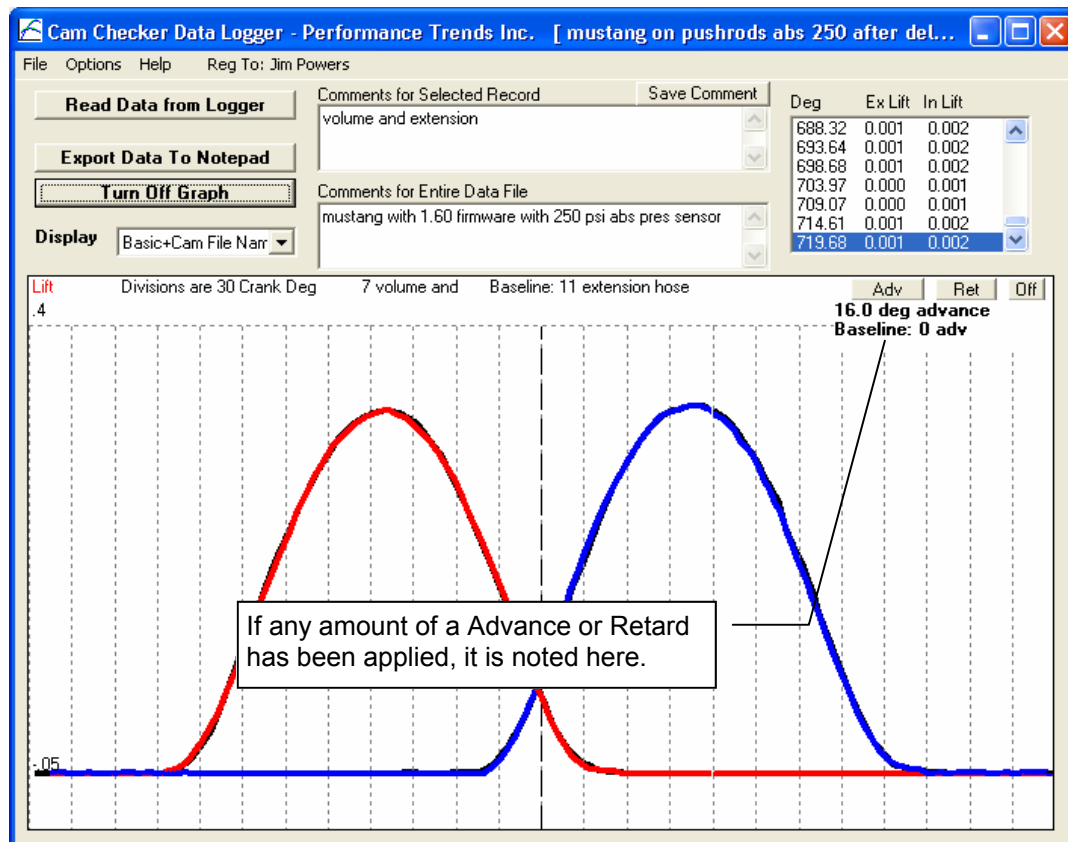
When you click on the Adv or Ret buttons and you are graphing with a Baseline profile, you also have an option to 'Find' the best advance or retard to produce the closest agreement between the baseline and the current profile you are graphing a cam profile. This is handy for getting better agreement between 2 cam profiles to check for how different



the 2 profiles are, by reducing any difference in cam timing from, say, timing chain stretch.

If you make a change in Adv or Ret, you have to click on the "Turn Off Graph" button and then click on the "Graph Profile" button for any change in cam timing to be shown.

Note: You can only Adv or Ret the current profile you are graphing, not the baseline. If you pick a different current profile to graph, the Adv or Ret is carried over to that profile also.



Crate Motor Bracket

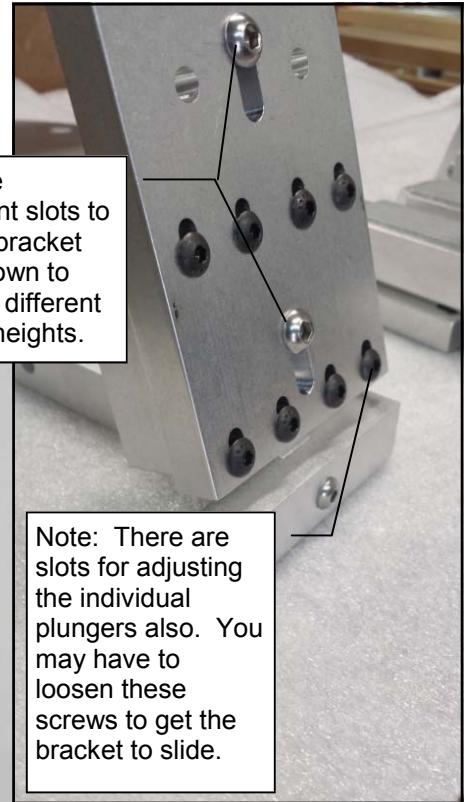
The Crate Motor Bracket is designed for the 602, 603 and 604 GM crate motors very popular in certain classes of racing.

To install the bracket, remove the valve cover. Remove the rocker arms for the cylinder you want to test. Leave the pushrods in the lifters.

Install the bracket using the 1/4 20 thumb screw into the valve cover bolt hole between the 2 valve springs. Tighten it down firmly, being sure the 2 pushrods are seated into the spring loaded lifter body recesses inside the bracket. It will rest on the 2 valve cover gasket "rails" on the head.

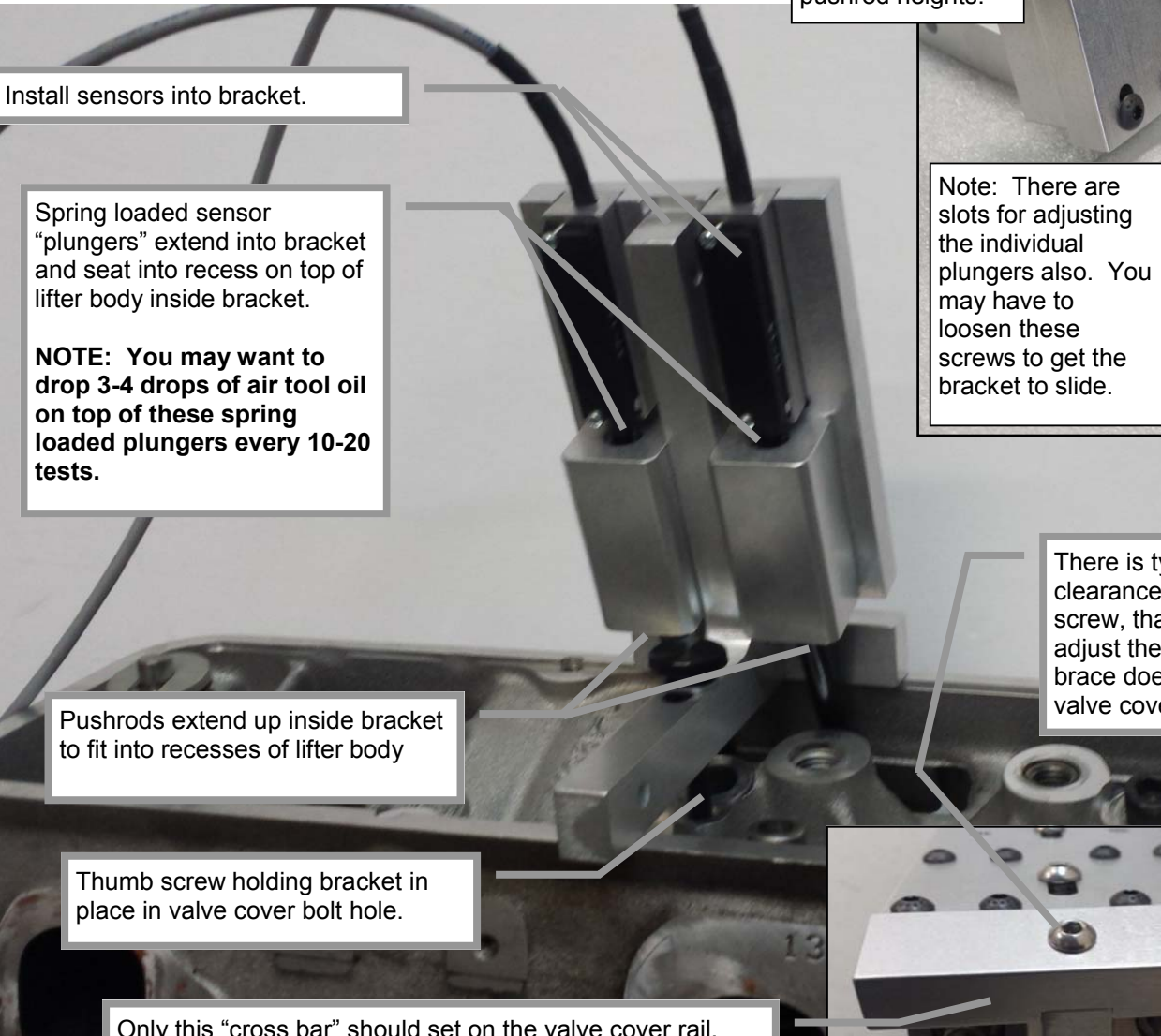
Install the 2 length sensor bodies on to this bracket. You can not use the thumb screws for the sensors because they are too long. Use the 1/4 20 button head screws which come with the bracket. The spring loaded plastic plungers of the sensors will seat into the recesses inside the bracket, on top of the lifter body.

You are now ready to test.



There are adjustment slots to slide the bracket up and down to adjust for different pushrod heights.

Note: There are slots for adjusting the individual plungers also. You may have to loosen these screws to get the bracket to slide.



Install sensors into bracket.

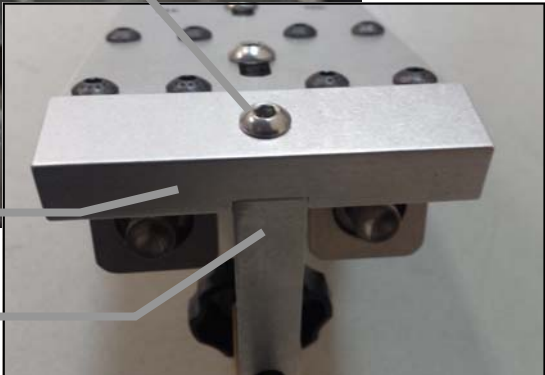
Spring loaded sensor "plungers" extend into bracket and seat into recess on top of lifter body inside bracket.
NOTE: You may want to drop 3-4 drops of air tool oil on top of these spring loaded plungers every 10-20 tests.

Pushrods extend up inside bracket to fit into recesses of lifter body

Thumb screw holding bracket in place in valve cover bolt hole.

Only this "cross bar" should set on the valve cover rail.

There is typically enough clearance around this screw, that you can adjust the bracket so the brace does not hit the valve cover rail.



Be sure this brace does not set on the valve cover rail, or the bracket could rock.

USB Driver Installation Sheet

This sheet hits the major points for getting your data logger communicating to your computer.

Plug in your Performance Trends USB device to one of your computer's USB ports You should hear the USB connect sound, and your computer should say "Found new hardware".

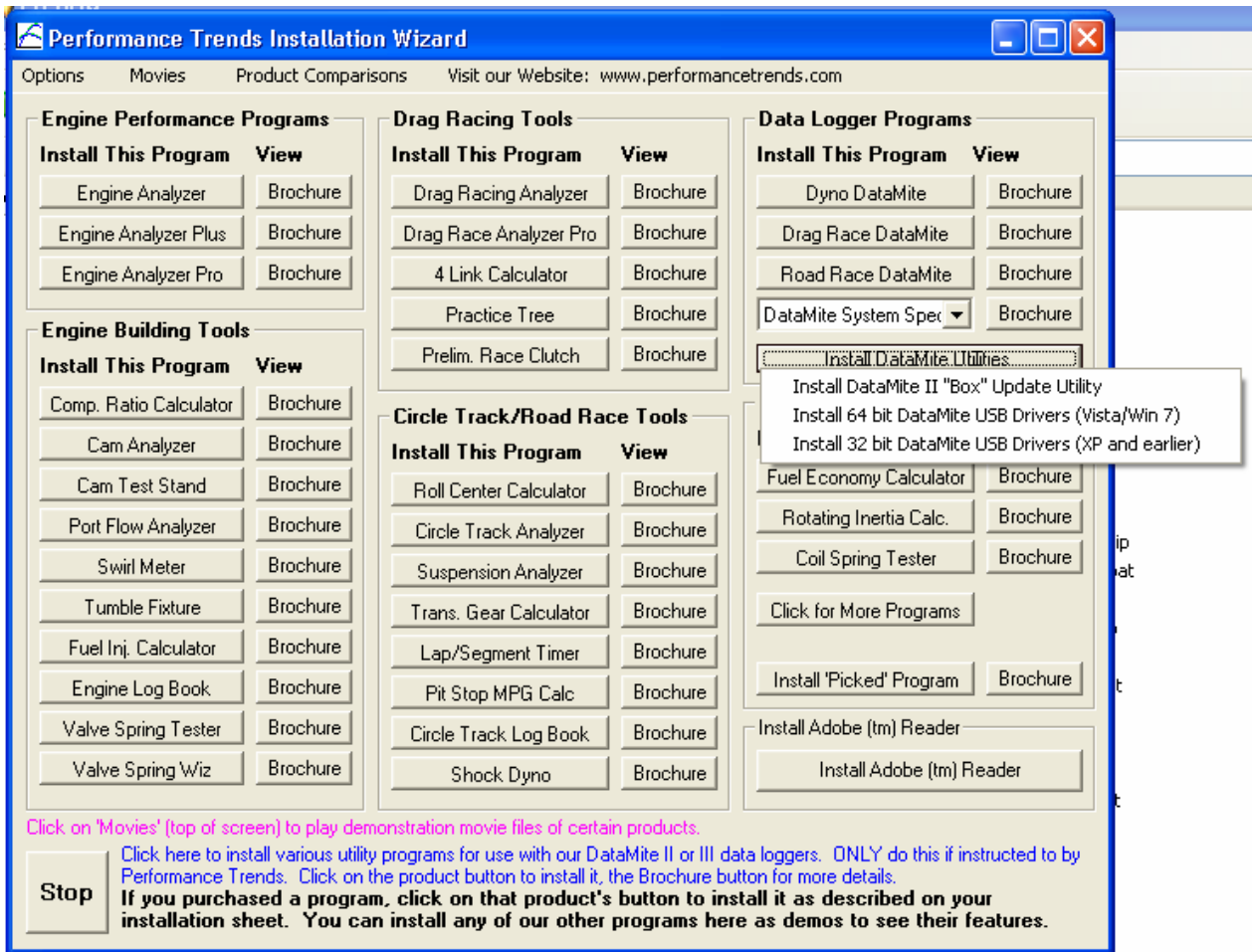


It may ask if it should connect to the internet to find a driver. Say No, and when it asks for you for a CD, put the Performance Trends Installation CD in your computer (the same CD which contains your data loggers software). When the Installation Wizard comes up, click on Stop at lower left corner. **Wait about 60 seconds to see if the USB Driver Installation Wizard comes up.**

If it does, then click on OK for the intro messages, then click on Stop in the lower left corner to shut it down. With the Installation Wizard gone, follow the instructions in the Found New Hardware Wizard. When complete, it should now say "Your hardware is ready to use."

If it does NOT, then unplug your USB cable from the computer. Remove and reinstall the Performance Trends Installation CD again. When the Installation Wizard comes up click on the "Install DataMite Utilities" button in the "Data Logger Programs" section at the upper right corner.

Choose "Install 64 bit DataMite USB Drivers" (for most new, 64 bit computers). Follow program instructions for installing USB Driver, accepting all default suggestions if offered. Once completely done installing, click on "Stop" at lower left corner of the Installation Wizard and remove the CD. Start up your software and see if it communicates now.



Cam Checker Options, Testing Motor on Stand (without starter)

To test a motor on an engine stand, you need a special rotary sensor. It is a sensor which only has 10 turns of rotation before it bottoms out (stops turning). We need this special type of sensor because when you turn the motor over by hand (bar it over), you will start and stop. The rotation is not continuous like when turning it over with the starter.

First, make the following changes to the recorder options, by pressing the Options button at the upper left of the display. Then select Calibrations and make these adjustments:

Pres Threshold set to .000240
Rotary set to .000200
Dead Band set to 5

Then back out of Calibrations and go into Procedure and make these adjustments:

Step Size set to 10
Method set to Every 360

Then back out of options and save these changes.

You will replace the pressure sensor with a linear sensor like used for the tappet lift measurement. Set this up to measure piston travel near TDC. Typically it works best if the piston pushes the sensor in about 3/4" (.75 inch) at TDC. See picture below.

Set up your rotary sensor to ride on something turning with the crankshaft. We have different size rubber wheels available depending on the diameter of the damper or pulley the sensor will ride on. You want the 10 turn sensor to turn about 2 to 2.5 rotations for every 1 rotation of the crank. See picture below



With these adjustments made above, rotate the rotary sensor backward to the start of its rotation and place it on the component turning with the crank. Press the Record button on the QCC logger and start turning the engine over. Try not to go real fast when the piston is near TDC, pressing on the TDC sensor.

The logger will stop recording when it has recorded enough data. Then you can analyze the data as outline in other sections of this manual.

Check our movie on our website under Support, then Movies, or on our youtube channel for more info.