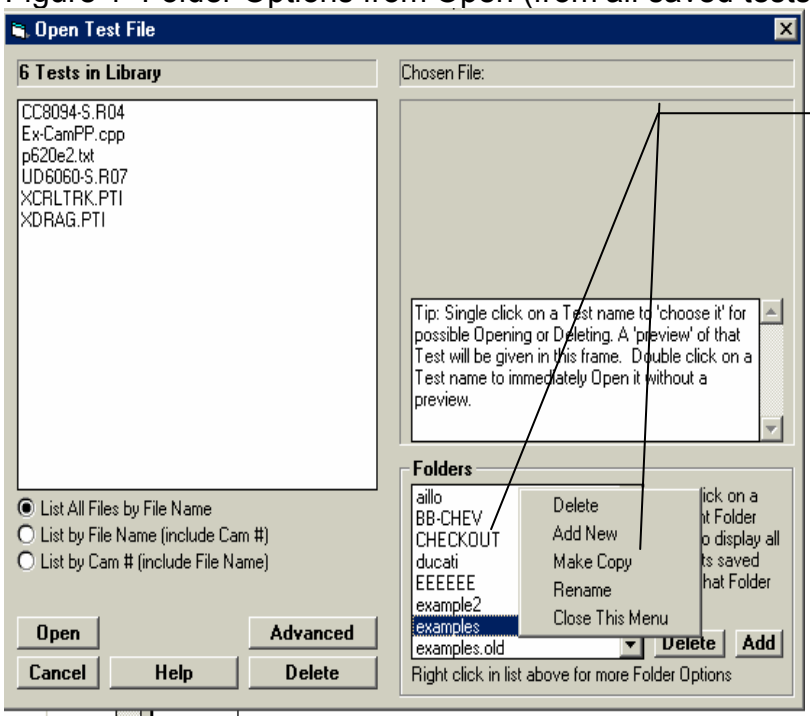
Appendix 3 New Features in Version 3.2

Several new features are included in v3.2, including:

- Full 32 bit version, which is much more compatible with newer printers, printer drivers and operating systems, like XP, 2000, NT4 etc.
- Full 32 bit version lets you use much longer, more flexible file names for saving your files.
- Click on "File", then "Open from all saved tests" and you have many more features for saving, copying, deleting and renaming folders, which are sets of cam test files.
- You can now write (export) files in Comp Cam's ™ format. This lets you create individual file lobes of intake and exhaust lobes so you can mix lobes from different cam files.
- User manual is now access bile from within the program by clicking on Help at top of the Main Screen, then Display User's Manual. The program uses Adobe Acrobat ™ to display it in PDF format.
- The graph screen now enlarges to fill the entire computer screen.
- You can now select the amount of smoothing the program should do to manually entered cam lift data. For example, data entered at more than every 5 degrees should probably have less than the Std smoothing.
- You can now select to manually enter the degree increments in most any step size you want. This allows you to concentrate the readings in only the area you want (like around .050 lift and peak lift). This is done by selecting User Entered for Degree Steps in Test Setup.
- Program now tries to automatically recognize if a file was recorded with millimeters or inches lift. It then converts it as necessary for the current Preference setting of either millimeters or inches lift.
- Several edit options added at top of main screen.
- Preference added for using either millimeters or inches for lift inputs.
- Added option to Copy To or Paste From the Clipboard the Lift Data Column. Click on Top Row in Lift Column "Tappet Lift" to see this option.
- Added options to read different lobes in Cam Pro Plus files. It previously defaulted to just the first lobe, typically Cylinder #1.
- Added Edit Command to Copy or Swap Lobes option under File command.

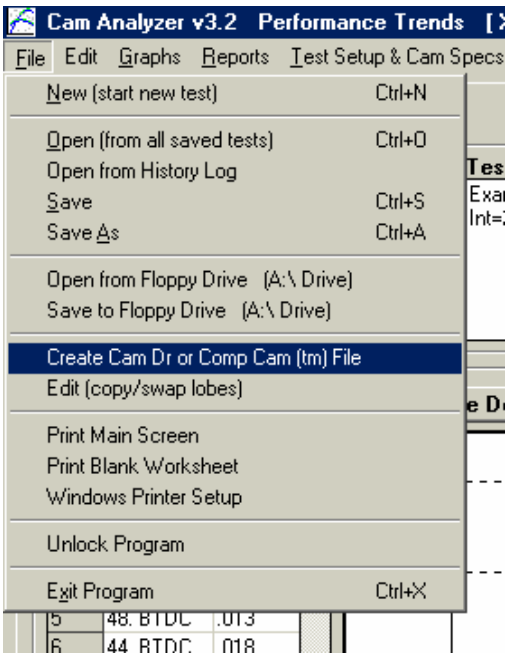
Figure 1 Folder Options from Open (from all saved tests) Screen



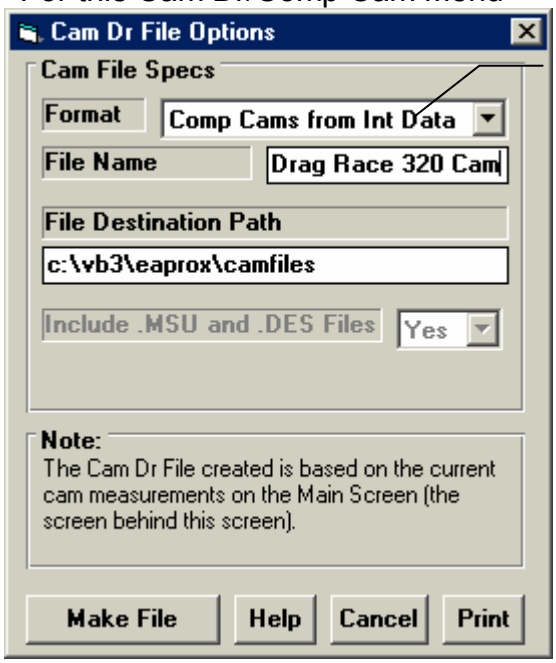
Some of these features will be illustrated below.

Figure 2 Exporting Cam Files in Comp Cams ™ File Format

Click on File, then Create …

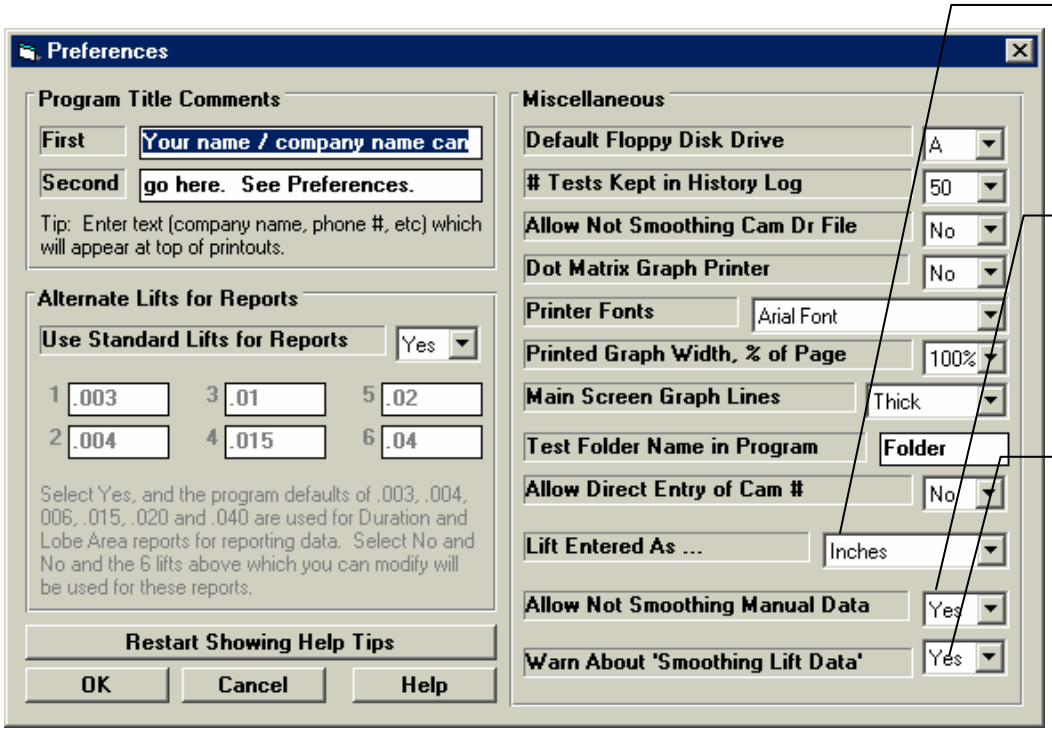


For this Cam Dr/Comp Cam Menu



Select Comp Cams option for either exporting the Intake or Exhaust cam profile from the current cam profile on the Main Screen.

Figure 3 New Preferences

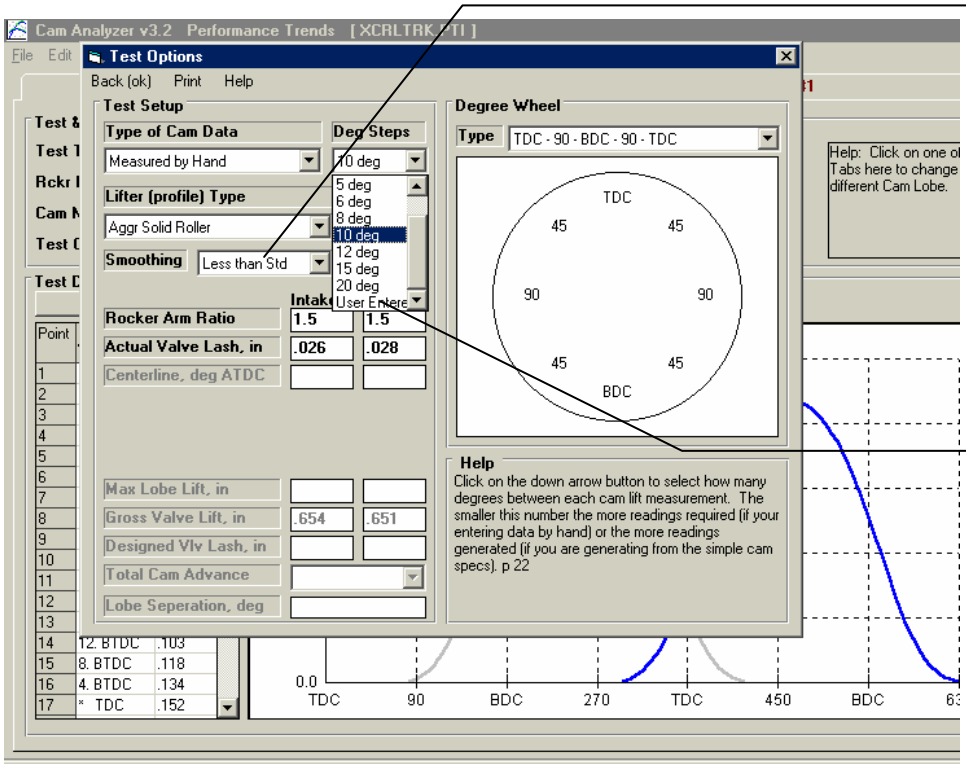


Lift can be entered either as inches or millimeters.

Select Yes here to show the “Smoothing” option in the Test Options screen. See Figure 4.

Here you can turn On or Off warnings which may appear when you close the Test Options menu about Smoothing hand measured Lift Data depending on the Deg Incs you have selected.

Figure 4 Two Important New Test Options



New Smoothing options for Cam Data which has been “Measured by Hand”. If you are using large “Deg Steps” (larger than 6 degrees), it is recommended you use “Less than Std”. There is usually NO reason to use “None” unless you want to compare the actual data measured with the “smoothed” data.

“User Entered” for Deg Steps let you enter the degree wheel reading at each reading. This way you can concentrate on areas of particular interest, say at peak lift and at the lower lifts, and record fewer points at other points to save time.

Figure 5 Edit Options, Including Converting Between Millimeters and Inches

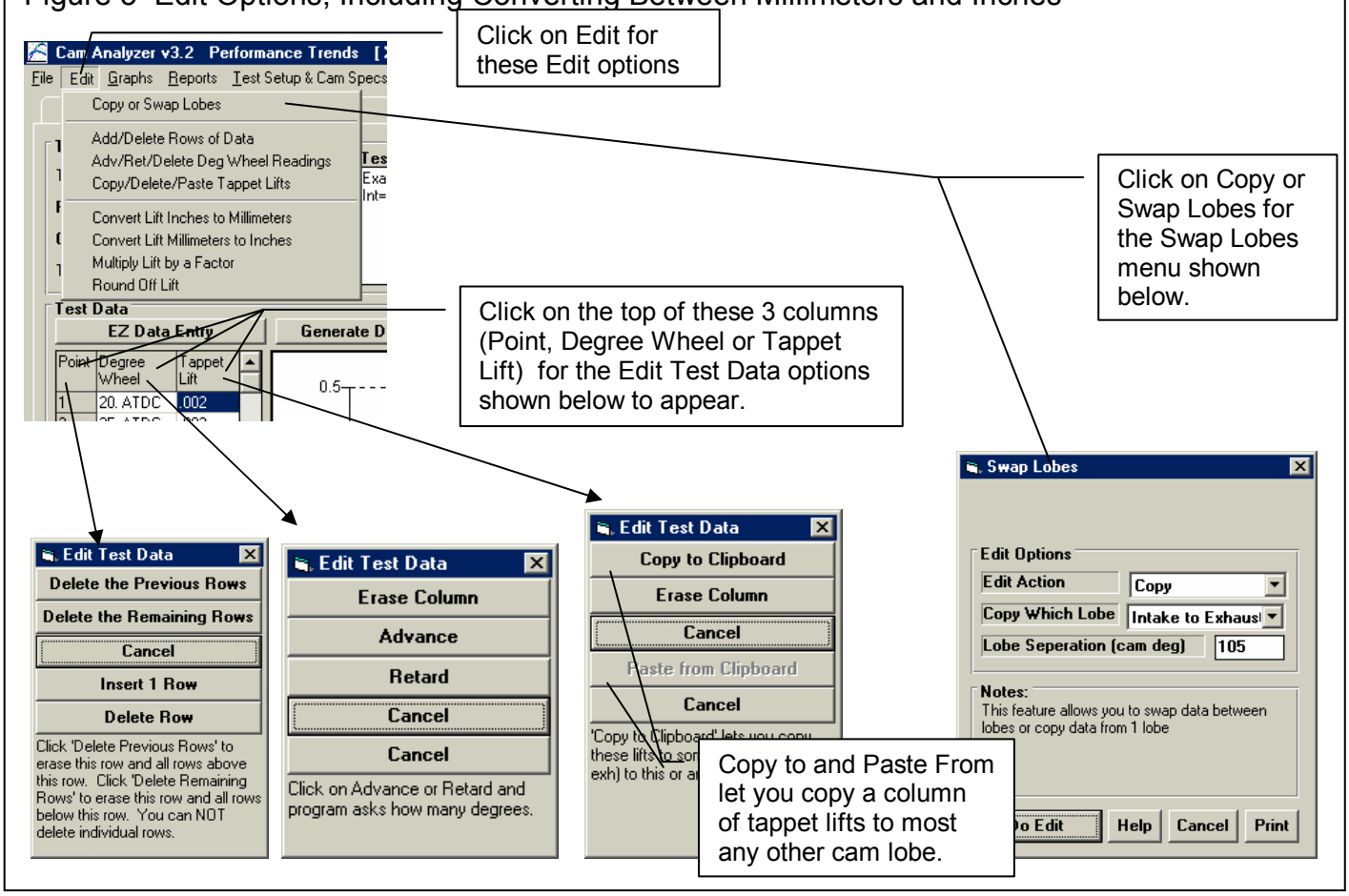
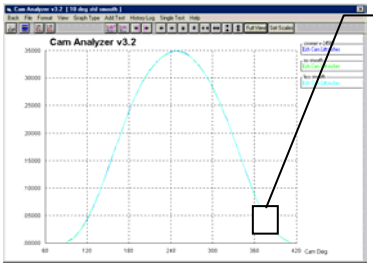
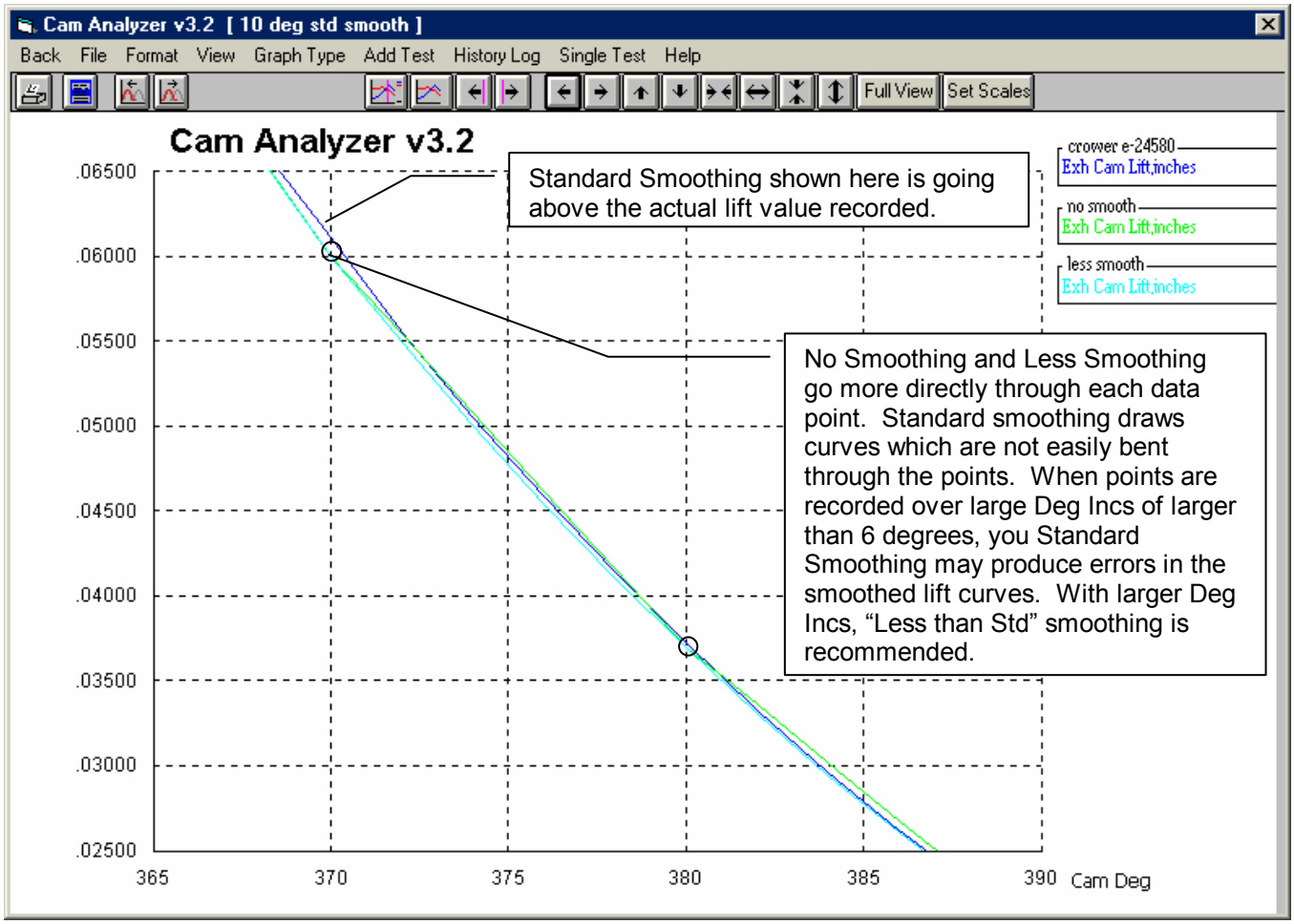


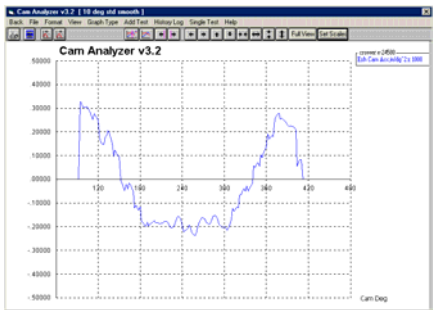
Figure 6 Illustration of "Smoothing"



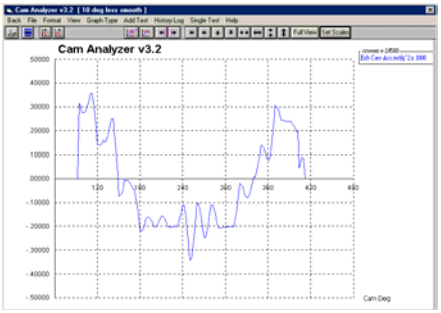
This graph is of 3 cam files Measured by Hand with 3 different smoothing settings, Standard, Less than Standard and None. See Figure 3. With mouse, click and drag to draw a box around the closing ramp to zoom in.



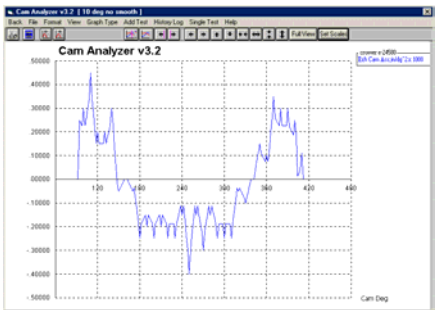
Acceleration with Standard Smoothing (relatively accurate)



Acceleration with Less than Std Smoothing (jumpy data)



Acceleration with No Smoothing (very jumpy data)



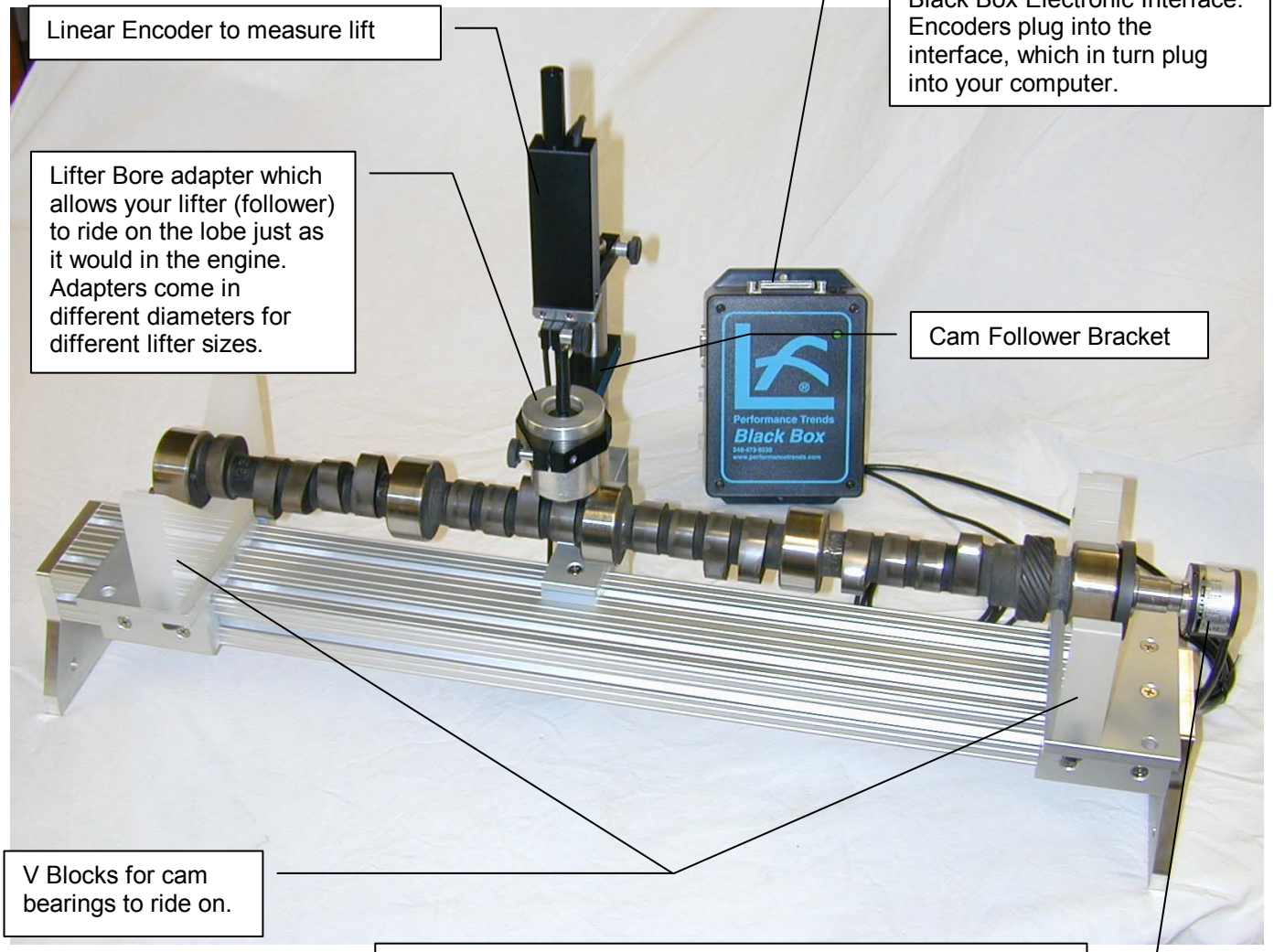
Tips on Smoothing

- No Smoothing draws straight lines directly through each data point. Even if each data point you record is exactly correct, this method of estimating the cam profile between points is not very accurate, because the cam profile is a curve, not segments of straight lines.
- Standard smoothing draws curves which are not easily bent through the points. This was the smoothing done to all cam profiles in version 2.0. Since the curves are not easily bent, it may not draw the cam profile exactly through each point you record. This can actually be more accurate because it is impossible to exactly measure each point. This method can also "flag out" errors in data entry when hand recorded points do not lie on smooth curves. However, if you are using large degree wheel increments for making measurements (something larger than 6 degrees), this method may be too "stiff" to bend accurately through the points you have recorded.
- Less than Standard Smoothing draws curves between points, but bends more easily than Standard Smoothing. This is the amount of smoothing recommended if you are using large degree wheel increments, something greater than 6 degrees.

Appendix 4: New Features for Cam Test Stand (v3.2 B)

Several new features are included in v3.2 B. Most all these features involve using the electronics, encoders and test stand to measure camshafts quickly and accurately. Figure A4.1 shows the cam test stand and critical components.

Figure A4.1 Cam Test Stand



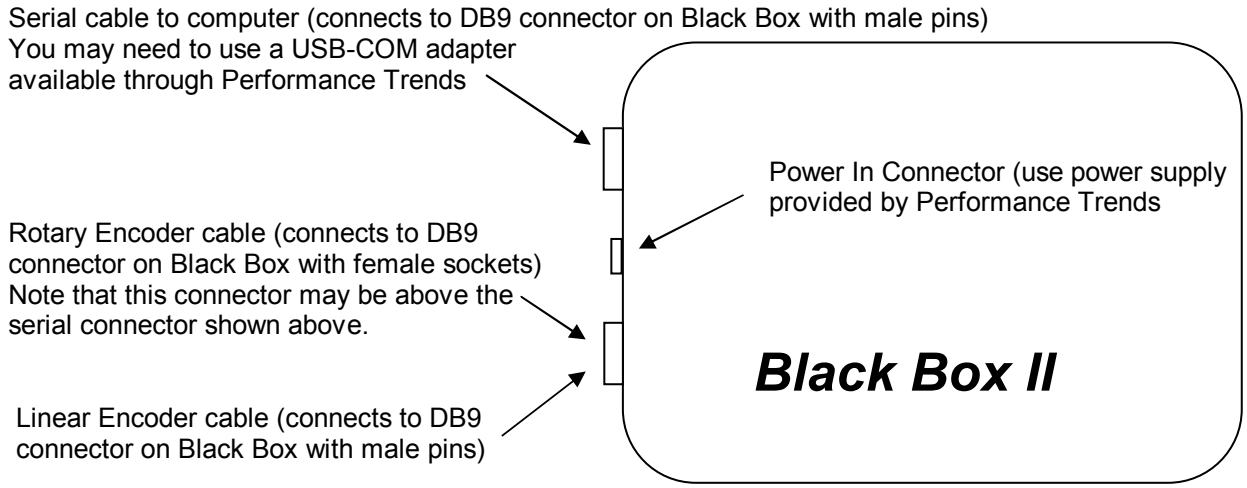
The first part of this supplement will be arranged as a series of steps to get your software and hardware setup so you can start measuring cams and analyzing the results. At the end of this supplement there will be sections discussing more new features.

A4.1 Setting Up and Running A Test

1 Set Up Black Box II

Make the connections as shown in Figure A4.2. You will need a USB-COM (serial) adapter if your computer does not have a true COM (serial) port.

Figure A4.2 Black Box Connections



Encoders should have proper connectors so they can not be plugged in incorrectly.

2 Set Up Software

It is easiest to start by opening up an example test which was done with the Cam Test Stand. This is shown in Figure 3. Click on File, then Open from All Saved Tests at the upper left corner of the main screen. Click on the SB Ford on Stand or SB Chevy on Stand from the Examples folder, then click on Open to open that test file. Back at the main screen you will see all 16 lobes with tabs across the top for each one in cylinder numbering order. At the bottom of the main screen you will see the lobes drawn out as they are arranged on the camshaft itself, including bearings, distributor gear (if any), etc.

You can click on the tabs at the top, or the numbers on the lobes on the bottom to move to that particular lobe. Then its data is listed in the spreadsheet in the lower left corner and its graph is shown on the graph section in color. If you have selected the appropriate preference, lobes for all other cylinders are also shown for comparison to let you spot lobes which are different from the rest. See Section A4.4 New Preferences.

You must tell the software what type of rotary encoder you are using. See Figure A4.4 This is done by clicking on Settings at the top of the main screen, then Tester Calibration, then typing in 2500 for Rotary Sensor Pulses/Rev. (Old Cam Dr encoders are 3600.) You can also set the Com Port you will use to connect to the Black Box, typically Com 1 on older computers. If you are not sure which com ports are available on your computer, click on the Find button and let the program try all com ports to see if it can find the Black Box. Be sure the Black Box is powered up (green LED lit) and the serial cable is connected correctly when doing this. This "Finding" process may take 30-60 seconds.

When you have set these items, click on Back at the top of the Cam Tester Specs screen, then choose to save these changes when asked by the program. These will then be saved as the "Master" Cam Tester Specs, which the program assumes is the encoder you are using right now. If you would open a previously done test, you may see different Cam Tester Specs. That is because those items were used for that test, which may not be the same as for the Cam Test Stand you are running right now.

Figure A4.3 Opening an Example Test Which Was Done on a Cam Test Stand

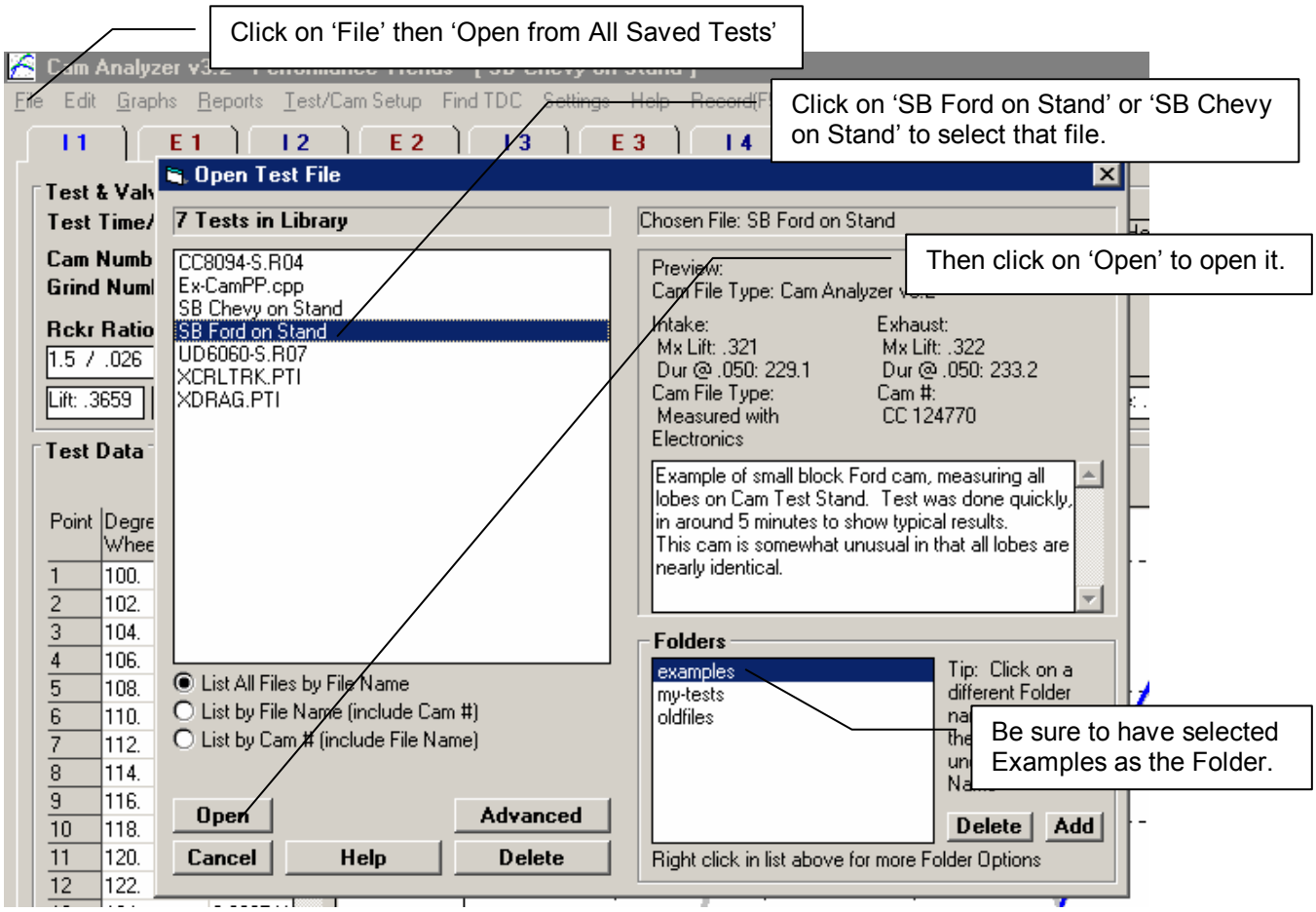
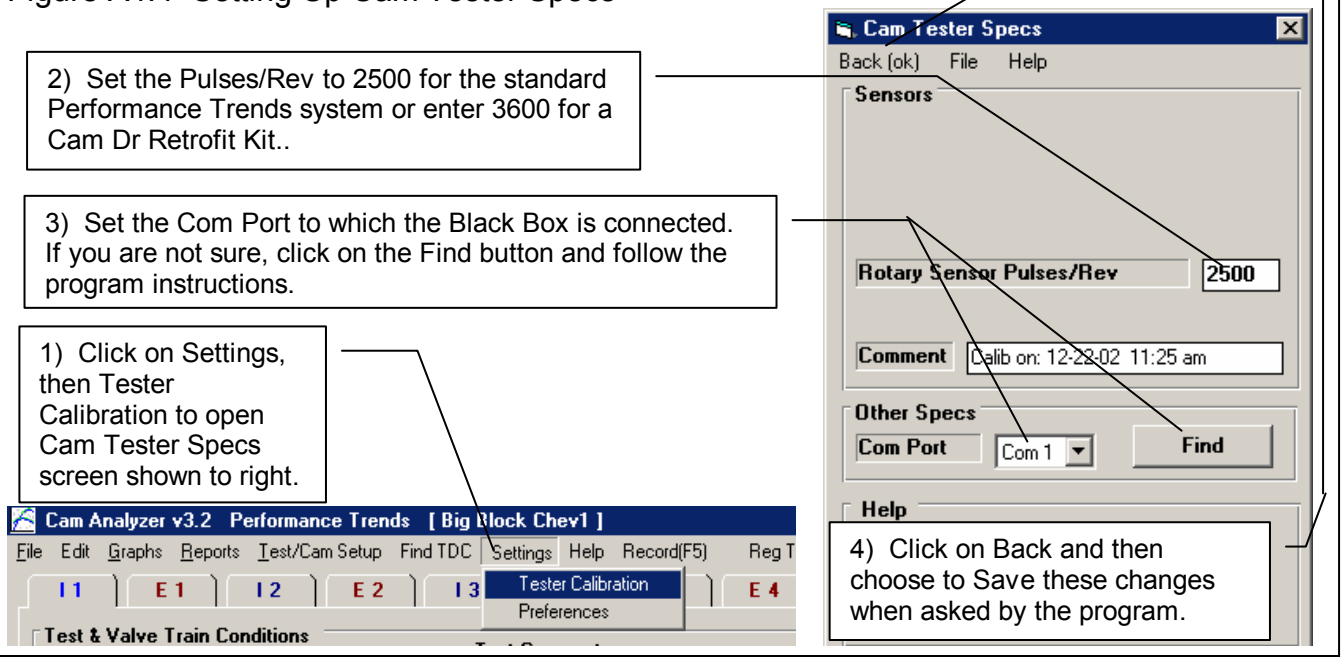


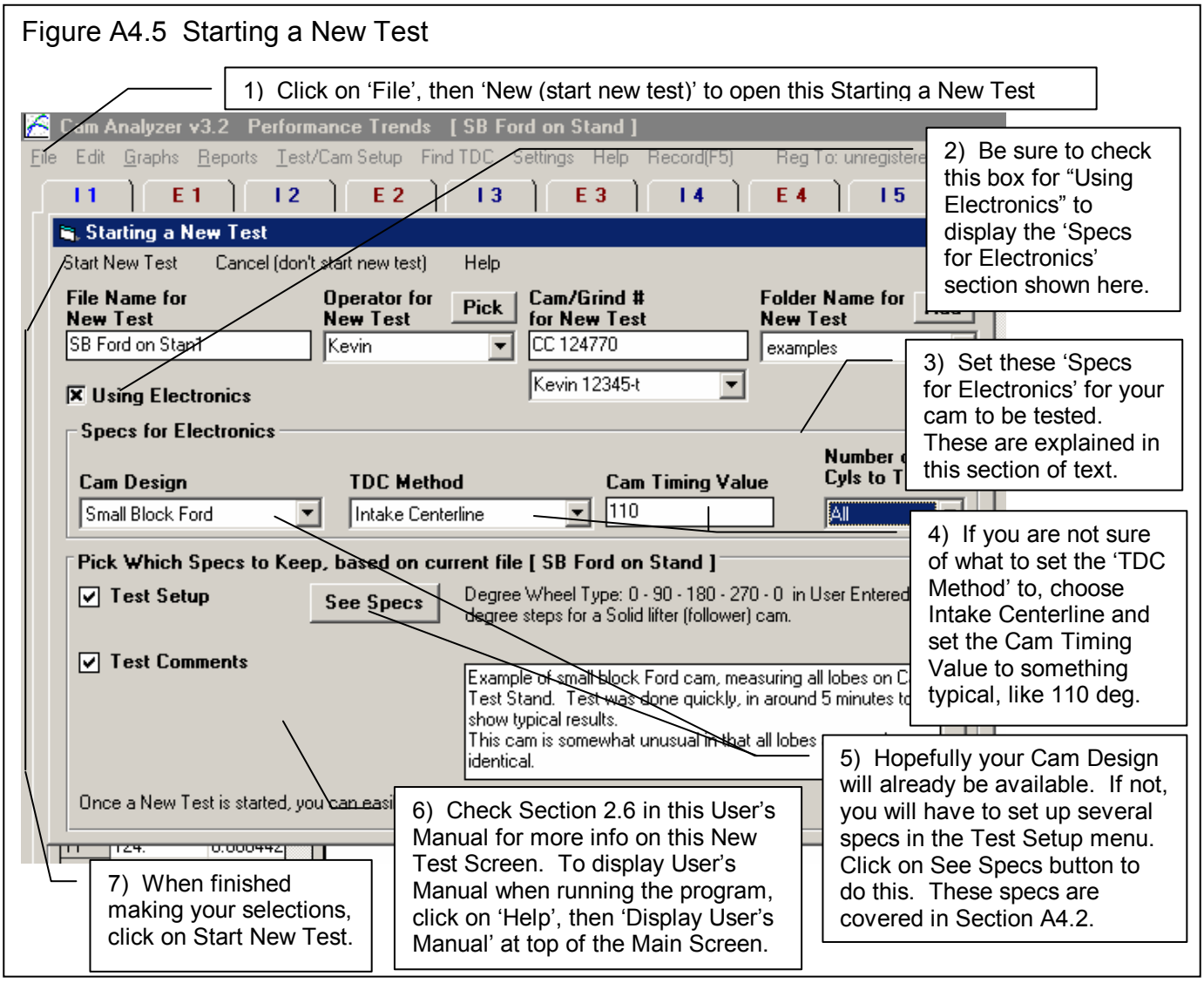
Figure A4.4 Setting Up Cam Tester Specs



3 Starting a New Test

To start a new test, click on 'File', then 'New (start new test)' at the upper left corner of the main screen. See Figure A4.5.

Figure A4.5 Starting a New Test



Specs for Electronics

Cam Design
TDC Method
Cam Timing Value
Number of Cyls to Test

The section 'Specs for Electronics' in the Starting a New Test screen contains critical items the software needs to know how your cam lobes are arranged on the camshaft. These critical items are covered in the upcoming Section A4.2.

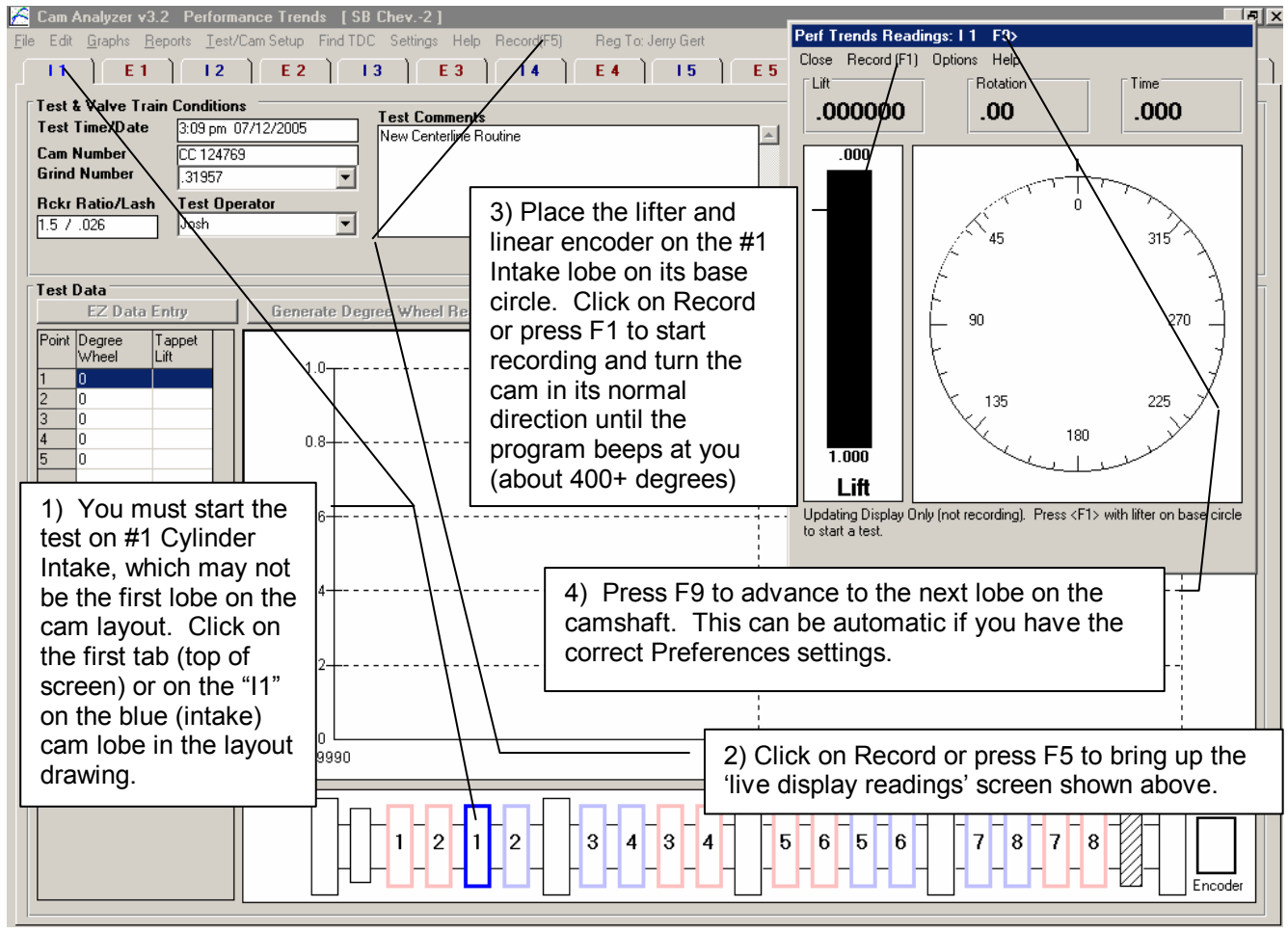
For other inputs in this screen, check Section 2.6 in this manual. To Display this User's Manual when running the program, you can click on Help, then Display User's Manual at the top of the main screen.

When you have entered all the info and changes for this screen, click on 'Start New Test' at the upper left of this screen. You will be returned to the main screen with all lobes blanked out.

4) Running a Test

Figure A4.6 outlines the major steps to run a cam test. These steps will be discussed in more detail in the text of this section.

Figure A4.6 Running a Test from the Main Screen



1) You must start the test on #1 Cylinder Intake, which may not be the first lobe on the cam layout. Click on the first blue tab at the top of screen or on the "I1" (for Intake #1) on the blue (intake) cam lobe in the layout drawing at the bottom of the screen.

2) Click on Record or press F5 to bring up the 'live display readings' screen shown above. When you first start talking to the Black Box, both encoders are zeroed out. This does not mean the measurement is zero. The true zero degrees will be determined after the #1 Intake lobe is measured, based on the timing method you have selected in the Starting a New Test screen. Zero lift is redetermined for each lobe based on the lowest reading read for that lobe (typically on the base circle).

If you get a message that the Black Box is not communicating, check some of the troubleshooting tips at the end of this document.

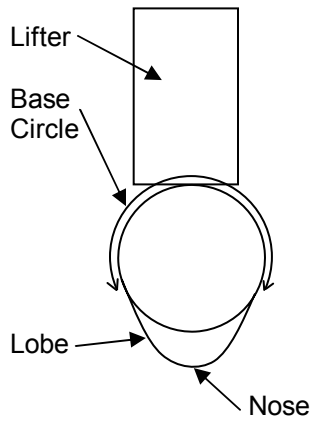
3) Place the lifter and linear encoder on the #1 Intake lobe on its base circle. See Figure A4.7. This is the part of the cam lobe on the opposite side from the 'nose' or peak. Click on Record or press F1 to start recording and turn the cam in its normal direction until the program beeps at you (about 400+ degrees). Turn the cam relatively slowly and smoothly. It should take at

least 10 seconds to rotate the cam. It is most critical to rotate the cam slowly when on the actual lobe. When on base circle, you can rotate the cam more quickly.

If you turn the cam in the wrong direction, it will beep at you. If this happens and you believe you are turning it in the correct direction, check that the Rotary Encoder is pictured on the correct end of the cam in the Cam Layout drawing. If that is correct, then you must have the Rotation Direction wrong in the Cam Layout specs, discussed in Section A4.2.3.

4) Press F9 to advance to the next lobe on the camshaft. This can be automatic if you have the correct Preferences settings. If you have turned other Preferences on, the program will make some checks to see that the lobe measurements appear accurate. Some of these checks have to do with turning the cam too fast. Others have to do with whether these results look the same as what was measured on #1 cylinder. Since this is #1 cylinder, this particular check is not done. If you are mostly interested in a quick check, these checks are not that important. If you want accurate acceleration and jerk details, you should use these checks to 'flag out' lobe measurements which could have errors. See Section A4.3 on New Preferences.

Figure A4.7 Start with Lifter on Base Circle



Loosen the Cam Follower Bracket, lift the follower up into its adapter, and slide the lifter and bracket to the next lobe as identified in the Cam Layout drawing by the highlighted lobe (brighter color than the rest). Lower the follower to the cam lobe and tighten the bracket. Then rotate the cam until the lifter is again on base circle (see Figure A4.7) and press F1 to start recording. Then rotate the cam slowly and smoothly until it beeps at you. The program will make it's checks and then you or the program will advance it to the next lobe. Just keep repeating this pattern until all lobes are measured that you wanted to measure.

Tips:

The lifter must slide smoothly in the lifter bore adapter and the cam bearings must slide smoothly on the V blocks. Cozmoline (an 'anti-rust' coating) from new cams will be on the bearings and can get on the lifter itself and cause sticky, jerky (inaccurate) measurements. For quick checks of duration and lift this is OK if you are careful.

Be sure the pointed tip of the rotary encoder assembly is fully inserted into the pilot of the cam. If this is not done, you will see that the ring magnet will not be concentric on the cam's end bearing, and the encoder will 'orbit' as you turn the cam.

Be sure the linear encoder's tip is on a flat section of the lifter and not near the oil hole for the pushrod.

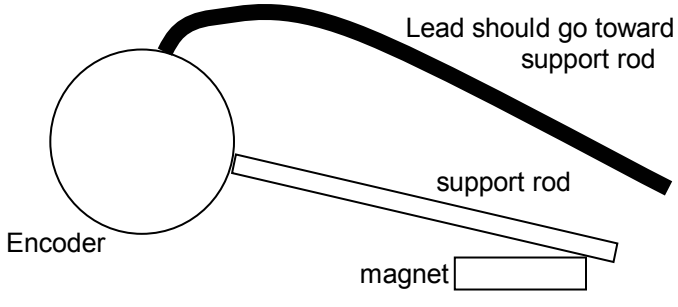
The slower you turn the cam, generally the more accurate the readings. You especially want to turn the cam slowly on the opening and closing ramps, where lift changes rapidly. We've measured lobes rotating them in anywhere from 5 seconds up to 30 seconds per lobe. Stopping the rotation to reposition your hand has generally not been a problem.

When you turn the cam, turn on a gear or bearing well away from the lobe being measured and close to one of the V block supports on the Cam Test Stand. This helps ensure you are not loading and bending the camshaft. Also, try to only put a torque (twist) on the cam, and no side or up/down loading.

Route the linear encoder's cable away from the camshaft. Route the rotary encoder's cable in the same direction as the Support Rod which sets on the magnet.

Avoid having the camshaft move longitudinally (along its length) because the Rotary Encoder Support Rod may change its rotary position slightly on the magnet which keeps the rotary encoder indexed correctly.

Figure A4.8 Rotary Encoder Cable Routing



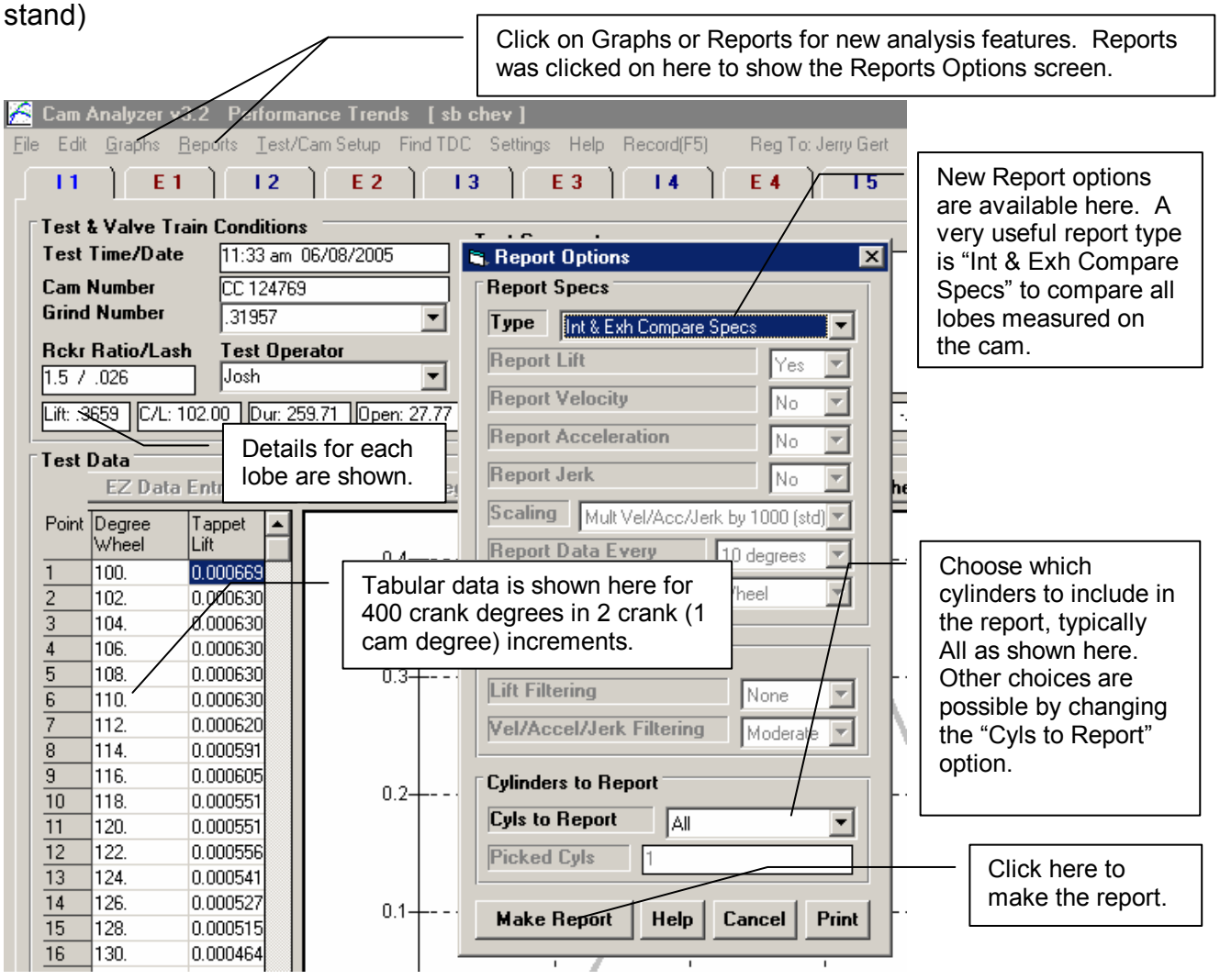
If you must restart measuring a cam you have already measured lobes on, you must first remeasure #1 Intake. This gets the rotary encoder and Black Box electronics indexed correctly. Then you can go directly to the next lobe in the sequence. (Note that it is most accurate if you do ***not*** have to do this, but the amount of error introduced by this method is typically less than 0.2 degrees.)

5 Analyzing Data:

There are several new types of graph and report options that the v3.2 B provides. These are available by clicking on either Graph or Report at the top of the main screen as shown in Figure A4.9.

One of the most useful new reports is the Int & Exh Compare Specs, which lets you compare all lobes on the cam you tested. You can quickly see which lobes are significantly different than the others. Figure A4.9 shows you how you request the report on all Intake and Exhaust lobes. Figure A4.10 shows the resulting report.

Figure A4.9 New Analysis Features for Measurements Taken Electronically (with cam test stand)



Another new report type is Compare Measurement Comments. As discussed earlier, the program makes checks of the measurement data for each lobe measured. The results of these checks are saved so that you can check them if you want. See Figure A4.11. These checks include:

Max Gaps: You would have to turn the cam extremely slowly for the computer to get a measurement at each cam degree of rotation. Therefore, the program uses sophisticated math to fill in gaps in your measurements. If the gap to be filled is too great, the results may have some errors. The Max Gaps comments display the largest gap in crankshaft degrees and largest gap in lift. These checks are only made for the actual lobe, and not on base circle, where measurements are not that critical. For example, if you see something unusual in a lobe, you can check these comments to see if there may be a reason for the unusual results and my decide to measure the lobe again.

Max Error: In the process of filling in the gaps, the program estimates the amount of ***average*** error estimating lobe lift for each gap. Although these errors look small, it must be remembered that the actual error could be much greater than the ***average*** error. Also, even small errors in lift can produce very large errors in acceleration and jerk calculations.

High Accels: The program checks each lobe to see if there are unusual looking "breaks" in the lift curve, like a sharp bump or dip. With a follower on the cam (not a small pointer), it is impossible for these to be seen even if they were there. Therefore, it can be assumed these are measurement errors. If these "breaks" are found, the words "High Accels" are added to the Measurement Comments.

Figure A4.9 also shows a new option for graphs and reports, in the Cylinders to Report section at the bottom of their screens. In this section, you see 'Cyls to Report', which can be set to All, or Cyl 1 Only, or Pick. If you choose Pick, then the "Picked Cyls" entry box becomes enabled. There you can type in a list of cylinder numbers, separated by commas for the cylinders you want included in the report. For example, you could enter:

1, 4, 5

And the program would then do the report on only cylinders 1, 4 and 5. This can be most useful for graphs, where space in the legend limits the number of graphs you can include on one graph. Figure A4.12 shows picking 3 cylinders for the current test for graphing.

Figure A4.10 Int & Exh Compare Specs Report from Screen in Figure 9

Cam Analyzer v3.2 Performance Trends [sb ford try from new 006-newCL]

Back Print Report Types File Help(F1)

Comments

Report of: Cyl 1, Cam Data Test Time: 12:42 pm 06/06/2005 Events Rated at .05" Tappet Lift

	CLine	Dur	Open	Close	Lb Area	Lb Lift	Vlv Lift	RAR	Lash	LbSep/Adv	Overlap
Int:	105.0	228.2	8.9	39.3	25.34	.318	.477	1.5	.026	107.4	15.7
Exh:	109.8	233.5	46.6	6.8	26.13	.322	.483	1.5	.028	2.4 Advance	

Lobe	Lobe Lift	Center Line	Lobe Sep.	Advance	Duration	Open	Close	Lobe Ar			
# 1	.3181	105.00	107.38	2.38	228.17	8.88	39.29	25.341			
# 2	.3192	104.84	107.60	2.76	229.15	9.50	39.65	25.646			
# 3	.3200	104.69	107.52	2.83	229.69	9.91	39.78	25.696			
# 4	.3181	104.81	107.35	2.54	228.97	9.35	39.62	25.565	.351	-.219	.318
# 5	.3180	105.00	107.38	2.38	228.01	8.92	39.09	25.254	.362	-.221	.315
# 6	.3186	104.87	107.47	2.60	229.01	9.27	39.74	25.711	.361	-.221	.321
# 7	.3198	104.32	107.39	3.07	229.77	10.02	39.76	25.734	.356	-.219	.317
# 8	.3188	104.72	107.48	2.76	229.16	9.71	39.45	25.466	.352	-.221	.313
# 1	.3222	109.76	107.38	2.38	233.45	46.63	6.81	26.126	.321	-.223	.318
# 2	.3209	110.36	107.60	2.76	232.49	46.65	5.85	26.065	.326	-.221	.327
# 3	.3214	110.35	107.52	2.83	233.41	46.98	6.42	26.120	.319	-.223	.322
# 4	.3216	109.89	107.35	2.54	232.72	46.35	6.36	26.039	.327	-.221	.332
# 5	.3221	109.75	107.38	2.38	233.36	46.49	6.87	26.085	.327	-.223	.330
# 6	.3217	110.06	107.47	2.60	232.82	46.56	6.27	26.137	.333	-.224	.329
# 7	.3208	110.45	107.39	3.07	232.73	46.76	5.97	25.998	.324	-.224	.323
# 8	.3216	110.23	107.48	2.76	233.25	46.75	6.51	26.075	.326	-.222	.329

The Cam Timing method for this cam was Intake Centerline at 105 deg. Note that #1 Cylinder has exactly 105 deg centerline and most all the others are different because they are all measured with respect to #1 cylinder intake.

Figure A4.11 Compare Measurement Comments Report

Cam Analyzer v3.2 Performance Trends [sb chev]

Back Print Report Types File Help(F1)

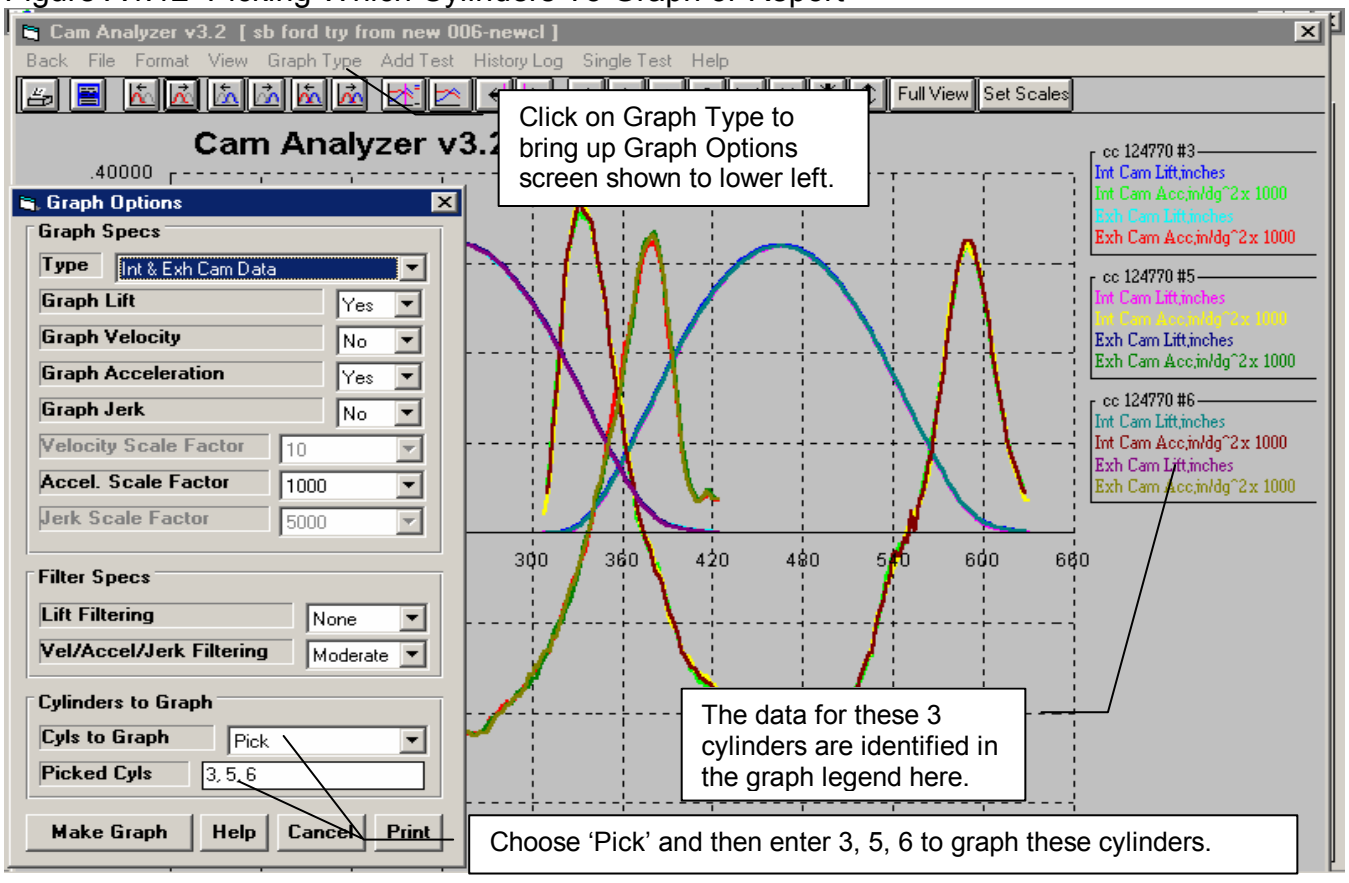
Comments

Report of: Cyl 1, Cam Data Test Time: 11:33 am 06/08/2005 Events Rated at .05" Tappet

	CLine	Dur	Open	Close	Lb Area	Lb Lift	Vlv Lift	RAR	Lash	LbSep/Adv
Int:	102.0	259.7	27.8	51.9	32.58	.366	.549	1.5	.026	105.5
Exh:	109.0	268.2	63.0	25.2	34.61	.382	.573	1.5	.028	3.5 Advance

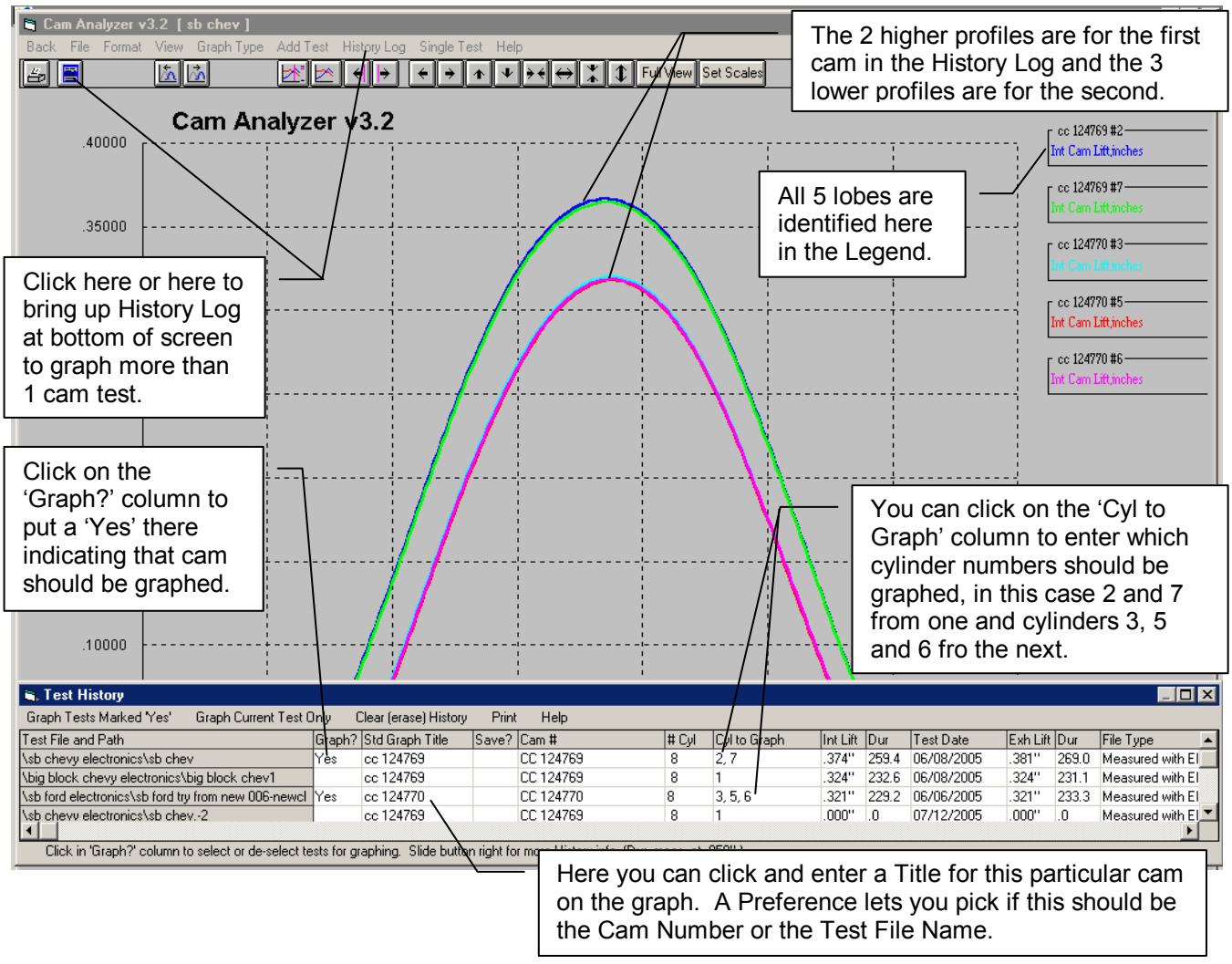
Lobe	Comments
# 1	Max Gaps: Deg = 5.8 Lift = -.001 Max Er = .00011 @ .305 lift
# 2	Max Gaps: Deg = 4.8 Lift = -.002 Max Er = .00012 @ .132 lift
# 3	Max Gaps: Deg = 6.3 Lift = -.002 Max Er = .00011 @ .052 lift
# 4	Max Gaps: Deg = 5.0 Lift = -.001 Max Er = .00009 @ .125 lift
# 5	Max Gaps: Deg = 5.5 Lift = -.001 Max Er = .00009 @ .164 lift
# 6	Max Gaps: Deg = 6.8 Lift = .019 Max Er = .00011 @ .143 lift
# 7	Max Gaps: Deg = 7.4 Lift = -.001 Max Er = .00008 @ .065 lift
# 8	Max Gaps: Deg = 5.9 Lift = .016 Max Er = .00009 @ .277 lift
# 1	Max Gaps: Deg = 6.8 Lift = -.001 Max Er = .00010 @ .197 lift
# 2	Max Gaps: Deg = 8.4 Lift = -.002 Max Er = .00016 @ .251 lift
# 3	Max Gaps: Deg = 6.6 Lift = .018 Max Er = .00008 @ .245 lift
# 4	Max Gaps: Deg = 5.9 Lift = -.002 Max Er = .00012 @ .071 lift
# 5	Max Gaps: Deg = 5.3 Lift = .015 Max Er = .00011 @ .168 lift
# 6	Max Gaps: Deg = 4.9 Lift = -.001 Max Er = .00007 @ .069 lift
# 7	Max Gaps: Deg = 6.3 Lift = -.002 Max Er = .00019 @ .035 lift
# 8	Max Gaps: Deg = 5.9 Lift = -.002 Max Er = .00012 @ .128 lift

Figure A4.12 Picking Which Cylinders To Graph or Report



You can also specify which cylinders to include in a graph in the History Log. Figure A4.13 shows how you can pick different lobes from different cam test files for comparison graphs.

Figure A4.13 Picking Different Lobes from Different Cams

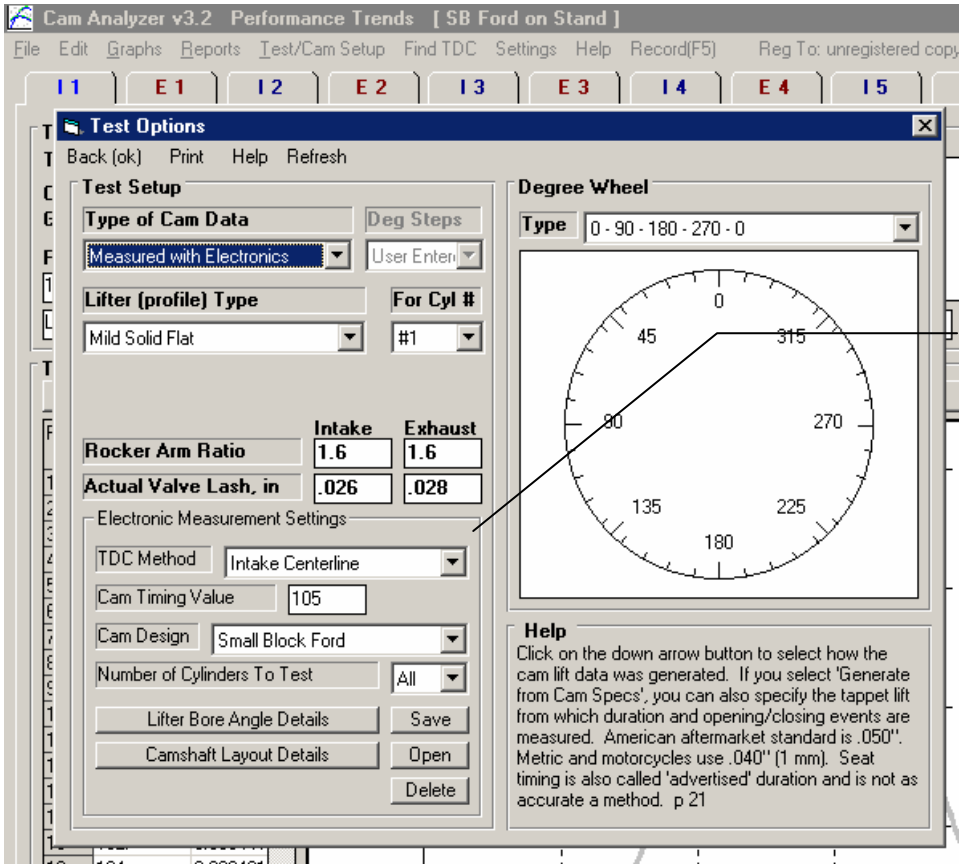


A4.2 New Test/Cam Setup Specs

If you had clicked on the See Specs for Test Setup specs in the Starting a New Test screen, you would be shown the screen in Figure A4.14. This screen is also available by clicking on Test/Cam Setup at the top of the Main Screen. In this screen are several important items concerning how the lobes are laid out on the camshaft, and how you want the cam data indexed to TDC.

When using the Cam Test Stand without the cam in the engine, there is no way to measure how the cam will be timed in the engine. It can only measure how the lobes are timed with respect to each other. When you select the TDC Method and Cam Timing Value, the program predicts all the cam timing values *assuming* you install the cam as the TDC Method and Cam Timing Value indicates.

Figure A4.14 Test/Cam Setup Specs



Type of Cam Data

When you choose 'Using Electronics' in the Starting a New Test screen, this spec is set to Measured with Electronics. You can also choose this in this screen after starting a test, but the program may not perform as expected. That is because this items is so critical to how the entire test is done. If this items is not set correctly, it is best to start a new test and be sure to choose 'Using Electronics' when you start the new test.

Lifter (profile) Type

The program uses your choice here only to know if the cam uses Hydraulic (no lash) or Solid (with lash) followers.

For Cyl

This will identify the cylinder number should you have selected to only measure 1 cylinder in the 'Electronic Measurement Settings' section for 'Number of Cylinders to Test'.

Rocker Arm Ratio
Actual Valve Lash, in

These items let the program convert the measured lobe lift into valve lift for calculate results in reports and graphs. If you select one of the Hydraulic Lifter (profile) Types, the Actual Valve Lash inputs will be disabled.

A4.2.1 Electronics Measurement Settings

TDC Method
Cam Timing Value

These two items work together to let you identify how this cam is timed in the engine. If your cam card gives you info on the cam's timing, you can enter these values directly. For example, if the cam card says the intake centerline is at 108 degrees, then choose Intake Centerline as the TDC Method and enter 108 as the Cam Timing Value. If the cam card says you should check the cam's intake lift at TDC in the engine, and it should be .145" lift, then choose Intake Lift at TDC as the TDC Method and enter .145 as the Cam Timing Value.

If you do not know how the cam is timed and have no cam card, then the recommended entries are Intake Centerline as the TDC Method and 110 as the Cam Timing Value.

When you measure a cam, the program will try to exactly put the intake lobe for Cylinder 1 at the exact timing you have specified here. (The intake lobe on Cylinder 1 is the first lobe which must be measured.) All other lobes will be timed as measured with respect to #1 Intake. (Note that the other intake lobes will probably not be exactly the same as #1 due to manufacturing tolerances.)

Cam Design

Here you can choose one of the preloaded cam designs provided by Performance Trends, or choose the top choice of Custom. If you use Custom, then you must click on the Lifter Bore Angle Details and Cam Layout Details buttons and enter all these items for your engine and cam. These items are discussed later in this section.

Cyls to Test

Here you can select to do all cylinders on the cam or just a smaller set. Typically you will only choose either All or just 1, where this would be for cylinder #1 only.

A4.2.2 Lifter Bore Angle Details

Most engine builders do not worry about how the lobes are exactly laid out on the camshaft. But to the cam grinder, these angles are critical to getting each lobe timed exactly correct for each cylinder. Figure A4.15, diagram A shows lifter bores for a typical V-8 engine with normal clockwise rotation. All intake and exhaust lifters are at the same angle on the right bank and all are at a different, but equal angle different or the left bank.

For purposes of the Cam Analyzer, Lifter Bore Angles are measured with respect to #1 Cylinder Intake. If other lifter bore angles are the same as #1 Cylinder Intake, then you do not have to specify a Lifter Bore Angle for them. For most all V type engines, all cylinders on the other bank from #1 will have a different Lifter Bore Angle, which must be specified to the program. The left diagram A in Figure A4.15 shows a typical GM or Mopar V-8 engine, with #1 cylinder on the left bank and all lifter bores for the same bank exactly in line with each other. Diagram B shows one of the more complicated Lifter Bore Angle layouts you are likely to encounter, that for the Big Block Chevy. This engine has lifters at 4 different angles, 3 different angles with respect to #1 Intake. All these angles must be specified to the program and the cylinders and whether intake and/or exhaust lobes are involved. (Luckily, Performance Trends has loaded in several of these details for several engines, including the BB Chevy, and you can just pick a Cam Design and avoid these inputs.)

If you click on the Lifter Bore Angle Details button, you will be presented with the screens similar to those shown in Figure A4.16. These items identify the angle between the lifter bores for pushrod type engines. The angles on this screen describe how many ***cam*** degrees ***before*** #1 Cylinder Intake the other lobes are timed. These are the same angle that can be read from a blueprint of the engine.

Number of LBAs (Lifter Bore Angles) Needed

For most inline, pushrod engines, these inputs are not needed. You will specify 0 as the Number of LBAs needed and all other inputs are disabled. For V type engines, you are likely to need at least 1 LBA (like shown in Figure 4.15 diagram A) and possibly up to 3 (as shown in Figure 4.15 B).

Lifter Bore Angle #1

This is the number of degrees other cylinders' lifter bore angle comes ***before*** #1 Cylinder Intake's lifter bore. For example, in Figure 4.15 diagram A, because of the rotation direction, the right bank comes approximately 90 degrees before #1 cylinder. DO NOT assume that V engines have a lifter bore angle of 90 degrees or the same angle as the angle between cylinder bores. Most often they do not. You must check with the engine builder to know what the lifter bore angles are exactly.

Notice in Figure A4.16 that for the Small Block Ford (and most Fords) that #1 cylinder is on the right bank and the cylinders on the left bank come ***after*** #1 cylinder. For the Ford, the LBA is specified as a ***negative*** number because the other bank's cylinders come ***after*** #1 cylinder.

Cylinders Using LBA 1

Here you will enter a string of number separated by minus signs or dashes (-) for each cylinder number which will use this lifter bore angle.

Int or Exh

Here you specify if just the Intake lobes, just the Exhaust lobes, or both the Intake and Exhaust lobes will use this LBA.

Example for Filling In Specs for Big Block Chevy

The LBAs for the BB Chevy are 77.5 degrees between intake lifter bores and 90 degrees between exhaust lifter bores. That means the right bank's intakes occur 77.5 deg before the #1 intake. The #1 exhaust (and other exhausts on the left bank) occur (90-77.5) / 2 = 6.25 deg degrees after the #1 Intake (-6.25 deg). The right bank's exhausts occur 77.5 deg +6.25 deg before #1 intake. Using this info you will fill in the Lifter Bore Angle Details screen as shown in Figure A4.16 for the Big Block Chevy. (As stated earlier, Performance Trends has loaded in several of these details for several engines, including the BB Chevy, and you can just pick a Cam Design and avoid these inputs.)

Figure A4.15 Lifter Bore Configuration (viewed from front of engine)

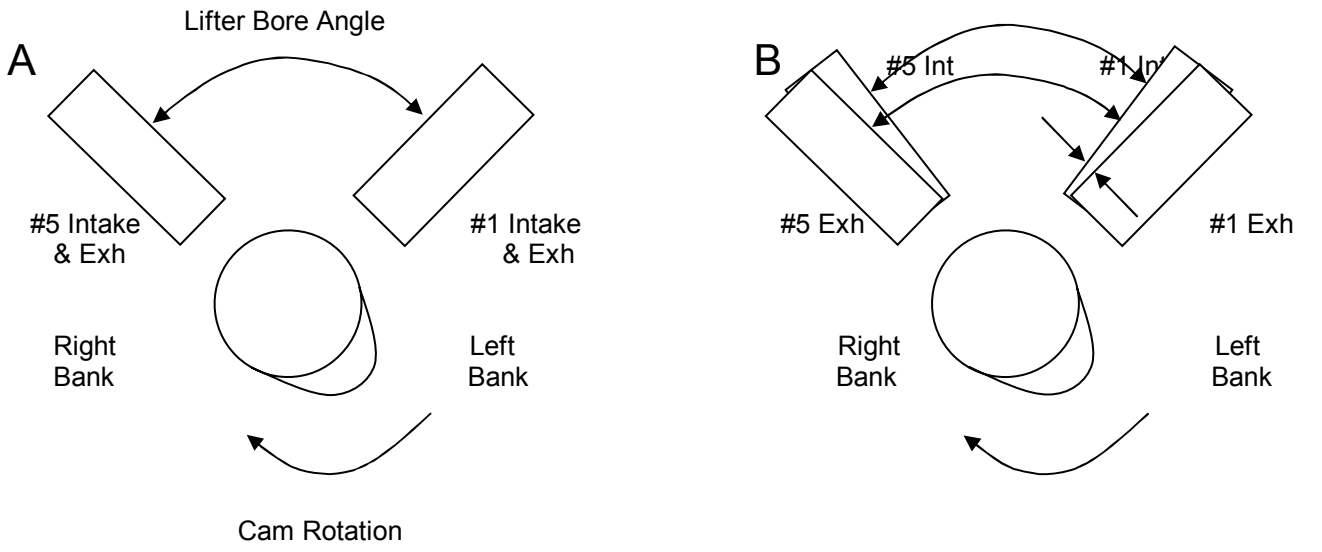
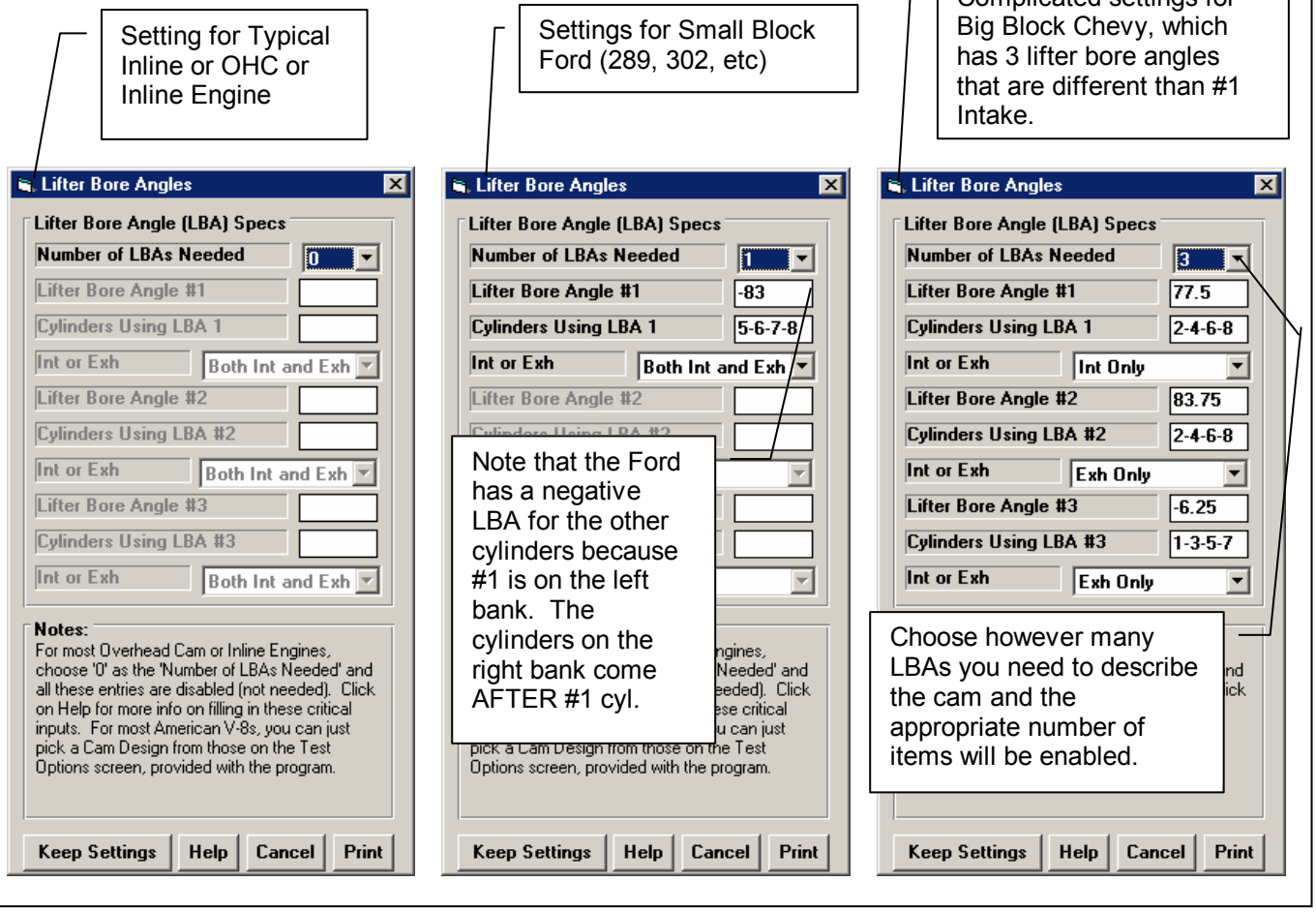


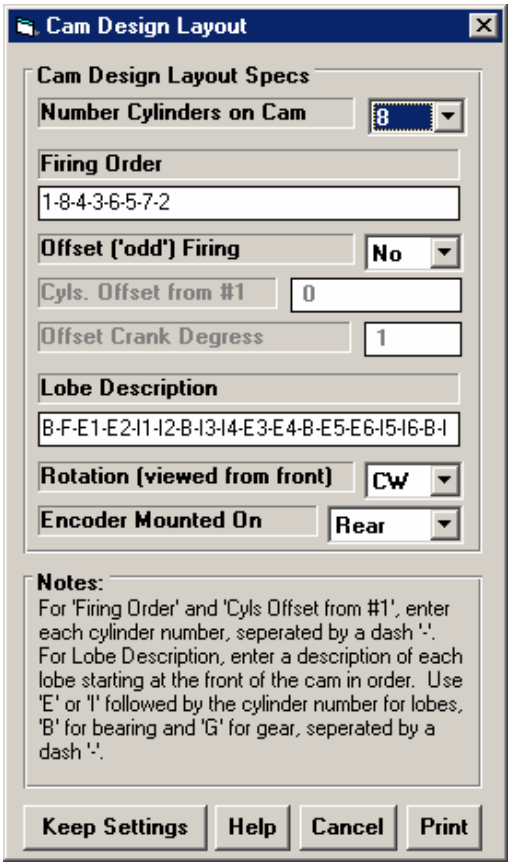
Figure A4.16 Some Typical Lifter Bore Angle Details Screens



A4.2.3 Cam Layout Details

This screen contains other details about the cam in addition to the Lifter Bore Angle details, like firing order, how the lobes are organized on the cam, etc.

Figure A4.17 Cam Layout Details Screen



Number Cylinders on Cam

Choose the number of cylinders for lobes on this cam.

Firing Order

Here you will enter a string of number separated by minus signs or dashes (-) for the firing order of the engine. You must start with cylinder #1.

Offset ('odd') Firing

Choose 'Yes' if you have an odd or uneven firing engine. The most notable odd fire engines are the Buick 'Odd Fire' V-6 and the Harley Davidson V twin. For most engines, you will choose 'No'.

Cyls. Offset from #1

If you chose 'Yes' for Offset Fireing above, you will enter a string of number separated by minus signs or dashes (-) for the cylinders which are different from cylinder #1.

Offset Crank Degrees

Enter the number of degrees which the 'Cyls, Offset from #1' fire ***before*** they should if the engine was even firing.

Lobe Description

Here you will enter a string of numbers and letters separated by minus signs or dashes (-) for each lobe, bearing journal, fuel pump eccentric and distributor gear on the cam. Possible entries include:

Ix	where x is a cylinder number. The 'I' indicates an intake lobe.
Ex	where x is a cylinder number. The 'e' indicates an exhaust lobe.
B	A cam bearing
G	A distributor (or other) gear
F	A fuel pump eccentric

This info is used to draw the Cam Layout on the main screen. Although you will only measure the lobes, this extra detail helps you recognize which lobe you are on and what type of cam you are measuring.

Rotation (viewed from front)

Here you choose whether the cam turns CW or CCW when viewed from the front of the engine. Moat all non-marine engines turn CW.

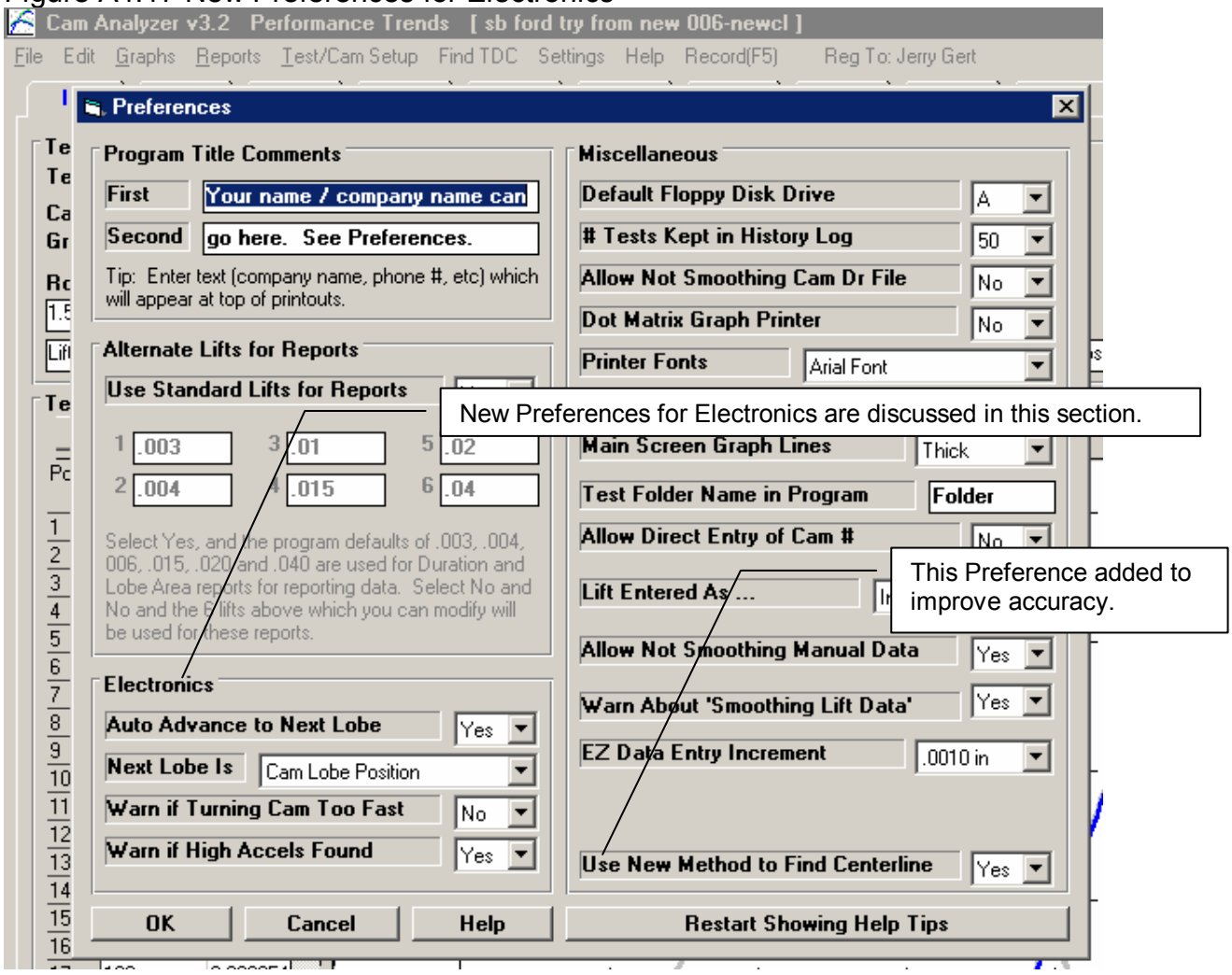
Encoder Mounted On

Here you tell the program if the encoder is mounted on the front or rear of the camshaft. The encoder is then drawn in this position in the Cam Layout on the Main Screen. It also lets the program know how the encoder's readings should be coming into the program if you are turning the cam in the correct location.

A4.3 New Preferences

Several new Preferences have been added to let you customize how the program works with the electronics. See Figure A4.17.

Figure A4.17 New Preferences for Electronics



Auto Advance to Next Lobe

Select Yes and the program will automatically go (advance) to the next lobe on the camshaft after measuring a lobe. To which lobe is identified in the next Preference, "Next Lobe Is".

Next Lobe Is

If you selected Yes for Auto Advance above, this setting lets you select if you want the "next lobe" to be either the next lobe down the camshaft (as pictured in the Cam Layout drawing) or the next cylinder number (as identified on the tabs across the top of the main screen). Most users will select "Cam Lobe Position" on the actual camshaft.

Warn in Turning Cam Too Fast

After you measure a cam, the program checks if the "gaps" between measurement points are larger than what should be used for good accuracy. If the gap is large, the program will give you a warning message, where you can select to either continue to the next lobe, or redo the lobe just measured. If you want to be as precise as possible, set this to Yes. If you just want to quickly check a cam for duration, lobe separation and lift, then set this to No.

Warn if High Accels Found

After you measure a cam, the program checks if there a "bumps" or "dips" in the lift data which are not likely to be accurate. If they are found, the program will give you a warning message, where you can select to either continue to the next lobe, or redo the lobe just measured. If you want to be as precise as possible, set this to Yes. If you just want to quickly check a cam for duration, lobe separation and lift, then set this to No.

Use New Method to Find Centerline

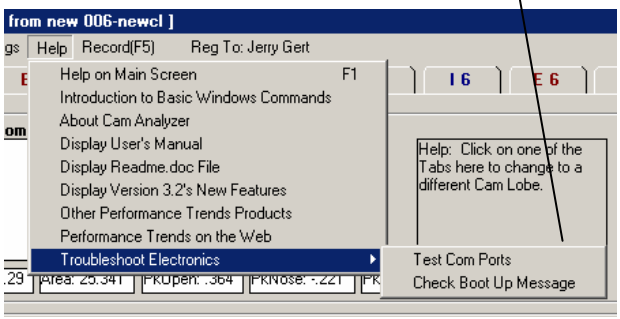
Once we were using electronics to measure the cam lobes, we found that the method we were using to determine centerline was not as accurate or repeatable as it could be. We were using several points at near peak lift to determine centerline. Now we go much farther down the opening and closing profile to determine the lobe centerline. This has proven to be much more repeatable, within .1 degrees or better. The old method was repeatable within .5 degrees or so, which was sufficient for the hand measurements we used to do. We recommend setting this to Yes. No should only be used if you want to repeat results from an older version of Cam Analyzer.

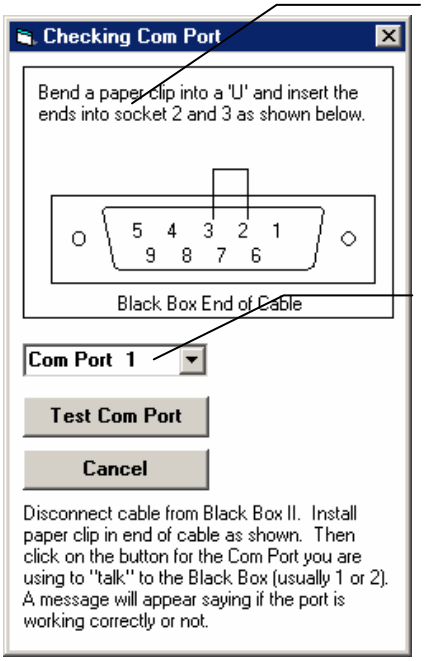
A4.4 Troubleshooting Communications to Electronics

If you find that the program can not communicate with the Black Box, you may first want to let the program try to "Find" it as shown in Figure A4.4. If it can not be found, check the Troubleshooting features built into the Cam Analyzer in Figure A4.17. The first test available of "Test Com Port" is a very easy test to pass. That means if you can not pass it, there is a definite problem with the computer's Com port, or the cable, or you are doing the test wrong. If the problem proves to be with the computer (which is usually does), then you must contact your computer repair shop. You could also switch to a USB to Com port converter if you have a USB port. (USB-Com port converters are typically not as reliable as a true Com port.) The "Check Boot Message" is a more thorough test, and checks both the Com port and cable, and some basic functioning of the Black Box.

Figure A4.18 Troubleshooting Options

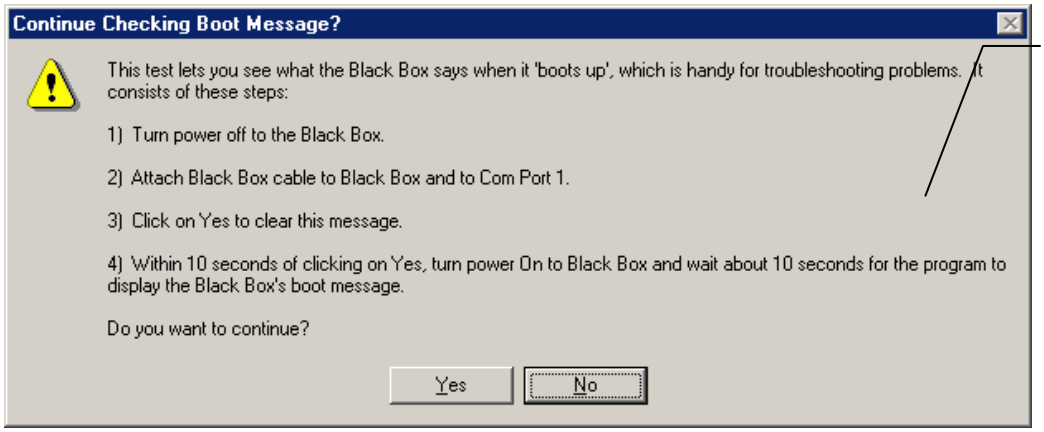
Click on Help at top of Main Screen, then Troubleshooting, then pick from these 2 options.



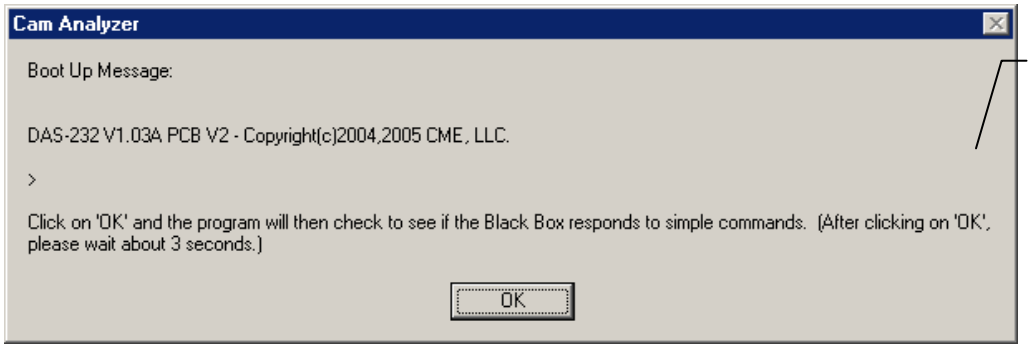


Follow instructions here and down below to run the 'paper clip' test to see if the com port is working at all.

Insert paper clip or piece of wire from pins 2 and 3. Then pick which port to test and click on the Test Com Port button and see if program says port is working.



Instructions for running the "Boot Up Message" test, to see if the com port can read data from the Black Box II. This does not test if the computer can send data or the Black Box can read the data sent to it.



Typical response if the Boot Up Message can be read correctly.

Response when it appears that the Black Box can read some very simple commands.