



CAUTION: CAREFULLY READ INSTRUCTIONS BEFORE PROCEEDING. THE USER IS ASSUMED TO BE FAMILIAR WITH MICROSOFT WINDOWS AND PC OPERATION.

OVERVIEW

New Harley-Davidson® motorcycles use the SAE J1850 data bus for communications between the engine control module (ECM), instrument module (IM), turn signal/security module (TSM/TSSM), and diagnostic scan tools. The Twin Scan 88 is a low cost scan tool that is compatible with 2001-2006 H-D® fuel injected models using the Delphi® fuel injection system (including V-Rod®) and 2003-2006 carbureted models with new 12 pin ignition module. Please note that 1999-2003 carbureted Twin Cam 88® models and all models with the earlier Marelli® fuel injection lack the J1850 data bus and are not compatible with the Twin Scan 88.

The Twin Scan 88 connects to the four terminal Deutsch style data link connector on the H-D® wiring harness and requires a laptop PC for user interface and data display. You can read and clear diagnostic trouble codes from the ECM, TSM/TSSM, speedometer, and tach (on models with IM data bus). You can view real time engine data on an instrument panel type display.

The Twin Scan 88 also features stand-alone data logging (no laptop PC attached). This feature provides diagnostic capabilities not found in any other available tools. The Twin Scan 88 is especially useful for diagnosing hard to find intermittent trouble codes. The motorcycle can be operated while the unit is installed. Under normal conditions (no trouble code), the unit can be set up to store data for the last hour of operation. If a trouble code is set, the unit automatically stops logging data 30 minutes after the code is set. Even days or weeks later, you can download the data. You can examine in detail what happened before and after the code was set. You have a range of capabilities for analyzing and printing out logged data that is displayed in a chart recorder format.

The Twin Scan 88+ is an enhanced version that includes an input that can be connected to a Daytona Sensors WEGO II wide-band oxygen sensor interface. When the WEGO II is connected, the Twin Scan 88+ will log engine data along with the actual air/fuel ratio (AFR). The Twin Scan 88+ is an ideal tuning aid for use with the Screamin Eagle® Race Tuner (SERT) on

fuel injected motorcycles. The software analyzes logged data and displays AFR and the required volumetric efficiency (VE) correction (in percent) with the same RPM rows and throttle position sensor (TPS) columns used in the SERT tables.

Several sample data files are included in the program folder when Twin Scan software is installed:

Sample1.log - Twin Scan 88 data from a fuel injected Twin Cam 88® application showing a trouble code being set

Sample2.log & Sample3.log - Twin Scan 88+ data from a V-Rod® showing air/fuel ratio data logged from attached WEGO II

Figure 1 – Twin Scan 88



PC REQUIREMENTS

The Twin Scan 88 has a female 9 pin D-sub connector that interfaces to an RS-232 serial port on the laptop PC. You will require a 9 pin male-to-female extension cable such as our P/N RS232-CBL-10. Similar cables are available from Belkin (www.belkin.com) as P/N F2N209-06-T or Office Depot as P/N 825851. You can also find the same type of cable at most office and computer supply stores.

Data transfer occurs at 56 kBaud. The high baud rate limits the maximum cable length and the use of an extension cable over 12 feet in length is not recommended. Due to the cable length limitation and the need for portable access, a laptop PC is recommended. The PC must have a free serial port (COM1-255) with a standard 9 pin male D-sub connector. If your laptop does not include a serial port, you can use a USB adapter. However, not all USB adapters will work correctly with the Twin Scan 88. Most of the inexpensive USB adapters are intended for interfacing Palm Pilot type devices and do not support the high baud rate required by our unit.

We sell and recommend a low cost USB adapter (P/N USBG-232) that has been tested with a wide range of system configurations. The USBG-232 adapter comes with correct and updated driver files on CDROM. After installation the USBG-232 adapter will usually appear as COM5.

We recommend a laptop with Pentium processor and super VGA display (SVGA with 1024 x 768 pixel resolution) running Windows 98/ME/XP. Data chart display is graphics intensive and a high speed Pentium processor is recommended. Processors slower than 300 MHz will exhibit sluggish program loading and response. The PC must have a CDROM drive for program loading.

Twin Scan software includes print commands to print downloaded data. The program has been tested with Hewlett-Packard laser and inkjet printers and Epson inkjet printers. We recommend using a color inkjet printer.

SOFTWARE INSTALLATION

The software is supplied on CDROM media or in the form of a compressed file downloaded from our website. The installation process uses InstallShield. This industry standard installer is based the new Microsoft Windows Installer service that greatly reduces potential problems such as version conflicts and allows for application self-repair. Since Windows 98 systems did not originally include the Windows Installer service, the required installer software is included in the distribution media.

Before proceeding with installation, shutdown any other applications that may be running. Use the Windows Explorer or the Run command from the Windows Start Menu to launch setup.exe in the Twin_Scan folder on the CDROM or the setup.exe file downloaded from our website. InstallShield will install the software in an appropriate folder under Program Files.

Once InstallShield has completed the installation, Twin Scan will appear on the Windows Start Menu. You can then launch it just as you would any other Windows program. Several sample data files are included in the program folder.

Twin Scan software requires the Monospace 821 BT fixed pitch printer font in order to properly align columns when printing. The Monospace 821 BT font is included in the distribution media and automatically copied to your Windows Fonts folder during installation. A backup copy is also placed in the program folder. If you accidentally delete this font, use the Install New Font command from the Fonts folder File menu. The filename associated with Monospace 821 BT is monos.ttf.

TWIN SCAN OPERATION

The Twin Scan 88 connects to the four terminal Deutsch style data link connector on the H-D[®] wiring harness. In most cases, the data link connector is near the ECM (engine control module). Refer to the H-D[®] Electrical Diagnostic Manual for your model for connector location. Some models may have similar appearing connectors that could be mistaken for the correct data link connector.

The Twin Scan 88 is powered through the data link connector whenever the ignition key is turned on. Please note that communication with the laptop PC is only possible when the ignition key is turned on.

In general the engine does not have to be running to read and clear diagnostic codes. However, some custom wiring harnesses or wiring damage can lead to situations where the run/stop switch must be turned on to power up the various modules on the data bus.

If the Twin Scan 88 is left connected, it will log data to internal memory whenever the ignition key is on, even if the engine is not running. This allows diagnosing conditions that cause the engine to stall. However, if the ignition key is inadvertently left on for an extended period of time, older data will be overwritten and lost.

CAUTION: Twin Scan 88 units are not sealed against moisture damage. If the motorcycle is to be driven with the unit installed, it should be protected with a plastic bag. There is no warranty on units with moisture damage.

SOFTWARE OPERATION

Connect the Twin Scan 88 to the data link connector on the motorcycle. Use an extension cable to connect the unit to a serial port on your laptop PC or USB adapter. Turn the ignition key on.

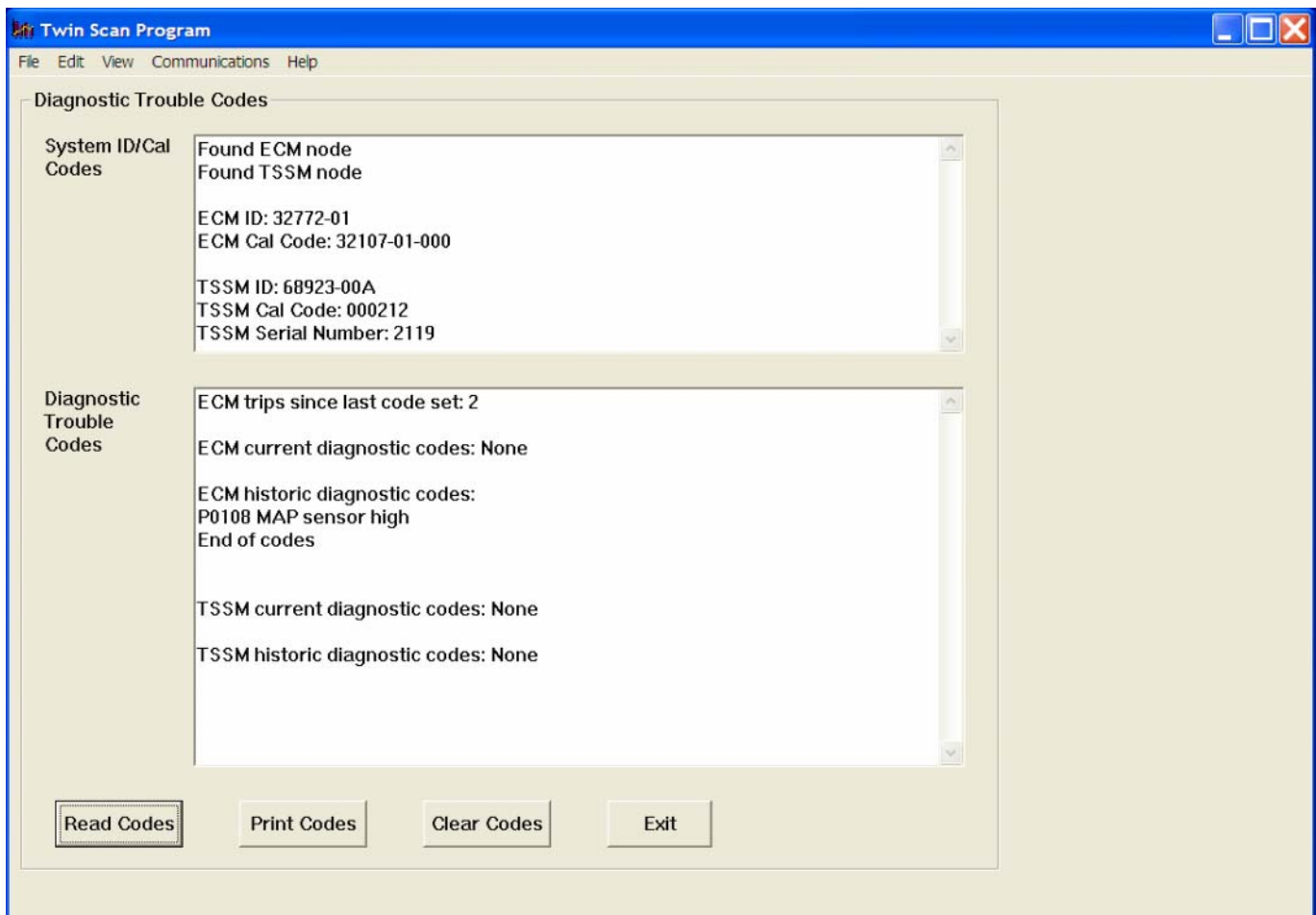
After the Twin Scan program is launched, the main screen appears as shown below but without any data displayed. COM1 is used as the default port. If you connected the Twin Scan 88 unit to a different COM port, use the Port Setup command on the Communications menu.

You can test communications between the Twin Scan 88 and the laptop PC by using the Read Firmware ID command on the Help menu (the ignition key must be on). If you get an error message, please refer to the Communications Troubleshooting Flowchart on page 12.

DIAGNOSTIC TROUBLE CODES

Use the View Diagnostic Trouble Codes command on the View menu. Click on the Read Codes button to display information for all available modules. As shown in Figure 2, the upper half of the screen displays the system ID and calibration code information. The lower half of the screen displays diagnostic trouble codes. Each current and historic trouble code is displayed along with a brief description. The software includes a database of all diagnostic trouble codes published by Harley-Davidson®. **Please refer to the H-D® Electrical Diagnostic manual for your model for detailed explanations and troubleshooting flowcharts.**

Figure 2 – Diagnostic Trouble Code Display



You can print the displayed information to any Windows printer by clicking on the Print Codes button. You can use the Print Setup command on the File menu to select the printer.

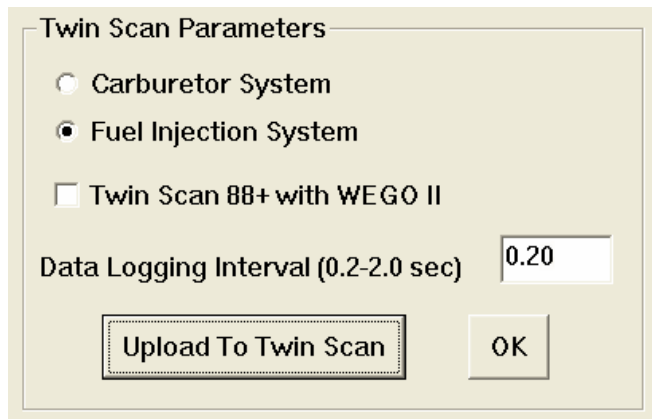
You can clear any codes by clicking on the Clear Codes button.

TWIN SCAN SETUP

Prior to using the real time engine data display or data logging features, you must set up the correct parameters. Use the Edit Twin Scan Parameters command from the Edit menu. A dialog box will appear as shown in Figure 3. You can select the type of engine control (carburetor or fuel injection) and the data logging interval.

Selecting the Twin Scan 88+ option only affects real time display of air/fuel ratio (AFR) data. Irregardless of whether or not this option is selected, the Twin Scan 88+ will always log AFR data when a WEGO II is connected. If you mistakenly select this option for a standard Twin Scan 88, real time data display will fail with a timeout message.

Figure 3 – Twin Scan Setup



The Twin Scan 88 data buffer stores the **last** 1600 data points. If you set the data logging interval to 2.0 seconds, the unit will log about one hour of data. Data logging intervals of 0.5-2.0 seconds are suitable for on-road tests; a shorter interval of 0.25 seconds is recommended for dyno or shop tests. Once you have selected the appropriate parameters, click on the Upload to Twin Scan button.

You can clear the data within the Twin Scan 88 by using the Clear Twin Scan Data Buffer command from the Communications menu. If you change the data logging interval, you should also clear the Twin Scan 88 data buffer.

REAL TIME ENGINE DATA DISPLAY

You can display real time engine data by using the View Real Time Data command on the View menu. Real time engine data is displayed on an instrument panel type layout with round tach and speedometer gauges and bar graph type gauges for most other parameters. Barometric pressure, idle RPM and system status are displayed in additional boxes. If the engine is not running, most values will appear as zero. Figure 4 shows the parameters displayed for a fuel injection system. A subset of these parameters is displayed for a carburetor system.

Displayed parameters include:

RPM – engine crankshaft RPM (numeric value displayed beneath gauge)

VSS – vehicle speed in MPH (numeric value displayed beneath gauge)

BAT – battery voltage

MAP – manifold pressure in In-Hg (29.92 In-Hg corresponds to sea level atmospheric pressure)

TPS – throttle position (0 to 100%)

FRONT ADV, REAR ADV – ignition advance in degrees BTDC

FRONT INJ PW, REAR INJ PW – injector pulse width in milliseconds

FRONT KNOCK, REAR KNOCK – knock retard value in degrees

AFR — if the Twin Scan 88+ option is selected for a fuel injection system, the air/fuel ratio bar graph has dual pointers as shown in Figure 4. The yellow pointer on the left side is the air/fuel ratio command (from the AFR table in the Delphi® system). The white pointer on the right side is the actual air/fuel ratio measured by the WEGO II. The legends CMD and WEGO serve as a reminder. Note that the WEGO value will remain near 10 until the sensor has warmed up. For other system configurations, only a single pointer is displayed and an appropriate legend identifies the data as either COMMAND or WEGO.

IAC – idle air control stepper motor position (higher number means more idle air)

ET – engine cylinder head temperature (deg C)

IAT – intake air temperature (deg C)

BARO – barometric pressure in In-Hg (29.92 In-Hg corresponds to sea level atmospheric pressure)

IDLE RPM – this is the target value the system is attempting to maintain

Additional status data is displayed in a box at the upper right of the screen. This data includes:

ENGINE RUN – red if engine off/stalled, green if engine is running

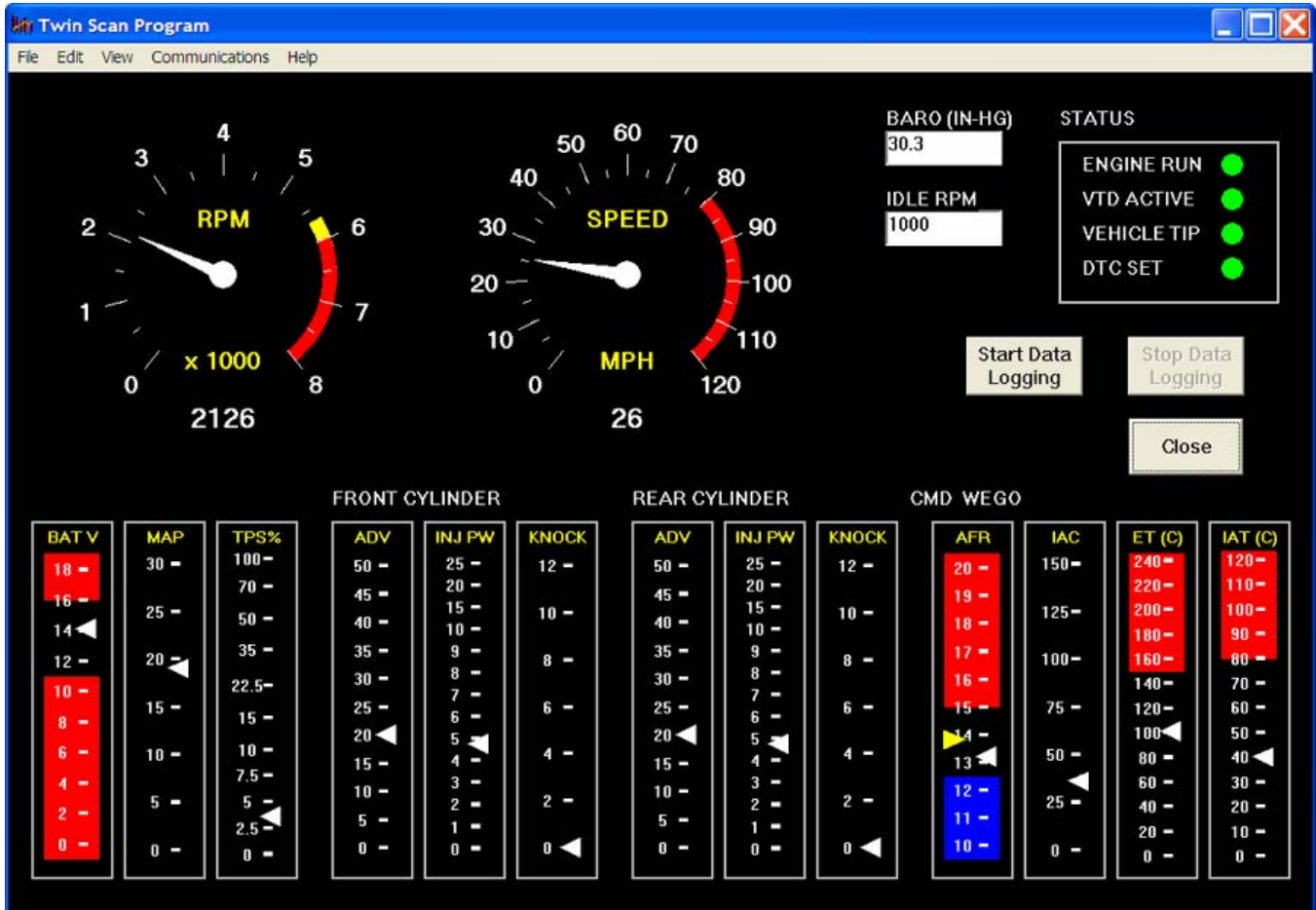
VTD ACTIVE – vehicle theft deterrent system active. Red if TSSM module present, otherwise green. Does not indicate if system is armed or tripped.

VEHICLE TIP – red if vehicle tipped (excessive bank angle), otherwise green

DTC SET – red if a diagnostic trouble code is set, otherwise green

You can log data directly to the laptop PC while real time engine data display is active by clicking on the Start Data Logging button. Data is logged to a buffer memory that stores 1600 data points using the data logging interval you entered on the Twin Scan Setup dialog box. You can start and stop data logging as desired. The last 1600 data points will remain in the program data buffer. **Please note that data logging to the buffer within the Twin Scan 88 is disabled during real time display.**

Figure 4 – Real Time Engine Data Display



BUFFER MEMORIES AND DOWNLOADING DATA

There are two separate buffer memories: the scan tool data buffer (within the Twin Scan 88) and the program data buffer (in the laptop PC).

When the Twin Scan 88 is operated in stand-alone mode without a laptop PC attached, data is logged to its internal memory. This scan tool data buffer contains the **last** 1600 data points. You can download this data into the laptop PC using the Download Data from Scan Tool command on the Communications menu. You can clear the data within the Twin Scan 88 by using the Clear Twin Scan Data Buffer command from the Communications menu.

The Twin Scan program running on the laptop PC also has a buffer memory. The program data buffer can obtain data from one of three sources:

1. Data can be logged directly to the program data buffer in the laptop PC during display of real time engine data. **Please note that data logging to the buffer within the Twin Scan 88 is disabled during real time display.**
2. Data can be downloaded from the Twin Scan 88. In this case, the data is transferred from the scan tool data buffer to the program data buffer.
3. You can also open a previously saved file using the Open File command on the File menu. Data in the file is loaded into the program data buffer.

Any existing data in the program data buffer is automatically cleared when you download data or open a file. You can also manually clear the program data buffer by using the Clear Program Data Buffer command from the Edit Menu.

Regardless of the original source, the contents of the program data buffer can be saved to a file using the Save File command from the File menu. You can attach a comment or view an existing comment using the Edit Comment command from the Edit menu.

Note that Twin Scan 88 data files use a .log extension. You should create a separate folder to store these files.

DATA LOGGING CHART DISPLAY

You can display the contents of the program data buffer on a chart recorder type screen by using the View Chart (Logged Data) command on the View menu. **The last data logged will appear at the right end of the chart.** Figure 5 shows the parameters displayed for a fuel injection system. A subset of these parameters is displayed for a carburetor system.

Data parameters are the same as those listed on pages 4-5 for real time data display. An additional box at the lower right side of the screen shows the actual data logging interval in seconds.

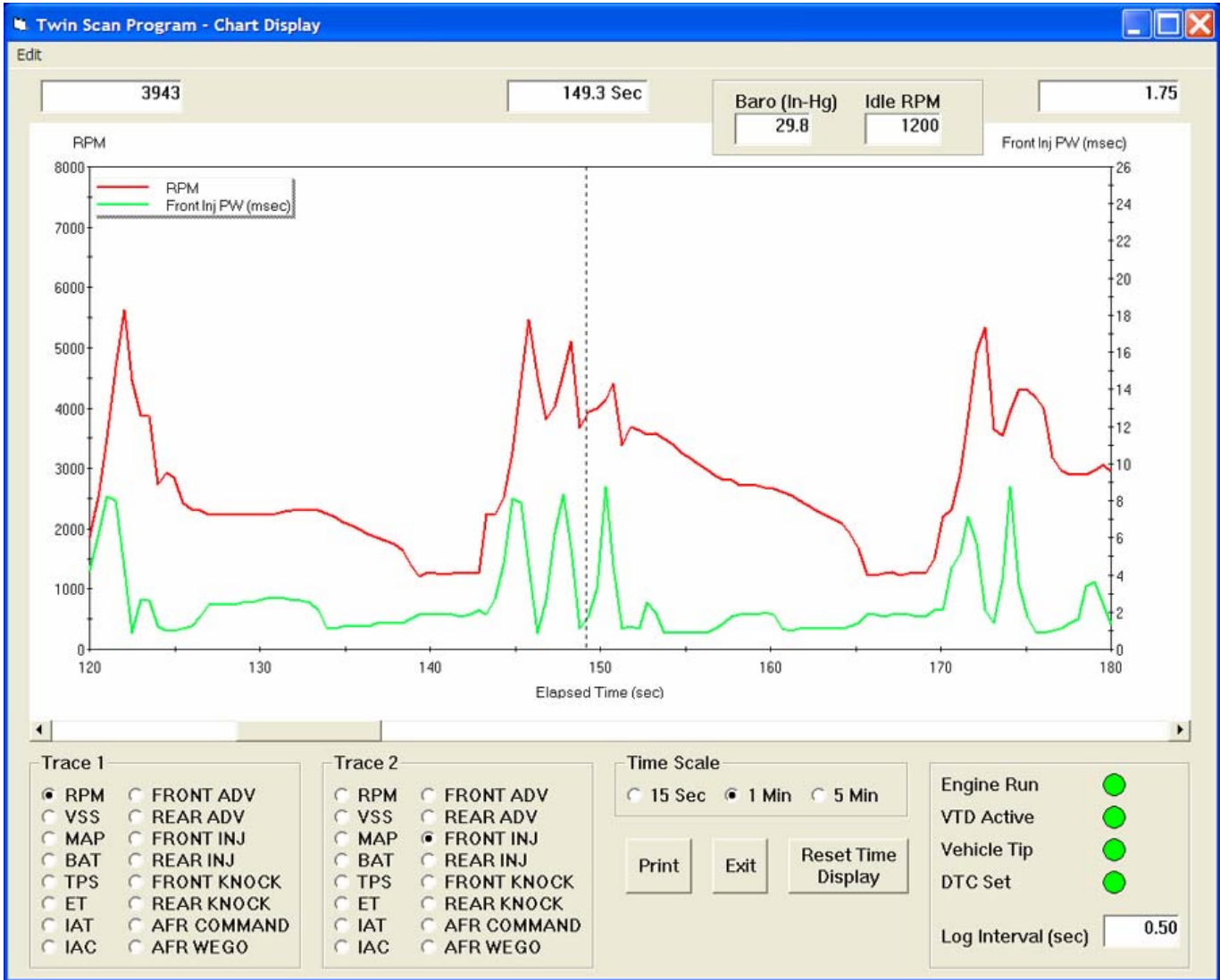
You can use the Maximum RPM command from the Edit menu to change the maximum RPM value displayed on the chart.

You have a range of capabilities for analyzing the data displayed in the chart recorder format. You can select two parameters for display. Trace 1 is displayed in red with its Y axis legends on the left side of the chart. Trace 2 is displayed in green with its Y axis legends on the right side of the chart.

The X axis is always elapsed time. You can select from one of three time scales. You can use the scroll bar to move the chart display window in terms of elapsed time. If you hold the left mouse button down within the chart area, a cursor line appears. The exact values of the parameters displayed on trace 1 and trace 2 and the elapsed time appear in windows above the chart.

If you want to analyze the elapsed time between two events (for example the time required to accelerate from 0 to 60 MPH), you can move the cursor to the first event and then click on the Reset Time Display button. You can print the displayed chart to any Windows printer by clicking on the Print button (a color inkjet printer is recommended for best results).

Figure 5 – Data Logging Chart Display



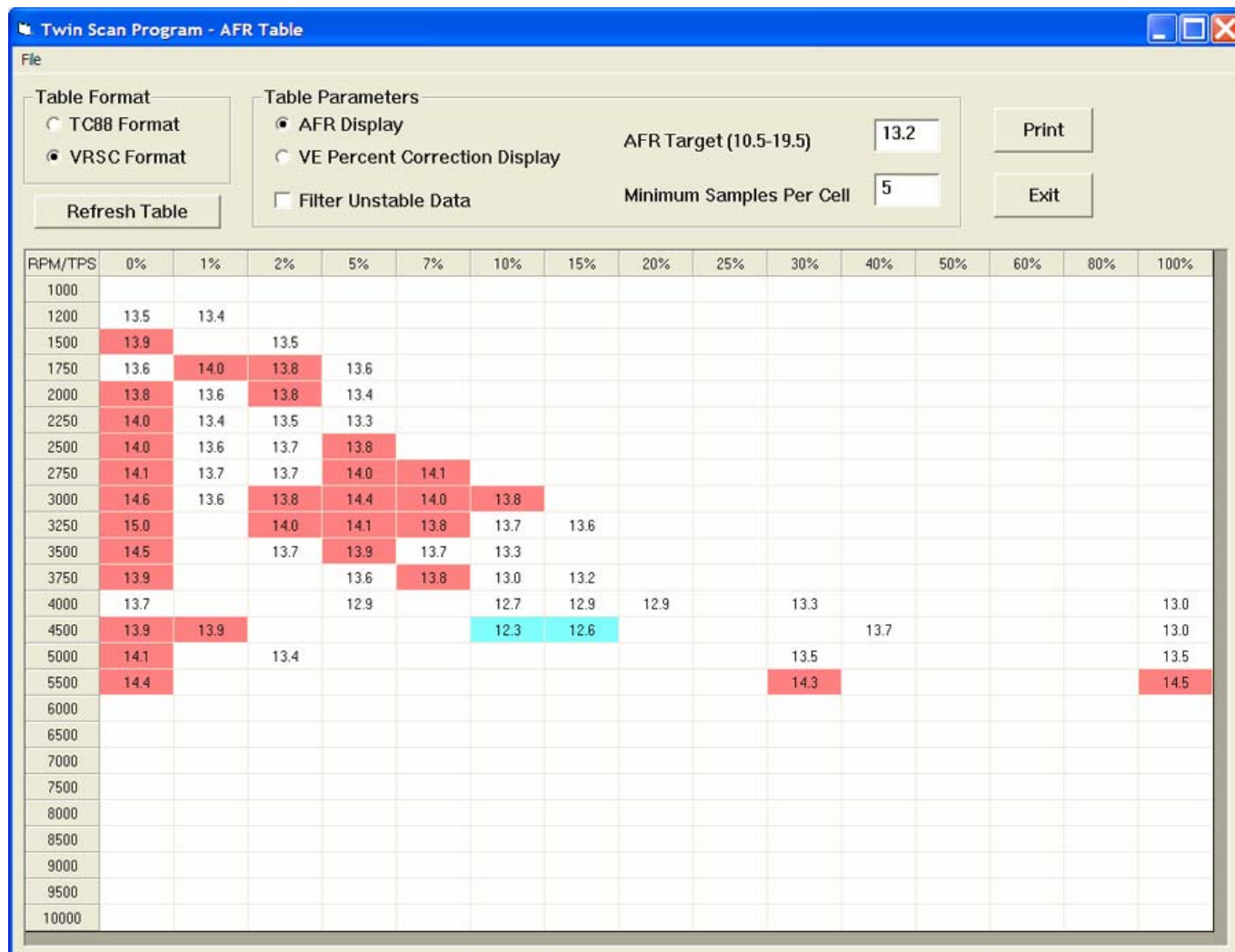
AFR TABLE DISPLAY

AFR (air/fuel ratio) table display is only applicable to Twin Scan 88+ units when operated with an attached WEGO II unit on a fuel injected motorcycle. In this mode of operation, the Twin Scan 88+ is used as a data acquisition system to log AFR data measured by the WEGO II. A mating connector is provided on the Twin Scan 88+ for the 0-5 volt analog output of the WEGO II (white wire with Packard Weather Pack connector). Refer to the WEGO II instructions for installation and operation details. For

best accuracy, the WEGO II black ground wire should be connected to the same frame ground as the H-D[®] data link connector.

AFR data that has been logged can be analyzed and displayed by using the View AFR Table command on the View menu. Figure 6 shows AFR display in VRSC (V-Rod[™]) format. You can select TC88 format for Twin Cam 88[®] applications. AFR data is displayed with the same RPM rows and throttle position sensor (TPS) columns used by the Screamin Eagle[®] Race Tuner (SERT).

Figure 6 – AFR Display



Under Table Parameters, you can select:

AFR Display – air/fuel ratio data as shown above

VE Percent Correction Display – required volumetric efficiency correction in percent, based on the target AFR value (normally 13.2 as recommended in the SERT manual when tuning with a wide-band exhaust gas oxygen sensor system)

Target AFR – determines required percent VE correction. Any cells that differ at least 0.5 AFR from the target AFR value are shaded blue for rich or red for lean.

Minimum Samples Per Cell – default value is 5. Setting a higher value results in more accurate table

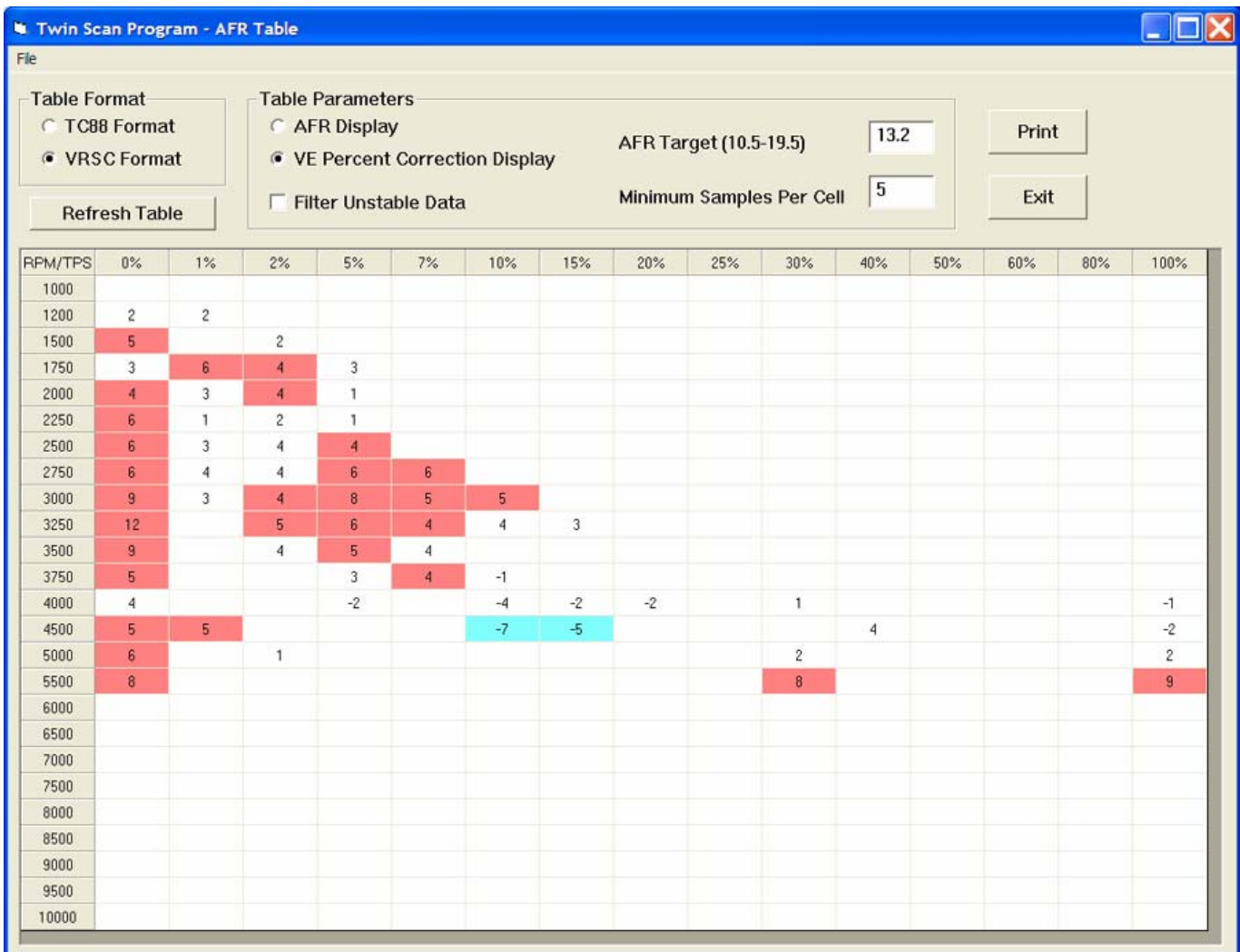
values, but may result in fewer total cells with enough samples to appear in the table.

Filter Unstable Data – when this option is selected, a data sample is only included if the preceding sample was also in the same cell. This option reduces errors during transients, but may prevent any data from being included during rapid acceleration.

After you select a different table format or change table parameters, you must click on the Refresh Table button to display the revised table.

Figure 7 shows VE percent correction display in VRSC (V-Rod™) format. You can click on the Print button to print out the table.

Figure 7 – VE Percent Correction Display



You can analyze data from multiple files that you previously saved. If you want to add more data (perhaps logged under conditions that will yield coverage of additional cells), use the Open Additional File command from the File menu. The data will be analyzed and incorporated into the table. You can open an unlimited number of additional files. However, you cannot refresh the table format or parameters once you open an additional file. These selections will become grayed out. Also, you cannot save or view the original data once you open an additional file. Make

sure you save any downloaded data before opening an additional file.

To start a new analysis, you must exit from AFR Table Display and then use the Open File (or Download) command from the main menu.

You can easily make the required corrections in the SERT Tuning Mode program by referring to the printed VE percent correction table and marking off cells as you edit them. Figure 8 shows a typical SERT VE table.

Figure 8 – SERT VE Table

RPM	Throttle Position (Percent)											
	0	1	2	5	7	10	15	20	25	30	40	50
1000	86.0	86.0	87.0	87.0	88.0	86.0	82.0	82.0	83.0	79.0	79.0	80.0
1200	86.0	88.0	86.5	87.0	87.5	86.0	82.0	82.0	83.0	79.0	79.0	80.0
1500	90.0	93.5	94.0	95.0	94.0	94.0	87.0	80.0	78.0	76.5	76.5	77.0
1750	88.5	94.0	92.0	92.5	88.5	86.5	84.0	81.0	79.5	78.5	78.0	78.0
2000	86.5	94.0	94.5	94.5	91.5	89.0	87.0	87.0	84.5	83.0	86.0	87.5
2250	86.0	97.0	100.5	101.5	100.5	98.0	98.0	97.5	94.5	89.0	88.5	88.0
2500	91.5	95.5	98.5	100.0	98.5	97.0	94.0	89.0	82.0	78.5	74.5	76.0
2750	92.0	94.0	95.5	95.0	93.0	92.0	89.0	84.5	79.0	74.5	72.0	72.0
3000	90.5	91.0	94.5	94.5	93.5	93.5	90.5	86.0	83.0	81.0	77.0	76.5
3250	93.0	93.0	98.0	101.0	101.5	100.5	99.0	97.0	96.5	93.0	89.5	85.5
3500	98.5	96.5	100.5	109.5	109.5	108.0	106.0	106.0	106.0	105.0	100.5	96.5
3750	99.0	97.5	103.0	114.5	115.0	113.0	112.5	112.0	111.0	105.0	100.0	96.0
4000	96.0	100.5	105.5	114.5	115.5	115.0	115.5	113.0	110.5	102.0	95.0	92.0
4500	100.0	108.0	109.0	114.0	113.5	115.0	115.5	113.0	107.0	100.0	91.5	88.0
5000	108.0	108.0	108.0	108.0	109.5	108.0	108.0	109.0	104.0	98.5	89.5	86.0
5500	110.0	106.0	103.5	102.5	101.5	100.5	100.5	101.0	99.5	97.0	88.5	86.5
6000	111.5	105.0	101.0	97.0	99.0	97.0	97.0	97.0	97.0	95.5	89.5	87.5
6500	112.0	105.0	100.5	99.5	97.0	95.5	94.5	94.0	96.0	94.5	89.0	87.5
7000	110.0	105.0	100.5	99.5	99.0	96.5	95.0	94.5	95.5	98.0	93.0	91.0
8000	110.0	105.0	101.0	95.5	94.0	97.0	95.0	93.5	98.5	102.0	97.5	94.5
9000	112.0	110.0	106.0	102.5	94.0	90.5	86.0	85.0	90.0	95.5	94.5	92.5
10000	112.0	110.0	106.0	102.5	94.0	90.5	86.0	85.0	90.0	95.5	94.5	92.5
11000	112.0	110.0	106.0	102.5	94.0	90.5	86.0	85.0	90.0	95.5	94.5	92.5

For the SERT VE table, 2 units corresponds to one percent. You can start editing on a row, leave the mouse cursor on the increment box, and use the tab and/or arrow keys to navigate to successive cells. For each cell that requires a positive VE correction, right click the mouse as required (one click per percent).

Mark off each cell on the printout after you correct it. Corrected cells will also appear shaded in the SERT program. After you have completed all the cells that require a positive correction, repeat the process for all the cells that require a negative correction (leave the mouse cursor on the decrement box).

SERT TUNING STEPS

1. Start with the front cylinder (the choice is arbitrary). Install the WEGO sensor on the front exhaust pipe.
2. In SERT Tuning Mode, set all values in the AFR table to the 13.2 target value, save your edited data to a file, and program the ECM. Note that the AFR target value of 13.2 is suggested in the SERT manual. However, you may want to use an AFR target value of 12.8 for a high performance engine.
3. Use the Twin Scan 88+ system to log, download, and save several sets of data under varying conditions. Use a medium data logging interval (0.5 sec) for runs at steady speeds and a short interval (0.25 sec) for runs with rapid acceleration and transients.
4. Analyze the data, print out the VE percent correction table, enter the required corrections in SERT Tuning Mode, save your edited data to a file, and program the ECM.
5. Repeat steps 3 and 4 until no shaded cells (excessively rich or lean) appear in the VE percent correction table. Don't worry about cells with a few percent error. If no shaded cells appear, everything is within ± 0.5 AFR. This is about the expected accuracy of the Delphi[®] open loop speed-density system.
6. Move the WEGO sensor to the opposite cylinder and repeat steps 3-5.
7. In SERT Tuning Mode, set reasonable values in the AFR table, save your edited data to a file, and reprogram the ECM.

IMPORTING DATA INTO EXCEL

Data files saved from the Twin Scan program are in comma delimited ASCII format. You can easily import a data file into other programs such as Microsoft Excel for further analysis. You can also view data files with a text editor such as Windows WordPad. To import a data file into Excel:

1. Start Excel. In the File Open dialog box, select Files of type: All Files (*.*). Then browse for the data file.
2. The Text Import Wizard appears. For step 1, select delimited file type. For step 2, select comma delimiter. For step 3, select general column data format. Then click on Finish.
3. You can then format the data and save the spreadsheet as an Excel file.

COMMUNICATIONS TROUBLESHOOTING FLOWCHART

Follow the communications troubleshooting flowchart shown on the next page. Experience has shown that most communication problems are motorcycle electrical system faults, user error, or PC compatibility issues.

Communications Troubleshooting Flowchart

