

Turbo
Data
Systems
Technologies

TurboLink™

Version 2.13

User Manual



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1.0 Introduction

Thank you for buying Turbo Data System's TurboLink™ scan tool. We believe it is an essential tool for tuning your car to its performance and efficiency peak. You may be familiar with other scan tools available on the market, but we believe that this package is the most cost effective tool available for the turbo Buick and GM TBI owner. The software has been designed, implemented, and tested by turbo Regal enthusiasts and has been tailored to fit their unique needs. Whether you are a racer or just a weekend tuner, we think you will find that TurboLink™ provides you a custom window into the heart of your GM vehicle, namely the Electronic Control Module (ECM).

TurboLink™ reads the data stream available from your Assembly Line Diagnostics Link (ALDL) connector under your dash. The car's ECM provides this information at a rate of about 1 frame of data every 1.5 seconds. This data is a compilation of readings gathered from the sensors and internal data that the ECM maintains to compute fuel, spark, and boost parameters. This data is interpreted, stored and displayed by the TurboLink™ hardware and software for use in diagnosing problems and tuning for maximum performance.

The data rate is a function of the ECM and not a limitation of TurboLink™.



Please read the following Warranty for important licensing and warranty restrictions. Your rights will be affected.

1.1 DISCLAIMER OF WARRANTY



The TurboLink™ Software and its interface cable are sold "AS IS". No warranty of performance or merchantability is expressed or implied. The user must assume all risk of using this product and any liability of the manufacturer will be limited exclusively to replacement of the TurboLink™ product for a period of one (1) year from the date of purchase by the original purchaser. Damage caused by neglect, accident, or incorrect use of this product are not covered by this warranty. See registration card for more legal information.

2.0 System Requirements

Minimum system requirements for TurboLink™ are as follows:

- 100% IBM¹ compatible computer XT, AT, 286, 386, 486, Pentium
- MS DOS² 3.02 or higher.
- Display Adapter: Video Graphics Array (VGA)
 or Enhanced Graphics Adapter (EGA)
 or Color Graphics Adapter (CGA)
- ALDL Interface Cable
- TurboLink™ Interface Cable
- TurboLink™ software diskette
- TurboLink™ User Manual
- 1984-87 Buick Grand National, T-Type, Turbo Regal or 1989 Pontiac Turbo Trans Am or 1984-85 Turbo Riviera, 1987-92 GM VIN K 5.7 liter cars/trucks, or VIN 3 Buick/Olds/Pontiacs.

¹ IBM is a registered trademark of International Business Machines

² MS DOS is a product of Microsoft Corporation

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3.0 Technical Assistance

If you are a registered user and are having trouble installing, connecting, or using your TurboLink™, call the following number for assistance:

1-402-292-6707 or FAX us at 1-402-291-9012

If nobody is available to help, leave a message and we will return your call as soon as possible. Email: kenmosher@turbo-link.com. Web: <http://www.turbo-link.com>.

4.0 Quick Start

This section gives you a brief overview of how to install and start using your new TurboLink™ package. It is recommended after using the TurboLink™ package for awhile, that you take the time to read the rest of this user manual to familiarize yourself with all of the available features and options.

4.1 Inventory

When you unpack your TurboLink™ package, you should have the following:

- One diskette with the TurboLink™ software
- One ALDL cable for attachment to the TurboLink™ Interface Cable and the car's ALDL port
- One TurboLink™ Interface cable for attachment to the computer's parallel port and the ALDL cable
- Boost Sensing kit ***OPTIONAL for use ONLY WITH Turbo Regals with '86/87 ECM***
- 3 BAR MAP sensor ***NOT SUPPLIED WITH KIT***
- Registration Form (the last page of this manual)

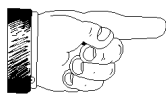
Please take this opportunity to fill out your Registration Form and mail it. This is very important, since only Registered users will receive product notices, free offers, and technical support.

4.2 Installation of Software on Your Computer

Installation of TurboLink™ is very straight forward. Insert the TurboLink™ diskette into your disk drive and copy all the files from your master disk to a single directory on your hard disk, or to another diskette. This can be done from the DOS prompt or from the Windows File Manager. Be sure that you put TurboLink in a directory without any previous versions of TurboLink present, as this will cause problems with both versions trying to use incompatible defaults files.

You may also run TurboLink™ directly from the supplied disk, but it is recommended that you make a backup copy of the master disk and run the program from your backup copy.

NOTE:



Backup copies are for your personal use only. Distribution of copyrighted software is against the law. It is recommended that you make a backup diskette copy of your Master diskette and to *write protect* your Master Diskette while making the backup copy. Put the Master Diskette in a safe place to ensure you can always restore the original version of TurboLink™. See the last page of this manual for more information.



4.2.1 MS-DOS Installation Examples

In the following examples, the "Enter Key" or "Return Key" is represented with the following symbol: <ENTER> When you see this symbol, you should use the "Enter Key" or "Return Key" on your computer's keyboard.

The following is an example installation from MS DOS:

1. Insert the TurboLink™ MASTER diskette into the A: floppy drive and reboot the computer.
2. Follow the prompts and instructions as the computer boots. This should successfully install the program.
3. Once the program is installed, you can run it from MS DOS at anytime by typing "CD \TLINK" followed by "TURBOLNK". The program will now run and you can operate it as described in this manual.

An alternate way to install from MS DOS:

1. Boot your computer normally and wait for the MS DOS prompt.
2. Type "A:INSTALL.BAT" and follow the prompts.
3. Once the program is installed, you can run it from MS DOS at anytime by typing "CD \TLINK" followed by "TURBOLNK". The program will now run and you can operate it as described in this manual.



Be sure the files *TURBOLNK.EXE*, *TLUTIL.DAT*, *PMODULES.DAT* and **.DFT*. (if any) are all in the same directory. TurboLink™ uses the *.DFT* file to store defaults and the *.DAT* file to store the diagnostic trouble code information.

4.2.2 Windows 3.x Installation Example

1. Start your computer and get Windows up and running.
2. Insert the TurboLink™ diskette into the A: floppy drive.
3. From the Program Manager "FILE" menu, choose "RUN"
4. Enter "A:\INSTALL.BAT" and click OK.
5. Once the program is installed you can run it from Windows via a Program Item you create or via the File Manager.
6. The program will now run and you can operate it as described in this manual.

4.2.2 Windows 95 Installation Example

1. Start your computer and get Windows 95 up and running.
2. Insert the TurboLink™ diskette into the A: floppy drive.
3. From the START button, choose "RUN"
4. Enter "A:\INSTALL.BAT" and click OK.
5. Once the program is installed you can run it from a desktop shortcut, from Explorer or by double clicking the file icon in the \TLINK directory.
6. The program will now run and you can operate it as described in this manual.

4.5 Basic Operations

TurboLink™ operation consists of a few basic concepts for the selecting of options and entering of data.

4.5.1 Standard Keys

The following general methods are used throughout the software:

- **Arrow Up /Arrow Down Keys**
These keys are used to navigate in option boxes and to highlight the option you want to select. They are also used to step through previously recorded data a frame at a time.
- **Page Up/Page Down Keys**
These keys are used to step through previously recorded data 20 frames at a time.
- **Home Key**
This key is used to step to the first frame of recorded data.
- **Enter or Return Key**
This key will select a highlighted option or will terminate a string that you enter in response to a prompt.
- **Escape (ESC) Key**
This key is used to exit from menus or backup one screen.
- **Space Bar Key**
In the record modes, this key starts and stops recording functions.
- **Function 1 (F1) Key**
In the display and replay modes, the F1 key will display any malfunction codes that the ECM is reporting. If no malfunction codes are present, the software will tell you. See the "Malfunction Code Viewing" section for more information.
- **Function 2 (F2) Key**
After the F1 key is used to display malfunction codes, the F2 key will allow you to scroll to pick a particular code (there may only be one) and to obtain more diagnostic information about the code.
- **Function 3 (F3) Key**
In the record modes, this key will save the current recording to disk in a serial numbered file. See the "Quick Save" section for more information.
- **Function 5 (F5) Key**
This key is used to recalibrate the **OPTIONAL** boost sensing module. The car must have the key on, engine off for the calibration to be successful. A message will tell you whether the calibration was successful or not.

4.5.2 Frame Number/Time Index

The Replay Recorded Data screen incorporates a Time Index and Frame Number (in parenthesis) in the upper right hand corner of the screen. This number helps you determine where/when the data frame you are viewing occurred.

These numbers indicate the relative position of the frame from the record trigger. In other words, the Frame Number indicates how many frames before or after the record mode was entered and the Time Index



indicates approximately how much time in minutes and seconds. A negative number (i.e. -1, -2, -3, etc.) indicates the frame was recorded **BEFORE** the trigger. A positive number indicates the frame was recorded **AFTER** the trigger.

When you go to the Replay Recorded Data option, you will notice that you are looking at the frame recorded at Frame Number "0"/Time Index 0:00. You can scroll backwards through the data (the negative numbered frames) to view the events leading up to the trigger condition, as well as scroll forward to view the frames recorded after the trigger condition.

This ability helps catch intermittent problems and allows you to capture data even though the data you want to see has already gone past. For example, you stage your car, make a run and in the shutdown area you notice that you forgot to hit the Space Bar to begin recording. No problem! Just hit the Space Bar and later when you are reviewing the run (via the Replay Recorded Data option), you just need to scroll backwards from Frame Number "0" to see the run. Frame Number "0" in this case actually occurs when you remembered to hit the Space Bar in the shutdown area, so the run actually occurred somewhere in the previous frames. Be sure let it record for a few frames before stopping it, or you may have an empty buffer.

4.5.3 Malfunction Code Viewing

TurboLink™ displays an indication of "Malfunction Codes Detected" in the Numerical mode or the "Malfunction Code" screen LED box is filled in the Graphical mode any time the ECM reports a malfunction code (also referred to as "Trouble Codes"). The codes can then be viewed at any time by hitting the "F1" key and reading the code and description provided on the pop-up screen.

By hitting the "F2" key, you can select the error code that you want additional information about by selecting it with the up/down arrow keys and hitting "Enter". TurboLink™ will display a short description of possible causes and corrections for the error codes. Since the program is fetching the data from disk, it may take awhile to display this information. Please be patient.

Codes can be viewed in either the Realtime Display mode or in the Replay Buffer Data mode.

4.5.4 Quick Save Capability

Whenever you are recording in the RealTime Displays, you have the option of hitting the F3 key to immediately save the data. This allows you save a run with a couple key strokes and minimize the danger of your attention wandering from operating the vehicle. To perform Quick Save, hit the Space Bar to stop recording and then hit the F3 key.

By hitting the F3 key, the file is saved in the current working directory with a filename containing an embedded sequential serial number. You can then resume recording by reactivating the record trigger and repeat the entire process multiple times.

When using this option, you are not prompted for a file comment. However, you can later recall the saved file via the Disk Options menu and resave it with a file comment and/or another name. This allows you to review the data and insert a comment into files saved via the Quick Save option.

4.5.5 Boost Recording

The ECM does not measure, so it cannot report the boost levels in the data stream for the Turbo Regals, therefore, TurboLink™ can not display it without the **OPTIONAL** boost sensing hardware. This is surprising, since the analog dash cars are equipped with a Manifold Absolute Pressure (MAP) sensor for the stock boost gauge.

To connect your optional boost sensing hardware, refer to **Appendix A** of this manual. Once the hardware is connected, choose the MAP option from the PREFERENCES menu, calibrate the sensor using the F5 key in the RealTime Display mode, and you should be ready to go. This procedure is explained in detail in Appendix A in this manual.

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4.6 Connecting TurboLink™ to a Vehicle

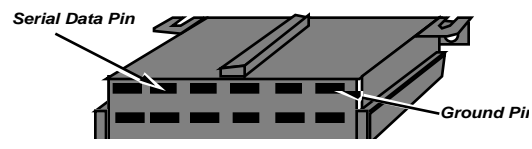
The basic TurboLink™ package is very easy to hook up. Be sure that all equipment is powered off and the ignition switch is in the OFF position before connecting or disconnecting any cables.

WARNING

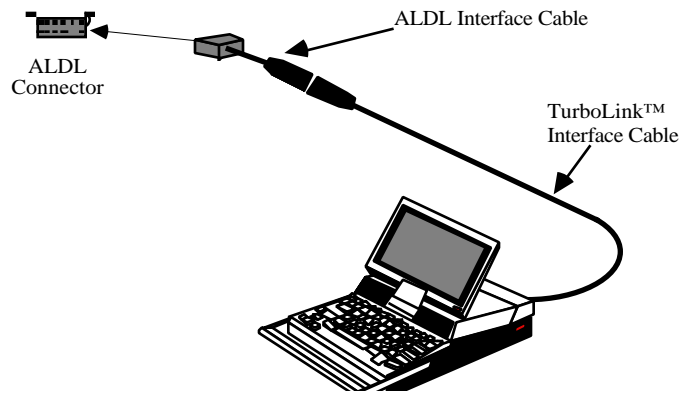


Be sure that the ignition key is OFF and that all equipment is powered down when connecting and disconnecting cables. If you fail to follow these precautions, damage to the PC parallel port or the car's ECM may result. Be sure to read and understand these instructions before attempting to install TurboLink™.

The ALDL connector is located under the center dash section on the driver's side for bucket seat equipped cars. On bench seat cars the plug may be tucked up under the dash a little further, but is located in basically the same location. The figure below shows the what the plug looks like.



Simply plug the ALDL Interface Cable into the ALDL connector, plug the other end into the TurboLink™ Interface Cable, and then plug the TurboLink™ cable into the parallel port (sometimes labeled as the "PRINTER" port) on the back of your computer. Ensure that all connections are tight and cables are routed in a manner that they will not interfere with operation of the vehicle. The next figure shows a typical installation.



You are now ready to use TurboLink™! Please read the rest of this instruction manual for how to operate TurboLink™.

WARNING

Be sure to route the interface cable in a manner that does not interfere with the operation of the brake pedal, the accelerator, the shifter, or any other vehicle controls. Also, it is highly recommended that the laptop computer be securely fastened into the passenger's seat with the seat belt before operating TurboLink™. Be extremely careful in observing the TurboLink™ displays and operating the computer while the vehicle is in motion. Your primary attention MUST be on operating the vehicle.

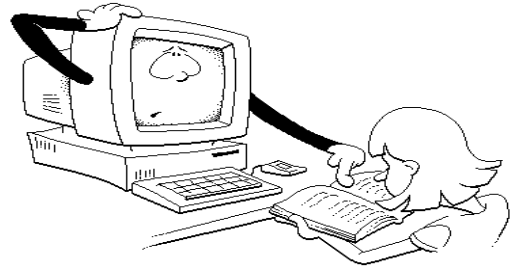


5.0 Trouble Shooting Tips

5.1 TurboLink™ Displays Bad Data

PROBLEM

My TurboLink™ seems to occasionally display "garbage" data. Some people may see a symptom where the data seems to be fine until they press the brake pedal or turn on the Air Conditioner. It may even fail to connect to the car's ECM.



POSSIBLE CAUSES & SOLUTIONS

1. First, check the obvious. Check all connections to the ALDL plug, connections to the back of the computer, and connections between the ALDL Interface Cable and the TurboLink™ Interface Cable.
2. Make sure that the ignition key is in the "ON" position. The ECM will not transmit data to TurboLink™ if the key is in the "ACCESSORY" position, or not fully "ON".
3. Your computer may not supply enough voltage to the circuit (in the PC end of the TurboLink™ cable). Get the Radio Shack battery holder (PART NO. 270-383) and 4 AA batteries to plug into the supplied "pig tail" connector. **DO NOT use a 9 volt battery here!**
4. If all connections are clean and tight, the car ignition is "ON" or the car is running, and TurboLink™ is running in the Realtime Display mode and the data being displayed has bad values or will not display then try the following:
 - a. **Check all the vehicle grounds, including the engine block to chassis ground, the negative battery cable and especially the connector going to the coil pack.**
 - b. Disconnect the High Speed Fan Relay and retest. The High Speed Fan Relay has been known to cause grounding problems that corrupt the data from the ALDL port. This effect has been noticed on other scan tools as well as TurboLink™. If disconnecting the relay cures the problem, then replace the relay and ensure that it is properly grounded.
 - c. Make sure you have noise suppression spark plug wires and that all plug wires are clean and tightly connected to the coil pack terminals and the spark plug terminals. The Buick ignition system and ECM can be susceptible to electrical noise, and this can affect the data supplied to TurboLink™. *NEVER RUN SOLID CORE WIRES* Always run a high quality noise suppression silicone jacketed spiral wound conductor style spark plug wire.
 - d. **If you have an '84/85 car**, there are known problems with several chips (including some original factory chips!) with bad ALDL data streams coded into them. Try replacing the EPROM (chip) in your ECM with a known good one.

5.2 TurboLink™ Won't Display Data in "Realtime Display" Mode

PROBLEM

My TurboLink™ will not display data when I choose the "Realtime Display" option. I've checked all the connections and even though everything is clean and tight, it refuses to do anything but count down and then tell me to check the connections. (See above first)

Occasionally, it will display data but the parameters being displayed are full of maximum values (TPS = 5.04+ volts, EGR = 100%, BLM = 255, etc.) OR the program only synchronizes occasionally.

POSSIBLE CAUSES & SOLUTIONS

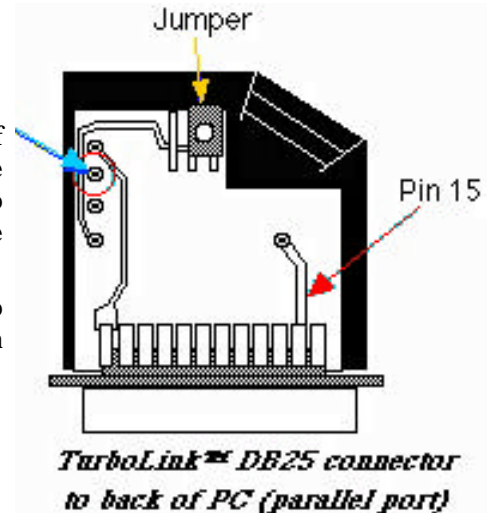
A single frame of bad data when the car is started while TurboLink™ is capturing data, or upon entry into the Realtime Display screen is normal, since the program is establishing synchronization with the data stream. The following procedures deal with chronic data corruption problems.

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Due to minor differences in parallel port architecture in some older PCs, it may be necessary to change a jumper located in the connector that plugs into the back of your PC. This jumper changes the mode that TurboLink™ uses to communicate with the ECM and usually resolves most compatibility problems.

If all connections are clean and tight, the car ignition is "ON" or the car is running, and TurboLink™ is running in the Realtime then try the following procedure.

1. Disconnect the cable from the PC and the car. Disassemble the connector that connects to the port on the back of your PC. The connector is square shaped and black or gray.
2. Be sure to note where all the screws and cable strain relief pieces fit. This is important when you reassemble the shell. The actual board is covered with a sealant to provide shock and moisture resistance and to protect the board components.
3. Be careful when removing the board from the shell to prevent problems with breaking the fragile components on the back of the board.
4. Locate the jumper as shown in the figure at right.
5. Carefully change the jumper to the other position.
6. Reassemble the connector.
7. Reconnect TurboLink™ and retest.
8. If TurboLink™ is still having problems, please call the technical assistance line.



5.3 TurboLink™ Disk Errors

PROBLEM

When I try to save or retrieve data, I get:

Not Ready Reading Drive A
Abort, Retry, or Fail?

POSSIBLE CAUSES & SOLUTIONS

1. A disk is not inserted in the drive, or is in the wrong drive. Reinsert the diskette in the drive and hit "R" for Retry.
2. The disk in the drive is not properly formatted. Use the DOS FORMAT command to format the diskette and try again.
3. The disk in the drive is corrupted or damaged. Try to use some of the advanced DOS utilities to fix the disk and retrieve the data on it. In the meantime, use a new diskette to save the data.
4. This is not a valid disk drive on your system. Use the "Change Working Directory" option in the Preferences menu to change your working directory/drive to one that is valid.

PROBLEM

When I save a run, it doesn't go to the directory I expected.

POSSIBLE CAUSES & SOLUTIONS

The working directory is not set to where you want the files to be placed. Use the Preferences menu to set the working directory to the working directory you wish to use.

PROBLEM

When I try to save a run, TurboLink™ won't let me.



POSSIBLE CAUSES & SOLUTIONS

1. The file name has already been used in that directory. Choose another name and try to save it again.
2. The disk is full. Insert a new formatted disk and retry.
3. The directory is full. Choose another working directory and save the run.

PROBLEM

TurboLink™ is reporting that TLUTIL1.DAT is the wrong version or corrupted.

POSSIBLE CAUSES & SOLUTIONS

1. The file TLUTIL1.DAT is not in the same directory as TURBOLNK.EXE. TLUTIL1.DAT is used for storing diagnostic data related to trouble codes and must be in the same directory.
2. The file TLUTIL1.DAT has been corrupted, deleted or moved. Reload the file from the Master disk.

5.4 TurboLink™ Display Problems

PROBLEM

When I use the DOS shell and then "EXIT" back to the program, the display is sometimes screwed up.

POSSIBLE CAUSES & SOLUTIONS

1. You are using an old version of DOS. TurboLink™ uses some advanced system calls to do some of the screen layout and drawing. A work around is to exit the screen and then return to force a redraw. The best solution is to upgrade to a later version of DOS.
2. You are using a modified DOS system that isn't 100% IBM compatible. The best solution is to upgrade to a standard DOS, if your computer will support it.

5.5 TurboLink™ Graphical Display Problems

PROBLEM

When I enter the graphical display screen, the bars indicating the parameters show up, but the colored portion of the bar showing values is missing.

POSSIBLE CAUSES & SOLUTIONS

1. You have more than one version of TurboLink™ in the same directory. The TurboLink™ default file (*.DFT) is used to tell TurboLink colors and contrasts to use. If more than one version of TurboLink™ is present in the same directory, they will corrupt the DFT file, since the file format usually changes between versions.
2. To solve the problem, ensure that each version of TurboLink™ resides in its own directory.

5.6 TurboLink™ Printing Problems

PROBLEM

When I try to print to a printer directly from TurboLink™, it runs off the page.

POSSIBLE CAUSES & SOLUTIONS

1. You have chosen the MANUAL mode of printer control and your printer is set up for 80 characters per line. Try the AUTO mode, which will attempt to command your printer to print 132 characters

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per line.

2. Your printer doesn't recognize the command to go to 132 column mode.
3. To solve the problem, use the MANUAL mode and set the printer to condensed font via the printer's front panel controls (see your printer manual for more information).

PROBLEM

When I try to print to a printer directly from TurboLink™, the printer does not print.

POSSIBLE CAUSES & SOLUTIONS

1. You have a printer that does not work in a standard way (such as a postscript laser printer). Save the print output as a "Normal File" and use your normal PRINT utility or print from a word processor program.
2. Your printer cable is wired incorrectly or is incorrectly connected to the PC. Double check all connections.

5.7 TurboLink™ CSV File Importing Problems

PROBLEM

When I try to open a file that has been saved as a CSV file by TurboLink™, my spreadsheet program will not allow it.

POSSIBLE CAUSES & SOLUTIONS

Most spreadsheet programs have an "IMPORT" function or menu option. They often require you to use this option to read a CSV file. Refer to the "Importing Data" section of your spreadsheet application's User Manual.

PROBLEM

When I import a file that has been saved as a CSV file from TurboLink™, my spreadsheet program does not show the column headers. When I export the file as "Normal file" the column headers are OK in my word processing file.

POSSIBLE CAUSES & SOLUTIONS

1. Some spreadsheet programs may try to convert the text for the column headers into formulas or numbers. Due to the sheer number of variants of CSV interpretation and number of versions of the various spreadsheet applications, it is not always possible to guarantee that everything is 100% compatible. The only problems reported have involved the data headers being scrambled or lost, but the data is always intact.
2. You may have re-enter the column headers while using your spreadsheet program.

6.0 TurboLink™ Operation

6.1 The Main Screen

The Main Menu consists of several major screen areas, each with its own special purpose.

6.1.1 Date and Time Display

In the left top corner of the screen, the current date (as set by DOS on your computer) is displayed. In the right corner of the screen, the current time (as set by DOS on your computer) is displayed.

6.1.2 System Parameters

On the left side of the screen you will notice an area labeled "System Parameters". This area gives you information regarding your computer's configuration and the current status of TurboLink™.



The **Current Drive** parameter shows which drive TurboLink™ is using to store and retrieve data files from.

The **Working Directory** parameter shows which directory TurboLink™ is using to store and retrieve data files from. This parameter can be changed via the "Disk Utilities" menu described in the following sections.

The **Disk Space** parameter shows how much space (in kilobytes or megabytes) is left on the current drive. This parameter can help alert you of dwindling disk space and allow you to insert a new floppy or to dump old data files off to backup floppies to prevent filling the disk completely.

The **ECM Parallel Port** parameter shows which port your computer is using to talk to the TurboLink™ Interface Cable. The hexadecimal address and Interrupt Request Queue (IRQ) number of the port is also displayed and can be helpful if you need to call for technical assistance.

The **Current VIN** shows the Vehicle Identification Number (VIN) that is associated with the data loaded in the Replay Buffer. This will be blank if no data has been recorded. The VIN is saved with any recorded data that you save to disk and can help in identifying which car the data was captured from.

The **RecordTrigger** parameter displays the current method for activating the recording of vehicle data. This parameter may be changed via the "Preferences" menu. When "**Space Bar**" is displayed, you may hit the Space Bar Key to activate the recording of data. When "**Malf. Code**" is displayed, TurboLink™ will automatically start the recording of data when the ECM detects and reports a Malfunction Code. When "**TPS Threshold**" is displayed, recording will automatically start when the TPS voltage is exceeded. This can be very useful if the computer is remotely mounted, as some NHRA tech. officials require. The recording of data is only possible when TurboLink™ is in the **Realtime Display Mode**.

The **ModeCommanded** parameter displays the current mode that you have chosen for the ECM. This parameter will show "ALDL" or "Normal", depending on your choice. The chosen mode will then be commanded to the ECM when you go into the Realtime Display menu.

The **Engine Loaded** parameters show information about the currently chosen vehicle. Use the "Preferences" menu to change this.

The **Buffer Contents** parameter shows you if there is recorded data ready for display or data saved from the Realtime Display Mode. If "Empty" is displayed, obviously, no data is present. If "***New Recording***" is displayed, data is being held in preparation for saving to disk via the "Disk Utilities" menu. TurboLink™ will allow you to proceed and overwrite this data, but will ask you to confirm your choice. If a file name ending with ".ECM" is displayed, a file has been retrieved via the "Disk Utilities" menu and is awaiting viewing via the "**Replay Recorded Data**" menu or printing via the "Preferences" menu.

6.1.3 Choose Option Requester Box

On the right side of the screen, a requester box is displayed with the menu choices available to you. To choose a menu function, use the Up Arrow/Down Arrow keys to highlight the function you wish to perform. When your selection is highlighted, hit the Enter key to make the selection.

6.2 Realtime Data Display Mode

When you choose "Realtime Display" from the main screen, you get a requester asking whether you wish to view the data in numerical mode or graphic mode. Highlight your choice and then hit the Enter key. The car's ECM will first be commanded to enter the mode displayed in the "Mode Commanded" parameter.

6.2.1 Numerical Display

In this mode, the data gathered from your car's ECM is displayed in Numerical format. Notice that the various items are grouped according to function. See the ECM Information section for descriptions of the data items and their use.

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In addition, in the right lower corner of the screen the current **Time Index** (from when the record mode is triggered - with zero indicating the frame in which the recording started, minus indicating time BEFORE the trigger, and plus indicating the time AFTER the trigger.) TurboLink™ stores up to 50 frames before you hit the record trigger, to allow for historical data leading up to the event you wish to observe.

The **Fuel System Status** area displays data related to the car's fuel injection system and sensors that affect fuel delivery.

The **Ignition System** area displays data related to the ignition system of the car.

The **Vehicle Status** area displays the status of various switches and sensors in the car that are basically either ON or OFF.

The **General/Sensors** area displays data gathered from various other sensors in the car.

The bottom of the display will show the status of the link to the ECM. It will show **"*Receiving*"** when data is being received and **"*Idle*"** between reception of frames from the ECM. If no data has been received from the ECM within the time-out period, TurboLink™, will notify you and suggest an action. Various parts of the bottom of the screen are used to show key assignments and record trigger.

The display in the top left corner of the screen shows the current mode that has been commanded by TurboLink™ to the ECM. Notice that in the **Vehicle Status** area, there is an ECM mode parameter that reports what mode the ECM is ACTUALLY in. ***This can be important, since if the reported mode differs from the commanded mode, it might indicate a problem with the ECM.***

The display in the top right corner of the screen shows the current status of the record function. If you are currently recording data, this parameter will show "ON".

The F1 key can be pressed at any time to display any **Malfunction Codes** reported by the ECM.

The F3 key can be pressed at any time after recording is halted to **Quick Save** a recording to disk.

To capture data, you can hit the **Space Bar** to trigger the recording process (if Record Trigger is set to Space Bar). When data is being captured, the upper right corner of the display will show **"**RECORDING **"**.

To Calibrate the OPTIONAL Boost Recording hardware, hit the F5 key with the car's ignition on, *but not running*. This will zero the boost/vacuum gauge.

6.2.2 Graphical Display

In this mode, the data gathered from your car's ECM is displayed as various bars and round gauges that are illuminated in response to the data. This mode is useful for spotting trends, maximum/minimum values, and for reading the data at a glance.

The top of the screen is dedicated to several indicators that fulfill the same function as LEDs. When the square is colored in, it indicates that this parameter is active.

In the right upper corner, frame information is displayed in the same manner as it is in the Numerical Display Mode.

The main display area consists of a gauge indicating **RPM** (to the maximum of 6350 RPM reported by the ECM), a gauge indicating **vehicle speed** (again limited to the maximum reported by the ECM), a gauge indicating either **Manifold Absolute Pressure (MAP)** [OPTIONAL] or **Manifold Air Temperature (MAT)** as a numeric field at the right side of the screen, a bar indicating **Throttle Position Sensor (TPS)** voltage, a bar indicating **O2 sensor voltage** in millivolts multiplied by 10, a bar indicating factored **Air flow** in grams per second multiplied by 10, a bar indicating the **Load Filtered Variable (LV8)** in grams per cylinder multiplied by 10, and a bar indicating degrees of **Knock Retard** (if available for vehicle selected)

The F1 key can be pressed at any time to display any **Malfunction Codes** reported by the ECM.

The F3 key can be pressed at any time after recording is halted to **Quick Save** a recording to disk.

To capture data, you can hit the **Space Bar** to trigger the recording process (if Record Trigger is set to Space Bar). When data is being captured, the upper right corner of the display will show **"**RECORDING **"**. The frame number will also increment as frames are stored in the buffer. If the Record Trigger is set to **"Malf. Code"**, a malfunction code from the ECM will automatically trigger the recording sequence.



To Calibrate the OPTIONAL Boost Recording hardware, hit the F5 key with the car's ignition on, *but not running*. This will zero the boost/vacuum gauge.

6.3 Replay Recorded Data

The Replay Recorded Data function provides a way to step through previously captured data. You can use it to review data that was captured via the Realtime Display option or loaded from disk via the Disk Utilities function.

Just like in the Realtime Display function, you have the choice of reviewing the data in either a Numerical format or a Graphical format. To step through the recorded data, use the Up Arrow key to see one frame at a time in the forward direction and the Down Arrow key to step in the backwards direction. Use the Page Up key to step 20 frames forward and the Page Down key to step backward 20 frames. The Home key will return you to the number zero frame. The ESC key will return you to the Main Screen.

The F1 key can be pressed at any time to display any Malfunction Codes reported by the ECM. The F2 key will provide more information about any selected Malfunction Codes, if desired. The bottom of the screen displays any comments associated with previously saved data and the vehicle type.

6.4 Set ECM Mode

This menu choice is used to choose a mode for the car's ECM. You have the choice of "Normal" or "ALDL" mode. TurboLink™ will command the ECM to enter the chosen mode upon the activation of the Realtime Display menu.

CAUTION: The ALDL mode should only be used to perform diagnostic functions and should never be used for Wide Open Throttle operation.



6.5 Disk Utilities

This menu choice is used for accessing files on the disk drive with TurboLink™. System Parameters, as previously described, are again displayed. A Disk Options Requester box is available on the right side of the screen. The bottom line displays status and help information.

6.5.1 Save Buffer to Disk

This option allows you to save captured data to the disk for later review and analysis. When you choose this option, a requester prompting for a file name will be displayed. Enter a file name with 8 characters or less and hit Return to save the data in a file with this name. The files are approximately 7600 bytes long. Hit ESC to abort the operation.

6.5.2 Retrieve Buffer from Disk

This option allows you to retrieve previously saved data. When this option is chosen, a scrolling requester is displayed. Use the Up/Down Arrow keys to highlight the data file to retrieve. Hit Return to choose the file. The file is then loaded into memory and can be reviewed using the Replay Recorded Data function.

6.5.3 Change Working Disk Drive

This option allows you to change the disk that TurboLink™ uses to store and retrieve files from. When you

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choose this option, TurboLink™ will allow you to pick a new disk drive.

When the scrolling list appears, highlight your choice (using the up/down arrow keys) and hit "Enter" to make your selection.

6.5.4 Change Working Directory

This option allows you to change the directory that TurboLink™ uses to store and retrieve files from. When you choose this option, TurboLink™ will prompt you to enter the new directory.

Enter the directory in normal DOS style, with the "\" character separating the various levels of subdirectories. (e.g. tink\my\working\directory). If you want, you can exit to the DOS Shell and change directories. When you return to TurboLink™, you will get a notification that your working directory has changed. No action is necessary, it is just a notice.

6.5.5 DOS Shell

This option allows you to temporarily exit to DOS. This allows you to execute DOS commands or execute other applications and return to TurboLink™ by typing EXIT at the DOS prompt.

6.5.6 Return

This option allows you to Return to the Main Screen.

6.6 Preferences

This option allows you to set up various parameters to set the record trigger, change units from English/Metric, and set the default VIN. The left side of the screen displays current status.

6.6.1 Current Settings

On the left side of the screen you will notice an area labeled "**Current Settings**". This area gives you information regarding your computer's configuration and the current status of TurboLink™.

The **Display Units** parameter shows what the current units are - English or Metric. If English is chosen, vehicle speed will be displayed in miles per hour and temperatures will be displayed in degrees Fahrenheit. If Metric is chosen, kilometers per hour and degrees Celsius will be displayed.

The **Display Mode** parameter shows what the current setting for the screen is, either COLOR or BLACK AND WHITE (best for some LCD screens).

The **SoundStatus** parameter shows what the current setting is, either ON or OFF. This controls whether the computer will beep at you on certain events or not.

The **Splash Screen** parameter shows whether the startup TurboLink™ screen is shown (with the picture of the Grand National) or not. If your computer display does not display VGA resolution pictures, this setting will have no effect, since the software cannot display it anyway.

The **LPT1 Interrupt** parameter shows what the current IRQ for the printer port is. This is important for compatibility with certain computers, but once chosen shouldn't have to be changed.

The **Record Trigger** parameter displays the current method for activating the recording of vehicle data. This parameter may be changed via the "Preferences" menu. When "Space Bar" is displayed, you may hit the Space Bar Key to activate the recording of data.

When "Space Bar" is displayed, TurboLink™ will begin recording when you hit the Space Bar. The Space Bar is also used (no matter what record trigger is chosen) to stop recording.

When "Malf. Code" is displayed as the **Record Trigger**, TurboLink™ will automatically start the recording of data when the ECM detects and reports a Malfunction Code. The recording of data is only possible when TurboLink™ is in the Realtime Display Mode.

When "TPS" is displayed as the **Record Trigger**, TurboLink™ will automatically start the recording of



data when the TPS voltage exceeds the chosen value. The recording of data is only possible when TurboLink™ is in the Realtime Display Mode.

The **MAT/MAPSensing** parameter indicates whether you have chosen to record and display MAP/Boost (with the optional hardware) or MAT.

The **Default VIN** shows the Vehicle Identification Number (VIN) that you have chosen in the "Preferences" menu. This VIN is saved with any recorded data that you save to disk and can help in identifying which car the data was captured from.

The **Current Engine Loaded** shows the type of car that you have chosen in the "Preferences" menu. This vehicle type is saved with any recorded data that you save to disk and can help in identifying from which car the data was captured.

6.6.2 Utility Options Requester Box

On the right side of the screen, a requester box is displayed with the menu choices available to you. To choose a menu function, use the Up Arrow/Down Arrow keys to highlight the function you wish to perform. When your selection is highlighted, hit the Enter key to make the selection.

6.6.3 Display Units

This option allows you choose either English or Metric display units for use in the Realtime Display mode or the Replay Recorded Data mode.

6.6.4 Sound

This option allows you to turn the sound (a simple beep) ON or OFF. 6.6.4 LPT1 Interrupt

This option allows you to change the IRQ that TurboLink™ uses to communicate to your computer's parallel (printer) port. This parameter should not be chosen unless all other trouble shooting has been accomplished.

6.6.5 LPT1 Interrupt

This option allows you to change the IRQ that TurboLink™ uses to communicate to your computer's parallel (printer) port. This parameter should not be chosen unless all other trouble shooting has been accomplished.

6.6.6 Set Default VIN Number

This option allows you to enter a VIN number that will be stored with any data captured by TurboLink™. This helps you determine which car the data was captured from.

6.6.7 Record Trigger

This option allows you choose either the Space Bar, TPS Threshold, or Malfunction Code as the trigger for capturing data in the Realtime Display mode.

6.6.8 MAP/MAT Option

This option allows you to choose whether you wish to display and record BOOST (with the optional hardware) or to record MAT.

6.6.9 Set Vehicle Type

This option allows you to scroll through a list of vehicles or special data stream types to match the vehicle that you are gathering data from.

6.6.10 Enable Splash Screen

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This option allows you to turn ON or OFF the initial startup screen with the picture of the Grand National. This option will only have an effect if your computer supports VGA resolutions.

6.6.11 Set B&W or Color Mode

This option allows you to set the screen display to full color mode or Black and White mode. The Black and White Mode is sometimes desirable on non-backlit LCD screens (especially palmtops).

6.6.12 Return

This option allows you to return to the main menu.

6.7 Print Utilities

This option allows you to set up various parameters to control printing.

6.7.1 Printer Parameters

This option allows you to set the Start Frame/Stop Frame and Page Length. This allows you to customize your printout to fit your printer and your paper. Press the ESC to abort this action.

6.7.2 Auto-Condensed Printing

This option should normally be set to "Automatic". TurboLink™ will send a command string to your printer to command it to print the output in "Condensed" or "132 column" mode. This allows the data to fit on a 8.5" wide piece of paper.

If your printer does not support this command string properly (like some HP LaserJet/Ink jet printers), or if you have a wide carriage printer (132 column), you may want to override this automatic command. In this case, choose "Manual" and control the print style via the front panel controls on your printer. If this does not work, use the Normal File option to save the data as a file and use a word processor to display and print the data in a format compatible with your printer. Make sure you use a nonproportional font, such as Courier.

6.7.3 Printer Port

This option allows you to set the desired printer port for outputting your data.

6.7.4 Print Destination

This option controls whether the data is output to the printer or to a file for export to other applications. When this option is chosen, a requester is displayed "Direct Print Output" allowing you to choose the file's destination.

6.7.4.1 Printer

This option will direct the output to your printer.

6.7.4.2 Normal file

This option will direct the output to a file on your disk. This file will be a text file that can be printed later or imported into your favorite Word Processing application.

6.7.4.3 CSV file

This option will direct the output to a Comma Separated Value (CSV) file for importation into your favorite spreadsheet or database application. CSV files are understood by most of the popular spreadsheet and database programs and will provide you with a means to manipulate the data, produce



graphs of the data, and reformat the data.

Notice the fields that indicate a "5" or a "0" in some of the columns. This corresponds to "Rich" for the "Mix" column and to "ON" or "YES" for the TCC, 3rd, and 4th fields. This was done to allow you to graph these fields easily without having to convert text (like "Y" or "N") into some sort of number the spreadsheet graphing functions require.

NOTE: *Some spreadsheet programs may try to convert the text for the column headers into formulas or numbers. Due to the sheer number of variants of CSV interpretation and number of versions of the various spreadsheet applications, it is not always possible to guarantee that everything is 100% compatible. The only problems reported have involved the data headers being scrambled or lost, but the data is always intact. You may have to re-enter the headers in your spreadsheet program,*



6.7.5 Begin Printing Buffer

This option controls the outputting of the data to the printer.

6.7.6 Return

This option allows you to return to the Main Screen.

6.8 Print Utilities Display

The following items are displayed on the left side of the screen and present current settings for the print functions:

The **Print Range** parameter shows the current print setting. It shows the first frame and the last frame to be printed.

The **Page Length** parameter shows how many lines per page are to be printed. Most printers will work well when you use lines per page in the range of 60 to 66.

The **Printer Port** parameter shows the hexadecimal address that the printer port is located at. This information can come in handy if you need technical assistance in printing output.

The **CondensedPrint** parameter shows whether TurboLink™ will send a command for your printer to print in 132 column mode or whether TurboLink™ will rely on you to control the output via the printer's front panel controls.

The **Print Dest.** parameter indicates whether the program will print to your printer or to a file that can be transferred to other applications.

6.9 Hints for Tuning with TurboLink™

- Be sure to pay attention to the status bar at the bottom of the screen. It will often give you a one line description of an option's function, directions for using a particular option, or current status of disk loading/saving.
- Try to organize your saved data files by occasionally moving some files to floppy or dividing them up into several directories. This can make it considerably easier to sort through different saved recordings and to find certain events for analysis.
- **Although the interface cable is designed to be robust and to put up with a certain amount of abuse, try to keep the cable from being exposed to unnecessary moisture or stress. Always unplug the cable by grasping the connector and gently pulling it loose. Never "yank" the plugs out by pulling on the cable wire.**
- Try to avoid exposing the ALDL cable or the TurboLink™ Interface cable to



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- excessive heat or cold. Store your TurboLink™ in a temperature controlled place (not your trunk or the backseat) if you can. Excessive temperature swings can make the connectors brittle and prone to breakage.
- Be sure to watch the boost gauge when diagnosing a run or trying to trouble shoot a problem (if you do not have the optional boost sensing kit). Boost levels have a dramatic effect on readings.
 - **Be very careful when plugging and unplugging the cable from your car. A small static zap or voltage surge can damage a part of the TurboLink™ circuit board that controls the ALDL ECM function.** When this occurs, the ECM will be in ALDL mode (regardless of the mode chosen via the Main Screen) whenever the cable is plugged in. If you suspect this has happened, go to the Numeric Display and look at the ECM STATUS parameter. If it won't come out of ALDL, you will need to have the cable repaired (send it via mail with a note and we will fix it).
 - Some car models don't display malfunction codes (and other data) unless the car is in the ALDL mode. This is particularly true for the '84-85 Turbo Regals. Be sure that the ECM Mode field shows "ALDL" when you choose the ALDL mode from the "Set ECM Mode" menu. Some cars may not respond to a command to go to ALDL mode. If this is the case, check that all connectors are clean and tight and that car's diagnostic connector doesn't have loose wires.
 - For most cars, try to tune fuel pressure and other parameters such that the O2 volts read in the 0.760-0.780 range at WOT. This will usually result in the best performance. As always, this can vary from car to car, so be sure to watch for Knock Retard. You should never see more than 7-9 degrees during a run. Optimal is a peak of 2-3 degrees, with most of the run consisting of 0-1 degree of Retard.
 - Performance for the Turbo Regals is maximized by finding the maximum boost that can be run without encountering excessive knock (ignition retard) or excessively rich air/fuel mixtures. Richer air/fuel ratios **DO NOT** compensate for inadequate fuel octane or over boost conditions. Begin with moderate boost levels (17-18 psi) and adjust the fuel pressure to accomplish the O2 voltages described previously. A good starting point with most fuel systems with an enhanced in-tank fuel pump or puller pump is 40-43 psi (without the vacuum line hooked up to the regulator). Watch for retard. When things have stabilized and all parameters are set to a good baseline, increase boost in 1 psi increments and retune the fuel pressure with each adjustment.
 - ****Never exceed 23 psi with stock head gaskets unless you have your tuning parameters under PRECISE control!**** If you do, and knock occurs, you will probably blow a head gasket. Some low timing chips will allow you to run more boost, but you must be very careful to avoid detonation or lean air/fuel mixtures to avoid engine damage.
 - Never try to set the Throttle Position Sensor (TPS) to more than 4.85 volts. Excessive voltage can result in the ECM setting a TPS High Malfunction Code during a run. A value over 4.55 volts is sufficient.
 - It can be helpful to catch numerous runs with TurboLink™ and then use the export functions in the Print option to make CSV files. These CSV files can then be imported into a spreadsheet tool and graphed. With several runs on the same graph it is easier to get an idea of averages, shift points, etc. This can be important in spotting trends.
 - Be sure to calibrate the optional Boost Sensing hardware periodically during the day. Air Density changes can make for minor errors in the readings (usually < 0.5 " Hg.).

7.0 Tutorials

7.1 Tutorial 1 - Starting TurboLink™

This tutorial assumes that you have the TurboLink™ package correctly connected to your PC and your car, as described previously in this manual.

Using the DOS change directory command ("cd"), change your current working directory to the one containing TurboLink™.

Example:

```
C:>cd tlink <ENTER>
```

Now type "turbolnk" at the DOS prompt.

Example:

```
C:\tlink>turbolnk <ENTER>
```

TurboLink™ will now initialize and come up with the Main Screen. You are now ready to start receiving data from the ECM. This screen allows you to perform all the major functions of TurboLink™. The Realtime Display option will link with the ECM and show data as it is read from the ECM. You then have the option to save the data or just view it. The Replay Buffer Data option allows you to view data previously recorded. The Set ECM Mode allows you to change the ECM mode from Normal to ALDL and back again. The Disk Utilities option takes you to a sub menu to save, retrieve and manipulate data. The Preferences option allows you to set/change program preferences. The Print Utilities option allows you to print to a printer, save data to word processor files, and save data to spreadsheet files.

Notice that the current system parameters are displayed in the area pointed out by the bubble number "1"

```

Turbo Data Systems Technologies                                TURBOLINK v2.12
-----
07/10/98                Beta Release 12c                    18:04:17
                        Not For Distribution
-----
System Parameters:
Current Drive      : C:
Working Directory:  \TLINK\TLV212
Disk Space        : 106.938 MBytes
ECM Parallel Port: LPT1 @ 0378H (IRQ7)
Current VIN       :
Record Trigger    : Space Bar

Mode Commanded    : NORMAL
Year Loaded       : 1987
Engine Loaded     : 3.8L INTERCOOLED-TURBO V6 SFI

Buffer Contents   : Empty

(C) Copyright 1994-1998 TDS Technologies                    Use ↑;↓
                                                           Release v2.12
-----
Show realtime data as it is produced by the vehicle ECM
    
```

TurboLink™ MAIN SCREEN

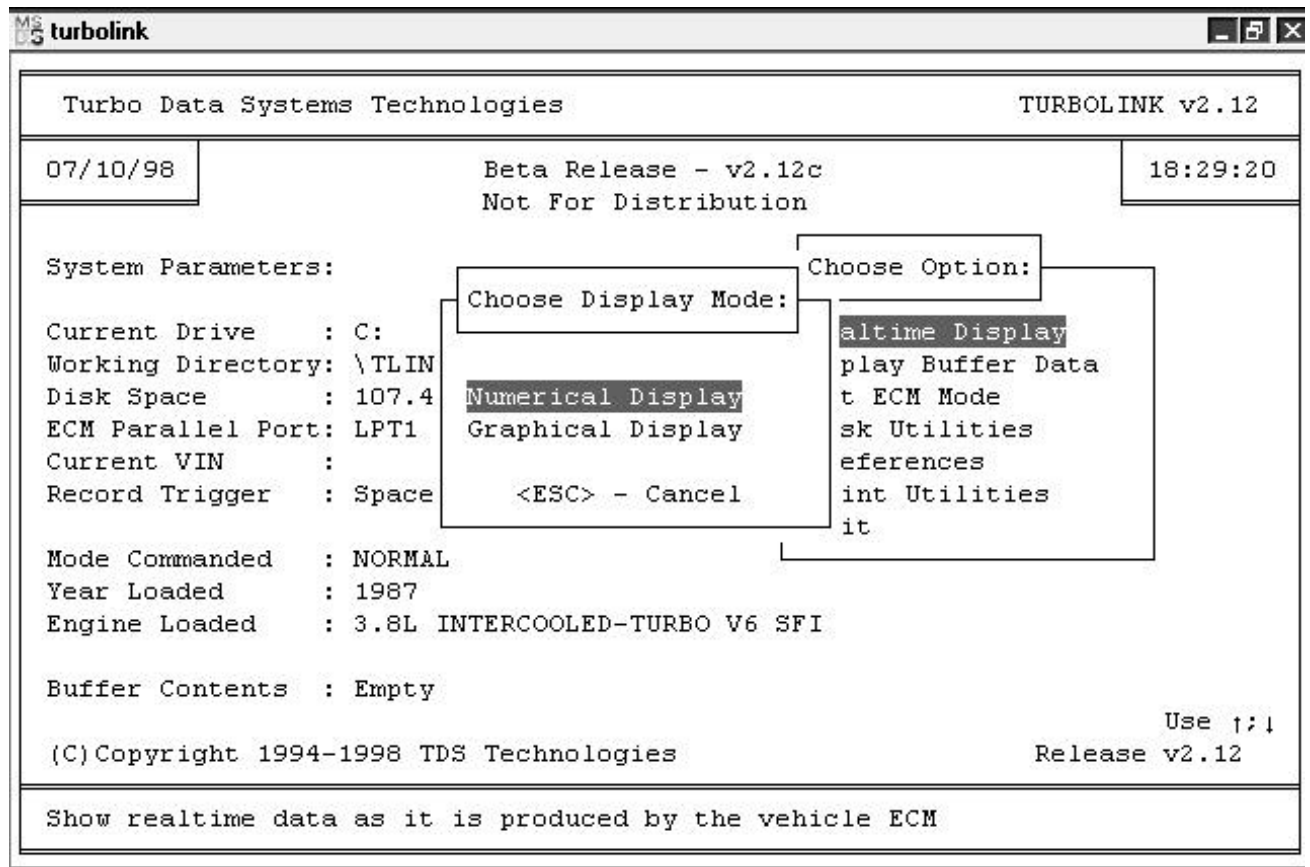
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7.2 Tutorial 2 - Capturing Data Using TurboLink™

This tutorial assumes that you have the TurboLink™ package correctly connected to your PC and your car, as described previously in this manual.

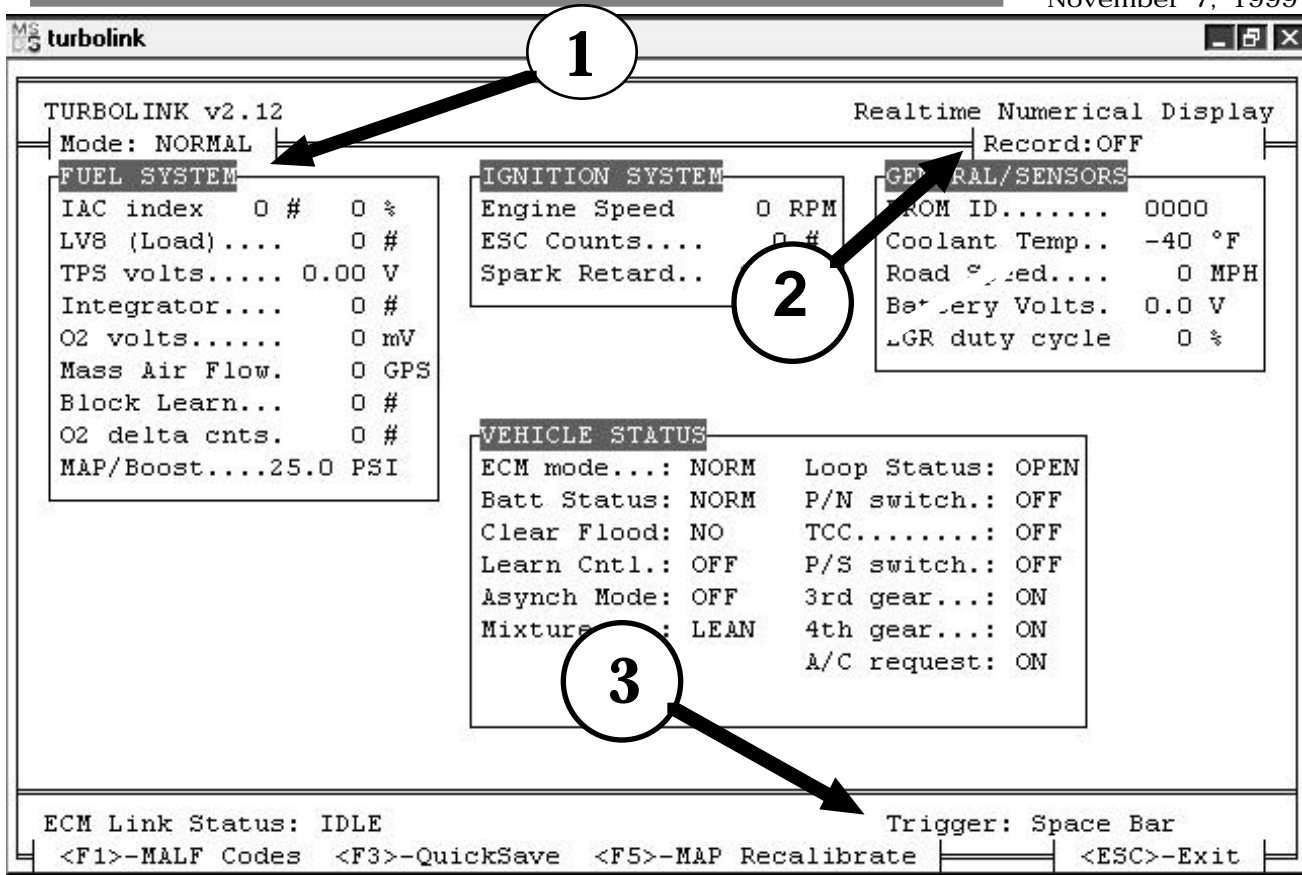
To capture data using TurboLink™, choose the "Realtime Display" option from the Choose Option requester by highlighting it and hitting the Enter key. A requester will be displayed with the option of Numerical Display and Graphical Display. Highlight "Numerical Display", using the Up/Down Arrow keys and hit Enter. The program will then link up with the ECM and bring up the Realtime Display screen.

NOTE: TurboLink™ will display data received from the ECM at a rate of approximately one new frame every 1.25 seconds. This refresh rate is not a limitation of TurboLink™, but rather the ECM.



MAIN SCREEN WITH NUMERICAL DISPLAY SELECTED

Notice the area of the screen (shown by bubble "1") that indicates the mode that you have selected for the ECM. This area should read "NORMAL" for this exercise. To start recording data, hit the Space Bar (which is the record trigger as shown by bubble "3") and recording will start. Bubble number "2" shows the area of the screen that will indicate "Record: ON" when recording starts. When you have recorded a few minutes of data, hit the Space Bar again to halt recording. Notice that the area pointed to by "2" shows "Record: OFF". Now hit the ESC key to return to the Main Screen



NUMERICAL DISPLAY SCREEN


Notice that in the **System Parameters** area of the Main Screen, the **BufferContents** area now indicates "*** New Buffer ***". This means that the captured data is now in the buffer awaiting your action. At this time you may save the data to disk, review the data via the **Replay Recorded Data** option, or ignore the data and either record new data or exit the program without saving the data.

7.3 Tutorial 3 - Saving Data Captured with TurboLink™

After executing Tutorial 1 & 2, you will notice that the System Parameters section of the Main Screen has changed. The Buffer Contents parameter has changed to **** New Buffer **** to indicate that data is awaiting saving to the disk or for you to review it as shown by bubble "1".


To save the data to disk, choose the "Disk Utilities" function from the Main Screen by highlighting the selection and hitting Enter. The Disk Utilities Screen will then be displayed.

A requester is displayed and you are prompted for a file name consisting of 8 characters or less. Type "Tutorial1" and hit Enter. TurboLink™ will prompt you to enter a brief comment at the bottom of the screen at the "->" prompt. Type "Tutorial One containing some test data from my car" and hit Enter.

Turbo Data Systems Technologies		TURBOLINK v2.1	
1/15/96		10:23:27	
System Parameters:			
Current Drive	:	C:	
Working Directory:	:	\TLINK	
Disk Space	:	19.290 MBytes	
ECM Parallel Port:	:	LPT1:@03ABH (IRQ7)	
Current VIN	:	1G4HP174500004	
Record Trigger	:	Space Bar	
Mode Commanded	:	NORMAL	
Year Loaded	:	1987	
Engine Loaded	:	3.8L INTERCOOLED-TURBO V6 SFI	
Buffer Contents	:	** New Buffer **	
Copyright (C) 1994,1995 TDS Technologies		Use  Release v2	
Shows realtime data as it is produced by the vehicle ECM			

Choose Option:
 Realtime Display
 Replay Buffer Data
 Set ECM Mode
 Disk Utilities
 Preferences
 Print Utilities
 Exit

1



MAIN SCREEN WITH NEW DATA IN THE BUFFER

The status area at the bottom of the screen will display "Saving Tutorial1 to disk ..." as TurboLink™ writes your data to a file on the disk. When it is finished, TurboLink™ will return you to the Disk Utilities Screen. Choose Return to display the Main Screen again.

7.4 Tutorial 4 - Using Quick Save to Save Data Captured with TurboLink™

An alternative to the method of saving data presented above in Tutorial 3 is to use the Quick Save capability. To use Quick Save, do the following:

1. Start Recording in the Realtime Display by hitting Space Bar (or other record trigger)
2. When you have accumulated the desired number of frames, just hit space bar (to halt recording) and then the F3 key
3. TurboLink™ will exit the Record mode and save the file. You can restart the recording process or exit the Realtime display.

Perform Tutorial 3 again and this time, use the Quick Save feature.

This will activate the Quick Save option and your data will be saved to a serial numbered file (TLQS0001.ECM) with no comment. Later, you can retrieve the data via the "Retrieve Buffer" option in the Disk Utilities menu and resave it with a new file name and comment (see Tutorial 5). The Quick Save feature allows you to record your data with a single keystroke which is very useful when you must have your primary attention on operating the vehicle. When you have the vehicle safely parked, you can review the data and resave it.

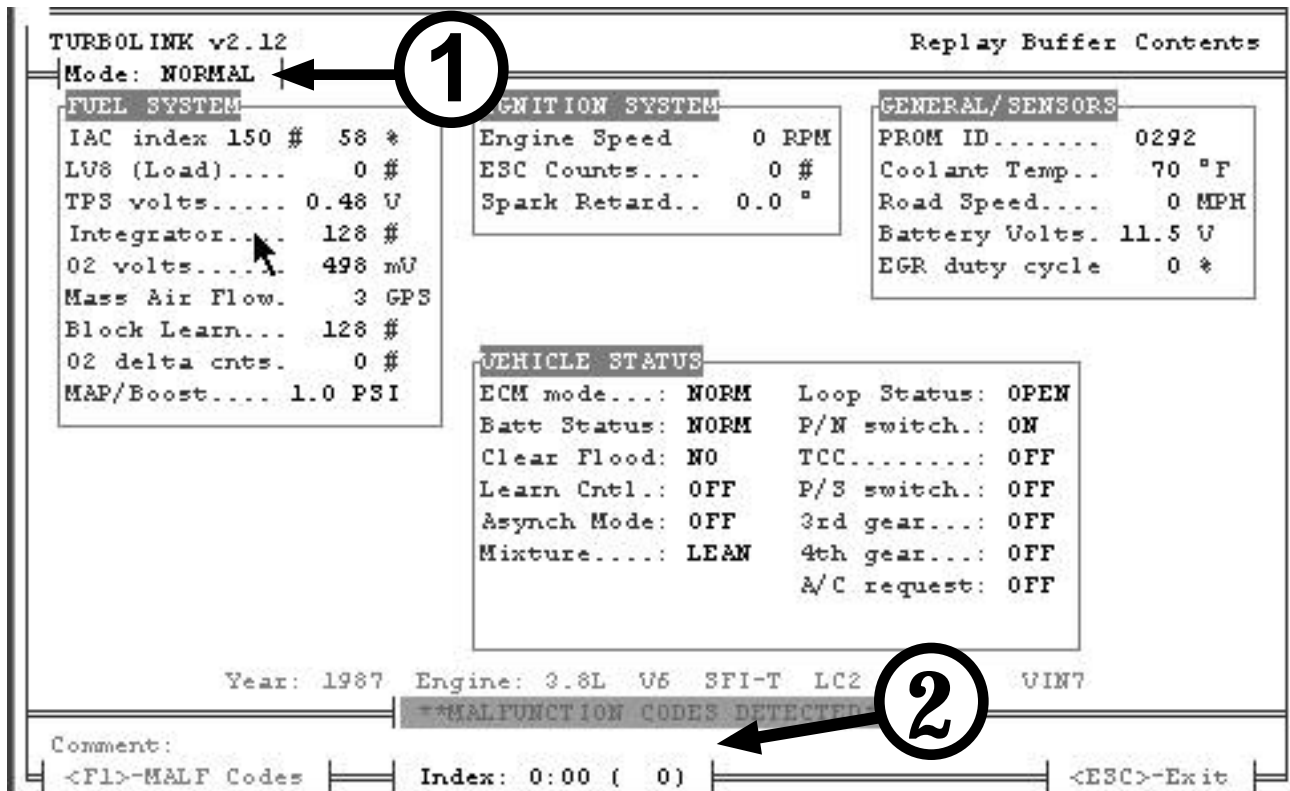
7.5 Tutorial 5 - Reviewing Data Captured with

TurboLink™

If you have completed Tutorials 1-4, there will already be captured data in the buffer awaiting review. If not, you can go to the Disk Utilities menu and retrieve previously saved data by choosing the "Retrieve Buffer From Disk" option. Once the data is shown in the Buffer Contents field on the Main Screen, we can proceed.

Choose "Replay Recorded Data" from the Option Requester. TurboLink™ will prompt you for a display mode, either Numerical or Graphical. For this tutorial, choose "Numerical Display". The Replay Recorded Data Screen will be displayed in the Numerical mode.

To step through the data frame by frame, use the Up/Down arrow keys. Notice that the time index increments and decrements accordingly relative to when the Record Trigger was activated. To return to the record trigger frame, hit the HOME key and to step through the data 20 frames at time, use the Page Up/Down keys. When you are finished viewing the data, hit the ESC key to return to the Main Screen.



REPLAY BUFFER IN THE NUMERICAL MODE

Notice that the area pointed to by bubble "1" shows the mode the ECM was in when the data was recorded. TurboLink™ automatically remembers the appropriate mode and display parameters that were in force at the recording time. Bubble "2" points out the "Time Index" indicator that shows the frame time (minutes:seconds) in relation to when the recording was started. The frame number is displayed in parenthesis. Negative numbers indicate frames that occurred BEFORE the record trigger and positive numbers indicate frames that occurred AFTER the record trigger.

Choose "Replay Recorded Data" again, but this time choose the "Graphical Display" option. TurboLink™ will then display the data in a graphical format.

Use the same keys and techniques you used with the Numerical screen to navigate through the data. This is the same screen that can be used in the Realtime Display mode. The data is displayed using the bar

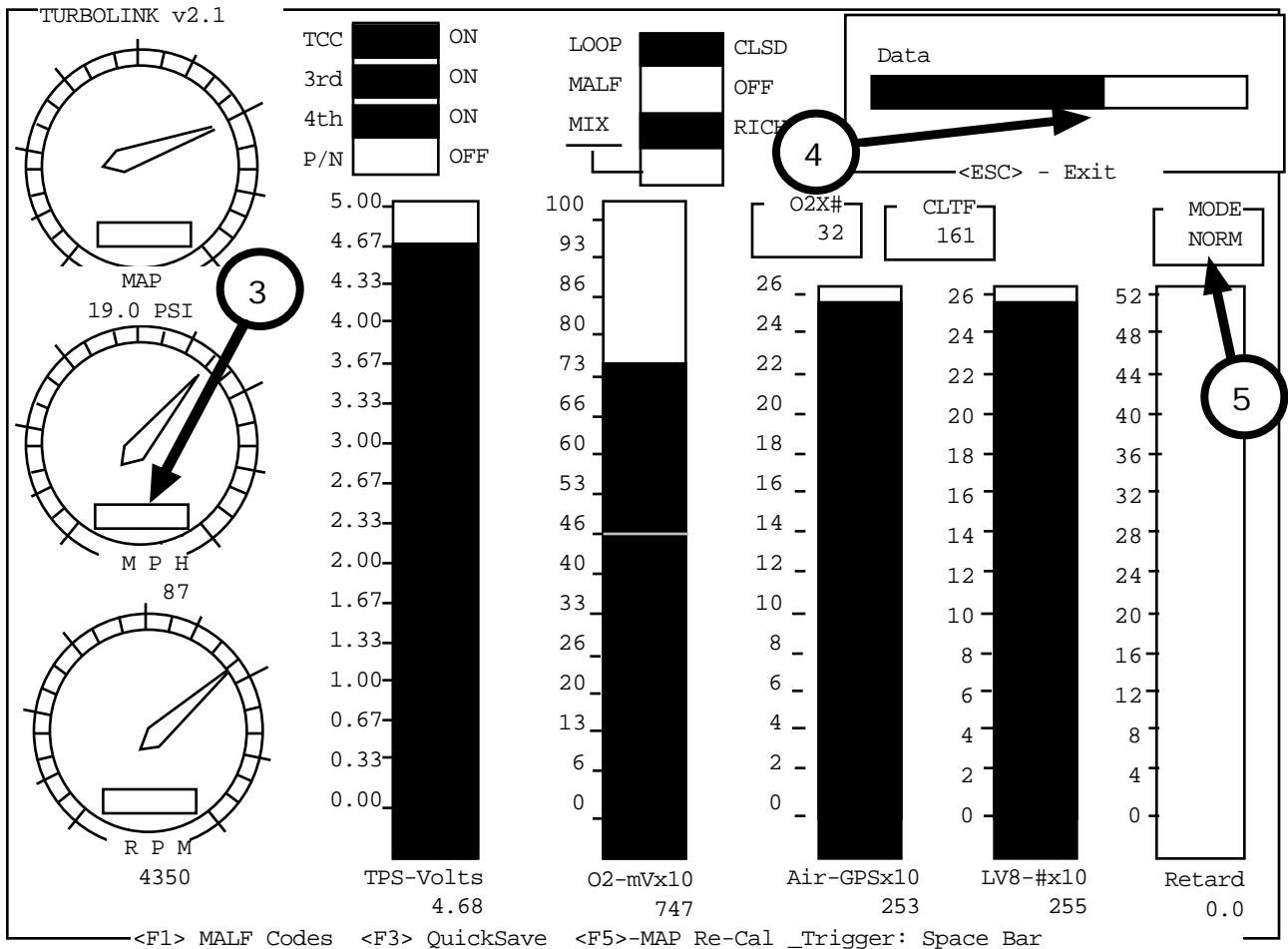
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graphs on the screen. The first gauge on the left displays Engine vacuum or boost (Manifold Absolute Pressure) if you have the optional Boost Sensing kit. If you do not have this kit, or if you do and you select the MAT option in the Preferences menus, this gauge will not be present and MAT will be displayed in a numerical box at the right side of the screen.

The next gauge displays engine RPM. The actual value of the RPM is displayed under the bar.

The next gauge displays the vehicle speed in MPH (or KPH). The bubble marked “3” points out the LED that is filled (lit) when the gauge value is zero. This allows you to quickly scan the data stream for zero values.

The TPS voltage is displayed next. The fourth bar displays the O2 voltage in millivolts.



This bar also indicates a RICH/LEAN air fuel mixture, depending on the O2 voltage.

The fifth bar displays the Mass Air Flow (MAF) reading as Grams Per Second (GPS). The sixth bar displays the Load Filtered Variable (LV8) in Grams Per Cylinder (GPC). The LV8 is calculated based on several sensors .

The last bar indicates ignition timing Retard. The ECM will retard the timing to prevent detonation (knock).

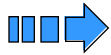
The bars displayed will vary with the ECM mode and the vehicle type, since not all values are displayed for all vehicles.

The horizontal bar in the upper right hand corner (marked with “4”) shows the status of the data being captured. The bar is incremented for every parameter that is received.

Just below the data status bar is the ECM status box (marked with “5”). This box will display the



commanded state of the ECM (NORM/ALDL/BACKUP).



Not all cars will have all data values available in all modes. The display automatically adjusts for the amount of data available for the chosen vehicle and ECM mode. TurboLink™ also “remembers” the ECM mode and vehicle for any data saved and recalled from the disk. Some cars display much more data with the ECM in the ALDL mode.

7.6 Tutorial 6 - Printing Captured Data

If you have completed Tutorials 1-5, there will already be captured data in the buffer awaiting review. In this tutorial, we will print the data out to a printer attached to your computer.

Choose the "Print Utilities" Menu from the Main Screen. Notice the "Current Settings" portion of the screen. It shows that the Print Destination is the printer and that the default frame range is from -20 to 100 (the entire buffer is -50 to 249). If you wish to print a portion of the buffer, you can select "Printer Parameters" to set the start/stop frame and the page length for the printer.

The “Auto-Condensed Printing” option is normally set to “Automatic”. This causes TurboLink™ to send a command string to your printer before printing begins that puts most printers into “Condensed” or “132 column” mode. If your printer does not support this command string, or you are using a wide carriage printer, or you want to control font and print style from the printer front panel controls, choose “Manual”.

When all parameters are set to your liking, choose the "Begin Printing Buffer" option. Make sure your printer is on line and the print head is at the top of the page (if your printer is dot matrix). Once the printer has finished printing, you can see how convenient the printed output can be in analyzing the data captured by TurboLink™.

You will notice that the data is preceded on each page by the following header:

```
TDS Technologies                TURBOLINK (c) Version 2.1
Vehicle Collection Report                Page: 1
```

```
-----
Buffer/File: TUTORIAL_1.ECM
Date: 11/15/97  Time: 11:12.23
Vehicle VIN: 1G4GHP779H0123456
PROM ID: 24AD  MODE: NORMAL
Comment:  SOME DATA CAPTURED FROM MY CAR
-----
```

Each column of data is marked with a heading. These headings are as follows:

- Index - time index of the frame
- IAC - Idle Air Control Counts
- CLTF or CLTC - Coolant temperature in Fahrenheit or Celsius degrees
- MPH or KPH - Vehicle speed in miles per hour or kilometers per hour
- LV8 - Load filtered variable in grams/per sec/per cylinder
- RPM - engine speed in revolutions per minute
- TPS - Throttle Position Sensor in volts
- INT - Integrator value indicating the ECM's adjustment factor
- O2V - Oxygen Sensor voltage in millivolts
- CF - Clear Flood (Y=Yes, N=No)
- LC - Learn Control (Y=Yes, N=No)
- MIX - Fuel Mixture (R=Rich, L=Lean)
- LPS - Loop Status (O=Open, C=Closed)

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MAF	-	Mass Air Flow in grams per second (factored times 32)
PN	-	Park/Neutral Switch (Y=Yes, N=No)
PS	-	Power Steering Switch (Y=Yes, N=No)
AC	-	Air conditioner compressor request (Y=Yes, N=No)
TCC	-	Torque Converter Clutch (Y=Yes, N=No)
3RD	-	Third Gear Switch (Y=Yes, N=No)
4TH	-	Fourth Gear Switch (Y=Yes, N=No)
ESC#	-	Electronic Spark Control Counts (# of knock events)
BLM	-	Block Learn number
O2X#	-	O2 sensor cross counts (Delta)
RTD	-	Spark Retard in degrees
MAT or MAP	-	Manifold Air Temperature or Manifold Absolute Pressure (BOOST)
BATT	-	Battery Volts
EGR%	-	Exhaust Gas Recirculation percentage

7.7 Tutorial 7 - Exporting Captured Data

If you have completed Tutorials 1-5, there will already be captured data in the buffer awaiting review. In this tutorial, we will export the data to a file that can be viewed by other applications, such as Microsoft Works³, Microsoft Excel⁴, or Microsoft Word⁵. This ability is very useful when you wish to manipulate the data, chart certain parameters or paste the data into another format/file for sharing with other people.

TURBOLINK v2	Printer Utilities
1/15/96	10:23:27
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Current Settings:</p> <p>Print Range : Start Frame -50 Stop Frame 249</p> <p>Page Length : 60</p> <p>Printer Port : LPT1 @ 03BCH</p> <p>Condensed Print: Automatic</p> <p>Print Dest. : CSV file</p> </div> <div style="width: 35%; border: 1px solid black; padding: 5px;"> <p>Utility Options:</p> <ul style="list-style-type: none"> Printer Parameters Auto-Condensed Printing Printer Port Print Destination Begin Printing Buffer Return </div> </div>	
<div style="display: flex; justify-content: space-between;"> Copyright (C) 1994-96 TDS Technologies Release V2 </div>	
Use ↑; ↓	
Direct printer output to the printer or to a file	

To begin exporting the buffer captured in the previous tutorials, choose the "Print Utilities" Menu from the Main Screen.

Choose the CSV file option from the displayed requester. Now enter a file name (without the extension). An example would be "RUN1" and TurboLink™ will save the output to a file named "RUN1.CSV" in your working directory. This file can be imported into several popular spreadsheet applications.

³ Works is a product of Microsoft, Inc.

⁴ Excel is a product of Microsoft, Inc.

⁵ Word is a product of Microsoft, Inc.



Optionally, you can choose the "Normal file" option and the file will be saved in a text format that can be imported into your favorite word processor application as formatted text. A "Normal file" can be printed directly from MS DOS via the "print" command as shown here:

```
C:\TLINK:> PRINT RUN1.TLP<ENTER>
```

As an example, let's import the RUN1.CSV to a spreadsheet in Microsoft Works. RUN1.CSV was created in the above tutorial, so now we can enter:

```
C:\TLINK>WORKS RUN1.CSV <ENTER>
```

When Works asks you whether RUN1.CSV is a word processor file, a spreadsheet, or a database file, respond with "Spreadsheet" (by clicking the mouse or selecting with the cursor). Works will then open the file RUN1.CSV as a spreadsheet and will display the data as columns of numerical data. Adjust the column widths to about 6 and arrange the data in a manner convenient to analyze. You can also use the built-in graphing capabilities to graphically represent parts of the data.

Other spreadsheet applications such as Microsoft Excel, Lotus 1-2-3⁶, and Quattro Pro⁷ all will import the data files in a similar manner. You can also choose the "Normal file" output option and create a text file for importing into your favorite word processor application.

7.8 Tutorial 8 - ALDL Mode

The Assembly Line Diagnostic Link (ALDL) mode allows you to read different data from the ECM. This mode is sometimes referred to as the "Special State" or the "10K Ohm State" in some repair manuals. Fuel injected GM vehicles automatically raise the idle speed to 1000 RPM and add extra spark advance to the spark calculations when in this mode. The ALDL mode feature is primarily used to check the operation of the Electronic Spark Control (ESC).

It is not recommended that the vehicle be operated in ALDL Mode for extended periods!



In the ALDL Mode, the ECM disables some of its safety checks (to allow for problem diagnosis), so a WOT blast in the mode might result in damage to the engine. The ALDL Mode is safe to use, but the Road Mode should be used for most normal vehicle operations. The '84-85 cars do NOT have as much information presented in the data stream as the '86-87 cars. The only way to obtain additional parameters (such as Malfunction Codes) is to put the car in "ALDL mode", which is not recommended for continuous vehicle operation.

To enter the ALDL mode, perform the following steps:

1. From the main screen, choose "Set ECM Mode"
2. Choose "ALDL Mode".

This will command the car to enter ALDL mode. The graphical and numerical screens will both indicate the mode in status bar of ALDL (flashing).

⁶ Lotus 1-2-3 is a product of Lotus Corporation

⁷ Quattro Pro is a product of Borland International, Inc.

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8.0 ECM Information

8.1 3rd Gear Switch

When this parameter indicates "ON", the ECM is reporting that the transmission 3rd gear switch is enabled and the car should be in 3rd gear, if it is illuminated by itself. This indicator is also "ON" when the transmission is in fourth gear.

8.2 4th Gear Switch

When this parameter indicates "ON", the ECM is reporting that the transmission 4th gear switch is enabled and the car should be in 4th gear. The 3rd gear switch indicator will also be "ON" at this time.

8.3 Air Conditioner (A/C) Requested

This indicates the Air Conditioner compressor has been turned on if "YES" is displayed in this field. The ECM uses this switch to increase the idle speed to compensate for the extra drag of the A/C compressor. When the A/C is in operation, this field will fluctuate between "YES" and "NO" as the the compressor cycles on and off.

8.4 Air Divert Switch

This switch supplies air from the air pump to the Air Switch Solenoid when it is in the ON position. In the OFF position, the air is routed to atmosphere.

8.5 Air Switch Solenoid

When air is supplied from the Air Divert Switch (see above), this solenoid routes air to the exhaust ports in the ON position or to the catalytic converter in the OFF position.

8.6 Battery Volts

This field indicates the battery voltage as reported by the ECM. Normal values should be in the 12.9-14.1 volts range when the car is running. With the key on and engine off, 11.8-12.0 volts is normal. If you have a Volt Booster, you may see voltages in the high 14/low 15 volt range when the car is producing 10 psi or more of boost.

8.7 Block Learn Multiplier (BLM)

This number gives an indication of the engine's Air/Fuel ratio. This field indicates long term adjustments by ECM to injector on time. This number indicates a Block in the fuel delivery curve that the ECM uses based on several factors, including RPM and MAF. The BLM gives an indication of Air/Fuel ratio. The ECM uses a table of different BLMs depending on RPM and MAF. This field indicates the value the ECM is currently using.

A normal value for the BLM is 128, with the ECM adjusting it periodically to compensate for changes in engine load. The value can be in the range of 105 to 160. A BLM greater than 128 indicates the ECM is increasing the injector on time to compensate for a lean condition. A BLM less than 128 indicates the ECM is decreasing the injector on time to compensate for a rich condition. It is normal for this number to fluctuate around the 128 value, but a continually high or low BLM value can indicate problems with injectors, fuel pressure, obstructed fuel filter, EGR, or an aftermarket chip with an unusual fuel curve at idle.

8.8 Clear Flood

When this field is "ON", the injectors have been shut off and the accelerator pedal is held to the floor while the engine is cranking. This helps clear excessive fuel from the intake manifold.



8.9 Closed Loop Indicator

When this field is "OPEN", the ECM is in OPEN LOOP mode. This means that the engine is operating on a default set of values and the oxygen sensor is not being read for air/fuel calculations.

This mode is most commonly active as the car is warming up and has not reached operating temperature yet. The oxygen sensor must attain a temperature of at least 600 degrees before its readings can be used for air/fuel calculations. Sometimes the ECM can go to OPEN LOOP if a prolonged period of the engine idling occurs, since it can allow the oxygen sensor to cool off below its operating temperature.

When this field is "CLSD", the ECM is in CLOSED LOOP and all sensors are used for air/fuel calculations.

8.10 Coolant Temperature

This field indicates the coolant temperature as reported by the sensor located in the front of the intake manifold. Depending on your "Display Units" choice in the Preferences menu, it will be displayed in degrees Fahrenheit or degrees Celsius (CLTF or CLTC). The coolant temperature will affect many of the calculations that the ECM makes regarding timing advance, TCC lockup, idle speed, EGR and air/fuel ratio, so it is important to verify that this value is accurate. If it is not, you may have to replace your coolant sensor. Coolant temperature is dependent on your thermostat and the fan turn on temperature in your EPROM. A car with a 160 degree thermostat should remain very close to 160 degrees on a normal day. The temperature may climb to 170-180 degrees in traffic, but should drop back to close to 160 degrees with the car moving. The programmed fan temperature can also affect this.

8.11 ECM Mode

This field indicates the mode that ECM has been commanded to be in by TurboLink™. When the field indicates "NORMAL", the ECM is in Road Mode (normal driving mode) and all available data is displayed. When the field indicates "ALDL" the car is in the ALDL diagnostic mode that shows additional data in some cars. This mode should be used just to diagnose problems and should not be used for normal driving. If you see the mode change to "BACKUP", you may have a badly seated EPROM chip or a malfunctioning ECM, because TurboLink™ does not command those modes.

8.12 EGR Duty Cycle

This field indicates the duty cycle in percent of the EGR solenoid. This means that if the field indicated 75%, the EGR solenoid was active for 75% of the time. Normally the EGR valve will be in the range of 40%-80% at light throttle positions and cruise. EGR is 0% at WOT and idle.

The EGR valve and solenoid is located on the driver's side intake manifold and is used to reduce emissions by cooling the combustion charge and reducing nitrogen oxides. A malfunctioning EGR valve can cause part throttle "pinging", poor mileage, poor idle, and poor cold start performance.

8.13 Engine Speed

This field reports the engine speed in Revolutions Per Minute (RPM). The maximum value reported by the ECM is 6350 RPM.

8.14 ESC Counts

This field indicates how many times that the ESC has detected detonation. This is a running total of the time the signal from the ESC module is low (in milliseconds) divided by 256. The ECM may or may not decide to retard the timing based on what the ESC is reporting, which will explain frames where there are times when you'll see a few ESC counts, but no retard. The ECM decides if it should retard the timing based on the amount of time (per event) that the ESC has detected knock. You may have retard with a relatively low ESC count (due to all of the counts occurring during the same event), or a larger number of ESC counts with relatively little retard (a few degrees due to the ESC counts occurring over multiple knock events).

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8.15 Idle Air Control (IAC)

This field indicates the number of counts that the Idle Air Control (IAC) motor performs to maintain the idle speed requested by the ECM. This field is also shown as a percentage.

The IAC motor extends and retracts a small plunger in the throttle body several times a second to allow air to bypass the closed throttle plates at idle and maintain idle speed. This value may be in the range of 0% (no air bypass) to 100% (maximum air bypass) and the counts range from 0-255.

Normally, the IAC should be in the 20-25% range at idle.

8.16 Integrator

This field shows the ECM short term adjustments to the Air/Fuel mixture. Like the Block Learn Multiplier (BLM), this value is used to vary injector on time based on engine load and sensors.

A normal value for the Integrator is 128, with the ECM adjusting it periodically to compensate for changes in engine load. The value can be in the range of 0 to 255. An Integrator greater than 128 indicates the ECM is increasing the injector on time to compensate for a lean condition. An Integrator less than 128 indicates the ECM is decreasing the injector on time to compensate for a rich condition. It is normal for this number to fluctuate around the 128 value, but a continually high or low Integrator value can indicate problems with injectors, fuel pressure, obstructed fuel filter, EGR, or an aftermarket chip with an unusual fuel curve.

8.17 Knock Retard

This field indicates the degrees of spark retard that the Electronic Spark Control (ESC) module is administering to the spark curve to try to keep detonation (or knock) from occurring. The ESC uses the knock sensor (located at the rear of the engine block) to detect sound frequencies indicative of detonation and then retards the timing to try to eliminate the knock. It does this at a rate programmed into the EPROM chip, normally about 2-4 degrees per second.

After the ESC has retarded the spark until no knock is detected, the timing is added back in to restore performance. In racing applications, a small amount (2-5 degrees) of retard during a run is acceptable. More than 10 degrees of retard for more than one or two frames, and you should let off the throttle and correct the situation by reducing the amount of boost, using a fuel with more octane, or increasing the fuel pressure.

8.18 Learn Control

This field indicates that the ECM is in the Learn mode if "ON" is displayed. When this field is "ON", the BLM field can be updated by the ECM. This field is may frequently be "ON" when the engine is up to operating temperature and not in PE mode.

8.19 Load Filtered Variable

This field indicates a calculated scaled value that corresponds to engine load. LV8 is calculated from many factors and is used in determining engine operating parameters. The higher the number, the higher the load on the engine, and the lower the number, the lower the load on the engine.

It is calculated by $(\text{air flow}/\text{engine speed}) * K$ where K is a constant. The LV8 should max out at 255 on a WOT run in a good running turbo Regal running 17-18 psi of boost (or more).

8.20 Manifold Absolute Pressure

This field indicates the vacuum (in inches of Mercury (IN/HG)) or boost (pounds/in² (psi)).

This requires the optional boost sensing kit and a 3 BAR MAP sensor for this field to be valid for TURBO REGALS.

If the boost sensing kit is not present, this field will read Manifold Air Temperature (see below). Be sure to choose this in the "PREFERENCES" menu.



8.21 Manifold Air Temperature

This field shows the intake air temperature in Celsius or Fahrenheit degrees, depending on Display Units choice in Preferences (MATF or MATC). This sensor is mounted at the beginning of the MAF intake hose. The MAT reading will be fairly close to the outside air temperature. If there is a significant amount of underhood heated air being introduced, the temperature may rise 10-20 degrees above the outside air temperature. It is not uncommon for the MAT to **DROP** during an extended WOT blast, due to the demand for outside air from the engine. Be sure to choose this in the "PREFERENCES" menu.

8.22 Mass Air Flow

This field is determined from the Mass Air Flow (MAF) Sensor input to the ECM and is reported in grams/second. The MAF is located in the inlet hose close to the radiator. Normally this value will be 4-7 gms/sec at idle and will approach 255 gms/sec at WOT. Even with the car off and key on, this value will show 2-4 gms/sec. The WOT value will vary depending on state of tune, how much boost and air density. Normally a 12 second car will show 255 gms/sec at WOT with 19-20 psi of boost. The actual air flow is greater than that shown, because the MAF value is factored.

8.23 Mixture Status

This field indicates either "Rich" or "Lean", depending on O2 voltage. Voltage above 0.441 is considered "Rich" and voltage below 0.441 volts is considered "Lean". The car will fluctuate centered around this 0.441 volts point, as the ECM continuously adjusts the mixture.

8.24 O2 Delta Cross Counts

This field indicates how many times per second that the O2 Sensor voltage swings above or below stoichiometric (14.7:1) Air/Fuel ratio. An active sensor (a change of 15-40 counts per frame) indicates a healthy sensor.

This number indicates the **CHANGE (or DELTA)** of counts since the previous frame (not total counts).

8.25 O2 Voltage

This field shows the oxygen sensor voltage in millivolts. The oxygen sensor is used by the ECM to measure the amount of oxygen in the exhaust stream and to adjust the Air/Fuel mixture. A tight, leak free header system and uncontaminated oxygen sensor are critical for the ECM to correctly adjust the Air/Fuel mixture. An O2 voltage of 441 millivolts indicates a stoichiometric mixture.

The oxygen sensor will never show exactly 441 millivolts for more than a second or so when it is fully warmed up, because it is constantly adjusting the Air/Fuel ratio.

8.26 Park/Neutral (P/N) Switch

This field indicates that the gear selector is in either Park or Neutral if it shows "ON".

8.27 Power Steering (P/S) Switch

This field indicates that the Power Steering pump is demanding more power from the engine to maintain pressure under load. This causes the ECM to increase the idle speed to compensate for the load. This switch is very rarely "ON" and is only activated upon sudden steering wheel input at very low speeds (such as parking).

8.28 PROM ID

This field is located at the top left corner of the screen and indicates the EPROM's number as a Hexadecimal number. This can be useful to identify different chips being used. Some chip makers will use this field to send other data (injector pulse width, e.g.), but TurboLink™ expects this to be PROM ID.

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8.29 Road Speed

This field indicates the vehicle's speed in either miles per hour (MPH) or kilometers per hour (KPH), depending on your Display Units choice in the Preferences menu.

8.30 TCC/Shift

ON MANUAL TRANSMISSION VEHICLES: This indicates that the ECM has lit the SHIFT light suggesting a higher gear for better economy. ON AUTOMATIC TRANSMISSION VEHICLES: See below.

8.31 TCC Solenoid

This field indicates that the Torque Converter Clutch (TCC) is locked up when it displays "ON". This field only shows when the ECM requests TCC lockup and will not show when the TCC is locked up via a user installed switch. The TCC lockup is controlled by the EPROM (chip).

8.32 TPS Voltage

This field displays the voltage returned by the Throttle Position Sensor (TPS) in volts. The TPS volts are always in the range of 0-5 volts. The TPS should be adjusted to read 0.42-0.48 volts at idle and 4.55-4.85 at Wide Open Throttle (WOT) with the key on, engine not running. A value of greater than 4.55 is recommended.

Values of greater than 4.85 are not recommended and can cause the ECM to issue a Malfunction Code if the throttle is held at those values for a significant amount of time.

9.0 Additional TurboLink™ Support and Resources

If you have access to the Internet (via direct connection, an Internet service provider, America On-Line, CompuServe, etc.) there are several services and forums available to you. There is an electronic mailing list dedicated to turbo Buick performance that can be subscribed to by sending mail to:

gnttype-request@gnttype.org

For information on the list or for help in subscribing to the list, contact us at:

gnttype-info@gnttype.org

The World Wide Web address for the Turbo Regal Home Page is:

<http://www.gnttype.org>

TurboLink™ related questions, problems, suggestions and orders can be sent to:

kenmosher@turbo-link.com

The World Wide Web address for TurboLink™ is:

<http://www.turbo-link.com>

Visit this site often to obtain product announcements, service bulletins, current news, tricks and tips, and upgrades.

My personal World Wide Web address is:

<http://members.home.com/kenmosher>

Be sure to read the **tips_and_tricks** for latest information regarding the operation of TurboLink™.

APPENDIX A

Connecting the OPTIONAL Boost Sensing Hardware

The following describes how to connect your optional BST-001 Boost Sensing Hardware kit to your car so that TurboLink™ will display and record boost/vacuum. When you unpack the kit, you should make sure that you familiarize yourself with the harness and the kit contents.

Inventory of package contents:

Vacuum Tee	(Supplied)
Vacuum Hose	(Supplied)
Boost Sensing Harness	(Supplied)
3 BAR MAP Sensor	(NOT Supplied ... purchase from GM/AC Delco, part number 16040749)

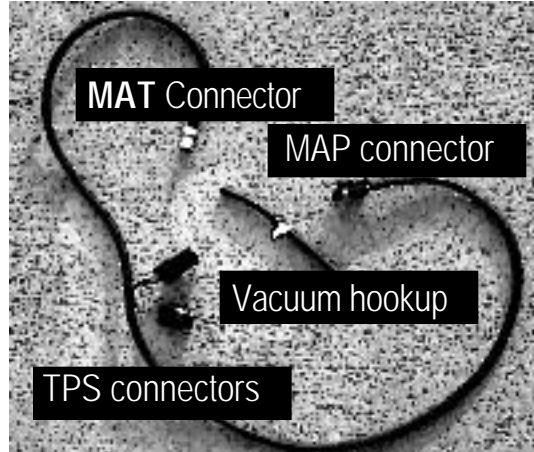


Figure 1 - BST-001 Harness

**** Be careful with the harness... there are electronics embedded in some of the connectors. Don't bang it around or subject it to static electricity! ****

Step 1:

Locate the Manifold Air Temperature (MAT) sensor (Figure 1). This sensor is located towards the front driver's side of the car in the air cleaner tube (or screwed into the air filter base for most aftermarket cold air induction packages.)

1. Disconnect the wire to the MAT sensor
2. Plug the 2 wire BST-001 MAT sensor connector (see Figure 2) into the ECM connector. The MAT sensor will not be connected any more.

This will not affect vehicle operation, since the Turbo Regals use the MAT only for minor adjustments to the MAF tables in extreme temperatures. The Preferences option allows you to choose either MAP or MAT readings, which you control by plugging/unplugging the BST-001

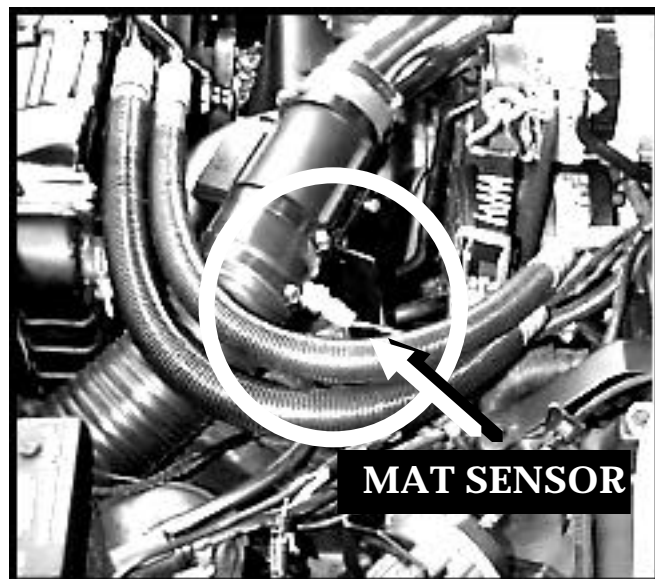


Figure 2- MAT Sensor Location

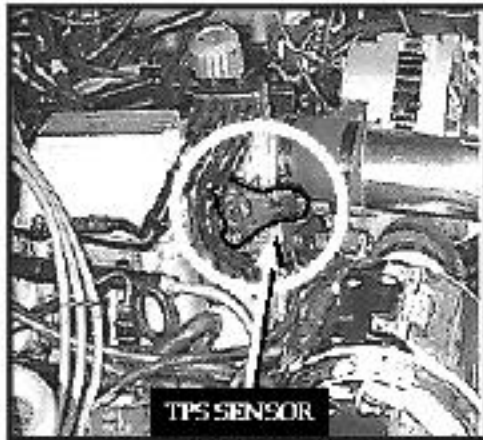


Figure 3 - TPS Sensor Location

Step 2:

Next locate the TPS sensor (**Figure 3**). This is the three wire sensor on the passenger's side of the throttle body.

1. Route the boost sensing harness in a manner that doesn't interfere with the alternator or other engine components over to the TPS.
2. Unplug the TPS connector and plug BST-001 male 3 wire plug into the TPS.
3. Plug the car's TPS harness connector into the BST-001 female 3 wire plug.

Step 3:

Now route the harness over to the passenger side fender well and locate the existing MAP sensor (on analog dash cars) or the boost switches (on digital dash cars)

(**Figure 4**).

The the MAP sensor has a 3 wire connector that plugs into it and a vacuum line (*analog dash cars*). The boost switch is a round device with a single wire and a vacuum line going to it (*digital dash cars*).

1. Use the supplied vacuum "Tee" and hose to "Tee" the vacuum line from the existing MAP (*analog dash cars*) or boost switch (*digital dash cars*) into your new 3 BAR MAP (*not supplied*).
2. Plug the 3 wire harness connector from the BST-001 boost sensing harness into your 3 BAR MAP sensor (*not supplied*).
3. Check all connections to ensure they are clean and tight. Ensure that all wires are routed in such a manner that they do not interfere with other components.

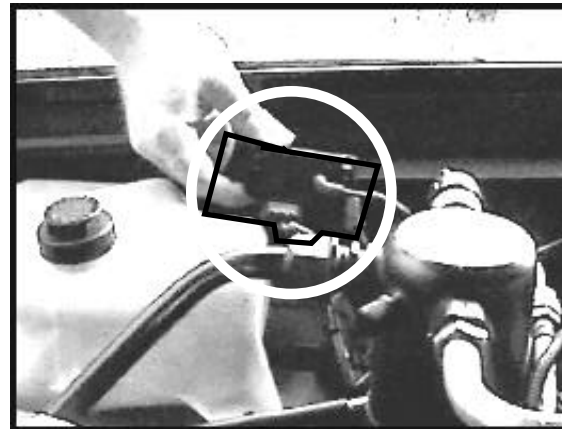


Figure 4 - Installing the 3 BAR MAP



APPENDIX B

Calibrating the OPTIONAL Boost Sensing Hardware

To use your newly installed boost sensing feature, you must first go to the Preferences option from the main screen in TurboLink.

1. Choose the option labeled “**MAT/MAP Option**”.
2. A requester box will appear asking you to choose either **MAT** (if you wish to read Manifold Air Temperature and you have disconnected the boost sensing harness from the MAT and reconnected the MAT) **OR** **MAP/Boost** (if you wish to read boost using the option boost sensing harness).
3. Highlight your selection by using the up/down arrow keys and hitting <Enter> when you are sure of your choice.
4. Notice that the left side of the screen now indicates your choice in the “Current Settings:” area in the MAT/MAP Sensing field.
5. Connect to the car as described in the Tutorials.
6. BEFORE starting the car, it is advised to calibrate the MAP sensor by turning the KEY ON (engine off) and then choosing the Realtime Display option to connect to the car.
7. Once TurboLink™ establishes connection to the car, hit the **F5 key** to zero the boost gauge on the display. A message indicating success of the calibration command will be displayed momentarily.

Periodically you should repeat this procedure as temperature and barometric changes may affect the readings by as much as 1 psi. If you see the gauge (or number) not reading zero with the **KEY ON/ENGINE OFF** at anytime, it indicates that recalibration is necessary. Simply hit the F5 key when in the RealTime Display mode with the KEY ON and the ENGINE OFF and TurboLink™ will recalibrate and save the sensor information.

TurboLink™ will “remember” this calibration on all saved runs so that later review is accurate. Also, note that occasionally at the end of a run you may see TurboLink report a slight “spike” in the boost reading just as you get off the throttle. This is due to the fact that the throttle has closed and there is a slight spike in the boost that is hard to catch on a boost gauge.

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Appendix C**TurboLink™ Registration Card**

To receive product upgrade notices, new product notices, and to receive technical assistance in the use of TurboLink™, please take a moment to fill out and mail the Registration Card below. Just fill out the registration information, and mail it or fax it. The address and fax number are at the bottom of this page.

**TurboLink™ Version: V2.13****Name:** _____**Street:** _____**City:** _____ **State:** _____**Zip Code:** _____ **Phone:** _____**Email Address:** _____**Computer(s) TurboLink™ is used on:** _____**Comments/Suggestions?** _____

Car(s) owned: _____

TDS Technologies c/o Ken Mosher 3368 Tammy Street Omaha, NE 68123
 (402) 292-6707 voice (402) 291-9012 fax Internet: kenmosher@turbo-link.com http://www.turbo-link.com

Software License Agreement

TDS Technologies reserves the right to make modifications or improvements to TurboLink™ at any time and without notice. This is a legal agreement between you and TDS Technologies, covering your use of your TurboLink™ hardware, software and documentation (hereafter referred to as "TurboLink™"). Be sure to read the following agreement before using TurboLink™.

BY USING TURBOLINK™ (REGARDLESS IF YOU HAVE REGISTERED TURBOLINK™ OR NOT), YOU ARE AGREEING TO BE BOUND BY THE TERMS OF THIS AGREEMENT. IF YOU DO NOT AGREE TO THE TERMS OF THIS AGREEMENT, DO NOT USE TurboLink™ AND DESTROY ALL COPIES IN YOUR POSSESSION.

TurboLink™ is owned by TDS Technologies and is protected by United States copyright laws and international treaty provisions. Therefore, you must treat TurboLink™ like any other copyrighted material (e.g., a book or musical recording). Paying the license fee allows you the right to use one copy of TurboLink™ on computers your PERSONALLY own. You may not rent or lease TurboLink™, nor may you modify, adapt, translate, reverse engineer, decompile, or disassemble TurboLink™ software or hardware. If you violate any part of this agreement, your right to use this software terminates automatically and you must then destroy all copies of TurboLink™ in your possession.

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