

THE SCANGAUGE

by *Linear***Logic**

INSTALLATION AND OPERATION



www.scangauge.com

www.linear-logic.com

WARNING

Use of the ScanGauge while driving could lead to an accident and serious injuries. The primary attention of the driver should always be on safe driving. As with any gauge or other instrumentation system in a motor vehicle, the information should be observed as part of a normal sequence of observations performed in the operation of the vehicle. Changes to the selections in the ScanGauge should only be made when it is safe to do so. **The driver must remain attentive to driving the vehicle.**

The mounting of the ScanGauge and the routing of the cable connecting it to the vehicle should be done with suitable caution that it does not create an unsafe condition. This includes but is not limited to the following:

- Don't mount the ScanGauge where it can obstruct the view of the driver.
- Don't mount the ScanGauge in a manner which could cause it to be propelled through the vehicle during an accident causing injury, such as over or near an air-bag.
- Don't route the cable in a manner which would interfere with the operation of the vehicle controls.

RIGHTS AND OBLIGATIONS

The ScanGauge may be used on any number of vehicles. The software contained in the ScanGauge is copyright protected by Linear-Logic and may not be transferred or disassembled and used in another product, in part or in whole. The artwork used in generation of the circuitry is also copyright protected and cannot be used in part or whole by any person or entity without the express written permission of Linear-Logic.

©2004-2005 Linear-Logic. All rights reserved.

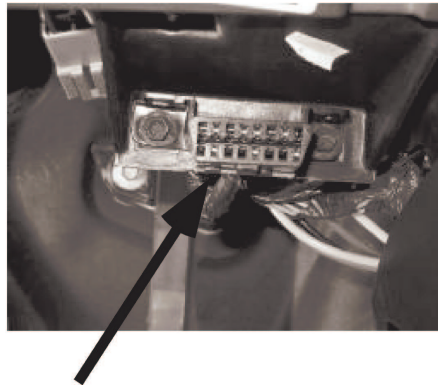
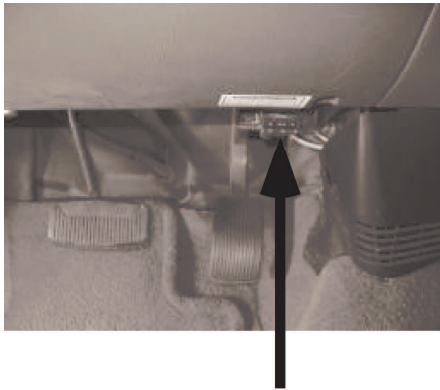
Version 2.51

Information in this manual and the specifications and operation of the ScanGauge itself are subject to change without notice.

INSTALLATION

NOTE: If this is a temporary use of the ScanGauge in the vehicle, there is no need to perform vehicle displacement setup unless fuel economy or fuel consumption will be measured.

- 1) **Locate the OBD Connector.** This connector is normally located under the dash on either side of the steering column. It can also be located under the dash on the passenger side in some vehicles. On rare occasions it is behind the ashtray in the dash or in the armrest. It may have a cover on it which can be pulled off by hand.



Typical OBD2 Connector Location OBD2 Plug

- 2) **Locate a place for the ScanGauge.** **IMPORTANT: Don't place it on an airbag cover or where it will be propelled by a deploying airbag.** The location should be where it can easily be seen from the normal driving position. It should not be placed where it will obstruct the drivers view outside the vehicle or of other gauges.



Typical below Dash Installation



Typical above Dash Installation

- 3) **Turn the vehicle on.** If it can be run, start it. If it can't be run, turn the key to the "run" position. This is the position it is normally in when the vehicle is being driven.
- 4) **Plug the ScanGauge Plug into the OBD2 socket.** The ScanGauge derives all it needs to power and operate itself from the OBD2 connector. No other connections are needed for its operation. Wait for the ScanGauge to Connect.

NOTE: If it does not connect after 60 seconds, refer to "TROUBLESHOOTING" on page 24.

- 5) **Perform Vehicle Setup if this is the first time it has been used on this vehicle.** The various settings can be reached via `MORE>SETUP` and choosing the different setup options to select the units of measure, engine size, fuel type and fuel tank size. The information can be changed and saved again as often as needed.

When the ScanGauge is first connected, it attempts to communicate with the vehicle. Communications can be established with the key in the run position, even if the engine is not actually running. It could take up to 60 seconds for the connection to be made after the unit is plugged in and the key in the run position.

While establishing communications, the first line on the display shows:

```
Connecting...
<TRIP      MORE>
```

The `TRIP` and `MORE` buttons can be used even if a connection is not established. If the key is off, the ScanGauge will stay in this screen and continue attempting to communicate with the vehicle computer. It will not go to sleep mode until communications has been established.

When communications has been established, the display will change over to :

```
<SCAN      GAUGE>
<TRIP      MORE>
```

OPERATION

The ScanGauge is easy to hook up to a vehicle equipped with an OBD2 connector. It is also very easy to use. The operation is menu driven and does not require memorizing sequences of button presses to use. After each button is pressed, new selections will appear in the display prompting you for what can be done next. The HOME button will take you back to the starting point at any time.

MENU DRIVEN SELECTIONS

There is a button located at each corner of the display. When a ‘<’ or ‘>’ is displayed next to the button, pressing the button will do what is shown in the display next to it. For instance the HOME screen shows the following:

```
<SCAN          GAUGE>
<TRIP         MORE>
```

Pressing the button at the upper-left corner will bring up selections for scanning the vehicle’s computer for trouble codes and other information. Pressing the upper-right button will bring up Gauges showing the current information for the vehicle, such as Speed, RPM, fuel economy, etc.. Pressing the lower-left button shows trip information and the lower right button brings up more types of selections.

Sometimes there is no ‘<’ or ‘>’ next to the button. In most of these cases, this is information like in the following display:

```
P0321          CLEAR>
<PREVIOUS     NEXT>
```

The P0321 is a trouble code, pressing the upper left button will not perform any function. The other buttons perform the functions shown next to them.

Some screens are strictly for information, such as the following:

```
Codes Cleared
--Ready--
```

This screen will be shown if the vehicle responds that all codes have been cleared following a button press telling it to clear them. This screen is exited by pressing the HOME button, returning you to the starting screen.

AUTOMATIC SLEEP MODE

About 15 seconds after turning off the vehicle or pressing a button after the vehicle engine is turned off, the ScanGauge will automatically power down into a sleep mode. The display will go blank and the backlighting will turn off if it was on. Starting the engine or pressing the HOME button will automatically restart the ScanGauge and it will return to the screen and lamp settings it had just before it went to sleep.

AUTOMATIC MODE RECOGNITION

Different vehicles use different types of signaling from their computers. The ScanGauge can quickly determine which type your vehicle is using. You don't have to know which type it is for it to be used.

AUTOMATIC REPEAT BUTTONS

Pressing the buttons and holding them for more than a second will cause them to automatically repeat at a rate of about 2 times a second. This allows for rapid stepping to a value without a lot of button pressing.

USER PROGRAMMABLE COMMANDS

Up to 10 commands can be generated, edited, saved and sent to the vehicle computer. This allows for future codes and some special commands to be added by the user.

FLASH MEMORY

The ScanGauge uses a type of memory which doesn't require batteries or a source of power to maintain. This means that your settings will not be lost if you disconnect the vehicle battery or disconnect the ScanGauge.

The actual saving of the current settings occurs whenever the unit goes to sleep or when the `SAVE` or `DONE` selections are made.

HOME

When the ScanGauge is running, pressing the HOME button will bring up the following HOME screen:

<SCAN	GAUGE>
<TRIP	MORE>

If the ScanGauge is asleep, pressing the HOME button will cause it to wake up to the screen it was using when it went to sleep. Pressing the HOME button again will take it back to the HOME screen. The following button sequences assume a start from HOME.

GAUGE

Pressing the button next to GAUGE causes the display to change to show the currently selected gauges. They are automatically updated. The following screen shows a typical gauge display:

710RPM	28MPH
15.2MPG	50FWT

This is a special case display. Even though there are no '<' or '>' next to the displayed gauges, pressing the button next to one of the gauges will cause it to change to different gauges. For instance, pressing the upper left button causes the display to change to:

10TPS	28MPH
15.2MPG	50FWT

The upper left display has changed from reading the RPM to reading how much the throttle is being pressed. Pressing the button again will change the display to the next available gauge. The selection will continue through all of the possible gauges and then loop back to the starting gauge.

The information available will vary from vehicle to vehicle. If the information is not available for a certain gauge, no data will be shown for it. If the same gauge is selected for more than one position, only one of them will show data (if it is available). The other positions will show the abbreviation, but no data.

GAUGE ABBREVIATIONS

The following table shows what the gauge names mean. In some cases, the unit selection will determine the gauge abbreviation.

CLSD LP OPEN LP	Fuel system loop status	This indicates when the oxygen sensor is being used to control the mixture (closed-loop) and when it is not (open-loop). It is usually closed except when the engine is cold or under full throttle acceleration.
FIA CIA	Intake-Air-Temperature	Temperature of the air going into the engine. At highway speeds, this will typically be a few degrees higher than the outside air temperature. At idle or low speed, it may be much higher in temperature than the outside temperature due to the low air-flow into the engine and the high under-hood temperatures warming it up.
FWT CWT	Water Temperature	Water/Coolant temperature. A vehicle with a 50/50 mix of coolant and water will not boil over until about 265 degrees F at sea level. This will be reduced at higher elevations.
FPR	Fuel-Pressure	This is the fuel pressure from the fuel pump. Very few vehicles report this.
GPH LPH	Gallons-per-Hour Liters-per-Hour	Fuel consumption rate in the selected units. This is sensitive to throttle, gear and loading changes.
IGN	Ignition timing	Shows the amount of timing advance (or retard). The more advance there is (or less retard), the better for fuel economy and power. The limit is set by the octane of the fuel, the intake air temperature, and the load on the engine. A lower than normal amount of advance for similar temperature and speed could indicate too low an octane of fuel is being used.
LOD	Engine Loading	This is a percentage of the maximum power available currently being generated. In some vehicles it is the maximum available at the present RPM.

MPG KPG MPL KPL	Miles-per-Gallon Kilometers-per-Gallon Miles-per-Liter Kilometers-per-Liter	Fuel economy in the units selected. This is updated about every 2 seconds (Normal Rate). This means that the fuel economy is for the previous 2 second period. Small changes in throttle position or load will show almost immediate changes in fuel-economy.
MPH KPH	Miles-per-hour Kilometers-per-Hour	Speed in the units selected.
MAP	Manifold-Absolute-Pressure	This indicates the pressure in the intake manifold. It is reported in pounds-per-square-inch (PSI) by default but can be changed to kilo-pascals (KPA) if desired. At sea level, the pressure at wide open throttle can be as high as 15 PSI or 10kPA. If the engine is turbocharged or supercharged, the pressure can be higher than this.
RPM	Revolutions-per-Minute	The RPM of the engine.
TPS	Throttle-Position-Setting	In some vehicles, a closed throttle will read 0 and full throttle will read 100. Other vehicles will have a higher value than 0 for a closed throttle and an open throttle value less than 100.
VLT	Battery Voltage	Normal running battery voltage is between 13 and 15. When the engine is off it should be between 11 and 13. Voltages higher than 15 volts can damage batteries and electrical components. Voltages below 13 when the vehicle is running could indicate poor charging of the battery. Voltage below 11 when the engine is off could indicate a low battery charge or a shorted battery cell.

SCAN

An example screen where no codes were found would be:

No Codes Found
--Ready--

"--Ready--" indicates all tests have been completed since the last reset. This is needed in some states to indicate a valid OBD test. If "--Not Ready--" is displayed, the vehicle hasn't completed some test cycles. It could take up to several days after codes are cleared for the vehicle to be "--Ready--".

If there are any stored Diagnostic Trouble Codes (DTCs), the number will be displayed. An example screen for 2 stored codes would be:

```
  2 Stored Codes  
<CODES      FRZD>
```

This selection can only be reached if there is at least one trouble code. Pressing the button next to `FRZD` will show the data for each of the Parameter Identifications Descriptors (PIDs) if data was captured when the trouble occurred. The screen will allow you to step through the PID numbers using the lower left and right buttons and see the available data. Gauge values will be shown in the top line for those PIDs which directly correspond to a gauge. The values in the second line are in hexadecimal just as they are reported by the vehicle computer. You can exit this mode using the `HOME` button.

NOTE: Reading the Freeze Data does not clear it. This is done when the DTCs are cleared.

Selecting `CODES` will make the display show the trouble code. For example:

```
P0440      CLEAR>  
<PREVIOUS  NEXT>
```

This example shows a trouble code of `P0440`. Since there were 2 stored trouble codes in this example, pressing `NEXT` will show the other trouble code.

```
P0450      CLEAR>  
<PREVIOUS  NEXT>
```

Pressing `NEXT` again will not change the display because we are at the last trouble code. Pressing `PREVIOUS` will return the display to show the earlier trouble codes.

```
P0440      CLEAR>  
<PREVIOUS  NEXT>
```


Pressing the `CLEAR` button will result in a prompt from the ScanGauge to verify that you want to clear the trouble code(s) and turn off the “Check Engine” lamp.



CLEAR CODES ???
<YES NO>

If you want to continue to clear the trouble codes, press YES. If you decide not to clear the trouble codes, press NO.

When the YES button is pressed, the ScanGauge will send out a signal to clear all of the trouble codes. If it is successful, the display will show:



Codes Cleared

This should also turn off the “Check Engine” light on the dashboard and clear the freeze data.

DECODING DTCs

The DTCs vary from vehicle to vehicle and you will need to find the definitions for your vehicle.

An excellent way to do this is to use a good search engine on the internet. Use “Trouble Codes” as the search words. You can add your make of vehicle to narrow the search. Adding the actual DTC to the search could bring up a lot of information on the problem if it is a common failure.

A good web site to try is: <http://www.troublecodes.net/> .

Another way to find the trouble code meaning and also information on what might be causing the problem is to do a search on the trouble code and the type of vehicle. For instance searching for P0440 Ford will return not only the code definition, but also information on the cause and cure.

When you find a list of codes for your vehicle, it would be a good idea to print them out and keep them in the glove box for future reference. It is comforting when you are on a trip and the “Check Engine” light comes on to be able to read the code and determine if it is a critical problem or not.

The shop manuals for your vehicle will also contain the information for the trouble codes.

TRIP

The trip button allows information about the current trip, all trips for today and all trips for a previous day to be obtained or monitored. Also, information about fuel, distance and time since the last fill-up and remaining fuel, distance and time on the current tank of fuel is tracked and displayed. The following information can be displayed:

- Maximum Speed
- Maximum Coolant Temperature
- Maximum Engine RPM
- Average Speed
- Average Fuel Economy
- Trip Miles
- Trip Elapsed Time
- Trip Fuel Used
- Fuel Used Since last Fill-up
- Fuel Remaining
- Distance Driven Since last Fill-up
- Distance Remaining before tank is empty
- Time Driven Since last Fill-up
- Time Remaining before tank is empty

The following display is a typical trip display. Pressing the upper right or left button will allow you to change the displayed information for the trip/tank



< 15.3 MPG >
<CURRENT RESET>

For instance, pressing the upper right button will select the amount of fuel consumed on the trip. The following display is typical of the resulting output. The Current trip can be reset manually at any time by pressing **RESET**. It will also be automatically reset after about 3 minutes with the engine off.

```
< 5.2 GALLONS >
<CURRENT RESET>
```

Pressing the **RESET** button will reset all of the current trip data. The following display would be seen:

```
< 0.0 GALLONS >
<CURRENT RESET>
```

Pressing the **CURRENT** button will change to a different trip. This is shown in the following screen:

```
< 5.2 GALLONS >
<TODAY * >
```

Notice that there is no **RESET** for **TODAY**. The **TODAY** trip will automatically reset after the engine has been off for 8 to 10 hours (as when sitting overnight). The values for **TODAY** will be transferred to the **PREVIOUS DAY** and the values which were in **PREVIOUS DAY** are thrown out.

The asterisk (*) in the lower right corner indicates that the ScanGauge was disconnected for at least part of the day and the data may not be complete. This will be transferred to the **PREVIOUS DAY** along with the data.

NOTE: If the vehicle is driven early in the morning and then not again until late that evening, the data will be transferred to the previous day. If the vehicle is driven until late at night and then used again very early in the morning, the data will stay in the **TODAY** trip. The end of **TODAY** requires the vehicle be off, the ScanGauge connected and the vehicle not driven for 8 to 10 hours.

Pressing the **TODAY** button again will change the display to the **PREVIOUS DAY**:

```
< 10.4 GALLONS >
<PREVIOUS DAY
```

Pressing the PREVIOUS DAY will change the display to the TANK trip display.

The TANK selection can tell you much about the current tank of fuel. For instance, the following display tells you that if your mileage remains the same as it has since the last fill-up, you will run out of fuel in 92.7 Miles.

```
< 92.7 MILES >  
<TANK TO EMPTY
```

In order for the TANK information to be useful, you must use set the size of the fuel tank using MORE>SETUP>FUEL>TANK SIZE. When you fill-up, you must use HOME>MORE>FILLUP to indicate the vehicle tank has been refilled. It is also necessary to fill the tank to make the TO EMPTY information correct.

The estimate of distance and time to empty is based on the economy that has been obtained so far on this tank of fuel. Right after refueling, these values will change fairly quickly. As more of the fuel has been burned from the tank the readings will stabilize.

It is possible to see the distance and time to empty increase as you drive. The distance can increase as you drive at a steady fuel efficient speed. This causes the fuel economy for the tank to rise and applying this higher fuel efficiency to the fuel remaining in the tank can actually result in more remaining distance. If you drive slower than the average speed of the tank so far, the time to empty can increase.

You should refill the vehicle when there is above 50 miles/km remaining. Pushing below 50 could result in running out of fuel.

Pressing the lower left button again will return the selection to the CURRENT trip. Continuing to press it will cycle the trips from one to the next. TANK shows different types of information in some cases from the other trips. TANK substitutes TO EMPTY data in place of MAXIMUM data.

MORE

Pressing MORE from the HOME display will bring up the following display:

```
<DISPLAY FILLUP>  
<SETUP      MORE>
```

MORE > DISPLAY

This selection leads to buttons choices which will allow the display contrast and backlighting to be changed.

```
<BACKLIGHT  
<CONTRAST
```

MORE > DISPLAY > CONTRAST

```
<  CONTRAST  >
```

Pressing the upper left button will decrease the contrast. Pressing the upper right button will increase the contrast. The contrast should be set to just below where the empty spaces don't show as a solid box. The button can be held down and the contrast will slowly change.

NOTE: Changing contrast significantly could require holding the button down for up to a minute.

The ScanGauge has a temperature compensation circuit which keeps the contrast from varying too much over its operating temperature range of 0°F to +160°F (-18°C to 71°C). At higher temperatures, the display will become dark and difficult to read. At lower temperatures, the contrast will be reduced and the characters will change more slowly. As long as the temperature doesn't exceed -22°F to 176°F (-30°C to +80°C), the display will return to normal operation when the ScanGauge temperature returns to the normal operating temperature range.

NOTE: A location in direct sunlight on the dashboard in a closed vehicle could exceed the normal operating temperature. The use of windshield shades or covering the ScanGauge with a piece of paper can significantly reduce this temperature.

NOTE: It is possible that the contrast can be adjusted so low that the display cannot be seen, or so high that it will appear as solid boxes. If nothing is visible, use the following sequence:

- 1) Press and release the Home button twice
- 2) Press and release the lower right button
- 3) Press and release the upper left button
- 4) Press and release the lower left button
- 5) Press and hold the upper right button until the display can be seen. It may be necessary to hold the button down for a full minute before the display is visible.

If only solid boxes are visible, use the following sequence:

- 1) Press and release the Home button twice
- 2) Press and release the lower right button
- 3) Press and release the upper left button
- 4) Press and release the lower left button
- 5) Press and hold the upper left button until the display can be seen. It may be necessary to hold the button down for a full minute before the solid boxes disappear and the display is readable.

MORE > DISPLAY > BACKLIGHT

This selection allows you to set the backlight level.



Pressing the button for one of these will cause the lamp intensity to be changed. The display will not change. The lamp intensity can be changed again by pressing another selection. Once the desired level is set, this mode must be exited by pressing the HOME button. The ScanGauge uses high intensity solid-state LEDs for back lighting. Since there are no filaments to wear out, it should never be necessary to replace a lamp, regardless of how long they are used.

MORE > SETUP

This selection allows you to set the ScanGauge up for a particular vehicle.

<ENGINE	UNITS>
<SPEED	FUEL>

MORE > SETUP > UNITS

Selecting UNITS will result in the following display:

<MILES	GALLONS>
< F	PSI >

This screen allows the units used and displayed to be changed. Pressing the MILES button will change the display to:

<KM	GALLONS>
<F	PSI >

This means that all gauges which use distance will use the units of kilometers instead of miles. Pressing it again will change it back to MILES.

Pressing the GALLONS button will cause it to change to LITERS.

Pressing the F (Fahrenheit) button will cause it to change to C (Centigrade).

Pressing the PSI (pounds-per-square-inch) button will cause it to change to KPA (kilo-pascals).

Pressing the HOME button will exit this screen with the units set to those indicated when the HOME button was pressed.

MORE > SETUP > ENGINE

The ScanGauge can be used on any number of different vehicles. On some vehicles, the fuel economy will be more accurate if the engine displacement is set for it. When a value is saved, it will be retained even if the ScanGauge is unplugged or the vehicle battery is disconnected. The setting can be changed at any time. If SAVE is not used, the entered value will be lost when the ScanGauge is disconnected. This may be the desired operation if the vehicle is not to have the ScanGauge regularly used on it.

```
< 3.0 LITERS >
SIZE          SAVE>
```

MORE > SETUP > FUEL

This selection leads to a screen that allows you to set the type of fuel used by the vehicle and the capacity of the fuel tank.

```
<TYPE
<TANK SIZE
```

MORE > SETUP > FUEL > TYPE

This screen allows fuel consumption to be more accurately computed for different types of fuels. The selections are GAS, DIESEL_a, DIESEL_b, HYBRID and LPG (Propane).

```
< GAS >
Fuel Type  SAVE>
```

The upper 2 buttons can be used to step to the type of fuel used in the vehicle. Pressing HOME will exit the screen and use the fuel selected until the ScanGauge is disconnected. Pressing SAVE will place the selection into Flash memory and use the selection until it is changed.

DIESEL_a and DIESEL_b do not refer to different types of diesel fuel. They only affect the way fuel consumption is computed and are selected based on the way the vehicle computer reports its sensor information. Most diesel vehicles use the DIESEL_a setting. To determine which your diesel vehicle uses, do the following:

With ENGINE SIZE set, DIESEL_a chosen for fuel, the engine warmed up to operating temperature and idling in neutral or park, select GAUGE and make one of the gauges show RPM and another show GPH. Note the GPH value. Next, use the throttle to raise the engine RPM to about 1500 RPM. If the GPH reading increased, you have a DIESEL_a vehicle. If the GPH dropped or stayed the same, you have a DIESEL_b vehicle and should change the Fuel Type to DIESEL_b.

MORE > SETUP > FUEL > TANK SIZE

This selection is used to tell the ScanGauge how much fuel can be held in the fuel tank. This information is available in the owners manual of the vehicle.

```
< 25 GALLONS >
Tank Size SAVE >
```

The upper buttons can be used to adjust the value to match that of the vehicle. The size will use GALLONS or LITERS depending on the selection you made in the UNITS screen. If the size in the manual is not in whole units, use the next lower value. For instance, if the capacity is 17.5 Gallons, use 17 Gallons. It is better indicate less fuel remaining, than really is.

NOTE: It is dangerous to run a vehicle out of fuel and can damage the fuel pump. Do not rely on the fuel gauge or ScanGauge at low fuel levels or low remaining distance or time.

MORE > SETUP > SPEED

Both speed and distance can be adjusted to compensate for changes in tire size, gears, tire wear, etc..

The setting can be changed at any time. If SAVE is not used, the entered value will be lost when the ScanGauge is disconnected. This may be the desired operation if the vehicle is not to have the ScanGauge regularly used on it.

```
< 0% >
0 => 0 SAVE >
```

The right and left upper buttons can be used to increase/decrease the selected adjustment in 1% steps. The lower left number is the speed reported by the vehicle. The lower right number is the speed which will be shown by the ScanGauge by applying this correction. Positive values of % will increase the displayed speed. Negative values of % will decrease the displayed speed. The approximate % to use for a tire size change can be computed by dividing the diameter of the original equipment tire by the diameter of the new tire, subtract this from 1 and multiply by 100. For instance, if the diameter of the original tires was 24 inches and the size of the new tire is 30 inches, $100 \times (1 - (24/30)) = 20$. Setting the value to 20% will compensate for the tire size change.

For gear changes, the formula would be $100 \times (1 - (\text{new ratio} / \text{old ratio}))$. For instance if the old ratio was 3.55 and the new ratio was 4.10, $100 \times (1 - (4.10 / 3.55)) = -15\%$.

One accurate way to set the speed is to use a handheld GPS. With one person driving, the other person observes the speed on the GPS and adjusts the % until the lower right value agrees with the GPS speed indication. Setting both the GPS and the ScanGauge to display KPH while making the adjustment will allow a more accurate adjustment to be made.

Another way would be to have the driver drive at a ScanGauge indicated speed of 60 MPH and measure the time between mile marker posts on a highway. For every second more than 60 it takes to go 1 mile, add 1% to the adjustment. It may be necessary to repeat this a few times until it takes 60 seconds plus or minus a second to go 1 mile.

Distance measurements can also be used to adjust the ScanGauge. Highway mile markers can be used to verify the correct setting. Use CURRENT TRIP DISTANCE and RESET when passing a mile marker. After a few miles see that the Miles changes as you pass the mile marker. Adjust the Speed up or down to adjust the indicated distance.

IMPORTANT: OBSERVE ALL SPEED LIMITS AND DRIVE SAFELY WHILE MAKING THESE ADJUSTMENTS. THE DRIVER MUST NOT BE DISTRACTED BY TRYING TO MAKE THESE ADJUSTMENTS WHILE DRIVING.

NOTE: The adjustment only affects the ScanGauge indicated speed and distance. It does not affect the vehicle speedometer or odometer readings.

MORE > FILLUP

This screen should be used every time the vehicle is refueled. In order for the TO EMPTY information to be valid, the TANK SIZE must have been properly set and the tank must be filled.

Using this screen will also make adjustments to the fuel consumption calculations and result in more accurate absolute fuel use and economy readings.

<	21.6	GALLONS	>
	0.0%		DONE >

The screen will show how much fuel the ScanGauge has computed to have been used since the last time a FILLUP was done. Use the value displayed by the pump or on the receipt to adjust this value up or down (using the upper buttons) to match it as close as possible. The lower line shows the “adjustment factor” in percent that the ScanGauge will use to compute fuel use. Press DONE after you have finished adjusting the indicated fuel to match the actual pumped fuel. Pressing DONE enters this correction factor into flash memory and resets the TANK trip information.

If the ScanGauge has not been connected since the last fillup, the TANK trip will show an asterisk in the lower right corner of the display and the adjustment screen will be skipped.

Do not make the adjustment if the ScanGauge was not installed or FILLUP not used the last time the vehicle was refueled. Pressing DONE will reset the TANK trip data without changing the adjustment factor.

If you move the ScanGauge to different vehicles, it is possible to manually enter the “adjustment factor” when you refuel. To do this, with the engine off use MORE>FILLUP>DONE to clear the TANK data. Then use MORE>FILLUP and adjust the % by using the upper buttons.

The adjustment factor for a vehicle can be determined by filling the vehicle up and using the MORE>FILLUP>DONE sequence to reset the TANK data, and on the next fill-up, record the % value after making the adjustment to the fuel done. You should run the tank down at least 10 gallons or $\frac{3}{4}$ tank if the tank doesn't hold much more than 10 gallons, before refueling and getting the adjustment factor in order to get better accuracy.

There will be variations in the agreement of the pump fuel used and the ScanGauge indicated fuel use from tank to tank due to:

- Different shutoff levels of the fuel pumps
- Different tilt of the vehicle at the fuel pump due to ground slope or vehicle loading
- Different temperature of the fuel (changes density – best to refill in the morning when the fuel is colder)
- Variations in vehicle sensors due to temperature and time
- Pump accuracy limits

These are just some of the variables that limit absolute accuracy and show why you should never trust a low reading of `DISTANCE TO EMPTY` to believe you will be able to make it to the next gas station.

`MORE=>MORE`

Pressing `MORE` twice brings up less commonly used functions.

```
<MODE          CMNDS>
<RATE          MORE>
```

`MORE>MORE>MODE`

This screen allows the operating mode to be read or set.

```
<          PWM          >
<PIDs          FORCE>
```

In this case, `PWM` is the current mode. Your display may be different.

Pressing the upper right or left button will allow different protocols to be chosen. The protocol is not changed until `FORCE` is pressed. It should be set this way only if it cannot be determined automatically. See `TROUBLESHOOTING` on page 24 for more information on vehicle modes.

`MORE>MORE>MODE>PIDS`

This selection is needed to screen the commands sent to some vehicles to let them operate correctly.

```
<  ALL          >
  PIDs          SAVE>
```

Pressing the top buttons will change between `ALL` and `SUPPORTED`. Most vehicles use `ALL` which is the factory default. But some vehicles will not work properly unless `SUPPORTED` is used. This is the case for 1995 to 1999 Subaru vehicles. If the ScanGauge connects but then goes to sleep after showing little or no data on the `GAUGE` display, change this to `SUPPORTED` and press `SAVE`.

MORE=>MORE=>CMNDS

```
< MEMORY 0 >  
<EDIT SEND>
```

In this mode sequences can be selected, edited or sent to the vehicle and responses displayed. This allows special sequences which are unique to a specific vehicle or rarely used to be sent. Any returned data will be displayed. Up to 10 sequences can be put into these memory locations for later recall. They are stored in non-volatile memory and will not be lost when the unit is disconnected from the vehicle.

The upper right and left buttons cause the memory selection to be changed. When the desired memory has been chosen, it can be edited or transmitted to the vehicle.

Pressing HOME will return the display to the home screen. Pressing EDIT will switch to an entry screen.

```
←..... →  
↑      OK>
```

This shows the display for an unprogrammed memory location. The lower-left button will increment the currently selected character through all the available hexadecimal values (0 to 9 and A to F) and back to a space. The upper-left and upper-right buttons will move the character selection. When the selection gets to the end of the top row, it will continue on the lower line. This allows the maximum length allowed to be sent by OBD to be sent.

Pressing OK will save the value to non-volatile memory and return to the previous screen where it can be sent or another memory location selected. Pressing the HOME button will exit this screen without saving the value and return to the HOME screen. An even number of characters must be used. If an odd number is used, a "0" is automatically appended to the command.

A CRC or Checksum is added automatically to the command when it is sent but it is not displayed in the edit screen.

An example of using these functions follows.

The EDIT function is used to set up the following command:

```
←686AF10100      →  
↑                OK>
```

Pressing OK changes back to the previous screen:

```
< MEMORY 0 >  
<EDIT SEND>
```

Pressing SEND causes the message to be sent. If there is a response to the message, it will be shown:

```
486B0E4100BE3EB8  
1006                OK>
```

The CRC sent back will be checked to make sure the correct data was received and is not removed from the displayed value. The first response returned after the command is sent is displayed. If there is a lot of traffic on the bus, this may not be the response to the command you sent. It may be necessary to resend the command and check for the correct response.

Pressing OK will return you to the previous screen where you can edit the command, resend it, or select another command.

```
MORE >MORE >RATE
```

This sequence will allow you to change the gauge update rate.

```
    RATE          FAST>  
<NORMAL          SLOW>
```

The update rate defaults to `NORMAL`. In some cases, a faster update rate can be used. If this causes some updates to be skipped or irregular operation, `FAST` should not be used. In some cases even `NORMAL` can be too fast and lead to poor operation. In these cases, `SLOW` should be used. `CAN` and `PWM` can usually use `FAST` rate. `VPW` and `ISO` may have a problem with a rate higher than `NORMAL`.

`MORE=>MORE=>MORE`

Pressing `MORE` three times from the `HOME` screen will get you to the following screen:

```
<VERSION
      USE DEFAULTS>
```

`MORE>MORE>MORE>VERSION`

```
Version 2.28
Linear-Logic
```

This selection shows the version of firmware which is in the ScanGauge and also serves as the Copyright notice for Linear-Logic, the company which made the firmware. The actual version number you see may be different than the one shown here.

`MORE>MORE>MORE>USE DEFAULTS`

`USE DEFAULTS` will allow you to reset the ScanGauge to the factory default settings. All units, engine displacement, engine type, tank size, gauge settings, trip and screen settings will be changed to the factory settings. You will be prompted to assure that you want to do this before it is actually done.

```
USE DEFAULTS ???
<YES          NO>
```

Pressing `YES` will reset the values to factory defaults and pressing `NO` will exit the screen without changing the values.

TROUBLESHOOTING

PROBLEM: *Never stops saying "Connecting..."*

#1 CAUSE: Vehicle ECU not on

#1 SOLUTION: Turn key to RUN or start engine

#2 CAUSE: ECU not responding properly.

#2 SOLUTION: Use MORE>MORE>MODE and try Forcing the following modes:

FORD Products: PWM or CANSF

GM Products: VPW , ISO or CANSF

Chrysler Products: ISO, VPW or CANSF

Volvo Products: ISO, CANSF or CANLF

Others: ISO, KWPS, KWPF, CANSF, CANLF, CANSS or CANLS

#3 CAUSE: Vehicle is not OBDII, OBD2 or EOBD compatible.

#3 SOLUTION: None - ScanGauge requires vehicle to be OBDII, OBD2 or EOBD compatible

PROBLEM: *Connects and then goes to sleep after 10 to 15 seconds.*

#1 CAUSE: Engine is not running

#1 SOLUTION: Start engine

#2 CAUSE: ECU requires only Supported PIDS (Common on 1995-1999 Subaru)

#2 SOLUTION: Use MORE>MORE>MODE>PIDS select SUPPORTED and SAVE

PROBLEM: *Poor MPG and TRIP Fuel use accuracy.*

#1 CAUSE: Some sensor initial accuracy not good (especially Diesel)

#1 SOLUTION: Use FILLUP procedure to adjust for sensor errors.

IMPORTANT: Use MORE>FILLUP at first fillup after connecting ScanGauge. At second fillup, use MORE>FILLUP and adjust top line to match amount of fuel used to fill tank, then press DONE.

PROBLEM: MPG and TRIP Fuel use very inaccurate after using fillup adjustment.

CAUSE: Error in adjustment procedure.

SOLUTION: Use MORE>MORE>MORE>USE DEFAULTS>YES then redo setup of ScanGauge.

PROBLEM: Some gauges are blank.

CAUSE: Some sensors are not used in the vehicle or data is not reported by ECU

SOLUTION: None

FOR EXAMPLE: About 10% of vehicles show FPR and 50% show MAF. 1995-1999 Subarus don't show intake air temperature. Some Ford diesels don't show coolant temperature.

Limited Warranty

Linear-Logic will repair this product with new or rebuilt parts, free of charge, in the U.S.A. for a period of 90 days from the date of original purchase in the event of a defect in materials or workmanship.

Warranty service can be obtained by sending the product to:

Linear-Logic attn: Service
2634 W Naranja Ave
Mesa, AZ 85202-7213

Include your name, address, telephone number and/or e-mail address along with a copy of the receipt if purchased at a retail store.

If purchased through mail order or the internet, include the date it was received and if it was sent to a different name and/or address, include the address it was sent to and the name it was sold to.

Also include a information about the problem including the type of vehicle you are using it on the a description of the problem.

An e-mail to service@linear-logic.com may be able to assist in solving a problem and will not diminish your rights to the full warranty.

Limits and Exclusions

There are no express warranties except as listed above.

LINEAR-LOGIC SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF THIS PRODUCT, OR ARISING OUT OF ANY BREACH OF THIS WARRANTY. ALL EXPRESS AND IMPLIED WARRANTIES INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO THE APPLICABLE WARRANTY PERIOD.

If a problem with this product develops after the warranty period, you may contact our service department via the mail address or e-mail address listed above for a cost estimate on repairs to the unit. If the problem is not handled to your satisfaction, contact our customer care department at customer.care@linear-logic.com