

# TECHNICAL MANUAL

## M.H. Corbin, LLC. OBD-II Vehicle Distance Translator



Version 3.1

May 2014

## Table of Contents

1. Revision History .....	2
2. Overview.....	3
2.1. Summary .....	3
2.2. Concept of Operations .....	3
3. Vehicle Distance Translator Installation .....	3
4. Calibration.....	4
5. Recommended Operation of Vehicle.....	7
6. Troubleshooting .....	8
6.1. NiteStar DMI is not registering distance .....	8
6.2. User has to perform the steps listed in Section 6.1 every time vehicle is shut off .....	9
7. Returns .....	9

## 1. Revision History

<b><i>Revision Number</i></b>	<b><i>Details</i></b>	<b><i>Date</i></b>
0.1	Initial Version	Jun 2011
0.2	Prototype Version	Jul 2011
0.9	Pre-release Version	Jan 2012
1.0	Release Version	Apr 2013
2.0	Release Version	Aug 2013
3.0	Release Version	Mar 2014
3.1	Release Version Notes	May 2014

## 2. Overview

### 2.1. Summary

The M. H. Corbin OBD-II Vehicle Distance Translator (VDT) is designed to translate OBD-II vehicle speed data into a frequency of digital pulses for use by the NuMetrics NiteStar Distance Measuring Instrument System (DMI).

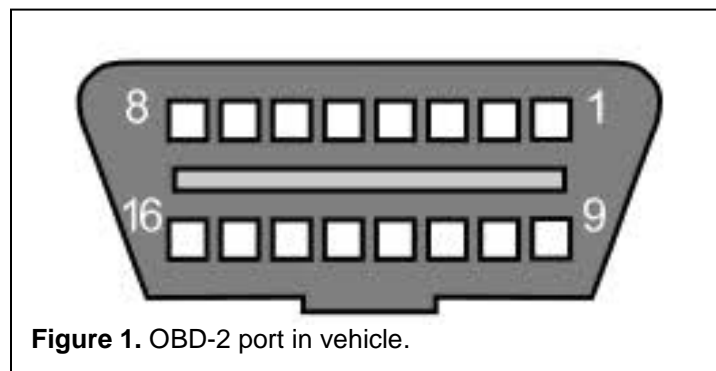
### 2.2. Concept of Operations

- The VDT board connects via OBD-II port to the vehicle's ECU, and via a cable to the DMI.
- Approximately every 500ms, the VDT polls the vehicle's speed from the ECU via the OBD-II port.
  - VDT calculates rate of distance being travelled using this speed data from the ECU
  - VDT triggers periodic digital pulses (1 pulse per .9113444 feet travelled) to the DMI based on the vehicle speed.
  - As the vehicle decelerates/accelerates, the period of the digital pulses is adjusted to reflect this change in rate at which distance is travelled.
- DMI utilizes digital pulses to record total distance traveled.
- VDT detects when vehicle has been turned off/on so that user can leave device plugged in without draining battery.

## 3. Vehicle Distance Translator Installation

Many vehicles only allow the ECU to communicate when the ignition key is in the ON position. For best results, the first time the unit is connected to the vehicle, ensure the vehicle is on and the engine running. This ensures the vehicle's ECU is fully operational before the VDT begins attempting communications. Once the unit has been verified to work with the user's vehicle, the VDT may be left plugged into the OBD-II port when the vehicle is shut off. To use the VDT:

1. Start vehicle.
2. Pair the OBD-II DMI Translator with the vehicle by connecting it to the vehicle's OBD-II port, shown in Figure 1.



3. Plug the cable from the OBD-II VDT into the “Power” port of the NiteStar DMI.
4. Power on NiteStar DMI.
5. Calibrate the NiteStar DMI as shown in Section 4 below.

## 4. Calibration

The DMI works by counting pulses that are received from the sensor. The number of pulses is different for each vehicle, so the DMI must be calibrated for each vehicle.

The calibration number you find for your vehicle will be the number of feet the vehicle travels between each pulse multiplied by 1000. This number should be between 400 and 1400. If the number is outside this range the accuracy of the DMI may be adversely affected.

### 4.1. Pre-Calibration Procedure

1. Accurately measure a straight road course 1000' long using a tape measure or similar device. Mark the beginning and end with a paint mark, stake in the ground, or other fixed object.
2. Check the air pressure in the vehicle tires. Make note of the pressure and recheck each day before beginning use of the DMI.
3. Drive the vehicle for approximately 5 miles before running the calibration course. This will help to match the same operating temperatures that the tires will have during normal use
4. For maximum accuracy the speed at which the calibration is done should be the same as the speed at which the measurements will be made. For example, if the measurements will be made at 25 mph, then the calibrations should be done at 25 mph as well.

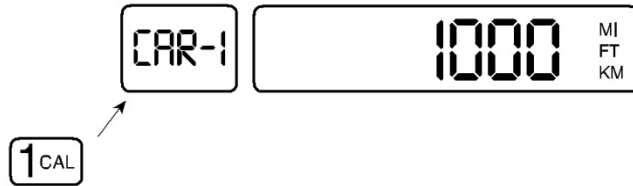
Note that if more than one speed will be used in different measurement situations, it is possible to calibrate it up to four different speeds and store them in the DMI as four separate vehicles. Then when making measurements, the correct speed can be chosen by selecting from one of the four vehicles. Alternatively, the different calibration factors can be noted and entered manually before the measurements at different speeds are made.

### 4.2. Instrument Calibration

1. Insure the DMI is in the **FEET** unit mode. If not, depress the **UNIT** key until the DMI display shows **\_FT**.

NOTE: NiteStar Calibration **MUST** be done in **FEET** mode.

2. Insure the DMI is in **COUNT/HOLD** mode and depress the **1 CAL** key. The display will show:



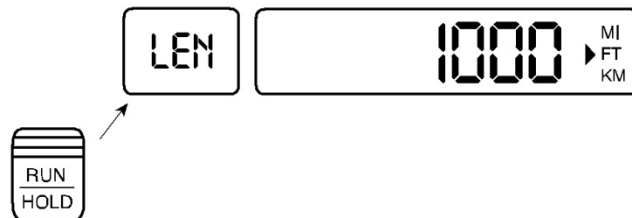
If the display is blank, enter **1000** then press **MARK/ENTER** to save. To return to calibration mode, press the **1CAL** key again.

**IMPORTANT NOTE:** The NiteStar can store up to 4 calibration numbers for 4 different vehicles. The display will show you are working on the calibration number for car -1 and at present it is 1000. You may step through the 4 calibration numbers by pressing the **DISP/HOLD** key.

**PROCEED TO THE START OF THE 1,000 FOOT COURSE.**

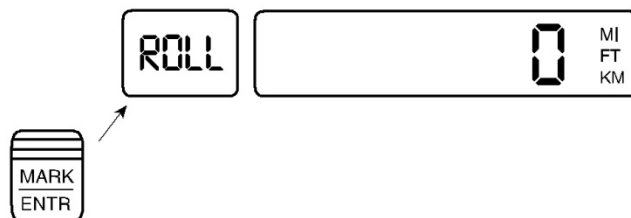
Align a fixed point on the vehicle exactly with the marker for the beginning of the calibration course. A piece of tape temporarily fixed to the vehicle works well as a reference for the fixed point.

3. Press the **RUN/HOLD** key.
4. The display will show:

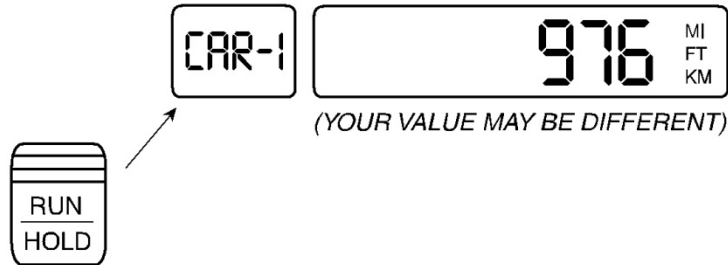


5. Depress **MARK/ENTER**. The display will show 0. When the vehicle moves the display will show the pulses counted. The value displayed is a tabulation of pulses counted by the instrument and not a distance traveled.

**NOTE:** The SPEED window will NOT operate at this time.



6. At the end of the 1000 foot course, slow the vehicle carefully so it is exactly aligned with the end of course marker. When the car is aligned, press the **RUN/HOLD** key and the number in the display will become your calibration number for this vehicle, (this number should be between 400 and 1400). **Please write this number in the back of your manual or other location that will stay with the vehicle.**



Once you have recorded your calibration number, press **MARK/ENTER** and your calibration number is stored in the DMI. The display should show the course length.



7. Make sure this value is saved by turning the NiteStar off. (Press the **ON/OFF** key).
8. If this is the first time you have calibrated a DMI, repeat the procedure and see if you get the same calibration value.

### 4.3. Calibration Summary (Automatic)

With the instrument in **COUNT/HOLD**:

1CAL key - CAR NUMBER XXXX

DISP/HOLD - Change car number

RUN/HOLD - LEN <1000'> in current units.  
(Enter new course length if needed)

- **MARK/ENTER** - ROLL 0

*Roll through calibration course!*

- **RUN/HOLD** - CAR NUMBER CCCC (New cal number)
- **MARK/ENTER** to enter calibration number (course length is displayed)
- **ON/OFF** (Stores your calibration number into memory)

#### 4.4. Calibration Summary (Manual)

To enter in a known calibration number if your vehicle has previously been calibrated.

With the instrument in **COUNT/HOLD**:

- **1CAL** key - CAR NUMBER XXXX
- **DISP/HOLD** - Change car number
- Enter new calibration number ( \_ \_ \_ \_ )
- **MARK/ENTER** - Will exit calibration mode
- **ON/OFF** (Stores your calibration number into memory)

### 5. Recommended Operation of Vehicle

Some makes of vehicles contain ECUs which report the speed of travel as the car was several seconds ago, not the speed currently being travelled. Because the VDT operates using the speed reported by the ECU, the user may notice during acceleration or braking that the speed readout on the NiteStar DMI is slightly retarded from the speed the vehicle is actually travelling.

For example, if the user is watching the distance and speed readout on the NiteStar DMI while starting to drive from a standstill, the distance may not begin registering until a few seconds after the user has started driving. This is normal operation of the vehicle's ECU and is not an indication of a defective unit.

Similarly, if the user is slowing the vehicle down, the distance readout on the NiteStar DMI will continue incrementing for a few seconds, even after the vehicle has come to a complete stop. This is normal operation of the vehicle's ECU and is not an indication of a defective unit.

For vehicles with retarded speed readout, the user is recommended to operate the vehicle within the following guidelines to ensure accurate measurements:

- A. The user ends measurement when the vehicle is travelling approximately the same speed as when measurement was initiated.
- B. The user brakes/accelerates the vehicle with approximately the same force.

Note: Experience has shown that the ECU accuracy, precision, delay and linearity vary from vehicle manufacturer, model and year. This variation is a function of the vehicle, and not of the DMI unit. For best results the unit should be calibrated at a similar speed to the intended speed of use. If the intended speed of use is 20-30 mph then the calibration should also be done at this speed. Some error may be expected if the calibration is done at a substantially different speed from the intended use speed.

Examples of advisable operation follow:

- Matt wants to measure the length of a guard rail. Matt pulls up on the side of the road to the start of the guard rail and configures his NiteStar DMI to start recording distance. Matt drives to the end of the guard rail, stops, and takes a reading after the NiteStar DMI has stopped recording distance.
- Mike wants to measure the length of a guard rail. Mike is on the highway travelling 50-60mph and does not want to pull over to make a measurement. Mike begins measurement of the guard rail, and ends measurement while still travelling 50-60mph.

Examples of inadvisable operation follow:

- Matt wants to measure the length of a guard rail. Matt pulls up on the side of the road to the start of the guard rail and configures his NiteStar DMI to start recording distance. Matt accelerates to 55mph and drives past the end of the guard rail, stopping measurement and taking a reading as he passes the end.
- Mike wants to measure the length of the guard rail. Mike is on the highway travelling 50-60mph and does not want to pull over to make a measurement. Mike starts measurement as he passes the beginning of the guard rail, and decides to pull over at the end of the guard rail. Mike brings the vehicle to an aggressive stop engaging the antilock brakes on the vehicle or causing the tires to skid, immediately stops measurement before the NiteStar DMI has finished incrementing distance, and takes a reading from the NiteStar DMI.

In the scenarios listed as inadvisable operation, the trip is not “complete” from the perspective of the NiteStar DMI due to the delay that exists between a change in the vehicle’s actual speed, and when the vehicle’s ECU has recognized this new speed.

## 6. Troubleshooting

Recommendations to troubleshoot several potential issues are presented below:

### 6.1. NiteStar DMI is not registering distance

*Please have the user perform these steps:*

1. Ensure the vehicle is in the on state and engine running.
2. Unplug the OBD-II VDT from the vehicle,
3. wait 5 seconds,
4. and plug it back in.
5. Next, ensure the OBD-II VDT is plugged into NiteStar DMI’s “POWER” port and not “DATA” port.
6. Ensure the NiteStar DMI is not displaying “Count Hold” or “Display Hold” and is otherwise operating properly (see your NiteStar DMI operation guide / user’s manual to verify proper configuration).
7. Drive vehicle.



If NiteStar DMI is still not registering distance, follow the steps listed under Section 7 “Returns” to have the user return the device to the dealer for a replacement. If the replacement also does not work, the vehicle may not be supported (unless the vehicle was manufactured prior to January 1<sup>st</sup> 2000, this is unlikely). If the replacement does not work, the dealer should record the make, model and year of the vehicle the user is using the device in, and inform M. H. Corbin. of this data.

## 6.2. User has to perform the steps listed in Section 6.1 every time vehicle is shut off

Dealer should record the make, model and year of the vehicle the user is using the device in. In addition, if possible, obtain a voltmeter reading of the battery voltage of the vehicle while it is running, and after the engine has been shut off. Notify M. H. Corbin. of this vehicle data.

## 7. Returns

If the user is unable to get the VDT to operate in their vehicle after following the steps listed in Section 6.1 “NiteStar DMI is not registering distance”, instruct the user to perform the following steps before returning the device to the dealer:

1. Start vehicle
2. Allow vehicle to run for 15 seconds
3. Plug VDT into the vehicle
4. Wait 30 seconds.
5. Unplug the VDT from the vehicle.

These steps will ensure the VDT is storing the most up-to-date messages and records from the vehicle, which will later be analyzed by M. H. Corbin to determine the source of malfunction. If the device has not been plugged into any other vehicle besides the one in which the user desires to use the device with, performing these steps is not mandatory.