MH CORBIN INC
Highway Information Systems

TECHNICAL MANUAL

M.H. Corbin, Inc. OBD-II Vehicle Distance Translator

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1. Revision History

Revision Number	***Details***	***Date***
0.1	Initial Version	8 Jun 2011
0.2	Prototype Version	July 1, 2011
0.9	Pre-release Version	10 Jan 2012
1.0	Release Version	1 April 2013

2. Overview

2.1. Summary

The M. H. Corbin OBD-II Vehicle Distance Translator (VDT) is designed to translate OBD-2 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-2 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.

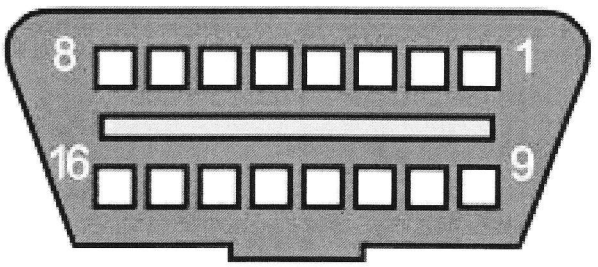

Figure 1. OBD-2 port in vehicle.

3. Plug the cable from the OBD-II VDT into the "Power" port of the Nitestar DMI.
4. Power on Nitestar DMI.
5. Set Nitestar DMI calibration value to "911" (for details on why the value should be "911" see section titled *"Configuring the DMI"*).
6. Drive vehicle.
7. Distance should be counting on the Nitestar DMI. If it is not, see section titled *"Troubleshooting"*.

4. Configuring the DMI

The VDT outputs one pulse per kilometer-per-hour that the vehicle ECU reports the car is travelling. For example, if the vehicle is travelling 60 Miles Per Hour, the vehicle ECU speed would read between 96 and 97 Kilometers Per Hour. Because one KPH is equivalent to 0.9113444 feet per second, if the DMI's calibration number is set to "911" (0.911 feet are travelled per pulse received), then the DMI will track distance as accurately as the car's internal Odometer. For best results, the calibration value should never exceed 913 or be less than 909 feet per pulse.

Because the VDT is retrieving speed data directly from the vehicle's ECU, **for most accurate distance measurement, the DMI's calibration value must be set to "911". This corresponds to 0.911 feet per pulse.**

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.

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 1st 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.