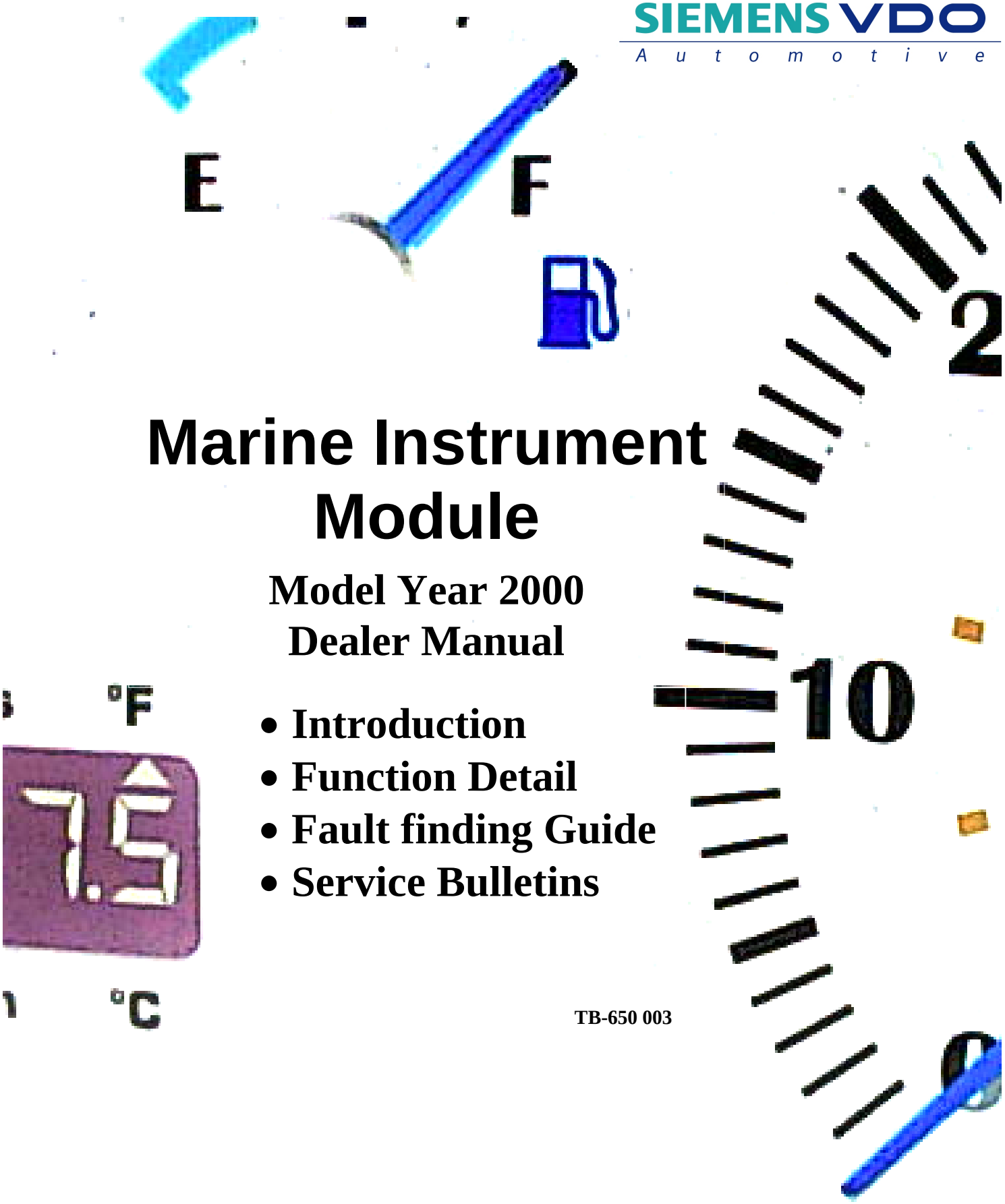
SIEMENS VDO
Automotive



Marine Instrument Module

Model Year 2000
Dealer Manual

- Introduction
- Function Detail
- Fault finding Guide
- Service Bulletins

TB-650 003

Introduction

The VDO Marine Instrument Module is a highly integrated microcontroler based assembly that combines tremendous capability with reliability and ruggedness. This combination of attributes is possible by taking advantage of component quantities available only through VDO's automotive and industrial programs and blending them with 30 years working in the Marine environment.

VDO is committed to supplying rugged, sophisticated, cost effective, display technology previously unavailable to the marine market.

Model Year 2000 Instrument Module Functions:

I/O Module functions:

- Speedometer - 270° crosscoil movement
  Options: 80 mph (270° scale)
  60 mph (270° scale)
  50 mph (270° scale)
- Tachometer (6000 rpm) - 270° crosscoil movement
- Fuel Level - 90° crosscoil movement, Low Fuel Telltale
- Oil Pressure - 90° crosscoil movement, Low Pressure Telltale
- Coolant Temperature - 90° crosscoil movement, High Temp. telltale
- Voltage Level - 90° crosscoil movement, Voltage Warning telltale
- Trim - 90° crosscoil movement
- Audible alarm - Continuous tone unit, minimum of 100dB$_{sp}$, engine signal warnings & system fault conditions.
- Depth Sounder - single row 4 digit, 7 segment, LC display and Telltales for FEET or METERS, shallow water alarm
- Mode and Adj. button inputs - Select modes and update display
- Clock - HH:MM, 7 segment, LCD
- Odometer & Trip Odometer - 0.0 to 9999 mi or km, 7 segment, LCD
- Engine Hours & Trip Hours - 0:00 to 9999 hrs., 7 segment, LCD
- Seawater Temperature - 30.0 to 104.0°F or –1.0 to 40.0°C, 7 segment LCD

O/B Module functions:

- Speedometer - 270° crosscoil movement

  options: 80 mph (270° scale)
  60 mph (270° scale)
  60 mph (220° scale)
  50 mph (270° scale)

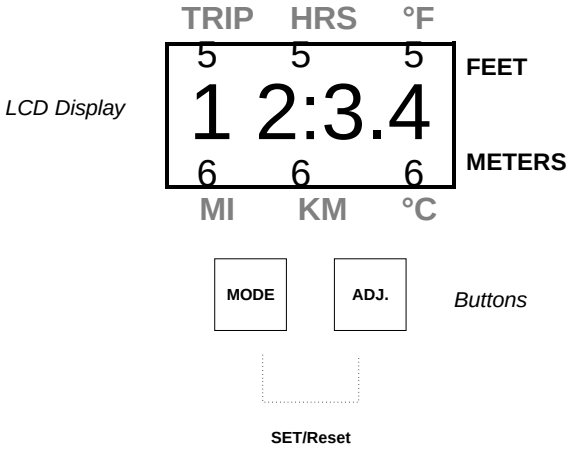
- Tachometer (7000 rpm) - 270° crosscoil movement
- Engine System Monitior - RED warning tell tales and audible alarm for:

  Low oil tank level
  High engine temperature
  No oil pressure
  Check engine

- Fuel Level - 90° crosscoil movement, Low Fuel Telltale
- Voltage Level - 90° crosscoil movement, Voltage Warning Telltale
- Trim (Optional) - 90° crosscoil movement
- Audible alarm - Continuous tone unit, minimum of 100dB_{sp}, engine signal warnings & system fault condi1tions.
- Depth Sounder - single row 4 digit, 7 segment, LC display and Telltales for FEET or METERS, shallow water alarm
- Mode and Adj button inputs - Select modes and update display
- Clock - HH:MM, 7 segment, LCD
- Odometer & Trip Odometer - 0.0 to 9999 mi or km, 7 segment, LCD
- Engine Hours & Trip Hours - 0:00 to 9999 hrs., 7 segment, LCD
- Seawater Temperature - 30°F to 104°F or –1°C to 40°C, 7 segment LCD

Operator Interface

A four character, seven segment LCD display and two dashboard mounted buttons make up the operator interface. The LCD also has a colon for clock display and a decimal point to show finer resolution values.
Various information types can be displayed on the LCD. The operator advances through the available displays by pressing the MODE button. Dial legends surrounding the LCD are highlighted by pointer symbols above and below the numeric segments. Depth sounder mode is indicated by lighting the FEET or METERS telltale to the right of the LCD.



Note: A VDO ***Quick Start*** guide showing all functions and settings can be found on the last page of this manual.

Main Function Descriptions: V 1.0

Tachometer: 0-6000 I/O, 0-7000 RPM OB The Tach input is selected at the Boatbuilder for pulse per rev value of: 1-10 pulses using VDO calibration software.

Speedometer: The speed of the boat is measured using the paddle wheel input from the transom mounted triducer (Airmar P-32). The speed values can be adjusted by +- 50% with VDO calibration software.

Fuel Gauge: The fuel level is measured using a standard US Ohm range 240-330 • sensor (Default) or selecting a VDO range 10-180 • sensor using the VDO calibration software.

Alarm: A **low fuel** warning symbol will illuminate when the level reaches 1/6 of a tank, or less.

Fault: US Range = less then 15• or more then 280•
VDO Range = less then 3• or more then 210•
In a fault condition the pointer will return to empty and the horn will "beep" every 2 seconds for 10 seconds max. The telltale will stay lighted until the problem is resolved.

Coolant Temperature Gauge: The temperature is measured using either a standard US range sensor (default) or a VDO range sensor can be selected using VDO calibration software.

Alarm: The Temperature telltale will light, the horn will "Beep" for 10 seconds if the temperature rises above 213° F.

Fault: An Ohm value below 37• US (27• VDO) or above 800• US (500• VDO) will illuminate the telltale, "Beep" the horn, and the pointer will move to the fully "Hot" position.

Oil Pressure Gauge: Oil pressure, 0-80 PSI is measured using a standard US 240-33 • sensor (default) or a VDO 10-180 • sensor can be selected using VDO calibration software.

Alarm: The Oil Telltale will light, the horn will "beep" for 10 seconds if the oil pressure drops below 6 PSI.

Fault: An Ohm value 15• US (3 • VDO) or above 280• US (210 • VDO) will illuminate the telltale, "beep" the horn every two seconds and the pointer will drop to "zero".

Voltage Gauge: The voltage is measured from the ignition switch input with a scale of 10-16 volts.

Alarm: The "Battery" telltale will light and the horn will "beep" for 10 seconds if the voltage measures below 11v or above 16v.

Fault: The module will shutdown if the voltage goes below 7v or above 16.5 in order to protect voltage sensitive components. Resetting the Clock and Depth defaults may be required.

Trim Gauge: The trim gauge is driven by the OEM trim sensors which can be selected using the VDO Calibration software. The Module can be programmed for current Mercury, OMC, Yamaha, and Honda trim values. No alarm or fault signals

Outboard System Monitor (O/B modules ONLY)

The modules for outboard engine craft include the outboard engine system monitor. It provides warning telltales and an audible alarm for the Oil Pressure, Engine Temp, Oil Level, and Check Engine signals for an OMC System Check sensor equipped outboard engine.

OIL PRESSURE

The telltale shall turn on any time the Oil Pressure warning switch contact closes and the ignition is on. The telltale shall remain on for a minimum of 30 seconds, and it will remain on until the fault is corrected and the sensor contact opens or the ignition is turned off.

ENGINE TEMPERATURE

The telltale shall turn on any time the Engine Temp. warning switch contact closes and the ignition is on. The telltale shall remain on for a minimum of 30 seconds, and it will remain on until the fault is corrected and the sensor contact opens or the ignition is turned off.

CHECK ENGINE

The telltale shall turn on any time the Check Engine switch contact closes and the ignition is on. The telltale shall remain on for a minimum of 30 seconds, and it will remain on until the fault is corrected and the sensor contact opens or the ignition is turned off.

OIL LEVEL

The telltale shall turn on any time the Oil Level switch switch contact closes and the ignition is on. The telltale shall remain on for a minimum of 30 seconds, and it will remain on until the fault is corrected and the sensor contact opens or the ignition is turned off.

HORN CONTROL

This audible alarm control shall sound the horn upon the occurrence of any of the four described alert conditions, while the engine is running (at least 500 RPM). The alarm horn shall sound for 10 seconds and then turn off.

SELF TEST

When the ignition is turned on the outboard monitor system shall perform a self test. The self test shall be a ½ second beep by the audible alarm horn. All four of the warning telltales shall turn on. Upon conclusion of the test, the four tell tales shall turn off in sequence.

Clock Display

The Clock display is selected by pressing the MODE button. During Clock display the colon blinks once per second.

Time of day is set by pressing and holding MODE and ADJUST for 2 seconds while in the Clock Display mode. MODE is then used to advance through the time set features. Hours are set first, then minutes, then 12/24 hour mode. The selected digits blink while being set. While in set mode ADJUST is pressed to increment the selected unit. Hours is set in the 24 hour format, rolling to zero at 24. Minutes rolls to zero at 60. While setting the 12/24 hour feature, 24 is displayed in the hours position and 12 is displayed in the minutes position. The current mode blinks (i.e. in 24 hour mode the "24" blinks).

MODE and ADJUST are debounced for 3/8 of a second. If the ADJUST button is held for 2 seconds while setting a numeric value the key auto repeats at a rate of 6 per second (i.e. to scroll through all 60 minutes requires 12 (2+10) seconds).

When the ignition is turned off the present mode is saved and the LCD displays time of day. Time setting functions are not available with the ignition off. When the ignition is turned on the LCD returns to its prior display mode.

The clock keeps time up to 21 days after ignition is turned off. During this time the system is in its power saving state. After 21 days the module shuts down to conserve battery power. When ignition is turned on after 21 days, the clock restarts at midnight in the mode active at ignition off. Time of day must be set again.

Depth Display

Water depth is measured using an external transducer (AIRMAR "P32 or P19" 200 kHz, not provided by VDO North America). It works by measuring the reflected energy of a 200 Khz pulse as it bounces off the bottom. Depth measurement is

based on the speed of sound in fresh water at 25°C. Small errors result from salinity and temperature.
The display indicates depth in feet (1..300 feet) or tenths of meters (0.5..100.0 meters). Accuracy beyond 300' depends on bottom conditions, salinity, transom angle, transducer installation and aiming of the transducer. The displayed value is updated every 300 milliseconds. NOTE: VDO North America has no control over depth transducer installation, and does not warrant its operation. The 300' operation is in salt water, with an AIRMAR P19-U transducer pointed fully down. Performance of the transducer at speed is affected by air bubbles in the water and the ability of the transducer to maintain contact with the wake.
A shallow water depth alarm feature can be set in increments of 1' (0.3m). The operator sets the value by pressing and holding dashboard mounted MODE and ADJUST buttons for 2 seconds. Entering shallow water causes a continuous chirping sound and blinking up/down arrow segments.
The shallow water alarm setting is displayed as blinking digits. Current depth is displayed as steady (not blinking) digits. If the alarm screen is blank no shallow water alarm is set. If the depth screen shows dashes the depth is zero or indicates a bad sensor reading.
Pressing the MODE button initiates "Set Mode". The shallow water alarm setting blinks along with the down arrows on the display. Pressing ADJUST sets the alarm towards deeper water. Pressing MODE again indicates the up arrows. With the up arrows on, pressing ADJUST sets the alarm towards shallower water. Holding ADJUST longer than 1 second speeds up the process of making the alarm setting deeper or shallower.

Pressing MODE again allows the depth measurement units to be changed. While in "Units Mode", the shallow depth alarm setting blinks and the "FEET" or "METERS" telltale flashes. Pressing ADJUST changes between feet and meters.
Pressing MODE again allows the depth sounder system to be enabled or disabled. In this mode a blinking message "On" or "OFF" appears. Pressing ADJUST changes between Sounder On and Sounder Off. In the "OFF" mode the sounder no longer sends out its periodic sonar ping. **The "OFF" mode should be enabled when using Fish Finders or other equipment that has the same 200kHz frequency to avoid "Cross talk"**
Pressing MODE again causes a return to normal "Depth Mode". In any case, thirty seconds after the last button press, the display automatically returns to depth mode.
In Depth Display Mode, pressing ADJUST displays the shallow water alarm setting. The alarm setting blinks for ten seconds. When shallow water is encountered the up/down arrows blink and the audible alarm beeps.

Pressing ADJUST turns the beeper off, but only for the present low water event. Entering deeper water re-enables the beeper for the next encounter with shallow water.

- See VDO *Quick Start* on the last page of this Manual

Odometer (Log) and Trip Odometer (Trip Log)

The **Log** calculates total mileage based on input from the paddlewheel. This value is not resetable except at the factory and is stored in nonvolatile memory.

The **Trip Log** is a resetable distance log that will display distance accumulated since last reset. The operator presses both Mode and Adjust while in the Trip Log mode to reset to "Zero".

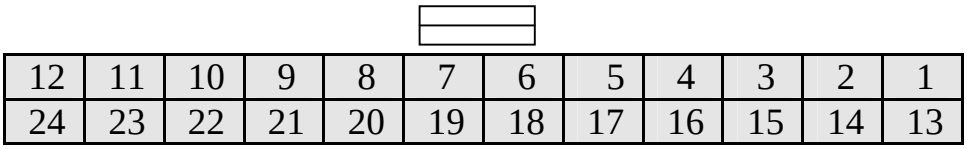
The Log and Trip Log functions will display Statute Miles when the Depth function displays "Feet". Kilometers will be displayed when the Depth displays "Meters".

Engine Hours: Total engine running hours (above 500 RPM) will be displayed in 1 hour increments.

Trip Hours: This is a resetable function of the engine hours with Hour/Minute resolution up to 100 hours maximum. Pressing both Adjust and Mode while in Trip Hour mode resets the values to "Zero"

Seawater Temperature: This function measures the water temperature at the transducer (Airmar P32 or equivalent). When the Depth function is in "FEET" the function defaults to "°F"(Fahrenheit). When the Depth function is in "Meters" the temperature defaults to "°C" (Centigrade).

Connector



12	11	10	9	8	7	6	5	4	3	2	1
24	23	22	21	20	19	18	17	16	15	14	13

(Harness side view)

Electrical Pinout

Pin No.	Signal	Pin No.	Signal
1	Depth transducer signal	13	Depth transducer return
2	GND (depth)	14	Depth Shield
3	GND (signal)	15	Spare (TEST/PGM Signal Prototypes only)
4	GND (Power)	16	Seawater Temperature
5	Lighting Input	17	Check Engine Warning Switch (O/B only)
6	Trim Input	18	Oil Level Warning Switch (O/B only)
7	Serial TX	19	Mode Push-button
8	Serial RX	20	Adjust Push-button
9	Fuel Input	21	Speed sensor (+), 12v out
10	Oil Pressure Input (I/O) or, Oil Pressure Warning Switch (O/B)	22	Ignition (B+)
11	Engine Temperature Input (I/O) or, Engine Temp. Warning Switch (O/B)	23	Battery
12	Tach Input	24	Speed Input

- The module connector is an Amp Mate-N-Lok. # 770587-1
- The pin connectors are Amp # 770988-1
- The extractor tool for removing the pins is Amp # 455822-2

Fault Finding Guide

Observed Problem	Field Procedure	Reference
No function with key on .	- Check for voltage at pins 22 & 23 - Check for ground Connection between pin 4 & Battery Neg.	See “Volt Gauge”
Erratic function, Pointers flickering And horn chirping	- If Mercury OB check for Inductive spark plugs necessary on 50 70 90 &120 HP models. This Plug eliminates Voltage spikes from the ignition coils. Module is protected.	-Call Mercury -See VDO Bulletin “7.10.99”
Speed & Depth stop working at high speed.	- Check for transducer positioning. Ducer is likely too low and cavitating. Ducer should be nearly flush with bottom if transom mount.	See Airmar install bulletin
Speedo not functioning, Depth OK	-Check connections on 24 pin connector. - Check for voltage switching from 0-8v + between #24 and ground while turning paddle wheel one blade at a time.	See VDO Bulletin “6.25.99”
Alarm horn sounds, Tank light on, Fuel level is ok.	- Check tank sending unit for Ohm values. Check Ground on sensor. Remember, open circuit is a fault.	See “Fuel Gauge”
Alarm horn “chirps” with key on, Boat is on trailer.	- The depth transducer will mimic a depth of about .7 ft when out of the water. Shallow Depth Alarm will sound if a depth alarm value is present. Reset to “O” depth alarm	See “Depth”
Trim Gauge will not go full down or Trim not moving.	-Check OEM trim sensor for proper adjustment & Range. -Check for a sensor. Some engines do not have them	See engine manual
Depth and Clock settings reset to “O” with key off. Clock not working with key off.	Check for voltage on pin 23, this should be constant power to keep memory function.	

Remember:

- An Alarm is a constant tone for ten seconds, the telltale will stay on after the tone stops.

- A Fault alarm is caused by an “open” or “shorted” sender circuit or a sender out of the normal range. The tone is a “Beep” every two seconds for ten seconds.

If you cannot determine the root cause of a problem or need a replacement Module contact your Customer Service department at the Boat Manufacture or call VDO.

VDO Marine Customer Service Bulletin

Product Line(s): All Outboard Modules **Date: 1.28.99 Update: 7.10.99**

Problem Observed: The 12 volt supply line from Mercury 50,70,90,and perhaps 120 HP carries unusually high voltage spikes or EMI due to voltage "Crossover" from the new power pack spark modules. (See Fig.1)

These voltage spikes will cause the VDO Module to "reset" and "Beep" erratically due to the overvoltage protection circuitry built into the module. This problem has not been known to damage any Module units however the Module will not work correctly until the EMI is eliminated.

These voltage spikes will damage unprotected voltage sensitive devices such as the Airmar speed transducers and audio equipment.

Field Solution: Installing Inductive type spark plugs will eliminate this problem (per Mercury Owners manual). Check the recommended application.

NGK # BUZHW is a typical application. The "Z" in the designation indicates Inductive Type.

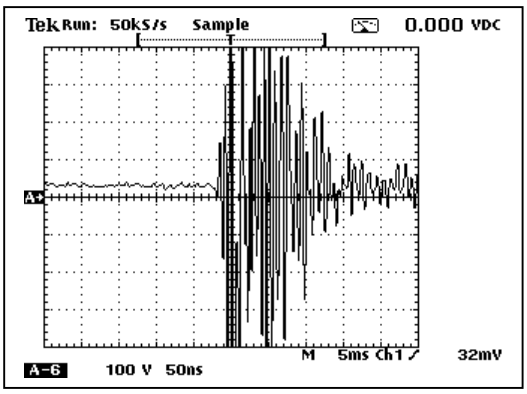


Figure 1, Before inductive plugs.

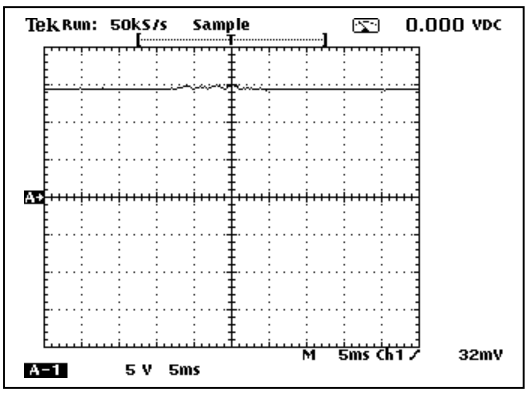


Fig. 2 After inductive plugs

VDO Marine Customer Service Bulletin

Product Line: All Marine Modules **Date: 6.25.99**

Problem: Speedometer not functioning

A number of speedo failures have been reported. This problem has been traced to component failures in the **Airmar P32 Triducer** (Depth/Speed/Temp unit). The depth function is not usually affected.

There is a simple test to determine if the speedo circuit has failed.

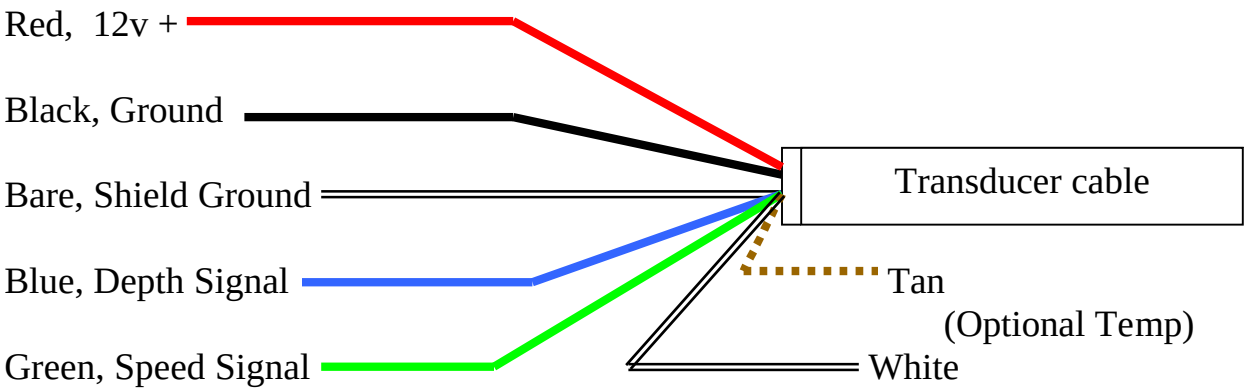
1. Connect a DC Voltmeter to the "Green" (Signal) and "Bare" (ground) wires of the Transducer.

2. With the key switch "on" rotate the paddle wheel **one paddle at a time.** The Voltage should switch from about "8" volts to near "0" volts as the two magnets in the (4) paddles pass by the body of the transducer.

3. If the Voltage does not change as the paddle is slowly rotated replace the transducer.

4. It is also good practice to check the new transducer before mounting it. Use jumper leads to power the unit.

Diagram of transducer leads



VDO Marine **Customer Service Bulletin**

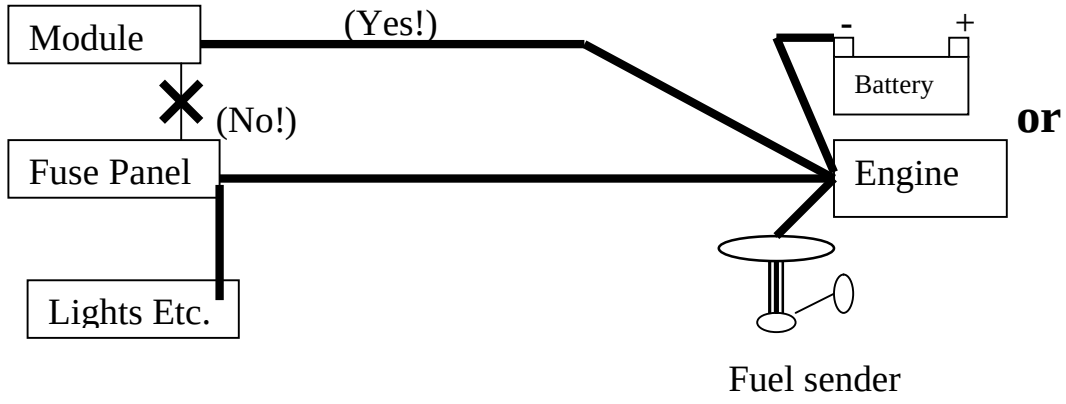
To: All Marine Module OEM users. Date: 4.28.99

Subject: Ground requirements for the Marine Module

The Marine Module uses voltage comparison circuits for gauge functions and to activate various alarm and or fault functions. This technique eliminates the need for separate switches and facilitates the ability to program different parameters.

Inadequate Ground Potential can cause errors. **A separate dedicated ground** (Min.18AWG) from the Engine block or Battery to the module is necessary for proper function of the Alarm and Fault Alarm functions.

Ground Circuit Diagram:



The diagram shows that there should **not** be a ground lead between the Module and the negative (Common) side of the fuse panel.

Please refer to the Module Specifications Manual for the proper pin assignments.

Contact the Boat Manufacturer or VDO Marine Dept. if you are not sure or have further questions.