EFI Connections™

Today's Technician's Link to Marine EFI Systems

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In This Issue

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EFI Battleground Heats Up

As if the planets suddenly aligned themselves in the EFI universe, key marine engine manufacturers fired electronic shots over competitor's bows this past fall with the introduction of bold new EFI systems. Volvo Penta and Indmar both launched engines equipped with entirely new EFI control modules. Two new electronic control modules introduced by Volvo Penta and one by Indmar bring the total number of in-production ECM types to six for the sterndrive / inboard engine market. That is quite a contrast for an industry segment which only six years ago used a single type of electronic control module across virtually all engine brands.

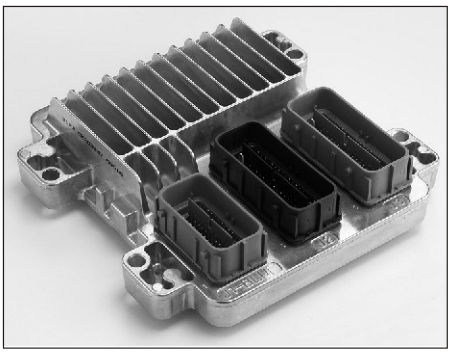
New systems increase the mix for 2006

Marine technician's expertise will again be challenged this season as engine manufacturers, in their quest to satisfy increased performance demands as well as upcoming California emission regulations, utilize more sophisticated and diverse engine management systems. Sequential multi-port fuel delivery, electronic throttle control and in-vessel networking capabilities are among the new engine control system features being put into widespread use this year.

This past fall Volvo Penta began ramping up production of their new EGC equipped engines. The EGC or "Electronic Gas Control" system, utilizes an ECM which is radically different from the electronic control modules Volvo had used on prior engines. Volvo Penta engineers collaborated with an outside design firm to develop EGC and as a result, have created a fully sequential fuel injection system with unique performance and diagnostic capabilities.

Two EGC system types are currently being produced, one with electronic throttle control capabilities and a second system employing standard throttle and idle air control mechanisms. Either EGC system will present marine technicians with new service procedures, service terminology and completely new fault codes. In addition to these changes there is a new 8 pin engine diagnostic connector.

Indmar is the first marine engine manufacturer to utilize GM / Delphi's new MEFI-5 control module. MEFI-5 is a new breed of ECM which differs substantially from prior marine ECM modules offered by the GM / Delphi alliance. MEFI-5 offers fully sequential injection and is also equipped with a new high speed CAN communication link which supports both engine diagnostics and



GM / Delphi's MEFI-5
Engine Control Module

in-vessel networking. New diagnostic service procedures, fault codes and a new 6-pin diagnostic connector are but a few of the changes technicians will see on Indmar's 2006 MEFI-5 equipped engine line up.

Software update kits for Rinda Technologies marine service tools are available for these new EFI systems. Please contact us for additional details.

From the TOP

What's trendy in California eventually becomes trendy across the rest of the USA. At least that's the informal theory which has applied to everything from hot rods and iPods to Googleing our fingers away on the famous Silicon Valley based company's website. Not surprisingly, the theory has also applied to emission regulations.

Marine manufacturers have been working overtime to implement emission control technologies on their engines in order to comply with upcoming California marine emission laws. Catalytic converters, oxygen sensors and upgraded engine control modules are among the new devices you will see. Although the emission requirements only apply to marine engines sold in California, there's a good chance this trend will eventually propagate or, at the very least, cause technological changes to engines sold in all 50 states.

We have been working closely with marine engine manufacturers to ensure that our diagnostic tools will support the requirements of these new systems and regulations. This issue of EFI Connections features some of the newest systems being implemented and highlights what you will need in order to be prepared for marine engine service in 2006 and beyond.

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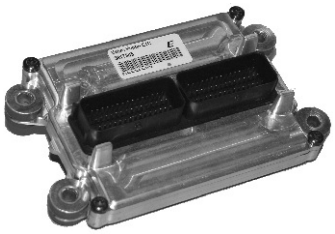
Volvo Penta's new generation EGC system

Marine technicians peeking under the engine hatches of 2006 Volvo Penta powered boats may notice something different. It's Volvo's new Electronic Gas Control (EGC) engine management system. The EGC system represents a significant step forward in Volvo Penta's trend toward increasingly sophisticated vessel / propulsion control. Two EGC system types are currently in production, one with electronic throttle control capabilities and one designed for standard cable driven throttle systems.



EGC supplants the prior Delphi MEFI-4 control system that Volvo Penta had used on all of their gasoline EFI engines since 2001. In addition to providing fully sequential fuel injection the new system is designed to accommodate future exhaust catalyst monitoring functions. Catalyst monitoring signifies Volvo Penta's preparation for compliance with California's upcoming marine emission requirements.

Identification of engines equipped with the EGC system is fairly easy as they incorporate a new, distinctively shaped, 90 pin electronic control module (shown at left) and also have an 8 pin diagnostic data connector.

Updated diagnostic tools along with new service procedures are among the requirements technicians will be confronted with when attempting to service engines based upon the EGC system.

Update kits are available for all of Rinda Technologies hand-held and PC based diagnostic tools to support Volvo Penta EGC equipped engines. Please contact us for details on upgrading your tools.

Indmar blazes ahead with Delphi's MEFI-5 system

Indmar, a premier manufacturer of inboard engines for the ski boat industry, is the first marine engine builder to utilize Delphi's new MEFI-5 engine management system. MEFI-5 (shown here and on page 1) is the first marine control system from Delphi to incorporate integrated electronic throttle control, sequential fuel injection and, in anticipation of future California emission rules, catalyst monitoring capabilities.

Unlike prior generations of MEFI modules, MEFI-5 is actually a spin-off from one of Delphi's high-volume automotive engine management systems. Seeking to provide more sophisticated features at a lower cost to the marine industry, Delphi engineers based MEFI-5 off of one of their new "engine mountable" automotive ECMs. Delphi programmers then completely re-engineered the module's software and tailored it specifically for marine use. The result is an outstanding marine engine management system that exceeds the capabilities of any prior MEFI system Delphi has offered.

Technicians should note that diagnostics on MEFI-5 are performed exclusively though a high speed CAN network interface. This interface is similar (though not identical) to Mercury's Smartcraft CAN network. CAN based diagnostics are the wave of the future in the marine industry and will also be required to comply with California's upcoming marine emission legislation.

New software as well as update kits are available for Rinda Technologies service tools to support MEFI-5 diagnostics. Please contact us for details on upgrading your existing tools.

Being Prepared for EFI Service

What you need to know, and grow...

The phone calls have become all too familiar as another warm summer day begins at our facility in Chicago. A service manager from a marina in Michigan is on the line who says in a slightly panicked voice, "I need one of your engine scanners, how fast can you get it here? Can you ship it overnight?"

After asking a few basic questions an all-too-common story unfolds; the service manager states "I have an inboard here that won't run over 2800 rpm, the boat has been here for two weeks and the customer is furious, he wants it repaired by the weekend."

A Prerequisite

These last minute, panic induced requests for our marine diagnostic tools have unfortunately become commonplace during the height of boating season every year. Even though electronic fuel injection (EFI) has been available on stern drive and inboard engines for nearly 14 years many dealerships are not sufficiently prepared to diagnose and service these engines.

We routinely receive calls from dealerships that have yet to equip themselves with even the most basic EFI service tools. One common statement we hear from these facilities is "we have many customers who own EFI engines but none of them has had a problem yet". While this may be a wonderful testament to the reliability of modern marine engines, it is specifically this unpreparedness that causes a significant amount of customer dissatisfaction, lengthy repair times and, in some cases, unnecessary repairs.

Moving Target

In addition to actually owning EFI service equipment, being "prepared" for EFI service encompasses much more than just having an engine scanner in your toolbox. It involves keeping the equipment up-to-date with the latest software, having the latest service information available and also participating in the training programs offered by marine engine manufacturers. In this article we hope to provide you with some insight into the latest developments in EFI technology and how it will affect your service department. Marine EFI systems are a moving target, even though you may have gone to service school and purchased diagnostic tools "just a few years ago", your knowledge along with your service tool's capabilities may already be out-of-date to handle this year's models.

Background

Gasoline sterndrive and inboard marine engines have changed dramatically since the introduction of electronic fuel injection in 1992. Some of the changes have been manufacturer induced, providing better engine control and performance, other changes have been brought on to comply with governmental and environmental requirements. As a result of these collective forces, marine engines have steadily grown in electrical complexity thereby requiring more sophisticated tools and training to properly service.

Transition to EFI

In the 1990s carburetors began to disappear as marine engine manufacturers began shifting their engine product lines toward electronic fuel injection. Today that transition is nearly 100% complete as evidenced by most sterndrive and inboard engines being sold as EFI models only. Even though a few carbureted models are still available the venerable marine carburetor is about to be transitioned into a museum exhibit, right next to the coal-fired boilers of yesteryear.

Evolution in Throttle Control

While the number of marine EFI engine models grew throughout the 1990's as well as the beginning of this decade, marine EFI technology took its next major step forward about four years ago with the introduction of Electronic Throttle Control (ETC). This evolutionary step was brought on by advances in engine electronics that allowed manufacturers to implement "throttle-by-wire" systems which eliminate the need for mechanical throttle control cables. ETC systems send electronic signals from one or more helm throttle levers back to the engine control module to regulate engine speed and also perform shift functions. Similar systems were used in large diesel powered vessels for many years, however newer technology has made ETC economically feasible to install on smaller watercraft including run-abouts and ski boats.

For marine technicians, electronic throttle systems have spawned a new level of troubleshooting complexity since many ETC equipped vessels have multiple computer modules interconnected through an in-vessel communication network. A basic understanding of how the network functions, knowing proper configuration and maintenance procedures, along with having the correct diagnostic tools is vital to servicing ETC equipped vessels.

Although electronic throttle systems are still in their early stages in the pleasure boat industry, most major marine engine manufacturers already have or are slated to introduce ETC systems. Boat builders are being trained to make this transition in technology with many builders already

Tech Tip

GM-Delphi EFI Part Number Reference

The GM-Delphi marine EFI engine management system was first introduced in 1992 and has been utilized by virtually all major sterndrive and inboard engine manufacturers over the years. The system has gone through several product generations and we regularly get calls from marine technicians trying to identify the various module types based upon the bar coded label that is attached to the bottom of every unit.

Below is a handy listing of all known GM-Delphi module types that have been used in the marine industry since 1992. We thank General Motor's Powertrain division for making this information available to us so we can share it with you.

Part #	Type
16159919	MEFI-1
16189069	MEFI-1
16220371	MEFI-1
16234539	MEFI-1*
16210729	MEFI-2
16237009	MEFI-3
16237019	CEFI-3
16236999	MEFI-3*
12569494	MEFI-4
12575479	MEFI-4a
12584052	MEFI-4b
12597744	MEFI-5
12607802	MEFI-5a

* Used exclusively by MerCruiser

...continued from page 3

producing one or more ETC equipped models. As a result of this activity you may see one of these systems in your dealership much sooner than you think.

Catalysts are Coming

Where internal combustion engines operate pollution unfortunately follows. Today's fuel injected gasoline marine engines are cleaner and use fuel much more efficiently than their predecessors. Unlike their automotive counterparts, sterndrive and inboard marine engines sold in the US have been void of emission controls such as catalytic converters, evaporative emission devices, exhaust gas recirculation valves, etc. They have also been exempt from the strict governmental rules that automobiles have been subjected to since the 1970s. All of that is about to change in the next few years as the state of California phases in emission regulations for marine engines. As mentioned in the side-bar on page 2, while initially required by California law, these emission requirements will likely propagate or at least cause technological changes to marine engines sold in all 50 states.

Catalytic converters along with additional sensors to monitor their operation will be among the first emission devices you will see on upcoming marine engine models, possibly as soon as the 2007 model year. Electronic control modules on these engines will be required to perform additional diagnostic tests in order to comply with legislation and as a result will dictate changes to engine service tools and procedures. A considerable amount of this is still in the formative stage with details being worked out by the marine industry and the legislators, however it is not a matter of "if" emission requirements will be phased in, it is only a matter of when. As of this writing the implementation of California marine emission requirements will likely begin between 2008 and 2010.

Increasing Complexity

Over the past 14 years marine engine technology has steadily increased its reliance on computerized engine control systems and electronics. Troubleshooting and routine maintenance tasks that once required little more than a toolbox full of basic mechanical tools now require the use of electronic engine scanners, PC based diagnostic tools as well as knowledge of electronic and electrical systems. Marine dealerships will be required to service increasingly complex systems in a prompt and efficient manner to maintain customer satisfaction and also retain profitability in their service department.

Key Recommendations

Following are some recommendations to help service technicians stay on top of the rapidly changing marine engine technology.

- Stay up to date with engine manufacturer's service manuals and bulletins. Most manufacturers now make their service literature available in electronic form. A single CD can replace an entire bookshelf full of printed manuals. Using CDs you will also be able to store all of that information on your PC so it's readily accessible and easily searchable.
- Attend the engine and boat manufacturer's service schools on a regular basis. Most of the manufacturers kick off their training sessions in the fall of each year. Obtain their schedules and make a commitment to attend.
- Invest in the proper diagnostic tools to maintain your service capabilities, increase efficiency and profitability. Not having the proper tools will cost you (and your customers) time, money and also have a negative impact on customer satisfaction.
- Keep your service tool's software up to date, check with the tool's manufacturer for updates and revisions.
- Be aware of major changes in the personal computer industry. Many service tools, such as our Diacom software, operate on a notebook PC platform and rely on a minimum level of hardware and Windows software to function properly. Check with the diagnostic software manufacturer to be sure you are running an acceptable PC system.
- If you are unfamiliar with PC technology, enroll in a PC familiarization course at your local community college. A marine dealership's reliance upon PCs is increasing and it is important to have good basic skills when operating one.

DIACOM® Marine

Advanced diagnostics for MerCruiser, Volvo Penta, Indmar, Pleasurecraft Marine, Crusader, Marine Power, Kodiak, Flagship Marine, GM RamJet crate engines and more....

- **Productivity equals profitability.** Leverage the computing strength of industry standard notebook PCs to diagnose EFI faults in less time.
- **Stay compatible and competitive.** Easily access CD based service information, exchange engine data over the Internet, free yourself from dedicated diagnostic tools and take advantage of the latest notebook PC technology.

The Diacom PC based diagnostic system gives you the power and flexibility you need to troubleshoot today's advanced marine EFI systems. Diacom Marine breaks down the barriers between you and your troubleshooting tasks with it's intuitive features and complete set of analysis tools. Now you can harness the power of your notebook PC and turn EFI numbers into answers.

PC Diagnostic Power

Diacom Marine is a powerful Windows based diagnostic tool that is revolutionizing marine engine service. With advanced engine control systems now standard on nearly all gasoline inboard and stern drive engines, you need a service tool that pinpoints problems quickly and accurately. Diacom unlocks the computing power of your notebook PC and provides state-of-the-art features that simply leave other diagnostic tools in it's wake.

You Spoke, We Listened

We started with a blank screen and designed Diacom Marine from the ground up with your feedback and suggestions in mind. After all, who knows better than you when it comes to getting your job done? Over the past decade we've collected a wealth of knowledge from the marine service technicians and dealerships we support. This gave our engineers quite a wish list of features to consider. Thanks to your input, Diacom has been made more intuitive, more streamlined, and more discoverable, so you can complete all of your work in less time.

Internet Connectivity

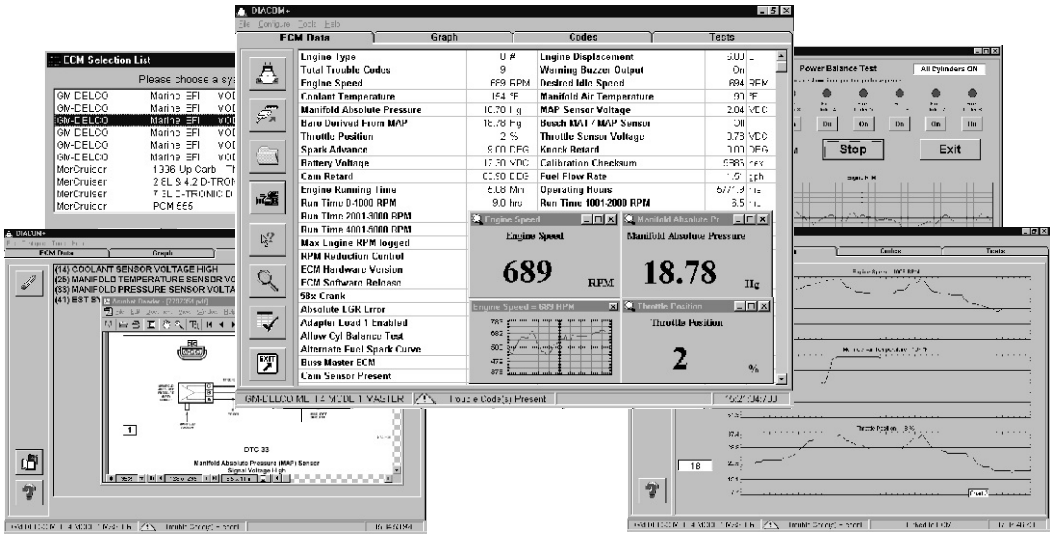
Chances are the Internet has already changed the way you interact with your customers and suppliers. Now it will change the way you troubleshoot. Diacom was

designed to be Internet "aware" and provides features that allow the easy exchange of data with other parties. Diacom can also convert engine data into formats easily read by other popular PC programs such as Microsoft Excel and Access.

Rinda Technologies Inc.

DIACOM® Marine

Speed, precision, power and flexibility. Professional features to get the job done.



Big Screen, Huge Advantage

Notebook screens have never been bigger and brighter. Diacom takes full advantage of your PC's expansive display and shows you the "Big Picture" of what's happening. Now you can spend less time pressing scanner buttons, scrolling through lists of parameters, and more time seeing what your EFI numbers mean. Diacom's data display can be easily customized allowing you to view each EFI system type in a way that best suits your taste. Throw in features such as side-by-side twin engine displays, instant pop-up graphs, enlarged parameter windows, extensive data recording capabilities, report printing, and you'll see why more marine technicians are choosing Diacom than ever before.

The Electronic Information Age

All of those years of searching through stacks of service manuals and technical bulletins are finally coming to a close. Most manufacturer's now provide engine service information on CDs which can be easily searched and updated. Diacom has been designed to seamlessly access this information, displaying it effortlessly and accurately when you need it most. Simply click on any trouble code in Diacom's display screen to launch the service information feature[1].

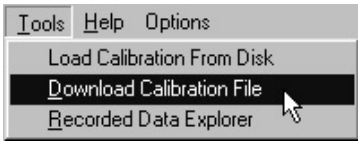
Tests Made to Order

The marine industry's ever increasing variety of EFI systems unfortunately means that tests designed for one type of engine control system probably won't apply to other systems.

Diacom's adaptable "Tests" screen is designed to automatically configure itself for the EFI system under investigation. Using Windows ActiveX programming technology, this feature simplifies your work by displaying and delivering the unique set of tests that apply to the particular system you are troubleshooting.

Special Functions

As a factory authorized dealership you know the value of having the latest service technology at your fingertips. Working closely



with marine engine manufacturers, we have incorporated specialized EFI system functions[2] into Diacom Marine. Now factory authorized service facilities can use a single integrated diagnostic program to not only troubleshoot but also perform system upgrades and memory updates electronically in just minutes. ECM exchanges can now be minimized and in most cases entirely eliminated.

For More Information

To obtain a comprehensive list of features and information about Diacom Marine as well as other Rinda Technologies products, please visit our website at www.rinda.com. Product specialists can also be reached in the USA and Canada by calling 773-736-6633.

System requirements

To use Diacom, you need:

- PC with Pentium 200 MHz or higher processor
- Microsoft Windows 98, Windows 98 Second Edition, Windows Millennium Edition, Windows XP, or Windows 2000
- For Windows 98 and Windows 98 Second Edition
  - 64 MB of RAM minimum
- For Windows Millennium Edition, Windows XP or Windows 2000
  - 128 MB of RAM minimum
- 50 Meg or greater of available hard disk space.
- CD-ROM drive
- 9 pin serial COM port or USB port.
- VGA (640 x 480) or higher resolution display screen with 256 colors or greater.
- Mouse, touchpad, or compatible pointing device.

Additional items or services required to use certain features:

- Internet connection for email and web related features.
- Appropriate document viewing utilities such as Adobe Acrobat and Microsoft Internet Explorer to view electronic service information.
- Diacom special functions require usage authorization and data files supplied by engine manufacturers.

1. Engine service manuals in electronic format must be obtained from the engine and /or vehicle manufacturers.
2. Usage restrictions apply based upon dealer type and status. Diacom special functions vary with EFI system type and engine manufacturer.

Please note all specifications are subject to change without notice. Photos and screen images shown may differ based upon product version or other factors. Information presented in this document is believed to be accurate. Responsibility for errors, omission of information or results from the use of this information cannot be assumed by Rinda Technologies, Inc.

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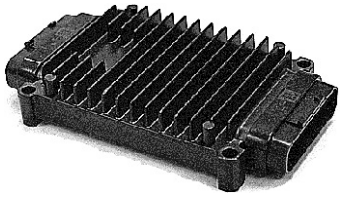
EFI Toolbox



Products for Marine Service Technicians

MerCruiser - Scan Tool

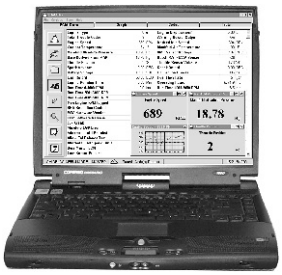
Developed specifically for MerCruiser dealerships worldwide, this scan tool packs powerful diagnostic features and provides support for sterndrive and inboard EFI systems from virtually all major marine engine manufacturers. The MerCruiser scan tool displays complete EFI system information allowing quick problem diagnosis. This tool also features functional test capabilities to exercise ECM outputs, has a built-in fuel injector tester and is supplied in a padded hard shell carrying case.

#94050m **$399.00**

TechMate - Scan Tool

Designed for independent repair shops, this close cousin of the MerCruiser scan tool displays complete EFI system information and supports all major sterndrive and inboard manufacturers. TechMate displays live sensor readings, ECM fault codes and provides fault code explanations. Its built-in fuel injector tester performs single pulse and multi-pulse tests to locate injector problems. Functional test capabilities allow EFI outputs to be exercised for component testing. TechMate is supplied in a padded hard shell carrying case.

#94040 **$399.00**



Diacom Marine - PC software

Diacom Marine harnesses the power of your notebook PC to form a sophisticated EFI diagnostic system. Supporting all major sterndrive and inboard engine manufacturers, Diacom Marine allows a technician to quickly view engine performance data and zero in on malfunctions. Diacom Marine is capable of recording and graphing data from all accessible EFI system sensors and controls to help you zero in on intermittent problems.

#94010	**(standard kit)**	**$579.00**
#94010v	**(includes Volvo EGC)**	**$649.00**
#94030	**(includes MEFI-5 CAN)**	**$699.00**

Upgrade Kits - for existing tools

#94091	Diacom Upgrade for Volvo EGC	(specify serial or USB kit)	**$199.00**
#94081	Diacom Upgrade for MEFI-5 CAN	(specify serial or USB kit)	**$249.00**
#94086	Diacom EGC / MEFI-5 bundle	(specify serial or USB kit)	**$299.00**
#94056	Scan Tool 4.9 Upgrade (includes EGC)		**$149.00**
#**94058**	Scan Tool Upgrade for MEFI-5		**Coming Soon!**

EFI Diagnostic Adapters

#94005	GM-Delphi MEFI 1 - MEFI 4b	**$39.00**
#**94006**	MerCruiser PCM / ECM 555	**$39.00**
#94014	MerCruiser 2.8L / 4.2L D-tronic diesel	**$39.00**
#94020	MerCruiser Thunderbolt V	**$49.00**
#94021	MerCruiser 7.3L D-tronic diesel	**$49.00**
#**94023**	GM-Delphi MEFI-5 CAN network interface	**$249.00**
#94024	Volvo Penta EGC	**$49.00**
#**94022**	KEM Industrial EFI	**$49.00**
#94011	Mercury 3.0L outboard	**$39.00**
#**94013**	Mercury Racing 2.5L outboard	**$39.00**

For a complete list of our marine products please visit www.rinda.com

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Important Information for Marine Service Technicians