WOODWARD

Product Manual 26634
(Revision C, 03/2022)
Original Instructions

SECM112 Digital Control

Vehicular Applications
Hardware Only

Installation Manual

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, on the *publications page* of the Woodward website:

http://www.woodward.com

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions— A bold, black line alongside the text identifies changes in this publication since the last revision.

Manual 26634

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Important Definitions

This is the safety alert symbol used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER** - Indicates a hazardous situation, which if not avoided, will result in death or serious injury.
- **WARNING** - Indicates a hazardous situation, which if not avoided, could result in death or serious injury.
- **CAUTION** - Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury.
- **NOTICE** - Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT** - Designates an operating tip or maintenance suggestion.

⚠WARNING

Lockout/Tagout

Ensure that personnel are fully trained on LOTO procedures prior to attempting to replace or service equipment on a "live" running engine. All safety protective systems (overspeed, over temperature, overpressure, etc.) must be in proper operational condition prior to the start or operation of a running engine. Personnel should be equipped with appropriate personal protective equipment to minimize the potential for injury due to release of hot hydraulic fluids, exposure to hot surfaces and/or moving parts, or any moving parts that may be activated and are located in the area of control of the equipment.

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

WARNING

Automotive Applications

On- and Off-Highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

WARNING

IOLOCK

IOLOCK: driving I/O into a known state condition. When a control fails to have all the conditions for normal operation, watchdog logic drives it into an IOLOCK condition where all output circuits and signals will default to their de-energized state as described below. *The system MUST be applied such that IOLOCK and power OFF states will result in a SAFE condition of the controlled device.*

- **Microprocessor failures will send the module into an IOLOCK state.**
- **Discrete outputs / relay drivers will be non-active and de-energized.**
- **Analog and actuator outputs will be non-active and de-energized with zero voltage or zero current.**

Network connections like CAN stay active during IOLOCK. This is up to the application to drive actuators controlled over network into a safe state.

The IOLOCK state is asserted under various conditions, including:

- **Watchdog detected failures**
- **Microprocessor failure**
- **PowerUp and PowerDown conditions**
- **System reset and hardware/software initialization**
- **PC tool initiated**

NOTE—Additional watchdog details and any exceptions to these failure states are specified in the related section of the product manual.

NOTICE

Battery Charging Device

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Regulatory Compliance

International Compliance

UNECE Type approved to UNECE Regulations 10, 67, and 110.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Touch your finger to a grounded surface to discharge any potential before touching the LECM or installing cabling connectors. Alternatively, ESD mitigation may be used as well: ESD smocks, ankle or wrist straps and discharging to a reference grounds surface like chassis or earth are examples of ESD mitigation.
    - ESD build up can be substantial in some environments: the unit has been designed for immunity deemed to be satisfactory for most environments. ESD levels are extremely variable and, in some situations, may exceed the level of robustness designed into the control. Follow all ESD precautions when handling the unit.
        - I/O pins within connectors have had ESD testing to a significant level of immunity to ESD, however do not touch these pins if it can be avoided.
            - Discharge yourself after picking up the cable harness before installing it as a precaution.
        - The unit is capable of not being damaged or improper operation when installed to a level of ESD immunity for most installation as described in the specifications. Mitigation is needed beyond these specifications.

IMPORTANT

External wiring connections for reverse-acting controls are identical to those for direct-acting controls.

Chapter 1.
General Information

Introduction

Scope

The intent of this document is to detail the installation requirements of the 112-pin Small Engine Control Module (SECM112). This module was previously referred to as ECM-OH (On-Highway). Active SECM112 part numbers are listed in Table 1-1.

Table 1-1. SECM112 Part Numbers

Module	Description
	SECM112 MY12
1751-6601	MODULE - ECM-OH-01C OH6 CALIBRATIBLE CONTROL MODULE (MPC5644)
1751-6605	MODULE - ECM-OH-01 OH6 PRODUCTION CONTROL MODULE (MPC5642)
1751-6605-XX	MODULE - ECM-OH-01 OH6 PRODUCTION CONTROL MODULE (MPC5642)
1751-6605-XXX	MODULE - ECM-OH-01 OH6 PRODUCTION CONTROL MODULE (MPC5642)
	SECM112 MY18
1751-6812	MODULE - SECM112 6-IGBT & 6-INJ PRODUCTION
1751-6813	MODULE - SECM112 6-IGBT, H3 & NO INJ. PRODUCTION
1751-6814	MODULE - SECM112 6-IGBT, H3 & 4-INJ PRODUCTION
1751-6815	MODULE - SECM112 6-IGBT & 6-INJ CALIBRATION
1751-6816	MODULE - SECM112 6-IGBT, H3 & NO INJECTORS CALIBRATION
1751-6817	MODULE - SECM112 6-IGBT, H3 & 4-INJ CALIBRATION
	SECM112 MY20
1751-6852	MODULE – SECM112 6-IGBT, H3 & NO INJ, AN34-37 (MPC5644)
1751-6854	MODULE – SECM112 6-IGBT, 6-INJ, AN34-37 (MPC5644)
1751-6862*	MODULE - SECM112 6-IGBT & 6-INJ, AN34-37 CUSTOM, CAL (MY20)
1751-6863*	MODULE - SECM112 6-IGBT, H3 & 4-INJ, AN34-37, CUSTOM, CAL (MY20)
1751-6864*	MODULE - SECM112 6-IGBT, H3 & NO INJECTORS, AN34-37, CAL, NO CAN3 TERM (MY20)

XX and XXX – Alpha characters designated for specific customer's application
(*) MY20 Customer specific part numbers

Overview

The SECM112 is a full-authority engine control module capable of withstanding the environment within the engine compartment and either on- or off-engine mounting. The 4 mounting feet on the controller were designed to accept specific rubber grommets and aluminum bushings to provide both vibration isolation and electrical isolation of the module case from chassis ground. This mounting hardware is pre-installed on the part numbers listed above.

Environmental Requirements

Vibration and Shock

The SECM112 is designed for engine mount operation with the vibration isolators. If the SECM112 is mounted on a bracket not provided by Woodward, the bracket needs to be evaluated in the application. It is possible for a bracket resonance to be incompatible with the SECM112 product, causing premature failure of the module.

The vibration integrity of the SECM112 for a given installation can be verified by measuring the vibration spectrum of an installed unit when the engine / vehicle is operated under worst-case vibration conditions.

The vibration spectrum needs to be measured with an accelerometer on the SECM112 mounting foot as shown in Figure 1-1. If the measured spectrum is within the RV3 de-rated spectrum illustrated in red in Figure 1-2, the mounting location is acceptable for vibration.

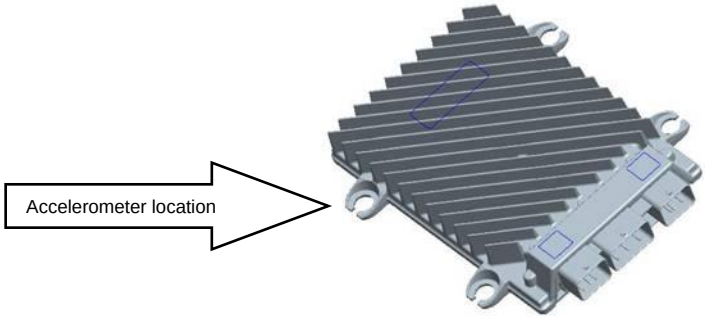

Figure 1-1. Location of Accelerometer to Measure Mounting Vibration

The harness must be firmly secured at a tie-down length not to exceed 150 mm from the center of the connectors.

Random Vibration

The SECM112 shall survive Woodward's RV3 random vibration specification (22.1 Grms / 3 hours per axis) per Woodward procedure 3-04-6231. The RV3 random vibration profile is illustrated in Figure 1-2 (blue line). A de-rated installation RV3 vibration for an estimated 7-year life is shown in red.

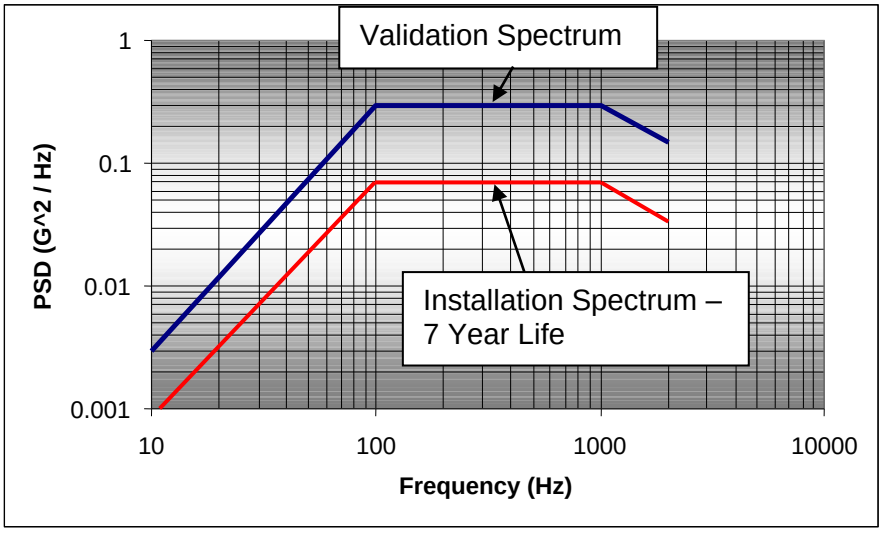

Figure 1-2. Random Vibration Spectrum

Temperature

The SECM112 is designed to be thermally isolated from the mounting surface and relies on air convection for cooling based on a minimum air flow at the worst-case operation mode. The following ratings apply to the SECM112 when installed properly:

- Ambient Operating Temperature: –40 °C to +105 °C
- Minimum Operating Airflow: 2 m/s
- Heat Soak Maximum Temperature: +125 °C

Customers can verify the temperature in the desired mounting location by placing a thermocouple in the air near the operating SECM112. If the external ambient conditions are not worst-case, this needs to be taken into consideration when measuring the SECM112 package temperature. If the measured air temperature when operating at worst-case (fastest) engine speed and worst-case (hottest) ambient conditions is less than 105 °C, the mounting location thermal stress is acceptable for the SECM112.

Chapter 2.
SECM112 Installation

Isolators

The SECM112 has 4 mounting feet and Figure 2-1 illustrates the isolator assembly pre-assembled on the module. All variants of the module come from the factory with the grommet and bushing pre-installed. Washers must be used and are provided by Woodward (default) or the user (upon request).

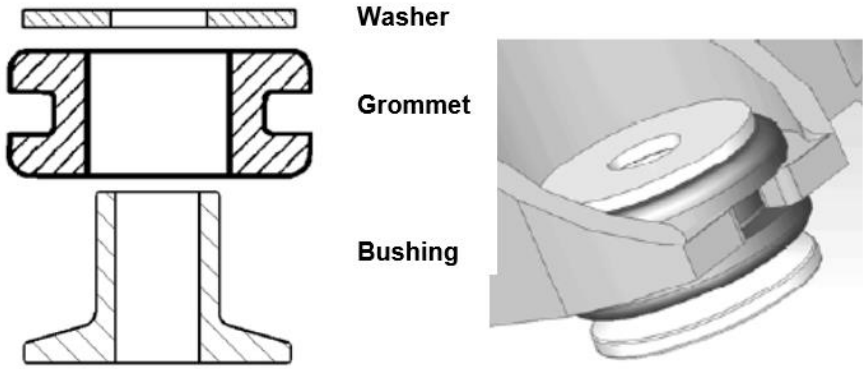

Figure 2-1. SECM112 Isolators

The isolator kit must be inspected for wear at least once per year. For on-engine mounting, Woodward recommends replacing the vibration isolators once a year or sooner if wear is observed.

Mounting

Figure 2-2 illustrates the package outlines. Measurements shown are in millimeters and [inches].

When installing the module into customer locations, Woodward recommends using an M6, ANSI B18.2.3.1M-1979 (R1995), ANSI B18.2.3.5M-1989, or DIN 931/DIN 933 metric hex screw with an 6 mm ANSI B18.22M-1981 (R1990) narrow metric plain washer that has a maximum outer diameter of 18.80 mm. Recommended torque for M6 hex screw: 57-67 IN_LBS [6.5-7.6 Nm]

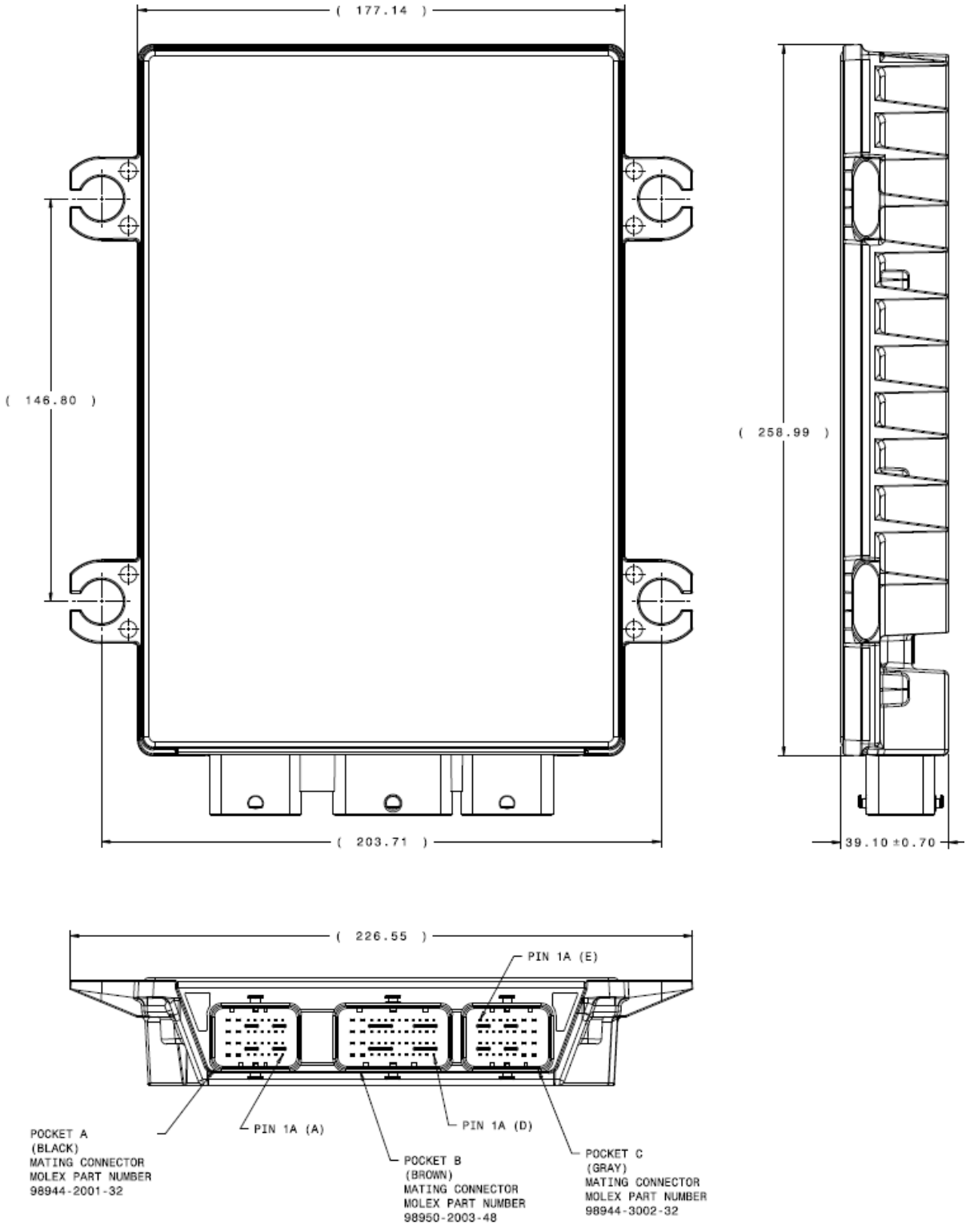

Figure 2-2. SECM112 Outline

Orientation

The SECM112 connector is rated for high pressure spray to IP6K9K; however, it is not recommended to mount with the connector facing up or with the harness routed upward directly from the module. This orientation can allow moisture to run down the harness to the wire seals in the connectors. The module must be mounted with the heat fins facing outwards to maximize airflow over the fins.

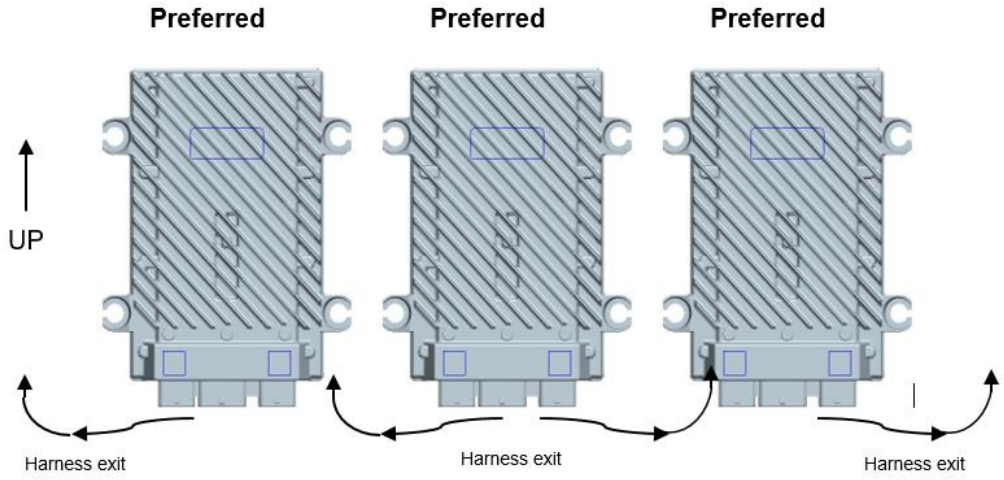

Figure 2-3. Preferred SECM112 Mounting Orientations

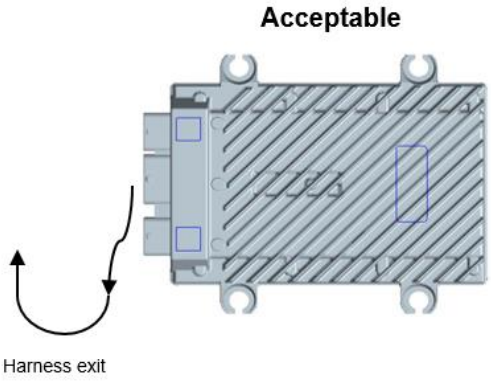

Figure 2-4. Acceptable SECM112 Mounting Orientations

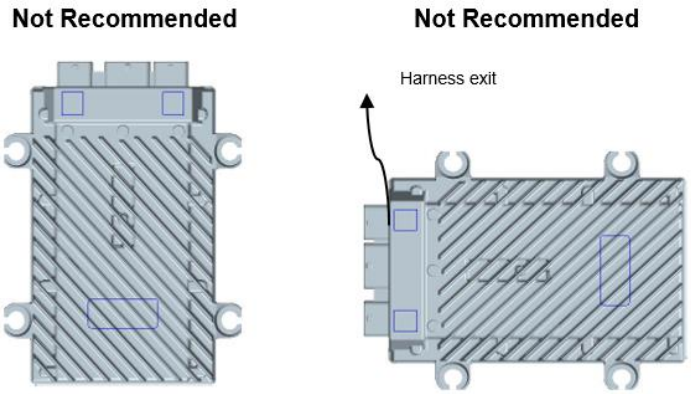

Figure 2-5. Not Recommended SECM112 Mounting Orientations

Harness Clearance

The minimum recommended clearance from the edge of the connector header to other objects is 75 mm as illustrated below.

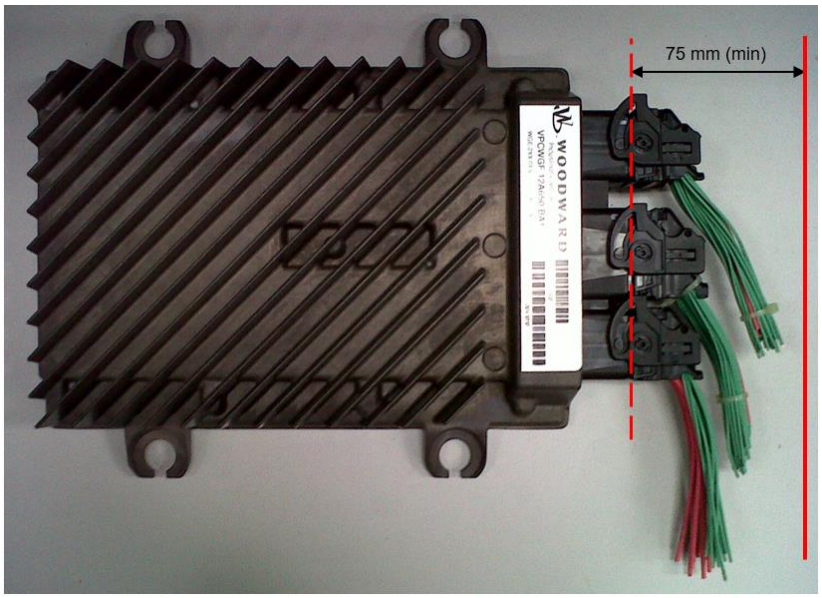

Figure 2-6. Harness Clearance

Connector Information

The SECM112 mating connectors, terminals, wire cap (backshells), and wire plug part numbers are listed in Table 2-1 below. Note that the center grey connector has the opposite orientation to the others. All unused pins must be plugged with the proper wire plugs to maintain environmental integrity. Reference Molex CMC connector application specification # AS-64319-002 rev. D (or later) for proper terminal and connector installation requirements and product specification # PS-64319-001 rev. D (or later) for connector specifications. Only the Molex connectors and terminals have been validated by Woodward. Any alternates will require customer validation for the environment in which they are used.

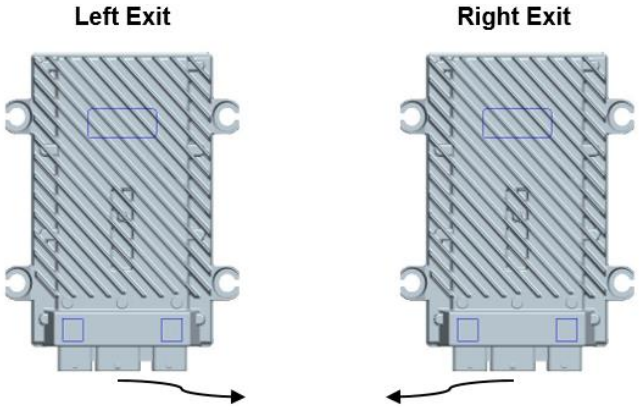

Figure 2-7. SECM Connector Orientations

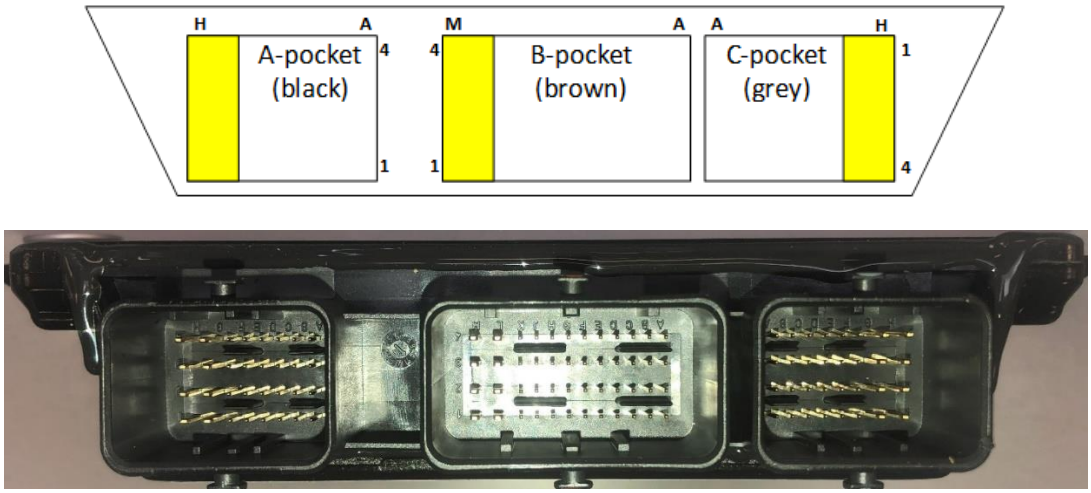

Figure 2-8. Connector Physical Pinout

Table 2-1. Connector System Part Numbers

Item	Molex PN	Woodward PN
Connectors (for Left Exit)		
32-pin, black (A), left wire output	643191211	
32-pin, grey (C), right wire output	643193218	
48-pin, brown (B), left wire output	643201319	
Connectors (for Right Exit)		
32-pin, black (A), right wire output	643193211	1635-2118
32-pin, grey (C), left wire output	643191218	1635-2119
48-pin, brown (B), right wire output	643203319	1635-2120
Terminals (Gold Plated)		
0.6 mm for 0.35 to 0.44 mm² wire (1.25 to 1.40 mm insulation)	643221229	1602-1208
0.6 mm for 0.50 mm² wire (1.40 to 1.70 mm insulation)	643221239	1602-1209
0.6 mm for 0.75 mm² wire (1.60 to 1.90 mm insulation)	643221219	1602-1210
1.5 mm for 0.50 to 1 mm² wire (1.40 to 2.15 mm insulation)	643231319	1602-1211
1.5 mm for 1 to 2 mm² wire (2.10 to 2.80 mm insulation)	643231219	1602-1212
Wire Caps		
32-pin	643191201	1219-1225
48-pin	643201301	1219-1226
Wire Plugs		
0.6 mm	643251010	1223-1330
1.5 mm	643251023	1223-1331

Table 2-1. Connector System Part Numbers (cont'd.)

Item	Molex PN	Woodward PN
Hand Crimper Tools		
0.6 mm (0.35 to 0.5 mm²)	638119100	8996-2227
0.6 mm (0.5 to 0.75 mm²)	638119200	8996-2228
1.5 mm (0.5 to 1 mm²)	638118900	8996-2229
1.5 mm (1 to 2 mm²)	638119000	8996-2230
Terminal Removal Tools		
0.6 mm	638132400	n/a
1.5 mm	638132300	n/a
Applicator Crimpers		
0.6 mm (0.35 to 0.5 mm²)	639021900	n/a
0.6 mm (0.5 to 0.75 mm²)	639022000	n/a
1.5 mm (0.5 to 1 mm²)	638688000	n/a
1.5 mm (1 to 2 mm²)	638688100	n/a

Table 2-2. Connector Kit

Kit P/N	Kit Contents	
	Woodward PN	Quantity
8923-1930 (Right Exit)	1635-2120	1
	1635-2119	1
	1635-2118	1
	1602-1211	30
	1602-1210	100
	1223-1331	10
	1223-1330	40
	1219-1226	1
	1219-1225	2

Chapter 3
Product Support and Service Options

Product Support Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

1. Consult the troubleshooting guide in the manual.
2. Contact the **OE Manufacturer or Packager** of your system.
3. Contact the **Woodward Business Partner** serving your area.
4. Contact Woodward technical assistance via email (**EngineHelpDesk@Woodward.com**) with detailed information on the product, application, and symptoms. Your email will be forwarded to an appropriate expert on the product and application to respond by telephone or return email.
5. If the issue cannot be resolved, you can select a further course of action to pursue based on the available services listed in this chapter.

OEM or Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full-Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.

A current list of Woodward Business Partners is available at **www.woodward.com/directory**.

Product Service Options

Depending on the type of product, the following options for servicing Woodward products may be available through your local Full-Service Distributor or the OEM or Packager of the equipment system.

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime.

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Flat Rate Repair: Flat Rate Repair is available for many of the standard mechanical products and some of the electronic products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option, with the exception that the unit will be returned to you in "like-new" condition. This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:
- return number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:
- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Replacement Parts

When ordering replacement parts for controls, include the following information:
- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

Engineering Services

Woodward's Full-Service Distributors offer various Engineering Services for our products. For these services, you can contact the Distributor by telephone or by email.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact.

Product Training is available as standard classes at many Distributor locations. Customized classes are also available, which can be tailored to your needs and held at one of our Distributor locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact one of the Full-Service Distributors listed at **www.woodward.com/directory**.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at **www.woodward.com/directory**, which also contains the most current product support and contact information.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used in Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Products Used in Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used in Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number _____

Prime Mover Information

Manufacturer _____

Engine Model Number _____

Number of Cylinders _____

Type of Fuel (gas, gaseous, diesel, dual-fuel, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.) _____

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Symptoms

Description _____

_____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Revision History

Changes in Revision C—

- Added Regulatory Compliance section
- Updated Table 1-1 to include SECM112 MY20 part numbers (Chapter 1)
- Revised graphic accompanying Table 2-1 (Chapter 2)
- Corrected mounting bolt size and added torque (Chapter 2)
- Eliminated Woodward part number of connector pin removal tools in Table 2-1 (Chapter 2)
- Added Table 2-2 Connector Kit description (Chapter 2)

Changes in Revision B—

- Updated part numbers in Table 1-1 (Chapter 1)
- Updated connector rating in Orientation section (Chapter 1)

Changes in Revision A—

- Updated Table 1-2 (Chapter 1)

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26634.

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