
Welcome ...

to the world of

MagicBus[®]

*An electronic solution that puts
the pleasure back into boating!*



RECREATIONAL CRAFT DIRECTIVE 94/25/EC

This product has been designed to be compliant with the above Directive.

Maximum performance, and compliance with the EMC Directive, can only be ensured by correct installation. It is strongly recommended that the installation conforms with the following standards:

APPLICABLE STANDARDS

- a) ISO 8846 Small Craft-Electrical Devices – Protection against ignition of surrounding flammable gases.
- b) ISO = International Standards Organization

SAFE BOATING STATEMENT

This device meets or exceeds the applicable ABYC, ISO, and USCG safe boating rules, regulations, standards, and guidelines.

SAFE BOATING ON THE WEB

U.S. Coast Guard www.uscg.mil
U.S. Power Squadron www.usps.org

The information contained in this manual is believed to be accurate at the time of going to print but no responsibility, direct or consequential, can be accepted for damage resulting from the use of this information. The manufacturers reserve the right to make changes, without notice, to any of its products.

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i6000 Series


User Manual

Rev. 0

Thank you for choosing Teleflex Marine, a #1 name in marine electronics. Teleflex Marine has built its reputation by designing and manufacturing top-quality, thoroughly reliable marine equipment. Your Teleflex Marine i6000 system is designed for trouble-free use in even the harshest marine environment.

We encourage you to read this manual carefully in order to get full benefit from all the features and uses of your Teleflex Marine product. Also, please register your purchase by filling out the warranty registration card at the back of this manual.

Notice to Boat Manufacturer, Installer, and Consumer

Throughout this manual, Warnings and Cautions (accompanied by the International Hazard Symbol ) are used to alert the manufacturer or installer to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly.

Observe these alerts carefully!

These “safety alerts” alone, cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing installation, operation, and maintenance plus “common sense” operation are the most effective accident prevention measures.

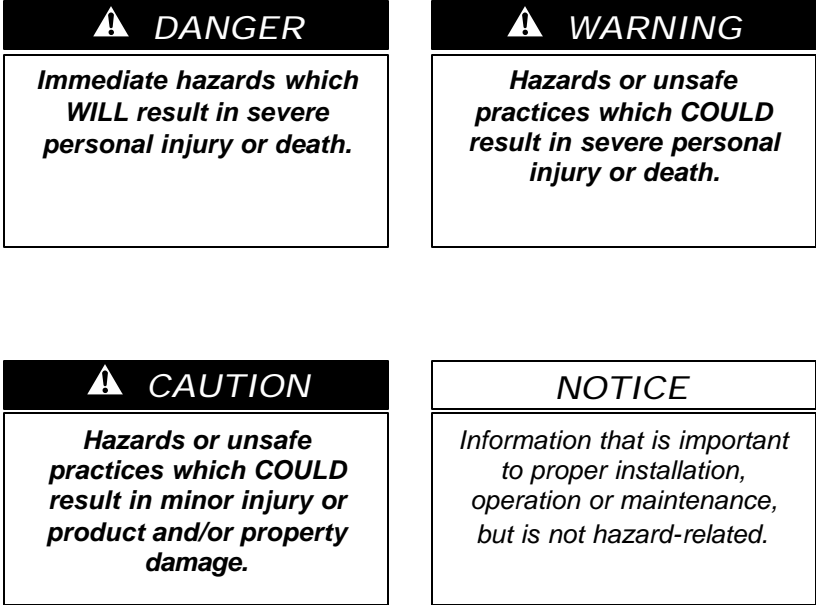


Figure 1


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Quick Start Installation & Setup Guide

Component Installation and Connection

 Required Components for a Single Station, Single Engine Configuration

 Components for Expanded Configurations

The "xx" suffix of wire harness part numbers is for the required length of the harness in feet.

MagicBus™ network - required for MagicBus™ tachometers and engine synchronization in multi-engine systems.

- CM100xx – Network comm. cable
- CM10050 - MagicBus™ Tee
- CM10051 - Male Terminator
- CM10052 - Female Terminator
- CM10401 – ECU MagicBus™ connection harness

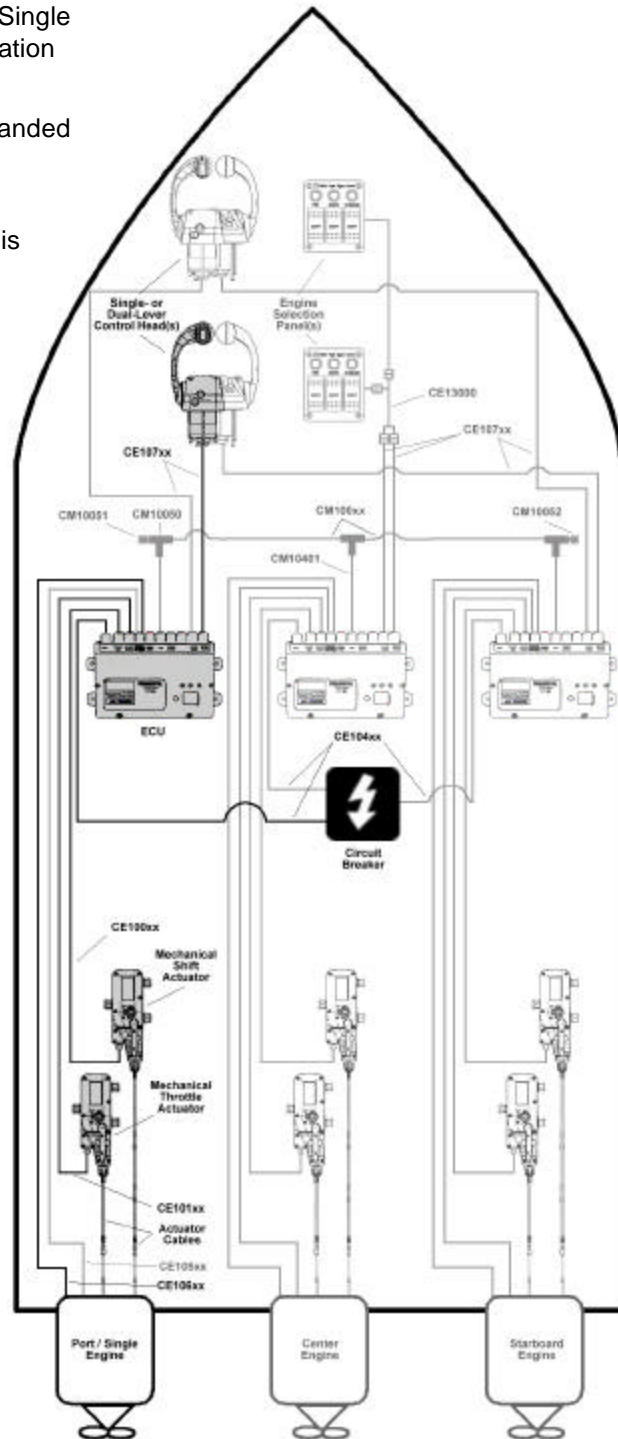
12 VDC Power must be supplied through a grounded Circuit Breaker accommodating a 10 Amp capacity per ECU installed.

Systems with Electronic Shift capability may replace the Mechanical Shift Actuator, its Actuator Cable, and its associated wire harness (CE100xx) with wire harness CE108xx, which connects directly from the ECU to the engine's electronic shifter.

Systems with Electronic Throttle Control capability may replace the Mechanical Throttle Actuator, its Actuator Cable, and its associated wire harness (CE101xx) with wire harness CE109xx, which connects directly from the ECU to the engine's electronic throttle body.

Wire harness CE105xx provides tachometer information passed on to the MagicBus™ by the ECU.

Wire harness CE106xx connects to the engine's starter or ignition circuit and provides Neutral Start Protection.

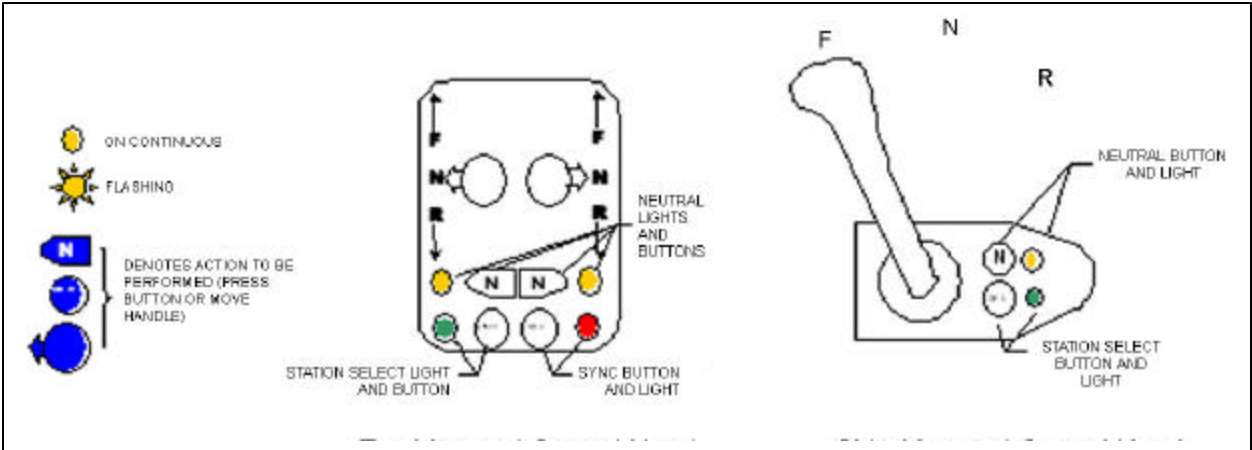


ECU Calibration and Feature Selection

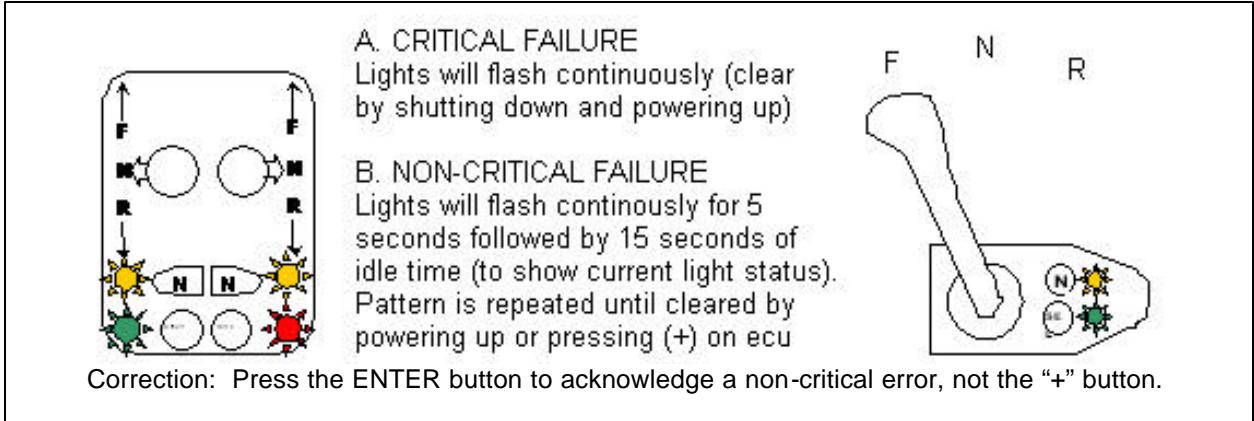
ECU Display	Menu / Options
CA	Calibration
C1	System Configuration
	C1 : Single Engine, Single Station, C2 : Single Engine, Dual Station, C3 : Dual Engine, Single Station C4 : Dual Engine, Dual Station, C5 : Single Engine, Single Function, C6 : Dual Engine, Single Function
Sd	ECU/Engine Assignment <Step skipped if configuration allows.>
	Sd :Starboard Po :Port Ce :Center
gS	Engine Type
	gS :Gas dS :Diesel Ob : Outboard
	g1 : Gas o1 : Outboard Applies Tach Filtering Band 1
	g2 : Gas o2 : Outboard Applies Tach Filtering Band 2
	g3 : Gas o3 : Outboard Applies Tach Filtering Band 3
	g4 : Gas o4 : Outboard Applies Tach Filtering Band 4
04	RPM - Pulses / Rev
	0 :No RPM, otherwise number of pulses per revolution (Range: 0 to 399)
L1	Control Head Lever 1
	FF :Full Forward IF :Idle Forward nU :Neutral Ir :Idle Reverse Fr :Full Reverse
L2	Control Head Lever 2 <Step skipped if configuration allows.>
	FF :Full Forward IF :Idle Forward nU :Neutral Ir :Idle Reverse Fr :Full Reverse
A1	Throttle Actuator <Step skipped if configuration allows.>
	PL :Pull PS :Push Cable to WOT 24 to 76 mm - Throttle Stroke, Idle to WOT SI : Set Idle position - Attach mechanical linkage
A2	Shift Actuator <Step skipped if configuration allows.>
	PL :Pull PS :Push Cable to Forward 14 to 40 mm - Forward Shift Stroke, Neutral to Forward 14 to 40 mm - Reverse Shift Stroke, Neutral to Reverse Sn : Set Neutral position - Attach mechanical linkage
EF	Electronic Throttle Engine Manufacturer <Step skipped if configuration allows.>
	EF :GM MEFI CU :Cummins CA :CAT
FE	Feature Selection
05	Throttle Limit <Step skipped if configuration allows.>
	05 up to 50%
F1	Forward Throttle Curve
	F1 though F8
r1	Reverse Throttle Curve
	r1 through r8
S	Shift Actuator Type <Step skipped if configuration allows.>
	S :Standard o :Optional, High Load
4.8	Programmable Shift Delay
	00, 1.2, 2.4, 3.6, 4.8, 6.0, 8.4, 9.6, 11, 12
XX	Fixed Shift Delay See Manual for Defaults in tenths of seconds. 2 seconds maximum.
	00, 01, 02, 03, 04, 05, 06,, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16,17,18,19, 20
oF	Station Select Protect
	oF :Protect OFF on :Protect ON
nl	Fail-Safe Response Mode <Step skipped if configuration allows.>
	nl :Neutral Idle ra :Range Gear
80	Center Engine Slave Mode <Step skipped if configuration allows.>
	80 :Follow Port 81 :Follow Same Gear 82 :Follow Reverse 83 :Neutral Disengage
90	Transmission Overshift <Step skipped if configuration allows.>
	90 :No Overshift 91 :Overshift

Quick Start Operations Guide

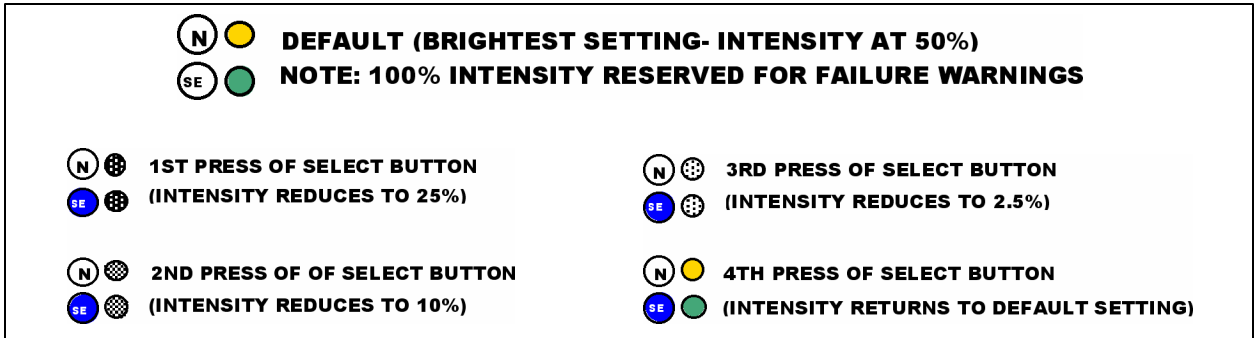
Key to Diagrams



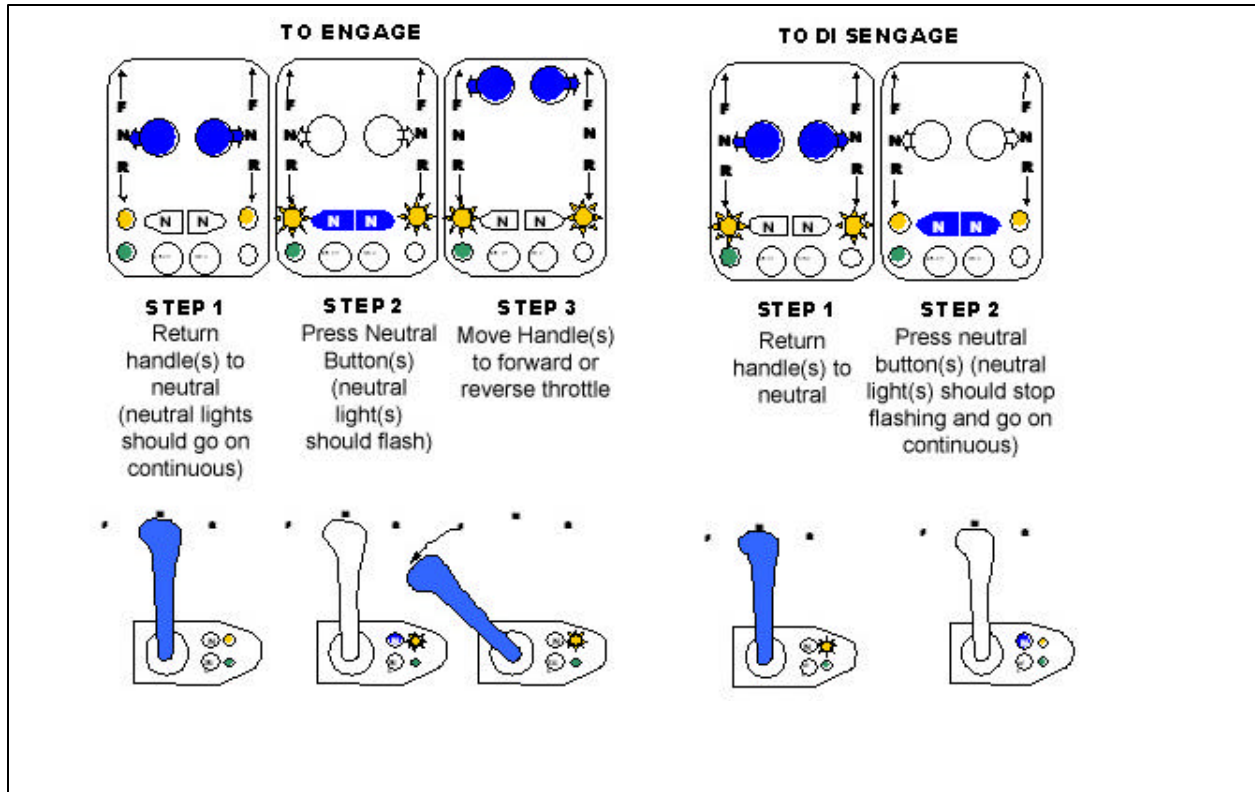
Understanding Failure Warning Indicators



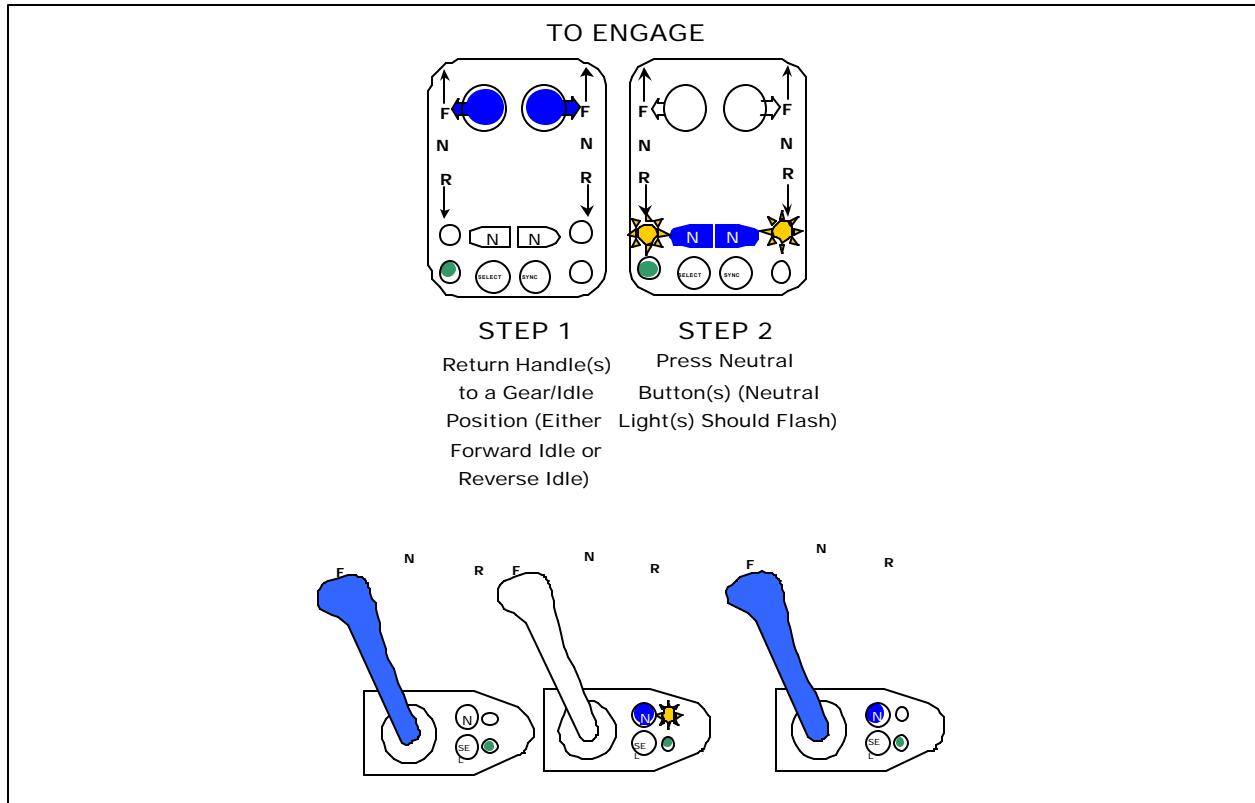
Dimming the Indicator Lamps (from the active station)



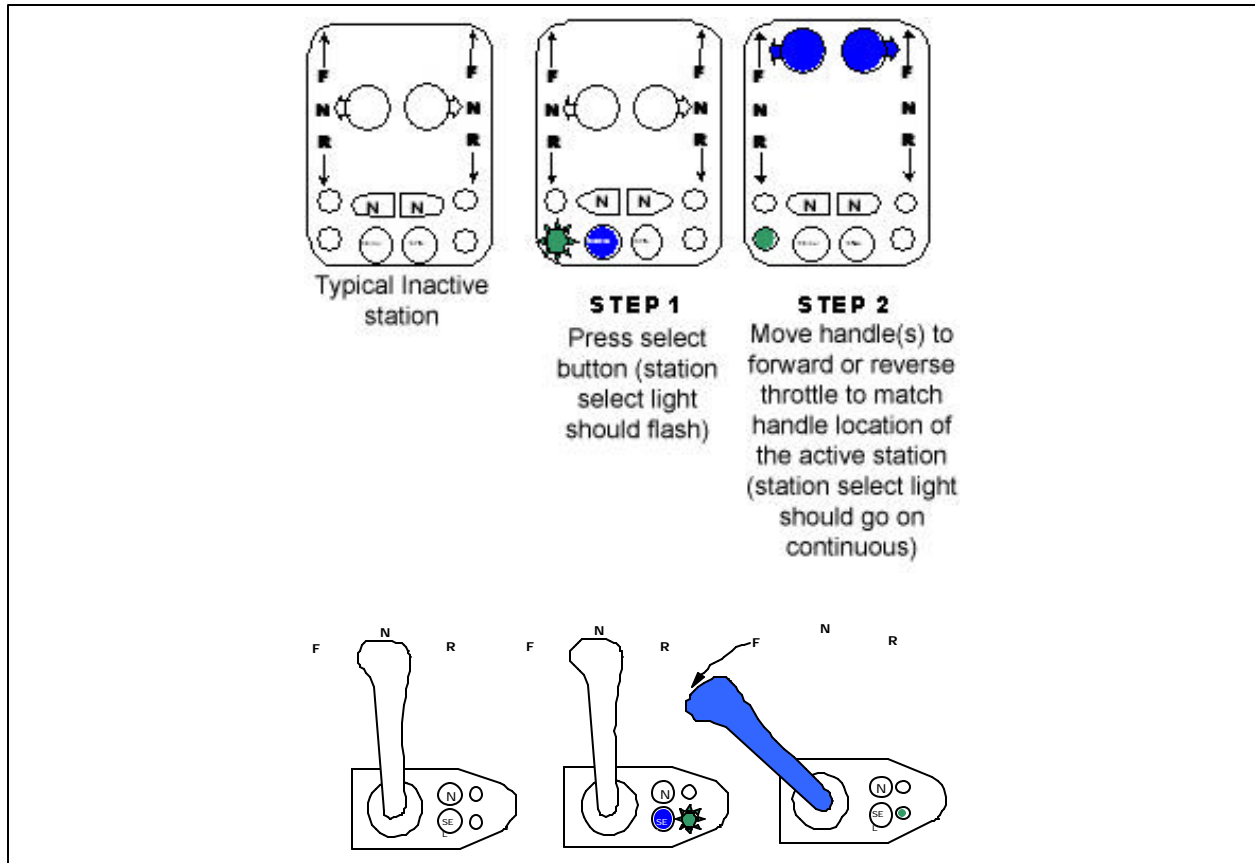
Engaging/Disengaging Neutral Throttle Warmup (NTW)



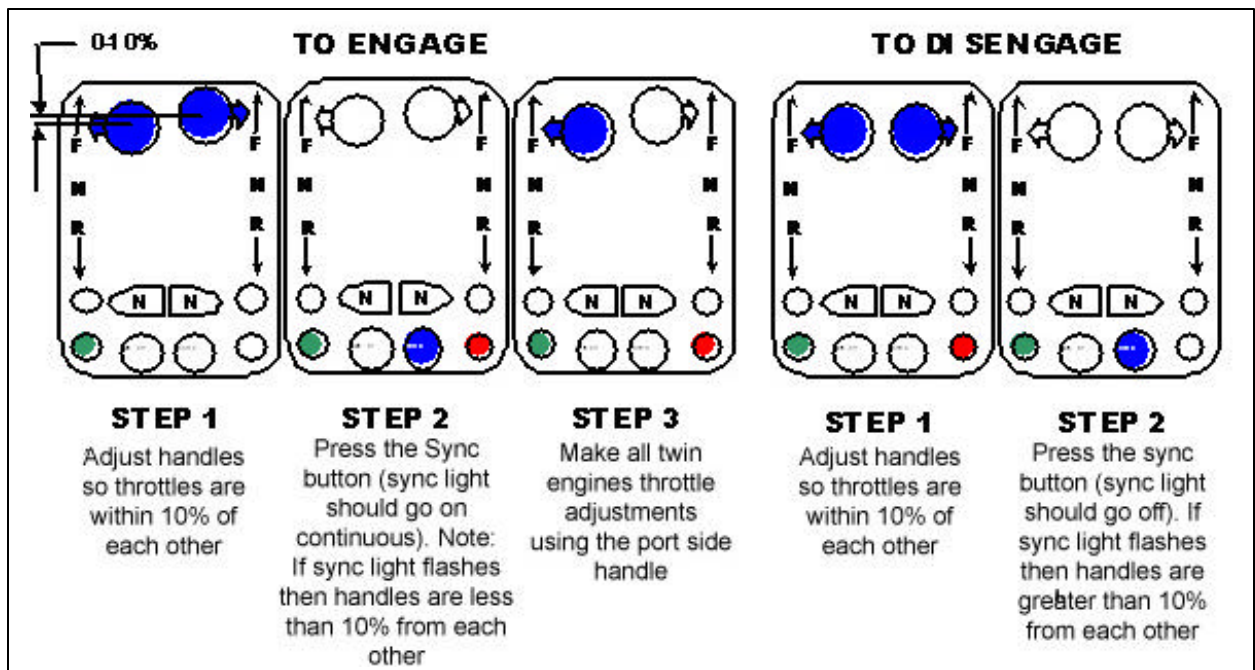
Engaging/Disengaging Split Range Throttle (SRT)



Selecting Active Station



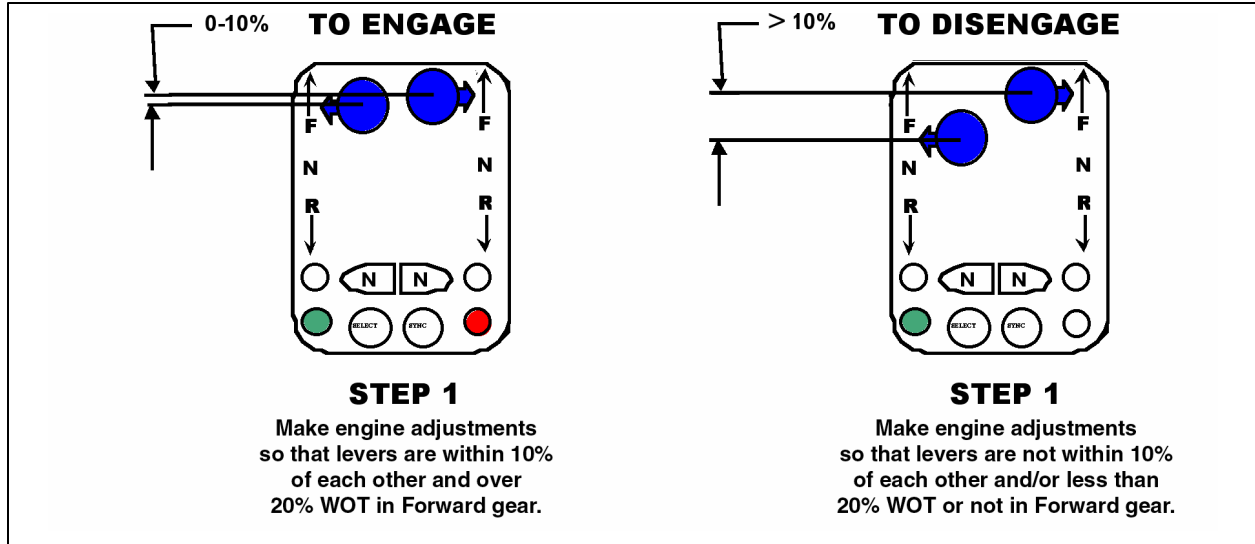
Engaging/Disengaging Power Train Sync (PTS)



Engaging/Disengaging Cruise Sync (CS)

Press SYNC button to enable CS.

SYNC Lamp comes ON to indicate CS is enabled, but not necessarily ON.



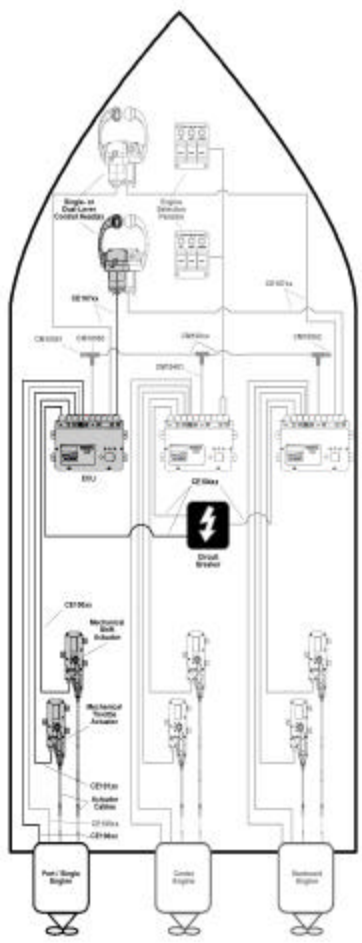
The i6000 System

System Overview

Congratulations on your purchase of the Teleflex Marine i6000!

After spending only a few minutes on the water with your i6000, you will quickly come to depend on the unit's accuracy and reliability in controlling your boat.

Schematic of various i6000 components and possible connections.



The i6000 System operates the shifting and throttle controls for your engines and can control single, dual, and even triple engine systems from up to two separate control stations if desired. The i6000's Shift and Throttle Control Heads come with single lever controls (controlling both shift and throttle with a single lever). The i6000 also supports either mechanical or electronic control of your shift and throttle components depending upon the specific needs of your boat.

Topside, the engines are controlled by the i6000's Control Head levers (and Engine Selection Panel in triple engine systems). Operation of the i6000 Control Head is not dissimilar to that of the traditional shift and throttle system you're probably more familiar with. However, the i6000's look, feel, and functionality is intended to match and surpass that available through traditional systems through its flexibility and features. The i6000's special features and engine operation modes are intended to make boating easier, and taking the time to learn how to use them will inevitably add to your boating pleasure. In triple engine systems, the i6000's Engine Selection Panel allows you to engage and disengage the various engines and indicates each engine's engagement status.

Figure 2

Below deck, the i6000 monitors and controls your engines through the use of Electronic Control Units (ECUs) and Actuators. ECUs coordinate the signals from the Control Heads, engines, and MagicBus™ network and direct the operation of the actuators to control the engines according to the features and options selected. Each engine has its own ECU to control it, and an engine's ECU is where the calibration, feature selection, and information reporting for that engine is performed. Actuators perform the physical movement of the engine parts necessary to shift gears and change throttle settings if purchase or use of electronic shift and/or throttle control options is not practical. Actuators work by moving cables connected to the engine's mechanical linkage. Each engine has its own Shift Actuator and Throttle Actuator if mechanical control is required for these functions.

MagicBus™

The i6000 System is engineered to work as a stand-alone system or as an integrated part of a Teleflex MagicBus™ system, which is a digital network for interconnecting system monitoring and control devices. A MagicBus™ network is required to use Teleflex MagicBus™ tachometers and engine synchronization in multi-engine systems. Connecting via the i6000 System, power and tachometer information can be provided to displays hooked-up throughout a MagicBus™ network.

Installation

A complete installation of an i6000 system consists of mounting and interconnecting the system's components, calibrating the system, selecting the desired features, and mechanically connecting the actuators to the engines and transmissions. Calibration and feature selection, covered in the "Setup" section of this manual (p. 29), involves tailoring the system to your configuration, your boat, and your personal preferences.

Before You Begin

Before you mount any of the components, place them on the surfaces you wish to mount them to. Ensure that the surfaces are large enough and provide adequate support for each component.

WARNING

Remember when mounting components not to screw or glue them directly into the hull. If the hull must be used, glue a wooden block to the hull and screw components into the wooden block with screws shorter than the thickness of the block.

Electrical connectors and actuator cable connectors must be protected from rain, spray, and washdown. Install the components with these connectors pointing downward, or at least angled downward, to protect them from drips. The components may have to be disconnected for service at some point during the boat's lifetime, so leave at least 4 inches (10 cm) of clearance in all directions for releasing and removing their connectors.

As an integrated part of your engine system, you may find it useful to create a log of your i6000 system components to record their maintenance and service history. A form to help you do this is provided on page 73. Start by entering each part and serial number. Then enter the date installed and calibrated, leaving space to record dates and descriptions for future modifications, updates, problems, and service. For the Electronic Control Unit (ECU) record the Required ECU Hardware code, Software Type, Software Version, and installed Options code. See "Setup" on page 29 to learn more about the ECU and how to get this information.

What You'll Need

Parts Supplied

The parts that come with your i6000 system depend on the specific configuration package you purchased. Packages are chosen according to the number and type of engines your boat has, the number of stations you want to install, and the type of Control Head(s) you desire. Below is a list of the different configuration packages available and the parts supplied for each type of installation; please ensure that all the appropriate parts were included in your package:

NOTICE

Single-lever Control Heads can be ordered in either top-mount or side-mount configurations. See "Getting to Know the i6000 Control Heads" on page 49 for more information.

NOTICE

Control Heads can be ordered with or without integrated Trim control. See "Getting to Know the i6000 Control Heads" on page 49 for more information.

- Single Station, Single Engine (SSSE) - one single-lever Control Head, one ECU, one Throttle Actuator (if not using electronic throttle control), and one Shift Actuator (if not using electronic shift). Actuator cables and all associated wiring should also be included if harness lengths were given at time of order.
- Dual Station, Single Engine (DSSE) - two single-lever Control Heads, one ECU, one Throttle Actuator (if not using electronic throttle control), and one Shift Actuator (if not using electronic shift). Actuator cables and all associated wiring should also be included if harness lengths were given at time of order.
- Single Station, Dual Engine (SSDE) - one dual-lever Control Head, two ECUs, two Throttle Actuators (if not using electronic throttle control), and two Shift Actuators (if not using electronic shift). Actuator cables and all associated wiring should also be included if harness lengths were given at time of order.
- Dual Station, Dual Engine (DSDE) - two dual-lever Control Heads, two ECUs, two Throttle Actuators (if not using electronic throttle control), and two Shift Actuators (if not using electronic shift). Actuator cables and all associated wiring should also be included if harness lengths were given at time of order.
- Single Station, Triple Engine (SSTE) - one dual-lever Control Head, one Triple Engine Selection Panel, three ECUs, three Throttle Actuators (if not using electronic throttle control), and three Shift Actuators (if not using electronic shift). Actuator cables and all associated wiring should also be included if harness lengths were given at time of order.
- Dual Station, Triple Engine (DSTE) - two dual-lever Control Heads, two Triple Engine Selection Panels, three ECUs, three Throttle Actuators (if not using electronic throttle control), and three Shift Actuators (if not using electronic shift). Actuator cables and all associated wiring should also be included if harness lengths were given at time of order.

A set of peel-off, pre-printed labels is included in all i6000 packages to aid in identifying wire harnesses during installation.

If any items are missing, call Technical Support at 1-610-495-7011.

Additional Tools and Items You'll Need

Be aware that you will most likely need to order the appropriate number and lengths of wire harnesses and actuator cables from Teleflex Marine to meet the specific needs of your boat before you can complete the installation. You will need to take measurements of several wiring and cable runs. To do so, carefully plan out where you will be installing the main components of your i6000 system and where you will be routing the wire harnesses and cables. Then, preferably, pre-install the various components prior to measuring to ensure that the measurements will be exact.

If your i6000 was configured by the factory to use mechanical actuators instead of electronic shift and throttle controls, you will need to measure for actuator cable lengths. Remember when planning/measuring the route of actuator cables that actuator placement should allow for the shortest, straightest possible run of the actuator cable to the associated engine's respective mechanical linkage. Try to avoid a route that bends a cable to a radius smaller than 6 inches (15 cm), even though a bend radius of 4 inches (10cm) is within specifications. Actuator cable lengths are measured differently depending on the type of engine(s) you have:

- Outboards - Measure from the actuator mounting location along unobstructed cable route to the center of the outboard. Add 2 feet (60 cm) to allow for loop, providing unrestricted engine movement. Round up to the next whole foot (30 cm).
- Inboards Or Stern-Drives - Measure from the actuator mounting location along unobstructed cable route to shift or throttle connection. Round up to the next whole foot (30cm) and order that length actuator cable.

When planning/measuring the route of wire harnesses, measure from the ECU mounting location along unobstructed wire runs, as far as practical from other high current wires, to the various points of connection. Round off each measurement to next whole foot (30 cm) and add additional length if uncertain.

Below is a list of the part numbers and the measurements and information to gather for each, if applicable, prior to ordering. The "xx" suffix is the length of the cable/harness in feet.

- Wire Harness Lengths
 - CE100xx - From each ECU to its associated Shift Actuator
 - CE101xx - From each ECU to its associated Throttle Actuator
 - CE104xx - From each ECU to the Circuit Breaker
 - CE105xx - From each ECU to its associated engine's tachometer sensor connector

- CE106xx - From each ECU to the corresponding engine's starter or ignition circuit
- CE107xx - From each Control Head to each ECU
- CE108xx - From each ECU to its associated engine's transmission (for Electronic Shift systems)
- CE109xx - From each ECU to its associated engine's electronic throttle connection (for Electronic Throttle Control systems)
- CE13000 - Engine Selection Panel Y-harness
- 6345517 - Dual-Lever Top-Mount Control Head Trim Harnesses
- Actuator Cable Lengths
 - CC648xx - From each actuator to its associated engine (universal type)
 - CC660xx - From each actuator to its associated engine (Mercury type)
 - CC661xx - From each actuator to its associated engine (OMC type)
- Actuator Cable Engine Connection Kits (for mechanical engine linkages)
 - Specify Kind - Std 33C, Merc KM, Jet Drive, or OMC
 - Specify Connection - Balljoint, post/clip, or pivot
 - Other - Cable Mounting Bracket, if needed
- MagicBus™ Cables and Connectors
 - CM100xx - From each ECU's MagicBus™ Tee to its neighboring ECU's MagicBus™ Tee
 - CM10050 - MagicBus™ Tee
 - CM10051 - MagicBus™ Male Terminator
 - CM10052 - MagicBus™ Female Terminator
 - CM10401 - From each ECU to the MagicBus™ network backbone

When ready, order all wire harnesses, actuator cables, and other needed parts from Teleflex Marine Customer Service at 1-610-495 7011.

In addition to the items above, you will also need the following for installation and operation:

- A 3" (75mm) hole saw
- A 3 1/2" (90mm) hole saw
- A powered hand drill and various drill bits
- Phillips and flat-head screwdrivers
- A ruler or measuring tape
- Pen or pencil
- Adhesive tape
- 12 volt power source (your boat's battery)
- An adjustable wrench
- Standard & Needle Nose Pliers-Medium size
- Wire Strippers & Cutters for #14 AWG wire
- Multimeter or test lamp-DC
- Two 10-amp circuit breakers per ECU
- Insulated butt connectors for #14 AWG wires
- A circuit breaker mounting enclosure

- Engine and transmission wiring connectors and terminals
- Stainless steel, self-tapping screws or machine nut-bolt pairs with various lengths depending on mounting surface thicknesses
- UV nylon mounting head ties. Clamps may be used instead, especially for actuator cables.
- Depending on the electrical requirements for your particular installation, a terminal crimping tool may be required.
- A cable-tie-tensioning tool may be helpful but is not required.
- A Polyethylene split loom is optional but recommended for wire harnesses that may be exposed to water, fuel, or lubricants.

Installing Control Heads

The i6000 system allows you to install Control Heads at two separate locations if you desire a second control station.

Determining Proper Mounting Location

Single-lever Control Heads (single-engine systems) come in either top-mount or side-mount configurations. Dual-lever Control Heads are only available in the top-mount configuration. This limits the mounting locations that can be used by each type.

Top-mount Control Heads are designed to be mounted on flat, horizontal surfaces convenient for operation and installation. Side-mount Control Heads are designed to be mounted on flat, vertical surfaces. See Figures 11-13 on page 49 to view each type.

Placement of i6000 Control Heads must allow for the full range of lever movement (156 degrees), without clearance problems. Be certain that control levers can be operated through their entire range without risk of hand or finger injury. Control Head indicators must be visible, and pushbuttons must be accessible to fingertips. Placement must also allow access behind the mounting surface for attaching mounting nuts and the harness connector.

Control Heads have detent and drag adjustment screws on the fore side of their housings that should also be accessible. In Side-mount Control Heads these adjustment screws are located under the cover. The screws require only 2 inches (5 cm) of clearance if you use a right-angle screwdriver.

Mounting the Control Head

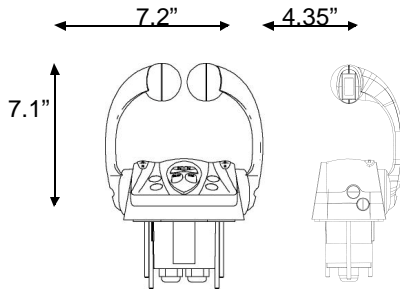
Top-mount Control Heads use the same mounting template. The Side-mount Control Head uses a different template. The mounting templates for both types can be found in the back of this manual.

Choose the mounting instructions below that are appropriate for your Control Head(s) configuration:

- 1) Top-Mount Control Heads – page 14
- 2) Side-Mount Control Heads – page 16

⚠ CAUTION

Before using a template from the back of this manual, measure it to be certain it is to scale.

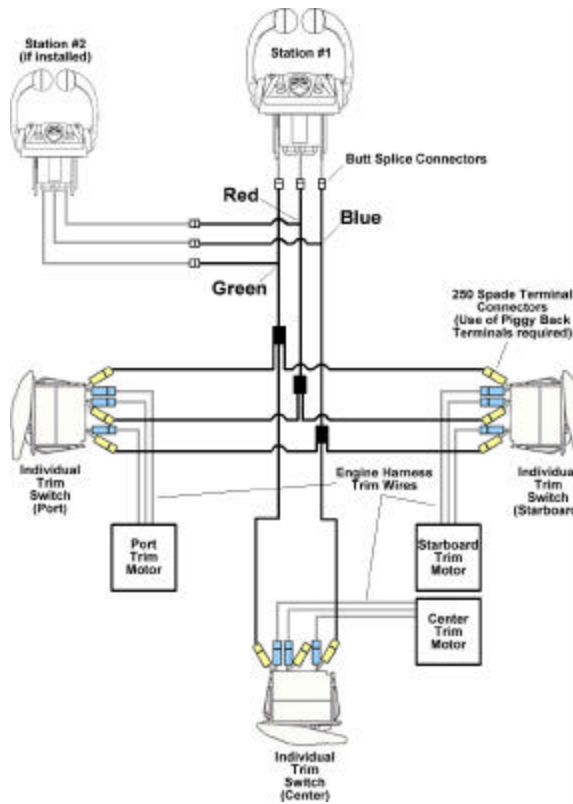


Top-Mount Control Heads

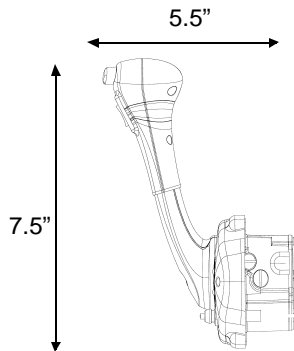
1. Tape the Top-Mount Control Head Template from the back of this manual to the chosen mounting location.
2. Mark the mounting surface for hole placement using the template.
3. Saw out the primary cutout with a 3inch or 75-mm. hole saw.
4. Drill the four 1/4 inch (6 mm) holes for the studs.
5. If your Control Head harness(es) won't reach from this installation point to the ECU mounting location, connect Extension Control Head wire harness(es) (part no. CE107xx), available from Teleflex Marine Customer Service at 1 610 495 7011.
6. Using the pre-printed labels, label each end of the harness(es) with "Control Head" and mark the Control Head or station number on each end if two control heads or stations are to be installed.
7. If the Control Head has more than one harness connected to it, then also note on each harness end which Control Head connector (port or starboard) the harness is connected to.

Wire connections for Dual-Lever Top-Mount Control Head Trim Harnesses.

Figure 3



8. If installing a dual-lever Control Head with trim control, you must connect the trim control wires from the Control Head through the primary cutout in the mounting surface to the Dual-Lever Top-Mount Trim Harnesses (part no. 63455517). Refer to Figure 3 (page 14) throughout the following trim wiring procedure. There are three harnesses—red, blue, and green. Attach each Trim Harness by the short end (with prewired butt splice connectors) to the matching color trim control wires coming from the Control Head using a crimping tool and additional insulated male/female butt splice connectors as needed. One extra female butt splice connector is connected and supplied with each Trim Harness. Connect the two female 250 Spade Terminal connectors at the other end of the red Trim Harness to the male power terminals on the port and starboard trim control switches respectively using piggy back terminals, or connect them directly to the port and starboard trim power wires from the engine harness. Using piggy back terminals, connect the blue Trim Harness' three female 250 Spade Terminal connectors to the terminals on the port, center, and starboard trim control switches used to raise the drive/engine. You may also connect them directly to the port, center, and starboard “trim up” control wires from the engine harness. Using piggy back terminals, connect the green Trim Harness' three female 250 Spade Terminal connectors to the terminals on the port, center, and starboard trim control switches used to lower the drive/engine. You may also connect them directly to the port, center, and starboard “trim down” control wires from the engine harness. The trim harness for Dual-Lever Control Heads contains diodes to isolate the i6000 System trim controls from the other trim controls.
9. If installing a single-lever Control Head with trim control, simply connect the trim control wires from the Control Head through the primary cutout in the mounting surface to the trim control wires from the engine harness. If the engine manufacturer does not provide or specify connectors, use insulated butt connectors. Connect red to red, blue to blue, and green to green. Red wires connect to input voltage. Blue wires are active when the trim switch is in the upper position (for drive/engine raising). Green wires are active when the trim switch is in the lower position (for drive/engine lowering).
10. Pass the free ends of the Control Head-to-ECU wire harnesses through the primary cutout in the mounting surface and insert the Control Head into the holes you just made.
11. Secure the Control Head to the mounting surface by tightening the four 10-32 nuts that were provided with the Control Head.



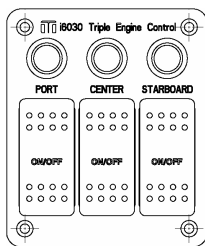
12. Adjust the screws on the fore side of the Control Head to change detent position firmness and/or drag (rotational resistance) for the lever(s) if so desired.
13. Repeat steps 1-12 to install a second control station of the same type.

Side-Mount Control Heads

1. Tape the Side-Mount Control Head Template from the back of this manual to the chosen mounting location.
2. Mark the mounting surface for hole placement using the template.
3. Saw out the two primary cutouts with a 3 1/2 inch (90 mm) hole saw.
4. If mounting with screws, drill five 1/8 inch (3 mm) holes. If mounting with nuts and bolts, drill five 1/4 inch (6 mm) holes instead.
5. If your Control Head harness(es) won't reach from this installation point to the ECU mounting location, connect Extension Control Head wire harness(es) (part no. CE107xx), available from Teleflex Marine Customer Service at 1-610-495-7011.
6. Using the pre-printed labels, label each end of the harness(es) with "Control Head" along with the control station number if installing two control stations.
7. If the system has trim control, connect the trim control wires from the Control Head through the primary cutout in the mounting surface to the trim control wires from the engine harness. If the engine manufacturer does not provide or specify connectors, use insulated butt connectors. Connect red to red, blue to blue, and green to green. Red wires connect to input voltage. Blue wires are active when the trim switch is in the upper position (for drive/engine raising). Green wires are active when the trim switch is in the lower position (for drive/engine lowering).
8. Connect the two black safety lanyard wires. If the switch is normally open, connect one wire to ground and the other to the ignition primary according to the engine manufacturer's instructions. If the switch is normally closed, connect one end to a fused 12 volt source and the other end to the ignition primary according to the engine manufacturer's instructions. Unless the engine manufacturer instructions suggest specific connectors, use insulated butt connectors.
9. Pass the free ends of the Control Head-to-ECU wire harnesses through the primary cutout in the mounting surface and insert the Control Head into the five holes you just made.

10. Remove the cover from the Control Head by loosening the three slotted screws.
11. Secure the Control Head to the mounting surface using five 10-32" (5 mm) stainless steel screws or stainless steel nut-bolt pairs.
12. Adjust the two screws on the Control Head to change detent position firmness and/or drag (rotational resistance) for the lever(s) if so desired.
13. Replace the Control Head cover with the three slotted screws removed in step 10.
14. Repeat steps 1-13 to install a second control station of the same type.

Installing Triple Engine Selection Panels



Engine Selection Panels are only for installation and use with triple engine systems.

Determining Proper Mounting Location

Engine Selection Panels are designed to be mounted on flat, surfaces convenient for operation and installation.

Mounting the Engine Selection Panel

1. Tape the Engine Selection Panel Template from the back of this manual to the chosen mounting surface
2. Mark the mounting surface for hole placement using the template.
3. If mounting with screws, drill four 3/16 inch (4 mm) holes. If mounting with nuts and bolts, drill four 1/4 inch (6 mm) holes instead.
4. Route and connect the 5' (1.5 m) cable from the Engine Selection Panel through the primary cutout to the Engine Selection Panel Y-harness (part no. CE13000) which has been placed in a convenient centrally located wiring run.
5. If installing a second Engine Selection Panel, repeat steps 1-4 using the second panel.
6. Secure the Engine Selection Panel(s) to the mounting surface with four 1/4 inch (6 mm) stainless steel screws or nut-bolt pairs for each panel being installed.

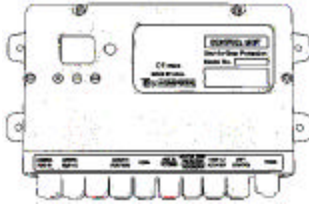
⚠ CAUTION

Before using a template from the back of this manual, measure it to be certain it is to scale.

Installing Electronic Control Units (ECUs)

You must install one ECU per engine to control each engine's functions.

Determining Proper Mounting Location



ECUs can be mounted on overheads, bulkheads, or other flat surfaces. The ECU should be positioned so that its electrical connectors face downward, or at least not upward, and there should be at least 4 inches (10 cm) of clearance in all directions around the electrical connectors for attaching wire harnesses.

The LED display on the ECU must be visible for setup and error reporting, so be sure the positioning of the ECU allows these to be easily read, preferably not upside-down. The pushbuttons on the ECU must also be accessible to fingertips for making adjustments.

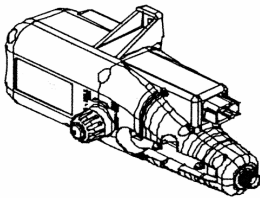
⚠ WARNING

- **Do not install an ECU where it may become wet.**
- **Do not install an ECU where ambient temperatures may exceed 158° F (70° C).**
- **Do not install an ECU near high-current devices or wiring runs.**
- **Do not mount an ECU directly on an engine or transmission.**

Mounting the ECU

1. Place the ECU on the chosen mounting surface and use the ECU itself to mark the mounting holes.
2. If mounting with screws, drill four 3/16 inch (4 mm) holes. If mounting with nuts and bolts, drill four 1/4 inch (6 mm) holes instead.
3. Secure the ECU to the mounting surface with four 1/4 inch (6 mm) stainless steel screws or nut-bolt pairs.
4. Repeat steps 1-3 for each engine's ECU. Be sure to note which ECU serves which engine.

Installing Mechanical Actuators



If both the Electronic Shift (ES) and Electronic Throttle Control (ETC) options packages were purchased and installed on your system then you will not need to install any mechanical actuators on your boat. Otherwise, you will need to install the appropriate number and types of actuators to operate your system.

If you don't have Electronic Shift, then you will need to install a Shift Actuator for each engine requiring mechanical shift. If you don't have Electronic Throttle Control, then you will need to install a Throttle Actuator for each engine requiring mechanical throttle control. Optional High-Load Actuators can be installed if required for outboard and stern-drives.

Determining Proper Mounting Location

Actuator placement should allow for the shortest, straightest possible run of the actuator cable to the associated engine's respective mechanical linkage. In planning actuator cable paths, try to avoid a bend radius smaller than 6 inches (15 cm), even though a bend radius as small as 4 inches (10cm) is within specifications.

Actuators should be mounted on overheads, bulkheads, or other flat surfaces. The actuators should be positioned so that their electrical connectors face downward, or at least not upward. Leave at least 4 inches (10 cm) of clearance in all directions around electrical connectors and mechanical cable connectors for attaching wire harnesses and actuator cables.

As a safety precaution, leave at least 5 inches (13 cm) of clearance in all directions around the manual override knob on each actuator. Also leave enough room for someone to use a screwdriver to pry the manual override wrenches away from the actuator bodies if necessary.

⚠ WARNING

- ***Do not install actuators where they may become wet.***
- ***Do not install actuators where ambient temperatures may exceed 158° F (70° C).***
- ***Do not install the actuators near high-current devices or wiring runs.***
- ***Do not mount actuators directly on engines or transmissions.***
- ***Do not position actuators such that actuator cables will require bends with a radius tighter than 4 inches (10cm).***

Mounting the Actuator

Shift Actuators and Throttle Actuators are externally identical except for their connectors. Shift Actuators have black connectors and Throttle Actuators have grey connectors. Their mounting procedures are the same. Double-check that you have the correct actuator for the chosen location before mounting each. For each actuator required:

1. Place the appropriate actuator on the chosen mounting surface and use the actuator itself to mark the mounting holes.

2. If mounting with screws, drill three 3/16 inch (4 mm) holes. If mounting with nuts and bolts, drill three 1/4 inch (6 mm) holes instead.
3. Mount the actuator with three 1/4 inch (6 mm) stainless steel screws or nut-bolt pairs.
4. Repeat steps 1-3 for each actuator needed. Make a note of which actuator is for which function on which engine.

Preparing the Actuator Cable

An actuator cable connects each actuator to its associated shift or throttle linkage on the actual engine or transmission. Figure 4 shows both ends of an actuator cable and their orientation to the actuator.

⚠ CAUTION

- **Do not install cables with any bends having a radius smaller than 4 inches (10cm).**
- **Do not subject cables to heat or abrasion.**
- **Do not lubricate core.**
- **Keep ends dry and clean.**

i6000 Actuator and Actuator Cable

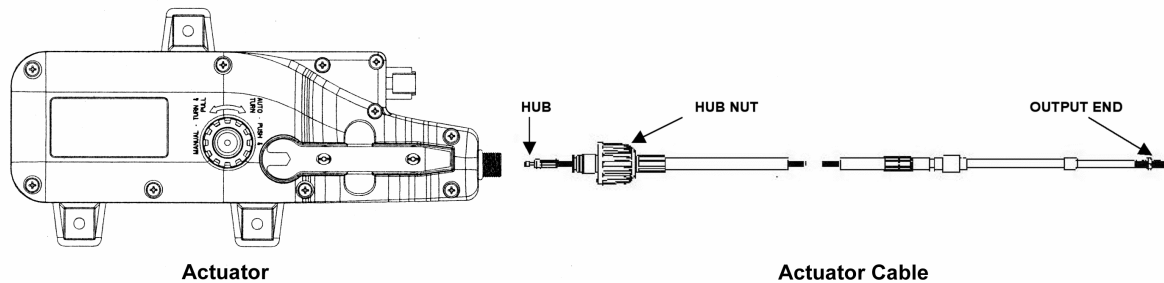


Figure 4

Make sure you have the correct number and lengths of actuator cables to complete the installation. If you are unsure or need to order cables, review the instructions under “Additional Tools and Items You’ll Need” on p.11.

⚠ WARNING

Open cable box carefully, because cable is coiled and may uncoil with considerable force.

When ready, proceed as follows to install the actuator cable(s), but do not actually connect the cables to the engine or transmission until instructed to do so during the calibration procedure.

1. Carefully remove actuator cable from box.

Location of Manual Override Knob and Wrench.

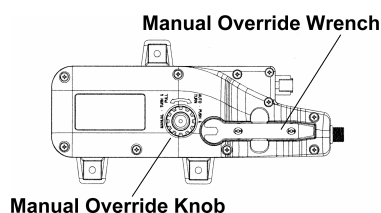


Figure 5

⚠ CAUTION

Do not actually connect the actuator cable to the engine or transmission until instructed to do so during the calibration procedure.

2. Choose an actuator and route the actuator cable along the shortest, straightest path from the actuator to its associated engine or transmission linkage. On jet drive systems, the “transmission” linkage will be at the hydraulic valve that controls the boat’s split duct thrust reversing deflector (“bucket”).
3. Remove the Manual Override Wrench (Fig. 5) from the actuator. Use a screwdriver to pry it loose if necessary.
4. Unscrew the actuator’s Manual Override Knob, then pull it away slightly from the actuator to expose the square hub on the metal shaft.
5. Using the Manual Override Wrench, turn the actuator shaft 180° counterclockwise, exposing the cable Connector Slot.
6. Place the actuator cable’s Hub (Fig. 4) into the Connector Slot of the actuator and slide the Cable Hub Nut over the connection.
7. With the cable aligned straight into the actuator, hand tighten the Cable Hub Nut to the actuator.
8. Rotate the shaft back 180° clockwise with the wrench. Push the Manual Override Knob in and hand tighten. If the knob will not push in far enough for the threads to mesh, push or pull the cable output end slightly.
9. Prepare the output end of the cable for connection using the appropriate Actuator Cable Connection Kit (if needed) and following engine or transmission manufacturer instructions.
10. Secure the Actuator Cable approximately every 2 feet (0.6 m) with stainless steel screws and mounting head ties or clamps.
11. Repeat steps 1-10 for each actuator. Make a note of which actuator cables are for which functions.

Connecting Components

Wire harnesses must now be routed and connected between all the different components. Every boat is different and there may be several ways to route the harnesses. Inside the boat there is often a channel or conduit used for wiring. This can also be used to route the wire harnesses and cables for the i6000 system.

When routing the harnesses, remember that they must not be cut or spliced, and care should be taken not to damage the cable insulation. If a harness is too short, replace it with a correct-length harness. Don't add a short harness to make up the required length. When ordering new harnesses, the xx suffix on the harness part numbers specifies the length of the harness in feet. Run harnesses over the shortest and straightest possible path. Secure harnesses every 2 feet (0.6 m) with stainless steel screws and mounting head ties or clamps. Excess harness should be neatly coiled and secured with nylon ties. Harnesses should be run as far as practical from high current wires or wiring runs and should not be subjected to water, fuel, lubricants, or excess heat.

The Deutsch connectors on the harnesses are color-coded and constructed so that a harness connector cannot mate with the wrong type of component connector. However, in dual station and/or dual engine configurations, components can be connected to component connections for the wrong engine, transmission, or control station. Keep in mind that one ECU controls one engine and transmission. Therefore, dual engine configurations require two ECUs and two sets of identical connectors, even if there is only one control station. Additionally, dual station multi-engine configurations require each Control Head to be connected to specific connectors on two different ECUs.

Component connections to the ECU. Dark components and connections are for a Single Station, Single Engine configuration with mechanical shift and throttle actuators. All others are for expanded configurations. The mechanical actuators and their wire harnesses are eliminated in systems with Electronic Shift/Throttle.

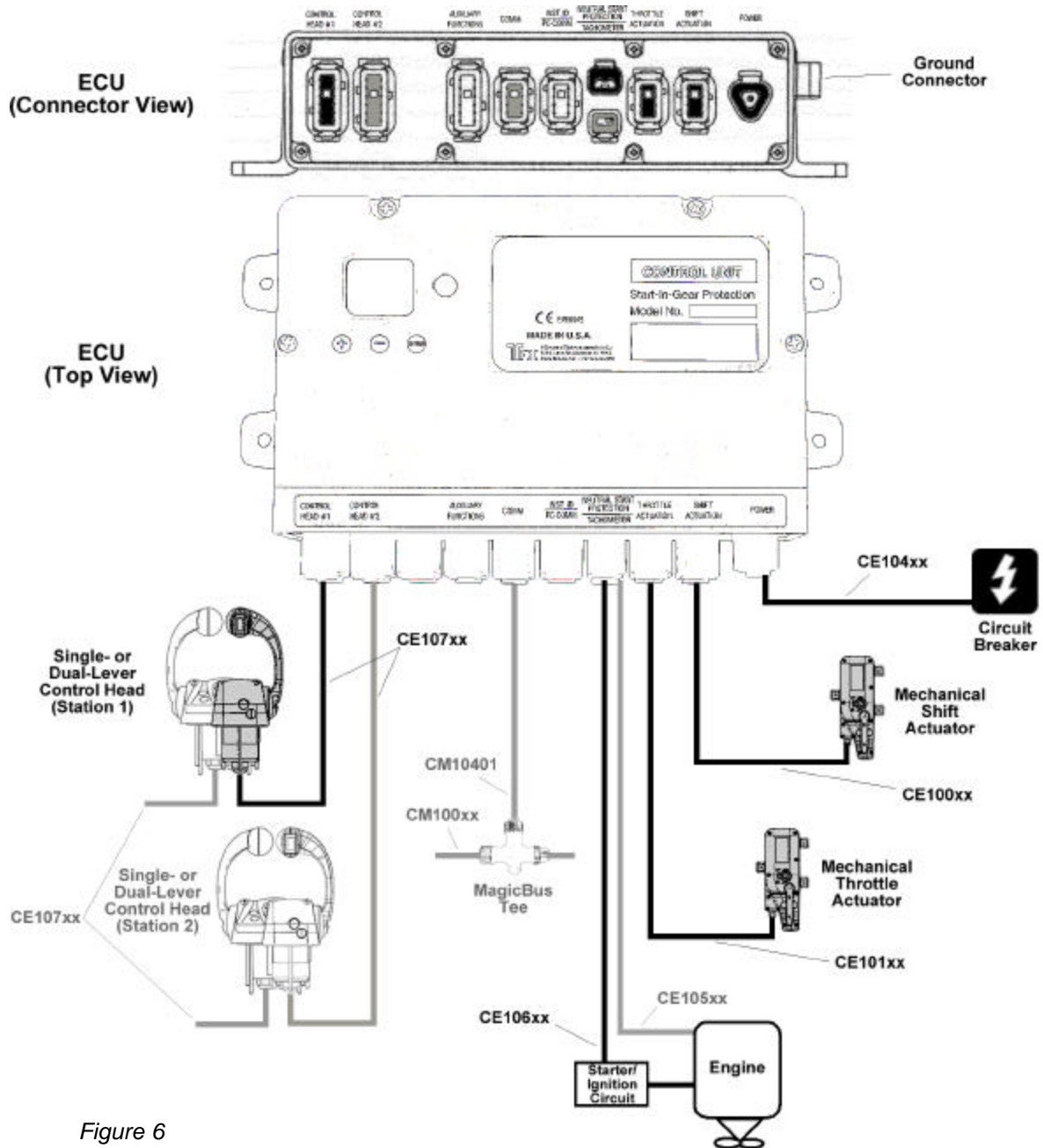


Figure 6

Before proceeding, make sure you have the correct number and lengths of wire harnesses to complete the installation. If you are unsure or need to order harnesses, review the instructions under “Additional Tools and Items You’ll Need” on page 11. Refer to Figure 6 when connecting components.

⚠ CAUTION

Avoid running wire harnesses along other wires or harnesses that carry high current or might cause EMI (electromagnetic interference). Examples are generator leads or spark plug wires. Such runs could cause system interference or possibly even failure.

⚠ CAUTION

Once you’ve routed a harness, make sure the connections are tight. The i6000 System will malfunction if harnesses are not firmly connected.

1. Route the free end of the wire harness that you prepared in the “Mounting the Control Head” section (page 13) from the location of the main Control Head to the ECU. If your boat has more than one engine, start by routing the free end of the main Control Head’s starboard side harness to the starboard engine ECU first. If a harness is too short, order an extension harness (part no. CE107xx, where xx is the length in feet) from Teleflex Marine Customer Service at 1-610-495-7011.
2. Take the free end of the Control Head harness you just routed and connect it to the connector on the ECU marked “CONTROL HEAD #1”.
3. If your boat has more than one control station, route the free end of the same-side harness of Control Head/Station #2 to the same ECU you just connected to but connect it to the ECU connector marked “CONTROL HEAD #2”.
4. If you were required to install an Actuator to mechanically control the engine’s throttle, then connect the Throttle Actuation wire harness (part no. CE101xx) to the connector marked “THROTTLE ACTUATION”. Then route the free end to the Actuator you have assigned to control the throttle for this ECU’s associated engine and connect it tightly.
5. For engines with Electronic Throttle Control (ETC), connect part no. CE109xx to the ECU connector marked “THROTTLE ACTUATION”. Then route and connect the free end of the harness to the corresponding engine’s electronic throttle connection according to the engine manufacturer’s instructions.
6. If you were required to install an Actuator to mechanically shift the engine’s transmission, then connect the Shift Actuation wire harness (part no. CE100xx) to the connector marked “SHIFT ACTUATION” on the same ECU you’ve been working on. Route the free end to the Shift Actuator for the associated engine and connect tightly.

7. For engines with electronic shifting, connect part no. CE108xx to the ECU connector marked "SHIFT ACTUATION". Then route and connect the free end of the harness to the corresponding engine's transmission according to the engine manufacturer's instructions.
8. On the same ECU, connect the Neutral Start Protection wire harness (part no. CE106xx) to the connector marked "NEUTRAL START PROTECTION". Then route and connect the free end to the corresponding engine's starter or ignition circuit according to the engine manufacturer's instructions.
9. If your boat has more than one engine, repeat steps 1-8 using the port side Control Head wire harness(es) and the port engine ECU and Actuators instead.
10. Secure all harnesses every 2 feet (0.6 m) with stainless steel screws and mounting head ties or clamps.

Additional Steps for Triple Engine Systems

11. Connect a set of extension harnesses (part no. CE107xx) long enough to reach the Center Engine ECU to the free ends of the previously prepared Engine Selection Panel Y-harness (part no. CE13000). Route the newly-extended free ends to the Center Engine ECU and connect them to the ECU connectors marked "CONTROL HEAD #1" and "CONTROL HEAD #2".
12. Repeat steps 4-8 for the Center engine ECU.
13. Triple engine systems MUST have the MagicBus™ network installed. Follow the instructions under "MagicBus™ for Tachometers and " below.
14. To finish up, secure remaining harnesses every 2 feet (0.6 m) with stainless steel screws and mounting head ties or clamps.

Connecting Optional Devices

NMEA Compliant Devices

Many optional devices are available for you to connect to your system via the NMEA communications protocol. This is a standard defined by the National Marine Electronics Association and commonly used by marine electronics manufacturers. You can quickly and easily connect NMEA 2000 or even NMEA 0183 devices to your i6000 system to display engine data, etc, if you have properly set up the MagicBus™ network and have the necessary equipment installed. For more information on connecting NMEA compliant devices to the MagicBus™ network, contact Teleflex Marine Technical Support at 1-610-495-7011.

⚠ CAUTION

Do not use ties or clamps on MagicBus Tees, connectors, or terminators.

⚠ CAUTION

MagicBus™ for Tachometers and Engine Synchronization

A MagicBus™ network is required to use Teleflex MagicBus tachometers and engine synchronization in multi-engine systems. If utilizing engine synchronization or MagicBus tachometers, follow the instructions below.

When installing MagicBus components, pay close attention to connector polarity, do not stress the cables, and do not bend the Tees. When installing multiple adjacent Tees, make sure that the mounting surface is flat, so they will not be stressed or bent when secured. If the surface is not flat, secure only one of the adjacent Tees.

Example: MagicBus connections. Unshaded example components are added to the network to share information with the ECU.

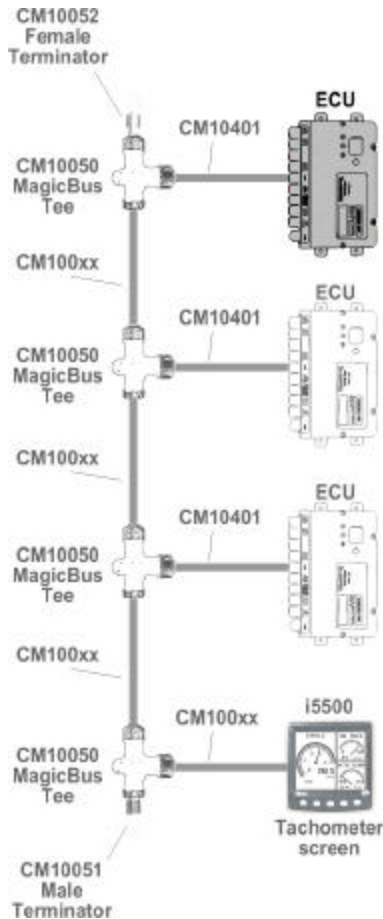


Figure 7

Before proceeding, make sure you have the correct number and lengths of cables and connectors to complete the installation. If you are unsure or need to order cables and/or connectors, review the instructions under “Additional Tools and Items You’ll Need” on page 11. Refer to Figure 7 for an example of a MagicBus™ network while installing.

1. On each ECU, connect an ECU Comm Cable (part no. CM10401) to the ECU connector marked “COMM”. Then connect the free ends of each to the perpendicular connectors of MagicBus™ Tees.
2. If installing MagicBus™ tachometer(s), follow the tachometer’s installation instructions then connect the free end of each tachometer or interface cable to the perpendicular connector of a MagicBus™ Tee. On each ECU, connect a Tachometer Sensor harness (part no. CE105xx, see Fig. 6, page 28) from the ECU connector marked “TACHOMETER” (located below “NEUTRAL START PROTECTION” connector) to the corresponding engine’s tachometer sensor connector, according to the engine manufacturer’s instructions.
3. Connect all MagicBus™ Tees together (or to an existing MagicBus™ network) using MagicBus™ Comm Cables (part no. CM100xx) and terminate each end of the MagicBus™ backbone using male (part no. CM 10051) and female (part no. CM 10052) terminators.
4. Secure the Tees to convenient, appropriate mounting surfaces with stainless steel screws.
5. Secure MagicBus™ cables every 2 feet (0.6 m) with mounting head ties or clamps and stainless steel screws.

Connecting Electrical Power

If you own a Teleflex i1001 Power Distribution Box, you may skip this section and follow the instructions provided with your i1001 to connect the power to your i6000. Use of the i1001 provides the best results and easiest installation solution.

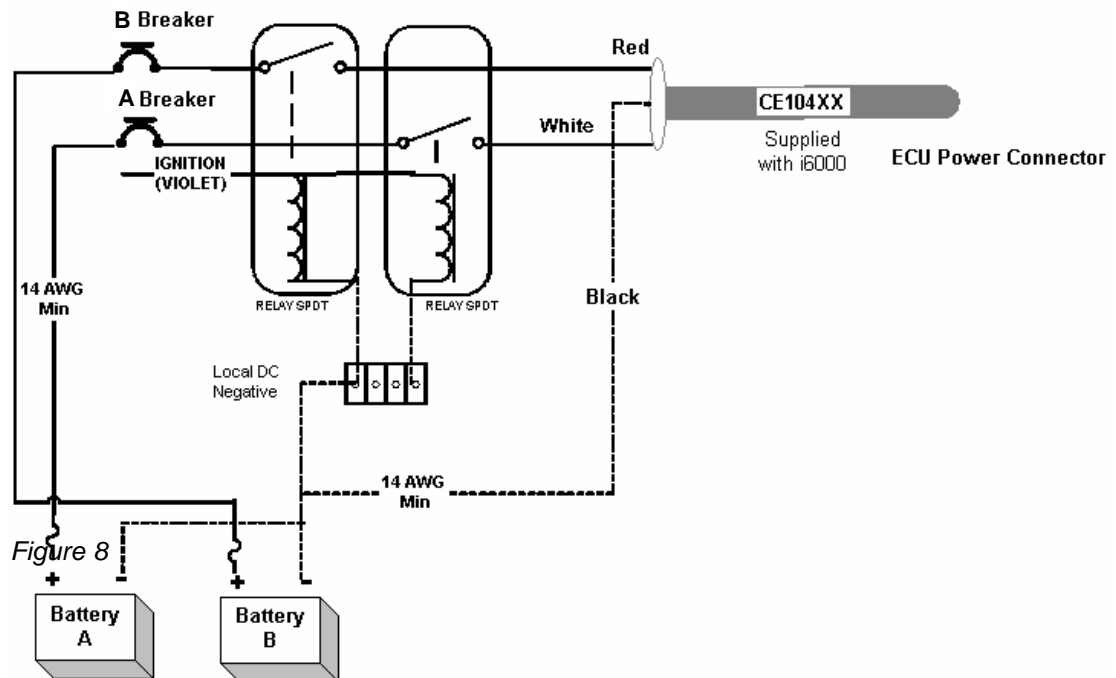
Power is supplied to the i6000 System through a three-conductor shielded harness. This harness provides voltage redundancy and minimizes the effects of electromagnetic interference.

Before proceeding, make sure you have the correct length of wire harness to complete the installation. If you are unsure or need to order a harness, review the instructions under "Additional Tools and Items You'll Need" on page 11. Refer to Figure 8 while connecting power.

⚠ WARNING

Disconnect all DC power before starting wiring installation. Do not mount the relay where it will be exposed to moisture, lubricants, fuel, or flammable vapors.

ECU electrical power and wiring connections.



Proceed as follows to connect the i6000 System to 12-volt power:

1. Install two sealed SPDT (Single Pole Double Throw) 30 amp relays.
2. Connect both relay solenoids to the wire (usually violet) from the ignition switch.
3. Install 14 AWG (minimum) wire from voltage source A to a marine approved circuit breaker rated at 10 amps.
4. Install 14 AWG (minimum) wire from the circuit breaker to one side of the relay contact pair for primary power.
5. Connect the red conductor of the ECU Power harness (part no. CE104xx) to the other side of the relay contact pair for primary power.
6. Install 14 AWG (minimum) wire from voltage source B to a marine approved circuit breaker rated at 10 amps.
7. Install 14 AWG (minimum) wire from the circuit breaker to relay contact pair for backup power.
8. Connect the white conductor of the ECU Power harness to the other side of the relay contact pair for backup power.
9. Connect the black conductor of the ECU Power harness to battery ground.
10. Connect DC power.
11. Turn on the ignition
12. Verify operation with a test light or meter. See that 12 volts is applied between contacts A and C on the ECU Power connector when breaker A is energized and between contacts B and C when the B breaker is energized.
13. Connect the Deutsch connector of the ECU Power harness to the connector on the ECU marked "POWER".
14. Remove the large Phillips screw to the right of the POWER placard on the ECU.
15. Put the Phillips screw through the terminal on the green wire and replace the screw; thereby, grounding the harness shield to the ECU chassis.
16. Make sure all connections are tight. The i6000 System will malfunction if harnesses and wires are not firmly connected.
17. Secure the ECU Power harness and power wires approximately every 2 feet (0.6 m) with mounting head ties or clamps and stainless steel screws.

NOTICE

Battery ground is required for proper system operation.

Setup

After the i6000 System components have been mounted and interconnected, the system must be set up to agree with the engine and transmission and the operator's preferences. All calibration and feature selection functions for the i6000 are performed through the individual engines' ECUs. Each ECU must be programmed separately in order for the i6000 system to function properly.

Working with the ECU Display and Controls

ECU Buttons and Display.

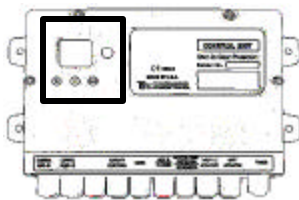
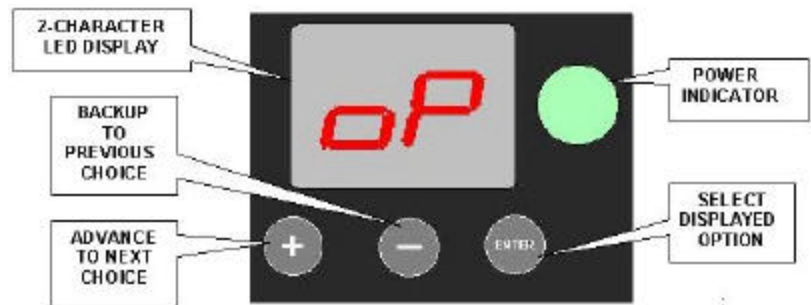


Figure 9

Calibration, feature selection, and attaining information about the i6000 system are all executed on the ECU through the use of the three ECU buttons and LED display on the front of the ECU. The two-digit display will flash repeatedly if a menu option has not been selected for the menu presented. A steady display indicates that an option was previously selected.



ECU Button Functions



“+” - If the display is flashing, pushing this button displays the next menu option. If the display is steady, pushing this button advances you to the next menu, leaving the selection for the previous menu untouched.



“-“ - If the display is flashing, pushing this button displays the previous menu option. If the display is steady, pushing this button returns you to the previous menu, leaving the selection for the menu just displayed untouched.



ENTER – If the display is flashing, pushing this button selects the displayed option. If the display is steady, pushing this button “deselects” the displayed menu option (causing it to flash), and allows you to use the “+”, “-“, and **ENTER** buttons to scroll through the available menu options for that menu and make a new selection.

Information mode Software Type codes.

ECU Display	Software Type For
00	Standard System
01	Jet Drive System with General Motors Delphi ETC Body
02	Standard Jet Drive System
03	Jet Drive System with General Motors Hitachi ETC Body

Information mode Options codes. The zeros in the last three Options codes (10, 20, and 30) are replaced with any one of the other Options codes when those options are purchased with them in combination, e.g., the Options code for VSW with PTS is 24.

ECU Display	Options Installed
0	No Options
2	Split Range Throttle (SRT)
4	Power Train Sync (PTS)
6	SRT & PTS
8	Electronic Shift (ES)
A	ES & SRT
C	ES & PTS
E	ES, PTS, & SRT
10	Cruise Sync (CS)
20	Variable Shift Window (VSW)
30	CS & VSW

Table 2

ECU Modes

When you power on an ECU, either by ignition switch or reconnecting the power harness, the green power indicator next to the two-character LED display should come on, and the ECU should start in *Calibration* mode unless previously calibrated. If it was previously calibrated, it should start in *Operation* mode.

You can determine which mode the ECU is in by checking the code displayed on the two-character LED display just after powering on the ECU. The Mode Menu is the initial menu presented whenever the ECU is powered on. ECU mode descriptions and their corresponding display codes are listed below:

- **Operation – oP.** This mode is the actual mode of use for controlling shift and throttle. It is the initial mode automatically selected when the system is powered on, unless the system requires calibration.
- **Information - IF.** This mode presents five consecutive displays:
 - 1) **88.**, which is a 1-second LED test that lights all segments of the 2-digit LED indicator to ensure they are all working correctly.
 - 2) the Required ECU Hardware code, which is a set of two numbers (displays for 1 second) identifying what ECU electronics the factory installed to work with the software: **00** (non-diesel), **01** (Electronic Throttle Control), **02** (diesel), or **03** (jet drive).
 - 3) the Software Type, which is a set of two numbers (displays for 1 second) identifying which software code set is installed on the ECU. For a list of Software Type codes, see Table 1.
 - 4) the Software Version, which is a letter followed by a number (displays for 1 second) identifying the revision number of the installed software code set
 - 5) the Options code, which lists which options package was purchased and installed on your system (displays until another mode is selected). For a list of Options package codes, see Table 2.
- **Error Reporting - Er.** This mode is for reviewing system failures. The most recent 100 critical and non-critical codes are displayed in reverse chronological order. The most recent error code is displayed first. If more than 100 errors have been reported, the oldest failures are discarded and the most recent 100 failures are retained.
- **Feature Selection – FE.** This mode is for setting up the additional features to customize the system to your preferences. The features are preset to defaults which you should review prior to use.
- **Calibration - CA.** This mode is for calibrating the system to correctly control your boat. If the system has never been calibrated, this is the initial mode after power is applied.

Choosing the ECU Mode

The ECU mode is normally selected automatically by the system at the time of startup (see “ECU Modes”, page 30), but it can also be changed manually by using the “+”, “-“, and **ENTER** buttons at the ECU’s Mode Menu. It will be necessary to manually change the ECU mode in order to thoroughly calibrate and customize your system.

To manually change the ECU mode, first make sure the ECU is displaying the Mode Menu (see “ECU Modes”, page 30). If the Mode Menu display is flashing, pushing the “+” or “-“ buttons will display the other mode choices available. When the desired mode is displayed, pressing the **ENTER** button will confirm your choice and switch the ECU to the desired mode.

When a mode is already selected (indicated by a steady display), pushing the **ENTER** button will cause the display to flash, allowing you to once again use the “+” and “-“ buttons to scroll through the available mode choices. Pushing the “+” or “-“ buttons while the display is steady will have no effect.

WARNING

Do not use the Information, Error Reporting, Feature Selection, or Calibration ECU modes while the boat is underway. The engine(s) should be off since the boat cannot be controlled while in these modes.

Calibrating the System

Calibration is performed primarily at the ECU. Before you can operate your i6000 system, you must first teach the ECUs how to correctly interpret the Control Head signals and manipulate the mechanical actuators (if any). The calibration procedure allows you to do this. If the system was previously calibrated with different Control Heads or actuators, it must be recalibrated to teach the ECU the characteristics of the new hardware.

The *Calibration* menus described below are in the sequence presented by the ECU. The defaults identified are the first choices presented by an uncalibrated system.

NOTICE

If your boat has more than one engine, you must calibrate each one of your ECU(s) separately for the system to function properly. Additionally, many of the menus must be calibrated the same way on each ECU so that there isn't conflicting calibration information. Menus that must be calibrated the same way system-wide are System Configuration and Engine Type.

Select an ECU and test the ECU's LED display by selecting the *Information* ECU mode (see "1F mode", page 30). When ready to calibrate the ECU, select *Calibration* mode (see "Choosing the ECU Mode", page 31) and run through each of the *Calibration* menus listed below, following the instructions. When finished, set the ECU to *Operation* mode. Repeat this entire procedure for each ECU you have installed.

System Configuration Menu

This menu tells the ECU how many engines and control stations you have. The full list of valid configuration codes is:

- (1 - Single Station, Single Engine (SSSE))
- (2 - Dual Station, Single Engine (DSSE))
- (3 - Single Station, Dual Engine (SSDE))
- (4 - Dual Station, Dual Engine (DSDE))
- (5 - Single Station, Single Engine, Single Function Controls)
- (6 - Single Station, Single Engine, Single Function Controls)
- (7 - Single Station, Triple Engine (SSTE))
- (8 - Dual Station, Triple Engine (DSTE))

Default = (1 (Single Station, Single Engine)).

1. The ECU displays one of the configuration codes listed above (designated by (and a number).
2. If the configuration code is correct and steady, press "+" to move on to the next menu.

3. If the configuration displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the “+” or “-” button repeatedly until the correct configuration is flashing on the display. Press **ENTER** to select it. The first choice of the next feature menu will then appear.

NOTICE

The ECU/Engine Assignment Menu is automatically skipped if you chose a single engine configuration.

ECU/Engine Assignment Menu

Identify the ECU/engine being calibrated. Possible assignments are:

- **Sd** - Starboard
- **Po** - Port
- **(E** - Center (triple engine configurations)

Default = **Sd** (Starboard).

1. The ECU displays **Sd** to indicate starboard engine or **Po** to indicate port engine.
2. If the correct engine is displayed steady, press “+”.
3. If the engine displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the “+” or “-” button repeatedly until the correct engine is flashing on the display. Press **ENTER** to select it.

Engine Type Menu

This menu tells the ECU what kind of engine it will be controlling. The types available are:

- **9S** – Gas or **91,92,93,94** (gas)
- **ob** – Outboard or **o1, o2, o3, o4** (outboard)
- **dS** – Diesel

Default = **9S** (Gas).

1. The ECU displays **9S** to indicate gas, **ob** to indicate outboard, or **dS** to indicate diesel.
2. For outboard and gas some applications may require a wider RPM band to “lock-in.” The X1,X2,X3,X4 options are user options if the sync operation does not result in a stable operation.
3. If the correct engine type is displayed steady, press “+”.
4. If the engine type displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
5. Press the “+” or “-” button repeatedly until the correct engine type is flashing on the display. Press **ENTER** to select.

NOTICE

If RPM pulses are specified for one engine/ECU, they must be specified for all engines/ECUs, otherwise you will cause a non-critical error (#26).

RPM pulse settings for Yanmar systems. *Exceptions to the below table are models 3GM35 (114 Pulses/Rev) and 4JH3E-YEU (116 Pulses/Rev).

Yanmar Model #	Pulses/Rev
1GM	97
2GM	97
3GM*	97*
3JH2	114
3JH3	116
4JH*	127*
4LH	127
6LP	117
6LY	129
6CH	129
6CX	129

Table 3

RPM Pulses per Revolution Menu

This menu tells the ECU the number of pulses per RPM that it should expect from its associated engine if a Tachometer Sensor harness was installed (see “MagicBus™ for Tachometers and Engine Synchronization”, page 26). If you did not install a tachometer sensor, the correct number of pulses should be set to 00 (no RPM Input).

In order to represent the entire range of pulses possible of 00 through 399 on the two-digit display, the decimal points are also given value.

- The right-most decimal point represents 100 when lit
- The center decimal point represents 200 when lit
- Both decimal points lit together represent 300

The following are examples:

- **29** = 29 pulses per RPM
- **29.** = 129 pulses per RPM
- **2.9** = 229 pulses per RPM
- **2.9.** = 329 pulses per RPM

Default = **04** (for Gas engine types) or **06** (for Diesel engine types).

1. The ECU displays a number in the range 00 to 399. Table 3 specifies appropriate values for popular marine engines if a sensor was installed.
2. If the correct number of pulses is displayed steady, press “+”.
3. If the number of pulses displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the “+” or “-” button repeatedly until the correct number of pulses is flashing on the display. Press **ENTER** to select it.

NOTICE

The Control Head Levers Menu is automatically skipped on center engine ECUs (triple engine systems).

NOTICE**Control Head Levers Menu**

In this menu, you are prompted to teach the ECU each of the key lever positions.

During the calibration procedure: a lever about to be calibrated is noted by the flashing green indicator on the same side of the Control Head as the lever; the amber lamp will flash when you are seeking the next lever position; and a steady green lamp will indicate that a lever position was successfully “taught.” If you have a multi-engine system and the Control Head lamps appear to be lighting on the wrong side for the ECU/engine you’re calibrating, you may have connected or calibrated the ECU incorrectly. Recheck your connections and repeat the calibration from the beginning.

Key Control Head lever positions.

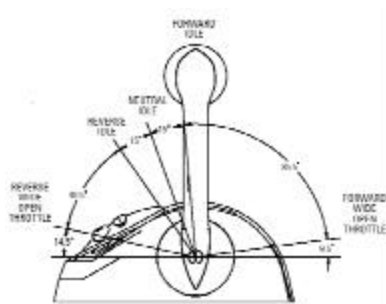


Figure 10

NOTICE

Alternately, you can use the ENTER button on the ECU at each of the Lever Calibration steps instead of the SELECT or SYNC button.

1. The ECU displays **L1**. This is the starting point for Control Head lever calibration.
2. Press **ENTER** to proceed (or push “+” or “-“ to skip to the next or previous calibration point). The display **FF** indicates the ECU is ready to calibrate Control Head lever #1. (Control Head lever #1 is cabled to this ECU’s Control Head #1 connector.)
3. Go to the main Control Head.
4. Move the corresponding lever (starboard or port) for the engine/ECU you’re calibrating to the “Full Forward” position and press the button (**SELECT** or **SYNC**) next to this lever on the Control Head. Use **SELECT** for the port engine lever and **SYNC** for the starboard engine lever in multi-engine systems. After completing this step, the display back on the ECU should read **IF**.
5. **Jet drive systems skip this step** Now move the lever to the “Idle Forward” position and, again, press the corresponding button (**SELECT** or **SYNC**) next to it on the Control Head. After completing this step, the display back on the ECU should read **NU**.
6. Now move the lever to the “Neutral” position and, again, press the corresponding button (**SELECT** or **SYNC**) next to it on the Control Head. After completing this step, the display back on the ECU should read **IR**.
7. **Jet drive systems skip this step** Now move the lever to the “Idle Reverse” position and, again, press the corresponding button (**SELECT** or **SYNC**) next to it on the Control Head. After completing this step, the display back on the ECU should read **FR**.

8. Now move the lever to the “Full Reverse” position and, again, press the corresponding button (**SELECT** or **SYNC**) next to it on the Control Head.
9. Return to the ECU. If you specified a configuration with more than one Control Head earlier in the calibration sequence then the ECU should now be displaying **L2** indicating the ECU is ready to calibrate Control Head lever #2. . (Control Head lever #2 is cabled to this ECU's Control Head #2 connector.) Otherwise, you are done calibrating Control Head levers for this ECU and may skip to the next menu (“Throttle Actuator Menu”) below.
10. Press **ENTER** to proceed (or push “+” or “-“ to skip to the next or previous menu). The ECU displays **FF**.
11. Go to your second control station and repeat steps 4-8 using your second Control Head.
12. Return to the ECU for the next menu.

NOTICE

The Throttle Actuator Menu is automatically skipped on systems with Electronic Throttle Control (ETC).

Throttle Actuator Menu

In this menu, you are prompted to set the following parameters:

- 1) The action required of the actuator cable to open the throttle: Pull (**PL**) or Push (**PS**).
Default = **PS**.
- 2) The distance, in millimeters, the actuator cable must be moved to go from idle to wide open throttle (referred to as the actuator or throttle stroke). The acceptable range is 24 to 76 millimeters (0.945 to 2.99 inches).
Default = **24** mm.
- 3) The “Idle” position of the actuator cable.

NOTICE

The last parameter of the Throttle Actuator Menu (setting the “Idle” position) is also the step in which the final physical connection is made between the actuator cable and the mechanical throttle linkage.

1. The ECU displays **A1** for Throttle Actuator calibration.
2. Press **ENTER** to proceed (or push “+” or “-“ to skip to the next or previous menu).
3. The ECU displays **PS** (Push) or **PL** (Pull) as the action to open the throttle.
4. If the correct action is displayed steady, press “+”.

5. If the action displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
6. Press the “+” or “-” button repeatedly until the correct action is flashing on the display. Press **ENTER** to select it.
7. The ECU next displays a flashing number in the range of **24** to **76**. This is the actuator stroke length, in millimeters, from idle to WOT (Wide Open Throttle). This should agree with the stroke recommended by the engine manufacturer. If this value is unknown, go to the engine, move the mechanical throttle linkage, and physically measure this distance.
8. If the correct stroke is displayed steady, press “+”.
9. If the stroke displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
10. Press the “+” or “-” button repeatedly to change the stroke in 2 mm increments until the correct stroke is flashing on the display. Press **ENTER** to select.
11. The ECU displays a steady **SI** (Set Idle).
12. Press **ENTER** to proceed (or push “+” or “-“ to skip to the next or previous menu).
13. The Throttle Actuator then moves the actuator cable to the “Idle” position.
14. Go to the engine corresponding to the ECU you’re calibrating and adjust the actuator cable’s end connector for the engine’s “Idle” position. Then attach the cable end to the mechanical throttle linkage on the engine.
15. Return to the ECU and press **ENTER**.
16. If you have an electronically shifted transmission then the ECU should display a steady **--**, indicating that calibration has been completed successfully. If the ECU displays a flashing **--**, at least one step was omitted during calibration, and you will need to repeat the calibration procedure, filling in any omissions. Pressing “+” will cause the ECU to return to the Mode Menu.
17. If you have a mechanically shifted transmission then you will also need to calibrate the Shift Actuator in the next menu below before you will be finished with calibration.

 **CAUTION**

*Following the **SI** display, pressing **ENTER** will cause the Throttle Actuator to move the actuator cable. Keep clear.*

NOTICE

The Shift Actuator Menu is automatically skipped on systems with Electronic Shift (ES).

Shift Actuator Menu

In this menu, you are prompted to set the following parameters:

1. The action required of the actuator cable to shift the transmission to Forward: *Pull* (**PL**) or *Push* (**PS**).
Default = **PS**.
2. The distance, in millimeters, the actuator cable must be moved to go from Neutral to Forward (referred to as the forward shift stroke). The acceptable range is 14 to 40 millimeters (0.551 to 1.57 inches).
Default = **14** mm.
3. The distance, in millimeters, the actuator cable must be moved to go from Neutral to Reverse (referred to as the reverse shift stroke). The acceptable range is 14 to 40 millimeters (0.551 to 1.57 inches).
Default = **14** mm.
4. The "Neutral" position of the actuator cable.

NOTICE

The last parameter of the Shift Actuator Menu (setting the "Neutral" position) is also the step in which the final physical connection is made between the actuator cable and the mechanical shift linkage.

1. The ECU displays **A2** for Shift Actuator calibration.
2. Press **ENTER** to proceed (or push "+" or "-" to skip to the next or previous menu).
3. The ECU displays **PS** (Push) or **PL** (Pull) as the action to shift the transmission to Forward.
4. If the correct action is displayed steady, press "+".
5. If the action displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
6. Press the "+" or "-" button repeatedly until the correct action is flashing on the display. Press **ENTER** to select.
7. The ECU next displays a flashing number in the range of **14** to **40**. This is the actuator stroke length, in millimeters, from Neutral to Forward. This should agree with the stroke recommended by the engine manufacturer. If this value is unknown, you can go to the engine, move the mechanical shift linkage, and physically measure this distance.
8. If the correct stroke is displayed steady, press "+".

9. If the stroke displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
10. Press the “+” or “-” button repeatedly to change the stroke in 2 mm increments until the correct stroke is flashing on the display. Press **ENTER** to select it.
11. The ECU again displays a flashing number in the range of **14** to **40**. This is the actuator stroke, in millimeters, from Neutral to Reverse. This should agree with the stroke recommended by the engine manufacturer. If this value is unknown, you can go to the engine, move the mechanical shift linkage, and physically measure this distance.
12. If the correct stroke is displayed steady, press “+”.
13. If the stroke displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
14. Press the “+” or “-” button repeatedly to change the stroke by 2 mm increments until the correct stroke is flashing on the display. Press **ENTER** to select it.
15. The ECU displays a steady **SN** (*Set Neutral*).
16. Press **ENTER** to proceed (or push “+” or “-“ to skip to the next or previous menu).
17. The Shift Actuator then moves the actuator cable to the “Neutral” position.
18. Go to the transmission corresponding to the ECU you’re calibrating and adjust the actuator cable’s end connector for the transmission’s “Neutral” position. Then attach the cable end to the mechanical shift linkage on the transmission.
19. Return to the ECU and press **ENTER**.
20. If you are using an actuator to mechanically control your boat’s throttle then the ECU should display a steady - -, indicating that calibration has been completed successfully. If the ECU displays a flashing - -, at least one step was omitted during calibration, and you will need to repeat the calibration procedure, filling in any omissions. Pressing “+” will cause the ECU to return to the Mode Menu.
21. If you have Electronic Throttle Control (ETC) then you will also need to specify the engine manufacturer in the next menu below before you will be finished with calibration.

⚠ CAUTION

Following the **SN** display, pressing **ENTER** will cause the Shift Actuator to move the actuator cable. Keep clear.

NOTICE

On jet drive systems, the “transmission” is the hydraulic valve that controls the boat’s split duct thrust reversing deflector (“bucket”).

NOTICE

The Electronic Throttle Engine Manufacturer Menu only appears on systems with Electronic Throttle Control (ETC).

Electronic Throttle Engine Manufacturer Menu

In systems with Electronic Throttle Control (ETC), you must specify the Electronic Throttle Engine Manufacturer for the ECU to use ETC correctly. The options available are:

- **EF** - GM MEFI
- **(U)** - Cummins
- **(A)** - CAT

Default = **EF** (GM MEFI).

1. The ECU displays **EF** (GM MEFI) or the last selection chosen if previously setup.
2. If the correct selection is displayed steady, press “+”.
3. If the selection displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the “+” or “-” button repeatedly until the correct selection is flashing on the display. Press **ENTER** to select.

The ECU should display a steady **--**, indicating that calibration has been completed successfully. If the ECU displays a flashing **--**, at least one step was omitted during calibration, and you will need to repeat the calibration procedure, filling in any omissions. Pressing “+” will cause the ECU to return to the Mode Menu.

Selecting Features and Customizing the System

Before you use the i6000 System, you should ensure the appropriate features are selected and setup to your preferences. Feature selection is performed at the ECU in the Feature Selection mode. This mode allows you to set up additional features and customize the system. The features come preset to defaults which are listed in the procedures below. You should review these prior to use. If all of the feature selection defaults are acceptable to you then you may skip or postpone the feature selection procedure.

The *Feature Selection* menus described below are in the sequence presented by the ECU. The defaults identified are the first choices presented by an uncustomized system.

NOTICE

If your boat has more than one engine, you must select the features on each one of your ECU(s) separately for the system to function properly. Additionally, many of the menus must be setup the same way on each ECU so that there isn't conflicting information. Menus that must be setup the same way system-wide are Throttle Limit, Forward Throttle Curve, Reverse Throttle Curve, Programmable Shift Delay, Station Select Protection, and Fail-Safe Response Mode.

Select an ECU and test the ECU's LED display by selecting the *Information* ECU mode (see "1F mode", page 30). When ready to select features on this ECU, select *Feature Selection* mode (see "Choosing the ECU Mode", page 31) and run through each of the *Feature Selection* menus listed below, following the instructions. When finished, set the ECU to *Operation* mode. Repeat this entire procedure for each ECU you have installed.

NOTICE

The Throttle Limit Menu is automatically skipped if you did not purchase a Split Range Throttle, Jet Drive, or Variable Shift Window i6000 System.

Throttle Limit Menu

Depending on the options package or configuration purchased, this menu either tells the ECU what percentage of throttle is the maximum for Split Range Throttle, what the boost level is for the Jet Drive Boost, or what the acceptable throttle setting is for shifting into gear on Variable Shift Window (VSW) systems that can tolerate higher throttle level shifting. The selectable range is from 5% to 50%.

Default = **25** (25% Throttle) *Note: Is set to 0 for Boost in Jet Boat Configuration.*

1. The ECU displays **25** (25% Throttle) or the prior value chosen if previously changed.
2. If the correct percentage is displayed steady, press "+".
3. If the percentage displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the "+" or "-" button repeatedly until the correct percentage is flashing on the display. Press **ENTER** to select.

Forward Throttle Curve Menu

Eight different forward throttle sensitivity curves (*F1* through *F8*) are available. These curves determine the relationships between lever position and throttle movement. These selections can be easily changed later if you find you are not comfortable with the selected curve. Possible reasons for changing include a curve that feels awkward because it is too different from your previous boat or throttle system or a curve that does not seem optimal for docking. The relationships between lever and throttle positions are described in "Appendix A: Throttle Curves" on page 64. This is also referred to as Programmable Throttle Control.

Default = *Forward Throttle Curve* **F1** (see "Forward Throttle Curves (Table 5)", page 64) .

1. The ECU displays **F** and a number (*Forward Throttle Curve* **F1** through **F8**). The throttle curves are described in "Forward Throttle Curves (Table 5)" on page 64.
2. If the correct forward throttle curve is displayed steady, press "+".
3. If the throttle curve displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the "+" or "-" button repeatedly until the correct throttle curve is flashing on the display. Press **ENTER** to select.

Reverse Throttle Curve Menu

Eight different reverse throttle sensitivity curves (*R1* through *R8*) are available. These curves determine the relationships between lever position and throttle movement. These selections can be easily changed later if you find you are not comfortable with the selected curve. Possible reasons for changing include a curve that feels awkward because it is too different from your previous boat or throttle system or a curve that does not seem optimal for docking. The relationships between lever and throttle positions are described in “Appendix A: Throttle Curves” on page 64. This is also referred to as Programmable Throttle Control.

Default = *Reverse Throttle Curve R1* (see “Reverse Throttle Curves (Table 6)”)

1. The ECU displays **R** and a number (*Reverse Throttle Curve R1* through *R8*). The throttle curves are described in “Reverse Throttle Curves (Table 6)”.
2. If the correct reverse throttle curve is displayed steady, press “+”.
3. If the throttle curve displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the “+” or “-” button repeatedly until the correct throttle curve is flashing on the display. Press **ENTER** to select.

Shift Actuator Type Menu

NOTICE

The Shift Actuator Type Menu is automatically skipped if you purchased the Electronic Shift (ES) options package.

This menu tells the ECU what kind of actuator you are using. The Optional High-Load Shift Actuator is generally used with outboard and stern-drive boats. Two different shift actuation choices are available:

- **S** – *Standard Actuator*
- **O** – *Optional High-Load Actuator*

Default = **S** (*Standard Actuator*).

1. ECU displays **S** (*Standard Actuator*) or **O** (*Optional High-Load*).
2. If the correct actuator type is displayed steady, press “+”.
3. If the actuator type displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the “+” or “-” button repeatedly until the correct actuator type is flashing on the display. Press **ENTER** to select.

Programmable Delay Menus

The i6000 system can ensure that all shifts into gear occur at throttle and power train inertia levels that will not harm your transmission, such as might occur if someone were to accidentally throw a lever from Full Forward to Full Reverse. To allow for the specific situation of your boat, and to allow for inertia to decay before shifting into gear, a shift delay can be specified. No delay is applied going to Neutral Gear.

The **Programmable Shift Delay** is a setting for how long the system will wait before shifting into gear. The application and duration of the selected shift delay is dependent upon the time spent at a particular throttle setting while in gear.

The resulting shift delay applied is the selected Programmable Shift Delay Value proportioned by the current Throttle Percentage and then applied to a rolling average whose time window is equal to 4 times the Programmable Shift Delay setting.

When the throttle is moved, the new computed value is added to the rolling averaged value. If the throttle remains steady the new computed value will be achieved after the time of 4 times the Programmable Shift Delay Setting (length of average window) . Each time the throttle is moved, the new computed value is used by the rolling average.

The delay will be proportionally less than the selected delay for shorter durations in gear at throttle settings less than wide open throttle. This results in shift delay protection while cruising yet zero shift delay when quickly shifting back-and-forth at low RPMs, such as during docking maneuvers, when you need quick engine response the most. The Delay may be selected from 0 (none) to 12 seconds in 1.2 second increments.

For example with Programmable Shift Delay set at 12 seconds the following running conditions will occur:

Running at Full Throttle: after 48 sec., a 12-sec. delay is applied

Change to Half Throttle: after 48 sec., a 6-sec. delay is applied

The **Fixed Shift Delay** is the specific time for which the shifting of the transmission will be delayed. This number is not a function of any other variable such as engine speed or time in gear and is always a delay for the specified time, so as to ensure a fixed delay time in shifting into gear. The Delay may be selected from 0 (none) to 2.0 seconds in 0.1 second increments. This delay is additive to the Programmable Shift Delay.

Programmable Shift Delay (Speed-Time Delay)

The default delay value for the Shift Delay is set as a function of the engine setting as listed below. The default settings are:

Engine Setting	Default Delay
Outboard - ob	4.8
Gas - gs	4.8
Diesel - ds	4.8

1. The ECU displays two digits (the shift delay between 0 and 12 seconds, however the ECU does not show the decimal points).
2. If the correct shift delay is displayed steady, press “+”.
3. If the delay displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause flash.
4. Press the “+” or “-” button repeatedly until the correct delay is flashing on the display. Selections are:

00 – no delay	12 = 1.2 sec.	24 = 2.4 sec.	36 = 3.6 sec.	48 = 4.8 sec.
60 = 6.0 sec.	84 = 8.4 sec.	96 = 9.6 sec.	11 = 11.0 sec.	12 = 12.0 sec.

5. Press **ENTER** to select.

Fixed Shift Delay

The default delay value is set as a function of the engine setting and type of Shift Device. Default delay settings are below:

System Type ==>	Mech. Shift MT	Elect. Shift MT	Mech. Shift ET	Elect Shift ET
Engine Setting	Default	Default	Default	Default
Outboard: ob	0	0	0	0
Gas: gs	0	.3	.2	.5
Diesel: ds	0	.3	.2	.5

1. The ECU displays two digits (the shift delay between 0 and 2 seconds, however the ECU does not show the decimal points).
2. If the correct shift delay is displayed steady, press “+”.
3. If the delay displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause flash.
4. Press the “+” or “-” button repeatedly for 0.1 second increments/decrements until the correct delay is flashing on the display. Selections are:

00 – no delay; 01 = .1 second; 02 = .2 second.; through 20 = 2.0 seconds

5. Press **ENTER** to select.

Station Select Protection Menu

Station Select Protection prevents accidental switching between control stations in dual station boats. If chosen, a change of control stations requires that Control Head buttons be pressed in a specific sequence-**SELECT**, **SELECT**, port **N** (neutral), **SELECT**. The menu options available are:

- **oF** – Station Select Protection Off
- **on** – Station Select Protection On

Default = **oF** (Station Select Protection Off).

1. The ECU displays **oF** (Station Select Protection Off) or **on** (Station Select Protection On).
2. If the correct selection is displayed steady, press “+”.
3. If the selection displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the “+” or “-” button repeatedly until the correct selection is flashing on the display. Press **ENTER** to select.

Fail-Safe Response Mode Menu

Either of two Fail-Safe Response Modes may be selected in case of a critical system failure: *Neutral Idle* (**nl**) and *Range Gear* (**ra**).

In *Neutral Idle* Fail-Safe Response Mode, Control head or Throttle Actuator failure results in neutral gear and idle throttle. Shift actuator failure results in idle throttle and the Shift Actuator remaining in the gear engaged at the time of the failure.

WARNING

Certain types of failures, such as actuator sensor or motor failures, may prevent the system from reaching the selected Fail-Safe Mode.

NOTICE

The Fail-Safe Response Mode Menu is automatically skipped on center engine ECUs (triple engine configurations); their fail-safe response mode is automatically set to **nl** (Neutral Idle).

In *Range Gear* Fail-Safe Response Mode, failure of a Control Head or Shift Actuator results in the Shift Actuator remaining in the engaged gear at the time of the failure, but the Throttle Actuator position depends on its position at the time of the failure. If the Throttle Actuator is open more than 40% above idle, it will be reduced by 10% of its position at the time of the failure. If it is less than 40% above idle, it will not be changed. For example, if it is at 70% it will be changed to 63%; if it is at 30% it will not be changed. Note however that Throttle Actuator failure will result in the throttle remaining at the last setting when the failure occurred.

Default = **nl** (*Neutral Idle*).

1. The ECU displays **nl** (*Neutral Idle*) or **ra** (*Range Gear*)
2. If the correct selection is displayed steady, press “+”.
3. If the selection displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the “+” or “-” button repeatedly until the correct selection is flashing on the display. Press **ENTER** to select.

Center Engine Slave Mode Menu

In triple engine systems this menu tells the ECU how the Center engine is to behave. To understand triple engine operation, some new terms need to be introduced:

- An engine is **ENGAGED** when it responds to Control Head lever movements.
- If it is **DISENGAGED**, the actuators for that engine are maintaining their position at Neutral Idle. This should **NOT** be read to mean that the engine is turned off. It merely means that for the configurations described below, the ECU has placed its actuators at the positions of Neutral Gear and Idle Throttle.

The i6000 offers 4 options for Center engine behavior:

- **80** – *Center follows Port*. The center engine always responds exclusively to the movements of the Port handle. Upon power-up, the Center engine is automatically engaged. If desired the Center engine can be manually disengaged via the Control Panel.
- **81** – *Follow if Same Gear*. The center engine responds to the movements of the Port handle as long as Port & Starboard are in the SAME GEAR. If Port & Starboard are in different gears, the Center disengages until Port & Starboard are once again in the same gear (when it will automatically re-engage). Upon power-up, the Center engine is automatically engaged. If desired the Center engine can be manually disengaged via the Control Panel. **This is the default setting for Triple Engine applications.**
- **82** - *Follow Reverse*. The Center engine responds to the movements of the Port handle unless the Starboard moves to Reverse. If the Starboard Engine moves to Reverse, the Center Engine will follow. If the Starboard engine shifts out of Reverse, the Center will return to following the Port. Upon power-up, the Center engine is automatically engaged. If desired the Center engine can be manually disengaged via the Control Panel.

NOTICE

The Center Engine Slave Mode Menu only appears on properly assigned Center Engine ECUs.

NOTICE

The option code numbers in the Center Engine Slave Mode Menu begin with the number 8 to help discriminate them from other option code numbers seen in other menus.

- **83** - *Neutral disengage*. The Center engine responds to the movements of the Port handle unless either the Port or the Starboard shifts into Neutral. If either engine is shifted into Neutral, the Center engine will disengage. It will remain disengaged until BOTH engines are placed into GEAR AND the Center is manually re-engaged via the Control Panel.

Default = **81** (*Follow if Same Gear*).

1. The ECU displays **81** (*Follow if Same Gear*) or the last selection chosen if previously setup.
2. If the correct selection is displayed steady, press “+”.
3. If the selection displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the “+” or “-” button repeatedly until the correct selection is flashing on the display. Press **ENTER** to select.

Transmission Overshift Menu

This menu addresses problems with some engines that are difficult to pull out of gear. When Transmission Overshift is enabled, the actuator will move the engine’s mechanical shift linkage out of its gear position, past its normal Neutral position, then back again to Neutral to ensure the engine completely shifted out of gear. The menu options are:

- **90** - *No Overshift*
- **91** - *Overshift*

Default = **90** (*No Overshift*).

1. The ECU displays **90** (*No Overshift*) or the last selection chosen if previously setup.
2. If the correct selection is displayed steady, press “+”.
3. If the selection displayed is incorrect, check to see if the display is flashing. If it is not flashing, press **ENTER** to cause the display to flash.
4. Press the “+” or “-” button repeatedly until the correct selection is flashing on the display. Press **ENTER** to select.
5. The ECU should display a steady **--**, indicating that calibration has been completed successfully. If the ECU displays a flashing **--**, at least one step was omitted during calibration, and you will need to repeat the calibration procedure, filling in any omissions. Pressing “+” will cause the ECU to return to the Mode Menu.

NOTICE

The Transmission Overshift Menu is automatically skipped if you purchased the Electronic Shift (ES) options package.

NOTICE

The option code numbers in the Transmission Overshift Menu begin with the number 9 to help discriminate them from other option code numbers seen in other menus.

Testing the System

⚠ WARNING

Check with your engine manufacturer to ensure that adjustments to the engine’s shift and throttle settings can be made while it is off before performing this test.

For boats using actuators, follow the instructions below for checking the actuator settings for proper actuator cable movement and stroke length prior to use on the water. These tests should be performed with the engine(s) off.

1. Cycle the power on the i6000 system by either turning the ignition off and back on or disconnecting and reconnecting the Power wire harnesses on each ECU.
2. Physically check to ensure that the mechanical throttle linkage on the engine and/or shift linkage on the transmission are firmly attached and have been moved to the initial “power-up” positions of Neutral gear and Idle throttle. If either is set improperly, repeat the calibration sequence for the appropriate actuator.
3. Check the displays on each ECU. The displays should all read **oP**. If stroke length and/or action (push/pull) were set incorrectly one or more of the following error codes may have been generated: **28, 29, 11, 12, 61, 62, 64, 65, 66,** and **67**. For details on these error codes, their meanings and solutions, see “Error Reporting on the ECU” on page 60. If suggested solutions do not remedy the problem, repeat the calibration sequence for the affected actuator.
4. Move each engine’s lever in turn to Full Forward at the Control Head. See “Control Station Selection” on page 51 for more information on selecting and activating Control Heads.
5. Physically check that the mechanical throttle linkage on the engine and/or shift linkage on the transmission have been moved to the Forward gear and WOT positions. Pay particular attention to the stroke length and action (push/pull) used by the actuator(s). If either is set improperly, repeat the calibration sequence for the appropriate actuator.
6. Check the displays on each ECU. The displays should all read **oP**. If stroke length and/or action (push/pull) were set incorrectly one or more of the following error codes may have been generated: **11, 12, 61, 62, 64, 65, 66,** and **67**. Rule out any other possible causes, then repeat the calibration sequence for the affected actuator.
7. Move each engine’s lever in turn to Full Reverse at the Control Head.
8. Physically check that the mechanical throttle linkage on the engine and/or shift linkage on the transmission have been moved to the Reverse gear and WOT positions. Pay particular attention to the stroke length and action (push/pull) used by the actuator(s). If either is set improperly, repeat the calibration sequence for the appropriate actuator.

-
9. Check the displays on each ECU. The displays should all read **oP**. If stroke length and/or action (push/pull) were set incorrectly one or more of the following error codes may have been generated: **12, 62, 64, and 66**. Rule out any other possible causes, then repeat the calibration sequence for the affected Shift Actuator.
 10. Repeat steps 4-9 for each Control Head installed.
 11. If the linkage positions were correct and no error codes were generated during the performance of this test, the system is now ready for testing on the water.

Operation

Getting to Know the i6000 Control Heads

A top-mount single-lever Control Head.

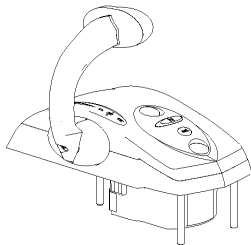


Figure 11

A side-mount single-lever Control Head.

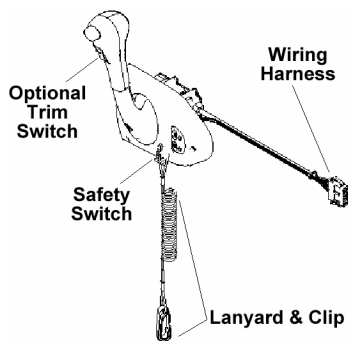


Figure 12

A top-mount dual-lever Control Head.

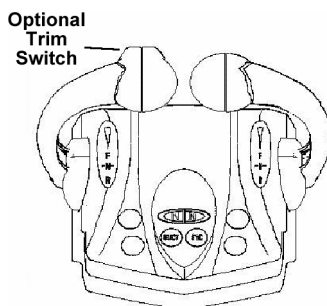
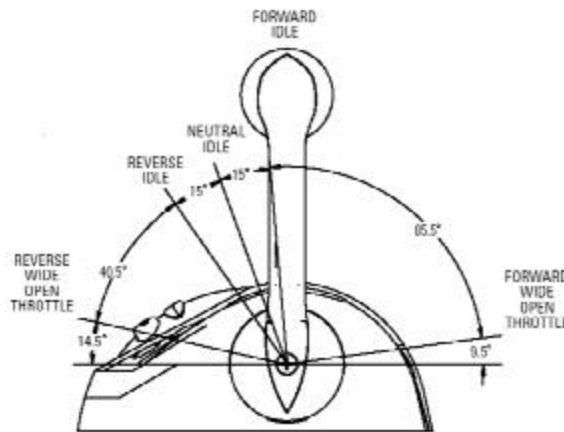


Figure 13

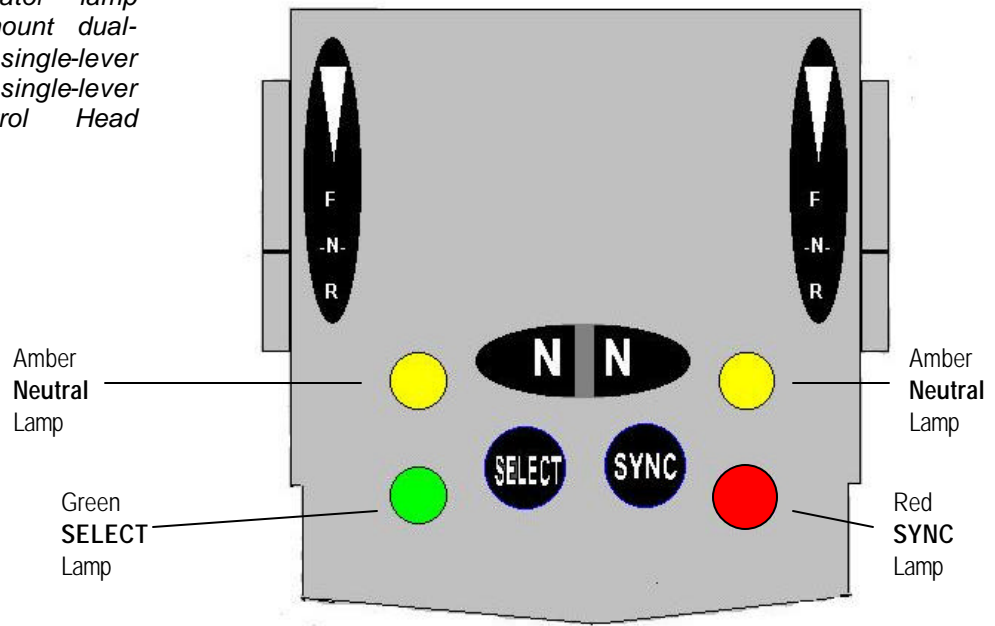
The i6000's Shift and Throttle Control Heads come with single lever controls. A single lever control controls both shifting and throttle for a single engine. Therefore, dual engine systems are controlled by a dual-lever Control Head--the port lever controlling shift and throttle for the port engine and the starboard lever controlling shift and throttle for the starboard engine. Control Heads that have only a single, single lever control (single engine systems) come in either top-mount or side-mount configurations. Dual-lever Control Heads are only available in the top-mount configuration.



For non-jet drive systems, the forward throttle range is 85.5° of lever movement; and the reverse throttle range is 40.5°. The total lever movement is 156°. Forward Idle is the 15° range between Neutral Idle and Forward Throttle. Reverse Idle is the 15° range between Neutral Idle and Reverse Throttle.

For jet drive systems, the ranges between Neutral Idle and Forward and Reverse Throttles is larger than in non-jet drive systems, but the total lever movement remains the same (156°). The range between Neutral Idle and Forward Throttle is 27.5°. The range between Neutral Idle and Reverse Throttle is also 27.5°. This 55° range between Forward Throttle and Reverse Throttle is called the Jet Drive Shift Zone because of the jet drive's ability to shift from Forward to Reverse in a linear fashion across this range. Certain jet drive specific functions can only be activated inside or outside the Jet Drive Shift Zone.

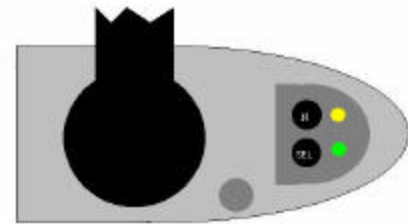
Button and indicator lamp positions on top-mount dual-lever (a), top-mount single-lever (b), and side-mount single-lever (c) i6000 Control Head configurations.



a

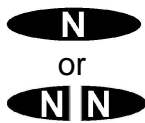


b

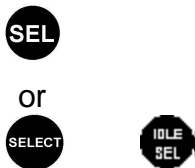


c

Control Head Button Functions



N – Neutral button. If the associated Control Head lever is in the “Neutral Idle” position, pushing this button engages/disengages Neutral Throttle Warmup (NTW). If the associated Control Head lever is in a Gear Idle position, pushing this button engages/disengages Split Range Throttle (if installed).



SELECT - If the station is inactive, pushing this button activates the station (used in conjunction with port **N** when Station Select Protection is on). If the station is active, repeatedly pushing this button cycles through four different indicator lamp intensities (the Control Head lever must also be outside the Jet Drive Shift Zone on jet drive systems). Additionally, on jet drive systems, pushing this button at an active station while the Control Head lever is within the Jet Drive Shift Zone engages/disengages Jet Drive Boost.

SYNC - Pushing this button engages/disengages the Power Train Synchronization (PTS) option (if installed) when the port and starboard Control Head levers are set to nearly the same positions.

TRIM - Optional button on the fore or port side of the lever handle (port lever on dual-lever Control Heads). Rocking this switch up or down raises or lowers the engine(s) as desired.

Safety Switch - A special function button on side-mount Control Heads (see Fig. 12, page 49). A lanyard clipped to both the operator and the **Safety Switch** trips the switch to kill the engine should the operator be thrown from the helm.

Starting Up the i6000

Your i6000 system is equipped with a Neutral Start Protection option. If properly installed, this feature prevents the engine from starting when the boat is in gear. The engine can only be started when the transmission is in Neutral.

NOTICE

The engine can also be started with the system in Neutral Throttle Warmup.

To start your engine, make sure power to the i6000 system is on. Then move all Control Head levers for all engines to Neutral and Idle. You may then start your engine using your ignition system.

Start in Gear Override

This feature allows for starting the engine when the system was powered down in gear. For single, dual and triple engine applications the Neutral Switch is depressed on i6000 power-up or key-on with systems using the i1001 module to enable the Start relay for Port and Starboard engines. On triple applications, the center engine uses the Center switch on the engine select panel held during power-up.

Control Station Selection

NOTICE

Station Selection is cancelled if activity is detected at the old station or levers at the new station are not matched to current settings within 5 seconds of the request.

If your boat is outfitted with multiple control stations, Station Select allows you to select which station will be used to control the boat. If your boat only has one control station, then the station will automatically be selected upon startup when the Control Head levers are in Neutral and Idle. A lit **SELECT** lamp indicates a station is active.

If Station Select Protection was enabled in *Feature Selection* ECU mode, a sequence of button presses is required at the desired station to gain control of the boat. This sequence is: **SELECT**, **SELECT**, port **N** (Neutral), **SELECT**. If Station Select Protection was not enabled, simply go to the desired station and press the **SELECT** button once.

In either case, the **SELECT** indicator will flash if the lever positions at the new station do not match the lever positions at the old station. Move the lever(s) to match the active shift and throttle positions. Once you have done this, the **SELECT** lamp at the new station will go steady (and the **SELECT** lamp at the old station will switch off), confirming that control has been transferred to the new station and you can now control the boat from this position.

NOTICE

Control Head (CH) errors on unselected Control Head

On multiple station applications the CH errors should only be reported after CH selection.

*Errors reported from the unselected head will result in a **non-critical error** both logged and displayed.*

If the user attempts to select the CH with errors, the request is ignored.

Indicator Dimming Feature

NOTICE

Indicator Dimming is only accessible from the active control station.

*On jet drive systems, indicator dimming only works if the port Control Head lever is **OUTSIDE** the Jet Drive Shift Zone. Inside the Zone, the **SELECT** button engages the Jet Drive Boost.*

The lamps on the Control Head(s) (and Engine Selection Panel(s) in triple engine systems) can be varied in intensity to a more comfortable level if desired. Maximum brightness is reserved to signal a critical or non-critical failure. In normal operation, you may choose from four levels of brightness. It is suggested that the lowest intensity be reserved for night running, with the higher levels of brightness to be used in varying degrees of sunlight.

If the indicator lamps are too bright and you are at the active control station, push the **SELECT** button (the Control Head lever must also be outside the Jet Drive Shift Zone on jet drive systems) and the lamps will dim. If the lamps are still too bright, you can continue pressing the **SELECT** button to cycle through the lamp intensity choices until you find the desired intensity.

Engine Selection in Triple Engine Systems

The Engine Selection Panel is used to control engine engagement and indicate each engine's engagement status. Upon startup, all engines are engaged. An engaged engine responds to Control Head lever movements and is indicated by a steadily lit lamp. Disengaged engines are maintained at Neutral Idle and are indicated by unlit lamps.

NOTICE

In triple engine systems using the “Neutral Disengage” Center Engine Slave Mode (#83), center engines can only be engaged when the other engines are in gear.

To engage an engine, simply press the switch for that engine. If the controlling lever for the engine isn't set to an acceptable engagement position, its status indicator lamp will flash once. If necessary, move the engine's controlling lever to either Neutral Idle, Gear Idle, or a gear with its throttle at less than 5% (or less than the Throttle Limit in Variable Shift Window systems) then press the switch again. The engine's status indicator lamp will light steady once the engine has engaged.

While engaged, the Center engine behaves as specified in the Center engine ECU's *Feature Selection* mode (see “Center Engine Slave Mode”, page 45).

NOTICE

In triple engine systems using the “Follows Reverse” Center Engine Slave Mode (#82), center engines that have followed another engine into Reverse will not revert control back to the port lever when the port engine is in a gear with its throttle at more than 5% (or more than the Throttle Limit set in Variable Shift Window systems).

Pressing an engaged engine's switch will disengage that engine and cause it to be brought to Neutral Idle and its ECU to stop responding to control head lever commands if the throttle is less than 5% (or less than the Throttle Limit set in Variable Shift Window systems).

While in Power Train Sync (PTS), any of the engines may be disengaged. However, disengaging the port engine while in PTS will cause the port engine ECU to stop providing RPM synchronization data and the remaining engaged engines will drop to “Lever Sync”. The remaining engaged engines will still follow the “percent of throttle” and shift settings of the port Control Head lever but will no longer perfectly match each others RPMs without the port engine's RPM data. To reestablish PTS, the port engine must be reengaged and the other PTS criteria met.

Neutral Throttle Warmup (NTW)

⚠ WARNING

Neutral Throttle Warmup will only engage when the system is in Neutral. Pushing the N (Neutral) button while in Gear Idle will engage Split Range Throttle (if installed).

Neutral Throttle Warmup (NTW) is an engine mode that allows you to apply throttle without engaging a gear. This feature is useful in starting or warming the engine.

To engage Neutral Throttle Warmup, move the engine's lever to the “Neutral Idle” position. Then press the **N** (Neutral) button next to this lever on the Control Head. A flashing **N** (Neutral) lamp indicates that NTW is engaged for this engine.

While in Neutral Throttle Warmup you can apply throttle in Forward or Reverse without actually engaging the gear.

NOTICE

On jet drive systems, NTW will not engage while Jet Drive Boost is engaged.

To disengage Neutral Throttle Warmup, return the engine's lever to the "Neutral Idle" position and once again press the **N** (Neutral) button next to the lever on the Control Head. The **N** (Neutral) lamp will stop flashing and remain steadily lit to indicate that NTW is disengaged and the engine will now respond to lever commands.

Power Train Sync (Option)

Multi-engine non-jet drive systems have the option of installing Power Train Sync (PTS) at the time of purchase. This engine mode option allows you to synchronize your boat's engaged engines by matching their RPMs and controlling them all with just the port engine Control Head lever, making the port engine the master for all.

PTS can only be engaged when there are no other engine modes enabled. Any other engine mode being used, such as Neutral Throttle Warmup or Split Range Throttle, must be disengaged before PTS can be engaged. These modes can be used after PTS has been engaged, however. Upon exiting PTS, each engine will remain in the mode(s) last used while in synchronization.

Sync entry in reverse.

Do not allow the operator to enter sync mode when in reverse for power train sync. Operation shall allow exit from sync mode from reverse.

⚠ CAUTION

*While in synchronization, only the master Control Head lamps (port lamps) will indicate the engine modes being used. Upon exiting synchronization, each set of Control Head lamps will reflect its own engine's modes independently. For example, only the port Neutral lamp will flash if Neutral Throttle Warmup is engaged while in PTS. If PTS is disengaged with NTW still active then **both** the port and starboard Neutral lamps will flash to indicate NTW is now engaged independently on each engine.*

Synchronization will fail to engage/disengage if port and starboard Control Head levers are not positioned correctly within 5 seconds of the request.

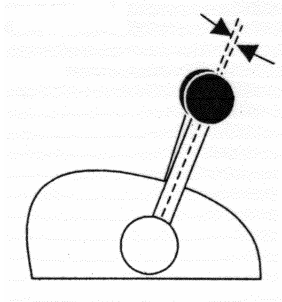


Figure 15

To engage PTS, first disengage any other engine modes being used. Match all engine shift and throttle settings by moving the active port and starboard Control Head levers adjacent to each other within 10% of each other's respective settings. Then press the **SYNC** button on the Control Head. The **SYNC** lamp will flash if the levers are not within 10% of each other's settings. Move the levers until they match the acceptable engagement positions and the **SYNC** lamp will stop flashing to remain steadily lit. A steady **SYNC** lamp confirms that PTS is engaged.

While the engines are synchronized, the i6000 matches the engines' speeds and keeps their transmissions in alignment. This enables you to throttle both engines and shift both transmissions with only the master (port) engine controls through their entire range of movement. Neutral Throttle Warmup or Split Range Throttle can each be engaged while in PTS by simply following their respective procedures using the master (port) engine controls.

To disengage PTS, the port and starboard Control Head levers must again be moved to within 10% of each other's respective settings. Then press the **SYNC** button on the Control Head. The **SYNC** lamp will flash if the levers are not positioned correctly to disengage. Move the levers until they match the proper settings and the **SYNC** lamp will stop flashing and turn off. An unlit **SYNC** lamp confirms that PTS is no longer engaged and the engines are once again working independently of each other.

Cruise Sync (Option)

Multi-engine systems have the option of installing Cruise Sync (CS) at the time of purchase. CS is an option allowing you to synchronize your boat's engaged engines automatically by matching their RPMs whenever both Control Head levers are above 20% throttle in Forward gear and within 10% of each other's position.

CS can only engage when there are no other engine modes enabled. Any other engine mode being used, such as Neutral Throttle Warmup or Jet Drive Boost, must be disengaged before CS can automatically engage. These modes can be used after CS has automatically engaged, however. Upon exiting CS, each engine will remain in the mode(s) last used while in synchronization.

⚠ CAUTION

*While in synchronization, only the master Control Head lamps (port lamps) will indicate the engine modes being used. Upon exiting synchronization, each set of Control Head lamps will reflect its own engine's modes independently. For example, only the port Neutral lamp will flash if Neutral Throttle Warmup is engaged while in CS. If CS is disengaged with NTW still active then **both** the port and starboard Neutral lamps will flash to indicate NTW is now engaged independently on each engine.*

CS will automatically engage and remain engaged whenever Control Head levers are adjacent to each other and over 20% throttle in Forward gear.

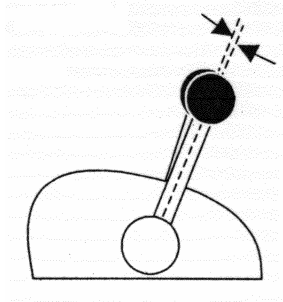


Figure 16

To automatically synchronize your engines using CS, first press the **SYNC** button to enable Cruise Sync, then disengage any other engine modes being used. Match all engine shift and throttle settings by moving the active port and starboard Control Head levers adjacent to each other within 10% of each other's respective settings. The levers must also be set to over 20% throttle in Forward gear. After the levers have remained adjacent for 1 second, a steady **SYNC** lamp confirms that CS has automatically engaged.

While the engines are synchronized, the i6000 matches the engines' RPMs. To maintain CS, simply move both Control Head levers together whenever making adjustments to the engine throttle settings. Neutral Throttle Warmup or Jet Drive Boost can each be engaged while in CS by simply following their respective procedures.

To disengage CS, simply move the port and starboard Control Head levers more than 10% from each other's respective settings or bring the Control Head levers below 20% throttle or out of Forward gear. After the levers have remained in this way for a brief moment, an unlit **SYNC** lamp confirms that CS has automatically disengaged and the engines are once again working independently of each other.

Split Range Throttle (Option)

This engine mode option gives you greater throttle sensitivity. In Split Range Throttle (SRT), moving an engine's control lever all the way to the "Full Forward" position will only produce the maximum percentage of wide open throttle selected in the *Features Selection* ECU mode (see "Throttle Limit Menu", page 41). Typical Throttle Limit percentages for SRT are 25% to 50%. When SRT is engaged your engines temporarily use linear throttle response, as illustrated by *Forward Throttle Curve F2* and *Reverse Throttle Curve R4* in "Appendix A: Throttle Curves" (page 64), for application of the chosen SRT Throttle Limit. The throttle curves previously selected in the *Features Selection* ECU mode are automatically restored upon disengaging SRT. To be able to use SRT, it must have been purchased as a part of the installed options package on your i6000 system. SRT is not available on jet drive systems.

To engage Split Range Throttle, move the engine's lever to a Gear Idle position (Forward Idle or Reverse Idle) and press the **N** (Neutral) button next to this lever on the Control Head. The **N** (Neutral) lamp will flash to indicate that Split Range Throttle is engaged.

While in Split Range Throttle, the system will shift normally but the throttle will be limited in both gears (Forward and Reverse) to the Throttle Limit percentage programmed for WOT (Wide Open Throttle) in the *Features Selection* ECU mode.

NOTICE

*If the system is shifted into Neutral while in Split Range Throttle engine mode, the **N** (Neutral) lamp will come on (steady) to indicate that the system is in Neutral. When the lever is moved back into gear, the **N** (Neutral) lamp will resume flashing to indicate that the system is still in Split Range Throttle.*

To disengage Split Range Throttle, return the engine's lever to a Gear Idle position (Forward Idle or Reverse Idle) and again press the **N** (Neutral) button next to the lever on the Control Head. The **N** (Neutral) lamp will stop flashing, indicating that Split Range Throttle has been disengaged.

Jet Drive Boost (JDB)

Jet Drive Boost is only available on jet drive systems and is a standard jet drive feature. Jet Drive Boost is used to temporarily increase the throttle in order to counteract a change in water currents, thereby keeping the boat stationary. It changes the throttle setting to the Throttle Limit specified in the *Features Selection* ECU mode (see "Throttle Limit Menu", page 41).

NOTICE

JDB will not engage while Neutral Throttle Warmup is engaged.

To engage Jet Drive Boost, move the port engine Control Head lever so it is within the Jet Drive Shift Zone. When a Control Head lever is within this Shift Zone, it is indicated by a steadily lit **N** (Neutral) lamp. Press the **IDLE/SEL** button next to this lever on the Control Head. A flashing **SELECT** lamp indicates that JDB is engaged.

NOTICE

*The flashing of the **SELECT** lamp for JDB is faster than that for Station Select.*

To disengage Jet Drive Boost, return the port engine's lever to the Jet Drive Shift Zone and once again press the **IDLE/SEL** button next to the lever on the Control Head. The **SELECT** lamp will stop flashing to indicate that JDB is disengaged.

System Failure Warnings & Responses

A failure in the system is categorized as either a non-critical or critical failure. The i6000 will signal you when a failure is detected by flashing the lamps on the Control Head(s), using a different pattern for each type of failure. Failures detected in the port ECU will be signaled using the lamps on the port side of the Control Head. Failures detected in the Starboard ECU are signaled using the lamps on the starboard side of the Control Head.

Non-critical failures do not effect the immediate safe operation of the boat but should be reviewed when back at dock. In most cases, these failures are signaled by a five-second, rapid-flash cycle at maximum lamp intensity. At the end of the five-second rapid-flash cycle the lamps will return to previous lamp settings for 15 seconds (indicating the current system settings). Some non-critical errors, such as "13" are logged only.

Critical failures effect the safe operation of the boat, need immediate attention, and are signaled by continuous flashing of the lamps on the Control Head. When critical failures occur, the system will automatically place the engine in the Fail-Safe Response Mode chosen in *Feature Selection*. If *Neutral Idle* was selected, the throttle will be set to Idle and the transmission shifted into Neutral. If *Range Gear* was selected, the throttle will be set according to the last valid setting and the transmission will be set to the last used gear. The nature of a critical failure precludes continued operation of the boat without remedial action. Once repairs are made, the power to the "failed" ECU must be cycled to resume operation.

⚠ WARNING

Extreme care should be taken when starting the engine(s) during a critical failure. In the special case of a critical failure, Neutral Start Protection is disabled and the engine(s) can be started while in gear.

To determine the specific nature of a failure, run through the procedures listed in the "Troubleshooting" section on page 59.

Error codes displayed on the ECU and flashing error indicators on the Control Head will continue until the failure is acknowledged by either pressing the **ENTER** button on the ECU or cycling its power.

Manual Override

Location of Manual Override Knob and Wrench.

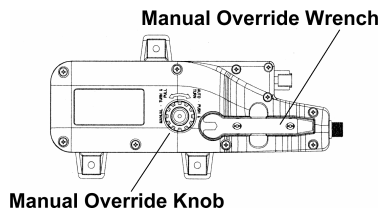


Figure 17

In the event of a critical failure, the actuators can be moved manually to control the engines. The actuators have a Manual Override Knob and a Wrench, which allow for manual movement of the actuator cables.

Before engaging Manual Override, first determine the specific nature of the failure (see "Troubleshooting", page 59). The system is functionally divided to allow independent manual operation of either shift or throttle. By discovering which function has failed, one can then select which actuator needs to be manually overridden.

To operate the failed actuator manually, simply unscrew the Manual Override Knob and pull it away from the actuator. Then use the wrench attached to the actuator housing to operate the actuator manually and return to dock to correct the failure.

Technical Information

Specifications

Power

Voltage Input	9 – 16 VDC
Circuit Breaker	One 10-Amp circuit breaker per ECU

Temperature

Operating Range	0° to 158° F (-18° to 70° C)
Storage Range	-40° to 176° F (-40° to 80° C)

Troubleshooting

Troubleshooting starts with a visual inspection. If a problem persists, use the *Error Reporting* mode of the “failed” ECU to isolate the problem.

Visual Inspection

If a problem is experienced with the i6000 system, first visually inspect the system for the most likely causes, which include the following:

- Loose harness connectors
- Poorly crimped butt connections
- Bent connector pins
- Mechanical obstructions
- Harnesses perforated by excessively tightened wire ties

WARNING

Do not use the Information, Error Reporting, Feature Selection, or Calibration ECU modes while the boat is underway. The engine(s) should be off since the boat cannot be controlled while in these modes.

Error Reporting on the ECU

If there are no obvious problems, use the *Error Reporting* mode of the “failed” ECU to isolate the problem. The last 100 error codes are recorded in the Error Buffer for future recall. To check these error codes, proceed as follows:

1. Stop the boat.
2. Go to the ECU for the engine indicated by the Control Head to be the failed system and choose *Error Reporting* mode (Er).
3. The ECU indicator will display the most recent failure code.
4. If no failures have been recorded, the ECU indicator will display a flashing - -.
5. Press “+” once to view each additional error code. The most recent 100 are stored in the ECU, in reverse chronological order.
6. Use Tables 4 and 5 below to interpret the failure codes and take the appropriate actions to correct the problem.
7. Press **ENTER** on the ECU to return to *Operation* mode. The ECU indicator should display **oP**.

System Voltage Log

This system will log all low voltage events when the system supply voltage is below 9 volts for greater than 3 seconds. This feature is available to aid service operation. It will record one event for each power cycle operation.

See Table 5 – Error Reporting Mode Non-Critical Codes 9 & 10 for more details (page 62).

Error Reporting mode critical failure codes.

ECU Display	Critical Failure	Suggested Action
51	Throttle Actuator Sensor	Manually override Throttle Actuator. Replace Throttle Actuator.
52	Shift Actuator Sensor	Manually override Shift Actuator. Replace Shift Actuator.
53	Lever 1 Sensor	Manually override Shift & Throttle Actuators. Replace Control Head #1.
54	Lever 2 Sensor	Manually override Shift & Throttle Actuators. Replace Control Head #2.
55	Throttle Actuator Sensor Power	Manually override Throttle Actuator. Check Throttle Actuator wire harness. Replace if necessary.
56	Shift Actuator Sensor Power	Manually override Shift Actuator. Check Shift Actuator wire harness. Replace if necessary.
57	Lever 1 Sensor Power	Manually override Shift & Throttle Actuators. Check wire harness for Control Head #1. Replace if necessary.
58	Lever 2 Sensor Power	Manually override Shift & Throttle Actuators. Check wire harness for Control Head #2. Replace if necessary.
61	Throttle Current	Manually override Throttle Actuator. Check Throttle Actuator Cable. Remove any obstruction, lubricate, or replace if necessary.
62	Shift Current	Manually override Shift Actuator. Check Shift Actuator Cable. Remove any obstruction, lubricate, or replace if necessary.
64	Motion Fault Shift Sensor	Same as #62 above.
65	Motion Fault Shift Drive Abnorm. Current	Same as #62 above.
66	Motion Fault Throttle Sensor	Same as #61 above.
67	Motion Fault Throttle Drive Abnormal Current	Same as #61 above.

Table 4

Error Reporting mode non-critical codes.

ECU Display	Non-Critical Failure	Suggested Action
1	Throttle Sensor	Replace Throttle Actuator.
2	Shift Sensor	Replace Shift Actuator.
3	Lever 1 Sensor	Replace Control Head #1.
4	Lever 2 Sensor	Replace Control Head #2.
7	Lever 1 Sensor Power	Check wire harness for Control Head #1. Replace if necessary.
8	Lever 2 Sensor Power	Check wire harness for Control Head #2. Replace if necessary.
9	Primary Power Supply - Low Voltage (below 9.0 volts) was detected for longer than 3 seconds	Check power supply connections and voltage (3 pin connector - red wire)
10	Backup Power Supply - Low Voltage (below 9.0 volts) was detected for longer than 3 seconds	Check power supply connections and voltage (3 pin connector – white wire)
11	Throttle Current	Check Throttle Actuator Cable for travel interference. Lubricate if necessary.
12	Shift Current	Check Shift Actuator Cable for travel interference. Lubricate if necessary.
13	Peer Communication Stopped	Check MagicBus comm cables. Check & confirm ECU/Engine Assignment is correct.
18	System Configuration Calibration Mismatch	Calibrate ECUs to have the same System Configuration information.
19	ECU/Engine Assignment Calibration Error	Calibrate ECUs so that none are assigned the same.
20	Engine Lead-Follow Setup Error	NA
21	Throttle Limit Feature Selection Mismatch	Select same Throttle Limit for all ECUs.
22	Fail-Safe Response Mode Feature Selection Mismatch	Select same Fail-Safe Response Mode for all ECUs.
23	Power Train Sync Available Setup Error	Ensure that Power Train Sync is installed on all ECUs or call Teleflex Marine Technical Support to
24	Forward Throttle Curve Feature Selection Mismatch	Select same Forward Throttle Curve for all ECUs.
25	Engine Type Calibration Mismatch	Calibrate ECUs to have the same Engine Type.
26	RPM Pulses per Revolution Calibration Error	Calibrate ECUs to have the same number of RPM Pulses per Revolution.
27	Reverse Throttle Curve Feature Selection Mismatch	Select same Reverse Throttle Curve for all ECUs.
28	Throttle Idle Startup Error	Check Throttle Actuator Cable. Remove any obstruction, lubricate, or replace if necessary.
29	Shift Idle Startup Error	Check Shift Actuator Cable. Remove any obstruction, lubricate, or replace if necessary.

Table 5

Maintenance

Your Teleflex Marine i6000 is designed to provide you with years of trouble-free operation with virtually no maintenance. Follow the simple procedures below to ensure that your i6000 continues to deliver top performance.

If the unit comes into contact with salt spray, simply wipe the affected surfaces with a cloth dampened in fresh water.

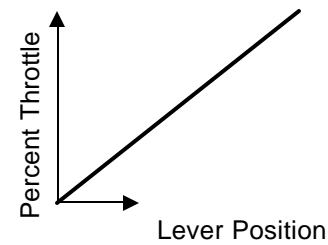
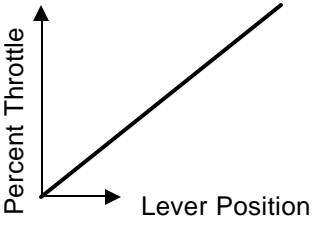
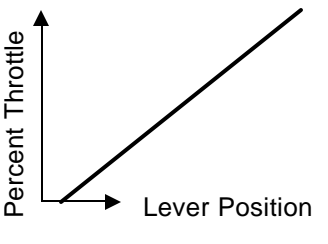
Do not attempt to repair the i6000 yourself. There are no user serviceable parts inside, and special tools and techniques are required for reassembly to ensure the waterproof integrity of the housings. **Repairs should be performed only by authorized Teleflex Marine technicians.**

Many requests for repair received by Teleflex Marine involve units that do not actually need repair. These units are returned “no problem found.” If you have a problem with your i6000, follow the instructions under “Troubleshooting” on page 59 before calling Customer Service or sending your unit in for repair. The i6000 contains several tools which can aid in determining if there is a problem and how to isolate and repair the problem in many cases.

Appendix A: Throttle Curves

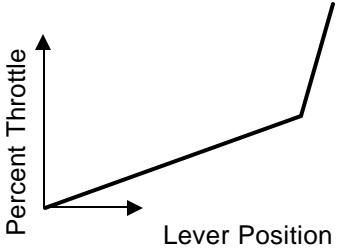
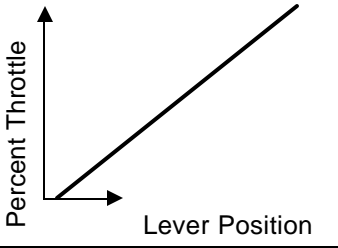
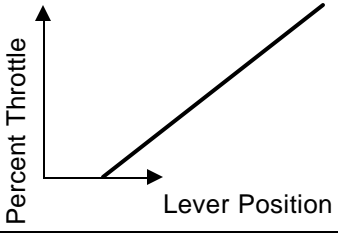
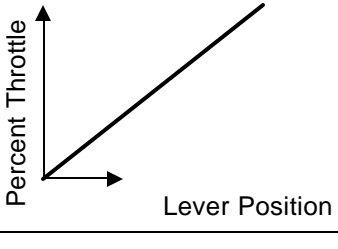
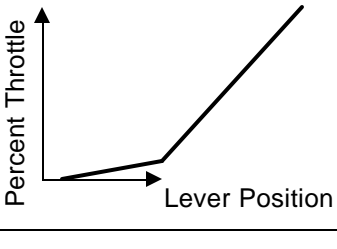
These tables show the lever positions within the forward and reverse lever ranges where the throttle begins to open. The tables also show thumbnail sketches of each throttle curve and specify where in the lever range each throttle curve slope change occurs and what the amount of throttle is at that position.

Forward Throttle Curves (Table 5)

Curve Option	Lever Position (°) / Throttle Opening (%)					Throttle Curve
	Throttle Opens At	Slope Change #1		Slope Change #2		
		Lever	Throttle	Lever	Throttle	
F1	3°	NA	NA	NA	NA	
F2	0°	NA	NA	NA	NA	
F3	7°	NA	NA	NA	NA	

Curve Option	Lever Position (°) / Throttle Opening (%)					Throttle Curve
	Throttle Opens At	Slope Change #1		Slope Change #2		
		Lever	Throttle	Lever	Throttle	
F4	0°	20°	10%	NA	NA	
F5	3°	23°	10%	NA	NA	
F6	7°	49°	35%	NA	NA	
F7	7°	49°	35%	65°	79%	
F8	3°	53°	80%	NA	NA	

Reverse Throttle Curves (Table 6)

Curve Option	Lever Position (°) / Throttle Opening (%)					Throttle Curve
	Throttle Opens At	Slope Change #1		Slope Change #2		
		Lever	Throttle	Lever	Throttle	
R1	0°	41°	40.5%	NA	NA	
R2	3°	NA	NA	NA	NA	
R3	7°	NA	NA	NA	NA	
R4	0°	NA	NA	NA	NA	
R5	3°	23°	10%	NA	NA	

Curve Option	Lever Position (°) / Throttle Opening (%)					Throttle Curve
	Throttle Opens At	Slope Change #1		Slope Change #2		
		Lever	Throttle	Lever	Throttle	
R6	7°	24°	14%	NA	NA	
R7	2°	37°	80%	NA	NA	
R8	7°	23°	13%	27°	25%	

Customer Service & Support

If you have any questions, call our Teleflex Marine Technical Support number: **1 610 495 7011**

Hours are Monday- Friday, 8:00 a.m. to 5:00 p.m. Eastern time.

E-mail concerning technical support issues can be directed to: i6000support@teleflex.com

If reading and following the suggestions under “Troubleshooting” on page 65 has not resolved any problems you may be experiencing with the product and you feel the product needs factory service, please follow the instructions under “Product Return Procedure” on page 75.

2-Year Limited Warranty

We warrant to the original retail purchaser that Teleflex Marine products have been manufactured free from defects in materials and workmanship. This warranty is effective for two years from the product manufacturer date, except where Teleflex Marine products are used commercially or in any rental or other income producing activity; then this warranty is limited to one year from the date of original purchase for mechanical and electrical products.

Teleflex Marine products found to be defective and covered by this warranty will be replaced or repaired at Teleflex Marine’s option, and returned to the customer. Items must be returned within the warranty period to the dealer from whom such products were purchased, or directly to Teleflex Marine.

Teleflex Marine’s sole responsibility under this warranty is limited to the repair or replacement of product that is, in Teleflex Marine’s opinion, defective. **Teleflex Marine is not responsible for charges connected with the removal of such product or reinstallation of replacement or repaired parts.**

Teleflex Marine will have no obligations under this warranty for any product that:

- *was not properly installed;*
- *was used in an installation other than as recommended in our installation or operation instructions or specifications;*
- *failed or was damaged due to an accident or abnormal operation including racing, misuse or alterations outside our factory;*
- *was repaired or modified by entities other than Teleflex Marine;*
- *was used on an engine/boat combination where the engine horsepower exceeds the rating established by the boat manufacturer;*
- *was used with other product(s) which, in Teleflex Marine’s opinion, are incompatible with the Teleflex Marine product.*

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, OBLIGATIONS OR LIABILITIES ON THE PART OF TELEFLEX MARINE AND WILL BE THE CUSTOMER'S EXCLUSIVE REMEDY EXCEPT FOR ANY APPLICABLE IMPLIED WARRANTIES UNDER STATE LAW WHICH ARE HEREBY LIMITED IN DURATION TO TWO (2) YEARS FROM MANUFACTURER'S DATE CODE ON PRODUCT. IN NO EVENT WILL TELEFLEX MARINE BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY RELATING TO THE PRODUCTS. Some states do not allow limitations on an implied warranty, or the exclusion of incidental or consequential damages, so the above exclusions may not apply to you. You may also have other rights that vary from state to state.

Teleflex Marine products returned under this warranty must be tagged with the customer's name, street address, and phone number to ensure proper handling, and returned freight prepaid to the selling dealer or to Teleflex Marine , 640 North Lewis Rd., Limerick, PA 19468.

Product Return Procedure

1. In order to return a product, please contact a Customer Service Representative at 1-610-495-7011 or e-mail at marineinfo@teleflex.com. Upon approval, a Return Goods Authorization (RGA) number will be assigned from the Customer Service Department. The RGA number is Teleflex's internal tracking document, which is necessary in order to process a return.
2. The actual product list of items to be returned must be submitted by telephone, fax or e-mail at marineinfo@teleflex.com. This list must include the Teleflex Marine part number, quantity being returned, product cost and reason for return. Also please include the customer debit/reference number if necessary.
NOTE: To ensure prompt attention and response, please provide an accurate phone number; fax number, and the name of a contact person.
3. All returned parts must be individually tagged with an assigned Teleflex Marine RGA number. All boxes and paperwork must also reference the assigned RGA number. Teleflex Marine will provide a return kit which will include:
 - a. A letter expressing our apology for any inconvenience the products in question may have caused.
 - b. Return instructions
 - c. RGA Form
 - d. RGA Tags for the return products
 - e. Shipping Label (UPS Ground), expenses for overnight returns are the responsibility of the customer
4. If the customer tracking process requires a claim/reference number per part, the customer must individually tag ALL parts with your claim/reference number.

-
5. A packing list must be included with the returned parts. This packing list must reference our Teleflex Marine part number, quantity being returned and Teleflex Marine RGA number. Only parts originally approved for return should be included. An RGA number cannot be used for multiple shipments. Each shipment requires a separate RGA number.
 6. Products should be sent to:
Teleflex Marine
ATTN: Warranty Department
640 North Lewis Rd
Limerick, PA 19468
 7. The Limited Warranty does not cover shipping costs to the Teleflex Marine Limerick facility, or any costs for labor or otherwise related to product removal or replacement, or any other costs of any nature without prior consent by Teleflex Marine Customer Service. Parts, products and accessories made by others are warranted only to the extent of the original manufacturer's warranty to Teleflex Marine.
 8. Teleflex Marine reserves the right to examine all returned merchandise. Teleflex Marine tests 100% of the returned products at its facility.
 9. All returns must be received **within 30 days** from authorization. Any product sent C.O.D. or without an RGA number will be refused. Products eligible for credit will be processed within 30 days.
 10. Customer Service is available for questions regarding customer returns. The customer may also e-mail Teleflex Marine at marineinfo@teleflex.com.
 11. A 15% restocking fee is required for all returns unless waived by authorized Teleflex Marine personnel.

Glossary

Actuator	i6000 component that performs the physical movement of the engine parts necessary to shift gears or change the throttle.
AWG	American Wire Gauge. A system for specifying the diameter of electrical conductors where the numbers increase as the wire diameters decrease.
CANbus	Control Area Network bus. An open-architecture, digital backbone used to interconnect monitoring and control devices.
Cruise Sync (CS)	An option to automatically synchronize your boat's engaged engines by matching their RPMs whenever both Control Head levers are above 20% throttle and within 10% of each other's position.
DSDE	Dual Station, Dual Engine.
DSSE	Dual Station, Single Engine.
DSTE	Dual Station, Triple Engine.
Control Head	i6000 component with levers to control the shift and throttle settings of engines.
Electronic Control Unit (ECU)	i6000 component that coordinates the signals from the Control Heads, engines, and MagicBus™ network to direct the operation of the actuators and/or control the engines.
Jet Drive	A drive system that generates thrust without propellers by pumping and directing an extremely high-intensity stream of water to aft.
Jet Drive Shift Zone	The 55° range between Forward Throttle and Reverse Throttle on i6000 jet boat Control Heads.
Lever Sync	Engaged engines follow the "percent of throttle" and shift settings of the port Control Head lever but do not match RPMs.
MagicBus™	Teleflex's CANbus protocol operating on NMEA 2000, providing a continuous stream of data to all devices plugged into the onboard network.
NMEA®	National Marine Electronics Association (NMEA is a registered trademark ®.)
NMEA 2000®	The new NMEA standard for connection protocols (a registered trademark ®).
Outboard	A boat with an engine mounted outside the stern.
Power Train Sync (PTS)	An engine mode option that allows you to synchronize your boat's engaged engines by matching their RPMs and controlling them all with just the port engine Control Head lever.
Shift Window	The maximum throttle value at which the i6000 will allow a shift into gear.
SPDT	Single Pole Double Throw. A switch or relay with one set of contacts and a lever or energizing solenoid that can be in either of two positions.
SSDE	Single Station, Dual Engine.
SSSE	Single Station, Single Engine.
SSTE	Single Station, Triple Engine.
Stern-Drive	Power train configuration with engine inboard and drive outboard.
Variable Shift Window System (VSW)	A purchasable i6000 options package that allows the user to change the acceptable throttle limit for shifting into gear on engine systems that can tolerate higher throttle level shifting.
WOT	Wide Open Throttle.

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i6000 Installation & Service Log

Parts Information

Control Head #1 Type: _____ Serial Number: _____

Control Head #2 Type: _____ Serial Number: _____

Engine Selection Panel #1 _____ Serial Number: _____

Engine Selection Panel #2 _____ Serial Number: _____

Port/Single ECU Hardware code: _____ Serial Number: _____

Software Version: _____ Options code: _____ Software Type: _____

Starboard ECU: _____ Serial Number: _____

Software Version: _____ Options code: _____ Software Type: _____

Center ECU: _____ Serial Number: _____

Software Version: _____ Options code: _____ Software Type: _____

Port/Single Shift Actuator: _____ Serial Number: _____

Port/Single Throttle Actuator: _____ Serial Number: _____

Starboard Shift Actuator: _____ Serial Number: _____

Starboard Throttle Actuator: _____ Serial Number: _____

Center Shift Actuator: _____ Serial Number: _____




Center Throttle Actuator: _____ Serial Number: _____

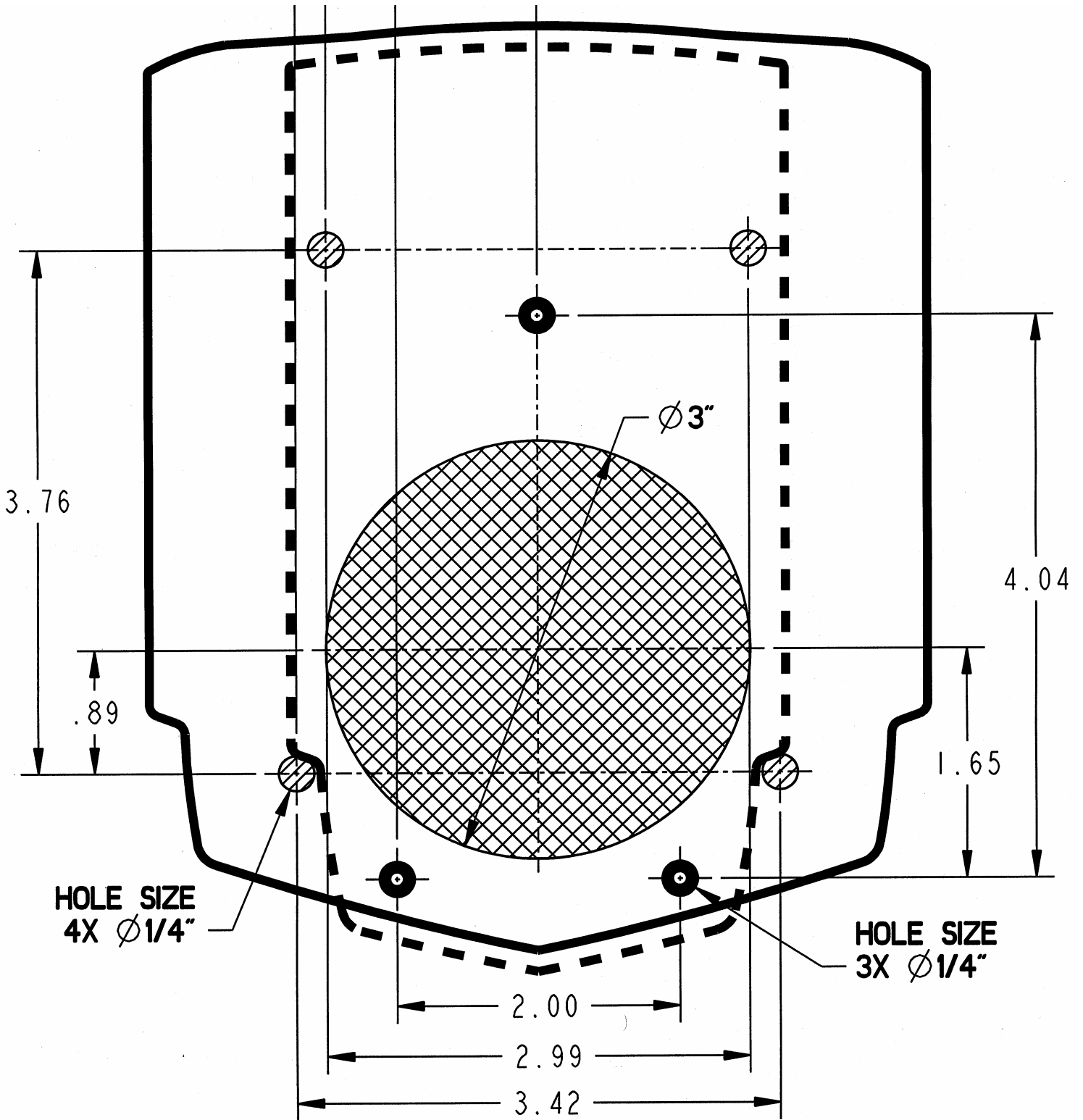
Installation & Service History

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Top-Mount Control Head Template

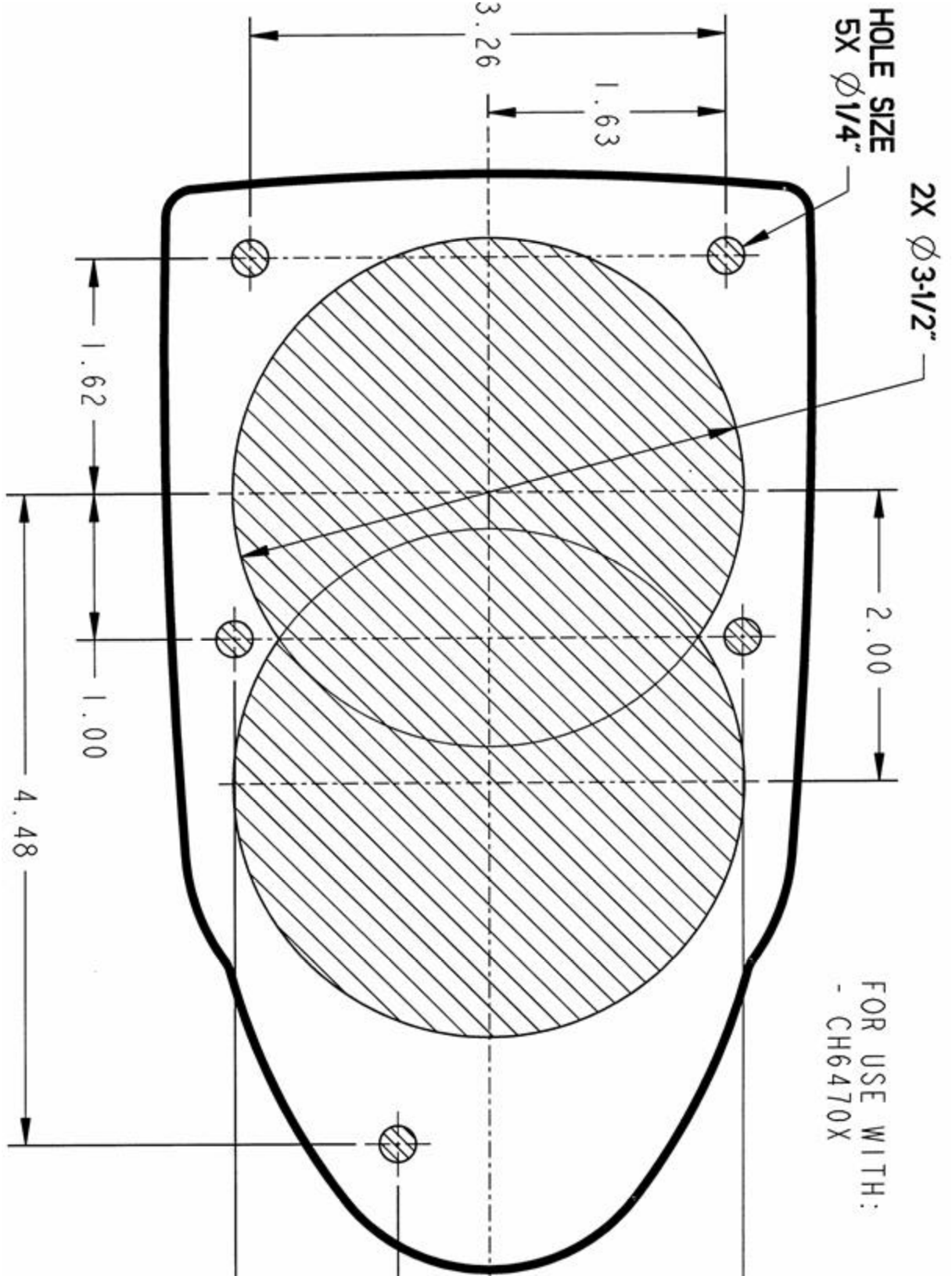
Cut out and use for top-mount Control Head installation.

-  — Dual-Lever Control Heads
-  — Single-Lever Control Heads
-  ALL



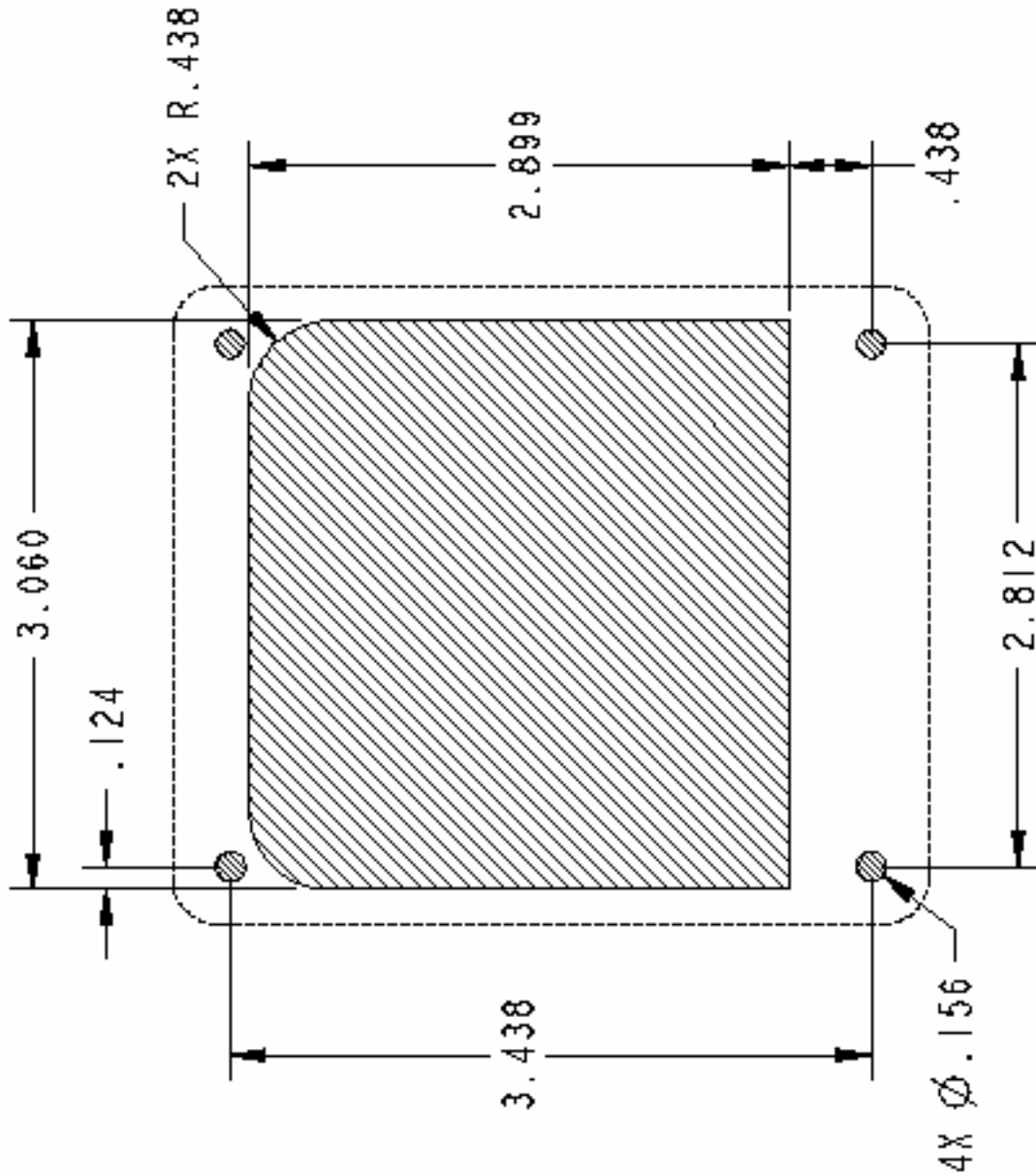
Side-Mount Control Head Template

Cut out and use for side-mount Control Head installation.

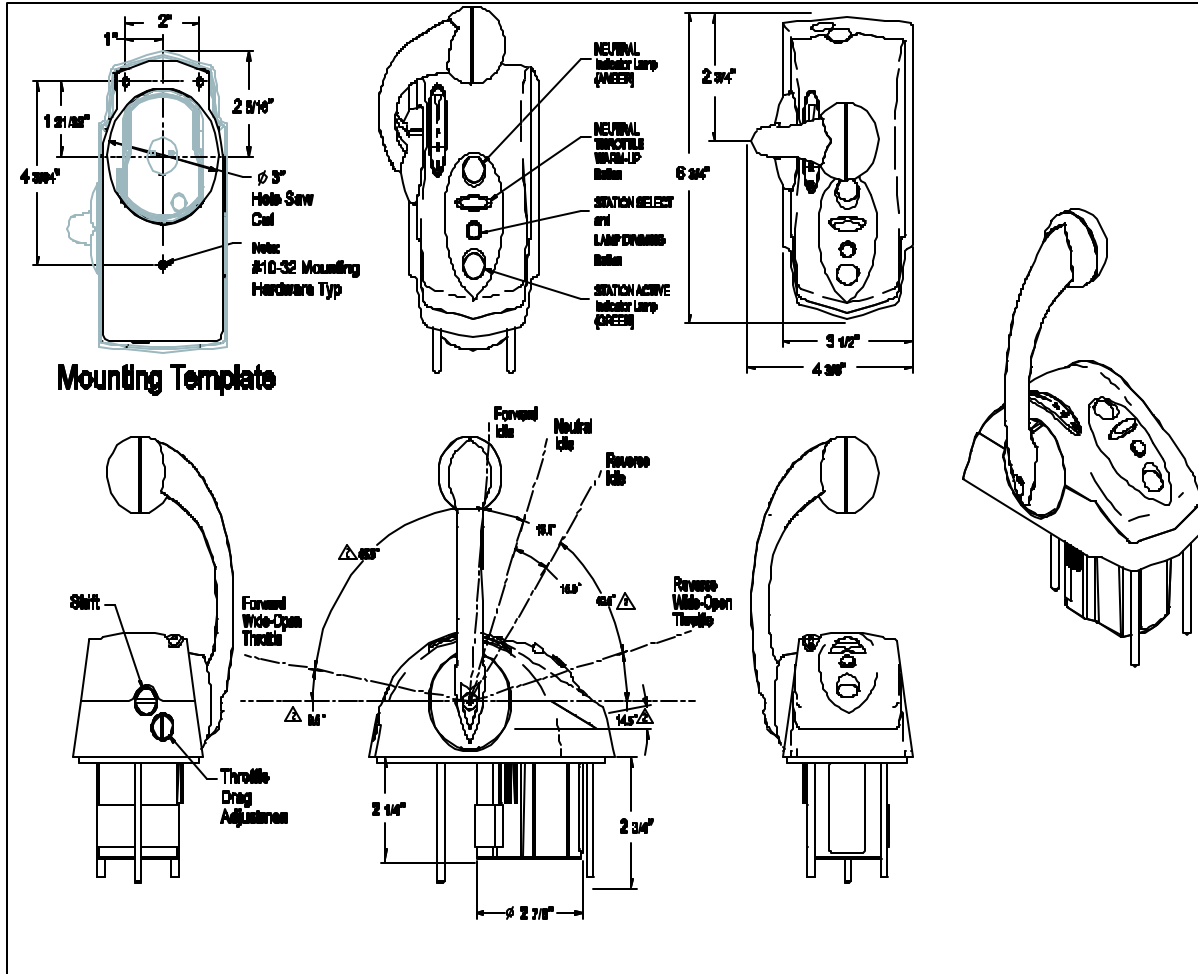


Engine Selection Panel Template

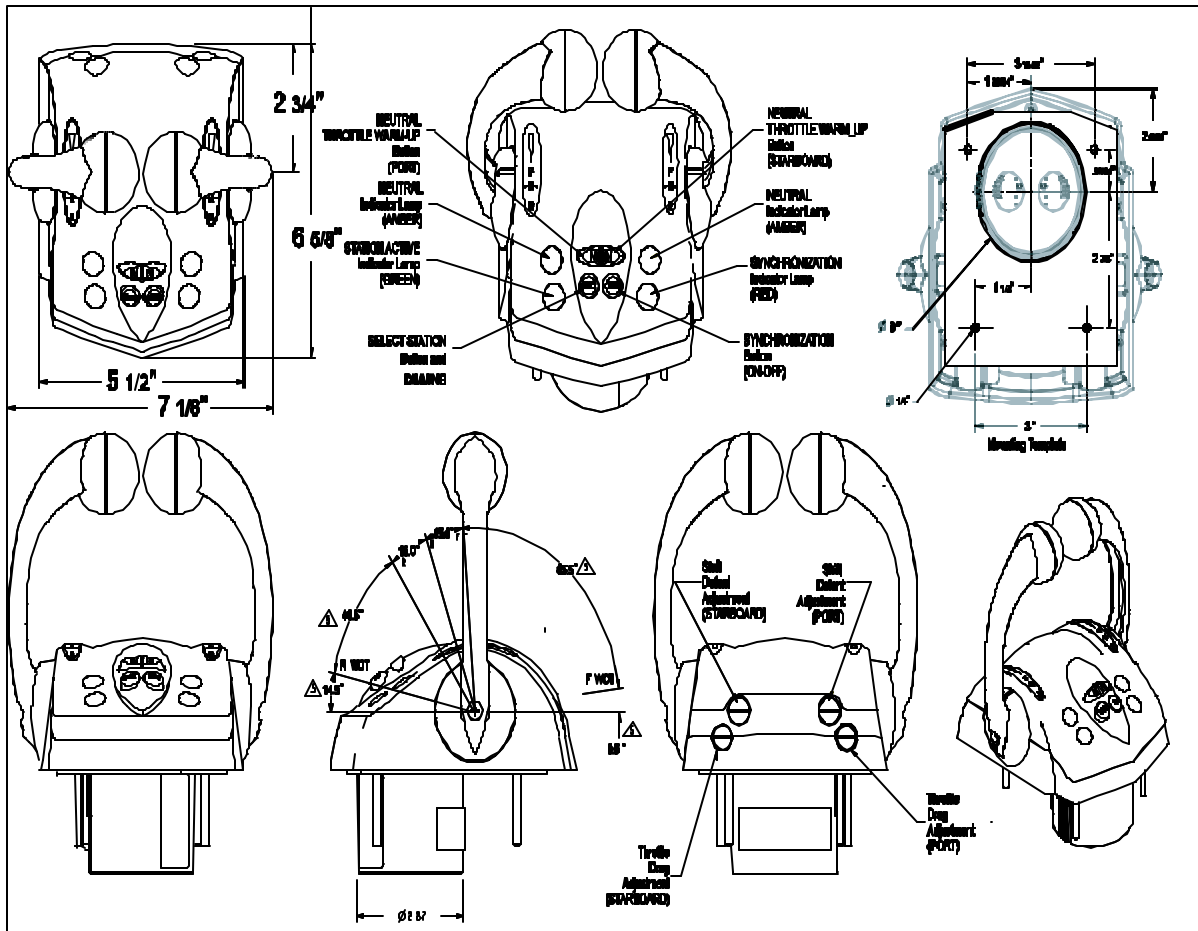
Cut out and use for Engine Selection Panel installation.



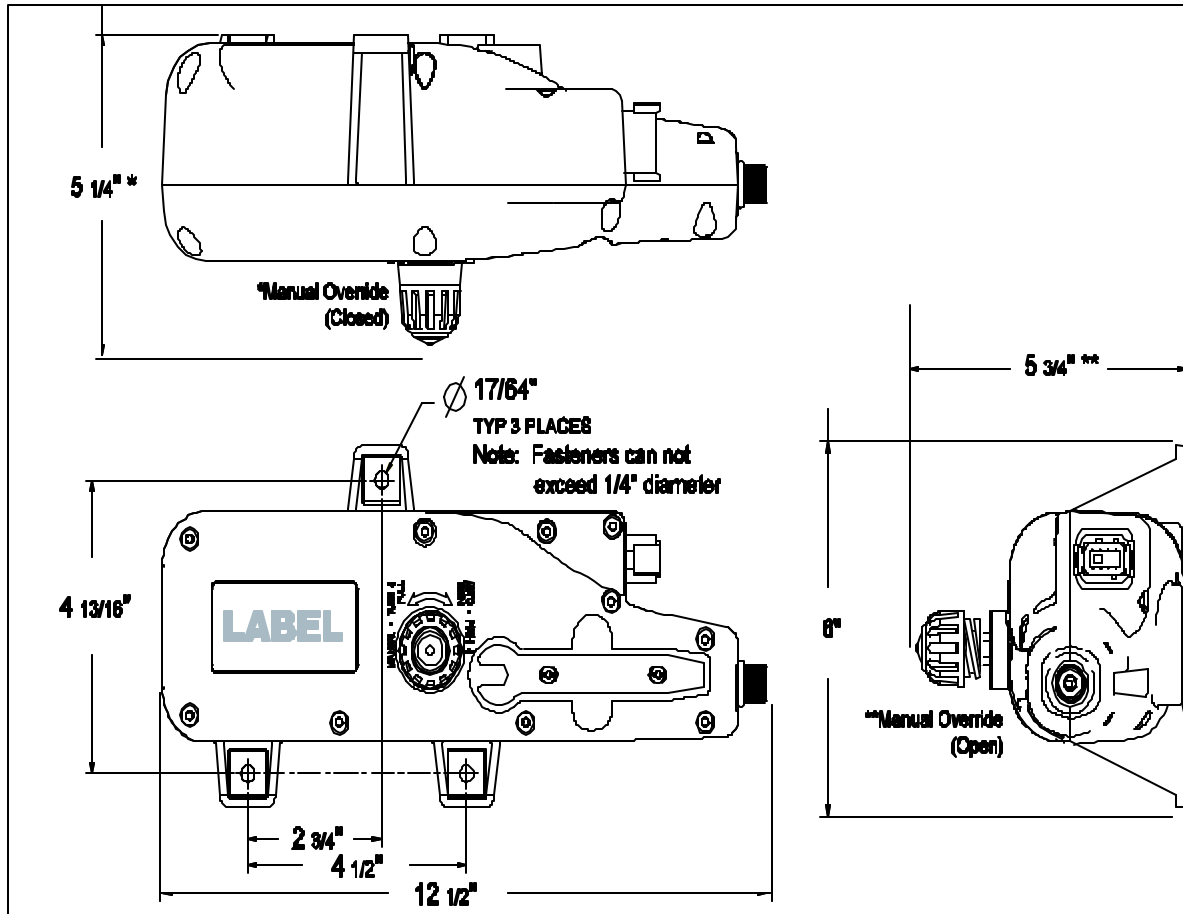
Line Drawing: Single Control



Line Drawing: Dual Control



Line Drawing: Actuator



Teleflex Electronics

2-Year Limited Warranty

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- was improperly installed;
- was used in an installation other than as recommended in our installation or operation instructions or specifications;
- failed or was damaged due to an accident or abnormal operation including racing, misuse or alterations outside our factory;
- was repaired or modified by entities other than Teleflex Marine;
- was used on an engine/boat combination where the engine horsepower exceeds the rating established by the boat manufacturer;
- was used with other product(s) which, in Teleflex Marine's opinion, are incompatible with the Teleflex Marine product.

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Teleflex Marine products returned under this warranty must be tagged with the customer's name, street address, and phone number to ensure proper handling, and returned freight prepaid to the selling dealer or to the appropriate Teleflex Marine manufacturing facility. The User Manual contains the return address of the facility.

NOTES

