



ELECTRONICS
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Operations Manual



Put the Pleasure Back into Boating!

MANOP6000SEM01
Revision A

Notice to Boat Manufacturer, Installer, and Consumer

Throughout this manual, warnings are used to alert the installer/operator 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.

WARNING

This device should not be used as a navigational aid to prevent collision, grounding, boat damage, or personal injury. When the boat is moving, water depth may change too quickly to allow time for you to react. Always operate the boat at very slow speeds if you suspect shallow water or submerged objects.

WARNING

This product contains lead, a chemical known to the State of California to cause cancer, birth defects, and other reproductive harm.



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

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

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Disassembly and repair of this electronic unit should only be performed by authorized service personnel. Any modification of the serial number or attempt to repair the original equipment or accessories by unauthorized individuals will void the warranty. Handling and/or opening this unit may result in exposure to lead, in the form of solder.

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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First Time Operation

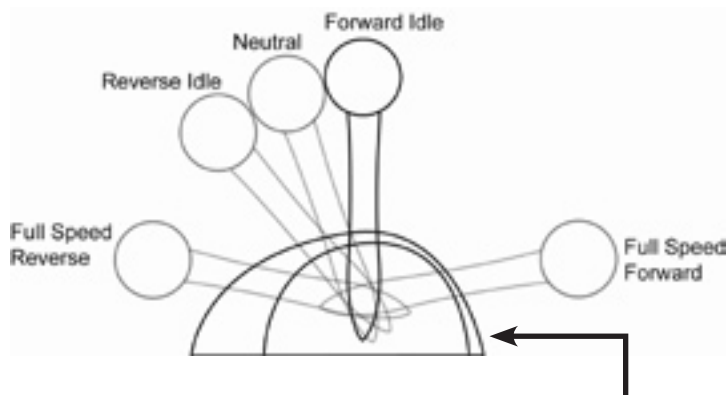
Various features of the electronic control system have been selected and set as part of the installation. They can be checked in Appendix C. They include:

- Max Throttle Amount in Split Range Throttle (SRT)
 - Shift Delays
 - Failure Modes
 - Station Protection
1. Before starting the engines for the first time, take a moment to familiarize yourself with the shift and throttle controls. With the engine not running, move the control lever over the full range until you are familiar with the feel. Note that the detent pressure and drag can be adjusted using the adjusting screw on the front surface of the control head. The top screw sets the detent pressure; the lower screw sets the drag.
 2. Place the control lever in neutral and turn the ignition switch to the On position -- *but do not start the engine*. The green control head light will illuminate.
 - a. Check to see if the green light on the control head is solid or flashing. If solid, proceed to the next step. If flashing, push the Select button to select the head. Position the control lever to neutral and the yellow light will now come on.
 - b. Start the engine.

Start Up

Shift & Throttle Control Head Functions

The Shift and Throttle Control Head comes with a dual function, single lever control. A single lever control initiates both shifting and throttle for a single engine.



Note that the detent pressure and drag can be adjusted using the adjusting screw on the front surface of the control head.

Control Head Operation

WARNING

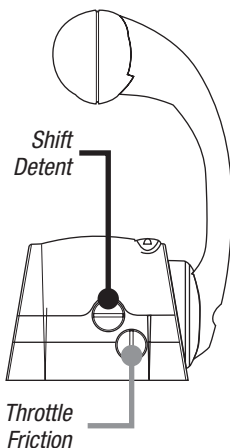
The boat will start to move during the next steps. Be very cautious when first engaging the gears to establish that forward is truly forward and reverse is truly reverse. A quick in-and-out of gear test is recommended. Ensure that the boat is clear of all obstacles forward and aft before conducting this test.

Identification

ENGINE TRIM CONTROL: 
in the handle (optional)

LEVER POSITION INDICATORS: 

ADJUSTABLE LEVER FEEL



Select/change Station: 

- A lit **green** SELECT lamp indicates a station is active. ●
- On single station boats, station selection is automatic.
 - For multi-station boats, choose a station and then press SELECT button with levers in neutral.

TO CHANGE STATIONS:

- Move to new station and press SELECT button. (**Green** lamp flashes.) ☀
- Match control handle positions with those of active station. (**Green** lamp goes steady when levers match and this station is now in control.) ●

Indicator Dimming Feature: 

Push **SELECT** button and the lamps will dim. There are four degrees of brightness from which to choose.

NOTE: Indicator Dimming is only accessible from the active control station. (Green lamp on steady.) ●

Operation

NOTE: The flashing yellow N (Neutral) lamp ☀ can indicate status of either NTW or SRT. Please exercise caution when engaging/disengaging either of these modes! A steady-on Neutral lamp ALWAYS indicates engine is in NEUTRAL. ●



Neutral Throttle Warmup (NTW):

Flashing **yellow** N (Neutral) lamp indicates NTW engaged.
☀ Allows throttle without gear engagement for engine start/warm-up.

TO ENGAGE NTW:

- Move engine lever to the “Neutral” position.
- Press the N (Neutral) button. (**Yellow** lamp flashes.) ☀

TO DISENGAGE NTW:

- Return engine’s lever to the “Neutral” position.
- Press N (Neutral) button. The **yellow** N (Neutral) lamp will go out - NTW is disengaged and the engine/transmission will now respond to lever commands. ○

Split Range Throttle (SRT):

Flashing **yellow** N (Neutral) lamp - SRT is engaged. ☀
Provides greater throttle sensitivity: moving an engine’s control lever to “Full Forward” will only produce the maximum percentage of WOT (Wide Open Throttle selected at set-up - typical Throttle Limit is 25%)

TO ENGAGE SRT:

- Move engine lever to Forward Idle position.
- Press N (Neutral) button. (**Yellow** lamp flashes.) ☀

TO DISENGAGE SRT:

- Move engine lever to Forward Idle or Reverse Idle
- Press N (Neutral) button. The **yellow** N (Neutral) lamp will go steady - SRT is disengaged. ●

System Alarms

CRITICAL ALARMS

Continuous flashing lights on the control indicates a **Critical Alarm**. System will do a “Safe Shut Down,” and **must be serviced before further use**.

When a critical alarm occurs, the system will automatically go to the selected “Fail Safe Response” mode (see page 17). The system **MUST** be shut down and restarted for most critical alarms. Some functions may operate for a time after restart. See display on Control Unit to determine cause of alarm (see “Critical Alarm Codes,” Appendix B).

If the alarm is caused by the Throttle Actuator hitting “Stop” - Wide Open Throttle (WOT) - the alarm will go away when the throttle is pulled back. **However, as with ALL Critical Alarms, the system must be serviced before further use.**

NON-CRITICAL ALARMS

Intermittent flashing of lights on the control (five seconds flash, normal for fifteen seconds, then repeating), indicates a **Non-Critical Alarm**. Acknowledge by a power up cycle or pressing the ENTER button on the Control Unit. Continue to operate and **have the system checked as soon as possible**.



Appendix A

Information - IF

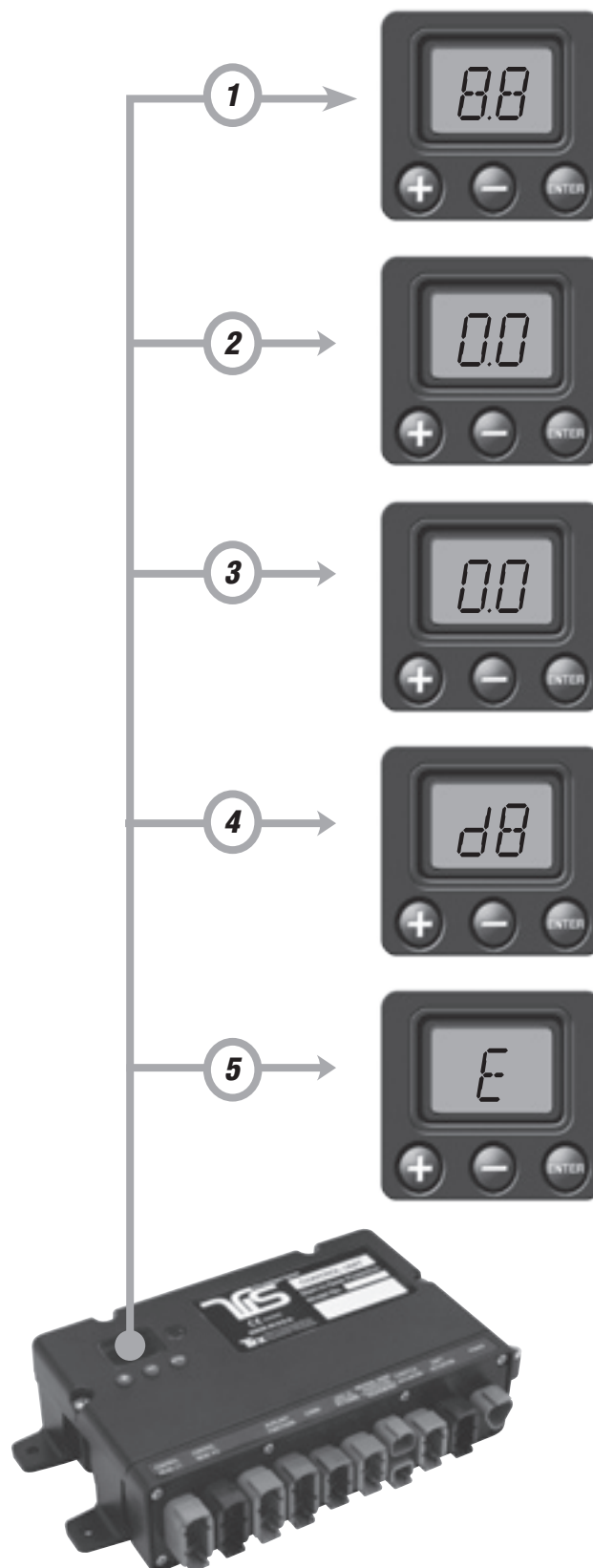
This mode presents five consecutive displays:

1. **8.8.**, 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), **02** (diesel).
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 Installation Book.
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 below.

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
30	CS & VSW

Information mode Option codes. The zeros in the last three codes (10, 20, 30) are replaced with any one of the other codes when those options are purchased in combination with the last three codes, e.g. the Options code for VSW with E is 28

NOTE: Codes displayed above in **GRAY** are used for **Dual Engine** purposes.



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 additional error codes. **NOTE: The error codes will be displayed in reverse chronological order (up to the last 100), from most recent error code to the oldest.**
6. Use the tables below and to the right to interpret the failure codes and take the appropriate actions to correct the problem.

Press **ENTER** on the ECU to return to Operation mode. The ECU indicator should display **oP**.

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 Abnormal 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.

Appendix B

ERROR REPORTING MODE • NON-CRITICAL FAILURE CODES

NOTE: Codes displayed below in **GRAY** are used for **Dual Engine** purposes.

ECU Display	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 SeaStar Solutions Technical Support to have it installed.
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.
31	Gear Startup Event - Stuck in Gear	Hold the Select button and restart.
32	Watchdog Startup Event	Check ECU Operation.
33	Troll Mode Mismatch	Calibrate ECUs to have same trolling setup.

Selecting Features and Customizing the System

Feature selection is performed at the ECU in the Feature Selection mode. The features come preset to defaults which are listed in the procedures below. You should review these prior to use.

- To view or change selection press “+” or “-” to move up or down the menu.
- To change a setting, press “ENTER” (menu will flash), then press “+” or “-” to select settings and ENTER to accept and go to next item.

Throttle Limit Menu

This menu either tells the ECU what percentage of throttle is the maximum for Split Range Throttle. The selectable range is from 5% to 50%.

Default = **25** (25% Throttle)

Forward Throttle Curve Menu

Eight different forward throttle sensitivity curves (F1 through F8) are available (see pages 12 and 13). 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.

Default = **F1** (Forward Throttle Curve)

Reverse Throttle Curve Menu

Eight different reverse throttle sensitivity curves (R1 through R8) are available.

Default = **r 1** (Reverse Throttle Curve)

Shift Actuator Type Menu

NOTE: 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 acuator you are using. The Optional High-Load Shift Actuator is generally used with stern-drive boats. Two different shift actuation choices are available:

- **S** - Standard Actuator
- **o** - Optional High-Load Acuator

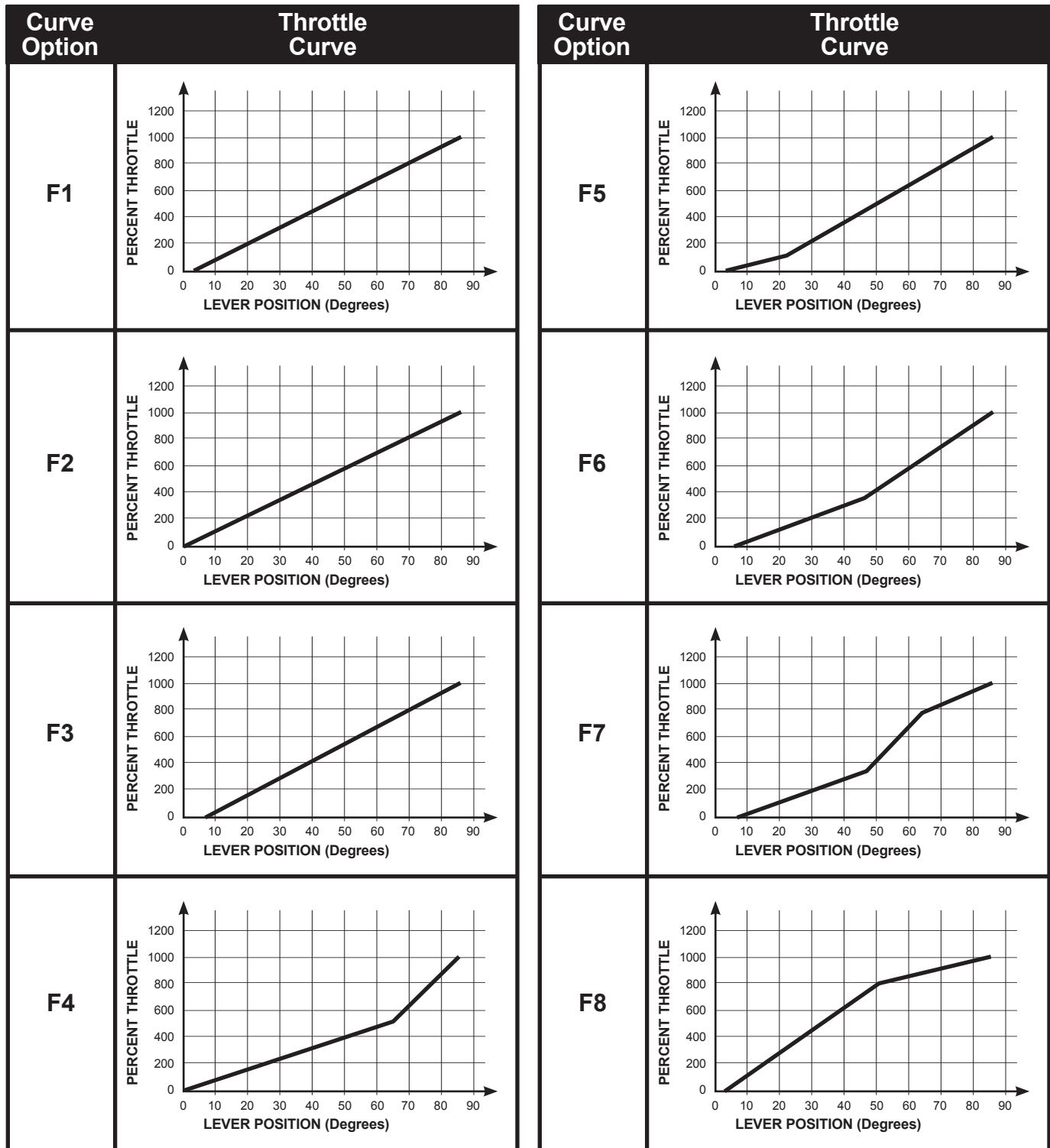
Default = **S** (Standard Actuator).

Appendix C

Throttle Curves

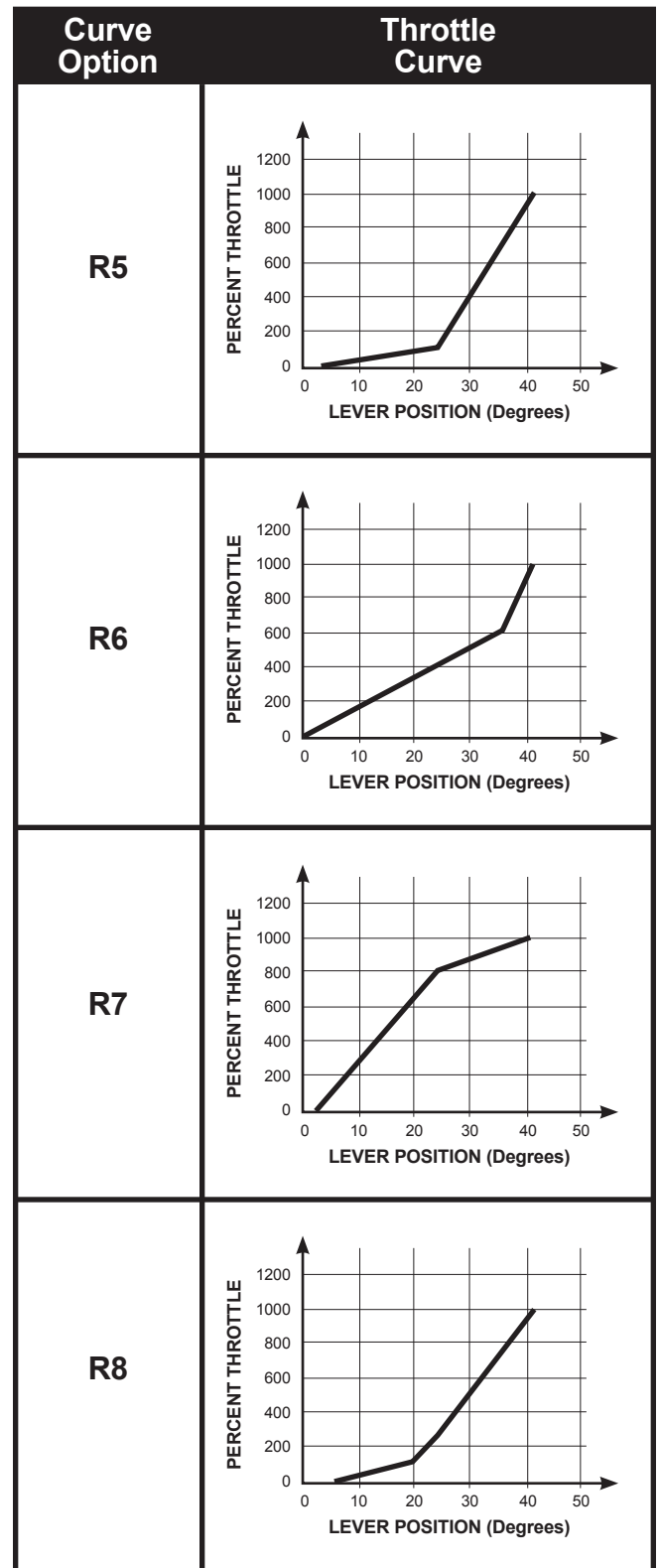
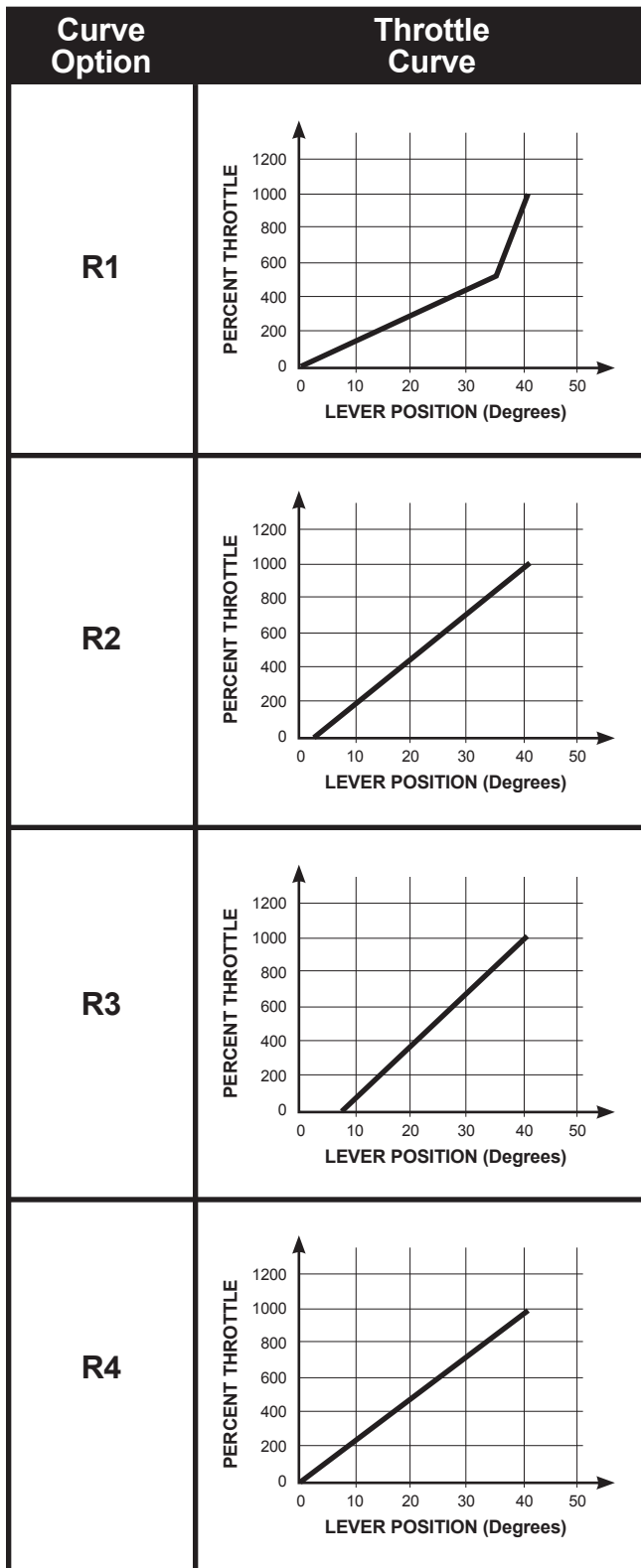
The tables show the lever positions within the forward and reverse lever ranges where the throttle begins to open. They also show thumbnail sketches of each throttle curve.

FORWARD



Throttle Curves

REVERSE



Appendix C

Programmable Delay Menus

In normal operation there is no delay. It only occurs on radical changes in throttle setting. There is never a delay going into neutral.

The i6000 system can ensure that all shifts into gear occur at throttle and boat 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.

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.

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

PROGRAMMABLE SHIFT DELAY (Speed-Time Delay)

The default delay value is 4.8.

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.

FIXED SHIFT DELAY

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.

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
<i>Engine Setting</i>	<i>Default</i>	<i>Default</i>	<i>Default</i>	<i>Default</i>
<i>Outboard: ob</i>	0	0	0	0
<i>Gas: gs</i>	0	0.3	2	0.5
<i>Diesel: ds</i>	0	0.3	0.2	0.5

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

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, N** (neutral), **SELECT**. The menu options available are:

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

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

Fail-Safe Response Mode Menu

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

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.

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 = **n I** (*Neutral Idle*).

Transmission Overshift Menu

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

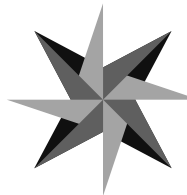
This menu addresses problems with some engines that are difficult to pull out of gear. When Transmission Overshift is enabled, the actuator will move the engine's mechanical shift linkage out of its gear position, past its normal Neutral position, then back again to Neutral to ensure the engine completely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

- **9 0** - No Overshift
- **9 1** - Overshift

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

Default = **9 0** (No Overshift).

For more information on SeaStar Solutions
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