GLENDINNING
ELECTRONIC ENGINE CONTROLS

OPERATION GUIDE

Ver. 1.3 (includes software version 5)

GLENDINNING MARINE PRODUCTS, INC.
740 Century Circle Conway, SC 29526
843-399-6146 FAX 843-399-5005
www.glendinningprods.com

GLENDINNING MARINE PRODUCTS, INC. **Electronic Engine Control System**
Operation Guide - Revision 1.3

Table of Contents

OPERATING INSTRUCTIONS

NOTE

Section 3.9 describes the indications of control system failure and the **emergency procedures** that are to be followed if the EEC System becomes inoperative. This section (3.9) of the manual must be read and understood by all vessel operators prior to startup of the EEC system.

3.1 General Information

In order to properly understand the operation of the Glendinning Electronic Engine Control system, there are certain key concepts or product components that one should have a clear understanding of. These key concepts include the following:

- Operational Modes
- Active Station vs. Inactive Station
- Control Buttons
- Indicating lights

Operational Modes

The Glendinning EEC system has 5 different "Operational Modes". It is important to understand the function of each of these modes and to keep in mind the specific Operational Mode that one is in. These Operational Modes include:

Cruise mode - This is the normal mode that the system is in while the system is operating. While in the Cruise Mode, the system operates exactly the same as any other single lever control system (mechanical, pneumatic, or electronic control)

Sync mode - This is the mode that the system is in when automatic synchronization is activated.

Warm up mode - This mode causes the gear actuator to be locked in neutral and the engines accelerated. This mode would typically be used while tied up to the dock, warming up the engines.

Slow mode - This mode is similar to "Cruise mode". While in Slow Mode however, the engine throttle is limited to about 50% of its normal speed range. (Full movement of the control handle will only get about 1/2 normal full throttle engine RPM). This mode is typically used when operating in close quarters or during maneuvering.

Troll mode – If installed, this is the mode that the system is in when troll is activated.

Active Station vs. Inactive Station

When the EEC system is Operational, only one control station (Control Head) may be in control at any one time. The control station that is operating the EEC system is called the "Active Station". All of the other installed control stations are called "Inactive Stations". System control may be transferred from the "Active Station" to any of the "Inactive Stations"

by following the procedures described below in Station Transfer (Section 3.8). The "Active Station" TAKE light will always be ON at the Active Station – this tells the boat operator that the station is in control. Also, the TAKE light will only be ON at the Active Station – only one station can be the Active Station – in control of the boat - at any time.

Control Buttons

The Operational Mode that the EEC system is in is controlled by means of (4) buttons, which are located on the top of the control head body. When each button is pressed *and released*, the Operational Mode, or function, associated with that button is activated. Pressing and releasing the button a second time will deactivate the operational mode. (NOTE: The button must be released in order for the button function to be activated or deactivated. Pressing the button alone – without releasing it - will have no effect.)

Each control head includes a keypad with four (4) control buttons. The function of each control button is described here briefly – see the referenced manual section for additional information:

Control Button	Description	Reference Section
TAKE	This button is used to "take control" when control is transferred from one station to another (Station Transfer)	3.8
SYNC	This button is used to put the EEC system into the Sync Mode. When this operational mode is activated, the EEC system will automatically control the speed of the port engine so that it exactly matches the speed of the starboard engine. **NOTE** On vessels equipped with Caterpillar engines with Electronic Engine Governors, the Synchronization function is accomplished by the engine governor and not by the Glendinning EEC system. In these installations, the Control Head does not have a button for engine synchronization.	3.4
WARM	This button will cause the system to lock the gear in the neutral position. Moving the control handle in the ahead direction will operate the engine throttle only, while the gear is locked in the neutral position.	3.5
SLOW	This button reduces the speed which will be achieved by full deflection of the control head handle. **NOTE** On boats equipped with troll valve actuators (for controlling the reduction gear trolling valve), the rightmost button will activate and deactivate the trolling valve actuator. In this situation, SLOW MODE can be obtained by pressing and releasing the TAKE and TROLL buttons *simultaneously*.	3.6
TROLL	On boats equipped with Trolling valves, one of the Control Head control buttons will be used to activate or deactivate the trolling valve actuator.	3.7

Indicating Lights

Four (4) lights are incorporated into the Control Head that corresponds with the each of the control buttons. The purpose of these lights are to inform the operator about the current EEC Operational Mode. At the Active Station, when the light is ON, the mode associated with that button is activated. When the light is OFF, its associated mode is deactivated.

"Heartbeat"

As described above, the Control Head indicating lights are fully lit at the "Active Station" to indicate the Operational Mode. At the Inactive Station, the indicating lights will blink very briefly (1 flash every 2 seconds) while the EEC system is operational. The Indicating lights which blink will correspond to those which are ON at the "Active Station". That is, while the EEC system is in the normal "Cruise Mode", only the TAKE light will blink. While the EEC system is in "Slow Mode", both the TAKE and SLOW lights will blink (1 flash every 2 seconds).

The purpose of the "Heartbeat" is to inform a person at the "Inactive Station" in two ways: 1) the EEC system is operational and 2) which operational mode the system is in.

NOTE

In addition to ON and OFF, the lights can indicate two other facts:

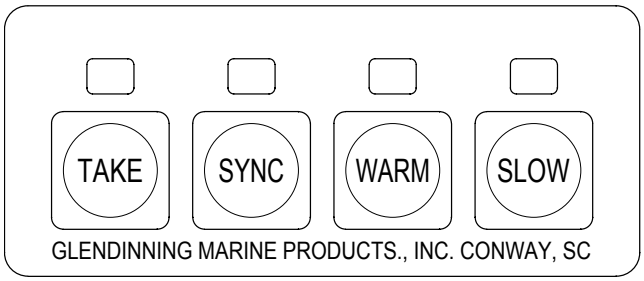
Slow blink - In general, the light will begin to slow blink (1 blink per second) after receiving input from the operator, for example, to acknowledge that a control button has been pressed. While the light continues to blink slowly, the EEC system is indicating that the operators' request is being processed. In most functions, this will mean that the EEC system is verifying that required conditions exist prior to accomplishing the requested function. If the light continues to blink for an excessively long period of time (more than 2-3 seconds), the operator will then know that one or more prerequisite conditions do not exist. (Two examples are 1) During station transfer, the station that wan
ts to take control must have their control handles aligned with the station that is in control at that moment. If the control handles are not aligned, the "TAKE" indicator light will continue to slow blink and 2) During startup, if the control handles are not in neutral, the "TAKE" indicator light will continue to slow blink until the control handles are put into neutral.

Fast blink - After the EEC system has verified that the prerequisite conditions exist, the light will begin to blink rapidly (5 flashes per second). This tells the operator that the system is ready to proceed with the next step as soon as the button is pressed a second time by the vessel operator. For example, the light will fast blink during the station transfer procedure, waiting for the operator to press the button the second time, after the control handles have been moved to an appropriate position for transfer.

Control Head Keypad styles

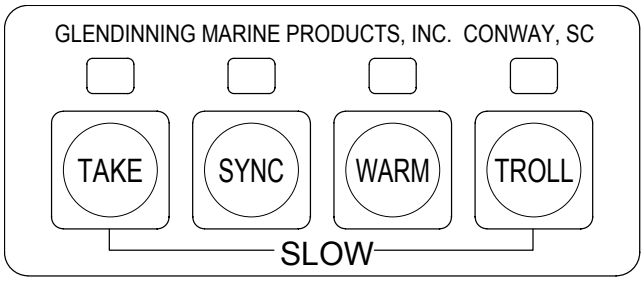
There are three (3) styles of control head keypads. Any style of keypad can be used in any installation configuration, however, jumper settings in the Station Processor must be changed to match the Station Processor operation to the keypad configuration.

Standard keypad – (Control Head Part # has a – SH or –SS suffix)



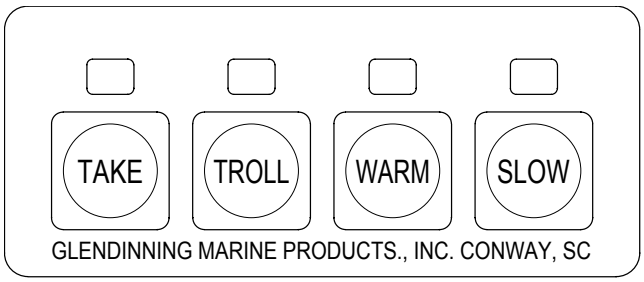
The Standard keypad is provided on boats not equipped with troll valves, and with non-electronically controlled diesels. Troll valve operation is not available with the standard keypad.

Troll keypad - (Control Head Part # has a – TH or –TS suffix)



The Troll keypad is provided on boats equipped with troll valves, and with non-electronically controlled diesels. SLOW mode operation is activated with a "2-button" press (TAKE and TROLL buttons pressed simultaneously)

CAT keypad - (Control Head Part # has a – CH or –CS suffix)



The CAT keypad is provided on boats equipped with electronically controlled diesels. Troll valve operation is activated by pressing the second button from the left.

3.2. Control System startup

NOTE

Prior to starting the engines, it is strongly recommended that the EEC system be started up using the procedure described in this section ***and then placed in the Warm Mode*** (see Section 3.5). With the EEC system in the Warm Mode, the boat operator can be assured that the engine transmission is in Neutral prior to engine start, and will remain in Neutral, until the system is placed in normal run / cruise mode.

The following procedure will activate the EEC system and bring it to the Cruise mode.

1. Verify that the Mechanical Backup Control head levers are in the Neutral position.

2. Turn on the "EEC Power Switch" or the circuit breakers which control power to the engine control system. The "EEC Power Switch" is normally located at the helm station that is equipped with the mechanical backup control head ("Main station").

3. Immediately after the EEC Power Switch is turned on, the EEC system will begin initialization procedures, including a transfer of control from mechanical backup to electronic. This process will take approximately 5 seconds. While the process is underway, the Control Head Indicator lights will "scroll" to indicate that power has been applied to the EEC system.

4. After approximately 5 seconds, the "TAKE" indicator light will remain ON (no blinking). The EEC system is now fully operational in the Cruise mode.

NOTES

1. One of these diagnostics that the EP does during the startup process is to verify that the Main Station Control Head (mechanical backup) control levers are in the "Neutral" detent position. <u>If both Control Levers are not in the Neutral position</u>, the Control Head Indicator lights will not "scroll". Rather, the TAKE / WARM / SLOW lights will slowly blink - pressing and releasing the TAKE button will have no effect. To continue the System Startup process, reposition the control levers into the Neutral detent and the startup process with continue automatically.

2. Step 4 of the above procedure applies to EEC Systems equipped with EP Software version 4 and later. (This software began shipping in February, 1999). For EEC systems equipped with earlier versions of software, a "2 button" press will be required to activate the Engine Control system, as follows:
   a. Approximately 5 seconds after turning on the EEC Power Switch, the "TAKE" indicator light at the "main station" will begin to blink slowly. Press and release the TAKE button <u>1 time</u>.
   b The "TAKE" indicator light at the "main station" will begin to blink quickly. Press and release the TAKE button <u>a second time</u>.
   c The "TAKE" indicator light at the "main station" will remain ON. The EEC system is now fully operational in the Cruise mode.

Remote station calibration

After the EEC system startup, each remote station Control Head must be placed in the neutral detent position for at least 5 sections for diagnostic testing. The completion of this testing will be indicated by the TAKE light blinking once every two seconds (the “heartbeat”).

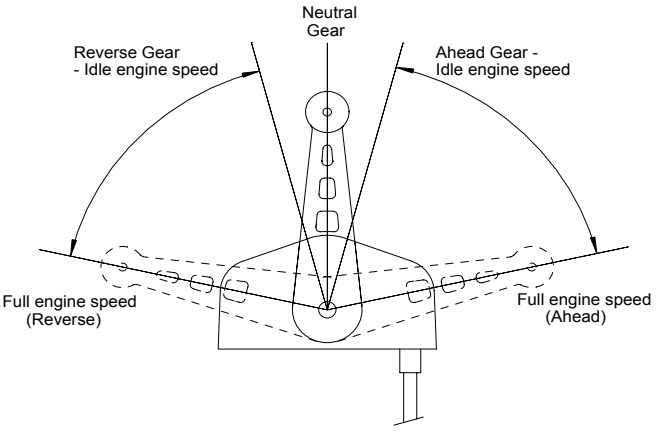
It is not necessary that the remote station (electronic control only) Control Head levers be in the Neutral position during startup. However, it is necessary that the Station Processor recalibrate the control head electronic position prior to transferring control to the remote station. This automatic calibration process is done by returning the control levers to the Neutral position after the EEC system has been started for approximately 4 seconds. After the Control Head calibration is completed, the TAKE light will begin to blink (“heartbeat”) indicating that the remote station is fully operational and that the remote station is an Inactive Station. Control transfer may be done at any time. If the remote station control head handles are in the Neutral position at the time of system startup, this calibration process will be accomplished simultaneously with the main station calibration.

Prior to the automatic calibration process described above, the Control Head TAKE and SLOW Indicator lights will be ON - as if the remote station was in Slow Mode. This will alert the operator to the fact that the remote handle has not yet been calibrated. Once the handles are placed in the Neutral position, the SYNC / TROLL and WARM Indicator lights will be lit, showing that the automatic calibration process is in progress.

3.3 Cruise Mode

General Description

While the EEC system is in the Cruise Mode of operation, the system will respond as a normal “single lever” control system. At the mid-point of the control lever position, the propulsion gear will be in the Neutral position. This will be felt on the control head by a detent position. Pushing the control lever forward one detent will engage the ahead gear, at idle RPM. Pushing the control lever still farther forward will throttle up the engine, still while in the ahead gear.



Pulling the control lever aft out of the Neutral detent position will cause the propulsion gear to go into reverse gear. Pulling the control lever farther aft will also throttle up the engine with the gear in reverse.

There are 5 possible control handle positions while in the Cruise Mode:

- Ahead gear - with throttle

- Ahead gear - engine idle
- Neutral gear - engine idle
- Astern gear - engine idle
- Astern gear - with throttle

Gear sequence

The EEC system will automatically sequence the gears when the handle is moved from the '*ahead with throttle'* position to the '*astern with throttle'* position. This means that the EEC system will only allow the gear to change position (ahead - neutral - astern) when the engine is at idle. And the engine throttle will only be advanced when the gear position is fully engaged with either ahead or astern.

Throttle Delay *(only applicable for EEC software version 4 and later)*

On some boats, it is possible that a prolonged period of time (up to 3 or 4 seconds) will transpire between the time that the transmission control lever is moved into gear and the time that the propeller shaft actually begins to turn. (By comparison, it only takes the EEC system Actuator approximately ½ second to move the transmission control lever from Neutral into Ahead or Astern gear). The actual time delay that exists in any transmission will depend on various factors and adjustments inside the transmission. During this period of time, it is possible that the boat operator will be able to speed up the engine RPM above idle. If the internal transmission delay is excessive, it is possible that gear damage may occur if the gear engagement occurs at a significant engine speed.

To prevent this possible damage to the gear, the EEC system can be calibrated to include an optional time delay between the moment that the transmission control lever reaches the Ahead or Astern position, and the moment that the engine is allowed to be accelerated above idle. The selected delay may be set as 0 seconds (no delay), 0.5 seconds, 0.8 seconds or 1.0 second.

The following example will illustrate the operation of the throttle delay:

1. Control Handle is moved from Neutral to Ahead gear position and 50% engine throttle.
2. Gear Actuator moves transmission control lever into Ahead position, immediately after movement of Control Head handle.
3. Selected time delay is inserted (0.5 sec, 0.8 sec, 1.0 sec).
4. After time delay, Throttle Actuator will move engine throttle / governor to selected engine speed position.

Gear Delay *(only applicable for EEC software version 5 and later)*

The EEC system can also be calibrated to include a second type of delay, called "gear delay". Gear delay will insert a time delay in the movement of the Gear Actuator when the control handle is moved from ahead or astern throttle position back to neutral or into the opposite gear. The purpose of Gear delay is prevent damage to the transmission if the gear is disengaged while the engine is at a significant speed above idle. Gear delay will allow the engine to slow down to idle (or to a speed close to idle) before the transmission is moved out of the gear position into neutral.

The actual amount of gear delay is determined by two things:

1. Gear delay setting in Engine Processor DIP switches – see Section 6.5 (System Calibration – Run Mode settings). This setting can be changed at any time that the EEC system is off. The gear delay has 8 possible settings, from 0 seconds (no delay) to 12 seconds.
2. The amount of time that the engine has been operated at the set speed. This delay is proportional to the amount of time that the engine has been operated at any particular speed. The following guidelines are used to determine the proportion:
    - the amount of delay time begins to build as the engine throttle is set above 1000 RPM.
    - The maximum delay time – that is, the delay time that is set by the DIP switch setting – is reached when the engine has been operating at full throttle for 5 times the DIP switch setting.
    - If the engine is operated at a high speed (90% of full throttle) and then slowed down to lower speed (30% of full throttle) for a short period of time, the gear delay will also be reduced in proportion to the slower engine speed.

Examples

1. If a 3 second gear delay is set on the EP DIP switches, the full 3 second gear delay will only be reached when the engine has been operated at full throttle for 15 seconds (5 x 3 second gear delay). If the engine is operated at a slower speed (less than full throttle), or for a shorter time that 15 seconds, the time delay will be correspondingly less than 3 seconds.
2. If a 9 second gear delay is set on the EP DIP switches, the full 9 second gear delay will only be reached when the engine has been operated at full throttle for 45 seconds (5 x 9 second gear delay). If the engine speed is reduced to 50% throttle for approximately 15 seconds, the time delay will be approximately 4.5 seconds, reflecting the slower engine operating speed.

The following example will illustrate the operation of the gear delay:

1. Boat is operating at cruise speed – ahead gear with throttle at 2000 RPM.
2. Control Handle is rapidly moved to neutral gear position (engine idle).
3. Throttle Actuator moves engine governor to idle position; engine RPM begins to descrease to idle, although this decrease is delayed due to natural engine inertia and the "windmilling" action of the propeller as the boat moves through the water.

4. After Throttle Actuator has moved engine governor to idle, Gear Actuator maintains transmission lever in ahead gear until predetermined time delay occurs (from 0 to 12 seconds).
5. After completion of time delay “wait time”, the Gear Actuator will move tranmission to neutral.

Bump mode *(only applicable for EEC software version 5 and later)*

The Electronic Engine Control system includes a special “bump” mode which allows the boat operator to control their engine speed with extreme precision. The bump mode allows the Throttle Actuator position (and therefore the engine governor / throttle) to be changed in very small increments, or bumps, by pressing and releasing the WARM (to increase engine speed) or SLOW / TROLL (to decrease engine speed). This feature is available at any time when the engine is being operated at any speed above idle – in normal “cruise” (“run”) mode or in “warm” mode.

NOTE: 1. Each bump will increase or decrease engine RPM approximately 15-20 RPM, although this value will from one installation to another.

2. The bump mode adds or subtracts small amounts from the Control Head handle position (although the handle does not move). If the Control Head is moved by the boat operator, the bump amount that has been added or subtracted is reset to zero, and the engine speed will be determined by the position of the Control Head handle.

3.4 Sync (Synchronization) Mode

General Description

The purpose of the EEC Sync Mode is to automatically match the speed of one engine (the port engine) with the speed of the other engine (starboard engine) while cruising. By maintaining the engines at virtually the same speed, noise and vibration caused by engines operating “out of sync” is eliminated. While the Sync Mode is operational, the difference between the port and starboard engine will normally not exceed 5 RPM.

NOTE

On boats equipped with Caterpillar ECM engines, the Glendinning EEC system Sync function is not operational. These engines are synchronized using the Caterpillar ECM system. Consult the Caterpillar engine Operation Manual for details.

Sync Mode activation procedure:

1. In order to activate the Synchronization Mode, the following *must* be true:
    1) the gears are in the ahead position
    2) engine speed is above 950 RPM

(Note: This speed will vary from boat to boat depending on various factors related to system calibration, engine governor cable connection geometry, and engine governor dynamics. If synchronization does not engage at 950 RPM, try advancing the engines to a higher speed – perhaps 1500 RPM – and retry)

3) engines speeds are within 250 RPM of each other for approximately 4 seconds

2. Whenever the engine RPMs meet the conditions stated above, press and release the SYNC button one time. The SYNC indicator light will go on. The EEC system will automatically adjust the speed of the Port engine to exactly agree with the speed of the Starboard engine.

3. While in Synchronization mode, the starboard engine speed can be changed. As the starboard engine RPM changes, the speed of the port engine will be automatically adjusted to match the new speed of the starboard engine. While in Sync mode, the port engine control lever will have no effect on the port engine – the EEC system is controlling the port engine for you. However, to make it easier to deactivate the Synchronization mode, it is good practice to keep the port engine control lever at approximately the same handle position as the starboard engine.

4. While in Synchronization mode, the engine RPM can be operated at any speed between idle and full throttle. At idle speed, or at full throttle, the Synchronization mode may enter the "limit" mode - see Note 3 below.

Sync Mode deactivation procedure:

1. Align the port Control Head handle with the starboard engine control handle.

2. Press and release the SYNC button one time. Sync mode will be deactivated and the EEC system will be returned to the normal Cruise Mode (Section 3.3).

NOTES

1. Normally, when deactivating the Synchronization mode, the port Control Head handle should be pre-aligned with the starboard handle. If it is not, the engine control system will enter a special mode called "transition Sync". Rather than have the port engine RPM change drastically to the RPM corresponding to the Control Head port handle position (which may be in any throttle position), the port engine will operate at approximately the same RPM as the starboard engine. This will continue until the port Control Head handle is aligned with the starboard handle, at which point the port engine will return to normal, non-synchronized, "Cruise mode" operation.

2. If both engine control levers (port and starboard) are brought back to the neutral position, the Synchronization mode will automatically deactivate without any action by the boat operator.

3. "Limit mode" (also called "psuedo-sync") – If the engines are operated at or near idle speed or near full throttle, it is possible that the Engine Control system will not have sufficient range of movement on the Port Engine governor to make the speed adjustments necessary

for synchronization. If this occurs, the Engine Processor will automatically enter a “psuedo-sync” mode. In this mode, the Port engine speed will be approximately the same (probably within 40 RPM) as the Starboard engine, but the Port engine will not be “synchronized”. This condition will be indicated to the boat operator by the Control head TAKE and SYNC lights flashing in tandem.

If this occurs, nothing should be done. The lights are blinking so that the boat operator knows that the EEC system is not actively synchronizing engine speed. When the starboard engine is moved away from idle or full throttle a small amount, the EEC system will restart the active synchronization mode and the TAKE and SYNC lights will return to their normal “full on” (non-blinking) condition.

3.5 Warm Mode

General Description

The purpose of the Warm Mode is to allow the engine to be throttled up while the gear is locked in the Neutral position. The Warm Mode is normally used during startup or while the vessel is at the dock, although it may be activated at any time.

Warm Mode activation procedure:

1. Move the Control Head levers to the Neutral position. Warm Mode may only be activated while the gear is in the Neutral position.

2. Press and release the WARM button one time. The WARM indicator light will turn ON indicating that the EEC system is in Warm Mode.

3. While the WARM light is ON, moving the control handle into the ‘Ahead’ detent will have no effect - the gear actuator will be locked in the Neutral position. Advancing the throttle past the ‘Ahead’ gear detent will cause the engine to increase in RPM. (The engine will only accelerate if the handle is moved into the Ahead position. Moving it into the Astern position will have no effect.)

Warm Mode deactivation procedure:

1. Move the Control Head levers to the Neutral position. Warm Mode may only be deactivated while the gear is in neutral.

2. Press and release the WARM button one time. The WARM indicator light will go OUT. The system is back in normal Cruise Mode (Section 3.3)

NOTE

On EEC systems with software *prior to* version 4, Station Transfer *is not possible* while the Active Station is in Warm Mode.

Station Transfer *is possible* while the Active Station is in Warm Mode on EEC systems with software version 4 or later.

3.6 Slow Mode

General Description

Slow Mode is essentially the same as Cruise Mode, with one difference: the maximum RPM that may be obtained is approximately 50% of WOT (wide-open throttle). The purpose of slow mode is to give the vessel operator approximately twice the precision compared with normal Cruise Mode. This is important while the vessel is being operated at slow speeds, such as during maneuvering or docking.

Slow Mode activation procedure:

1. Move the Control Head levers to the Neutral **or** Ahead / Astern idle detent position. Slow Mode may only be activated while the control handle is in one of the three detent positions.

2. Press and release the SLOW button one time. The SLOW indicator light will go ON, indicating that the EEC System is in Slow Mode.

NOTE

For boats equipped with troll valves, it may be necessary for two buttons – TAKE and TROLL - to be pressed simultaneously. See Control Head styles – section 3.1 for more information.

3. While in the Slow Mode, operation of the propulsion system is essentially the same as in normal Cruise Mode. The only differences are that engine throttle response will be slower and more precise, and maximum RPM obtainable will be approximately 50% of maximum.

Slow Mode deactivation procedure:

1. Move the Control Head levers to the Neutral **or** Ahead / Astern idle detent position. Slow Mode may only be deactivated while the control handle is in one of the three detent positions.

2. Press and release the SLOW button one time. The SLOW indicator light will go OUT. The system is back in normal Cruise Mode (Section 3.3)

3.7 Troll Mode

General Description

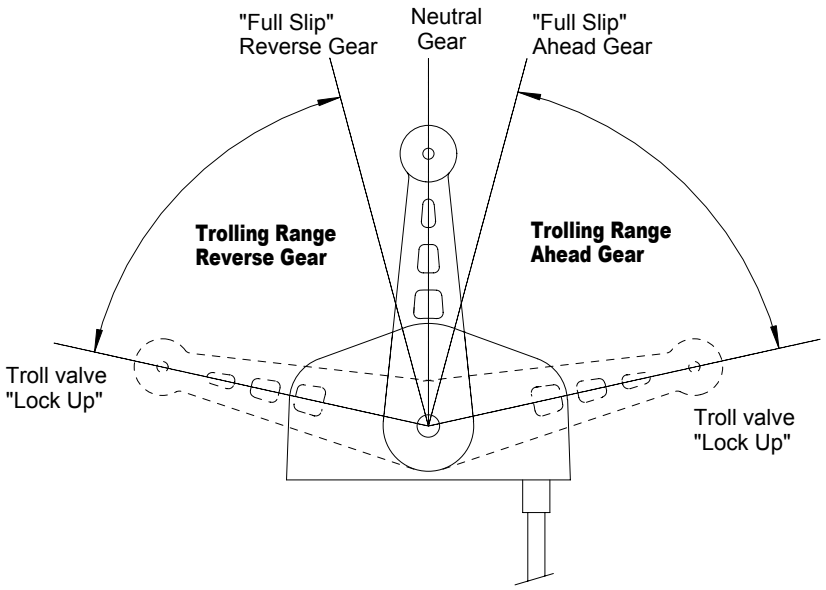
Troll Mode is used on boats that are equipped with trolling valve actuators to allow a boat speed slower than that typically obtained with normal engine idle. This is done by moving a lever on the engine transmission – called the “trolling valve” - which adjusts the gear oil pressure and allows the transmission to slip. The amount of slippage is adjusted by the position of the trolling valve.

While in Troll Mode, the boat operator is able to control the gear position (Ahead, Reverse, and Neutral) and the trolling valve position (Full slip to no slip). To prevent transmission damage, the engine throttle will remain in idle at any time that the troll valve is not in the Full Lockup – no slip - position. (While in normal Cruise Mode, the trolling valve actuator is always in the Full Lockup – no slip – position.)

Two methods of troll operation are available. These are described in the following diagrams. The specific method of troll operation that is in use is determined during control system calibration (See Operations Manual, Section 6.0 - Calibration)

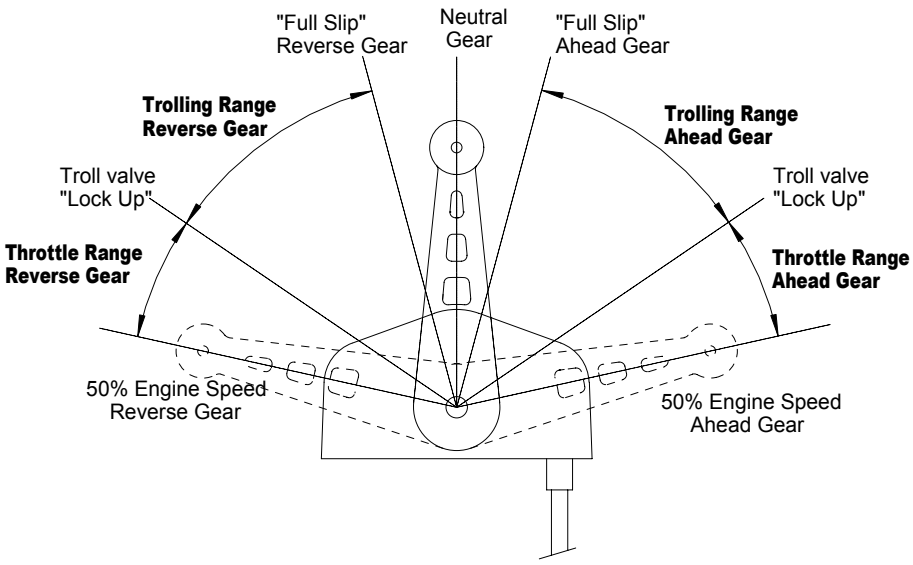
Method 1
“Troll only – no throttle”

This troll valve operation method permits only troll valve operation – engine throttle is locked at idle



Method 2
"Throttle at top end of troll"

This troll valve operation method controls troll valve through first 2/3 of handle travel – throttle is locked in idle. Last 1/3 of handle travel allows approximately 50% of engine throttle – troll valve is positioned in Full Lockup – no slip – while throttle is operated.



Troll Mode activation procedure:

1. Move the Control Head levers to the Neutral position. Troll Mode may only be activated while the control handle is in Neutral.

2. Press and release the TROLL button one time. In the engine compartment, the Trolling Valve Actuator will move the transmission trolling valve to the "full slip" position. The TROLL indicator light will go ON indicating that the EEC system is in Troll Mode.

3. While in the Troll Mode, moving the Control Head lever out of neutral into the Ahead or Reverse gear position will have no effect on the propeller shaft – the trolling valve is in "full slip" and there will be no propeller shaft movement.

4. As the Control Head lever is pushed past the Ahead / Reverse position into the normal position for engine throttle, the Troll Valve Actuator will move the trolling valve away from "full slip" toward the "full lockup" position, and the propeller shaft will begin to rotate. Propeller speed can be adjusted by moving the Control Head lever.

Troll Mode deactivation procedure:

1. Move the Control Head levers to the Neutral position. Slow Mode may only be deactivated while the control handle is Neutral.

2. Press and release the TROLL button one time. In the engine compartment, the Trolling Valve Actuator will move the transmission trolling valve to the "full lockup" position. The TROLL indicator light will go OUT, indicating that the system is back in normal Cruise Mode (Section 3.3).

3.8 Station Transfer

General Description

The purpose of the Station Transfer function is to allow the vessel operator to transfer control from one station to another. (This could also be described as changing the control station which is the "Active Station" - the "Active Station" is always that station that is in control of the EEC system.)

In order to understand the proper procedure for station transfer, two concepts must be kept in mind:

- Control can be transferred FROM one station (the "Active Station") TO any other "Inactive station" at any time. The propulsion plant may be in any position during the transfer process - ahead, astern, neutral, idle, or full throttle. If stations are transferred while the gears are in neutral, the "Inactive" (receiving) Station control levers must also be in the neutral gear position. If stations are transferred while the engines are in gear, the "Inactive" (receiving) Station control levers must be: 1) in neutral, **or**, in the same gear as the "Active Station" (i.e., ahead / astern) and 2) at or below the throttle position of the "Active Station". (That is, the Inactive Station control lever must be at or below the throttle position of the Active Station).

NOTE
This is only true for Engine Controls that include Version 4 software or higher.

For systems equipped with older software, station transfer can only occur while the system is in Cruise, Sync, or Slow mode only. (Station transfer is not allowed while the system is in Warm or Troll mode).

- Control transfer is a two step process. The first step involves signaling the EEC system that a control transfer is desired. This is done by pressing the TAKE button one time at the "Inactive Station" where you desire to take control. The EEC system will analyze the system status and determine whether control can be transferred. (This primarily checks to see if the "Inactive Station" control levers are in a position that is appropriate for station transfer). If the EEC confirms that station transfer is permissible, this will be signaled by a quick flashing TAKE light at the "Inactive Station". If some parameter prevents taking control (such as the Inactive (Receiving) Station control lever being in Reverse while the Active (In-control) Station is in Ahead) the TAKE light will 'slow blink'. It will continue to 'slow blink' until the parameter is changed or until a "time-out" is reached - approximately 12 seconds after first pressing the TAKE button.

Remember, Station transfer is only possible when:
Both Inactive Station control levers are in Neutral Gear
Or
Both Inactive Station control levers are in the same gear as Active Station (ahead/ astern), **and** at the same or lower throttle setting than Active Station.

Station Transfer Procedure

1. At the Inactive Station where you desire to take control, press and release the TAKE button 1 time. The Inactive Station control levers can be in any position when the button is pressed.

2. If Inactive Station control levers are in a position that is allowable for control transfer (see above), the TAKE light will begin to 'quick blink' and the control head will beep quickly.

3. If Inactive Station control levers are not in an appropriate position, TAKE light will 'slow blink'. The Inactive Station control levers should be moved to an appropriate transfer position, as described above. Doing this will cause TAKE light to 'quick blink'.

NOTE

The EEC system only allows a 12-second time period to make adjustments to the position of the Inactive Station control levers. If the control levers are not in an appropriate transfer position by the end of 12 seconds, the EEC system will revert back to a normal Cruise,Sync, or Slow Mode.

4. When TAKE light is 'quick blinking', press and release the TAKE button again (1 time). Control will immediately be transferred to the Inactive Station. This control station now becomes the Active Station and has full control of the EEC system.

NOTE

A good method of transferring stations while underway (ahead, with throttle) is to do the following:
1) Press and release the TAKE button one time at the Inactive Station
2) Advance the control handles to the full throttle ahead position. (The engine speed will not change since the control station is still Inactive). The TAKE light will blink slowly, indicating that the control handles are beyond the allowable position for station transfer.
3) Pull the control handles back slowly to the point where the TAKE light begins to blink quickly. At this point the control handles are aligned with the current engine speed.
4) Press and release the TAKE button again (one time). Control will be transferred immediately and the engine RPM will be virtually unchanged.

3.9 Alarm Mode / Mechanical backup operation

Alarm Mode Sequence

During normal operation, the Engine Processor continually monitors the operation of the entire control system to ensure that the system is functioning properly. In the event that a problem is discovered during these routine and continuous diagnostic checks, the EEC system will enter an "alarm mode". The following will occur when the "alarm mode" is entered:

1) The system actuators will remain at their "last- commanded" position; that is, the engine throttle and gear will remain in the same position they were in when the system entered the alarm mode.
2) The actuator solenoids will release, allowing the system to transfer automatically to mechanical backup operation.
3) All four (4) LED's on the control head will begin to blink in unison at all helm stations. The Control Head beeper will also begin to beep simultaneously.
4) The error code associated with the specific alarm condition will be indicated on the Engine Processor LED's.
5) The error code is stored in the system memory as an aid to troubleshooting the problem later.

Mechanical backup procedure

When the EEC system enters "alarm mode" as indicated by the (4) Control Head LEDs blinking simultaneously, the vessel operator should immediately accomplish the following:

1) If the vessel is being controlled at the Main control station, the one equipped with the integrated mechanical backup, the control system will revert to mechanical operation immediately.

NOTE

If the vessel is being operated in the troll mode when the system enters alarm mode, **the troll valves must be manually closed**. There is no automatic mechanical backup system for the troll valve actuator. Do not increase engine throttle above the speed allowed by the transmission manufacturer while the troll valve is open.

2) If the vessel is being controlled at one of the remote control stations (electronic control only), the vessel operator should move to the mechanical backup station and regain mechanical control. This is done by moving the Main control station (equipped with the mechanical backup system) to the same approximate position (i.e., Ahead with 60% throttle) as the remote control station when the system entered the alarm mode.

NOTE

In some cases, it may be necessary to "jiggle" the control handle a small amount in one direction or the other in order to regain mechanical backup control. Whether or not this small amount of control handle movement is necessary depends upon a number of factors, including: control handle position, length of mechanical backup cables, cable adjustment during installation, etc.

3) Investigating for the cause of the system failure can begin immediately or may be delayed until the vessel reaches its final destination.
    a) **Immediate investigation** - Leave EEC system ON in alarm mode with Control Head LEDs blinking and beeper sounding. DO NOT turn off the EEC Power Switch. Remove the EP Access and identify the LED's which are lit brightly. Once this information is recorded, the power to the Engine Processor may be turned off by pressing and releasing the EP circuit breakers. This will cause the Control Head LED's and beeper to cease blinking / beeping. Switch OFF the EEC power switch at the main panel.

NOTE

Immediate investigation should only be made if the vessel is tied up at the dock. If the vessel is underway, investigation of the alarm should be delayed until the vessel returns to the dock (see Delayed Investigation – next paragraph)

    b) **Delayed investigation** - Turn OFF the EEC system by switching the EEC power switch at the Main helm station to the OFF position. The Control Head LED's and beeper will cease. When the vessel has been tied up, follow the procedures under Section 5.1 "Troubleshoot Mode" to read the stored LED information.

4) Call GMP personnel with a description of the problem and LED error code information. (See Section 5)

NOTE

If electronic control is lost and then regained using the mechanical backup system, it is possible to attempt to restart the EEC while the vessel is underway. This may be done by placing the gear in the Neutral position, and proceeding with the System Startup procedures described in Section 3.2. The alarm codes that were stored during the original system failure will remain stored in system memory.

System Failure - No Alarm

There are 3 conditions where the EEC system may fail without entering the Alarm Mode:

1) DC power failure - Although dual battery inputs make the possibility of this occurring remote, a sudden and continuous loss of DC power input to the Engine Processor would make the EEC system stop "dead in its tracks".
   NOTE: A slow loss of DC battery voltage (i.e., battery charger failure) would be indicated by the system entering "alarm mode" due to low input voltage. This alarm code would be stored in system memory.
2) Power Switch power failure - A failure to supply power to the Power Switch at the Main station will have the same effect as a DC power failure.
3) Internal diagnostic failure - The diagnostic system fails to detect a system failure, or the diagnostic system has an internal failure causing it to cease operation.

If the system were to fail from one of the 3 causes listed above, the vessel operator would detect this failure in one of three ways:

1) The TAKE light, which is always fully ON (illuminated) at the Active Station, will go out.
1) If the vessel is being controlled from the mechanical backup helm station, the control handles may be much harder to move.
2) If the vessel were being controlled from a remote, electronic-only, station, movement of the control handles would result in no change of engine throttle and gear position. In this situation, mechanical control should be immediately regained at the mechanical backup station.

NOTE

The EEC system may be shifted to Mechanical backup operation at any time. This is done by simply turning OFF the EEC power switch at the mechanical backup helm station. The EEC system will be immediately de-energized and propulsion control may be regained using the mechanical backup system.

Mechanical backup system (Detailed description)

General

One of the key features of the Glendinning Electronic Engine Control system is the integrated mechanical backup system. In essence, the EEC system is really two control systems that operate in parallel to one another: 1) a computer controlled electro-mechanical system that permits control of gear and throttle from up to six different locations and 2) a mechanical control that permits control of the gear and throttle from one helm station. While the system is in operation, the specific system that is controlling the engine throttle and gear is determined by a custom designed coupler mechanism on the top of the actuator which is

located in the engine room. In the electronic operation, the coupler mechanism connects the electro-mechanical actuator output to the engine throttle and gear; the position and movement of the mechanical control system is ignored. In mechanical backup operation, the coupler mechanism connects the control cable from the mechanical backup station to the engine throttle and gear; the position and movement of the electro-mechanical actuator is ignored

Control Changeover - Electronic / Mechanical

In order to understand the method of transfer between the electronic and mechanical control systems, the concept of alignment must be understood. Control may only be transferred between the two parallel control systems when they are both in the same position. For example, if the vessel is being operated in the ahead gear at 2000 RPM in electronic control, the mechanical control system must be moved to a position that corresponds to "Ahead/ 2000 RPM" in order to regain mechanical control. (This alignment must only be approximate for transfer to occur).

When the vessel is being controlled electronically from the mechanical backup station, the electronic control system and the mechanical control are generally aligned. That is, when the system enters "alarm mode" when the system is being controlled electronically at the Main helm station, control will be transferred immediately from electronic to mechanical.

NOTE: In some cases, it may be necessary to "jiggle" the control handle a small amount in one direction or the other for this transfer to occur. Whether or not control will be immediate depends upon a number of factors, including: control handle position, length of mechanical backup cables, cable adjustment during installation, etc.

When the vessel is being controlled electronically from a remote, electronic-only, control station, it will be necessary to "align" the mechanical handles up with the current position of the engine throttle and gear in order to regain control. This may be done very simply by pushing the control lever in the direction of vessel movement (ahead or astern) and continuing to push the lever until a change is observed in the engine speed (RPM). At the moment that the mechanical control system is aligned with the electronic system, the engine will either increase or decrease slightly in RPM. The engines may now be controlled mechanically.

Control transfer from mechanical operation to electronic is accomplished every time that the EEC system is turned on. During system startup, the electronic control system automatically aligns itself up with the mechanical control. This is the reason why the main control station handles must be in the Neutral position prior to turning on the EEC power switch. (see section 4.2).

4.0 MAINTENANCE

4.1 Routine Maintenance

The EEC system has been designed to require as little maintenance as possible. In general, routine maintenance consists of inspecting the system components for mechanical tightness and for indications of external corrosion. This inspection should be done 2-3 times per season, perhaps at the beginning, middle, and end of each boating season.

System Component	Description
Actuator	a) Inspect external surfaces for corrosion, including actuator output shafts. Use "Corrosion Block" or equivalent to keep all Actuator surfaces free of corrosion. b) Verify that all control cable connections are tight. This includes: - control cable clamps, which hold control cables onto Actuator - terminal eye jam nuts – small nuts on control cable rod end which lock terminal eye in place - "shoulder bolts" – bolts which attach control cables to Actuator coupler plates
Engine Processor	a) Inspect external surfaces for corrosion b) Inspect wire connections for corrosion
Station Processor	a) Inspect external surfaces for corrosion and free from moisture b) Verify that connectors are tight.
Control Head	a) Inspect for visible moisture in control panel windows.

NOTE

If any **welding** is performed on the boat at any time, it is essential that the power input terminals and bonding system connection to the Engine Control System (EEC) must be disconnected from the Engine Processor. This is necessary to protect the system from any stray currents which may be created during the process of welding. Failure to do this may cause damage to the EEC components. This failure will not be covered by warranty.

4.2 System Calibration Check

When the EEC system is initially installed in a boat, the system is calibrated to the limits of travel for engine governor and transmission control levers. As long as nothing is disturbed with the control cables in the engine room, no re-calibration is necessary. However, during any routine work on the engine governor or transmission, it is possible that these settings may be disturbed. If there is any possibility that these control levers have been disturbed, the system calibration should be checked.

NOTE

Failure to have gear actuator properly calibrated may lead to transmission failure. Always verify that gear calibration is correct if any work is done on engine or transmission.

Recheck the system calibration using the following procedure:

1) Turn ON the EEC system (normal startup procedure - see Section 3.2)
2) Disconnect the control cable at the affected control lever - engine governor or transmission. (DO NOT disconnect the control cables at the EEC system actuators).
3) To check the transmission control cable calibration
   a) Place the Control Head in the Neutral detent position, and move the associated transmission control lever to it's Neutral detent. Verify that the control cable terminal eye is aligned with the control lever pivot pin.
   b) Perform the same check with the Control head and transmission in the Ahead and Astern gear positions.
4) To check the engine governor control cable calibration
   a) With the Control Head in the Ahead idle detent position, and with the associated engine governor lever at the idle mechanical stop, verify that the control cable terminal eye is aligned with the governor lever pivot pin.
   c) Perform the same check with the Control head and engine governor in the Full Throttle positions.

If the terminal eyes do not line up with the control lever pivot pins, the system must be re-calibrated. (See Section 6.0 - System Calibration)

4.3 Actuator Control Cable replacement

To replace the control cables which connect the EEC Actuator to the engine / transmission control levers, do the following:

1) Prior to removal of the existing control cable(s), verify that terminal eye locknuts are securely fastened.
2) Disconnect the control terminal eyes from the actuator coupler plate and governor / transmission control levers. Remove the existing control cable from the actuator and control lever.

3) Loosen and unscrew the terminal eyes off the old control cable, counting the number of turns. Install the terminal eyes on the new control cable, screwing them on the same number of turns.
4) Mount the new control cable in the engine / transmission cable mounts. Mount the other end of the new control cable in the actuator mounting blocks. Ensure that the control cable slots fit tightly on the cable clamps at both mounting positions.
5) Connect the terminal eyes to actuator coupler plate. Tighten the terminal eye locknuts. Secure the terminal eyes on the coupler plate pivots with cotter pins.
6) Verify that the terminal eyes have been correctly installed by verifying the system calibration (Paragraph 4.2). If the new control cable terminal eyes do not line up with engine / transmission control levers, adjust the terminal eye position (screw on / off).
7) When the control cable terminal eyes are lined up, tighten the terminal eye locknut, and secure the terminal eye on the engine / transmission control lever.

5.0 Troubleshooting

If difficulty is encountered during system operation, the following steps should be followed to determine the cause and / or fix the problem:

1. If the vessel is underway, immediately regain mechanical backup control. All troubleshooting steps should be postponed until positive control over the vessel's propulsion plant is regained.

2. If the difficulty occurs during system startup, follow the "EEC System Startup Sequence" flowchart depicted on the next page. Almost always, system startup problems are caused by Control Heads not being positioned in the Neutral position prior to startup, or by adjustment problems caused by mechanical backup misalignment / misadjustment.

3. Perform the steps listed under "Troubleshooting Mode (Recover Alarm Codes) described in Section 5.1. Obtain the following information:
   - Number of alarm code that was most recently stored in memory
   - Alarm code LED sequence for each alarm in memory.

4. With the alarm code information gathered in Step #3 above, and with the Engine Processor serial number (located on the front cover of the Engine Processor), contact the product service personnel at Glendinning Marine Products, as follows:

   Office phone: 800-500-2380
   Office fax: 843-399-5005
   Hours: 8:00 a.m. - 5:30 p.m. Monday - Friday (On many days, there are people at the factory either earlier or later than these hours)

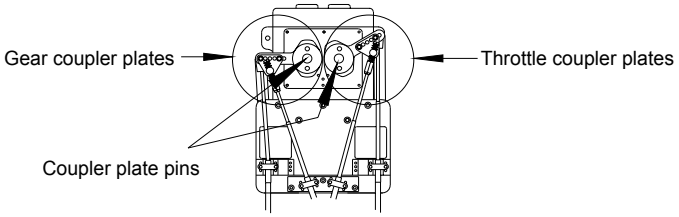
   Beeper: 843-477-6630
   When you hear the "three beeps", please key in the phone number where you would like to be contacted at. We will try to call you back as soon as possible. Please understand that this is a special beeper which is dedicated to responding to urgent calls regarding the EEC product ONLY and is not to be used for calls relating to our other products.

EEC SYSTEM STARTUP SEQUENCE

During the startup process, the EEC performs various diagnostic tests. In addition, the EEC system must changeover from mechanical backup operation (the failsafe mode that the system is in when powered off) to electronic operation.

Normally, mechanical backup can be aligned with the electronic control by adjusting the mechanical backup control head prior to system startup. If difficulty is encountered during startup, verify alignment of coupler plates on actuators in engine compartment.

Prior to startup, gear and throttle coupler plates on both gear / throttle actuators must be aligned (3 coupler plates / function)



Prior to EEC system startup, verify that Main Control Station is in neutral position.

If the Main Control Station is not also the mechanical backup station, verify that the mechanical backup controls are also in the neutral position

Turn EEC system ON

Move Main Station Control Head handles to neutral position

Is Main Station Control Head in neutral position?

NO

YES

TAKE / WARM / SLOW lights blink about 1 time every 2 seconds

Control Head lights will "scroll" -
(lights will move from left to right to left)

Actuator solenoids will attempt to engage

Actuators will move small amounts to align coupler plates.

Are Actuator solenoids engaged?

(Actuator solenoid engagement is indicated by coupler plate center pin being fully retracted)

Port Actuator solenoid will attempt to retract coupler pins first; Starboard Actuator solenoids will be energized only if Port Actuator coupler pin engagement is successful

NO

Does Actuator movement allow coupler plate center pins to fully retract?

YES

NO

YES

Control Head - TAKE light ON

System is ready for operation

System will go into ALARM mode
(4 control head lights blink)
Mechanical backup mis-alignment is excessive.

1) Turn off EEC system
2) Adjust mechanical backup control head position.
3) Restart EEC system.

5.1 Troubleshoot Mode (Recover Alarm History)

NOTE
This section is contained here for general information only. Troubleshoot Mode should only be accomplished when directed by Glendinning Marine Products or by a technician who has been trained by Glendinning Marine Products. Please contact Glendinning Marine Products for additional information.

As described above under Section 3.9, whenever the EEC system goes into the “Alarm Mode”, a code is stored in the system memory which indicates the diagnostic alarm that was encountered. This error code may be retrieved from the system at any time, even if the system has been turned off or even if the system has experienced multiple, or cascading, failures.

The general procedure that is used to recover the Alarm error codes is as follows:

1) Identify the number of the last alarm code stored in memory
2) Read each alarm code that is stored
3) Clear the alarm code memory.

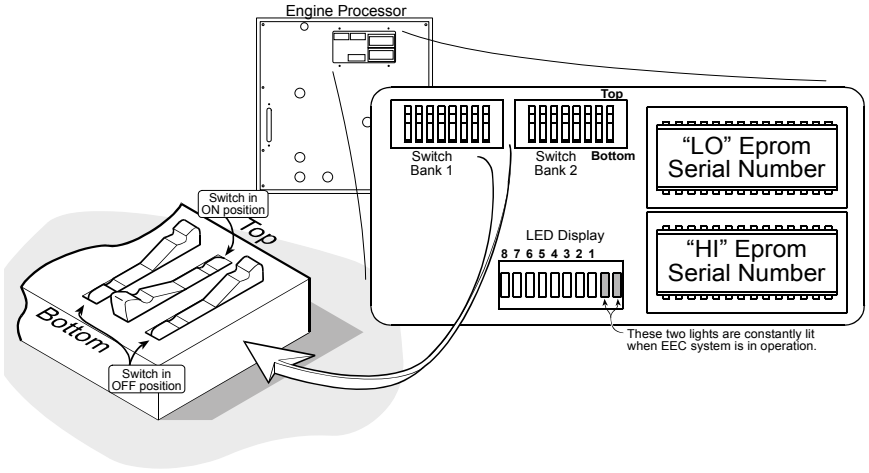
The following procedure is used to retrieve the Alarm Mode error codes:

IDENTIFY NUMBER OF STORED ALARM CODES

1. Turn “OFF” the EEC system. Open EP access panel to expose the LEDs and DIP switches.
2. Verify or record the positions (ON/OFF) of each of the EP DIP switches with the “DIP switch position table" that is kept in the front pocket of this manual. If they are not already recorded, write them in the chart below:

DIP Switch	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8
Bank 1								
Bank 2								

NOTE: Bank #1, Switches 1 - 4 are the only switch positions that need to be recorded. Do not change the position of any other switches.

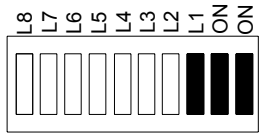


3. Position the DIP Switches as indicated below:

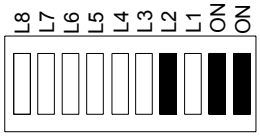
Switch Bank #1	Switch bank #2
Switch #1 - ON	Switch #8 - ON
Switch #2 - OFF	
Switch #3 - OFF	
Switch #4 - OFF	
Switch #5 - ON	

4. Turn ON the EEC system (use same switch at main helm station that is used to turn on the EEC system during normal operation).

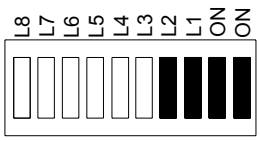
5. The location of the last alarm code that was stored in the system will be displayed on the EP LED.



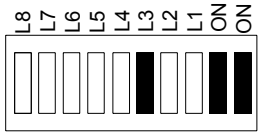
Last Alarm = #1 Alarm Code



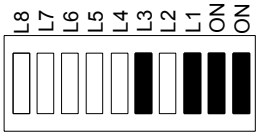
Last Alarm = #2 Alarm Code



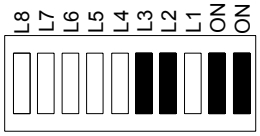
Last Alarm = #3 Alarm Code



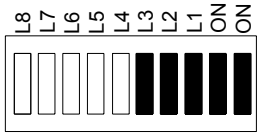
Last Alarm = #4 Alarm Code



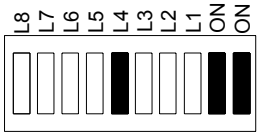
Last Alarm = #5 Alarm Code



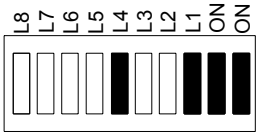
Last Alarm = #6 Alarm Code



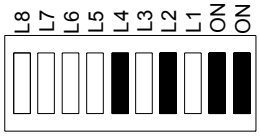
Last Alarm = #7 Alarm Code



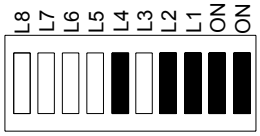
Last Alarm = #8 Alarm Code



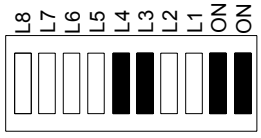
Last Alarm = #9 Alarm Code



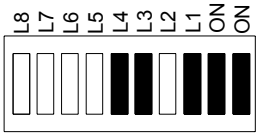
Last Alarm = #10 Alarm Code



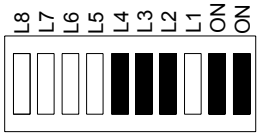
Last Alarm = #11 Alarm Code



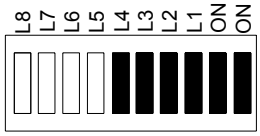
Last Alarm = #12 Alarm Code



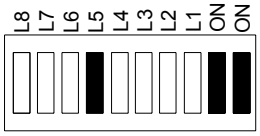
Last Alarm = #13 Alarm Code



Last Alarm = #14 Alarm Code



Last Alarm = #15 Alarm Code



Last Alarm = #16 Alarm Code

NOTE: If no lights are visible, there are no alarm codes stored in memory. Proceed to Step 9 .

RECOVER STORED ALARM CODES

6. Change Bank #1, Switch #4 to the OFF position. Alarm Code #1 will be displayed in the LEDs. Record Alarm Code.

7. Read all (16) Alarm code memory locations by positioning DIP Switch Bank #1 Switches 1-4 as indicated in the following table

Display Alarm Code	Bank #1, Switch #1	Bank #1, Switch #2	Bank #1, Switch #3	Bank #1, Switch #4	Bank #1, Switch #5
#1	**ON**	OFF	OFF	OFF	OFF
#2	OFF	**ON**	OFF	OFF	OFF
#3	**ON**	**ON**	OFF	OFF	OFF
#4	OFF	OFF	**ON**	OFF	OFF
#5	**ON**	OFF	**ON**	OFF	OFF
#6	OFF	**ON**	**ON**	OFF	OFF
#7	**ON**	**ON**	**ON**	OFF	OFF
#8	OFF	OFF	OFF	**ON**	OFF
#9	**ON**	OFF	OFF	**ON**	OFF
#10	OFF	**ON**	OFF	**ON**	OFF
#11	**ON**	**ON**	OFF	**ON**	OFF
#12	OFF	OFF	**ON**	**ON**	OFF
#13	**ON**	OFF	**ON**	**ON**	OFF
#14	OFF	**ON**	**ON**	**ON**	OFF
#15	**ON**	**ON**	**ON**	**ON**	OFF
#16	OFF	OFF	OFF	OFF	**ON**

CLEAR ALARM CODE MEMORY

8. Once all of the alarm codes have been retrieved, the alarm code memory may be cleared by positioning Dip Switch Bank #1, Switches #3 and Switch #5 to the ON position. When the Alarm Codes have been cleared, all 8 LEDs will be lit.

NOTE: Once the alarm codes have been recorded, it is good practive to clear them in order to prevent confusion if any additional alarm error codes are written to memory during future operations. However, there is no requirement to clear the memory once the codes have been retreived. Any future alarm mode error codes will be written to the next available alarm memory location.

9. Turn OFF the EEC system. Restore the EEC system to normal operation by resetting the DIP Switches to their normal operational position, as follows:

Bank #1, Switches #1 - 5 - Set to position recorded in Step 2 above.
Bank #2, Switch # 8 - Turn Switch OFF.

10. Replace the EP Access Panel. The EEC system is now ready for normal operation.

5.2 Alarm Error Codes

When the EEC enters “Alarm Mode” (Section 3.9), the specific diagnostic alarm which has caused the Alarm Mode is displayed on the EP LED and recorded in the system memory. The table below is a guide which links the LED indication with the alarm name, the reason for actuation, and recommendations for additional troubleshooting steps. The alarms have been grouped into sections based on the typical situation when they will be encountered, although it is possible that some alarms may be encountered in different situations.

This is not an exhaustive list of alarm codes. As indicated in the first part of this section, once the alarm codes are recovered, the preferred plan of action is to call the GMP factory and provide this information to the technical service department.

Alarm Error codes (LED lights)

LED Number - An ‘X’ in the column under LED number indicates that the LED is lit.

I. The following alarms may be observed during system startup.

LED Number										
8	7	6	5	4	3	2	1	Alarm Name	Cause of Alarm	Additional Troubleshooting
			X				X	ee_alarm	Internal memory error	Recalibrate EEC system – Sec. ___
	X				X			no_eec	EEC did not initialize during startup	Actuator coupler Plates not lined up. Make sure that they are lined up. Then restart EEC system.
X				X			X	invalid_power	Power supply out of range	Verify power input to EP. Measure voltage at input power terminal strip.

II. The following alarms may be observed during normal operation.

LED Number										
8	7	6	5	4	3	2	1	Alarm Name	Cause of Alarm	Additional Troubleshooting
X							X	Port Throttle High Current alarm	Port throttle actuator had excessive current	1. Inspect port throttle linkage for possible binding or other interference i.e. Too much over-travel 2. Verify that system does not travel past engine stops 3. Restart EEC system. 4. Possibly recalibrate system and restart.
X						X		Starboard Throttle High Current alarm	Starboard throttle actuator had excessive current	Carry out recommendations described above under “Port Throttle High Current alarm” for Starboard throttle.
X					X	X	X	Port Gear High Current alarm	Port gear actuator had excessive current	Carry out recommendations described above under “Port Throttle High Current alarm” for Port Gear actuator
X				X				Starboard Gear High Current alarm	Starboard gear actuator had excessive current	Carry out recommendations described under “Port Throttle High Current alarm” for Starboard gear actuator.
X				X		X		Port troll valve feedback alarm	Port troll valve actuator had excessive current	Carry out recommendations described under “Port throttle feedback alarm” for Port troll valve actuator.
X				X		X	X	Starboard troll valve feedback alarm	Starboard troll valve actuator had excessive current	Carry out recommendations described under “Port throttle feedback alarm” for Starboard troll valve actuator.

X					X		X	Battery low	Low input voltage	1. Measure the battery input voltages at the EP terminals - Must be at least: 9.75 VDC for 12 VDC 21 VDC for 24 VDC 2. Verify that power input connections are tight and free of corrosion
X					X	X		Battery high	High input voltage	1. Measure the battery input voltages at the EP terminals, Must be no higher than: 14.5 VDC for 12 VDC 27 VDC for 24 VDC 2. Verify battery charger / voltage regulator operation. NOTE: This alarm requires the high voltage condition to exist for approximately 5 seconds.
X	X			X			X	Handle Connection	Active Station lost connection with its control head	Check connection of large connector to active station SP. Disconnect and make sure all pins on the end of the cable connector can be seen.
		X	X	X	X			Reset Alarm	Engine Processor reset during operation.	Call GMP
X	X	X	X		X			Active_sta_alarm	Serial communications problem between EP and active station	1. Restart system. *** Possible RFI / EMI issues?

6.0 SYSTEM CALIBRATION

WARNING
Failure to properly calibrate the system prior to initial operation may cause significant damage to the system.

Introduction

The purpose of EEC system calibration is to adjust the EEC system actuator movement (length of travel) so that it matches the movement of the engine governor lever, transmission gear selector lever, and / or trolling valve control lever.

The EEC system must be calibrated after the system is installed, prior to initial operation. In addition, the EEC system must be re-calibrated whenever any change is made in the control levers of the engine governor, reduction gear, or trolling valve. Re-calibration will be also be required if any changes are made to the push-pull control cables that connect each actuator to the engine governor and / or gear box.

NOTE
Failure to recalibrate the EEC system after changes are made to engine and / or reduction gear control levers, or the interconnecting push-pull cables, could cause failure of one or more system components.

Calibration Procedure Overview

Calibration of the Electronic Engine Control system consists of manually controlling each actuator through the complete range of travel of the associated engine or gear control lever . At each endpoint of travel - engine throttle idle position, engine throttle full speed position, ahead gear position, astern gear position, etc. - the EEC system will “memorize” the location of this position and will use this position as a reference during operation. For example, during normal operation, when the vessel operator moves the control head lever to the "idle, neutral" position, the EEC system will move the engine throttle and gear control levers to the idle engine speed *postion* and neutral gear *position* that were set during the calibration procedure. Obviously, if this position is not correctly set during calibration, the EEC system will not move be able to move the control levers to the correct position.

Manual calibration consists of 6 steps:

6.1	System preparation	6.4	Handle calibration
6.2	Entering Calibration Mode	6.5	Exiting Calibration Mode
6.3	Actuator positioning	6.6	Calibration verification

6.1 System Preparation

Prior to beginning manual calibration, the EEC system must be prepared as follows:

1) Before calibration, all connecting push-pull control cables between the EEC actuators and engine, transmission, and trolling valve **must be completely installed**. Once calibration is completed, any changes that are made to the control cables or the engine / transmission control levers will make re-calibration of the EEC system necessary.

NOTE

Although the mechanical backup control cables may be hooked up (the cables which connect the EEC actuators to the mechanical backup control head), it may be easier to go through the calibration process with these cables disconnected at the actuator. These control cables can be safely hooked up after the calibration process is completed.

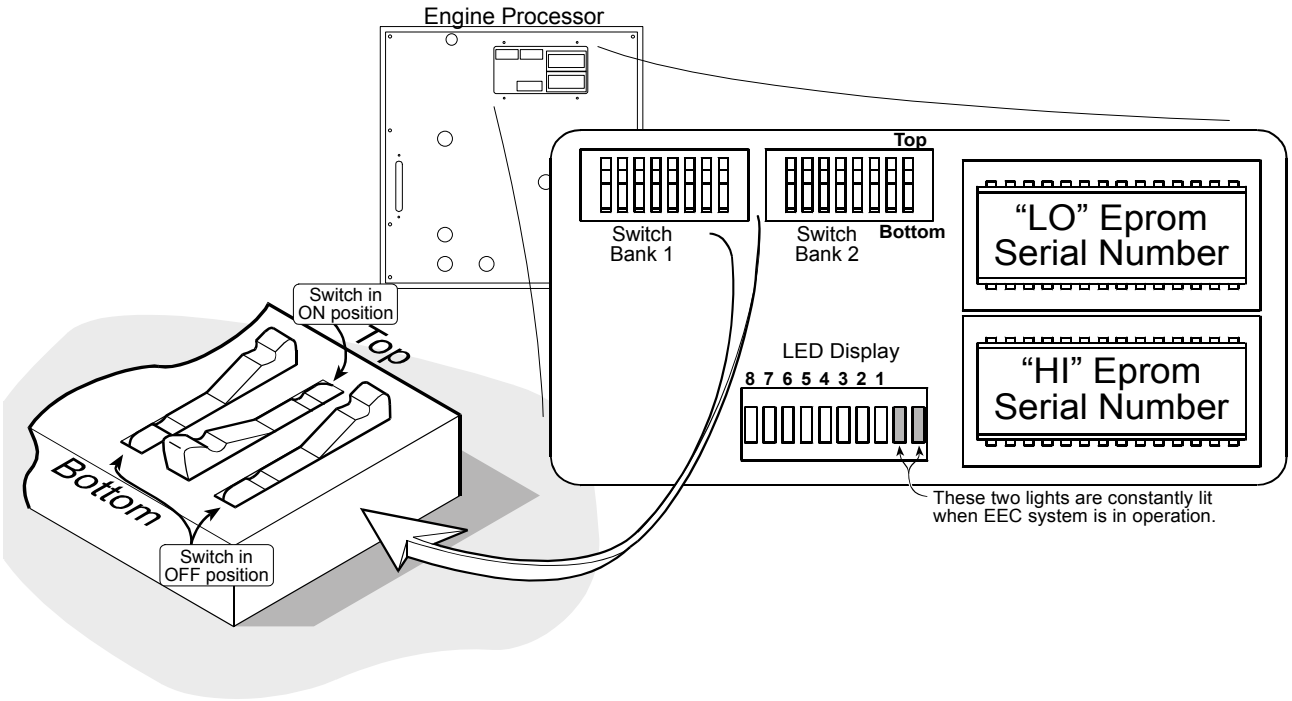
2) Verify that the Main station control handles are in the neutral position. The Main Station is the control station that is connected to the "S1" connection in the Engine Processor. Normally, the Main station is also equipped with the mechanical backup cables.

3) Turn OFF all power to the EEC system.

4) Open the Engine Processor (EP) access plate to expose the DIP Switches and LED indicator light assembly.

5) Set the switches as per the chart that follows.

Switch Bank 1		Switch Bank 2
Switch 1	**PORT Gear Cable Direction** ON – Pull to ahead OFF – Push to ahead	**Number of Stations** 1 Station - Switch 1 – ON, Switch 2 – OFF, Switch 3 – OFF 2 Stations - Switch 1 – OFF, Switch 2 – ON, Switch 3 – OFF 3 Stations – Switch 1 – ON, Switch 2 – ON, Switch 3 – OFF 4 Stations – Switch 1 – OFF, Switch 2 – OFF, Switch 3 – ON 5 Stations – Switch 1 – ON, Switch 2 – OFF, Switch 3 – ON 6 Stations – Switch 1 – OFF, Switch 2 – ON, Switch 3 – ON
Switch 2	**STBD Gear Cable Direction** ON – Pull to ahead OFF – Push to ahead	
Switch 3	**Throttle Act. Cable Direction (Both engines)** ON – Pull to open OFF – Push to open	
Switch 4	**Port Troll Lockup Direction** ON – Pull to Full Lockup OFF – Push to Full Lockup	**Calibration** ON – Calibration ON OFF – Calibration OFF (Run Mode)
Switch 5	**STBD Troll Lockup Direction** ON – Pull to Full Lockup OFF – Push to Full Lockup	**Calibration type** ON – Manual Calibration (Leave switch ON)
Switch 6	**Automatic Synchronizer** ON – Enabled OFF – Disabled	
Switch 7	**Troll valve Operation** ON – Enabled OFF – Disabled	
Switch 8	**Troll valve Mode** ON – Throttle at Top end OFF – Troll only (no throttle)	**Troubleshoot Mode** ON – Enable (leave switch OFF) OFF – Disable



NOTE: To set the switch position, push down on the side of the switch that is marked with your desired setting. Example, **Push down on the OFF side** if you want the **switch to be in the OFF position**.

The following provides more detail regarding the above switch settings:

Switch Bank 1

Switch 1, 2 - This switch position is determined by the direction of the control cable connection at the transmission gear control lever. For example, "**Pull to ahead**" indicates that the control cable ***pulls*** on the control lever to place the transmission in the ahead direction. This switch position should correspond with the data obtained in Section 1.1 of the manual.

Switch 3 - This switch position is determined by the direction of the control cable connection at the engine governor / throttle. For example, "**Pull to open**" indicates that the control cable ***pulls*** on the governor to increase engine RPM ("open" the engine). This switch position should correspond with the data obtained in Section 1.2 of the manual.

Switch 4,5 - This switch position is determined by the direction of the control cable connection at the troll valve control lever (if installed). For example, "**Pull to Full Lockup**" indicates that the control cable ***pulls*** on the troll valve control lever to close the troll valve and place the transmission in the no slip position. This switch position should correspond with the data obtained in Section 1.3 of the manual. (If a troll valve is not installed, the position of these switches does not matter).

Switch 6 - This switch position enables the Automatic Synchronizer capability. This switch should normally be turned ON in order to enable the capability for Automatic Synchronization during system operation. For engines with electronic governors where this capability is handled by the engine system (i.e., Caterpillar 3176, 3406, 3412, etc), this switch should be in the OFF position during calibration.

Switch 7 (Applicable **only** for *troll capable* Engine Processors only – GMP PN 11200-02T)

This switch position enables the capability for Trolling Valve operation.

- Turn switch ON if troll valve actuators *are* installed.
- Turn switch OFF if troll valve actuators *are not* installed.

Switch 8 (Applicable **only** for Version 5 software or later)

This switch position determines the type of Trolling Valve operation.

- Turn switch ON if combined troll valve and throttle operation *is* desired. (In Troll Mode, initial 65% of handle movement will control troll valve from full slip to lockup, final 35% of handle movement will control throttle from idle to approximately 40% RPM.)
- Turn switch OFF if combined troll valve and throttle operation *is not* desired. (In Troll Mode, handle will only control troll valve; engine throttle will remain at idle.)

NOTE: This switch position (Switch #8) is only applicable for Engine Control systems equipped with Version 5 software or later. Leave switch OFF while calibrating system for earlier software versions.

Switch Bank 2

Switch 1, 2, 3 - These switches should be set for the number of stations which will be connected to the Engine Processor.

Switch 4 - Turn this switch ON to enable the Calibration Mode. After Calibration is completed, turn switch OFF. (See Section 4.5)

Switch 8 - This switch enables "Troubleshoot" Mode, which is used to diagnose EEC system problems. This switch must be turned OFF during calibration.

NOTE: Switches 5, 6, and 7 in Switch Bank 2 should be placed in the OFF position during calibration

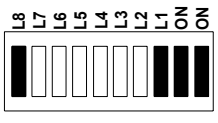
6.2 Entering Calibration Mode

1. Set DIP switches as described in the chart in the above section

> The EEC system will be programmed to operate based on the positions of the DIP Switches as they are set at the start of calibration. It is **very important** that care be taken **to position the DIP switches correctly** prior to turning the system "ON" in calibration mode. As a minimum the following switch must be set to "ON" to enter the Calibration Mode:
>
> DIP Switch Bank 2, Switch 4

2. Remove the Manual Calibration Box (MCB) from the EP enclosure.

3. Turn the EP "ON". The system will go through its startup sequence and the actuator solenoids will be energized locking the actuator coupler pins down. The LED's on the Engine Processor will then change to the sequence indicated at the right.

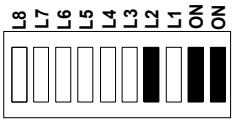


NOTE: LED light indications are applicable for *troll-capable* Engine Processors only (GMP PN 11200-02T). See Section 7.0 of this Operations Manual for LED indications on *non-troll* Engine Processors (GMP PN 11200-01).

NOTE

If the coupler plates on each Actuator are not lined up (these are the plates which are connected to the push-pull control cables), the system will not be able to enter the calibration mode. If the coupler plates are not lined up, the system will try for three times to start up and then will go in to alarm mode. If this happens, turn the system "OFF", line up the actuator coupler plates, and then turn the system "ON" again. In some cases, the actuator coupler plates may be kept in line by connecting all three coupler plates together with a electrical wire tie ('tie wrap'). This may be likely to happen if the mechanical backup control cables are not hooked up as recommended in Section 4.1.

4. The actual calibration procedure can be started by pressing the "Accept" button <u>one time</u> on the Manual Calibration Box (MCB). The EP LED lights will change to the sequence indicated at the right .



This light sequence indicates that the system is now ready to begin to calibrate the Actuator "end-point" positions. Calibration will begin with the Starboard throttle actuator.

6.3 Actuator Positioning

The actuators are calibrated by moving each actuator to each endpoint position and then "memorizing" that position by pressing the MCB "Accept" button. For a typical twin engine boat without trolling valves, there will be eight positions to identify:

1) Starboard throttle idle
2) Starboard throttle full throttle
3) Starboard gear ahead
4) Starboard gear astern
5) Port throttle idle
6) Port throttle full throttle
7) Port gear ahead
8) Port gear astern

For a boat that is equipped with a trolling valve, there will be a total of twelve positions to identify, the eight positions listed above as well as the following additional positions:

9) Starboard troll valve closed (lockup)
10) Starboard troll valve open
11) Port troll valve closed (lockup)
12) Port troll valve open

NOTE

1. The actuators that are calibrated <u>must be done in a specific order</u>:
   - Starboard throttle
   - Starboard gear
   - Port throttle
   - Port gear
   - Starboard troll valve
   - Port troll valve

2. The order of the actuator endpoint that is calibrated is <u>not important</u>; that is, full throttle may be calibrated *before* or *after* idle, astern gear calibrated *before* or *after* the ahead gear position.

Each actuator is calibrated by the following procedure:

1) Move the actuator by depressing the extend or retract button to move the actuator toward the endpoint of travel of it's associated control lever. The actuator will move steadily if the button is held down. The actuator will only move a small amount if the button is quickly pressed and released.

2) The actuator should be moved to a position where the associated engine / reduction gear control lever has reached its mechanical stop position. This can be done by observing the push-pull cable connection to the control lever and stopping the actuator when the connection visibly tightens. Move the actuator in the opposite direction if the connection appears excessively tight. **Make sure that the cable is not binding**. It is important to find the proper balance between the control cable position being "too loose" and not reaching its endpoint position (and therefore the engine not achieving idle speed or full throttle), and the cable being set up "too tight" and constantly operating in a compressed or stretched condition when moving to its endpoint of travel. Continue adjusting the actuator position until a good position has been achieved.

3) When the control lever endpoint is properly achieved, the position can be “memorized” by pressing the MCB “Accept” button (1 time).

4) Move the actuator in the opposite direction to calibrate the other endpoint of the control lever. Again, observe the push-pull cable connection and move the actuator to the point where the lever is hard against its mechanical stop, **but not binding**.

5) When the control lever endpoint is properly achieved, the position should be “memorized” by pressing the MCB “Accept” button.

6) After both endpoints have been calibrated, press the “Accept” button one additional time to calibrate the next actuator calibration position - see the order of calibration specified above.

7) Once both endpoints of the final actuator have been "memorized" - either the port gear actuator or the port troll valve actuator - the "Accept" button must be pressed one additional time. After the Accept button is pressed, the actuators will then move to the "idle / neutral" position (i.e., the gear actuators will move to neutral, the throttle actuators will move to idle) to confirm that the actuator positioning portion of calibration is complete. This will confirm that all Actuators have been successfully calibrated, all of the endpoint positions (engine idle, engine full throttle, etc.) have been stored in memory, and you are now ready to move the Handle Calibration.

NOTE

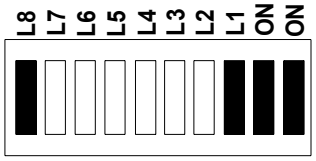
It is important to note that the Actuators will move to the "idle / neutral" position when calibration is complete. If the Actuators do not move, it is possible that an error has been made during the calibration process:

- The "Accept" button was not pressed one additional time, as described in Paragraph 7 above.
- Troll Valve Operation is set (DIP Switch Bank #1, Switch 7 in ON), but no Troll Valve actuators are installed.

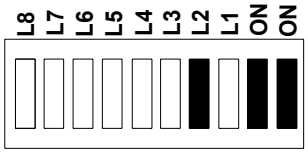
LED Light Sequence

NOTE: LED light indications are applicable for *troll-capable* Engine Processors only (GMP PN 11200-02T). See Section 7.0 of this Operations Manual for LED indications on *non-troll* Engine Processors (GMP PN 11200-01).

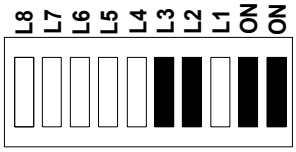
As an aid to the technician, the LEDs located in the EP access port will light up indicating the specific Actuator that is currently being calibrated, and whether both endpoints have been calibrated. The LEDs will light up according to the following sequence:



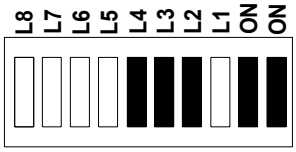
After system startup / prior to beginning calibration
LED L1 and L8 are ON
(The rightmost (2) LEDs are always on when EEC system is operational).



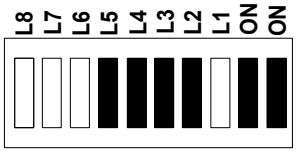
Starboard throttle calibration
LED L2 is ON



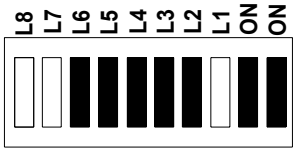
Starboard Gear calibration
LED L2 and L3 is ON



Port throttle calibration
LED L2, L3 and L4 is ON

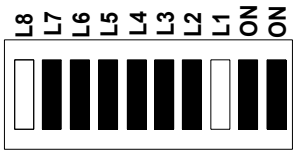


Port Gear calibration
LED L2, L3, L4, and L5 is ON

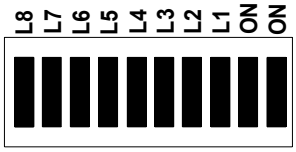


Starboard Troll Valve calibration
(if boat is equipped with troll valves)
LED L2, L3, L4, L5 and L6 is ON

NOTE: <u>If boat is not equipped with troll valves</u>, this light indication will signal calibration complete



Port Troll Valve calibration
(if boat is equipped with troll valves)
LED L2, L3, L4, L5, L6 and L7 is ON



Actuator calibration complete
(If troll valve actuators are installed)
All LED's are ON

Calibration Notes

Note 1: The above sequence of events should be carefully followed anytime that the EEC system is being installed or if several of the Actuator positions must be re-calibrated (such as after an engine replacement).

If only one Actuator position must be re-calibrated - for example, if the idle or full speed setting of one engine must be changed - it is not necessary to recalibrate every Actuator position. In this case, you can skip the calibration of Actuator positions that are already set and are satisfactory by simply pressing the "Accept" button instead of the "Extend" or "Retract" buttons. If the "Accept" button is the first button pressed, the Calibration process will skip that particular Actuator. You can identify which Actuator is in the process of being calibrated by looking at the LED indicators shown in the previous diagrams.

Note 2: During the calibration process, two of the Control Station indicating lights will be illuminated (outer left and outer right). This is normal - see next section on Handle Validation.

6.4 Handle Validation

The purpose of the Handle Validation procedure is to permit the installer and / or repair technician to verify that each control handle, control button, and indicating light correctly operation at the conclusion of the installation. The Handle Validation procedure does not actually calibrate the handles - this is done each time that the EEC system is turned on in normal operation.

Handle Validation can be done upon the completion of Actuator Postioning (Paragraph 6.3). You can confirm that you are ready for Handle Validation if the Actuators have moved to the "neutral / idle" position as described previously in Paragraph 6.3, item 7.

NOTE

Handle Validation does not have to be done each time you are calibrating the system. If you just calibrated the actuators a second time (i.e. the actuator settings were not correct and you had to re-calibrate) you can ignore the Handle Validation process and go to Exiting Calibration Mode – Set Run Mode switches (paragraph 6.5).

To begin handle calibration, go to the Main Control station (the control station that is connected to the "S1" connection in the Engine Processor).

1) During the Actuator Position process, the outer left and outer right indicating lights are illuminated (these are normally described as the "TAKE" and "SLOW" lights). When the calibration process is complete, the inner left and inner right ("SYNC" and "WARM") lights will be on. (If the TAKE – SLOW lights are still on, this would indicate that the Actuator Process has not yet been completed - see paragraph 6.3, item 7.
2) Move the port (left) control lever to "full ahead" position. The TAKE indicator light will go on.
3) Move the port (left) control lever to "full reverse" position. The SYNC indicator light will go on. (The TAKE indicator light will remain on.)
4) Move the port (left) control lever to the neutral position.
5) Move the starboard (right) control lever to "full ahead" position. The WARM indicator light will be lit. (The TAKE and SYNC indicator lights will remain on.)
6) Move the starboard (right) control lever to "full reverse" position. The SLOW indicator light will be lit. (The TAKE, SYNC, and WARM indicator lights will remain on.)
7) Move the starboard (right) control lever to the neutral position.
8) Turn Off each of the indicator lights by pressing each of the buttons starting from left to right (TAKE, SYNC, WARM, SLOW)
9) Immediately after the SLOW light has been turned off, all (4) lights will blink together 1 time to indicate that the Handle Validation procedure has been completed for this station.

The proper operation of all Main Station components - control lever sensors, indicating lights, and control buttons - has now been confirmed.

Check each of the other control stations by following a similar procedure to that described above:

1) Each of the other Control Stations will have the outer left and outer right indicating lights illuminated. In order to perpare the station for Handle Validation, press the TAKE button one or two times - the inner left and right lights will be illuminated.
2) Move the control levers as described in steps (2) - (7) above.
3) Turn Off each of the indicator lights by pressing each of the buttons starting from left to right (TAKE, SYNC, WARM, SLOW)

When the final station has been tested, all of the indicator lights will “blink“. This indicates that the handle calibration procedure has been satisfactorily completed.

6.5 Exiting Calibration Mode

After all the actuators are calibrated, restore the EEC system to normal operation by the following steps:

1) Turn the EEC system OFF.

2) Reset the DIP switches to their "Run Mode" position, as indicated in the following chart. (Change only the position of those switches indicated below - do not change the position of any switch not in the following list)

3) Close the EP access panel.

4) The EEC system may now be turned ON and started up in the normal “RUN” mode. The system will enter the normal initial diagnostics mode, energize actuator solenoids, and be available for operation after control is obtained at the main control station.

“Run Mode” DIP Switch settings

NOTE

The following chart is for Software Version 5 only. For EEC systems equipped with earlier software versions, see charts contained in the back of this manual (Section 7.0)

Switch Bank 1	Switch Bank 2
Synchronization Gain Gasoline (petrol) engines: Switch 5 – OFF; Switch 6 – OFF; Switch 7 – ON; Switch 8 - OFF Diesel Engines: Switch 5 – ON; Switch 6 – ON; Switch 7 – ON; Switch 8 - OFF	**Gear Delay (maximum)** No Delay - Switch 1 – OFF; Switch 2 – OFF; Switch 3 – OFF 3 seconds - Switch 1 – ON; Switch 2 – OFF; Switch 3 – OFF 4.5 Secs – Switch 1 – OFF; Switch 2 – ON; Switch 3 – OFF 6 seconds – Switch 1 – ON; Switch 2 – ON; Switch 3 – OFF 7.5 Secs – Switch 1 – OFF; Switch 2 – OFF; Switch 3 – ON 9 Seconds – Switch 1 – ON; Switch 2 – OFF; Switch 3 – ON 10.5 Secs – Switch 1 – OFF; Switch 2 – ON; Switch 3 – ON 12 Seconds – Switch 1 – ON; Switch 2 – ON; Switch 3 – ON
	Calibration - Switch 4 Turn Switch 4 OFF (Run Mode)
	Throttle Delay - Switch 5 and 6 No Delay - Switch 5 and 6 - OFF 0.5 second delay - Switch 5 ON, Switch 6 OFF 0.8 second delay - Switch 5 OFF, Switch 6 ON 1.3 second delay - Switch 5 and 6 - ON
	Troll Valve Delay - Switch 7 OFF - 2.0 second delay ON - 4.0 second delay
	Troubleshoot Mode - Switch 8 Turn Switch 8 OFF (Run Mode)

Switch Bank 1

Switch 5,6,7,8 - Synchronization gain adjusts the rate at which the EEC system in adjusts the speed of the port engine speed during automatic synchronization. Depending on a number of variables (type of engine, size of boat, shape of hull, etc.), this response rate will vary from boat to boat. The settings that are given are good settings to start with for sea trials. After testing, it may be necessary to adjust the Synchronization Gain for a faster or slower response.

NOTE: Switches 1,2,3, and 4 in Switch Bank 1 can be in any position (ON or OFF) during Run Mode. However, it is best if they are left in the same position as they are set during Calibration.

Switch Bank 2

Switch 1, 2, 3 (Applicable only for Software Version 5 or later)

These switches adjust the maximum amount of Gear Delay, which is a time delay introduced by the EEC system when going from Ahead or Reverse (with throttle) to Neutral. When Gear Delay is selected, and the Control Head handle is moved from the "in-gear" position (with engine throttle above approximately 1000 RPM) to the Neutral position, the Throttle Actuator will move the engine governor to idle and then the Engine Processor will wait for the selected period of time before moving the Gear from Ahead to Neutral. (See Section 3.3 for more information on this feature).

Switch 4 - Turn this switch **OFF** to enable the Run Mode.

Switch 5 and 6 (Applicable only for Software Version 4 or later)

These switches adjust the amount of Throttle Delay, which is a time delay introduced by the EEC system when moving the Control Head from Neutral to Ahead or Reverse gear. When Throttle Delay is selected, and the Control Head handle is moved from the Neutral position to either Ahead or Reverse, the Gear Actuator will move the transmission control lever to it's appropriate "in-gear" position and then Engine Processor will wait for the selected period of time before allowing the Throttle Actuator to increase engine RPM. (See Section 3.3 for more information on this feature).

Switch 7 (Applicable only for Software Version 5 or later)

Troll Valve Delay. When the "Throttle at Top end of Troll" mode is selected during Calibration (see Section 4.1, Switch Bank 1, Switch 8 = "ON"), a delay is always introduced when moving the Control Head from the throttle range back into the troll valve range, prior to the troll valve opening. This will ensure that the engine speed is below the maximum RPM permitted for troll valve operation when the troll valve is opened.

Switch 8 - This switch enables "Troubleshoot" Mode, which is used to diagnose EEC system problems. This switch must be turned **OFF** during Run Mode.

6.6 Calibration Verification

Upon completion of the Calibration procedure, it is advisable that the operation of the EEC system be inspected to verify that each engine throttle and transmission lever is being properly moved in the correct direction and through the full range of travel.

NOTE

It is extremely important that the Calibration be verified after the Calibration Procedure is completed. Failure to do this can cause gear / transmission failure if the gear control lever is not moved into it's correct position.

A suggested verification procedure follows:

1. Take control at any station that is convenient for good communication between the engine room and helm station.

2. With the station control levers (port and starboard) in the **neutral position**, verify the following for both engines and transmissions:
   - Engine governor - Idle position (mechanical stop)
   - Gear control lever - Neutral position
   - Trolling valve - Lockup position (troll valve closed) (if installed)

3. Move the station control levers (port and starboard) to the **ahead detent** position. Verify that both gear control levers have moved to the ahead position ***and that the control cable is not binding***.

4. Move the station control lever (port and starboard) to the **astern detent** position. Verify that both transmission levers have moved to the astern position ***and that the control cable is not binding.***

5. Move the station control lever (port and starboard) to the **full astern** position. Verify that both engine governors are at the full throttle (mechanical stop) position ***and that the control cable is not binding***

6. Move the station control lever (port and starboard) to the **neutral** position. Verify that both engine governors are at the idle (mechanical stop) position ***and that the control cable is not binding.***

7. (Troll valve equipped boats only) - Move the station control lever (port and starboard) to the **neutral position**. Press and release the troll switch on the control. Troll switch light will illuminate indicating that troll mode is energized. Verify that both troll actuators have moved to troll valve open position ***and that the control cable is not binding***.

8. (Troll valve equipped boats only) - Move the station control lever (port and starboard) to the **full throttle position**. Verify that both troll actuators have moved toward lockup position, but have not moved into the detented lock-up position ***and that the control cable is not binding***.

9. (Troll valve equipped boats only) - Move the station control lever (port and starboard) to the **neutral position**. Press and release the troll switch on the control. Troll switch light will go out indicating that troll mode is off and that normal gear / throttle operation is available.. Verify that both troll actuators have returned to the lockup position ***and that the control cable is not binding***.

NOTE

The following points should be kept in mind when verifying actuator position and operation:

Direction of travel - The location of engine idle and full throttle, gear ahead and astern, and troll valve lockup / slip should be considered to ensure that the EEC actuator is moving the engine and gear controls in the appropriate direction.

Actuator endpoint - The actuator should move its associated control lever to the mechanical stop without placing undue strain on the control cable or control lever.

Control lever detent position - When position the gear lever or trolling valve lever, it may be helpful to disconnect the push-pull cable from the lever and move the control lever independently from the EEC system.

After performing the Calibration Verification check, if you find that one actuator position needs to be changed, go to back to the beginning of the Calibration section and follow the instructions. You can skip over actuator positions just by pressing the “Accept” button. When skipping, watch the LED’s. This will let you know which actuator position you are at.

This completes the calibration procedure. The electronic engine control system is now fully operational and ready for use.