

TRAC

DIGITAL STABILIZERS

by American Bow Thruster

BASIC SYSTEM OPERATION

VER 3.4



TRAC DIGITAL STABILIZER - SYSTEM OPERATION

CONTENTS

- SECTION 1 - INTRODUCTION
Preparation for system Use
Basic Operating Requirements
Procedure to lock a non-operating fin
Standard Yokes
Notch-Lock Yokes
Operating the vessel with mechanically locked fins
Normal TRAC Stabilizer Operation
Hydraulic functions in TRAC Integrated Systems
- SECTION 2 - NORMAL SYSTEM OPERATION
Start-up and Run Procedures
STAR™ Operation
- SECTION 3 - ABNORMAL CONDITIONS
Where mechanical impact to a fin or shaft has occurred
Where electrical control malfunction is indicated
Where oil temperature or level or pressure problem is indicated
- SECTION 4 - MAIN SYSTEM ALARMS
Alarm types - Acute and Warning
“High oil temp / Warning only ..
“Extreme high oil temp / System disabled ..
“Low oil level / Warning only ..
“Extreme low oil level / System disabled ..
“Lost communication”
“Low Voltage on Servo”
“Servo Watchdog”
- SECTION 5 - SERVICE ITEMS
- SECTION 6 - PILOTHOUSE PANEL TOUCHSCREEN
ENABLE Page - Stabilizer Initialization
HOME Page Overview
HOME Page - Fins Centered
HOME Page - Fins Active
MENU Page
HEEL Page
SPEED Page
FINS Page
ALARM Page & Alarm Types
STAR™ Operation
PARAMETER Page
Display Contrast Adjustment
Display Contrast Recovery

System Operation

SECTION 1 - INTRODUCTION

Preparations for System Use

Before using TRAC Stabilizer equipment, the vessel operator should become familiar with basic system features by reading this short document, especially Sections 1, 2, 3, and 6. Beyond this, a basic understanding of the systems plumbing and electrical details should be attained. Consult the system wiring and plumbing diagrams and discuss these with American Bow Thruster as needed.

Basic Operating Requirements

Except for circumstances described in the immediately following paragraph, the TRAC stabilizer system must be operating whenever the vessel is underway or maneuvering. It is important for the stabilizer fins to be under system control whenever water may be forced over them, regardless of whether water flow is from forward or reverse motion of the vessel, or from prop wash during reversing maneuvers.

In some exceptional circumstances, where a fin cannot be placed under normal system control during vessel operation, then the disabled fin must be manually locked at its actuator. Exceptional circumstances would result from system hydraulic, electrical or mechanical problems. Failure to lock an uncontrolled fin may lead to actuator equipment damage from high energy mechanical stresses. For this reason, the procedure for locking fins will be discussed immediately below, before proceeding with other system operation details.

Procedure to lock a non-operating fin

The procedure by which a non-operating fin would be manually locked would vary with the style of yoke which connects the actuator shaft to the actuator cylinder. Two different yoke styles, standard and Notch-Lock, are illustrated in section 6 of the TRAC Stabilizer Installation Manual. You should determine which yoke style is installed on your vessel.

Standard Yokes

For actuators with Standard Yokes, either fin can be mechanically locked by manually adjusting the Yoke Jacking Bolts to rotate the yoke to a near-center position. When the yoke has been rotated to this position, the locking guide pin (no pin for 440 systems) can be inserted through the yoke-end and into the locking swing arm (original actuator designs) or into the locking plate (illustrated on pg 6 –2 of the installation manual).

Use extreme caution when inspecting or working near the actuator mechanism.

System Operation

DANGER !!! USE EXTREME CAUTION !!!
Unexpected and sudden yoke movement may occur.
Hazardous Pinch Points exist at the actuator assembly !!!

Do Not place hands or fingers under or around the edges of the actuator top plate.
Do Not place hands or fingers between the actuator cylinder and the actuator top plate.
Do Not rest hands or fingers on the locking plate.

- 1) Use the jacking bolts to rotate the yoke until the pin hole in the yoke's free end is aligned with the hole in the swing arm or the locking plate. For 440 systems, rotate until the yoke is symmetrically positioned with respect to cylinder trunion sockets.
- 2) Insert the locking pin through the yoke end and swing arm or locking plate.
- 3) Snug both Jacking Bolts against the yoke, and tighten the bolt jam nuts against the Jacking Bolt Blocks.

Notch-Lock Yokes

For actuators with Notch-lock Yokes, a fin will be mechanically locked when the locking cylinder's pin, which is spring loaded for extension, is pushed into the yoke's locking notch. Under most circumstances, the yoke will lock automatically whenever system hydraulic power is shut down in a normal sequence. Thereafter, the yoke will remain locked in a near-center position, even in the absence of system hydraulic power. Locked yokes are mechanically held at near-center position until the fin is "Enabled" (at the Pilothouse Panel touchscreen) and the locking pin is hydraulically retracted under normal system control.

If any circumstance should cause a fin to become disabled when the fin's yoke is not locked, then one of two procedures should be followed depending on prevailing conditions.

- a) If the fin becomes disabled while the boat is underway forward, then speed should be reduced and "S" turns should be repeated until the disabled fin's yoke passes through the center position to engage the spring loaded locking pin.

Extension engagement of the yoke locking pin can be confirmed by visual inspection at the actuator.

Use extreme caution when inspecting or working near the actuator mechanism.

DANGER !!! USE EXTREME CAUTION !!!
Unexpected and sudden yoke movement may occur.
Hazardous Pinch Points exist at the actuator assembly !!!

Do Not place hands or fingers under or around the edges of the actuator top plate.
Do Not place hands or fingers between the actuator cylinder and the actuator top plate.
Do Not place hands or fingers between the yoke and a retracted locking pin.

System Operation

b) If the fin becomes disabled when the boat is not underway, and when, by co-incidence, the yoke is not in a locked state, then the yoke should be manually rotated until the yoke notch engages with the spring loaded locking pin.

1. Release stabilizer system pressure by pressing “RESTART” at the TRAC Pilothouse Panel’s HOME page. This will de-energize the servovalve assembly’s A/B dump valve(s) to permit unrestricted actuator cylinder movement.
2. Observing the **Cautions** stated immediately above, inspect the disabled actuator to visualize the bolted clamping split in the actuator’s yoke.
3. Insert the flat blade of a stout 12” screwdriver into the yoke’s split (use other pry points if the split is not accessible) and apply steady pressure to rotate the yoke until the locking pin engages the yoke slot.

Operating the vessel with a mechanically locked fin

Mechanically locked fins will be secured against all normally encountered forces, and the vessel can be operated in any normal manner without concern for damage to the locked fins or actuator mechanisms. A disadvantage of mechanically locked yokes is that they will not yield to excessive rotation forces that could occur with abnormal or extreme conditions.

In some cases, the vessel may be operated with one fin locked and other fin(s) operating normally. All normal operating procedures will apply to any enabled fin.

In other cases, the vessel may be operated with all fins mechanically locked. Regardless, the TRAC Stabilizer control system should be turned on whenever possible to permit monitoring the system hydraulic oil temperature and level.

Whenever system hydraulic pumps are turning, temperature status of the system’s hydraulic reservoir should be monitored. For some installations, system control power may be required for normal operation of system hydraulic cooling. Whenever there are questions about these details, consult American Bow Thruster.

Normal TRAC Stabilizer operation

Normal operation will be described in Section 2 (following) after some general observations are made here.

As soon as the vessel’s engines have been started (and system hydraulic pressure becomes available) the TRAC Stabilizer system should be made live by turning on DC power, and both fins should be “Enabled” at the Pilothouse Panel touchscreen. Fins should be “Centered” until the vessel is underway forward, after which time they may be made “Active”.

Transmission linkage sensors are fitted on all systems to detect reversing on any propulsion engine. The control will automatically bring fins to center position when reversing is detected, and the Pilothouse Panel will display “Backing”.

System Operation

In systems with standard yokes, fins are hydraulically held at center position during backing maneuvers.

In systems with Notch-Lock yokes, fins are mechanically held at center position during backing maneuvers.

In either type of system, the display shows “BACKING” when sensors detect transmission reverse.

When the vessel goes to neutral or to forward after backing maneuvers are completed, the display will show “CENTER” for fin position (Notch-Lock yokes will unlock but remain at center position). It will be necessary to manually depress “Active” at the touchscreen panel once the vessel is underway (unless the “auto-active” feature is enabled in system parameters). The border of the “ACTIVE” key will flash if the key is pressed while inside the preset “backing-coasting” time interval. If the latter occurs, ACTIVE status will begin automatically at the end of coasting delay time.

When the vessel is underway, fins should be “ACTIVE” or at “CENTER”. Fins should not be mechanically locked when cruising except to address exceptional circumstances involving malfunction in the stabilizer system. Mechanically locked fins will not yield to excessive rotational forces that would normally be limited by relief valve action. Protective relief valves are defeated when yokes are mechanically locked.

Hydraulic functions in TRAC Integrated Systems

Where vessels are fitted with TRAC Hydraulic Thrusters as well as TRAC Stabilizers, there are variable requirements and capabilities for making appropriate hydraulic power available to all hydraulic functions.

Any limitation on simultaneous use of thrusters and other hydraulic functions, including the stabilizers, should be understood through consultation with American Bow Thruster.

All integrated (thruster/stabilizer) systems will have two separate control logic units. One of these, the Servo Control Box, serves only the stabilizer system. The other, the Central Control Box, serves the thruster(s) and additional hydraulic functions when the latter are included in the system. In integrated systems, the Central Control Box may affect hydraulic pump functions that are required for the stabilizer system and may require dc circuit power at all times.

System Operation

SECTION 2 - NORMAL SYSTEM OPERATION

Start-up and Run Procedures

1. Start engine(s) to drive the stabilizer hydraulic pump(s).
2. Turn on the TRAC Stabilizer DC circuit breaker.
3. Select or enable hydraulic pumps (if not done automatically).
4. Enable both fins at the TRAC Pilothouse Panel touchscreen and observe that both fins are "CENTERED".
5. Check for normal water flow from the stabilizer cooling pump's discharge through-hull (when so equipped).
6. During maneuvering, both fins should remain at "CENTER". Notch-lock yokes will be locked while backing, but the display will show "BACKING".
7. If standard yoke fins are driven off center during backing, stop backing and wait for the fins to center themselves; then resume maneuvering more gently.

If the vessel is maneuvered or reversed when fins are not powered to the center position (Standard Yokes) or locked (Notch-Lock Yokes), there can be abnormal high force contact between actuator assembly parts. Shaft, yoke, or cylinder damage can occur.

8. When backing is completed, and transmission reversing is no longer detected, the control will unlock Notch-Lock yokes. For both yoke types, the Pilothouse Panel will indicate fins at "CENTER".
9. When forward speed reaches 4 to 5 knots then, at your discretion, make both fins "ACTIVE".
10. In normal operation, fins should be "ACTIVE" or at "CENTER" whenever the vessel is under way. Any fin which, because of system malfunction, cannot be brought to either of these states, should be manually centered and locked at the earliest convenience.
11. At the HEEL page, select "ZH", "OPT", or "MAX" mode according to your preference. See Section 6 for details about the Pilothouse Panel's HEEL page and a description of Heel Modes.
12. Insure that proper vessel speed information is displayed at the HOME page speed indicator. See Section 6 for details about the Pilothouse Panel's SPEED page and a description of proper speed settings.
13. Procedures to be followed after docking or mooring depend on type of actuator yoke.

System Operation

For systems with standard yokes, if possible, keep the TRAC Stabilizer DC circuit breaker turned on after engine shutdown. When DC circuit power is maintained, the hydraulic system will create high resistance to fin movement even when the hydraulic pump is stopped.

By contrast, if the TRAC System DC circuit breaker is turned off, standard-yoke fins will be free to move as the boat rolls at anchor. When a fin is free at anchor, the actuator yoke may strike against mechanical end stops whenever roll motion is sufficiently large.

When the boat is docked or anchored for extended intervals of non-cruising, yoke pins should be inserted to secure fins in near-center position. Pinning is most easily accomplished by “Centering” fins under hydraulic power, and then manually turning jacking bolts to bear against the yoke. Use Extreme Caution when inspecting or working around the actuator equipment.

DANGER !!! USE EXTREME CAUTION !!!
Unexpected and sudden yoke movement may occur.
Hazardous Pinch Points exist at the actuator assembly !!!

Do Not place hands or fingers under or around the edges of the actuator top plate.
Do Not place hands or fingers between the actuator cylinder and the actuator top plate.
Do Not rest hands or fingers on the locking plate.

For systems with Notch-Lock yokes, the yokes will normally become automatically pinned during the sequence of docking maneuvers that precedes engine shutdown. When pins are automatically set, no special steps should be required to subsequently lock fins for short or long periods of non-use. However, when prolonged non-use is expected, it is recommended that yoke-pin status be visually confirmed by inspection of the actuators prior to leaving the vessel.

System Operation

STAR Operation:

Vessels equipped for STAR™ (Stabilization At Rest) operation will have the option of activating fins for reduction of roll motion when the vessel is not under way. STAR™ configurations typically include:

- 1) generator driven hydraulic pumps for system power when propulsion engines are off,
- 2) extended chord fins for enhanced lift-stroke capacity, and
- 3) actuator size upgrade.

STAR™ is enabled via parameter settings at the time of system commissioning. This mode of operation can then be from the Pilothouse Panel's HOME page whenever the vessel is at zero speed (providing hydraulic power is available).

STAR™ operation poses extreme danger to any swimmer or personal watercraft near the sweep area of any fin. Fin motion may occur suddenly, with high force and with extreme speed. Swimmers and watercraft must be kept away from fins when the system is operating in STAR™ mode.

DANGER! EXTREME PERSONNEL HAZARD! RISK OF SERIOUS INJURY OR DEATH !

1) Take all necessary steps to keep any person away from the fins. Unexpected fin motion may occur at any time. Keep persons clear of fins whenever STAR™ is enabled.

2) Make sure that a generator driven pump is operating to support STAR™ operation. This pump is typically selected at a system Pump Select Panel.

3) When the vessel speed is at "Zero" speed, as indicated at the HOME page display, and when transmission reversing is not detected, and when all enabled fins are "ACTIVE", the system is ready for STAR™ operation. When these conditions have been met, the border of the "AT SEA" key (lower left corner of Pilothouse Panel) will become highlighted to signify button enabled.

4) Touching the enabled "AT SEA" key will cause the key to display "ANCHOR" and will cause STAR™ operation to begin.

5) STAR™ operation will begin with an initialize routine** (see below) which automatically transitions to stabilization at rest.

System Operation

STAR™ stabilization will continue until manually suspended at the Pilothouse Panel, or until automatically terminated by transmission reversing sensors or shaft speed sensors.

6) Manually suspend STAR™ operation at any time by depressing “CENTER” at the Pilothouse Panel. Fins will become motionless at center position, without setting of the yoke locking pins. The lower left key will continue to display “ANCHOR”.

From this state, STAR™ operation may be resumed, by depressing “ACTIVE”. When STAR™ is resumed, initialization motions (described below) will not be repeated.

7) Automatic termination of STAR™ operation occurs if transmission reversing is detected or if non-zero shaft speed is detected. The lower left key will display “AT SEA”. After termination, STAR™ operation can be resumed according to steps 2 and 3 above.

With automatic termination of STAR™, the TRAC control transitions to an appropriate state determined by the cause of termination. When reversing is detected, fins will automatically center and lock via setting of yoke locking pins. When maneuvering is completed and the boat is underway forward, then fins should be made “ACTIVE” in the normal sequence of operation. If STAR™ has been active and the boat gets underway without backing then the fin command state will automatically change to AT SEA and the fins will remain ACTIVE.

** STAR™ Initialization consists of several initial slow sweeping motions of the fins which explore the limits of fin movement. These “initialization” movements automatically transition to normal STAR™ operation which then continues until cancelled by one of the actions in steps 4 or 5 above.

SECTION 3 - ABNORMAL CONDITIONS

Emergency abnormal conditions may involve different parts of the stabilizer system including the mechanical actuators, the fins, the electrical control circuits, or the hydraulic power circuits. Each of these categories is addressed below.

Where mechanical impact to a fin or shaft has occurred or is suspected:—

1. At the touchscreen, press “RESTART” to set the fins free.
2. Immediately make visual checks in the area of the actuator mountings. Look for any sign of damage to the actuator assembly or to the surrounding hull.

DANGER !!! USE EXTREME CAUTION !!!
Unexpected and sudden yoke movement may occur.
Hazardous Pinch Points exist at the actuator assembly !!!

Avoid pinch points for equipment parts that may move. **Do Not place fingers below the actuator top plate.**

3. Check for normal appearance of the connection between the actuator cylinder rod end and the yoke.
4. If no damage is evident, then enable one or both fins and make visual checks for normal actuator movement once under way.
5. If mechanical damage has occurred to an actuator cylinder, or if it is intended, for any reason, to deactivate the actuator on a given side, then mechanically lock the fin on the disabled side as described previously on pages 3 to 5 of this operations manual.
6. When systems have live pumps, hydraulic cooling is always necessary. Therefore the following conditions must be set to allow cruising with both fins free:
 - a. Maintain power to the Stabilizer Servo Box.
 - b. When systems have a Central Control Box, maintain power to this unit.
 - c. When integrated systems have a Stabilizer select switch at a Pump Select Panel, maintain “Stabilizer” state.

System Operation

Where electrical control malfunctions are indicated by Pilothouse Panel alarms including “communication errors”, “low voltage error”, “servo error”, “fin position error”. (See sections 4 and 6 of this manual for additional details on alarms)

1. In most instances of control system malfunction, the fins can be set “FREE” and the boat can continue with forward motion, at reduced speed, without adverse consequence. The fins will approximately self-trail (or automatically lock near center in systems with Notch-Lock Yokes) and should not influence maneuverability when underway forward. The stabilizer system circuit breaker should remain on to provide reservoir temperature alarms (unless the pump is decoupled from the engine).
2. It is always recommended to mechanically lock disabled fins as soon as possible. See procedures on preceding pages 3 to 5 of this operations manual.
3. In some instances, transient conditions may cause control errors. If a Pilothouse Panel alarm occurs, it is important to write down the exact nature of the alarm(s) and also to note any remarkable vessel operating conditions that preceded or coincided with the alarm(s).
4. If a transient condition has caused an alarm, then it may be possible to restore normal function by cycling the dc circuit breaker power to the stabilizer system.
5. If possible, consult with factory for trouble shooting guidance.
6. If normal operation is intermittent, and if symptoms do not produce uncomfortable motions of the boat, then continue with one or both stabilizers active.
7. If normal operation is intermittent, and if symptoms are localized to one side, then deactivate the troubled side and proceed with one side operational.
8. For any side that is de-activated (i.e. not enabled at the Pilothouse Panel) the yoke jacking bolts should be run in to secure the yoke at a position that aligns the fin approximately parallel to the keel. This position is indicated by the swing arm gage (when fitted), or alternately by the pointer gage on the top plate.
9. When systems have live pumps, hydraulic cooling is always necessary. Therefore the following conditions must be set to allow cruising with both fins free:
 - a. When systems have a Central Control Box, maintain power to this unit.
 - b. When systems have a Stabilizer select switch at a Pump Select Panel, maintain “Stabilizer” state.

System Operation

Where Pilothouse Panel alarms indicate oil temperature, oil level, or oil pressure problems. (See sections 4 and 6 of this manual for additional details on alarms)

1. Reduce speed or turn off the engine that drives the stabilizer hydraulic pump, then immediately inspect the stabilizer system hydraulic oil reservoir to confirm oil level and temperature with the sight glass thermometer assembly on the front of the reservoir.
2. For confirmed temperature problems, inspect and restore cooling pump water flow to all system the heat exchanger(s).
 - Temperature warning occurs at approximately 160 deg F.
 - Temperature shutdown (Manifold de-energized) occurs at approximately 180 deg F.
 - System temperature should not be allowed to exceed 220 deg F.
 - Oil temperature cannot be rapidly reduced unless both oil and cooling water flow is established thorough their respective sections of the system heat exchanger(s).
3. When the normal cooling pump water flow cannot be restored then consider temporary connection of either a raw water or fresh water source (7 to 9 gpm) to the heat exchanger water inlet.
4. For the pressure alarm, especially when correlated with a low oil alarm, check for loose and leaking hydraulic fittings, leaking actuator cylinders, or ruptured hydraulic hoses. Find and fix the source of leakage.
5. When temperature or level problems cannot be resolved, then the hydraulic pump(s) coupling to the engine should be removed. Live pumps should be disconnected from pto pads and pto cover plates should be securely installed.
6. Unpowered fins should be mechanically locked by using the procedures described on pages 3 to 5 of this operations manual.

SECTION 4 - SYSTEM ALARMS

(See sections 6 of this manual for additional details on alarms)

Two Types of Alarms

1) ACUTE ALARMS will produce insistent alert sound from the Pilothouse Panel. These alarms can be muted at the touchscreen, but will not clear themselves even if the cause is transient. The alarm will stay in place until the system is “Re-Started” at the Pilot House Panel.

Any alarm relating to reservoir temperature or oil level should be immediately investigated.

Acute alarms, except for individual fin error alarms, shut off flow of oil to the stabilizer servo valves. This may minimize, but not necessarily prevent further loss of oil, or further oil temperature rise.

2) WARNING ALARMS will produce less urgent alert sounds from the Pilothouse Panel. These alarms may also be “MUTED” and will clear themselves when the cause of the alarm goes away. These alarms should be logged and investigated as soon as possible, particularly if the warnings are for oil temperature or oil level.

System Operation

Selected Alarms and Suggested Responses

Alarm 1: **“High oil temp / Warning only / Check cooling system”**

Suggested response: Mute alarm at Pilothouse Panel, then reduce or stop engine speed to minimize hydraulic pump flow.

Immediately inspect the stabilizer system hydraulic reservoir to confirm the alarm. The temperature warning will occur at probe 160° F. The reservoir would be very hot to the touch and the sight gage temperature indicator should confirm this high level.

Inspect for cooling pump water flow from the discharge through-hull. If water flow is impaired, the lack of cooling flow will need to be immediately repaired.

When the cause of the temperature rise cannot be remedied, minimize heat gain in the hydraulic system by following steps detailed Section 3, Reacting to Abnormal Conditions.

The cause of temperature warnings must be resolved in order to prevent risk of injury to personnel and damage to equipment.

Alarm 2: **“Extreme high oil temp / System disabled / Check cooling system
Danger! Install locking pins first”**

Suggested response: Mute alarm at Pilothouse panel, then if possible stop the engine(s) coupled to the stabilizer hydraulic pump until a temporary alternate source of heat exchanger cooling water is in place.

Cool the system down by connecting a temporary alternate source of cooling water flow to the heat exchanger water inlet. With alternate cooling water flow in place, circulate hydraulic oil through the system by running the engine connected to the stabilizer hydraulic pump.

If an alternate cooling source is not available, then decouple the system hydraulic pump from the engine to prevent hydraulic flow and additional heat gain.

When the system temperature has fallen below 120 degrees, determine whether a repairable stoppage of cooling water flow was responsible for the heat gain condition. Do this by restoring normal cooling water connections and checking for through-hull discharge when the stabilizer system is enabled.

When the cause of the temperature rise cannot be remedied, minimize heat gain in the hydraulic system by following steps detailed Section 3, Reacting to Abnormal Conditions..

System Operation

Alarm 3: **“Low oil level / Warning only / Check system”**

Suggested response: Press “RESTART” at Pilothouse Panel in order to set fins “FREE”. This action will reduce oil flow to the servo valves.

Start in the engine room and first confirm the validity of the alarm at the reservoir sight gage. If oil level is low in the sight gage then look for signs of leakage around all hoses and fittings in the engine room. We are looking for several gallons of oil in the bilge.

If leakage is not found in the engine room, then proceed to the actuators and inspect hoses and fittings at port and stbd actuator cylinders & Servo Valves.

Loose fittings, failed hose crimps, ruptured hoses, or leaking cylinders must be fixed prior to re-use of stabilizers.

Consult the system Plumbing Diagram to guide your search for leakage.

When an immediate remedy is not possible, then center the fins and run-in the yoke jacking bolts to secure the fin position approximately parallel to the keel.

When immediate remedy is not possible, remove the pump(s) from the pto and install the pto cover plate.

Pumps must not be run without oil. Pumps run dry or without cooling may be destroyed.

Alarm 4: **“Extreme low oil level / System disabled / Check system /
Danger! Install locking pins first”**

Suggested response: Press “RESTART” at Pilothouse Panel in order to set fins “FREE”. This action will reduce oil flow to the servo valves. If possible, temporarily stop the engine that drives the stabilizer hydraulic pump.

Start in the engine room and first confirm the validity of the alarm at the reservoir sight gage. If oil level is not visible in the site gage then look for signs of leakage around all hoses and fittings in the engine room.

If leakage is not found in the engine room, then proceed to the actuators and inspect hoses and fittings at port and stbd actuator cylinders & servo valves.

Loose fittings, failed hose crimps, ruptured hoses, or leaking cylinders must be fixed prior to re-use of stabilizers.

The leakage source must be found and a determination made of as to whether reservoir oil level can be restored and maintained.

The option of restoring stabilizer function will depend on whether the leak source can be

System Operation

repaired or isolated, and whether the reservoir can be refilled without introducing contamination.

When an immediate remedy is not possible, then center the fins and run-in the yoke jacking bolts to secure the fin position approximately parallel to the keel.

When immediate remedy is not possible, remove the pump(s) from the pto and install the pto cover plate.

Pumps must not be run without oil. Pumps run dry or without cooling may be destroyed.

Alarm 5: **“Lost communication”**
 “Danger! Servo failure / Install locking pins / Open circuit breaker /
 Call factory”

Suggested response: Turn TRAC Stabilizer 24VDC Ckt breaker to “OFF”. Proceed to inspect the Power Cable (Cable #12) and the Serial Cable connections at the back of the Pilot House Panel and also at the Servo Control Box. Check twist lock connectors for tightness of mating connection.

If loose connections are found then remedy and restart immediately.

If no loose connections are found, then wait through 1 to 2 minutes of power-down and then try to restart the system.

If the system restarts then immediately measure DC supply voltage at the power terminals of the Servo Control Box. Also check these supply terminals for tight connection.

If the system cannot be restarted then keep the circuit breaker off and run-in the yoke jacking bolts to secure the fin position approximately parallel to the keel.

When the boat must be run with the stabilizer fins not enabled, then follow steps detailed in Section 3 “Reacting to Abnormal Conditions” : Electrical Control Malfunction.

Call factory to discuss problem.

System Operation

Alarm 6: **“Low Voltage on Servo”**
 “Danger! Servo failure / Install locking pins / Open circuit breaker /
 Call factory”

Suggested response: Turn TRAC Stabilizer 24VDC Ckt breaker to “OFF”. Proceed to measure DC supply voltage at terminals of Servo Control Box. Also check these supply terminals for tight connection.

If low voltage condition (less than 23VDC) is found at Servo Control Box supply terminals, then trace the problem to the source and remedy the cause of low voltage. Then restart the system.

If the voltage problem cannot be remedied then keep the circuit breaker off and run-in the yoke jacking bolts to secure the fin position approximately parallel to the keel.

When the boat must be run with the stabilizer fins not enabled, then follow steps detailed in Section 3 “Reacting to Abnormal Conditions” : Electrical Control Malfunction.

Call factory to discuss the problem.

Alarm 7: **“Servo Watchdog”**
 “Danger! Servo failure / Install locking pins / Open circuit breaker /
 Call factory”

Suggested response: Turn TRAC Stabilizer 24VDC Ckt breaker to “OFF”.

Run-in the yoke jacking bolts to secure the fin position approximately parallel to the keel.

When the boat must be run with the stabilizer fins not enabled, then follow steps detailed in Section 3 “Reacting to Abnormal Conditions” : Electrical Control Malfunction.

Call factory to discuss problem.

SECTION 5 - SERVICE ITEMS

Recommended Hydraulic Oil for TRAC Stabilizer System

ISO 46 for warm climates with seawater above 70° F (21° C)
 ISO 32 for mild to cold climates with seawater below 70° F (21° C)

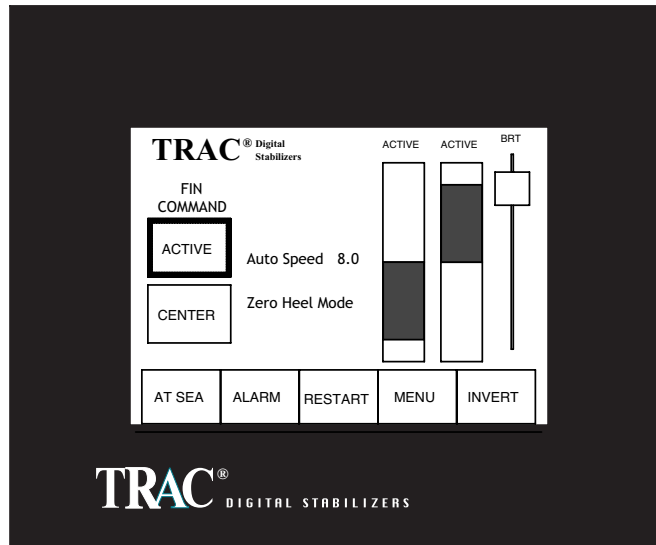
Recommended Inspection and Service Intervals

INTERVAL	ITEM
EACH ENGINE ROOM CHECK	INSPECT HYDRAULIC RESERVOIR LEVEL & TEMPERATURE.
DAILY AFTER SYSTEM START-UP	INSPECT COOLING PUMP OPERATION & DISCHARGE.
DAILY WHILE UNDERWAY SYSTEM ACTIVE	INSPECT PRESSURE AT STABILIZER MANIFOLD.
DAILY WHILE UNDERWAY SYSTEM ACTIVE	LISTEN FOR NORMAL ACTUATOR SOUNDS.
WEEKLY (DAILY WHEN CRUISING)	INSPECT ACTUATOR GEAR OIL HEADER TANKS.
MONTHLY (WEEKLY WHEN CRUISING)	INSPECT ACTUATOR MOUNTING AREA FOR WATER TIGHT INTEGRITY INSPECT ACTUATORS AND CYLINDERS FOR OIL LEAKS. INSPECT CYLINDER HOSES FOR CHAFING.
MONTHLY	CHECK RESERVOIR RETURN FILTER PRESSURE.
QUARTERLY	CHECK ZINC(S) AT RESERVOIR HEAT EXCHANGER(S); REPLACE AS NEEDED.
YEARLY	EXAMINE ALL ELECTRICAL CONNECTIONS. CLEAN & TIGHTEN AS NECESSARY.
YEARLY	CHECK ACTUATOR BONDING STRAP. CLEAN & TIGHTEN AS NEEDED.
YEARLY	REPLACE RESERVOIR RETURN FILTER.
EACH 1 TO 2 YEARS	REMOVE WINGLETS TO INSPECT SHAFT END ZINCS .
EACH 2 YEARS OR LESS	RUBBER IMPELLER COOLING PUMP - REPLACE IMPELLER. CENTRIFUGAL COOLING PUMP - INSPECT BRONZE IMPELLER.
1000 HRS	INSPECT CYLINDER TRUNION BUSHINGS.
6 YEARS OR 2000 HRS	REPLACE ACTUATOR SHAFT SEALS; INSPECT SHAFTS.
6 YEARS OR 2000 HRS	REPLACE ACTUATOR CYLINDERS.

SECTION 6 - PILOTHOUSE PANEL TOUCHSCREEN

The main operator interface for the TRAC Stabilizer system is the touchscreen Pilothouse Panel. The current version of this panel is designated PP v.04. The current version software for this panel will be designated 4.022 or higher (the installed software version displays on the MENU page).

The appearance of the HOME page of the v.04 panel, with version 4.022 software installed and and with fins enabled and active, is illustrated here.

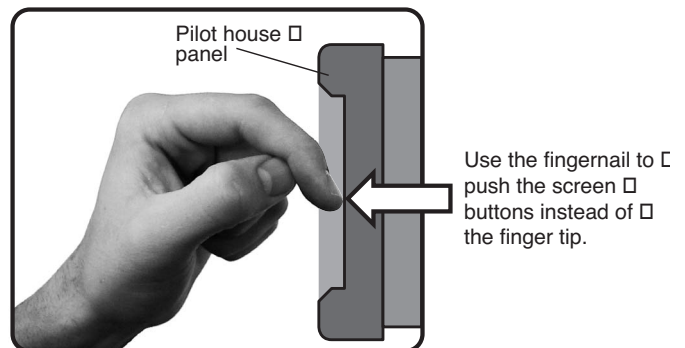


Once the stabilizer system has been made ready for action (by making hydraulic pressure available and by making all necessary electrical circuits live) operator control of the system is asserted at appropriate pages of the Pilothouse Panel. These pages with their different control functions are described below in the order in which pages would likely be accessed during normal operation.

System control parameters are set into non-volatile system memory at a series of Parameter pages at the time of system commissioning. Thereafter, system operation will normally proceed without requiring change of parameter values. Unless through consultation with authorized technical personnel, parameter settings should not be changed.

Hint:

Contact with the touchscreen for adjustments or selections may be more effective when contact is with the fingernail instead of the fingertip. Alternately use the plastic end of a pen. Never press with metal objects.



System Control: Stabilizer Initialization

The ENABLE page

The Pilothouse Panel's ENABLE page will appear whenever the stabilizer system dc circuit breaker is first turned on.

The ENABLE page will also appear if dc power is cycled off-to-on, or whenever a "RESTART" function key is available and depressed on another page.

Selections made at this page will determine which fins will be enabled for hydraulic control, and which fins will be kept "FREE" (not hydraulically powered).

Normally press the "ALL" key to enable all fins.

Any fin that is not enabled must be manually locked at the actuator before turning propellers (see Sections 1 & 2 of this Operations Manual).

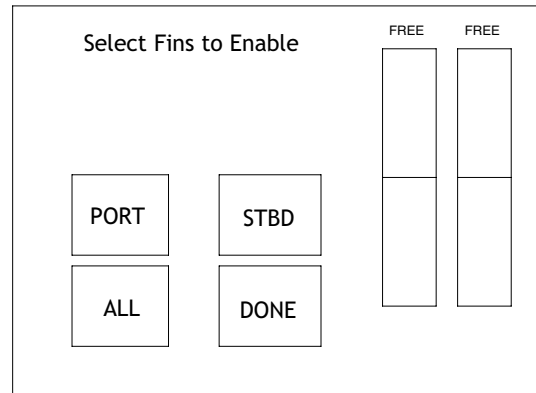
Alternatively, depress "PORT" and/or "STBD" followed by "DONE".

Either of these keypress sequences will cause automatic advance to the HOME page.

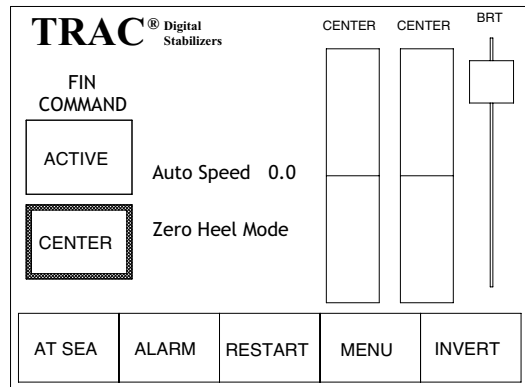
Any enabled fin will be at "CENTER"; that is, the enabled fin(s) will be hydraulically held at center position.

Any non-enabled fin will be indicated (above the fin position bars) to be "FREE", and should be manually locked before turning any propeller.

For many vessels, the ENABLE and HOME pages will be the only pages routinely used for normal operation.



Automatic transition



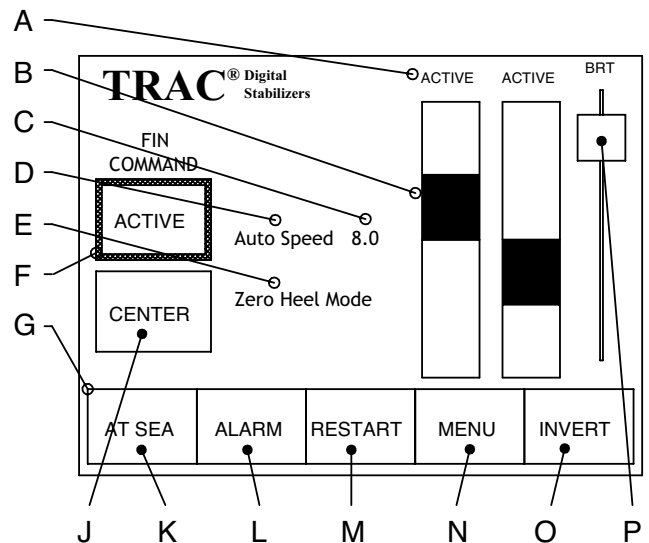
Home Page Overview

The HOME page will be displayed most frequently during normal stabilizer operation. This page has two purposes:

- 1) it provides indicators for basic information about system settings and performance.
- 2) it provides function keys for commanding basic system operations, for adjusting the panel appearance and for navigating to other panel pages.

INDICATORS:

- A. Status of individual fin; “ACTIVE”, “CENTERED”, “LOCKED” or “FREE”.
- B. Fin position indicator. Position of fin’s trailing edge in relation to fin centered.
- C. Vessel speed sensed by shaft sensor(s) (Auto Speed Mode) or set at SPEED page (Manual Speed Mode).
- D. Current Speed Mode as set at SPEED page.
- E. Current Heel Mode as set at HEEL page.
- F. Highlighted function key border indicates status of function.
- G. “At Sea” function key is visible only when the STAR™ Stabilization at Rest feature is available on the vessel. Special equipment is required for this function.



FUNCTION KEYS:

- J. Press “CENTER” to command fins to center position (parallel to the keel). Key border is highlighted when fins are hydraulically held at center position.
- K. The STAR™ function is available when the border of “AT SEA” is highlighted. At that time, pressing this key will toggle the key display to “ANCHOR” and STAR™ operation will begin.
- L. Depress the “ALARM” key to navigate to the ALARM page.
- M. Depress the “RESTART” key to set all fins “FREE” and return to the ENABLE page.
- N. Depress the “MENU” key to navigate to the MENU page.
- O. Depress the “INVERT” key to toggle the Pilothouse Panel display between normal and reversed backlighting.
- P. Touch and slide the brightness button to adjust intensity of display screen backlighting.

System Control: HOME page - Fins Centered

The HOME page is automatically opened after selections are completed at the ENABLE page.

This page displays all indicators and keys needed for most normal stabilizer control functions.

Normally at the time fins are enabled, hydraulic power will be available and transmission levers will be in neutral position.

Therefore, when the HOME page appears, the TRAC control will be commanding fins to center position. This will be indicated by highlight border around the “CENTER” key, and by center status and center position at the fin position indicators.

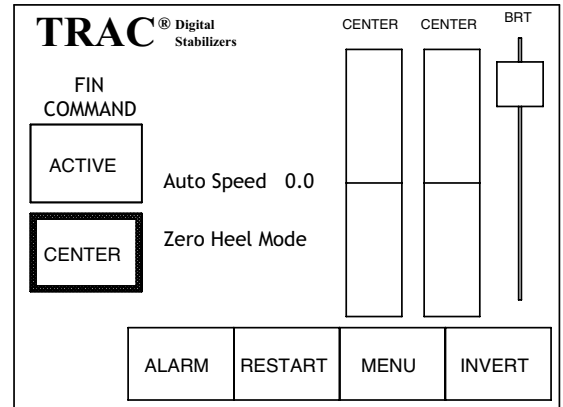
In systems without STAR™ accessories, the HOME page appears as illustrated in A (top right). In systems equipped for STAR™ operation, the HOME page appears as illustrated in B (middle right). The only difference is presence of the AT SEA function key.

- If the “ACTIVE” key is pressed, fin action could commence to counteract roll motion and heel angle. This should not be done until the vessel is underway. At dockside fins should be kept centered. STAR™ functions are discussed later.

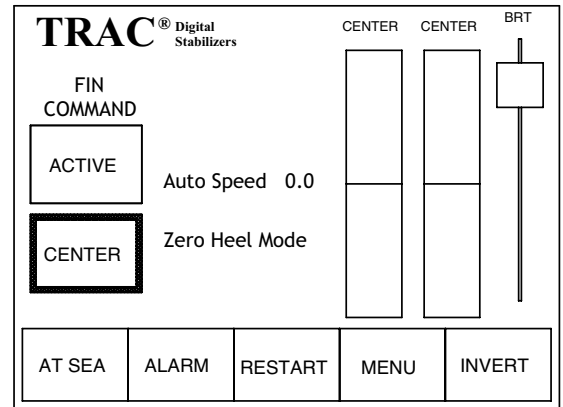
- If the highlighted “CENTER” key is pressed, the fin yokes would lock. The display would flip to the ALARM page and a silent message would advise against manual locking the yokes. Pressing “HOME” would return to the HOME page where “LOCKED” would be reported for fin command and fin status.

- If transmission reversing is detected while maneuvering, yokes will automatically lock to hold fins mechanically at center position. The command will show BACKING (illustration C at lower right) until transmission(s) are out of reverse. Thereafter the command will show CENTER until expiration of backing-coasting delay time (parameter variable).

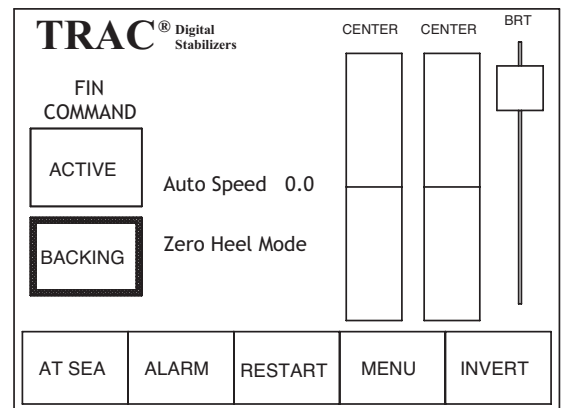
A



B



C

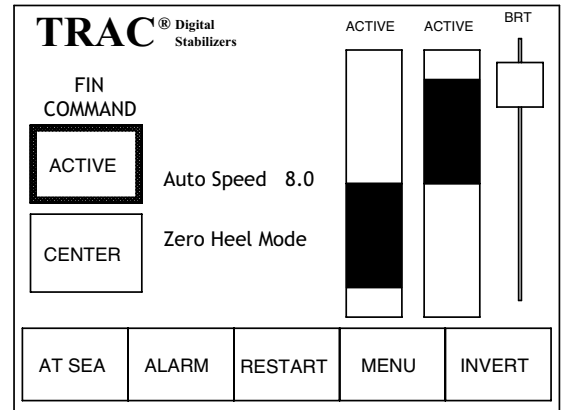


System Control: HOME page - Fins Active

When the vessel is underway, the “ACTIVE” key can be pressed to commence stabilization.

The display backlight intensity control slider is always available for reducing illumination during night operation. The INVERT key may be used at any time to also affect display brightness levels.

The fin position indicators provide nearly linear representation of each fin’s deviation from center position (center is approximately parallel to the keel). Fin angles will be roughly symmetric, but since each fin is controlled by an independent loop, slight asymmetries may occasionally appear and are normal.



Normal Operation

In normal operation (no stabilizer equipment problems) all fins should be ACTIVE or hydraulically at CENTER whenever the vessel is underway.

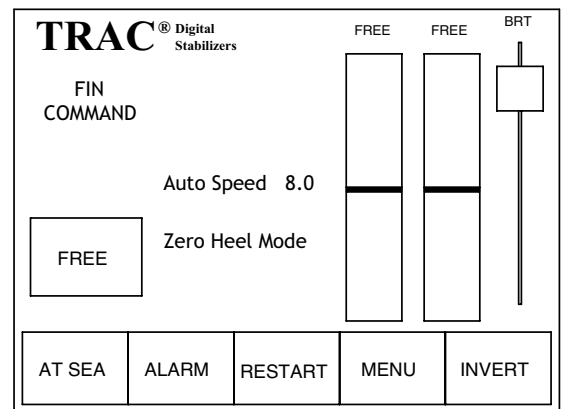
Speed displayed at the speed display should equal or should be greater than the water speed of the vessel. The latter is possible only when manual control of speed setting is asserted at the SPEED page (described later).

The current Heel Mode can be set at the HEEL page. Differences between Heel modes are described in Section 2 of this operations manual and also later in this section.

Abnormal Operation

In the event that system malfunctions prevent all fins from being enabled, any or all fins may be FREE. With all fins FREE, the HOME page appears as illustrated here (lower right).

Any fin that is FREE should be manually locked at the actuator at the earliest possible time (see Section 1 of this operations manual). The vessel should not be backed down, nor should any propeller be reversed with any fin free. Damage to actuators may occur.



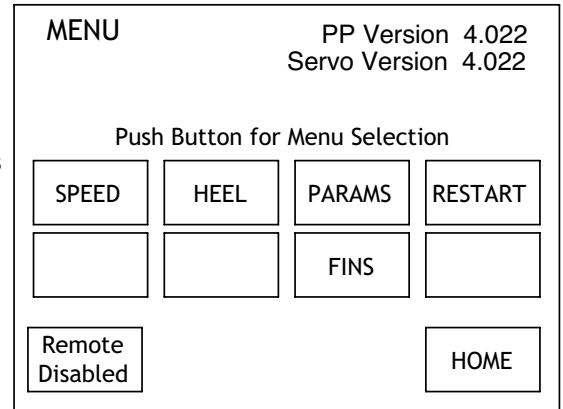
Independent control over the status of any fin can be asserted at the FINS page.

System Control: MENU page

The MENU page, accessible with keypress from the HOME, SPEED, and HEEL pages, is the portal to all main function control pages.

The MENU page lists the current installed versions of software for the Pilothouse panel and for the Servocontrol,

The REMOTE DISABLE / ENABLE key appears on this page only when a system parameter has been set to indicate the presence of a flybridge remote control. The function of this key is to activate or deactivate the remote flybridge control.



System Control: HEEL page

At the HEEL page, one of three different system operating modes can be selected.

ZH mode: The control works within the lift capacity of the fins to keep the vessel flat to the horizon. The horizon is set by parameter entry during system commissioning. When properly set the horizon parameter should not require further adjustment.

In ZH mode, the fins will resist heel from any source including wind and vessel trim imbalance. Fin strokes will oscillate through a line that can become far from the normal centerline. As a result, while holding the vessel flat to the horizon, fins may lose movement range needed to respond to roll impulses from the sea. Also, drag from the fins will be increased as the point of fin oscillation moves further from the normal centerline.

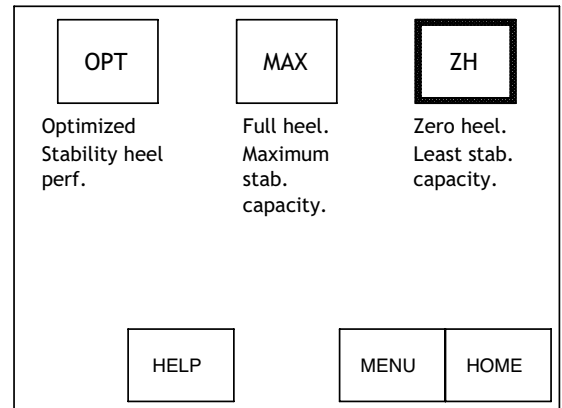
ZH mode is best for light sea conditions; preferably when the vessel is trimmed prior to making fins active; or when holding a flat horizon has priority over potential drag.

MAX mode: In MAX mode, the control will allow an amount of steady heel (set by parameter value: normally to 10 degrees). Fin motion will not be used to correct for heel that is within this allowed range. Therefore fin strokes will oscillate through a line that is closer to normal centerline. On average, greater movement range will be available for countering roll impulses, and fin induced drag will be minimized.

MAX mode is preferred for heavy beam seas, or for minimizing drag, or for maintaining feel for the trim state of the vessel.

OPT mode: In OPT mode the control performs like ZH except that it automatically and incrementally compromises toward MAX performance when the vessel experiences increasing steady trim imbalance. When the control detects continuing excessive restriction of available symmetric range for fin movement it allows increasing steady heel within the allowable range set by parameter value.

After HEEL mode selection has been made, press the HOME button to save the selection and return to the HOME page. The HELP button takes the user to a description of each mode. From the HELP page, push RETURN to reach the HEEL page.



System Control: SPEED page

Depending on stabilizer system equipment, vessel speed will be set automatically (by shaft rpm sensors) or manually (by keypad entry at the SPEED page).

Manual speed entry is possible on any vessel, even those fitted with shaft speed sensors.

It is essential that the TRAC servo control be informed of vessel speed. Reported speed, whether automatic or manual, must equal or exceed the actual through water speed of the vessel. These reported speeds are used by the control for setting system gains and for restricting maximum fin angles.

When the vessel is equipped with speed sensors, select “AUTO”. Then ignore the Manual Speed message which is irrelevant and always defaults to a value determined by parameter setting.

Speed sensors directly report propeller rpm which is displayed on the SPEED page. Speed values are derived from these rpm values through curve points entered as parameter values. When two sensors exist, the higher of the two reported values is used by the control.

The screenshot shows the 'SPEED' page interface. At the top, it says 'Detected Speed / RPM'. Below this, there are two rows of data: 'Port 8.0 kts' and 'Stbd 7.9 kts'. To the right of this data are two large arrow buttons, one pointing up and one pointing down. Below the detected speed data, there are two boxes: 'AUTO' (which is highlighted with a thick black border) and 'MANUAL'. To the right of these boxes, it says 'Port 1425 RPM' and 'Stbd 1405 RPM'. Below this, it says 'Manual Speed 20kts'. At the bottom right, there are two buttons: 'MENU' and 'HOME'.

When the vessel is not equipped with speed sensors, select “MANUAL”, then use the arrow keys to adjust Manual Speed to equal or exceed the current water speed of the vessel.

Whenever dc power is applied to the TRAC servo control, the current setting of MANUAL speed defaults to a value set in system parameters. This insures safe operation of the stabilizer but may not optimize performance.

The screenshot shows the 'SPEED' page interface. At the top, it says 'Detected Speed / RPM'. Below this, there are two rows of data: 'Port 8.0 kts' and 'Stbd 7.9 kts'. To the right of this data are two large arrow buttons, one pointing up and one pointing down. Below the detected speed data, there are two boxes: 'AUTO' and 'MANUAL' (which is highlighted with a thick black border). To the right of these boxes, it says 'Port 0 RPM' and 'Stbd 0 RPM'. Below this, it says 'Manual Speed 16kts'. At the bottom right, there are two buttons: 'MENU' and 'HOME'.

When MANUAL setting has been selected, the SPEED page should be revisited as needed to insure that manual speed is set to a value equal to or just exceeding the vessel speed.

Manually set speed should not be allowed to be lower than vessel water speed.

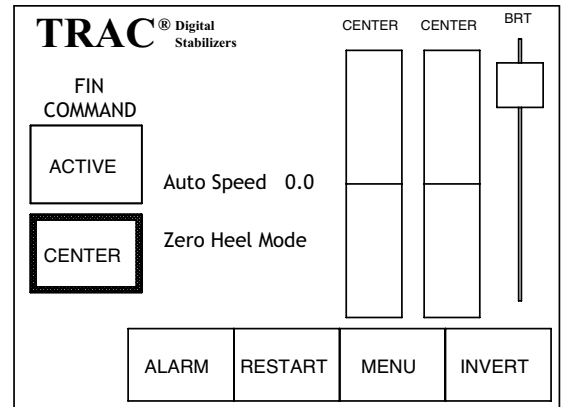
After speed selections and settings have been made, press HOME to save settings and return to the HOME page.

System Control: Fins page

The HOME page is shown here (top right) for convenient reference. The single ACTIVE and CENTER keys will command all enabled fins to these respective states. Also, the CENTER key, when highlighted, can be depressed to command all enable fins to the LOCKED state.

Individual fins are not addressable at the HOME page.

Fins not enabled at the ENABLE page are not addressable at the HOME page.

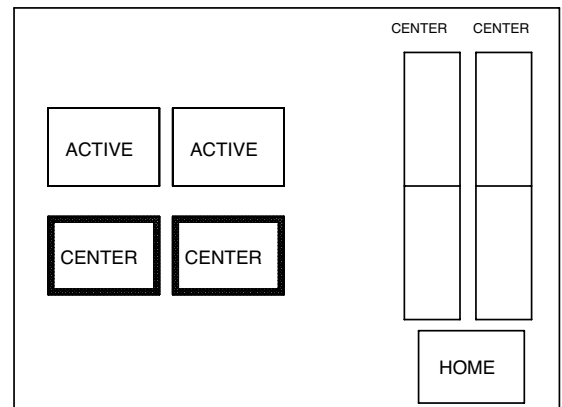


Whenever individual control over a fin is required, the FINS page allows setting any fin to any operational status.

From the MENU page, navigate to the FINS page.

Individual fins may be made ACTIVE, or brought to CENTER.

When the CENTER key border is highlighted, pressing “CENTER” will cause that fin to become mechanically LOCKED by release of the spring extended yoke locking pin.



Fin Locking

Under normal conditions actuator yokes will be mechanically locked only when transmission reversing sensors detect backing position. At all other times the yokes and fins will be either hydraulically CENTERED or ACTIVE. Manual locking of yokes (see Section 1 of this Operations Manual) should be done only when normal system control is not possible.

The control sequence that leads to automatic locking and unlocking is one in which the control appropriately sets or retracts the locking pin and then dithers the actuator cylinder to confirm entrapment or release of the yoke. When confirmation is not achieved, the system alarms and the unconfirmed fin is set FREE.

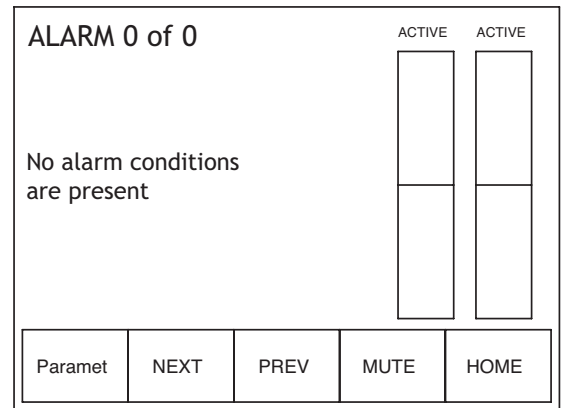
System Control: Alarm page

The ALARM page is reached in one of two ways.

1. At the HOME page, depress the ALARM key to navigate to the ALARM page.

This can be done at any time, and when no alarm conditions exist, the ALARM page will appear as shown in the illustration at top right.

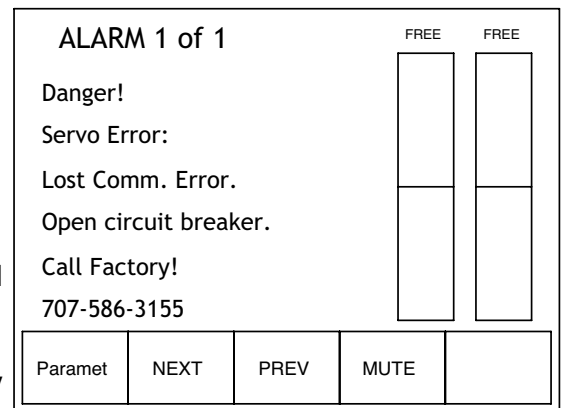
No operational status is changed when manually navigating to the ALARM page. Manual navigation to this page may be done when alarms have previously occurred and have been muted.



2. The control, upon sensing an alarm condition, will automatically flip to the ALARM page. One example is illustrated at middle right.

When any alarm occurs, the exact wording of the alarm condition should be recorded and recommended actions should be followed.

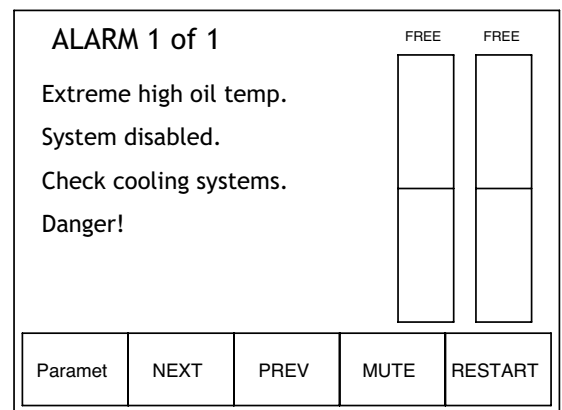
Refer to Sections 3 and 4 of this operations manual for more specific information on major alarm conditions and recommended responses. These sections should be studied in advance, if necessary in consultation with American Bow Thruster, to facilitate optimal responses in the event of system malfunction.



From the examples illustrated here, it can be seen that ALARM page options for navigation away from the page can vary depending on the type of alarm.

In most instances, response to an alarm will be to depress the MUTE key, then follow the recommended actions on the screen and as presented in Sections 3 and 4.

Check for multiple alarms. The occurrence of simultaneous multiple alarms will be indicated at the top left of the ALARM page. Individual alarm conditions can be examined by using the NEXT and PREV keys.



System Control: Alarm Types

There are two alarm types; Acute alarms and Warning alarms.

1. **Acute alarms** will change the operational status of the system. They will always require RESTART to return the system to active status, and they may require cycling of dc power to the control.

The cause of acute alarms, especially those involving reservoir temperature or level, should be immediately investigated.

The stabilizer system cannot be made active until acute alarms are resolved.

2. **Warning alarms** will not change the operational status of the system. These alarms may be muted at the ALARM page. The alarm is considered “acknowledged” by the vessel operator when the HOME key is pressed to return to the HOME page.

At the HOME page the presence of any acknowledged alarm, which has not been resolved, will be indicated by continued flashing of the ALARM key border.

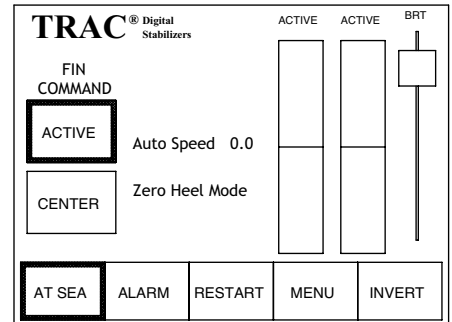
It is highly recommended, that Sections 3 and 4 of this Operations Manual be studied, preferably in association with the system plumbing and electrical diagrams to gain familiarity with the components and component locations for the stabilizer system. This knowledge will greatly enhance ability to investigate and resolve possible system malfunctions.

System Control: STAR™ OPERATION

On vessels fitted for STAR™ (Stabilization at Rest), this function is initiated at the Pilothouse Panel HOME page.

Necessary conditions to begin STAR operation are:

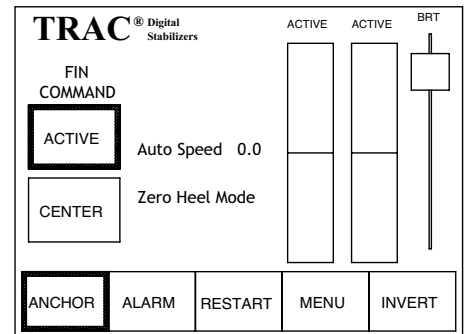
1) **DANGER! EXTREME PERSONNEL HAZARD!** Take all necessary steps to keep any person away from the fins. Unexpected fin motion may occur at any time. Keep persons clear of fins whenever STAR™ is enabled.



- 2) Reduce vessel speed to zero kts (confirmed at the speed indicator display).
- 3) Make sure that all enabled fins are “ACTIVE”.
- 4) Make sure that no reversing sensor is detecting transmission reversed.
- 5) When these conditions have been satisfied, the borders of the ACTIVE and AT SEA keys will be highlighted. Pressing the “AT SEA” key will then commence STAR™ operation.

The lower left key will change to display “ANCHOR”; this being the current status of active stabilization.

STAR™ operation begins with an initialization routine where fins sweep together, up and down at approximately the same rate (expect some rate difference between fins), until limits of travel have been established. These initial sweeps transition automatically to normal STAR™ operation.



STAR™ operation will continue without interruption until one of the following occurs:

1. The “ANCHOR” key is pressed. This action changes fin command status to “AT SEA” and “ACTIVE”.
2. The “CENTER” key is pressed to bring fins hydraulically to center position.
3. Transmission sensors detect reversing (fins center and lock).
4. Speed sensors detect non-zero speed, with reversing not detected (fins transition automatically to ACTIVE and AT SEA).

With interruptions 1 or 2 (above), STAR™ operation is suspended and may be resumed by key presses to highlight the “ACTIVE” key and the “ANCHOR” key. With interruptions 3 & 4, STAR™ operation is terminated and can be resumed only by setting up the necessary conditions described at the top of this page.

Refer to Section 2 - Normal Operation for additional description of STAR™ operation.

System Control: PARAMETER page



More than one hundred system parameters are set at the time of system commissioning to insure optimum system performance. These values are confirmed and adjusted by qualified technical personnel and should not be adjusted unless through consultation with American Bow Thruster.

You may navigate to the PARAMETER page to review parameter values by ascending through the list with the down arrow key.

To go directly to a parameter, enter the parameter number (enter a leading zero to address two digit parameters) then press "ENTER".

The values set for parameters cannot be changed unless a password is first entered at P010.

To exit the PARAMETER page and return to the HOME page, press the SAVE/EXIT key.

Enter Parameter number Followed by Parameter Value					
P010	0		1	2	3
P011	0		4	5	6
P012	1		7	8	9
P013	2				
P014	3				
P_					
FREE	SAVE / EXIT	ENTER	-	0	BS

Display Control: CONTRAST ADJUSTMENT

As shown earlier (HOME Page Overview) the display backlight Brightness Slider is always available.

Another display screen control which can affect screen legibility and which may need adjustment at some time is Screen Contrast.

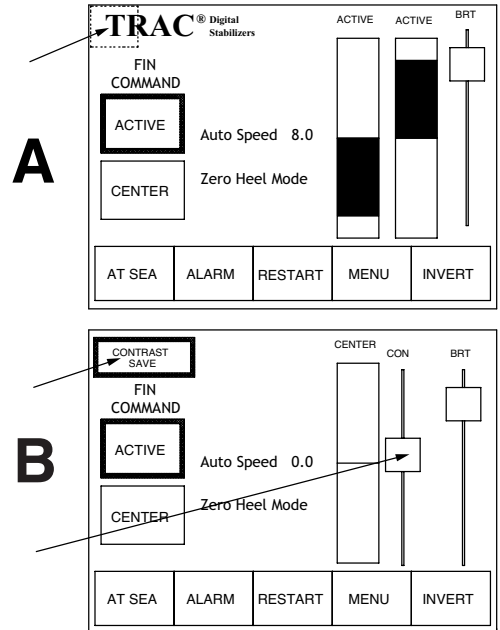
The screen Contrast Slider is normally hidden but can be made visible at any time by touching a hidden button at the upper left corner of the touchscreen (illustrated in panel A).

After touching this hidden button, the Contrast Slider appears as illustrated in panel B. If no contact with the slider occurs, the screen will revert to normal status in 5 seconds.

If contrast adjustment is made by moving the Contrast Slider, the new setting must be saved by pressing the CONTRAST SAVE key.

IMPORTANT. If the screen vanishes during extreme limits of contrast adjustment, simply do nothing further. The display will revert to its previously stored contrast setting after 5 seconds of inactivity. Contrast adjustment can then be repeated and the desired contrast can be saved by pressing CONTRAST SAVE.

In the event that extreme contrast settings are inadvertently saved and the screen becomes invisible, a screen recovery procedure is described below.



Display Control: CONTRAST RECOVERY

In the event that display Screen Contrast is inadvertently adjusted and saved when set to a level that renders the display screen invisible, the following simple procedure can be used to restore a visible screen.

1. RESTART the stabilizer system by cycling dc circuit power to the TRAC stabilizer servocontrol box.

2. Wait 15 seconds to insure automatic arrival at the ENABLE page (now invisible).

3. Touch the display screen as shown in A, first in the upper right corner (1) and then immediately in the upper left corner (2).

4. Wait until the control begins to cycle contrast to make the backlight and contrast sliders visible (as in B).

5. When the sliders are visible, touch the contrast slider button as shown in C (1). This will make a CONTRAST SAVE key appear (2). Continue by adjusting the contrast slider to achieve desired setting, then press CONTRAST SAVE.

If an acceptable level can't be found, don't press CONTRAST SAVE. The control will continue to automatically cycle the contrast setting and step 5 can be repeated.

