GARMIN™

TR-1
Autopilots

GLADIATOR

Owner's Manual

Safety

You are responsible for the safe and prudent operation of your vessel. Your TR-1 Autopilot is a tool that will enhance your capability to operate your boat and catch fish. It does not relieve you from the responsibility for safe operation of your vessel. You must avoid hazards to navigation and never leave the helm unattended.

- You must always be prepared to promptly regain manual control of your boat. The autopilot can fail and hard over.
- **Learn to operate your autopilot on calm and hazard free open water.**
- In case the autopilot becomes inoperable, remove the in line fuse from the battery power cable.
- If available, always use the engine kill lanyard when operating your boat.
- Use caution when operating the autopilot at high speeds near hazards in the water, such as docks, pilings or other boats.

Caution:

- Before drilling holes in your boat, be sure you know what you are drilling into. Watch fuel tanks, electrical cables and hydraulic hoses.

  Before starting the hydraulic installation, please verify the type of hydraulic steering in the boat. If it does not match the hydraulic layouts in this manual, please contact technical support for specific installation procedures. Examples: Capilano, Hynautic, Latham

- We recommend you consult your owners manual for the type of fluid that is recommended by the manufacturer of your helm.

NOTE:

Before proceeding with the installation and operation of the autopilot, read these instructions thoroughly. TR-1 Autopilots cannot accept responsibility for installations where instructions have not been followed, where substitute parts have been used, or where modifications have been made to our products. For technical support please call, 1-866-559-0229.

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User Guide

Introduction to Operation and Adjustments

This section of this manual provides you with information of the TR-1 Gladiator autopilots' capabilities. We have made every effort to minimize the pain in getting you up to speed as a user of the TR-1, however, programmable devices such as your TR-1, are often difficult to learn to use and to program. We recommend that you do not take your fishing tackle on your first trip with your new autopilot. Take a few hours on a nice day to get your system setup and familiarize yourself with its operation, then your first fishing trip with the unit will really have you smiling.

This manual is laid out in sections that are, as best we can make them, self contained. We start with the features and functions available and fundamentals of how the system works, then how to operate the basic functions, and finally how to get into the fine adjustments.

System Functions and Features

The TR-1 is a heading hold autopilot. It steers to maintain a constant magnetic heading. The autopilot measures magnetic heading with a fluxgate compass and receives rate of turn information from an angular rate sensor (gyroscope). The autopilot computer forms a rudder rate command from a combination of the compass, gyro, and engine tachometer signals. This rudder rate command is calculated and sent to the pump controller in the electrohydraulic unit electronics 20 times each second. The pump controller servos the pumping speed and direction to match the rudder rate command from the autopilot.

Beyond the basic heading hold function, the autopilot provides for several other modes of automatic and manually controlled steering functions. These are listed below.

1. Rudder. Rudder steering is used for electrically steering without feedback from the gyro or compass. The rudder moves while a turn button is held down, and stays in place when the button is let up. (Steering the boat with the handheld without heading hold.)

2. Rudder command / Attitude hold (RCAH). (Steering the boat with the Handheld while in Autopilot) RCAH is the primary means for changing the boats' heading with the remote.

3. Man Overboard. See page10. The autopilot will execute a turn to the reciprocal course and pass near the maneuver initiation point.

4. Zigzags. See page 11. The autopilot will steer a zigzag course with preset amplitude and period. Factory Default is set an amplitude (turn) of 30 degrees, and the period (length) set at 1.5 minutes.

5. Step turns. See page 12. The autopilot will execute predetermined fixed angle turns in this mode. (Factory Default is 15 degree turns)

6. Circles. See page 13. The autopilot will turn in continuous circles of preset lap time. (Factory Default is set at a 5 minute circle.)

7. U-Turns. See page 14. The autopilot will execute a U-Turn by using the right or left chevron buttons on the handheld

7. GPS steering.
   7a. The autopilot will steer to a waypoint or series of waypoints.
   7b. The autopilot will orbit a waypoint.
   7c. The autopilot will steer a Cloverleaf pattern over a waypoint.
   7d. The autopilot will steer a spiral search pattern around a waypoint.
   7e. The autopilot will steer to constant course over ground.

8. **Shadow Drive**. The autopilot relinquishes control of the autopilot when the helm is turned and then automatically takes over and steers when the boat is on a constant heading and there is no helm motion.

9. Reverse. The autopilot will attempt to execute many of the above steering functions while the boat is backing.

10. Return to Selected Heading. The autopilot will drive the boat to a previously stored heading.

11. U-Turn. The autopilot will execute a U-Turn; to port or starboard, depending on which button is pressed.

OPERATING THE SYSTEM

The autopilot is controlled with the handheld/remote, the helm and the deckmount switch. To make things easy to talk about we will name the buttons as shown in the picture of the remote below.

Most of the buttons in the system have multiple functions, and many functions are executed by button push sequences or by pushing more than one button at a time.

Power On/Off (Deckmount Switch)

Turn power on by pressing and releasing the [**Deckmount]** switch**.** Turn the power off by pressing and holding the switch down until the [**Deckmount]** switch light has extinguished (about three seconds).

Power on is indicated by illumination of the [**Deckmount]** switch button and one or more LED's lit on the Hand Held.

Both the [**Deckmount]** button light and remote **[STBY]** LED will blink for about 30 seconds after turning power on. During this 30-second time, the pilot computers are running self test and starting up the compass and gyroscope. Autopilot steering is not available during this start up period. While the system is in standby mode, the STBY LED will light solid on and the deckmount light will briefly turn off once a second (occulting at 1 Hz).

Illuminate Keypad on Remote

To illuminate keypad on the remote for nighttime operation:

Press and hold [**Setup**] and press and release the [**Up Arrow**].

Repeat to turn the back light off. The down arrow will toggle the brightness of the orange LED's between bright and dim when the setup is held down.

Engaging the Autopilot In Heading Hold

The **[Auto/Stby]** button engages and disengages autopilot steering. The [**Deckmount]** button performs the same function after the pilot is powered up.

When the button is pressed and released to go into Auto mode, the pilot captures the compass heading and subsequently moves the rudder to hold that heading. The LED next to "Auto" will illuminate and the deckmount light will be lit solid on. You should be steering your boat on a constant heading at the time you press the [**Auto/Stby]** button.

Change Heading with Rudder Function

The rudder (steering) is directly controlled by **[Right Arrow]** and **[Left Arrow]** buttons when the Rudder LED is illuminated. When you program the [**Plus (+)]** button for Rudder, the system will toggle between Rudder mode and heading hold mode when you press and release the [**Plus (+)]** button. **(Autopilot or heading hold are not available while you are in Rudder function.)**

Making A Turn While In Autopilot

RCAH (Rudder Command Attitude Hold)

You can steer to a new heading with the **[Right Arrow]** and **[Left Arrow]** buttons. See Fig. 1 .The pilot will alter the heading by one degree per momentary press of either of these buttons. For example, pressing the **[Left Arrow]** button five times will cause the heading to be changed by 5 degrees to the port. Holding either of these buttons down causes the pilot to turn the rudder so as to make a port or starboard turn. The rudder turns as long as the button is held down or until the rudder reaches the end of its travel range or the boat is turning at it's acceleration limit. When you release the button, the autopilot will move the rudder to stop the boat from turning. When the turn is stopped, the autopilot captures the compass heading and then moves the rudder so as to maintain this heading. An example of RCAH turn is shown in the figure 2 below.

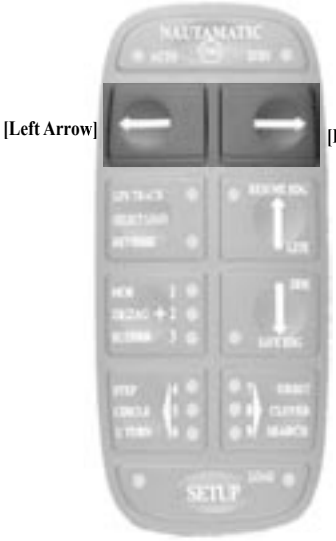


Fig.1

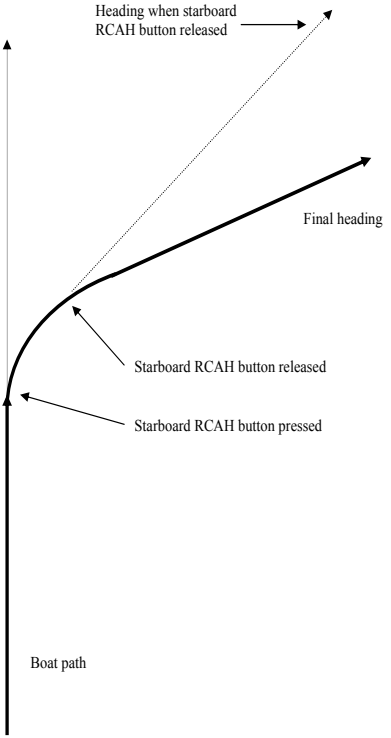


Fig.2

Shadow Drive ™

When the Shadow Drive feature of the autopilot is enabled, the helm acts as an autopilot dis-engage switch. If the autopilot is steering the boat, it will surrender control to the helm when the helm is moved. The autopilot will automatically re-engage when the boat is on a constant heading and there is no helm movement.

Warning Horn

The System sounds a warning horn on the following events:

1. When the rudder is hard against a stop (Double Beep).

2. When the compass is suspect. This may happen when the boat rate of turn exceeds the gyroscope's measurement range. It is most likely to happen when the boat is making high speed turns in rough water. The autopilot **will not** hold heading for several minutes after such an event (1 solid 3 second beep).

3. When the GPS sends a warning to the autopilot that the navigation data is not reliable. Press any key on the remote to silence the horn (Continuous beep).

4. When GPS Navigation is terminated by Shadow Drive (1 Single Short Beep).

Go to Stored Heading

If you press and release the Down Arrow button while the autopilot is in heading hold mode, the heading at the instant the button is pressed becomes the stored heading. Subsequently, while you are in heading hold (at any heading), pressing and releasing the Up Arrow button will cause the autopilot to steer to the stored heading.

Reverse

The autopilot will attempt to perform any of its steering functions when the boat is backing in reverse gear. To engage the system in reverse:

1) Start from [**Standby**]

2) **Press and hold** the GPS [**Rev]** button

3) Press and release the **[Auto/Standby**] button

4) Release the GPS [**Rev**] button

Selecting Patterns

When you select special functions, by the methods described below, you are simply choosing which function is to be executed by the pilot when you push one of the three special function buttons below.

The [**Plus (+)**] button is programmable to provide either MOB, Zig Zags, or Rudder. The [**Left Chevron**] button is programmable to provide either Steps, Circles, or U-Turns. The [**Right Chevron**] button is programmable to provide Waypoint Orbiting, Clover Leaf, or Search Steering in conjunction with your GPS.

To change the functions of these programmable buttons, follow the directions below.

1. Autopilot must be in Heading Hold or Standby Mode before selection process can start. (Auto LED solid on or STBY LED solid on. No other LED's on.)

2. Press and hold the **[Setup]** button. Three LED's next to the numbers 1 through 9 will illuminate, indicating which (3) special functions are programmed to do, the factory defaults are: 1) MOB when the [**Plus (+)**] button is pressed. 2) Step Turns to port when the [**Left Chevron**] button is pressed. 3) Step Turns to starboard when the [**Right Chevron**] button is pressed. 4) Orbit a waypoint clockwise when the [**Right Chevron]** button is pressed and the system is tracking a GPS signal. 5) Orbit a waypoint counterclockwise when the [**Left Chevron]** button is pressed and the system is tracking a GPS signal.

3. Select the Special Function you want to use by pressing and releasing the [**Plus (+)**] and/or Chevron buttons until the appropriate LED's are lit. See Special Function Indicators LED Numbers tables below.

4. Release the **[Setup]** button.

5. **To make the selected Functions into startup defaults (save the changes into permanent memory): <u>Press and release</u> the [Setup] button (the [Setup] LED should be lit), and then <u>press and hold</u> the [Select Load] button. While holding down the [Select Load] button, press and release the [Deckmount] On/Off button quickly, then release the GPS [Select Load] button.**

Pattern Indicator LED Numbers

Following the directions above, you will be able to access all of the Special Pattern Functions listed below on your handheld.

1	MOB
2	ZigZag
3	Rudder

4	Steps
5	Circles
6	U Turn

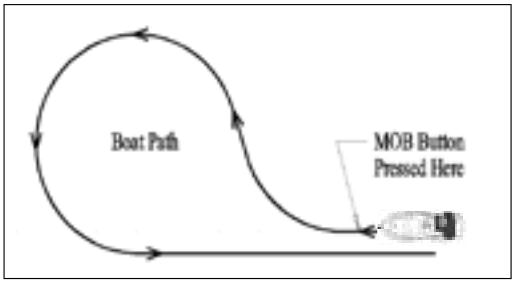
7	Orbits
8	Clover Leaf
9	Search

Change Heading Using Man Overboard

The Man Overboard (MOB) function causes the boat to turn to port until the reciprocal course is established, with the goal of running alongside the point where the Plus button was pushed, The boat path will be as shown in the figure below. **The pilot will return to heading hold if either of the Right Arrow, Left Arrow, or Plus buttons are pressed.**

Code 14: The Man overboard maneuver can be tuned to run close to the object or point at any given speed, but may miss at another speed. You should probably adjust the maneuver at a speed that is below planing speed. If the object or point passes on your starboard reduce code 14.

You are responsible as the captain of your boat to use the MOB feature in a manner as to not cause harm to any person or property. Be aware of any objects in the water before pressing the MOB button. The MOB feature is not set by GPS. Due to wind, waves and current your boat **may not** return to the exact reciprocal course when the MOB button is pressed.



To change the settings for Man Overboard:

1. Press and release the [**Setup**] Button. The [**Setup**] LED will illuminate to indicate the system is ready to take setup commands (button pushes).

3. Select and enter code 14 by pressing and releasing the buttons labeled 1 & 4 (14) until the appropriate LED's are lit. (See the Code and Setup Choice on the table below.)

4. Increase an adjustable parameter one step by each press of the [**UP Arrow**] button. When the parameter is adjusted to its maximum value, the [**Up Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

5. Decrease an adjustable parameter one step by each press of the [**Down Arrow**] button. When the parameter is adjusted to its minimum value, the [**Down Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

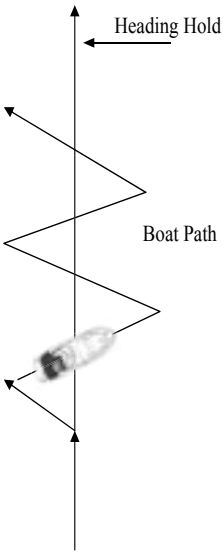
6. **To save the changes into permanent memory and make the selected function into a startup default: Press and release the [Setup] button (the [Setup] LED should be lit), and then press and hold the [Select Load] button. While holding down the [Select Load] button, press and release the [Deckmount] On/Off button quickly, then release the GPS [Select Load] button.**

Description	Code	Range of Settings	Factory Setting
MOB Overshoot	Code 14	1 most overshoot command, 40 most under shoot command	10
Code 14: The Man overboard maneuver can be tuned to run over or close to the object or point at any given speed, but may miss at another speed. You should probably adjust the maneuver at a speed that is below planing speed. If the object or point passes on your starboard reduce code 14.			

Change Heading Using Zigzags

Fig 3

If you program the **[Plus (+)]** button for Zigzags (Fig 3) ,and you then press the [**Plus(+)]** button the pilot will begin to zigzag about the heading you were on when you pressed the button. The zigzag angle and period are both programmable. An example zigzag path is shown in the figure below. When the system is doing zigzags, it will return to heading hold if either the [**Left Arrow]**, [**Right Arrow]** or [**Plus(+)]** buttons are pressed.



To engage Zigzags:

1) Press and hold the [**Setup**] button.

2) Press and light up the [**number 2**, **Zigzag**] LED on the handheld.

3) Release the [**Setup**] Button.

To start the zigzags, press and release the [**Zigzag/Plus (+)**] button on the handheld, the autopilot will start the zig-zags.

Factory default sets the zig-zags at 30 degrees per zig-zag and the cycle time is 3 minutes. If you wish to change those settings refer to the setup codes below and refer to **[Code 8**] for the Amplitude (Degree of turn) 10 choices; 5 to 50 degrees by 5's. [**Code 9**] The Zig-zag period (Length/Time) has 20 choices from 1/2 to 10 minutes by 1/2's.

To change the setup options for zigzags:

You must be in [Auto] or [STBY] mode before selection process can start

1. Press and release the [**Setup**] Button. The [**Setup**] LED will illuminate to indicate the system is ready to take setup commands (button pushes).

2. Select the Setup Code you want to use by pressing and releasing the button labeled 8 or 9 until the appropriate LED is lit. (See the Codes and Setup Choices on the table below.)

3. Increase an adjustable parameter one step by each press of the [**UP Arrow**] button. When the parameter is adjusted to its maximum value, the [**Up Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

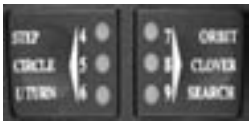
4. Decrease an adjustable parameter one step by each press of the [**Down Arrow**] button. When the parameter is adjusted to its minimum value, the [**Down Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

5. **To save the changes into permanent memory and make the selected function into a startup default: Press and release the [Setup] button (the [Setup] LED should be lit), and then press and hold the [Select Load] button. While holding down the [Select Load] button, press and release the [Deckmount] On/Off button quickly, then release the GPS [Select Load] button.**

Description	Code	Setup Options (Parameters)	Factory Settings
Zigzag Amplitude (Degree of turn)	8	10 choices/ 5 to 50 Degrees by 5's	30 degrees
Zigzag Period (Length)	9	20 choices 1/2 to 10 minutes by 1/2's	1.5 minutes

Change Heading Using Step Turns

If you program the [**Right Chevron]** and [**Left Chevron[** buttons for Step turns, when one of these buttons is pushed, the pilot will execute a port or starboard turn. The turn will terminate when the programmed step angle is reached. The step angles are programmable from 1 to 90 degrees. Multiple pushes of these buttons will result in a turn through an angle equal to the sum of the angles per push. For example, if you have programmed the pilot for 10 degree steps, five pushes of the [**Right Chevron]** button will turn you 50 degrees to starboard. 180 degrees is the maximum turn sum.



To use Step Turns:

1) Press and hold the [**Setup**] button.

2) Select and light up [**number 4**] **[Step**] LED on the handheld.

3) Release the [**Setup**] button.

4) When you are ready to initiate Step Turns, do so by pressing either the [**Right Chevron**] or [**Left Chevron**] Button. Factory default has these set for a 15 degree turn.

To change the setup options for Step Turns:

You must be in [Auto] or [STBY] mode before selection process can start

1. Press and release the [**Setup**] Button. The [**Setup**] LED will illuminate to indicate the system is ready to take setup commands (button pushes).

2. Select the Setup Code you want to use by pressing and releasing the button labeled 6 until the appropriate LED is lit. (See the Codes and Setup Choices on the table below).

3. Increase an adjustable parameter one step by each press of the [**UP Arrow**] button. When the parameter is adjusted to its maximum value, the [**Up Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

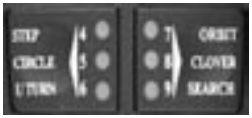
4. Decrease an adjustable parameter one step by each press of the [**Down Arrow**] button. When the parameter is adjusted to its minimum value, the [**Down Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

5. **To save the changes into permanent memory and make the selected function into a startup default: Press and release the [Setup] button (the [Setup] LED should be lit), and then press and hold the [Select Load] button. While holding down the [Select Load] button, press and release the [Deckmount] On/Off button quickly, then release the GPS [Select Load] button.**

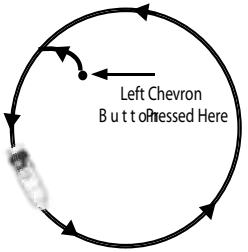
Description	Code	Setup Options (Parameters)	Factory Setting
Step Turns (Degrees per Step)	6	10 choices/ 1, 2, 3, 4, 5, 10, 15, 30, 45, or 90 Degrees	15 degree

Change Heading with Circles

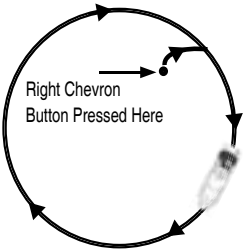
If you program the [**Right Chevron]** and [**Left Chevron]** buttons for Circles, pressing the **[Right Chevron**] button will cause your boat to be driven in a clockwise (see figure below) circle with a lap time between 1 and 90 minutes (programmable). The [**Left Chevron]** button will cause counterclockwise turns. You can exit the circle and return to heading hold anytime by pressing either the [**Right Arrow]** or **[Left Arrow**] button.



Circles: 1) Press and hold the [**Setup**] button. 2) Select and light up [**number 5**] [**Circle**] on the handheld. 3) Release [**Setup**] button. 4) When you are ready to start your circles press the [**Chevron arrow buttons**] in the direction you would like to start your turn. Example: To start your turns in a clockwise rotation, press the [**Right Chevron Arrow**] button. Factory default has the circles set at a 5 minute circle time. If you would like to change those settings, refer to [**Code 7**] in the table of setup codes (Below).



Counterclockwise Rotation



Clockwise Rotation

To change the setup options for Circles:

<u>You must be in [Auto] or [STBY] mode before selection process can start</u>

1. <u>Press and release</u> the [**Setup**] Button. The [**Setup**] LED will illuminate to indicate the system is ready to take setup commands (button pushes).

2. Select the Setup Code you want to use by pressing and releasing the button labeled 7 until the appropriate LED is lit. (See the Code and Setup Choices on the table below).

3. Increase an adjustable parameter one step by each press of the [**UP Arrow**] button. When the parameter is adjusted to its maximum value, the [**Up Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

4. Decrease an adjustable parameter one step by each press of the [**Down Arrow**] button. When the parameter is adjusted to its minimum value, the [**Down Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

5. **To save the changes into permanent memory and make the selected function into a startup default: <u>Press and release</u> the [Setup] button (the [Setup] LED should be lit), and then <u>press and hold</u> the [Select Load] button. While holding down the [Select Load] button, press and release the [Deckmount] On/Off button quickly, then release the GPS [Select Load] button.**

Description	Code	Setup Choices (Parameters)	Factory Setting
Circle Time	7	10 choices/ 1, 2, 3, 4, 5, 10, 15, 30, 45, or 90 Minutes	5

Change Heading with U-Turn

If you program the [**Right Chevron]** and [**Left Chevron]** buttons for U-Turns, pressing the [**Right Chevron]** button will cause the boat to make a U Turn to the starboard, and the [**Left Chevron]** button will cause the boat to make a U Turn to port. You can exit the U-Turn and return to heading hold anytime by pressing either the [**Right Arrow]** or [**Left Arrow]** button.

To Program a U-Turn:

<u>You must be in [Auto] or [STBY] mode before selection process can start</u>

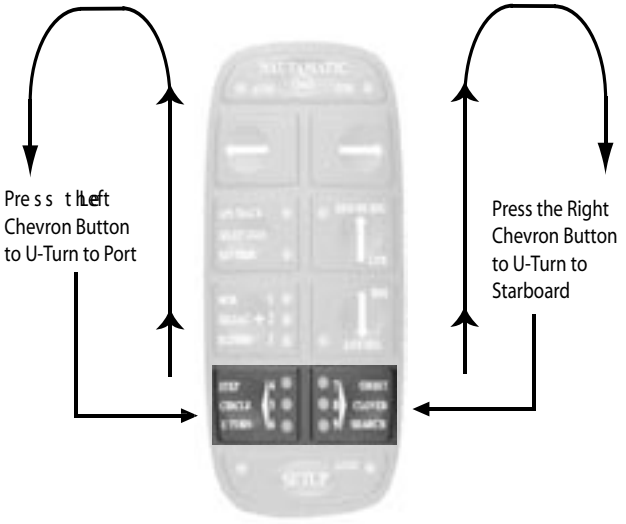
1. Press and hold [**Setup**] button.

2. While holding down the [Setup] button, select and light up [**number 6 LED**] [**U-Turn**] on the handheld. (press and release button until the 6 LED is lit.)

3. Release the [**Setup**] button.

4. When you are ready to initiate a U-turn press the right or left Chevron buttons, depending on the direction you want to make the U-turn. Example: To make a U-turn to starboard, press and release the [**Right Chevron button]**. If you want this button to be a startup default, you will need to download the settings into permanent memory, otherwise it will go back to factory defaults when the system is turned off and restarted.

5. To save the changes into permanent memory and make the selected function into a startup default: <u>Press and release</u> the [Setup] button (the [Setup] LED should be lit), and then <u>press and hold</u> the [Select Load] button. While holding down the [Select Load] button, press and release the [Deckmount] On/Off button quickly, then release the GPS [Select Load] button.



GPS Steering Patterns

The GPS steering functions are not guaranteed to work with all GPS systems. Each manufacturer of GPS equipment puts his own spin on how to assemble the data on the NMEA data bus. Sometimes the data on the bus will not conform to the needs of the autopilot. The autopilot expects to see, at least, the NMEA data sentences $GPRMB and $GPRMC at 4800 baud. These sentences are the minimum recommended data to be transmitted when there is an active way point. Some GPS systems do not conform to this NMEA specification.

Almost all GPS systems truncate the crosstrack error data to 0.01 NM resolution, this means that the autopilot cannot be expected to stay on track any closer than 60 to 120 feet from the course line.

There is a large discrepancy between manufacturers in how they warn the user when the navigation fix is compromised. Some systems alert the NMEA bus listener immediately upon position fix loss but wait 30 seconds to a minute to warn the operator on the GPS display. This is disconcerting to the user because his autopilot drops out (The autopilot stops using the GPS steering command immediately upon receiving a warning from the navigator.) of GPS steering and there is often no indication on the GPS display that anything is wrong with the GPS. Some manufacturers wait a 30 seconds to alert the user via the display and the devices on the NMEA data bus when the position fix is broken. The worst performance in all the GPS units we have tested occurs when a satellite is occluded by the horizon; we have seen steering errors on the order of several hundred feet in these situations.

The autopilot cannot fix steering errors that are GPS generated. Keep an eye on where you are going when you couple the GPS to the autopilot.

When the autopilot is taking steering commands from the GPS, the **GPS** LED will be lit solid. If the autopilot detects a GPS problem it will blink this LED and sound the warning horn. Press any button to extinguish the blinking LED, and cancel the warning horn.

North must be set in order for any of the GPS fishing patterns to work correctly. It also needs to be done if any GPS steering or radar overlay functions are going to be used.

Verify NMEA Connections: Verify that the NMEA connections for the GPS are functioning. Turn on the GPS. With the Autopilot in [**Standby**], press and release [**Setup**] button on the handheld. Press and light up the number 4 and the number 8 LED's [**Code 48**]. If the [**up arrow**] LED lights when you hold down the [GPS]/ [**Select Load**] button, the autopilot does not acknowledge the validity of the GPS data.

To set North:

To run a GPS course requires that the autopilot compass is in agreement with the GPS's magnetic map. You need to set North with the pilot in standby mode.

If you have a GPS connected to the autopilot and $GPRMC is valid and correctly formatted > Set North by running in STBY with code 48 selected, run your boat at planning speed, at any constant heading - press and hold the **GPS** [**Select Load**] button, and then press and release the [**Deckmount].** Your pilot will power down after North is set.

Course Over Ground

If you press and release the GPS button when the autopilot is in heading hold and the GPS does not have an active route, the pilot will maintain the GPS course over ground instead of the magnetic heading. Be aware that the course over ground calculated by the GPS is erratic at low speeds.

All the special function and turn buttons will continue to behave as if you are in normal heading hold. If you use any of the normal turning buttons, course over ground hold is terminated.

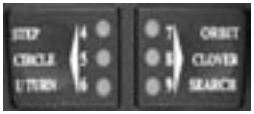
Steer to Waypoint(s)

If you press and release the **[GPS button]** when the autopilot is in heading hold and the GPS has an active route, the pilot will steer to the selected waypoint.

If you are more than 1,000 ft off the course line, the pilot will steer directly at the waypoint and not try to remove crosstrack error.

Cancel GPS navigation and return to heading hold by pressing the **[Right Arrow]** or **[Left Arrow]** button

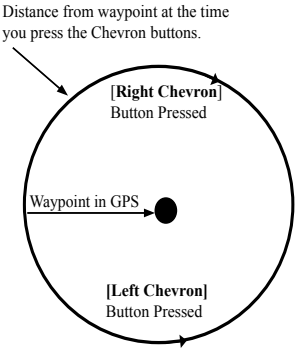
Orbit a Waypoint



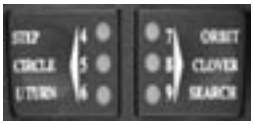
The autopilot will orbit the waypoint you have active in your GPS, with the waypoint to your starboard side if you press the **[Right Chevron]** button when the GPS LED is Lit and the special function Orbit has been enabled. The waypoint will be on your port side if you use the **[Left Chevron]** button.

To enable Orbits: Press and hold [**Setup**] button on handheld, press and select **[Orbits**] (number 7 LED on handheld).
The orbital radius is approximately the distance from the waypoint at the time you press one of the **Chevron** buttons.

Return to heading hold by pressing the **[Right Arrow]** or **[Left Arrow]** button.



Clover Leaf Pattern



The clover leaf pattern is intended for use when you wish to repeatedly pass over a point where you think fish may be holding.

You will need to setup the special nav function buttons (above) for search patterns.

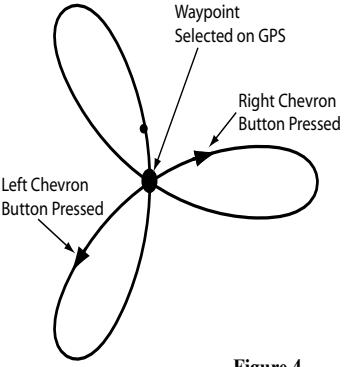


Figure 4

1. Press and hold [**Setup**] button on handheld.

2. While holding down the [**Setup]** button, select and light up [**number 8**] LED [**Clover**] on the handheld. (You will press the button twice.) Release the Setup button.

3. You must mark the location of the clover leaf stem with a waypoint in your GPS. Once the waypoint is saved, select "go to" this waypoint on your GPS.

4. From heading hold, press and release the **[GPS button]** on the handheld. The pilot will start maneuvering toward the waypoint.

If you have selected Clover Leaf pattern as the special function for the Chevron buttons, pressing either Chevron button will start the boat on the clover leaf pattern. If you used the Right Chevron button the clover leaf will be traversed by always turning to starboard, the Left Chevron button will cause the pattern to be traversed while always turning to port. (See Figure 4) The length of one of the clover leaves is programmed with setup code 28. It is adjustable in length from 500 ft to 6,000 feet in 100 ft. increments. See table below.

To change the setup options for Clover Leaf:

<u>You must be in [Auto] or [STBY] mode before selection process can start</u>

1. <u>Press and release</u> the [**Setup**] Button. The [**Setup**] LED will illuminate to indicate the system is ready to take setup commands (button pushes).

2. Select the Setup Code you want to use by pressing and releasing the button labeled 2 & 8 until the appropriate LED is lit. (See the Code and Setup Choices on the table below).

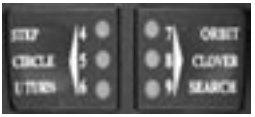
3. Increase an adjustable parameter one step by each press of the [**UP Arrow**] button. When the parameter is adjusted to its maximum value, the [**Up Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

4. Decrease an adjustable parameter one step by each press of the [**Down Arrow**] button. When the parameter is adjusted to its minimum value, the [**Down Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

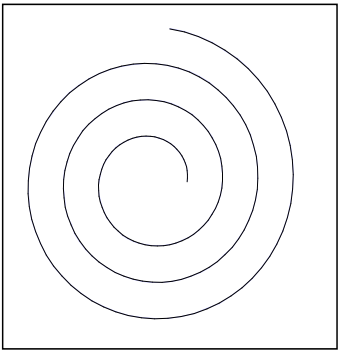
5. **To save the changes into permanent memory and make the selected function into a startup default: <u>Press and release</u> the [Setup] button (the [Setup] LED should be lit), and then <u>press and hold</u> the [Select Load] button. While holding down the [Select Load] button, press and release the [Deckmount] On/Off button quickly, then release the GPS [Select Load] button.**

Description	Code	Setup Options (Parameters)	Factory Setting
Clover Leaf Length	28	500 to 6,000 ft by 100ft. Increments	1,000

Search Pattern



To do an outward spiraling search from the waypoint, setup the special nav function buttons for search patterns.



1. Press and hold the [**Setup**] button on the handheld.

2. Press and light up the [**number 9]** LED on the handheld. Release the [Setup] Button.

3. When you are near the waypoint you want to search from, select "go to" this waypoint on your GPS.

4. With the pilot in heading hold, press and release the [GPS button] on the handheld, and then press and release one of the **Chevron** Buttons. If you pressed the [**Right Chevron]** button, the waypoint will remain on your starboard side as the spiral search unwinds.

To change the setup options for Search Pattern:

You must be in [Auto] or [STBY] mode before selection process can start

1. Press and release the [**Setup**] Button. The [**Setup**] LED will illuminate to indicate the system is ready to take setup commands (button pushes).

2. Select the Setup Code you want to use by pressing and releasing the buttons labeled 2 &5 until the appropriate LEDs are lit. (See the Code and Setup Choices on the table below)
3. Increase an adjustable parameter one step by each press of the [**UP Arrow**] button. When the parameter is adjusted to its maximum value, the [**Up Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

4. Decrease an adjustable parameter one step by each press of the [**Down Arrow**] button. When the parameter is adjusted to its minimum value, the [**Down Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

5. **To save the changes into permanent memory and make the selected function into a startup default: Press and release the [Setup] button (the [Setup] LED should be lit), and then press and hold the [Select Load] button. While holding down the [Select Load] button, press and release the [Deckmount] On/Off button quickly, then release the GPS [Select Load] button.**

Description	Code	Setup Options (Parameters)	Factory Setting
Search Spacing	25	50 to 1,000 ft, by 50 ft. increments	50

How to Change Settings Using The Table of Setup Codes

1. Autopilot must be in heading hold **[Auto]**,[**Standby**], or [**GPS Track**] mode before selection process can start. ([**Auto**] LED solid on or [**STBY]** LED on solid or [**GPS Track]** LED solid on.)

2. Press and release the [**Setup**] Button. The [**Setup**] LED will illuminate to indicate the system is ready to take setup commands (button pushes).

3. Select the Setup Function you want to use by pressing and releasing the buttons labeled 1 through 9 until the appropriate LED's are lit. (See the Table of Setup Codes and values changes on the following pages)

4. Increase an adjustable parameter one step by each press of the [**UP Arrow**] button. When the parameter is adjusted to its maximum value, the [**Up Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

5. Decrease an adjustable parameter one step by each press of the [**Down Arrow**] button. When the parameter is adjusted to its minimum value, the [**Down Arrow**] LED will light. The parameter is adjusted and is in use by the autopilot immediately.

6. You can stay in [**Setup**] and adjust more than one parameter.

7. Compass Calibration, and autotune are setup conditions that take the system over. You can get out of compass calibration by turning the power off and can back out of autotune by pressing any button on the remote. Setting compass North will cause the autopilot to turn off after the compass realigns. The button sequences for their operation are given in the table of Setup Codes on the following pages.

8. To view the operating value of an adjustable parameter, enter its code per the Table of Setup Codes, then press and hold the [**Select Load**] GPS button. The LED on the [**Up Arrow**] button will blink the number of tens the parameter is set to and the LED on the [**Down Arrow**] button will blink the number of ones the parameter is set to. For example, if the parameter is set to a current value of 15, the [**Up Arrow**] LED will blink once and the [**Down Arrow**] LED will blink 5 times to indicate the parameter is set to 1 (blink) X 10 + 5 (blinks) X 1. Of course, when a parameter is adjusted to its minimum or maximum value, the appropriate LED stays on solid per steps 4. and 5. above. Note: The number of blinks, like 15 in the example, tells you how many steps up from the minimum setting.

9. For temporary use of the adjusted parameters: Press and release the [**Setup**] button to exit the setup mode.

10. To make the selected Functions into startup defaults (save the changes into permanent memory): Press and release the [Setup] button (the [Setup] LED should be lit), and then press and hold the [Select Load] button. While holding down the [Select Load] button, press and release the [Deckmount] On/Off button quickly, then release the GPS [Select Load] button.

Table of Setup Codes and Values of the Parameters

SPECIAL FUNCTIONS SETUP CODES			
Description	**Code**	**Values of the Parameters**	**Factory Defaults**
Step Turns (Degrees per Step)	6	10 choices/ 1, 2, 3, 4, 5, 10, 15, 30, 45, or 90 Degrees	15
Circle Time	7	10 choices/ 1, 2, 3, 4, 5, 10, 15, 30, 45, or 90 Minutes	5
Zig-Zag Amplitude (Degree of turn)	8	10 choices/ 5 to 50 Degrees by 5's	30
Zig-Zag Period (Length)	9	20 choices 1/2 to 10 minutes by 1/2's	1.5
MOB Overshoot	14	1 most overshoot command, 40 most under shoot command	10
Code 14: The Man overboard maneuver can be tuned to run over or close to the object or point at any given speed, but may miss at another speed. You should probably adjust the maneuver at a speed that is below planing speed. If the object or point passes on your starboard reduce code 28. See page 15.			
Clover Leaf Length	28	500 to 6,000 ft by 100ft. Increments	1,000

NAVIGATION FUNCTION CODES			
Description	**Code**	**Values of the Parameters**	**Factory Defaults**
Navigation Gain	15	1 lowest gain, 73 highest gain	50
Navigation Trim Gain	16	1 lowest gain, 73 highest gain	49
Code 15 & 16: Most GPS systems only send cross track error across the NMEA 0183 data bus with .01 mile (60 feet) resolution. Unfortunately, they display cross track error to the nearest foot. What this means is, don't expect the autopilot to zero the cross track error because the information it has is-that any crosstrack error less than 60 ft (as seen on the GPS display) is zero feet. Adjust parameter 15 up until the boat oscillates back and forth near the course line, then back it down a few clicks. Increase parameter 16 until you can see that standoff from the course line decreases over time.			
Use Magnetic North	17	[**Up Arrow**] for Mag [***Down* Arrow**] for True Heading	MAG
Set North	48	In [***Standby***] Press and hold GPS [***Select Load***]- if Up Arrow LED lights, point boat north-then press and release DM	
Use Synthetic XTE	167	[**Up Arrow**] for on, [**Down Arrow**] for off	On
Code 167: On some GPS' this code may result in tighter tracking near waypoints.			
Use NMEA Checksum	347	[**Up Arrow**] for on, [**Down Arrow**] for off	On
Code 347: If your GPS calculates checksums wrong, you may still be able to use it with this code turned off. Data integrity is compromised in this condition.			
Use Reversed XTE	18	[**Up Arrow**] for on, [**Down Arrow**] for off	Off
Code 18: Some GPS' send the wrong direction to steer with the crosstrack error signal. Use this code to fix this problem.			
Use GPS 1 GPS 2	34	[**Up Arrow**] for 2, [**Down Arrow**] for 1	1
Code 34: This code switches between the two sources of NMEA navigation data used by the autopilot to steer with.			
Update rate for HDG out	49	0 (off) to 10 HZ Update Rate	10 HZ
Code 49: With this code at the bottom of its range (Down Arrow LED on) the autopilot does not transmit $APHDG. With any settings other than off, the data is transmitted at a rate equal to (1-code 49 setting) HZ. up to a maximum rate of 10 Hz.			
Fine Heading Adjust	168	[**Up Arrow**] increase heading out .1 deg. [**Down Arrow**] decreases heading out .1 deg. Note: Very Slow response to buttons.	

Table of Setup Codes

FINE TUNING CODES			
Description	**Code**	**Values of the Parameters**	**Factory Defaults**
Acceleration Limiter	5	1 lowest accel, 100 Highest accel	39
Code 5: This parameter limits the aggressiveness of the autopilot controlled turns. Turn it up to allow higher rate turns and down to limit the turn rate.			
Seastate Filtering	1	1 least responsive steering, 4 most responsive steering	4
Code 1: Seastate adjustments, toward least responsive, slow the heading response down and reduce rudder activity. Most of the time you will want to run with this parameter all the way at the top of its range. In choppy or trailing seas at low speeds, reducing this parameter will save wear and tear on your system.			
Low Speed Rudder Gain	27	1 lowest gain 97 highest gain	39
Low Speed Counter Rudder Gain	37	1 lowest gain, 97 highest gain	72
High Speed Rudder Gain	29	1 lowest gain 97 highest	39
High Speed Counter Rudder Gain	39	1 lowest gain, 97 highest gain	72
Following Seas Switch	159	[Up Arrow] on, [Down Arrow] off	off
Code 159: Turning this parameter on may increase stability in severe trailing seas.			
Turn Stop Adjust	268	1 least adjustment, 40 most adjustment	1
Code 268: At planing speed and for large turn angles; if your boat tends to turn further than you programmed for, (like 50 degrees when you programmed 45 degrees) and then slowly recovers to the turn angle you expected, turning this parameter up may solve the problem.			

AUTOMATED SETUP CODES		
Description	**Code**	
Calibrate Compass	47	Hold Down [Select Load] Button, Press and Release Deckmount Button to Start Calibration Process
Autotune	58	Hold Down [Select Load] Button, Press and Release Deckmount Button to Start Tuning Process. Code 57: Code 57 lets you select an alternate autotune. You may want to try this if the normal tune didn't work. After selecting the alternate by selecting code 57 and pressing the Down Arrow button (so that the Down Arrow LED is lit), go back to code 58 to initiate the autotuner.
Load Factory Compass	247	Hold down [Select Load] button, Press and Release Deckmount Button to Reload Factory Pilot Settings
Load Factory Pilot	248	Hold Down [Select Load] Button, press and release Deckmount Button to Reload Factory Pilot Settings
Show Software Version	369	Hold Down [Select Load] Button, version=blink code/100

Table of Setup Codes

TACHOMETER CODES			
Description	**Code**	**Values of the Parameters**	**Factory Defaults**
RPM Source Configuration	259	1, none/ 2, Port/ 3, Starboard/ 4, Both	2
Code 259: For single engine installations, set this code to 2 (1 blink) (and hook the blue and black wires up to your engine tach leads).			
Pulses per Revolution	267	1 to 255 by 1's	6
Code 267: The number of tach pulses per engine revolution is an engine specific parameter. The following settings are a good starting point, however you need to verify them on operation. V8 engines 4 ppr (3 blinks) Most outboards 6ppr			
Show Port RPM	35	Hold Down [Select Load] button: 1000's blink on Up Arrow 100's blink on Down Arrow	
Show Starboard RPM	36	Same As Above	
Transition RPM	348	100 to 6000 by 100's	3000
Code 348: Set this code to the RPM's that your boat runs when almost on plane.			
Low RPM Limit	357	100 to 6000 by 100's	500
Code 357: If your autopilot runs well at all RPMs but is a little too active at idle, you can increase this low limit RPM to a setting that is higher than your idle RPM to reduce autopilot rudder activity at idle.			
High RPM Limit	359	100 to 6000 by 100's	6000
Code 359: If your autopilot runs well at all RPM's but you would like a little stiffer heading hold at the top end, reducing this setting to an RPM lower than your actual peak RPM will help			

HYDRAULIC CODES			
Description	**Code**	**Values of the Parameters**	**Factory Defaults**
Helm Displacement	269	.1 to 6 by .1's	1.7
Pump Displacement	169	[Up Arrow] for 4 liter, [Down Arrow] for 2 liter	2 liter
Turns Lock to Lock	26	.1 to 10 by .1's	4.5
Sloppy Linkage Compensation	257	8 settings, 8 for most sloppy	1
Code 257: In case of sloppy and loose steering linkages, increasing this parameter may help to reduce heading oscillations due to the linkage. Use with caution.			
Shadow Drive Desensitize	368	1 most sensitive, 40 least sensitive	20
Code 368: If the shadow drive is being false tripped, i.e., autopilot is disconnected when the helm is held still, increasing this parameter may help. False tripping is usually due to leakage of fluid past the helm pump lock valve. You may need to repair the helm valves if you cannot eliminate false trips.			
Shadow Drive Enable	367	[Up Arrow] for On, [Down Arrow] for Off	on
Reversed Hoses	249	[Up Arrow] for Reversed, [Down Arrow] for Normal	Norm
Code 249: In case of hoses installed backwards, use this code to electronically reverse the steering direction.			

Chapter II

Autopilot Setup

Dockside Setup and Sea Trial Setup of Autopilot

Your autopilot needs to be setup and tuned to your boat dynamics and motor configuration. It is important to get the autopilot operating the best in can. The Dockside Setup and the Sea Trial Setup are steps that must be followed to achieve the best performance from the TR-1 Gladiator Autopilot. Have patience and try to do the Sea Trial Setup on a nice calm day. Follow the directions below. These steps are in a sequence to help keep you from making any errors. If you have any questions, please call us at **1-866-559-0229.**

1. Turn autopilot system on. Press the deckmount (on/off switch) **on**, the deckmount will blink slowly for 30 seconds during startup. The system will automatically go into standby mode, and the deckmount will then blink rapidly. No functions are available during startup. You will be using the handheld and deckmount switch to enter codes, change, and save the values of the parameters. Parameters and their values are on the Table of Setup Codes, (Pages 25-27)

2. Lock to Lock times. Count the number of turns it takes your helm to go from lock to lock and adjust the parameter of code 26 to match. (Factory default is set at 4.5) The value of code 26 can be seen in the blink code flashed on the up and down arrow buttons on the handheld. Press and light up the [**Setup**] LED , press and light up numbers 2 & 6, [**Code 26**]. **Press and hold** the [**Select Load**] (**GPS)** button. The number of turns is 1/10th of the blinked code + 1. Example: if the blinked code is 44 (The up arrow will blink 4 and the down arrow will blink 4) the number of turns is (44 + 1)/10 = 4.5 turns lock to lock.

3. Helm displacement. The value of [**Code 269**] should be set to reflect the helm displacement. (Factory Default is set at 1.7). Press and release **[Setup**] button. Press and light up [**Code 269**] on the handheld. By pressing and holding down the [**Select Load**] (GPS) button on the handheld, the up and down arrows will blink to reflect the helm displacement code. The helm displacement is usually written on the body of the helm pump. Example: The blinked code for a 1.7 cu in/rev helm would be 16, (the up arrow blinks once and the down arrow blinks 6) since (16 +1)/10 = 1.7.

4. Verify the direction of steering is correct. Turn the autopilot on and switch from standby to autopilot. When the right straight arrow turn button is pressed on the handheld remote, the motor should turn the boat to the right. When the left straight arrow turn button is pressed on the handheld/remote, the motor should turn the boat to the left. If this is incorrect use [**Code 249**] for reversed hoses. Press and release, and light up the [**Setup**] LED, press and light up [Code 249] on handheld, if the down arrow is lit, press the up arrow to reverse hoses. If you change this setting, **download changes into permanent memory** by following step 8.

Dockside Setup: Steps 1-9 can be done at the dock before heading for open water.

5. RPM Source Configuration. The default setting on the autopilot is set for a Single Engine. If you have twin engines or more, you will need to change [**Code 259**] to match your motor configuration. **Twin engines**; Press, release and light up the [**Setup**] LED on the handheld, press and enter [**Code 259**] on the handheld. Press the [**Up Arrow**] TWO (2) times which is setting the parameter to **[(4) Both**]. See page 22 code 259 for more information.

6. Verify the autopilot tachometer (Tach Sensor Cable) is functioning properly. With the engine(s) running. Press, release and light up the [**Setup] LED** on the handheld, and press and light up [**code 35**]. Press and hold the **[Select Load**] **GPS** button and you should see the [**Up Arrow]** and [**Down Arrow]** LED's blink your port engine's RPM. For example, when the [**Up Arrow]** LED blinks 2 times and the [**Down Arrow]** LED blinks 5 times your engine is running at 2500 RPM. **[Code 36]** works the same way as code 35 for the starboard engine instead of the port engine. The autopilot tachometer system has a lower limit setting of 200 RPM. If needed, adjusting [**Code 267**] (pulses per rev) to make your autopilot tachometer match the tach on your dashboard.

7. Transition RPM. This is the RPM at which your boat transitions from displacement to planing speed. [**Code 348**] is set to a factory default of 3000 (2 blinks of the [**Up Arrow]** LED and 9 blinks of the [**Down Arrow]** LED +1). You should set it to your boat's transition RPM. (Example: Say that your planing speed is at 2500 RPM's; With the [**Setup]** LED lit, press and light [**code 348**], since the factory default is 3000 which is 2 blinks of the up arrow and 9 blinks of the down arrow (The value can be seen with the [**Setup**] LED lit, press and hold the **[Select Load]** GPS , release the select load button, then click the down arrow 5 times; that will set your transition RPM's at 2500.) If you don't know what the transition RPM is, you will need to do this as part of your Sea Trial Setup.

8. Download to permanent memory the parameters you have adjusted so far. (This must be done) With the [**Setup]** LED lit, press and hold the **GPS** [**Select Load**] button on the handheld controller, the [load] LED should illuminate on the handheld, while still holding down the [Select Load] button, press and release the **[Deckmount], on/off button quickly,** then release the [**Select Load**] **GPS** button.

9. Verify NMEA Connections: Verify that the NMEA connections for the GPS are functioning. Turn on the GPS. With the Autopilot in [**Standby**], press and release [**Setup**] button on the handheld. Press and light up the number 4 and the number 8 LED's[**Code 48**]. If the [**up arrow**] LED lights when you hold down the [**Select Load**] (GPS) button, the autopilot **does not** acknowledge the validity of the GPS data.

Sea Trial Setup: Steps 10-15 will need to be performed on open water, free of obstacles.

10. Calibrate your compass. The autopilot compass is made with a fluxgate. Like all compass installations, fluxgate installations are susceptible to local magnetic disturbances that will cause erroneous heading outputs. The autopilot computer can detect and correct deviations caused by magnets and iron materials around the fluxgate- if the earths' magnetic field near the compass isn't too distorted. Even though the compass corrects iron induced errors, don't expect the correction to solve all ills associated with iron near the compass, placement of the compass in an iron free area is critical. You should only calibrate the compass on calm water. Stay away from large steel structures. Calibration will not work right if you try to do calibration with your boat on the trailer because the trailer is made with iron. Find some smooth water where you can drive in circles without running into anything.

1. Turn System On. Autopilot will be in Standby [STBY Mode]

A. Press and Release Deckmount Switch to turn autopilot on. Deckmount will begin to flash.

B. **[STBY]** LED will blink for 30 seconds.

C. When the Autopilot is done loading the **[STBY]** LED will light solid.

2. Press, release and light up the [Setup] LED on the Handheld, and enter code 47 on the handheld.

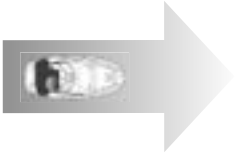
A. Press and release **[Setup]** button once to illuminate [SETUP] LED.

B. Press and release **[Left Chevron]** button once to illuminate the #4 LED.

C. Press and release **[Right Chevron]** button once to illuminate the #7 LED.

3. To start Compass calibration.

A. Start driving the boat in a straight line.



B. Press and **HOLD** the **[Select Load]** GPS button.

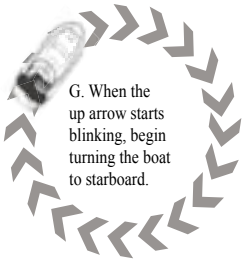
G. While holding down the **[Select Load]** button. Press and Release the **[Deckmount]** button once quickly.

Continued On Next Page

D. Release **[Select Load]** button

E. The **[UP]** arrow LED will light solid. (Continue driving in a straight line.)

F. Continue to drive in a straight line and watch for the **[UP ARROW]** LED to start blinking.



H. Turn at a rate that makes a full 360 degree turn in about 30 seconds. You will need to make at least 3 or more full turns. Keep turning until the **[UP ARROW]** & **[DOWN ARROW]** LED's both light up. They will stay lit for about 5 seconds and the system will completely power down. Your compass is now calibrated.

- **If Up and Down Arrows both blink continuously, compass calibration has failed - you must turn the system off by holding the Deckmount On/Off button down in order to try calibration again. Make sure the compass is mounted at least 24" away from any magnetic material, i.e. radios, speakers etc. Make sure it is orientated in the bracket correctly.**

Autotune

11. Restart the autopilot by pressing and releasing the Deckmount On/Off switch.

12. Autotune. The autopilot's autotune function can really simplify the problem of adjusting the feedback gains. The autotuner will adjust the gains well enough that you may not need to do any additional adjustments at all. You can adjust the autotune results after autotuning if needed.

In order to use the autotuner (or to tune the autopilot yourself), you must be in calm water with very little wind. You will let the autotuner drive your boat for several minutes, so you need to have as much as one half to 1 full mile of clear water in front of you when you start autotune. The autotuner will drive in a zigzag pattern and may not maintain the course you initially started on. You can abort autotuning at any time by pressing any button on the remote or by pressing the deckmount switch, or by steering from the helm.

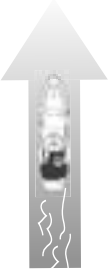
You will do autotuning at a fixed RPM, **don't change throttle settings once the autotuner has been started.** (If autotune fails try it again at a slower speed). Make sure the engine is trimmed all the way down and trim planes are fully retracted, and make sure the boat isn't listing. **Don't move around** in the boat while autotune is underway. If your boat has a vee bottom and tends to roll a lot when the rudder moves, you will get better autotuning results by doing autotune at lower RPMs than indicated above.

Step 1. The autopilot must be in standby. **[STBY]** LED is illuminated.

Step 2. Press, release, and light up the [**Set-up]** button (left) LED will light.

Step 3. Press and release the **[Left Chevron]** button two times, and light up #5 LED.

Step 4. Press and release the **[Right Chevron]** button two times, and light up #8 LED.



Step 5. Bring the engine(s) up to speed (lower RPM not planing) and steer the boat on a constant heading.

Step 6. **To engage autotune:**
Press and HOLD the GPS **[Select Load]** button. While holding down the **[Select Load]** button, Press and release the **[Deckmount]** button once quickly. Release the **[Select load]** button.

Step 7. The Autotuner will zigzag the boat for 15 cycles. If you run out of room, abort the tuner and try it again in a spot where you have more room to maneuver. You would like to see the time for one complete zigzag cycle to be between 3 and 6 seconds. Adjust RPM up to reduce cycle time and adjust the RPM down to increase the cycle time. The zigzagging will stop when the autotuner is done. Be prepared to regain control of the boat.

- **If the tune was good,** both the [**Up Arrow]** LED and the [**Down Arrow]** LED will turn on solid for 5 seconds
- **If boat goes into circles,** verify steering direction in step 4, page 28. (hoses could be reversed)
- **If the tune failed**, both the [**Up Arrow]** LED and the [**Down Arrow]** LED will blink for 5 seconds.
- **If tuning conditions are real bad**, the unit will simply go directly back to standby or shut down with no arrow LED indications at all.
- **If the quality of the tune is suspect**, the [**Down Arrow]** LED (only) will blink for 5 seconds; this may not be a bad tune - so try it in autopilot mode first before tuning again.

When autotune is done, check out the steering performance at low and high speeds. If low speed performance isn't too good, try autotuning again. If, after several attempts at autotuning, the performance isn't good you will need to resort to the fine tuning procedure in step 15.

Continued on Next Page

13. If the tune was good or suspect download to permanent memory the parameters you have adjusted so far (autotune). With the [**Setup**] LED lit, **press and hold** the **GPS [Select Load] button**-the load LED should illuminate, **press and release** the [**Deckmount] button**, then **release the GPS [Select load] button.**

Note: Press and release the [Setup] button to exit setup mode.

Set North

14. Set North. This needs to be done if any GPS or radar overlay functions are going to be used.

To run a GPS course requires that the autopilot compass is in agreement with the GPS's magnetic map. You need to set North with the pilot in standby mode. Setting North may require a significant amount of clear sea space in front of your boat (at least 1/2 to 3/4 of a mile).

Verify that the NMEA connections for the GPS are functioning. Turn on the GPS. With the Autopilot in [**Standby**], press and release [**Setup**] button on the handheld. Press and light up the number 4 and the number 8 LED's **[Code 48**]. If the [**up arrow**] LED lights when you hold down the [**Select Load**] (GPS) button, the autopilot does not acknowledge the validity of the GPS data.

With The GPS Connected to Autopilot:

1. With the system in [STBY]

2. Press and release **[Setup]** button once to illuminate (left) LED

3. Press and release **[left chevron]** button one time to illuminate the #4 LED.

(You have now selected code 48)

4. Press and release the **[Right Chevron]** button TWO times to illuminate the #8 LED.

5. Run your boat at planing speed at a constant heading. You will need at least 1/2 mile of hazard free water in front of you.

6. **Press and HOLD** the GPS **[Select Load]** button. The Load LED will illuminate on the **[Setup]** Button

7. While **holding down** the **[Select Load]** button. Press and Release the **[Deckmount]** button quickly.

8. Release the **[Select Load]** button, after **[Load]** LED diminishes. The system will power down after North is set.

Trouble Shooting Guide

Autopilot does not hold heading.

1. Did you calibrate the compass?
    a. Calibration must be done for the autopilot to work correctly.
2. Has some kind of magnetic interference been introduced within 24" of the Compass?
3. Is Compass Ball and Bracket firmly mounted?
4. Are the wires pointing down out of the Compass Ball?

Compass Calibration fails. (If the up and down arrows both blink and the warning horn sounds, compass calibration has failed-you must turn the system off by holding the Deckmount on/off button down in order to try calibration again.)

1. Check for magnetic disturbances
    a. Be at least 24" from speakers, iron, radios, etc.
    b. Do not calibrate compass on the boat trailer.
    c. Be sure you are on smooth water.
    d. Be sure that you continue turning starboard and do not turn back to the port.

Shadow Drive is being "false tripped" (autopilot disconnects when the helm is held steady)

1. May be due to air in the steering system.
    a. Check for air, and re-bleed if necessary.
2. May be due to leakage of fluid past the helm pump lock valve.
    a. Repair Helm valves.
3. Check location of Shadow Drive.
    a. Must be located near the lowest helm, or last helm in line before the pump unit.
    b. Must have short length of hose between helm and Shadow Drive.
    c. Must be mounted horizontally and as level as possible.
    d. Single helms **must no**t have a Tee fitting before Shadow Drive Valve.

Autotune fails. (Both the Up Arrow LED and Down Arrow LED will blink for 5 seconds)

1. Repeat the Autotune several times. If it fails each time, check the following.
    a. Try finding smoother water if conditions are rough or windy.
    b. Do not change throttle settings once the autotuner has been started.
    c. Engine speed is too slow or too fast. (Set the engine speed such that the boat is running the fastest speed it can before it starts to climb up on the bow wave.)

Autotune seems to be OK; then the next time you start autopilot it behaves as if it has not been tuned.

1. Did you download into permanent memory the autotune?
    a. You must download the autotune before turning the autopilot off.

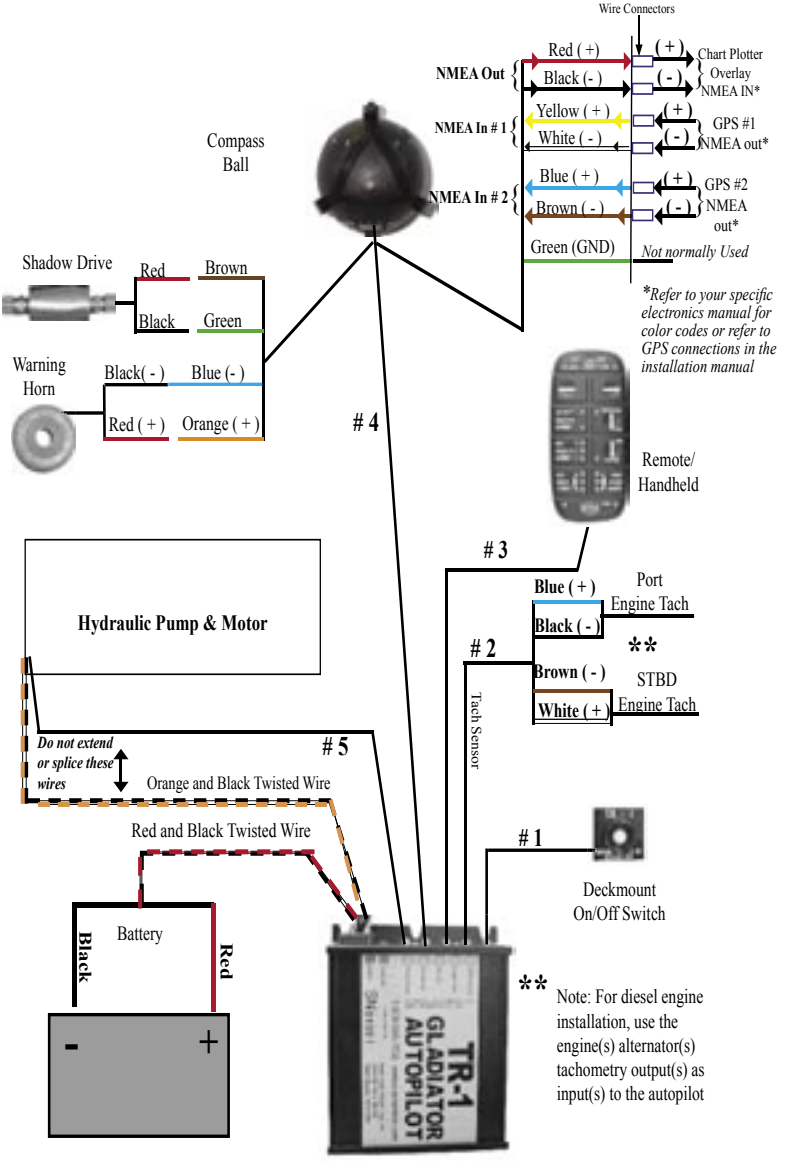
When starting Autotune the autopilot immediately turns in circles.

1. Hydraulic Hoses are backwards.
    a. Use code 249 to reverse hydraulic hoses.

When in navigation mode the Autopilot heading does not match GPS heading.

1. Was North set on the Autopilot? To run a GPS Course requires that the autopilot compass is in agreement with the GPS's magnetic map.
    a. See page 29
2. Are the GPS outputs turned on and correctly formatted? NMEA 0183.
    a. Sentences needed are RMB and RMC only. Un-needed sentences that are turned on may cause autopilot to drop out of navigation mode.

Electrical Layout



ECU
(Electronic Control Unit)

NMEA 0183 Connections

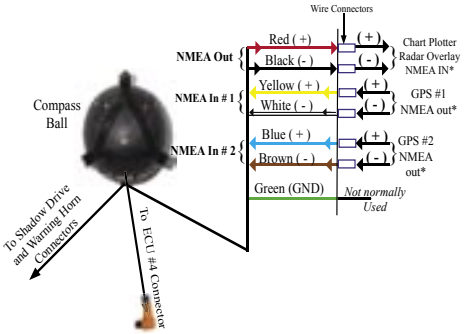
The Autopilot does not need to connect to a GPS for the autopilot to work, but if you want to use waypoint steering you must connect to a GPS and set North see page 30. The Autopilot will accept NMEA input from two GPS units and transmit NMEA to one receiving device. Only one of the GPS inputs is used for steering control at a time. Selection of the controlling GPS is made through the NMEA source selection [code 34] (see pages 19-22 for explanation of setup codes). The NMEA output port transmits the NMEA sentence $APHDG at 4800 baud. The output refresh rate is selectable via [code 49] from 0 to 10 Hz. The Autopilot requires the data sentences RMC and RMB to be on.

The NMEA conductors are in the cable stub at the base of the Compass Ball. (See Labels on Wires for Identification) The wire color codes and signal names are shown in the wiring diagram below.

You must calibrate the compass ball and set North during Sea Trial of autopilot for it to work correctly.

Note: If you are using Radar Overlay, you may need to adjust code 168 in order for your overlay to line up correctly.

See pages 38-41 in the installation manual or go to www.tr-1autopilots.com (Manuals)for updates of specific brands of GPS wiring configurations. Not all GPS brands and models are available. TR-1 updates these regularly. The chart is a guide only and is to help you with your GPS connections and should not be used as factual information. Please check your GPS manual for verification of NMEA 0183 connections on your application. This is not a compatibility chart, but most all GPS units are compatible with the TR-1 Gladiator.



Note: For non-compliant NMEA 0183 devices, please read page 33

Blue Connectors (for connecting wires from the Shadow Drive, Warning Horn and GPS)

Fig. 20

Fig. 21

Fig. 22

Twist wires together. (**Fig 20**) Slide the blue connectors over the wires (**Fig 21**) and crimp using pliers as in **Fig 22**. Be careful not to smash the connectors too hard, it will cut the wires.

Non-Compliant NMEA 0183 Devices

The TR-1 Autopilot is designed in conformance with the NMEA 0183 standard. The TR-1 will communicate reliably and safely when connected to other devices that meet this standard with the normal wire connections.. **Any device that requires a signal connection to ships ground is not in compliance with the standard.** The installer needs to confirm that connections to non-compliant devices are wired in a fashion to ensure a safe and effective connection. In these cases the following procedure shall be followed.

An indication that a device may be a non-compliant device is that the GPS signal is accepted by the TR-1, but the RADAR shows no heading data, or has an intermittent heading input signal.

When connecting the NMEA heading output to a non-compliant NMEA device, the NMEA positive signal from the TR-1 shall be connected to the receiver NMEA positive signal. The connection should then be tested to see if communications have been established, that is to say, does the intended receiver indicate that valid heading data is being received from the TR-1. If so then no other connections need to be made.

If the data is not being received by the receiving device, try to connect the receiving device power ground to the same power ground as the TR-1.

If this cannot be done, a last resort is to connect the power ground of the receiver to the green wire ground connection of the TR-1 NMEA interface wires through a 125mA inline fuse. **It is VERY important that the grounds never be connected without the fuse as this can create a fire hazard in the boat.** Please contact TR-1 Autopilot technical support for assistance.

When connecting the TR-1 NMEA input to a non-compliant device there should be no problem as the NMEA standard allows this connection to be made safely, although in this case ground noise may show up on the signal and cause intermittent problems. If these problems are experienced, a possible solution is to be certain that the “signal ground” and the power ground are connected at the same point.

Limited Warranty

Limited Warranty

This TR-1 product is warranted to be free from defects in materials or workmanship for one year from the date of purchase. Within this period, TR-1 will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident, or unauthorized alteration or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS, IMPLIED, OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL TR-1 BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

TR-1 retains the exclusive right to repair or replace the unit or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

Online Auction Purchases: Products sold through online auctions are not eligible for rebates or other special offers from TR-1. Online auction confirmations are not accepted for warranty verification. To obtain warranty service, an original or copy of the sales receipt from the original retailer is required. TR-1 will not replace missing components from any package purchased through an online auction.

International Purchases: A separate warranty is provided by international distributors for units purchased outside the United States. This warranty is provided by the local in-country distributor and this distributor provides local service for your unit. Units purchased outside the United States or Canada must be returned to a TR-1 authorized dealer in the United States for service.

To obtain warranty support, call or email TR-1 Technical Support Specialists to describe the problem you are experiencing and request a Return Material Authorization (RMA) tracking number. You will need to provide the unit's serial number (if applicable), your return shipping address, and a daytime telephone number.

Phone: 1-866-559-0229
e-mail: autopilot.support@garmin.com

After you receive the RMA number, securely package the unit and ship it (insured) to the following address:

Garmin International, Inc.
1200 E. 151st Street
RMA number (insert your RMA number here)
Dock Door #1
Olathe, KS 66062