ZERO OFF

GPS SPEED CONTROL

0.00 99
0.00 99
0.00 99
0.00 99
0.00 99
0.00 99
0.00 99

34.2

EX: 0.00

SLALOM S

SELECT

DOWN

UP

ON/OFF
MENU

OPERATION MANUAL

CONTENTS

ZERO OFF
GPS SPEED CONTROL

INTRODUCTION

ZeroOff is a new departure in boat speed control for watersports. It provides true closed loop control of boat speed which means that, as long as the boat motor has enough power, the boat will accurately track the speed desired by the driver without any need for complicated setup information to be entered into the system. Simply pick your desired speed, and shove the throttle handle wide open. ZeroOff will take care of the rest.

Closed loop speed feedback is based on signals received from the worldwide GPS satellite system put in place by the US government. For this reason, there is no need for maintenance intensive and unreliable pitot tubes or paddle wheels to provide a speed measurement. As long as the GPS antenna can see the sky, the ZeroOff is good to go with speeds controlled to within 0.1mph at all times… no calibration or setup procedures required. ZeroOff is NOT an engine RPM control system, although it can also be used in this mode. It is a true boat speed control system. It locks in on the target speed quickly and reliably with minimal overshoot, and handles turns without sagging or overshooting excessively. This makes it very well suited for use in sports such as Wakeboarding and Trick skiing. Wakeboarders will love how it handles double-ups. Drivers can quit worrying about what the speed is and focus completely on steering the boat.

For Slalom and Jump skiing, ZeroOff has been tailored to provide a similar feel to that provided by the expert hand drivers from the era before automatic speed control systems became available. Because it is a closed loop system, ZeroOff responds to how the skier pulls on the boat, and allows he or she to get free of the boat at appropriate times as they pass through the course. ZeroOff developers have worked closely with leading athletes from the world of three event skiing to ensure that not only is speed and course timing controlled accurately, but that the "feel" of the pull is outstanding and in synch with the skier's needs while passing down the course. Once again, all the driver has to focus on is maintaining his boat path.

Using GPS also allows ZeroOff to take advantage of position information provided by the satellite signals. ZeroOff can use GPS data to identify a boat's location on the surface of the earth with sufficient accuracy that courses for sports such as Slalom and Jump

competitions can be mapped and memorized. Once a course has been mapped into ZeroOff's permanent memory, it will always know when it is entering that course, and will provide all required speed control and timing measurements without the need for course magnets and magnet detector boxes. ZeroOff has been certified by the American Water Ski Association for use in all levels of Slalom, Jump and Trick competitions without the need for course magnets, and has shown itself to consistently control times in Slalom competitions to within +/- 1 hundredth of a second, regardless of adverse weather or course conditions, or skier variability. Competitive skiers like it because it levels the playing field and ensures consistent fair pulls through the course, while ski schools like it's ease of use in dealing with a wide range of skier styles and skill levels. No more entering skier and crew weights, or adjusting for head/tail winds or currents!!

ZERO OFF INTERFACE

Figure 1.

A. • 128 x 64 Back Lit Display Screen

B. • Select Button

C. • Scroll Down Button

D. • Scroll Up Button

E. • On/Off Menu

ZERO OFF FACEPLATE AND BUTTONS.

There are 4 user buttons for inputting commands, and a 128x64 pixel backlit LCD display showing operating parameters. General button usage involves tapping and holding the buttons to manipulate menus and parameter values.
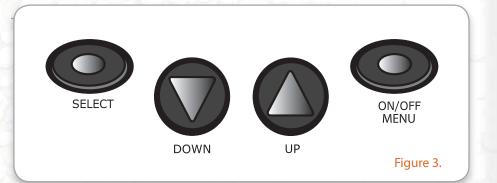
POWERING THE SYSTEM UP

The system turns on automatically when the ignition switch is turned ON. It will power up in the same configuration in which it was turned OFF as long as the battery has not been disconnected. This means that any speed or setup selections that existed when the ignition is turned off will be retained for the next operating session. The system will not function in speed control mode until a satisfactory GPS fix has been achieved, usually within 5-10 seconds of ignition ON. If the battery has been disconnected, the system will power up in a default mode.

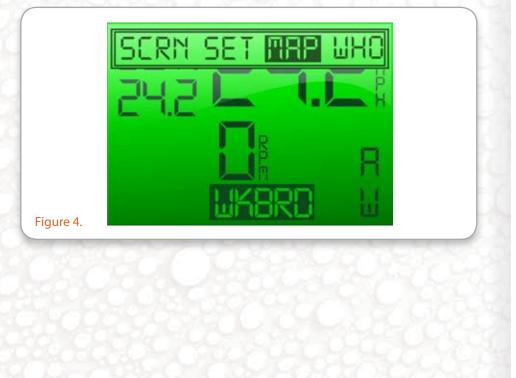## BUTTON OPERATIONS

SELECT

DOWN   UP

ON/OFF
MENU

Figure 2.

GENERAL BUTTON USE

A button "HOLD" usually requires keeping the button pressed for about 2 seconds, while a button "TAP" requires pressing and releasing the button in less than 1 second. Button actions are accompanied by screen responses and beeps from the display unit buzzer.
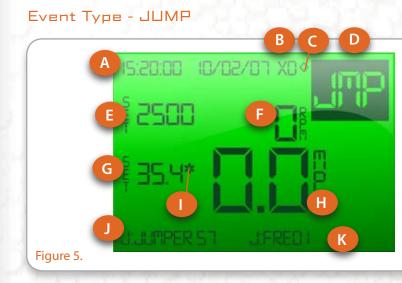
SELECT

DOWN UP

ON/OFF
MENU

Figure 3.

Tap <SELECT> to high-light variables
Tap <UP> or < DOWN> to modify selected parameter values.
Tap <ON/OFF> to turn unit on or off.
Hold <MENU> to invoke main menu system

Figure 4.

SCREEN MODES -Recreational

Event Type - JUMP

Figure 5.

A   **Time and date Indicator**
Time is shown XX:XX:XX
Date is shown MM/DD/YY

B   **Number of satellite**s
X = No Satellite fix
1-12= Number of satellites
D = Differential if present

C   **Page Icon**
Tap <SELECT> as required to highlight.
Tap<UP & DOWN> arrows to page up or down through the Screens (Recreational, Tournament & Timing Recap).

D   **Event Type Selection/Directional Arrow**
Event Type Selection: Highlight & Tap<UP & DOWN> arrows to change the event type (jump, slalom, trick, waypoint).

Directional Arrow: Reverts to this when Event Type is not active.
Directional arrow will show what direction the boat is moving in.
Arrow freezes when boat velocity is less than 1kph.

E **RPM set spee**d
Tap MENU while speed setpoint is highlighted to turn system on in RPM mode.
RPM mode only available from Recreational screen

F **Actual RPM**

G **Boat Set Speed (MPH or KPH)**
Fine Tuning: Highlight & tap <UP & DOWN> arrows to increase or decrease the set
speed by 0.1 MPH or KPH increments.

Fast Tuning: Highlight & hold < UP & DOWN > arrows to accelerate the rate of
change of set speed.

H **Actual Boat Speed (MPH**)

I **Official Tournament Set Speed**
System will pause briefly at official tournament speeds while modifying
set speed

J **Skier Selection**
If a skier is selected then the skier stored name will be shown in place of Latitude
(J for Jumpers only, see main menu).

K **Course Selection**
Only applies to Slalom, Jump and Waypoint.
If a course is selected then the stored course map name will be shown in place of
Longitude (see main menu).

SCREEN MODES -Recreational

Event Type - Slalom

Figure 6.

A **Time and date Indicator**
Time is shown XX:XX:XX
Date is shown MM/DD/YY

B **Number of satellite**s
X = No Satellite fix
1-12= Number of satellites
D = Differential if present

C **Page Icon**
Tap <SELECT> as required to highlight.
Tap <UP & DOWN> arrows to page up or down through the Screens (Recreational, Tournament & Timing Recap).

D **Event Type Selection/Directional Arrow**
Event Type Selection: Highlight and Tap <UP & DOWN> arrows to change the event type (Jump, Slalom, Trick, Wake, and Waypoint).

Directional Arrow: Reverts to this when Event Type is not active.
Directional arrow will show what direction the boat is moving in.
Arrow freezes when boat velocity is less than 1kph

E **RPM set spee**d
Fine Tuning: Highlight and Tap <UP & DOWN> arrows to increase or decrease the set speed by 10RPM increments.

Fast Tuning: Highlight and hold <UP& DOWN> arrows to accelerate the rate of change of set speed.

F **Actual RPM**

G **Boat Set Speed (MPH or KPH)**
Fine Tuning: Highlight and tap <UP & DOWN> arrows to increase or decrease the set speed by 0.1 MPH or KPH increments.

Fast Tuning: Highlight and hold < UP & DOWN > arrows to accelerate the rate of change of set speed.

H **Actual Boat Speed (MPH**)

I **Official Tournament Set Speed**
An asterisk is shown if the set speed (RPM or Boat) is an official tournament speed (Jump or slalom only).

J **Pull Type/Skier Selection**
A, B, or C
If a skier is selected then the skier stored name will be shown in place of Latitude (J for Jumpers only, see main menu).

K **Course Selection**
Only applies to Slalom, Jump and Waypoint.
If a course is selected then the stored course map name will be shown in place of Longitude (see main menu).

SCREEN MODES -Recreational

Event Type - TRICK

Figure 7.

A   **Time and date Indicator**
Time is shown XX:XX:XX
Date is shown MM/DD/YY

B   **Number of satellite**s
X = No Satellite fix
1-12= Number of satellites
D = Differential if present

C   **Page Icon**
Tap <SELECT> as required to highlight.
Tap <UP & DOWN> arrows to page up or down through the screens (Recreational, Tournament & Timing Recap).

D   **Event Type Selection/Directional Arrow**
Event Type Selection: Highlight & Tap <UP & DOWN> arrows to change the event type (Jump, Slalom, Trick, Wake and waypoint).

Directional Arrow: Reverts to this when Event Type is not active.
Directional arrow will show what direction the boat is moving in.
Arrow freezes when boat velocity is less than 1kph.

E **RPM set spee**d
Fine Tuning: Highlight & tap <UP & DOWN> arrows to increase or decrease the set speed by 10RPM increments.

Fast Tuning: Hi light and hold < UP & DOWN > arrows to accelerate the rate of change of set speed.

F **Actual RPM**

G **Boat Set Speed (MPH or KPH)**
Fine Tuning: Highlight and tap <UP & DOWN> arrows to increase or decrease the set speed by 0.1 MPH or KPH increments.

Fast Tuning: Hi light and hold < UP & DOWN > arrows to accelerate the rate of change of set speed.

H **Actual Boat Speed (MPH**)

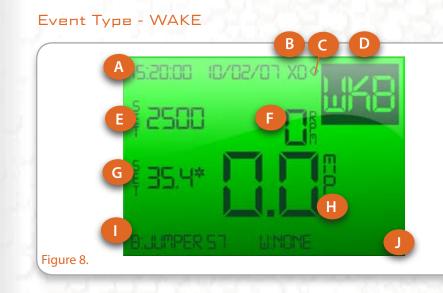**I** **Pull Type/Skier Selection**
A, B, or C
If a skier is selected then the skier stored name will be shown in place of Latitude (J for Jumpers only, See main menu).

J **Course Selection**
Only applies to Slalom, Jump and Waypoint.
If a course is selected then the stored course map name will be shown in place of Longitude (see main menu).

SCREEN MODES -Recreational

Event Type - WAKE

Figure 8.

A   **Time and date Indicator**
Time is shown XX:XX:XX
Date is shown MM/DD/YY

B   **Number of satellite**s
X = No Satellite fix
1-12= Number of satellites
D = Differential if present

C   **Page Icon**
Tap <SELECT> as required to highlight.
Tap <UP & DOWN> arrows to page up or down through the screens (Recreational, Tournament & Timing Recap).

D   **Event Type Selection/Directional Arrow**
Event Type Selection: Highlight & Tap <UP & DOWN> arrows to change the event type (Jump, Slalom, Trick, Wake and Waypoint).

Directional Arrow: Reverts to this when Event Type is not active.
Directional arrow will show what direction the boat is moving in.
Arrow freezes when boat velocity is less than 1kph.

E **RPM set spee**d
Fine Tuning: Highlight and tap <UP & DOWN> arrows to increase or decrease the set speed by 10RPM increments.

Fast Tuning: Highlight and hold <UP & DOWN> arrows to accelerate the rate of change of set speed.

F **Actual RPM**

G **Boat Set Speed (MPH or KPH)**
Fine Tuning: Hi light and tap <UP & DOWN> arrows to increase or decrease the set speed by 0.1 MPH or KPH increments.

Fast Tuning: Highlight and hold <UP & DOWN> arrows to accelerate the rate of change of set speed.

H **Actual Boat Speed (MPH**)

I **Pull Type/Skier Selection**
A, B or C
If a skier is selected then the skier stored name will be shown in place of Latitude. (J for Jumpers only, see main menu).

J **Course Selection**
Only applies to Slalom, Jump and Waypoint.
If a course is selected then the stored course map name will be shown in place of Longitude (see main menu).

SCREEN MODES -Recreational

Event Type - WAYPOINT

Figure 9.

Waypoint is used in recreational mode for locating a point that has been previously mapped. To map a waypoint see the Mapping section of the operational

A **Time and date Indicator**
Time is shown XX:XX:XX
Date is shown MM/DD/YY

B **Number of satellite**s
X = No Satellite fix
1-12= Number of satellites
D = Differential if present

C **Page Icon**
Tap <SELECT> as required to highlight.
Tap <UP & DOWN> arrows to page up or down through the screens (Recreational, Tournament & Timing Recap).

D **Event Type Selection/Waypoint Arrow**
Event Type Selection: Highlight and tap <UP & DOWN> arrows to change the event type (Jump, Slalom, Trick, Wake and Waypoint).
Waypoint Arrow: Is pointing in the direction of the way point.

E **RPM set spee**d
Fine Tuning: Highlight and tap <UP & DOWN> arrows to increase or decrease the set speed by 10RPM increments.

Fast Tuning: Highlight and hold <UP & DOWN> arrows to accelerate the rate of change of the set speed

F **Actual RPM**

G **Boat Set Speed (MPH or KPH)**
Fine Tuning: Highlight and tap the <UP & DOWN> arrows to increase or decrease the set speed by 0.1 MPH or KPH increments.

Fast Tuning: Highlight and hold the <UP & DOWN > arrows to accelerate the rate of change of the set speed.

H **Actual Boat Speed (MPH**)

I **Distance to waypoint**
If a way point is selected, DIST will equal the distance to the waypoint in miles.

J **Waypoint Name**

TOURNAMENTS

Event Type Modes - Jump

Figure 10.

A **Timing Display**
Positioned on left side of screen.
Shows the most recent run timing.

1st number is the 1st segment.
Smaller number under it is the deviation from the ideal time
(shown in hundredths of a second).

Highlighted: Time was Fast

Un-highlighted: Time was Slow

2nd number is the 2nd segment.
Smaller number under it is the deviation for the ideal time
(shown in hundredths of a second).

Highlighted: Fast

Un-highlighted: Slow

B **Boat Speed**
Stationary: When the boat is stationary the gauge will show the boat set speed.
Tap <SELECT> as required to highlight set speed.

Tapping UP/DOWN jumps the speed to the next official tournament speed.
Holding will result in rapidly jumping through the official setspeeds

Moving (over approx. 2 MPH): When the boat is moving over approx. 2 MPH the gauge will switch to showing the actual boat speed.

Moving & Highlighted: (over approx. 2 MPH) When the boat is moving over approx. 2 MPH the gauge will show the actual boat speed.

To modify the set speed while moving tap <SELECT> to highlight the speed.

Tapping UP/DOWN jumps the speed to the next official tournament speed. Holding will result in rapidly jumping through the official setspeeds

C **Official Tournament Set Speed**
An asterisk is shown if the set speed (RPM or Boat) is an official tournament speed (Jump or slalom only).

On tournament page, the set speed is always an official speed unless it has been modified to some intermediate value by switching over to the recreational screen to make the modification.

D **MPH icon target speed notification**
When the boat is locked on it's target speed the MPH icon highlights and the unit will beep.

E **Page Icon**
Tap <SELECT> as required to highlight, Tap <UP & DOWN> arrows to page up or down through the screens (Recreational, Tournament & Timing Recap available).

F **Actual engine RPM**

G **Pull Type**
A-ZZ with or without RTB

RTB – Return to base: Slows the boat in the second segment for less aggressive jumpers.

H **Operating mode/Course**
Shows JUMP until a course has been detected or selected. The nearest Jump course within 1km radius will

automatically be selected. To disable and force use of an arbitrary course manually, see MAIN MENU > MAP > ACTIVATE MAPPED COURSE.

I **ON/OFF button**
Tap <MENU> button to turn the cruise control on and off.

TOURNAMENTS

Event Type Modes - Slalom

Figure 11.

A **Timing Display**
Shows the most recent run.
Buoys 1-6 with actual times and deviations from ideal time for the current set speed (shown in hundredths of a second).
1st underline = Mid Course Time
2nd underline = Exit Time

Timing deviation
Highlighted = Fast
Un-highlighted = Slow

B **Boat Speed**
Stationary: When the boat is stationary the gauge will show the boat set speed. Tap <SELECT> as required to highlight set speed.

Tapping UP/DOWN jumps the speed to the next official tournament speed. Holding will result in rapidly jumping through the official set speeds

Moving: (over approx. 2 MPH) When the boat is moving over approx. 2 MPH the gauge will switch to showing the actual boat speed.

Moving & Highlighted: (over approx. 2 MPH) When the boat is moving over approx. 2 MPH the gauge will show the actual boat speed.

To modify the set speed while moving tap <SELECT> to highlight the speed.

Tapping UP/DOWN jumps the speed to the next official tournament speed. Holding will result in rapidly jumping through the official setspeeds

C **MPH icon target speed notification**
When the boat is locked on it's target speed the MPH icon highlights and the unit will beep.

D **Official Tournament Set Speed**
An asterisk is shown if the set speed chosen is an official tournament speed (Jump or slalom only).

E **Page Icon**
Tap <SELECT> as required to highlight.
Tap <UP & DOWN> arrows to page up or down through the Screens (Recreational, Tournament & Timing Recap available).

F **Last Buoy Timing Display**
This display will update to the most recent buoy timing as the boat travels thru the course. B1-B6 = Buoy 1 – Buoy 6 times EX: = Exit time

G **Pull Type**
A-C
A is a more aggressive pull, C is least.

H **Operating mode/Course**
Shows SLALOM until a course has been detected or selected.
Automatic course detection: The nearest slalom course within 1km radius will automatically be selected. To disable and force use of an arbitrary course manually, see MAIN MENU > MAP.

I **ON/OFF button**
Tap <MENU> button to turn the cruise control on and off.

TOURNAMENTS

Event Type Modes - Trick

Figure 12.

A **Boat Set Speed**

B **Actual Boat Speed**

C **Page Icon**
Tap <SELECT> as required to highlight.
Tap <UP & DOWN> arrows to page up or down through the Screens (Recreational, Tournament available).

D **Pull Type**
A-C

E **Operating mode**
Shows TRICK always

F **ON/OFF button**
Tap <MENU> button to turn the cruise control on and off.

TOURNAMENTS

Event Type Modes - Wake

Figure 13.

A Logo Box

B Actual Boat Speed

C Set Speed
Tap or hold <UP & DOWN> arrow to change the set speed.

D Page Icon
Tap <SELECT> to page back to recreation.

E ON/OFF button
Tap <MENU> button to turn the cruise control on and off.

SCREENS - TIMING

Jump

Figure 15.

Jump
Latest & Last: Shows history of the 2 most recent SEG 1 & 2 times.

Slalom

Figure 16.

Slalom
Latest & Last: Shows history of the 2 most recent sets of buoy timings, with mid course and exit timing highlighted.

MAIN MENU

Map
Function
Tap <SELECT> to invoke highlighted menu item

Figure 17.

Figure 18.

Creating new course maps – Store up to 10 maps.
Tap the <UP & DOWN> arrow keys to highlight the default course.

Name "Spare 0-9"

Tap <SELECT> to map/set-up course

Tap <MENU> to return to the previous screen

Activate a mapped course
Tap the <UP & DOWN> arrow keys to highlight the pre-mapped courses you want to activate.
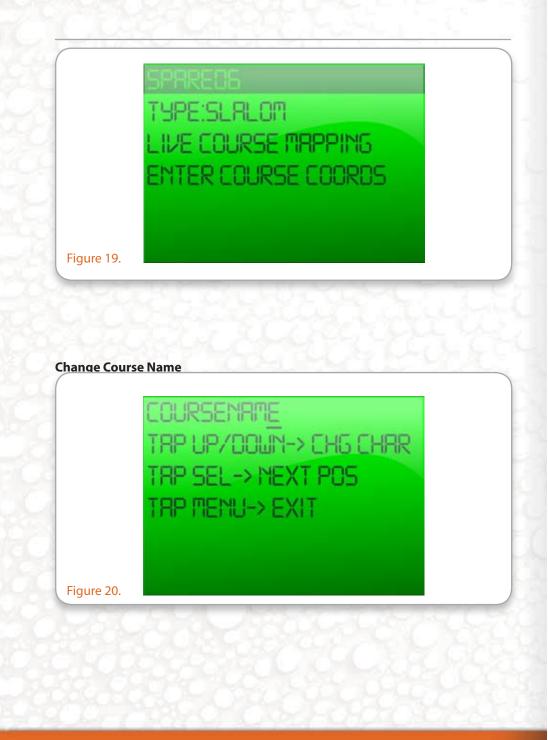
Tap <SELECT> to activate the highlighted course map.

Tap <MENU> to return to the previous screen.

Remap a pre-mapped course
Tap the <UP & DOWN> arrow keys highlight pre-mapped courses you want to modify.

Hold <SELECT> (2 seconds or until you hear 2 beeps) to modify course map variables.

Figure 19.

Change Course Name

Figure 20.

Course Mapping

MAPPING SLALOM WITH
DIFFERENTIAL GPS FIX
BEST MAPPING ACCURARCY
IDLE THRU 1ST GATE
TAP SEL AT GATE

Figure 21.

The head unit instructs the driver to tap the SEL button while idling through the entry and exit gates. This button tap should occur at the instant when the GPS antennas cross the plane of the gate (not the pylon). This will ensure more consistent entry gate triggering when going through the Slalom course in opposite directions.

It is not necessary to map more than the entry and exit gates since two points define a straight line, and the location of all gates in a properly surveyed Slalom or Jump course should be completely defined by the two gates mapped. Once the ZeroOff unit knows the location of these two gates, it simply calculates where all the remaining gates should be.

For timing purposes, ZeroOff uses the location of the entry gate as a trigger, and then calculates buoy times based on tracking how far it has travelled down the course. Distance down the course is calculated using knowledge of how fast the boat is travelling rather than triggering on the individual gate GPS coordinates. Since speed is know with very high accuracy, these distances are calculated with high accuracy, and are not subject to the slow +/- 1-2 meter drift inherent in the GPS position estimates. Thus, buoy time measurements are not subject to errors caused by normal GPS position estimate drift. GPS based velocity measurements are inherently more accurate than position estimates since they are based on a different physical measurement technique.

Status bar

MAPPING SLALOM WITH
DIFFERENTIAL GPS FIX
BEST MAPPING ACCURACY
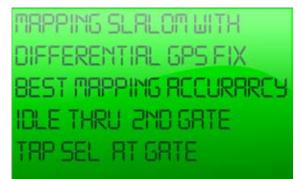IDLE THRU 2ND GATE
TAP SEL AT GATE

Figure 22.

Progress bar shows how far boat has progressed toward the 2nd gate to be mapped.

Will also sound a series of beeps as the boat nears the 2nd gate whose intensity increases to a solid beep at the gate.

While bringing the boat up to speed to the point where the ZeroOff speed control engages, the driver may manipulate the throttle as desired to pull the skier up and line the boat up for entry to the course. Once the boat has achieved the target speed, it is very important that the driver ensures the throttle handle is pushed all the way forward. Failure to advance the throttle to the full open setting while running the course may result in slow times since throttle handle position provides an upper limit on how much torque the engine is allowed to produce. A wide open throttle handle position frees up the engine to produce it's maximum torque output and allows the speed control to operate at it's optimum level.

Enter Course Coordinates

SLALOM COORD ENTRY
1ST LAT 29^33.0249374
UP/DN->CHG 1ST LAT
TAP SEL-> 1ST LONG
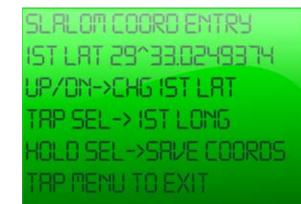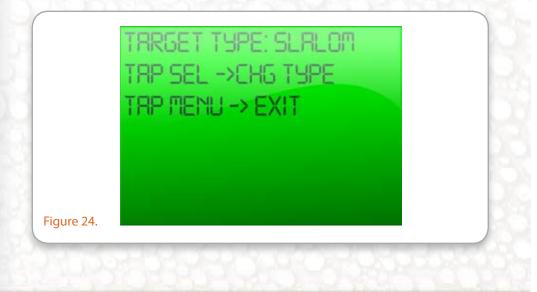HOLD SEL->SAVE COORDS
TAP MENU TO EXIT

Figure 23.

Use of this option requires knowledge of the course coordinates with very high precision, down to the 5th decimal place of a minute of latitude and longitude.

Select Course Type

TARGET TYPE: SLALOM
TAP SEL ->CHG TYPE
TAP MENU -> EXIT

Figure 24.

ZERO OFF

GPS SPEED CONTROL

WARNING; EXCLUSIVE REMEDY; LIMITATION OF LIABILITY; ASSUMPTION OF RISK.

a. Warning. The Product is designed solely for use with competitive water ski and wakeboard watercraft operating under ideal, calm conditions, utilizing a spotter and all other safety crew and requirements of tournament water skiing. The Product should not be used for any other purpose or under any other conditions.

b. ASSUMPTION OF RISK. YOUR PURCHASE AND USE OF THE PRODUCT IS EXPRESSLY CONDITIONED UPON YOUR ASSUMPTION OF ALL RISKS, DANGERS, CLAIMS AND LOSSES RELATING TO THE USE OF THIS PRODUCT, WHETHER OCCURING PRIOR TO, DURING OR SUBSEQUENT TO OR DIRECTLY OR INDIRECTELY CONNECTION TO SUCH USE, AND WHETHER CAUSED BY ANY PERSONS NEGLIGENCE OR OTHERWISE.

c. Sole Remedy. Purchaser's sole remedy for any claims, demands, losses or causes of action relating to any and all liability for damages for personal injury, property loss or economic loss arising from the purchase and use of this Product shall be limited to the replacement of the Product or a refund of all or a portion of the purchase price therefore, at the Purchaser's option, pursuant to Seller's Product warranty.

d. LIMITATION OF LIABILITY.   IN NO EVENT SHALL SELLER, ITS DIRECTORS, OFFICERS, AGENTS, EMPLOYEES AND/OR DEALERS ("SELLER") BE LIABLE TO PURCHASER, ITS CUSTOMERS, ASSIGNS, EMPLOYEES, AGENTS OR USERS (AUTHORIZED OR UNAUTHORIZED) ("PURCHASER") FOR INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES OR DAMAGES, LOSSES OR EXPENSES FOR PERSONAL INJURY, PROPERTY LOSS OR ECONOMIC LOSS, ARISING DIRECTLY OR INDIRECTLY FROM ANY ALLEGED BREACH OF WARRANTY, BREACH OF CONTRACT OR ANY ACT, USE OR OMISSION OF ANY PERSON, TORTIOUS OR OTHERWISE, INCLUDING BUT NOT LIMITED TO NEGLIGENCE, STRICT LIABILITY AND PRODUCT LIABILITY, WHETHER AT EQUITY OR AT LAW. PURCHASER HEREBY RELEASES AND FOREVER DISCHARGES SELLER UNDER ANY CIRCUMSTANCE AND THEORY OF LAW FROM ANY LIABILITY FOR THE SALE AND USE OF THE PRODUCT IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT. {1220171:}