Accuski ETC Operation Guide v9.00

Table of Contents

Manual Revision 1.2 for the latest revision visit www.accuski.com

Chapter I: Overview

A. Button Functions

- Press "⇑" To increase the value of a highlighted line
- Press "⇓" To decrease the value of a highlighted line
- To scroll to the next line, press "E"
- To go to the next screen selection indicated by the highlighted line, press "**T**"
- To return to the previous screen, press "**H**"
- To arm the system for an Auto-Pull-Up, press the red arm button

B. System Set-Up

The following three procedures must be performed before initial use of the system.

1. Potentiometer calibration – make sure engine is OFF. *This procedure is required so the AccuSki ETC system can learn where the idle and full throttle positions are for your particular boat.*

    1. On initial power-up, the system will require that you perform a "**ThrottleCal**" In this case go to step 4 below. From the home start-up menu, select AccuSki by scrolling the highlighted line to "**AccuSki**" with the "**E**" button and then pressing "T".
    2. You will now be at the AccuSki Screen. Press and hold "**H**" for five seconds to move to the setup and calibration screen. (See photo below)
    3. Highlight "**ThrottleCal**"using the **E** button and press "**T**".
    4. Follow the screen directions: Put the hand throttle in neutral and press "**E**".

5. When prompted, put the hand throttle all the way forward to full throttle, and press "**E**".
6. When system is finished sampling press "**H**" to return to the AccuSki Screen.
7. This procedure needs only to be performed once to set up the system, or in the event any changes or adjustment are made to the throttle linkage.

2. Boat selection. *This will set up the RPM Baselines (how many RPM's for each speed) for your boat type.*
    1. From the AccuSki Screen, Press **"H"** for five seconds to go the Setup/calibration screen.
    2. Highlight "Calibration" using the "**E"** button, then select by pressing "**T"**.
    3. Highlight the third line (boat type) with the "**E"** button and select your boat type with the **up/down arrow** buttons. Press "**E"**. You will be prompted if you want to load the baseline data, press "**E**" for yes, "**T**" for no. If your boat is not listed, pick the closest selection. For further fine-tuning and calibration, and to use the Auto-calibration feature, read Chapter II, section A.

3. Throttle Adjustment. *This procedure is required so the AccuSki ETC system can learn where the hand throttle position is for various speeds. This will allow a smooth transition when engaging to and from manual control of your boat. This procedure will require you to engage the system at four separate speeds, and the system will memorize the hand throttle position for those speeds.*
    1. From the AccuSki Screen Press "**H**" for five seconds to go the Setup/calibration screen.
    2. Highlight the fourth line "**ThrottleAdj"** with "**E"**; select with "**T"**.
    3. Ensure that the boat has a clear path so the system can accelerate to the indicated speed (14mph being the first).
    4. Perform an auto-pull up or manual pull up to the indicated speed (if the values are way off you will not be able to perform an autopull up yet, so engage using the manual pull up method). Follow instructions in Section C, Quick operating guide for the proper engagement procedure.
    5. For approximately 5 seconds after locking on to the set speed, the system will sample the throttle position and will show "Sampling" on the screen. When the

system stops sampling, pull the throttle back to idle. Wait for the next speed to increment automatically.

6. Repeat steps 4 and 5, for the next three speeds. (34mph is the max speed).
7. Press "**H**" to return to the setup/calibration screen, press "**H**" again to return to the AccuSki screen. **You are now ready to Ski!**

C. Quick Operation Guide

To chose any menu item use the E button to scroll the highlight to the item and then select the item with the T button. Remember that E scrolls the highlight and T selects the item.

RPM Based in Slalom & Jump. AccuSki is RPM based in slalom and jump mode, just like you drive now manually. Use the same thought process. In tailwinds, drivers normally back off a needle width on the RPM gauge (or speedo). With the AccuSki, you need to do the same, however you now can be more precise. Just press the up or down arrow keys at the RPM Adjust line to adjust the rpm set point in 5 rpm increments.

To Ski:

1. Select Event: slalom, tricks, jumping or wakeboard.
2. Select preset 0-9 with the up/down buttons.
3. Press "**T**' to go to the screen for the selected event.
4. Set the desired speed, skier weight, crew weight (total weight of the boat crew including driver, passenger, and lead weights).

Check Slalom setup settings

Press "**T**" twice to select the Event sub-menu

Select the "**PURATE**"; this is the pull-up rate, normally 18-22. Raise it for a faster pull up; lower for a softer pull up.

Select the "**AccuGate**" mode, "OFF" is the default, "Gate" for a slightly slower pull before the gates, or "55m" for the utilization of a magbuoy on 55 meter pre-gate

Set the "**TurnDelay**" time: 0 sec for straight in approaches, 1-20 sec for turn around islands

Set the "**Turn Rpm Mx**" island max rpm: usually about 2900 rpm.

Set the "**Timing Segments**": select proper number of timing segments: 1, 2, 3, 7a, or 7b, or 7c. 7a is the all-buoy timing method that takes times between each ball. 7c is the all-buoy timing method that cumulates times at each ball. All are IWSF approved.

Before each pass

In slalom, adjust "**RPMADJ**" for wind, normally down 5-20 rpm in a tailwind and then back up a similar amount to the original setting for the headwind. As rope gets shorter additional 5 rpm increments may also be required. In jumping, adjust "**RPMADJ**" up or down based on times from prior jump.

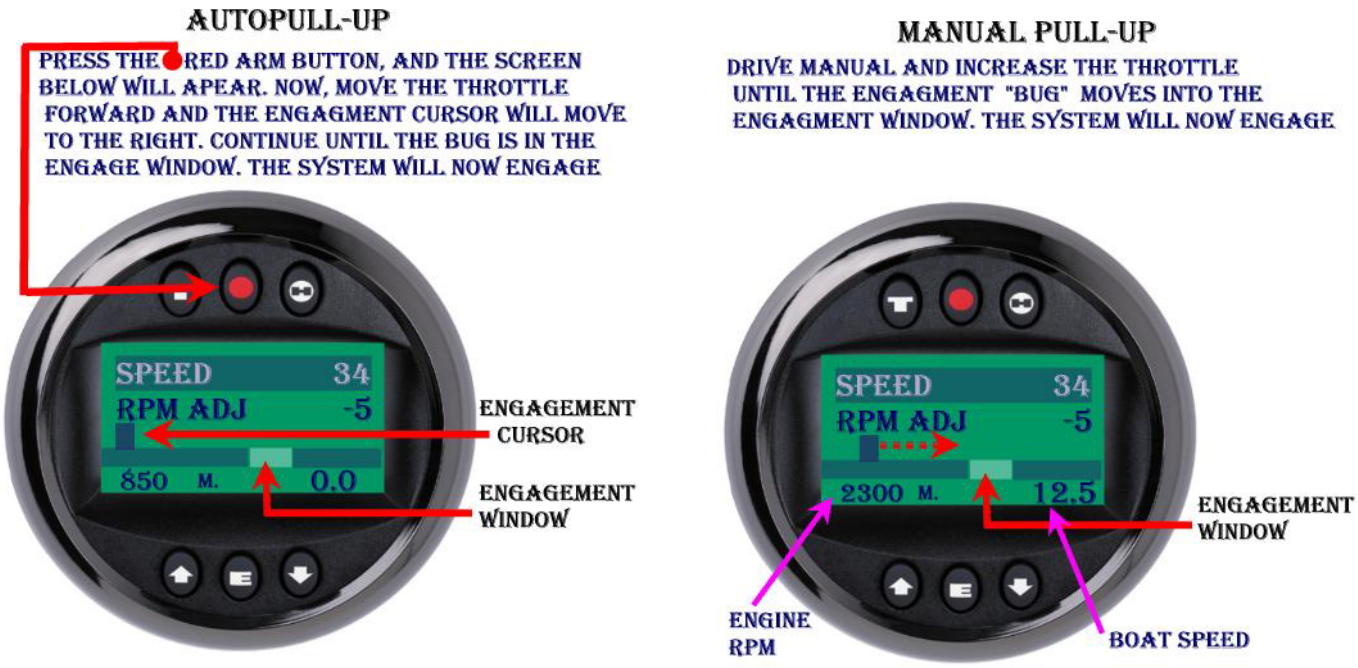
Manual Engagement

- Pull up skier manually with hand throttle.
- System will automatically display the "engagement graph" (see photo above).
- Advance the throttle until the engagement cursor enters the engagement zone, the system will accelerate to the rpm set point, lock on, and then hold speed.
- To disengage the system, pull the throttle back and control will return to the hand throttle.
- For running back to back passes without stopping at the course end: exit the course, pull back the hand throttle to take over manual control. As you come out of the turn, advance the hand throttle until the engagement cursor enters the engagement window.

For Auto-Pull Up

Use the automatic pull up feature for most setups; especially straight in, short approaches. The pull up rate can be adjusted from a value of 2 to 99. Too high a value may result in the boat overshooting your desired speed. If this happens lower the pull up value. Normally use a pickup rate of between 20-30.

- Press red arm button. Display will blink "ARMED" and horn will beep.
- Put hand throttle in gear; confirm skier is ready and rope is tight.
- Advance the hand throttle until the engagement cursor (see photo below) moves into the engagement zone. Do not move the throttle further.
- The system will beep twice, pull the skier up and accelerate to the rpm set point, lock on, and then hold speed.
- To disengage the system, pull the throttle back and control will return to the hand throttle



Turn Around Islands. This feature allows the boat speed to be controlled around the turn island. For turn around island sites or long approaches set the delay menu screen to an appropriate number of seconds and the turn island maximum rpm. The system will limit the boat speed to the turn

island maximum rpm during the delay while you go around the island. After the delay time expires, the boat will then advance to your desired speed.

Example: If the system has a set point of 3400 rpm for a particular speed and skier/crew weight, and you set a delay of 10, and a turn island max rpm of 2700. Upon performing an auto pull up, the system will advance the engine to 2700 rpm for 10 seconds after engaging the auto pull-up, before advancing the engine to 3400 rpm.

Adjustments

RPMADJ: With the same skier and conditions, every 5 rpm will result in about a 0.02 second change in the full course time. After completing a pass, you may need to fine tune the speed to get the course time desired; simply adjust the "**RPMADJ**" value up or down as appropriate. Therefore you can train at any speed you choose with 0.02 sec precision: actuals, slightly hot, slightly slow, a tenth hot, a tenth slow, etc.
Example: *You Run a 36 mph pass through the slalom course and get a time of 16.18 which is a deviation of +0.10 from the actual time of 16.08. You then dial in an* "RPMADJ" *value of +25 to get a 16.08 on the next pass.*

SEGADJ: (Range 0-50) The second segment time may be adjusted by pressing and holding the **H** button while on the Slalom event screen. Then use the **up/dn** buttons to adjust the second segment time up or down. A negative number slows the second segment.

Course Timer

After completing a pass, the timing screen will appear for 14 seconds. (The 14 sec is a default value that can be changed in the setup screen). The timer screen will display the time and the difference from ideal time for the selected speed. Any out of tolerance time will be displayed in "reverse video" to indicate to the driver that the pass is NOT IN TOLERENCE. See Chapter II Section E. for more details about the timer operation. The **red** button will reset the timer in the event of a false magnet hit.

Using the Recommended RPM adjust and Quick Calibrate Features

Overview: After completing a slalom pass, the timing screen will display for 14 seconds (showing the times and deviation from actuals), then a recommend RPM screen will appear; see photo below. This screen has two functions:

1. Displays the change in RPM the system calculates that is needed to achieve an actual time, and changes the "RPM ADJUST" value by that amount.

2. Displays the change in RPM the system calculates that is need to achieve an actual time, and changes the baseline tables by that amount. **This is a permanent change.**

You can chose to do nothing (no changes) by waiting for the disappear and return to the main slalom screen or press "H." To determine if you should change the "RPM Adjust" value or the baseline is determined by the situation. If you are initially calibrating the system or are getting times that are consistently off, use the change baseline feature. If you times are normally accurate, but you need

to make temporary adjustment for winds, shortening of the rope or adjust for the differences between skiers, use the "RPM Adjust" feature

Recommended RPM Adjust

After the timer screen displays for 14 seconds, the recommended RPM Adjust screen will appear. This screen will show what the system recommends for an adjustment in RPM to get an ideal time.

- To accept the recommendation, press "**T**"
- To decline, press "H" or do nothing and the screen will disappear in 14 seconds without making an adjustment. (The 14 sec is a default value that can be changed in the setup screen).
- This recommended RPM will change the value on the "RPM Adjust" line on the main slalom screen by the recommend amount.

For Example: If you had a RPM adjust of +10 RPM before you ran a pass, and after completing the pass the Recommend RPM adjustment is –20 RPM and you press "**T**" to accept the change; the system will subtract the recommended –20 rpm from the existing +10 rpm value of the RPM adjust line and change the value to –10 rpm.

Baseline Change After the timer screen displays for 14 seconds, the recommended RPM Adjust screen will appear. This screen will show what the system recommends for an adjustment in RPM to get an ideal time.

- To Change the RPM Baseline by that amount, scrolling down the screen with the "**E**" button until "**Baseline**" is highlighted and then press "**T**"
- Do not change the baseline when adjusting for wind, currents, shorter rope lengths, etc; for these adjustment you should use the RPM adjust.

Tricks & Wakeboard

Adjust the speed in +/- 1 mph increments with "**T"** and "**H"** respectively and fine adjust speed in +/- 0.1 mph increments with the **up/dn arrow** buttons. Press the red button while locked on to speed to start the 20 sec timer and horn. This function is discussed in further detail in Chapter IV.

D. Screen Descriptions

ACCUSKI: This screen appears upon system power-up and is used to select the event you wish to ski.

The digit to right of the event is the *skier- preset number*, to change the preset number use the **up/dn** buttons. The skier-preset feature is further discussed in Chapter II, section 4. Scroll to the desired event by pressing "**E**", then press "**T**" to select that event.

Slalom Screens: These two screens are used to select the variables for the slalom event.

MAIN SLALOM SCREEN

SUB SLALOM SCREEN

Main Slalom Screen: To select and change the commonly changed values for the slalom event.

"SPEED": This first line indicates the desired boat speed. The standard convention applies; Press "**E**" to select the line, use the **up/dn** arrows to change the value.

"RPM ADJUST": Changes the rpm set point in 5 rpm increments, which typically equates to a 0.02 change in course time. This allows you to compensate for winds, currents, shorter line lengths, skier variability or to just increase or decrease the time/speed to skier's preference.

"SKIER WEIGHT": Enter the skier's weight to the nearest 5 pounds. Skier weight adds additional rpm to the baseline rpm to compensate for the skier's load on the boat. Skier Weight is a close approximation of the skier's load on the boat. This parameter does not cause any change in the pull other than increasing the set point rpm.

"**CREW WEIGHT**": Enter Crew's weight to the nearest 5 pounds. The crew weight should include the driver, all passengers, and equipment. This adds additional rpm to the baseline rpm to compensate for the boat crew load. *New Feature*: Highlighting this line and pressing "T" will bring up the crew weight calculator.

Sub-Menu Slalom Screen: To select seldom used variables for the slalom event.

"Pull Up Rate": [1-99] This sets the Pull Up rate, the higher the number the quicker the pull up. This only affects the rate at which the boat pulls up a skier from a deep-water start.

"Wind RPM": *This feature can only be used with the optional GPS module.* Enter the RPM that you want to be automatically added to or subtracted when the boat is pointed in the direction of the "**Heading**" shown below. When the boat reverses direction the RPM you added will be taken away, or if the "**Wind RPM**" is negative the rpm will be added when the boat is headed in the opposite direction of the "**Heading**"

"Heading":[0-359] The compass direction of your slalom course, used with "**Wind RPM**".

"**ACCUGATE**": AccuSki has two different options that allow the boat to enter the course at the slowest possible speed, allowing the skier to get the best possible start for the gate. To, scroll to the desired choice (55m, Gate, or Off), press the up/down buttons to choose. Both 55m and Gate modes are approved for sanctioned USA WaterSki competition.

1. "Gate" delays the application of all the RPM dictated by the skier's weight setting until the gate entrance magnet is passed. .
2. "AccuGate 55M". This method requires that a magbuoy be placed on the 55-meter "pre-gates" to enable the AccuSki system to know where it is in the slalom course so as to precisely back off the throttle and add throttle when the skier begins the turn into the gates
3. "Off" turns off the AccuGate feature. The system will hold constant rpm at all times.

"**TURN DELAY**": Sets the delay period in seconds after the auto pull up during which the system shall maintain the "TURN Rpm" before increasing the RPM to the rpm set point. Use this feature for turn around island setups.

"**TURN Rpm Mx**": sets the maximum rpm for the delay period entered above.

"**TIME SEGMENTS**": [1,2,3, 7a, 7b or &7c] This is number of timing segments desired depending on number of magbuoys installed. 1 for full course time only; 2 for 1st and 2nd segments; 3 for 1st buoy, 1st segment and 2nd segment; and 7a, 7b or 7c for ALL BUOY TIMING.

Setup Screen: This screen is used adjust the AccuSki general system parameters:

To enter the Setup Screen:

1. At the Event Screen, press "**H**" for five seconds to move to the setup and calibration screen.
2. Highlite Setup and press "**T**".

"**SCRNTIM":** [1- 99] Sets the number of seconds that TIMER SCREEN will remain displayed after the end gates.

"**RPMADJT":** [1- 99] Sets the number of seconds that RECOMMENDED RPM SCREEN will remain displayed after the end gates.

"**TACH PPR**": [4 or 2] All engines are 4 pulses per revolution, except Toyota which is 2.

"UNITS": [English or Metric] selecting metric will automatically convert the current skier weight, crew weight and speed, to kilograms and kilometers respectively.

The following features can be accessed thru the setup screen by pressing the T button:

Restore Factory Defaults: Press "**T**" from the SETUP screen and the screen will show "Restore Factory Defaults" Press ENTER and you will be prompted "Are you sure" press "**E**" for Yes, "**T**" for no. This will restore all factory default settings except rpm baselines.

Manual Speedometer Calibration and speedo selection: This screen is used to change the venturi or pitot (speedometer input) pickup used for the AccuSki 2000 digital speedometer. "**HIGH**" the system will use the pickup registering the highest speed, utilizing this option allows the system to automatically switch inputs if one pickup becomes clogged. "**PORT**" selects port pitot pickup. "**STAR**" selects starboard pitot pickup. To manually calibrate the speedos select calibrate and choose star or port pick up. Drive the boat at a known speed, press "**E**", then adjust the digital readout with the arrow keys to match the known speed. Press "**E**" to save. Repeat for the other pickup.

Mag-Buoy strength tester: Press "**T**" three times from the SETUP screen and the screen will show the Magbuoy strength screen. Drive manually through the course and

the strength of each mag-buoy will register [0-100] Any value less than 30 indicates a weak magnet. Ideally, all magbuoys should be within 5 units of each other.

Calibration Screen: This screen is used to select boat Type, Edit Baseline tables, Auto-Calibrate, and save the user's baseline table.

CALIBRATION SCREEN

EDIT TABLE

To enter the Calibration Screen:

1. At the Event Screen, press "**H**" for five seconds to move to the setup and calibration screen.
2. Select Calibration and press "**T**".

EDIT TABLES: This screen is for manually adjusting the baseline RPM for a particular speed. The Slalom Table is shown above however; Trick and Jump, and Wakeboard Tables look identical.

To change an rpm baseline:

1) Use the **up/dn** buttons to select the speed that you want to adjust the baseline.
2) Press **"E"**when you have the desired speed selected and the " RPM" line will be highlighted.
3) Adjust the RPM value with the **up/dn** buttons.
4) Press "**H"** to return.

Jump and Trick calibration is adjusted with the same procedures, Press "T**" to toggle between the Slalom, Trick/Wakeboard and Jump Tables

AUTO CAL: This calibration method uses the AccuSki ETC computer to compare the slalom course times for the following speeds 14, 20, 28, and 34 mph with the ideal times. The computer then calculates the required baselines needed for those speeds to achieve an ideal time through the slalom course and interpolates the proper baselines for all other speeds. Auto-calibration also calibrates the AccuSki digital speedometers automatically. See Chapter II, Section A, Para 1 for more details.

SELECT BOAT: Used to select your boat type to set up initial baselines. Select your boat type and press "**T"**. You will be prompted if you want to load the baseline data, press "**T**" for Yes, "**H**" for no. If your boat is not listed select the closest selection.

SAVE USER: Saves your personal baselines for future use. Pressing "**T**" from this line will save the baselines that are currently in memory as adjusted with the Edit Table screen. You can restore your user baseline settings if changes are inadvertently made or if you changed them for a different site by selecting "**USER**" on the "select boat" menu and pressing "**E**" twice. The password is "8127" when you are prompted. There are three separate user tables, allowing you to save settings for up to three different sites.

D. "On the fly" Speed/Rpm adjustment

When the system is engaged the screen below will display both the RPMADJ and speed settings. This screen allows one touch adjustment of speed or rpm. To adjust the highlighted line, just press the **up/dn** buttons, on the "**SPEED**" line every button press will be 1 mph, on the "**RPMADJ**" line every button press will change the rpm by 5 rpm. To change the highlighted line from "**SPEED**" to "**RPMADJ**" or from to "**RPMADJ**" to "**SPEED**" press the "**E**" button.

Lock Out: In the slalom mode, the driver is locked out of the UP/DOWN keys once the timer picks up the first magbuoy. The driver can adjust on the fly anytime before. In the trick mode, the driver can adjust the speed up or down while engaged in 0.1 or 1.0 mph increments (5 rpm & 50 rpm increments in the RPM tricks mode).

On the Fly Adjustment

Press the Up/Down button to change the value of the highlited item (speed/rpm)

Chapter II. General Operation

CALIBRATION SCREEN

A. Baseline Calibration:

Each speed that you use should be calibrated to make use of the computer's ability to calculate the rpm set point for each different speed. The calibration numbers will be different for every boat, due to differences in props, hull drag, engine performance, etc. Factory preset baselines are for the average boat. However the differences between individual boats require different RPM for the same speed, so calibration is necessary. Once calibrated you should never need to recalibrate unless you change props. There are three separate calibration baseline tables: 1) Slalom 2) Trick 3) Jumping.

Three methods of calibration are available:

1. Quick Calibratre

2. Auto- Calibration

3. Calibration of each and every speed that you intend to use. This is done with the "EDIT TABLES" feature.

1. **Quick Calibrate Baseline Change**: After the timer screen displays for 14 seconds, the recommended RPM Adjust screen will appear. This screen will show what the system recommends for an adjustment in RPM to get an ideal time.

- To Change the RPM Baseline by that amount, scrolling down the screen with the "**E**" button until "**Baseline**" is highlighted and then press "**T**"
- Do not change the baseline when adjusting for wind, currents, shorter rope lengths, etc; for these adjustment you should use the RPM adjust.

2. **Auto-calibration:** This method uses the AccuSki ETC computer to compare the slalom course times for the following speeds 14, 20, 28, and 34 mph with the ideal times. The computer than calculates the required baseline rpms needed for those speeds to achieve an ideal time through slalom course and interpolates the proper baseline rpms for all other speeds. Auto-calibration also calibrates the AccuSki digital speedometer.

   a. From the Event screen, press "**H**" for five seconds to move to the setup and calibration screen.
   b. Select Calibration and press "**T**".
   c. Select AutoCal and press "**T**".
   d. The screen shown to the right will appear; the 1st auto cal pass of 14 mph is automatically set for you

AUTO-CALIBRATION SCREEN

   e. Enter the proper "**CREW WT**",

   f. Enter "**RPM ADJ"** if needed to compensate for a head or tail wind

   g. Press the **T** button.

   h. Select AccuG to "Y" if you have magbuoys on the 55m balls. Select "N" otherwise.

   i. Select the "**CAL SPEEDO**" value you desire. "**BOTH**" to calibrate both speedo pickups, "**PORT**" or "**STAR**" to select only one pick up, or "**NONE**" for do not calibrate speedometers.

   j. Select **"YES"** for "**CAL BASLINE"** to auto calibrate the rpm baseline values, unless you only want to calibrate the speedometer inputs.

   k. Select "OFF" for "IGNORMG" to turn off the timer's function that ignores the opposite side magbuoys. This may be necessary if your initial baseline rpms are way off. If you are not picking up times during the autocal process at any speed, turn "IGNORMG" off.

   l. Press **H**.

m. Prepare to run the slalom course without a skier, perform an auto pull-up or manual pull up and run a pass at the preset speed of 14 mph.

n. Upon the completion of your 14mph pass, disengage and stop the boat, a timing screen will appear indicating the course time and deviation from "ideal" times. The times and deviations for 20, 28 and 34 will show 0.0 because you have not run those yet.

o. After the timing screen is displayed for 14 seconds, the screen shown above will reappear with the speed automatically incremented to 20 mph.

p. Run the slalom course at the set 20mph.

q. Following steps (o-q) above again run passes at 28 and 34 mph.

r. After running the last pass at 34 mph, wait until the timer screen is no longer displayed, and press "**H**". The screen will show what speed ranges and speedos are being calibrated.

s. Press "**H**" again. Press "**H**" one last time and you will return to the Home screen. You have completed calibrating your AccuSki and are ready to ski. This entire process takes approximate 5 minutes, and normally you should achieve times close to ideal. If you desire you can rerun the Auto-Calibration procedure to achieve even more accurate results.

3. **<u>To calibrate a particular speed:</u>**

a) Go to "**Slalom**" screen, set the speed, set the skier weight at 0 pounds and the crew weight to the crew's (including driver) total weight. Make a run through the slalom course and make note of the time and deviation from actual time. Divide the deviation from the actual time by 0.004, this will give you an estimate of RPM change needed to run an actual time. [This is an approximation, every 5 RPM change will effect at .02 change in slalom course time for the average boat]

Example: *Run a 36 mph pass through the slalom course and get a time of 16.33 which is a deviation of +0.25 sec from the actual time of 16.08. Dividing +0.25 by0.004 gives you a needed adjustment RPM of +62.5.*

b) Go to the "**Slalom**" scroll to the "RPM adjust line" and enter the rpm adjustment determined in step a) above [round to the nearest 5 rpm]

Example: Enter +65 rpm in the "RPM adjust line"

c) Re-run the pass and repeat the steps in a) and b)

Example*: On the second pass the time is 16.04, a deviation of -.04 from an actual time of 16.08. Dividing* -.04 by .004 gives you an adjustment RPM of –10.

d) Follow steps a, b, & c above, for each speed you want to adjust.

Then, from the Event Screen, press "**H**" for 5 seconds and select "Calibration"

The following menu appears:

Edit Tables
Auto Cal
Boat Type
Save User

e) Select "EDIT TABLE" by highlighting and pressing **T**. The screen shown to Left will appear.

Using the **up/dn** arrows scroll to select the speed desired.

Press **E** to highlight RPM. Adjust the baseline RPM up or down with the **up/dn** arrows by the amount determined in steps a) through c).

Press **H** to save the new settings.

To save your new baseline table highlight the "Save User" line and press T. This will save your personal baseline tables under a boat name called "User". The boat named "user" can then be reloaded by selecting "user" in the 3rd line of the calibration menu.

Press "**H**" to go to the HOME screen

To Edit the Trick, Wakeboard and Jump Tables, Press "**T**" to toggle between the tables.

Once calibrated, you will not have to guess the skier's rpm number to pull an actual time. Inputting the speed desired, the boatload, and the skier weight, will allow the computer to calculate the proper rpm setpoint that is very close to an actual time for any skier. Variances will occur for skiers of different abilities. A 34 mph longline skier weighing the same as a 35 off skier will require a lower rpm set point because the pull is not as hard. Adjusting for varying skier abilities should be done with the "RPM ADJUST" feature at the slalom screen and not with the calibration screen.

TRICKS: If the baseline calibration rpm is too high at trick speeds the system will initially overshoot the set point speed in the TRICK SPEEDO mode and then take longer to settle in on the set point speed. Therefore, it is important to properly calibrate the lower speeds for tricks.

B. Digital Speedometer Calibration:

AccuSki digital speedometer is highly accurate and responsive. It must be calibrated to read the correct speed and for the speed based modes in Tricks and Wakeboard events to work properly. To calibrate you will need to compare the boat speed with a known speed source such as a radar gun, handheld GPS, previously calibrated analog speedometer gauge, or time the boat with a stopwatch or the course timer built into the AccuSki.

Basic operation: Pitot pickups or Borg-Warner's Venturi pick ups feed both the port and starboard pressure readings to the Accuski computer. You can choose to display the port, starboard, or highest reading. Select "Setup" from the Home screen and press T twice to get to the speedo select screen.

Calibration: The recommended method to calibrate the digital speedometer is to use the Auto-Calibrate feature outlined in Chapter II, section A.1.

To manually calibrate the speedometer follow the following procedure: To calibrate the port or the starboard speed-reading, Select "Adjust" from the speedo select screen, select the port or starboard line, press "E" once. The line will blink. Drive the boat manually to any steady constant speed, 30 mph recommended. Using a radar gun, handheld GPS, previously calibrated analog speedo, or course time data, adjust the digital speed reading with the up or down keys until the displayed digital speed matches the reference speed. Then press "E" to lock it in. Repeat for the other pitot or venturi pick up.

C. Fall Button Operation: (optional)

Fall: Immediately when skier looses handle: press the fall button once.

Miss: (skier misses but is still skiing): press fall button once upon miss, then when the ski line re-tightens, press the fall button again

How it operates: When pressed once, the rpm value for the skier's weight is subtracted from the rpm set point, When pressed a second time during the same pass a preset fraction of that rpm value is added back.

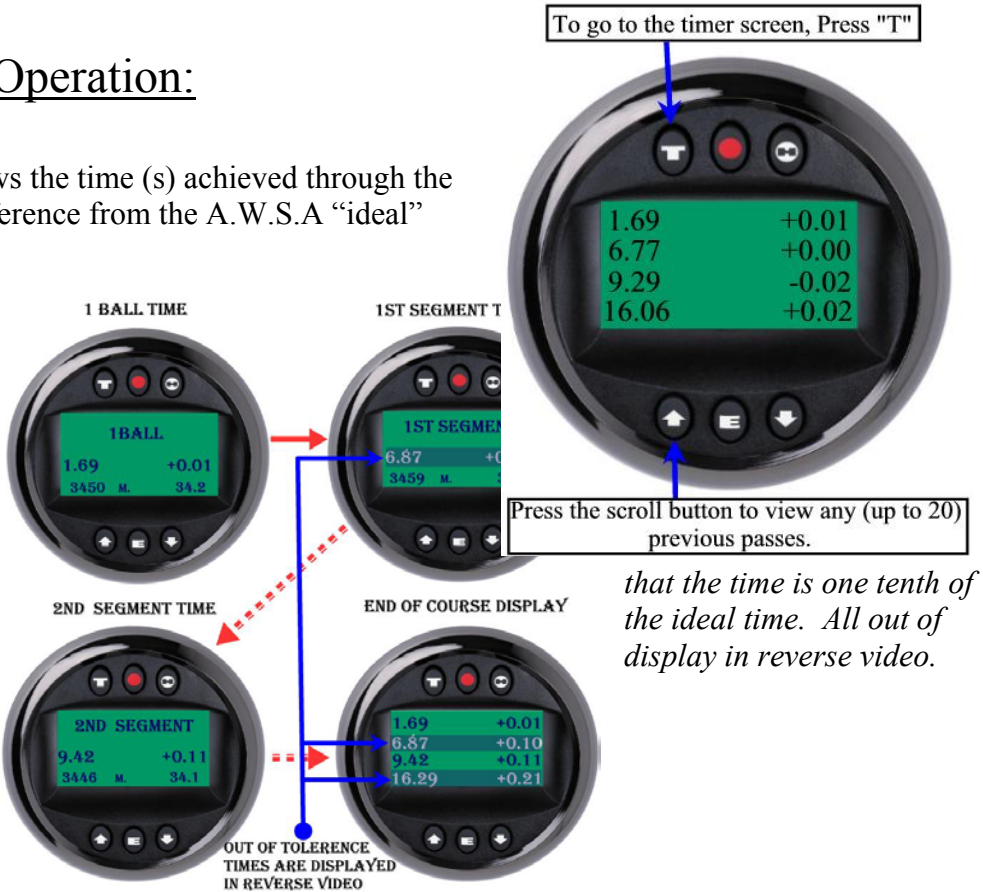
Better Alternative: Use all buoy (7 segment) timing. The fall button is eliminated with all buoy timing. See attached all buoy timing chart. Times are taken only until the miss or fall. All buoy timing is IWSF & AWSA approved.

D. Skier presets: Memorizes skier's weight, speed, pick-up rate and crew weight, no need to re enter you data ever time you ski.

There are 10 presets for each event. The presets may be accessed from the EVENT menu. Select the event desired, slalom, tricks, or jumping by highlighting with the **E** button. Now use the **up/dn** arrow keys to scroll to the desired preset. The number to the right of the selected event will scroll from 0 to 9. Press **T** to select the desired preset. The screen will then go to the selected preset's screen.

E. Timer Operation:

The timer screen shows the time (s) achieved through the slalom course and difference from the A.W.S.A "ideal" times.



For Example: *+0.04 means that the time is four one hundredth of a second slower than the ideal time, correspondingly -0.10 would mean a second faster than tolerance times will that the time is one tenth of the ideal time. All out of display in reverse video.*

Chapter III. Operation Hints and Tips:

A. **RPM Based in Slalom & Jump.** Accuski is RPM based in slalom and jump mode, just like you drive now manually. Use the same thought process. In tailwinds, drivers normally back off a needle width on the RPM gauge (or speedo). With the AutoThrottle, you need to do the same, however you now can be more precise. Just press up or down arrow keys at the RPM Adjust line to adjust the rpm setpoint in 5 rpm increments.

B. **Adjustability.** With the same skier and conditions, every 5 rpm will result in about a 0.02 second change in the full course time. Therefore you can train at any speed you choose with 0.02 sec precision: actuals, slightly hot, slightly slow, a tenth hot, a tenth slow, etc.

C. **Lock Out.** In the slalom mode, the driver is locked out of the UP/DOWN keys once the timer picks up the first magbuoy. The driver can adjust on the fly anytime before. In the trick mode, the driver can adjust the speed up or down while engaged in 0.1 or 1.0 mph increments (5 rpm & 50 rpm increments in the RPM tricks mode).

D. **Automatic Pull Up**. Use the automatic pull up feature for most setups; especially straight in, short approaches. The pull up rate can be adjusted from a value of 2 to 99. Too high a value may result in the boat overshooting your desired speed. If this happens lower the pull up value. Normally use between 20-30. High altitude sites may require higher numbers. Experiment to find the pull up that you like.

E. **Turn Around Islands**. <u>This feature allows the boat speed to be controlled around the turn island</u>. For turn around island sites or long approaches set the delay menu screen to an appropriate number of seconds and the turn island maximum rpm. The system will limit the boat speed to the turn island maximum rpm during the delay while you go around the island. After the delay time expires, the boat will then advance to your desired speed.

   Example: If the system has set point of 3400 rpm for a particular speed and skier/crew weight, and you set a delay of 10, and a turn island max rpm of 2700.

Upon performing an auto pull up, the system will advance the engine to 2700 rpm for 10 seconds, before advancing the engine to 3400 rpm.

F. **Manual Pull Ups or turns without stopping**.

1. Pull the skier up manually with the hand throttle. Keep accelerating until the engagement cursor is in the engagement window, see Chapter C, Quick Operation Guide.

2. For running back to back passes without stopping at the course end: exit the course, pull back the hand throttle to take over manual control. As you come out of the turn, advance the hand throttle until the engagement cursor enters the engagement window.

Chapter IV. Trick and Wakeboard Mode

Two Modes: Accuski 2000 provides two available modes for trick and wakeboarding.

a. Rpm control: The boat speed is controlled only by engine rpm.
b. Speedometer based control: The boat speed is controlled directly by reading speed at the pitot tubes. Speedo based mode is required for sanctioned competition.

MainTrick Event Screen: This screen is used to select the variables (Speed, Skier weight, Crew weight, and RPM adjust for the RPM mode) for the trick event. When utilizing the speed based modes in Trick and Wakeboard event the speed can be set in 0.1 mph increments with the arrow keys. Hold the key down to adjust in 1.0 mph increments. To access the sub-menus press "T" to toggle between the screens.

MAIN TRICK SCREEN

TRICK SUB-MENU

Trick Sub-Menu:

"PU RATE": Set the rate of pick up as in slalom, the higher the number the stronger (faster) the pull up.

"TRKTIMER": Sets the number of seconds for horn to sound.

"MODE": Sets the mode of operation for the event:

"RPM": The boat speed is controlled only by engine rpm.

"SPEED": The boat speed is controlled directly by reading speed at the pitot tubes.

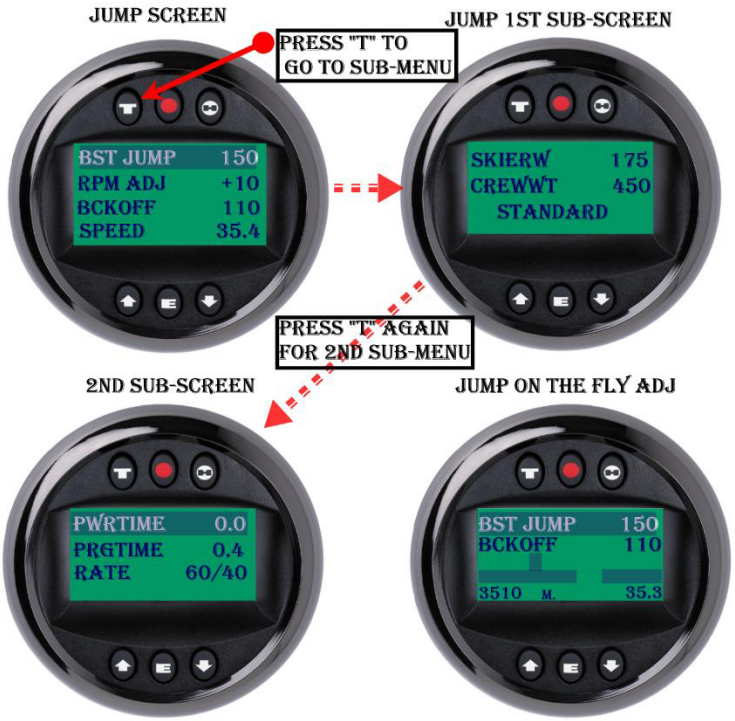
"TIMER": Trick/Wakeboard timer only, must drive manually.

For changing speed after pulling up the skier, refer to the display graphic below:

Chapter V. Jumping Mode Instructions

Theory of operation. The jump mode is pure rpm based. The software has been written to exactly mimic the throttle movements of world class jump drivers. A rope tension switch mounted on the rope near the towbar tells the system when the skier is pulling and when the skier is not pulling. To make full use of the system magbouys should be utilized. However, the system still provides a great jump pull without using magbuoys. To use the system the driver inputs the speed desired, the skier's weight, the crew weight, and the best jump distance of the skier. The computer then calculates the rpm values necessary to pull the skier at the desired speed throughout the various segments of the jump course. Information from the tension switch and the magnetic timing buoys is also fed to the computer and used to maintain the desired speed.

Jump Set Up:



"Best Jump" and "Skier Weight": The amount of throttle advancement given in the skier's pull is determined from an internal formula based upon the skier's weight and the Best Jump value. The amount of throttle during the pull can be adjusted up or down by changing the "**Best Jump"** distance in the jump menu. This number will need to be adjusted for each skier and after each jump to maintain times in the center depending on the ability level of each skier you pull. Do not adjust the skier's weight value to adjust the amount of throttle because this will result in bringing the skier into the course at the wrong speed. This is the same concept a Perfect Pass ™ jump letter that is determined by a skiers weight and best jump, however AccuSki does the calculation for you. Every 15 feet of Best Jump is equivalent to a letter in the PerfectPass system.

"Power Time", "Prog Rate", & "Prog Time": These three values may be modified, but we do not recommend any change to the factory preset values of 0.0, 60/40, and 0.2 respectively, except for Open division men jumpers which may require a change to the ProgRate and ProgTime.

"Power Time" is the additional time over the preset internal time that the throttle will remain on during the pull to the ramp after the tension switch disengages.

"Prog Rate" is progressive rate of the throttle application. A setting of 60/40 means that 60% of the throttle is added at the start and the remaining 40% is fed in after the **Prog time** has elapsed. A higher Prog Rate value will make the pull less progressive.

"Prog Time" is the additional time over the internal preset time between the system adding the "**Prog Rate**" (factory default is 60%) of the throttle and the remaining percentage of the throttle. A higher number will spread the application of the throttle out.

Open Division: Open division jumpers prefer a Prog Time setting of 0.0 and a Prog Rate setting of 70/30.

"Air Backoff": This is the amount of additional rpm reduction that will occur while the jumper is in the air. The range is –300 to +300 rpm. Normally this value is set at about 110. (Use negative Backoff numbers in the range of –300 to –250 for the new IWSF fast second segment rule.) Raise this value to slow down 2nd segment times if the 2nd segment times are consistently hot over the 1st segment times.

Tension Switch. Attach the tension switch to the tow rope next to the tow bar. For lighter skiers, place the tension switch on the rope where the rope is doubled spliced close to the tow bar (rope is thicker) as this will require lighter force to engage the switch. For heavier skiers, place the tension switch farther down the rope where the rope is thinner so that higher force will be required to engage the switch. Make sure the tension switch is secured to the tow bar with the strap and that the switch is plugged directly into the fall/jump button module socket.

Operation

1. Select jumping.
2. At the jumping screen, select speed desired, back off rpm, and best jump distance.
3. Hit "**T**" and select the skier weight and crew weight values.
4. Hit "**T**" again to go to the jump setup menu and verify the factory recommended default values are set for each parameter. Press "**H**" to return to jumping screen.
5. Pull up skier manually; during approach to jump course advance hand throttle slowly until bug goes into graph window. Stop moving hand throttle when display reads "Engaged".
6. The system will take over, lock onto the rpm setpoint, automatically add & back off the throttle when required according to the skier's pulls on the tension switch, and take both segment times. The system will automatically disable the jump tension switch when the boat passes the 2nd Magbuoy.
7. To disengage, pull the hand throttle back.

Adjustments

1. Use the "**Rpm Adjust**" line to adjust the rpm setpoint for wind, tide, or other minor adjustments when timing the boat without a skier.

2. Adjust the "**Best Jump"** distance up or down after each jump to keep the segment times centered. The amount of throttle advancement given in the skier's pull is determined from an internal formula based upon the skier's weight and the Best Jump value. The amount of throttle can be adjusted up or down by changing the Best Jump distance. This number will need to be adjusted for each skier depending on the ability level of each skier you pull. Do not adjust the skier's weight value to adjust the amount of throttle because this will result in bringing the skier into the course at the wrong speed. You may increase the Best Jump distance to an amount +50 over the skier's actual best jump. Every 15 feet of Best Jump value is equilivent to a letter in the Perfect Pass system.

3. **"Air backoff"** Adjust this value higher if you consistently are getting 2nd segment times hotter than 1st segment times. Factory default is 110 rpm. Use negative 200 to negative 300 for the new IWSF fast second segment rule.

4. In the jump setup menu there are some other values that may be modified, but rarely would you modify them from the factory defaults. These parameters are the "**Power Time",** the **''Prog Rate",** and the **"Prog Time"**, and the "**CC Time**".

   The "**Power Time"** value is preset at 0, which except under very unusual circumstances should not be modified. Power Time is the additional time over the preset internal time that the Power Add will remain on for the ramp pull after the tension switch disengages. This parameter only works with magnetic timing. You should increase this number if the system is backing off too soon on the ramp.

"**Prog Time**" is the additional time over the internal preset time between the system adding the Prog Rate percentage (factory default = 60%) of the throttle and the remaining percentage of the throttle. The higher the Prog Time and the lower the "**Prog Rate**" the more progressive the pull. 0.2 and 60/40 are the factory default settings and provide good progressive pulls for almost all skiers. Open division skiers prefer the "**Prog rate**" set at 70/30 and the "**Prog Time**" set at 0.0.

Chapter VI. Safety Features and Warnings

1. Two steps are required to engage in the auto pull up mode.
   a. The red "arm" button must first be pressed to arm the system. The system will disarm in 30 seconds if it is not engaged by moving the hand throttle forward.
   b. The hand throttle must be placed in the forward position.

2. Any movement of the hand throttle to neutral or reverse will cause the servo to return the engine to idle, and power is cut from the servo.

3. Over-rev protection. The system automatically shuts down in the event the Tach wire becomes disconnected, preventing an over-rev condition from occurring. System shut down also occurs on signal errors, voltage errors, over current conditions, and other hardware & software failure events.

4. The system will not advance past the EVENT screen unless the engine is in neutral.

5. If a malfunction does occur, put the boat in neutral, and immediately turn off the ignition key.

6. Do not allow anyone to use the system unless they have read fully this operation guide and warnings, and you have completely checked them out in the system's operation.

7. **Course Dimensional Errors**. AccuSki automatic timing system can easily pick up a 6" error in a slalom course. A timing buoy that is only 6" off will produce a 0.01 s timing error. This error is most apparent on one-buoy times, especially if the opposite one ball is off a like amount but in the opposite direction. This can produce one-buoy times that are off by 0.02 s.

8. **Upside down magnets** Magnets that are upside down, will produce timing errors of 0.05 - 0.08 seconds. If you get a different time going in different directions in the slalom course

an upside down magnet might be the cause. Using different type and size magnets may also cause such errors.

9. **Speed based modes.** In tricks speedo mode the system uses the pitot tubes for speed sensing information. Periodically, blow out the pitot tubes to clear them of water. Also, select "HIGHEST" under the setup sub-menu screen. This allows the system to read the highest pitot tube in case weeds block one of the tubes.

10. **Do not jump start the boat**, remove the battery, or reinstall the battery with the System power switch in the on position. This will fry the System computer in a nanosecond.

Chapter VII. Trouble Shooting

Spring on some carbureted engines, Malibu Vortec, and '96-98 Malibu Monsoon. On a few engines a return spring is required. Some engines already have the spring. If needed and its not on the engine, connect the supplied spring from a suitable location on the engine to the hole at the back of the throttle arm on the engine throttle body. You may need to stretch the spring out some, depending on the layout to get the right tension. The spring should be adjusted so that it brings the throttle arm back to idle but does not cause too much force against the servo. If the engine already has a spring you may also need to adjust it. This spring is necessary to pull the arm to idle on some engines.

"Speedo Calibration Error, Unit needs Service" - Unit really does not need service. This can be corrected two ways. First and the easiest, from the setup screen, press T, at "Restore Factory Defaults" press E twice. This will restore the speedo calibration

"Speed Table is Corrupt, return for service" - Again, no need to return for service. This error occurs when the baseline rpm for a higher speed has been erroneously set lower than that for a lower speed. To fix you can go to the Calibrate menu and then to "Edit Tables" and find the offending speed and fix it. Or, simply reload the baseline table for your particular boat using the 3rd line of the Calibration menu. You will then need to run auto-calibrate again to fine tune the baselines.

LT1 Engines. The spring on the throttle arm is frequently not installed right at the factory or sometimes the end of the spring is not in the groove that holds the spring in place. If the spring is not installed correctly the engine will not go back to idle, but will idle at high rpm. Frequently on LT1 engines you will need to wrap the spring around the throttle shaft one more time to get the right "return to idle" action.

Carbureted engines. If you experience surging while in the course, disconnect the secondaries on the carburetor. On some carbureted engines the secondaries kick in and out right at 34-36 mph, so they should be disconnected for slalom course skiing. There is usually a small cotter pin holding a short linkage to the secondaries, which you simply remove to disconnect the secondaries. Also, having too tight or strong of a return spring will cause this problem.

Speed Oscillations. If you experience speed oscillations while locked on or the speed greatly overshoots during the pull up, you may have too much slack in the cable going from the servo to the throttle lever arm. If there is too much slack, the servo uses up part of its travel taking up the slack instead of opening up the throttle. This puts the servo cam lobe in too early. Take up the slack by either adjusting the ball joint at the end of the cable or pulling the cable tighter through the cam and tightening with the lock screw on top of the cam.
Surging or speed oscillations can also be caused by a poor ground connection. Connect a wire directly from the ground wire of the system to the boat's battery ground.

Doesn't reach "RPM Lock" or gets slow segment times after getting actual one balls. You may have too much slack in the cable going from the servo to the throttle lever arm. If there is too much slack, the servo uses up part of its travel taking up the slack instead of opening up the throttle. Take up the slack by either adjusting the ball joint at the end of the cable or pulling the cable tighter through the cam and tightening with the lock screw on top of the cam.

System resets or shuts down in hard turns or over wakes. Your power and ground wire connections are probably loose or are connected poorly. Make sure the connections all make good contact. The ground connection must be secure. Improper non-noise suppression spark plug wires or non-resistor spark plugs can also cause power shut downs and glitches.

Times are not consistent, speed seems to wander, speed slows down in middle of course, speed surges. This is usually caused by a bad ground connection. Even if all appears that you have a good

solid ground connection, run a ground jumper wire from the wire labeled "ground" directly to the negative ground post on the boat's battery. This will solve the problem.

Tach wire error message displayed. This is caused by a loose tach wire connection. Recheck the connection. This message is also displayed if you attempt to engage the system with the engine not running.

Erratic Times. Unusual times are usually caused by upside down magnets. Listen to the engine and watch the tach gage. If the engine does not change by more than 50-100 rpm in the course and sounds steady the system is working properly and the magbouys are probably upside down or cracked.

Surging or speed oscillations in tricks. The pitot hoses may have water. Disconnect the hoses and blow the water out. Also, you may have the limits set too high in the trick setup screen; try lower numbers.

Servo Voltage Error. If you see this error message, your boat's electrical system voltage has fallen below 10.0 volts or gone above 15.0 volts, causing the speed control to shut off. The voltage encountered will be displayed in the lower right hand corner. This error is normally caused by a faulty alternator, voltage regulator, or battery. It can also be caused by a loose alternator belt. It can be caused by running too many electrical items at once that causes a voltage drop. It can also be caused by a loose power or ground connection to the MMDC, so check your connections on the red power wire and the black ground wire.

Abnormal Reset Error. If you see this message, simply turn the power off and turn the power back on. This error can be caused by a glitch in the boat's electrical system or radio interference that causes the system to reset. Simply cycle the power off and then back on to correct. This error will also occur if water is sitting on top of the 18 pin plug on the MMDC. Turn the power off, let it dry then recycle the power.

Timer Displays "Timing Error" Insure that you have the correct number of segments set. This value is set in the "SETUP SCREEN" [refer to the operation guide] One segment is for full course time only, Two segments is for 1st & 2nd Segment timing, Three segments for 1st buoy, 1st & 2nd Segments, and Seven segments is for all buoy timing.

Timer does not pick up any magnets, or only does for low speeds: AccuSki does not register magbuoy "hits" until the system is within 450 rpm of the RPM set point. This feature is to prevent picking up erroneous timing hits before entering the slalom course. If the boat does not get within 450 rpm of the set point before the entrance gates the timer will not pick up the magbuoys. Possible cause for not achieving set point are: 1) Too much slack in cable to servo. 2) Pivot bolt placement on Throttle arm is too far from throttle shaft, 1.5 inches is the norm 3)Pick up rate is too low, or 4) you have too high a delay value set in the slalom setup screen.

Transmission does not shift properly, Note occasionally after installing the transmission mounted safety switch, the transmission shift linkage may get out of adjustment. At the end of installation, be sure and check that the transmission goes into reverse and forward gears properly.

LIMITED WARRANTY

AccuSki is warranted by Borg-Warner for one year from date of purchase for Manufacturer's defects. The warranty is not valid if the computer is damaged from improper battery jumping. No other warranties are given, either expressly or implied. Borg-Warner is not liable for consequential damages of any kind.