Official Speed Control of USA WaterSki & U.S. National's

Official Speed Control of the Pro Tour, Masters, U.S. Open, Malibu Open

DigitalPro

By PerfectPass

Version 6.5N

ST300 Paddlewheel

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WORLD LEADER IN SPEED CONTROL

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APPENDIX

Warning: PerfectPass highly recommends you become familiar with the operation of your new boat prior to using the speed control. (Leave in OFF position).
Once you are familiar and comfortable with the operation and handling of your boat, try the speed control in the different modes without a skier to familiarize yourself with its operation. If you feel it is not working properly or have questions, leave in the OFF position and contact PerfectPass or your dealer immediately.

USER'S GUIDE

Section 1. GETTING STARTED

INITIAL SETUP - The display will guide you through this set up. Read slowly and carefully.

Your new PerfectPass system must now complete a short set up procedure to familiarize itself with your particular boat and engine. *(This may have been performed by your dealer if factory installed)*

Step (1) Engine Selection. On some systems you will be asked to select the engine in your boat. It will appear as [6.0 / 8.1 ^ = Yes], or for Malibu [LS1 / 8.1 ^ = Yes]. This means if you have an optional 6 or 8.l Litre engine, press **UP**. For 5.7 L and all others, press **DOWN**.

Step (2) The display will now show [read in MPH ^ = Yes]. It is asking you if you would like the display to operate in mph. If you do; confirm by pressing the **UP** key. If you want kph press the **DOWN** key. (We have selected mph for illustration purposes)

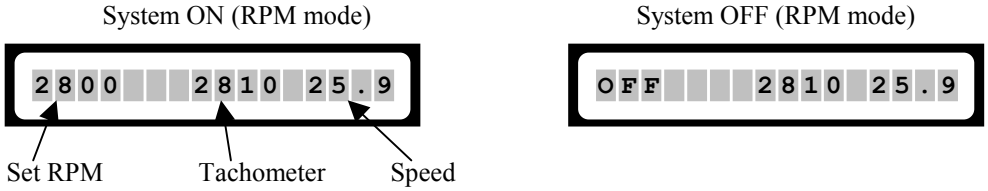
Step (3) [WAKEBD ONLY ^=Y] The display will now ask if you are a wakeboard only user. If you only intend to use the system for wakeboarding and open water skiing, press the **UP** key. For three event course skiing and wakeboarding, press the **DOWN** key. If you selected wakeboard only, the system will only have the following modes; Wakeboard, RPM, and Simple Slalom. You can switch back & forth later if you wish. See Section 8 page 13, General Information).

Step (4) The display will now ask you for the total crew weight, [CREW ADJ 000]. Dial in the approximate total weight of the driver and crew (in pounds). Press **MENU** key to proceed. This is for use in the Slalom, Jump, and Magnet Test modes only.

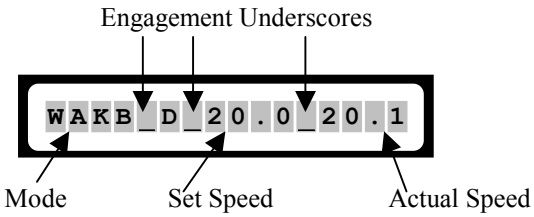
Step (5) The display will now move into the Slalom mode, described in the next section.

GETTING FAMILIAR WITH PERFECTPASS

Turning System ON and OFF – All system functions require the PerfectPass control system to be powered up (ignition in ON or Accessory position). The **ON/OFF** key turns the PerfectPass control ON or OFF. The system requires the boat to be in neutral before turning the system ON or OFF. After pressing the **ON/OFF** key [IN NEUTRAL ^ =Yes] will appear to remind the driver, and confirm the boat has been returned to neutral. When PerfectPass is OFF it will not engage. Any time you operate your boat the system will be powered up, although it can be in the OFF mode. Every time you power up PerfectPass it will return to the last event and speed that was used.

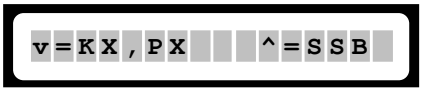


Engaging System – With PerfectPass ON, the system will automatically engage once the Set Point is reached. PerfectPass requires the driver to bring the boat up to and slightly past the set point before it will engage. When the system engages it will sound an audible beep and underscores will appear on the screen. In Wakeboard mode the screen appears as follows:



Disengaging System – The PerfectPass system is unable to increase throttle position past the physical position of the throttle handle. This important feature gives the driver the power to over ride the system at any point by simply pulling back on the throttle. If the throttle handle is moved back past a point slower then where the system needs to be to control it will disengage. The underlines will disappear and boat will be under manual control.

Understanding the Menu – The **MENU** key allows you to move through the various features and event modes as well as recalling timing data. Any time you scroll through the menu and see a "v =" or "^ =" the system is prompting you to press either the **UP** or **DOWN** keys to select or confirm an opinion. In the following example the system is indicating if you would like to adjust your KX or PX values to press the **DOWN** key, and to adjust the SSB value press the **UP** key.

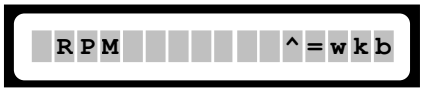


CHANGING MODES

As a Digital Pro the system will have all 6 modes (Simple Slalom only available in Wakeboard Pro). As a Wakeboard Pro the modes will be limited to Wakeboard, RPM, and Simple Slalom. To change modes press the **MENU** key until you see one of the following messages. Press the **UP** key to go to the next mode (abbreviated on the right hand side of the screen).

Digital Pro

Wakeboard Pro



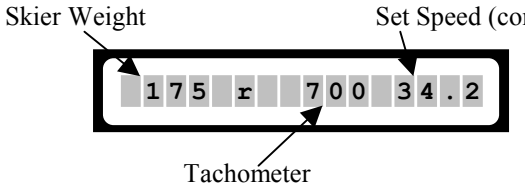
Section 2. SLALOM MODE

USING SLALOM MODE

The Slalom mode is designed to give a skier an optimum and consistent pull through a Slalom course while producing perfect timing passes.

- **Set Speed** - Speeds 24.9 mph through 36.0 mph use the RPM Based Slalom
  - Speeds 15.5 mph through 23.0 mph use Speed Based Slalom
- **User Preference** - You can access the Slalom Tournament mode if in RPM Based Slalom

The main RPM based Slalom screen appears as follows:



Main Slalom Screen

Entering Crew Weight - press **MENU** key 8 times from main screen and [CREW ADJ XXX] will appear (XXX=crew weight in pounds). Press **UP** or **DOWN** keys to set total weight of driver and crew.

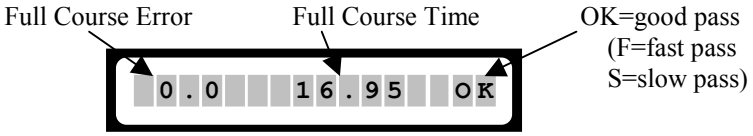
Selecting Set Speed – press **MENU** key twice, from main screen and [SPEED XXk = YY.Y] will appear (XX = Set Speed in kph, YY.Y = Set Speed in mph). Press **UP** or **DOWN** keys to select desired Set Speed

Entering Skier's Weight – skier weight appears on the left hand side of the screen while in RPM Based Slalom and can be adjusted by pressing **UP** or **DOWN** keys. The above screen shot indicates a skier weight of 175 pounds. If you are in the Speed Based Slalom mode press **MENU** key 3 times from the main screen and [^ = NEW SKIER] will appear, press **UP** key to enter new skier weight. If you are in the Tournament Slalom mode press **MENU** key 3 times from the main screen and [WEIGHT lbs XXX] will appear (XXX = skier weight).

NOTE:
Expert skiers will generally require their weight to get a good time, while novice skiers will likely use a lower value.

Driving Slalom - Pull the skier up normally and when the boat speed reaches the desired set speed you will hear an audible beep as it takes control. (Underscores will appear on screen to confirm engagement).

Timing - If not using a Smart Timer or optional Hand Timer this timing information will not apply to you. At the end of each timed pass, the full course time will be briefly shown as



The first digits displayed are the error from actual time. The screen will then flip over and display the first and second segment times followed by the error and suggested RPM Adjust for the next pass. At any point, you can press the **MENU** key once from the main Slalom screen to review the times prior to the next pass. Times will be cleared when timer is triggered. To quickly return to main screen, press the **UP** key. See 'Section 8 – Integrated Timing' for more details on setting up timing devices.

Suggested RPM Adjust - After your system has been calibrated the suggested rpm adjustment can be made to the skier weight if the times are not actual. For example after a pass with rider in tow the system suggests [+ 20 ADJ]. In this case the time was just slightly on the slow side so it is suggesting you increase the skier's weight by 20 for the next pass. This change will add 20 rpm to your boat on the next pass.

Cannot get valid times while running baselines - Whether you are running in the speed based mode (23 mph and below) or the rpm based slalom speeds, if the timer is "timing out" prior to the end of the course the boat speed may be too far off of actual. In this case, the "quick calibrate" will not work. You must do the following to manually adjust the speed so it is closer to actual so "quick calibrate" can be used.

RPM Speeds (24.9 – 36 mph) Go into the menu to [RPM @] and manually adjust the baseline setting. (Remember, 100 rpm is about 1 mph). Use **MENU** key to return to slalom screen and run timing pass again.

Speeds under 23.0 mph – To speed up or slow down the operating speed, go into the menu and find [Speedo Adjust] and manually adjust up or down the speed to more accurately reflect the target speed. Use **MENU** key to return to main screen and run timing pass again.

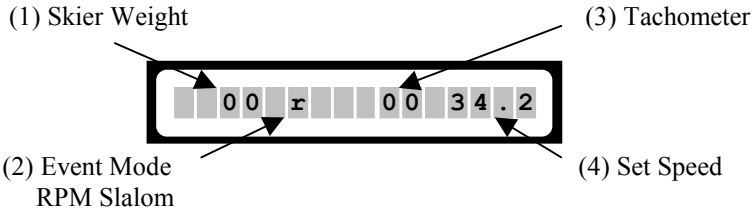
SETTING BASELINES / CALIBRATION

Slalom Calibration -To achieve the perfect timing pass with your boat it is essential the PerfectPass is setup to match your specific boat characteristics (i.e. hull shape, engine size, prop efficiency). This setup procedure is called the **calibration** and should be done for each Slalom speed you plan to use. The calibration procedure for each Slalom mode is explained below in its appropriate sub-section.

A slalom course is required for this important procedure.

RPM BASED SLALOM - 24.9 mph to 36.0 mph

RPM Baselines: Since the system does not know how many RPM it takes to run your boat at each speed it is necessary to set up an RPM Baseline value to run each official speed. This is done without a skier. When properly set up your boat should run near actual times at each speed without a skier. When towing skiers you will add a skier weight to compensate for the weight and pull of the skier. (This is discussed later).



1. Skier weight - leave at 00, details later
2. Event mode, r means rpm based slalom (Class R Time Charts)
3. Actual rpm of the engine (digital tachometer)
4. Set speed is the speed you wish to run and as shown is set at 34.2 mph (55 kph); this will convert to a digital speedometer as the boat speed is increased.

Steps for setting Baselines:

Step 1 Set desired speed (ie. 34.2 mph)
Step 2 Drive up and engage PerfectPass prior to course.
Step 3 You must time boat through course with Smart Timer (or optional Hand Timer). (System will record a mid course time and full course time on screen).
Step 4 Stop boat and press MENU Keys several times to "Recalibrate 34.2", press UP Key twice to confirm calibration.
Step 5 Repeat procedure at each speed you wish to set up.

SPEED BASED SLALOM - 15.5 mph to 23.0 mph

If you select a slalom speed of 23 mph or less, the system changes from RPM based to speed based using the paddlewheel. This is similar to the RPM based controlled described above. This calibration is done without a skier and with skier weight set to 00.

Quick Speed Calibrate - once you get times at 23 mph go, to [recal 23.0 ^ = Y] in the menu, and press **UP**. You will then see [MASTER RECAL ^ =Y] If you answer yes then all of your speed based slalom speeds will be automatically calibrated. Next [TRICK RECAL ^ = Y] will appear and this will accurately calibrate all trick speeds. (Only use the "Speedometer Adjust" feature as discussed in following paragraph).

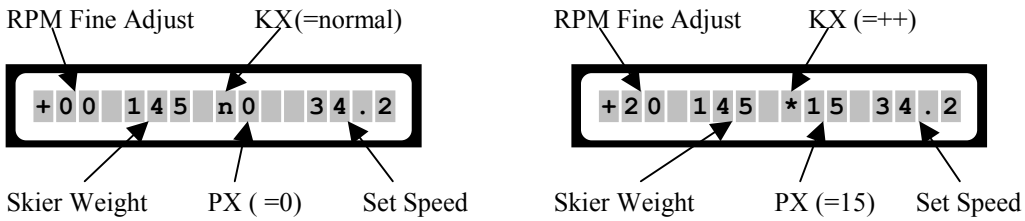
Now you must complete this same procedure each of the other set speeds you wish to set up. Change the set speed by going into the [SPEED 55k = 34.2] by pressing **MENU** key twice and change the speed using the **UP** or **DOWN** keys. Once again, drive up to or beyond the set speed to engage system. Time the boat through the course and after the times are displayed go into "Quick Speed Calibrate" in the menu.

Speedo Fine Adjust – Speedo Adjust has been added to the speed based slalom speeds. If you find the times are a little on the fast or slow side, press the **UP** or **DOWN** keys to make an adjustment. Example: The boat is slightly slow through the course. Press **UP** key twice and [+ .2 S 21.1 0.0] will appear. This adjustment only affects the selected speed. This is also convenient if driving in a waterway with currents.

TOURNAMENT SLALOM MODE

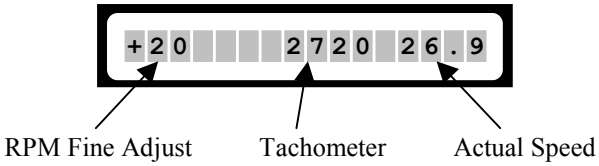
There is now a Tournament mode which must be used in R level tournaments. It can be accessed when in Slalom mode by pressing the **UP** & **DOWN** keys together. The main difference in Tournament mode is that RPM adjustments between passes are made via RPM fine adjust on the main screen, versus changing the skier weight. This allows the system to hold the skier's weight as a static value which should give a more consistent pull as PX, G% and SSB are affected by the skier's weight. The pull is unchanged from Slalom RPM mode.

When you first move into Tournament mode, the screen will appear as in the following examples:



Press the **MENU** key to enter your Crew Weight and Skier Weight. Crew Weight is found in the menu as [^ = CRW+] (CRW + means enter here for Crew Weight, SSB and RPM offset). The Skier Weight will be shown on the main screen.

As you accelerate, the screen will change and appear as:



At the end of the pass if a speed change is required (Example +20 RPM), then simply press the **UP** key to add 20 RPM to the RPM Fine Adjust as in the above example.

The PX and SSB can be quickly found and adjusted in the main menu.

To return to non-tournament Slalom mode, press the **UP** & **DOWN** keys together.

RPM OFFSET – This is available in tournament mode only and works in a somewhat similar fashion as "Skier Factor." The difference is it can be more accurate and can be set for 36, 34.2 and one value will control all slower speeds. If you are finding that you are running less (or more) than a skiers weight to achieve a good time, you can enter an rpm offset value.

Example: On a typical boat with a skier's actual weight entered, you have to run 25 less rpm to achieve an accurate time. If you are consistently seeing this, you can enter an offset rpm value (i.e.: -25) and the system will allow you to run all other values as you normally would.
The offset value is independently set for 36.0, 34.2 and all speeds below 34.2. (OFFSET LWR)
Rpm offset is found after SSB and will appear as [OFFSET 34.2 000]

ADDITIONAL INFORMATION & SETTINGS

Digital Speed Readout – The digital speedometer on the screen is for information only in Slalom mode. If you feel it is not reading accurately, go into [RECAL XX.X ^=Y]" in the menu after any timed pass (with "OK" times) and recalibrate (where XX.X = Set Speed).

Speeds 23 mph or Lower – If you are towing at these speeds, the system will control via speed instead of RPM. If future passes are at speeds above 23 mph (37 kph) then you must go into menu and select "New Skier" and enter their weight and KX/PX preferences, which will enable the system to seamlessly switch over to RPM mode when the higher speeds are selected.

Wind Adjust - The "Wind Adjust" feature found in the slalom menu, allows you to set an rpm value for wind strength. It will appear as [WIND ADJ 000]. Set a value such as 20 and press **MENU** to continue. It will then ask if the next pass is a head wind (h) or a tailwind (t). The wind direction request will appear after every pass. If you do not wish to use wind adjust, always reset the wind adjust value to 0. Alternatively drivers can increase the skier weight a little when driving into the wind and lower the skier weight when running down wind to compensate.

Setting Baselines / Calibrating Speedometer without a Course – If you do not have the benefit of a course, you can manually set baselines and calibrate the speedometer. This must be done at each slalom speed and you will require an accurate boat speedometer or GPS. Example: Starting at 36 mph, you engage system and note actual speed on the GPS is 35. Go into the menu to [RPM @ 36.0 3650] and raise the RPM Baseline about 100 rpm. This will speed up the boat to about 36 (100 rpm = 1 MPH). Menu back to main screen and run boat again. If speed is now accurate, the final step is to calibrate digital speedometer. Note the digital speed readout and if it is reading 37, go into menu to [recal 36.0 ^ = Yes] and press **UP**. [SPEEDOMTER ADJST] will appear. Now press the **DOWN** key and lower speedometer calibration by one mph. Run boat again to confirm accuracy. Once the baseline and calibration is set, it will be remember forever. Now change speed to 34.2 and repeat. All speeds must be done.

More Throttle – If you see the "#" sign after the speed pop up on the screen, the system is indicating it needs more manual throttle in order to maintain the speed. In this case just move the manual throttle forward a little.

Crew Weight Calculator - The system will add the weight of the individual crew members. Simply go to "Crew Weight" in the menu, then press the **DOWN** and **UP** keys together, enter the weight of crew member #1, press **MENU** and do the same for crew member #2. The system will total the weight automatically.

Smart Timer False Triggered - The Smart Timer is sensitive and will false trigger outside the course on waves, etc. To avoid false triggering, always slow the boat slightly to disengage the system after exiting the course between passes. The system will not false trigger if it is not engaged. (In the event the Timer does trigger before the course, press the UP key to reset Timer).

Optional Slalom Switch - If you have a Slalom Switch, refer to detailed instructions sent with switch. The switch is beneficial to "short line skiers". For full details, please contact PerfectPass, or log on to www.perfectpass.com.

PX (Switch Setting) - Factory setting is 0, which is the off position (typical values range from 5 – 15). If the optional Slalom Switch is used, this is the percentage of skier weight which is applied during each pull (i.e. A value of 10 would apply 20 rpm to a 200 pound skier). A value of 0 means no pull from the switch.
SSB (Second Segment Balance) - The percentage of skier value driven RPM that is removed during the second segment to maintain an ideal time in slalom. Example: If your 2nd segment is running a little on the fast side relative to the first

segment time, you would raise the SSB. The higher the value, the more RPM removed from the boat speed in the 2nd segment. (SSB is calculated as a % of skier weight. I.e. If SSB is set at 10% for a 200 pound skier; 20 RPM would be removed in the 2nd segment).
Most boats use a value of about 8. Some hulls may require values as high as 20 to keep the 2nd segment from running fast.

KX (Throttle Response) - Represents the throttle control response of the system. Under the current rules, a skier is encouraged to use factory settings, but has the right to opt for a higher (++) or lower (-) KX. (Higher means slightly more immediate control response).
If the driver presses the menu key several times, [v = KX, PX] will appear. Press the down key and KX will appear as [KX Normal]. You can press the up key for a higher KX (+) or the down key for a lower KX. The system will always return to the same KX selection, even if boat was powered down.

WT (Wait Time) - For tournament use to provide each skier the same wait time between passes. The number of seconds between passes (i.e. 40 seconds). Starts timing as boat exits the course. Two short beeps are indicated with 10 seconds left, followed by three long beeps when time is up.
(To access turn control OFF, then press **UP** & **DOWN** keys together while in Slalom mode).

Skier Factor (Skier FAC) - Factory setting 100%. The system is designed that a competitive skier's weight can be entered and the resulting time will be in tolerance. Should you constantly have to run a much lower (or higher) weight than actual, Skier Factor can be adjusted to allow actual weights to be entered. Example: A 200 pound skier must be entered at 160 in order to get a good time. Skier Factor should be set at 80%. (200 x 80% = 160)
(To access turn control OFF while in Slalom mode, press **UP** & **DOWN** keys together, then press **MENU**).

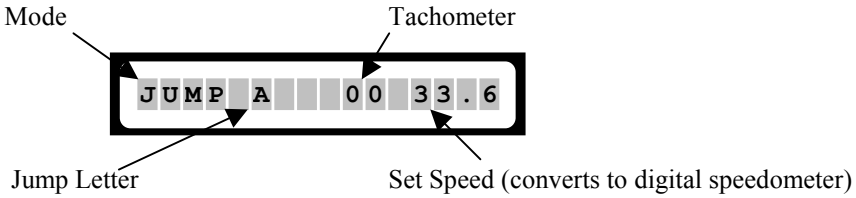
Section 3. JUMP MODE

USING JUMP MODE

WARNING: (Timing **must** be used in Jump mode and a proper two segment jump course is required for system to work properly. Do not use PerfectPass in Jump mode without a proper course, integrated timing and experienced operator. Because the counter cut pull and cut to the ramp are different, you must have timing activated and running as the boat heads towards the ramp.

*The Jump mode is RPM based and therefore baseline values must be established just as in Slalom mode. Setting the jump baseline values must be done in a proper two segment jump course. Jump Letter must be set at **A** for this process.*

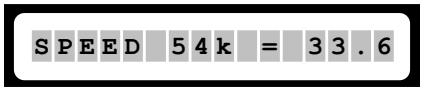
The Jump mode main screen will appear as follows:



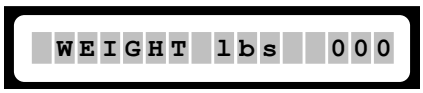
Entering Crew Weight - press **MENU** key 8 times from main screen and [CREW ADJ XXX] will appear (XXX=crew weight in pounds). Press **UP** or **DOWN** keys to set total weight of driver and crew.

Selecting Set Speed - press **MENU** key three times from main screen and [SPEED XXk = YY.Y] will appear (XX = Set Speed in kph, YY.Y = Set Speed in mph). Press **UP** or **DOWN** keys to select desired Set Speed.

New Jumper – to enter a new jumper press the **MENU** key 4 times and [v=S2% ^=NEW JMPR] will appear, then press **UP** key to enter a new jumper. You will be asked to enter and answer the following information after which a Jump Letter will be calculated for you and displayed on the main screen. Move to the next screen by pressing **MENU**.

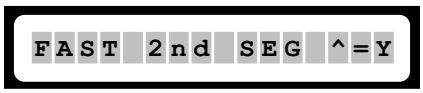


Select Desired Set Speed using **UP** or **DOWN** keys



Enter Jumper Weight

Enter typical jumping distance

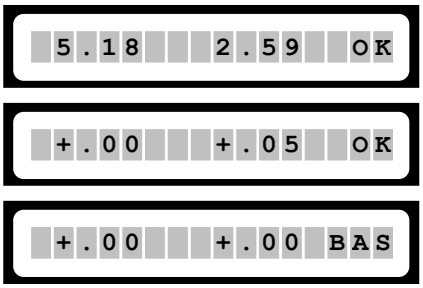


Press UP for Fast Second Segment
Press DOWN for Return to Baseline

Return to Baseline (RTB) – If you selected Return to Baseline instead of the fast second segment, the boat speed will immediately go to the baseline value as boat enters the second segment. If you have a skier using the switch with a value of J or higher, you can enter an S2 value which is a % of switch driven RPM. A setting above 0 will speed up boat in second segment if required to balance times. (This is similar to S2% used when Faster 2nd Segment is selected).

Fast 2nd Segment – If you selected to run the fast 2nd segment, the screen will add the icon **" ^ "** next to the Jump Letter as a reminder to the driver that you are running the faster times. [JUMP R^ 3350 35.4].

Calibrating RPM Baselines - You can set RPM Baseline values for all of the official jump speeds (28, 29.8, 31.7, 33.6, and 35.4) or just the ones you use regularly. Let us assume you wish to set up 35.4 mph (57 kph). Enter a set speed of 35.4 mph by pressing **MENU** key three times which will take you to [SPEED 54k =33.6], and press **UP** key to change speed to 35.4 mph. Set the Jump Letter to A. Now bring the boat smoothly up to the set speed to engage the system. *(The system engages as soon as the default RPM Baseline value is reached, underscores will appear on display, and audible beep will sound).* Enter the jump course and time both segments. As you exit the course the times will be displayed and then the difference from actuals. The display screen will show the 35.4 mph times in the following example screens which will each appear for about 2 seconds. Because the jump letter is set at A, RTB (return to baseline times are used)



1st and 2nd segment times just run

1st Segment and Error against RTB on 2nd Segment

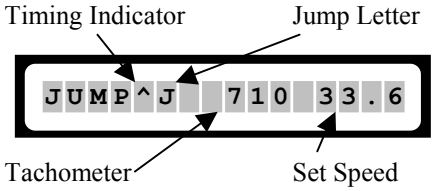
Segment Error against True Actual Speed

If they are not in tolerance or close to actual then the RPM Baseline values will require adjustment. The easiest way to do this in Jump mode is to go to Recalibrate by pressing the **MENU** key until you see [recal 35.4 ^ = Y]. Press the **UP** key to recalibrate. This will calibrate the digital speedometer and then the system will suggest how much the RPM Baseline value should be adjusted. It will appear as [+ 60 ADJ]. In this example it is suggesting your RPM Baseline should be increased by 60 rpm. The system will then ask if you want it to automatically adjust the baseline as suggested. It will appear as [+60 =>RPM@^=Y]. Confirm you want the auto adjustment by pressing the **UP** key.

Now engage system and time boat again. If the times are still not close enough, repeat above steps until accurate. If you wish to set up RPM Baseline values for other speeds (i.e. 31.7 mph), change the Set Speed and repeat the above steps.

JUMP DRIVING

WARNING – Using the Jump mode with Jump Switch is for experienced drivers and skiers only. Please read carefully prior to operating. The pull is very aggressive and designed for tournament water skiers only. You MUST have integrated timing and a proper jump course for system to operate properly.



Assuming the RPM Baseline values have been accurately set, you are now ready to tow skiers.

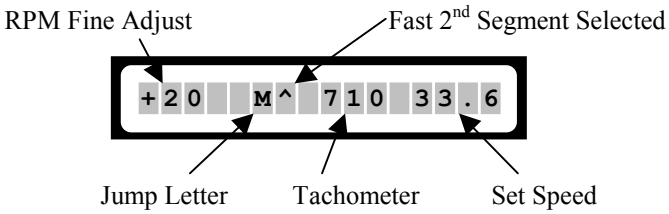
First enter a "New Jumper" as explained above. The display will then return to the main screen with a Jump Letter selected. In the above example, the letter "J" with fast second segment (^) has been selected. The Jump Letter can be changed by pressing the **UP** or **DOWN** keys. This letter represents how much throttle will be applied once the Rope Switch is closed as the skier pulls. The higher the Jump Letter, the more aggressive the pull.

The key to a good pull and good times is to get the correct Jump Letter. If the pull to the ramp is solid and the first segment time is good, you know the Jump Letter is OK. If the time on the 1st segment was slow, you will require a higher letter on the next pass and vice versa.

Important Note: If the timer is triggered prior to entering the course, it must be reset by pressing the **UP** key. Failure to reset will result in an improper pull to the ramp.

TOURNAMENT JUMP

This operating mode allows RPM Fine Adjust to be entered on the main screen at all times and can be tweaked as required with the **UP** & **DOWN** keys. In this mode the screen will appear as follows:



ADDITIONAL INFORMATION & SETTINGS

Crew Weight Calculator - The crew weight calculator can be accessed in Jump Mode as well as by pressing **UP** and **DOWN** keys together when [CREW ADJ XXX] is on the screen (XXX = total crew weight).

RPM Adjust – RPM Adjust is found in the normal menu screen and appears as [ADJUST RPM]. RPM adjust allows the driver to increase or decrease the overall times (1st & 2ng segment) by putting in a positive or negative RPM adjustment. Example: If the times are running consistently slow on both segments, you could add a value such as 20 rpm and the speed will be increased. You may wish to do this for a particular skier (a heavy puller) or for a number of skiers if the times are drifting in a certain direction. When a value has been entered the screen will add a **"+"** sign on the display to remind the driver this feature is in effect. [JMP+ R 3350 35.4].

> **Example**: If the times are running consistently slow on both segments, you could add a value such as 20 rpm and the speed will be increased. You may wish to do this for a particular skier (a heavy puller) or for a number of skiers if the times are drifting in a certain direction. When a value has been entered the screen will add a **"+"** sign on the display to remind the driver this feature is in effect. [JMP+ R 3350 35.4].

S2% - (Second Segment Percent) - This is a percent of the Jump Letter RPM that is applied once the boat enters the 2nd segment. Under IWSF and AWSA rules, the boat is permitted to speed up in the 2nd segment. The higher the number, the more the boat will accelerate. A typically value for S2% is Faster 60, the higher the value, the faster the 2nd segment.

> **Example**: If the 1st segment times are good, but the 2nd is a little slow, you would raise the number.

S2 RTB - Works similar to S2%. Used when "Return to Baseline" is selected. Only applicable if skiers are activating switch and use a Jump Letter of J or higher.

Jump Switch - For details on the optional Jump Switch (Slalom Switch) contact PerfectPass or log on to www.perfectpass.com .

S2 Fine - This adjustment allows the driver to effectively fine adjust the 2nd segment only. It comes set at 0, which means a neutral effect. A number such as 30 would increase the 2nd segment by 30 rpm. Higher number speeds up the second segment. If skier does not trigger switch or has a letter less than J, S2 fine should be used to speed up second segment.

> **Example**: A jumper that does not cut and does not fully activate the switch may require extra rpm in the 2nd segment to keep the 2nd segment in tolerance.

CT (Counter Cut Time) - The maximum length of time the system will throttle once the skier pulls and closes the switch on the counter cut. Example: a value of 175 is 1.75 seconds and may be used in a tail wind. In a head wind you may want a longer pull so you could move it to 200 – 220 (2.0 – 2.2 seconds). The factory default is 190.
(To access turn control OFF, then press **UP** & **DOWN** keys together while in Jump mode).

x8u and x8d - these settings were always riding in the software, but were not adjustable values. With the higher horsepower engines and strong props being produced, these values are available for adjustment if needed for high end jumpers. (To access turn control OFF while in JUMP mode, press **UP** & **DOWN** keys together, then press **MENU**).

> **x8u** – Represents the rate of throttle up on counter cut and cut for ramp once switch is activated. Larger the value, softer the start. In other words, the pull will not be as aggressive on the start, but more gradual. The smaller the value, the more aggressive it will throttle up as switch closes.
>
> > **Example**: A strong 6 Litre engine may need a larger X8u to avoid a strong initial pull as switch closes.
>
> **x8d** – Represents the rate of throttle down once skier stops pulling. The higher the value, the slower (softer) the throttle returns. The lower the value, the more aggressive it will throttle back.
>
> > **Example**: If a boat was not slowing quickly enough in the 2nd segment, you would lower the value.

Typical values 2005 Promo Boats

	5.7L	6.0L	HammerHead
x8u	50	1500	250
x8d	50	100	100

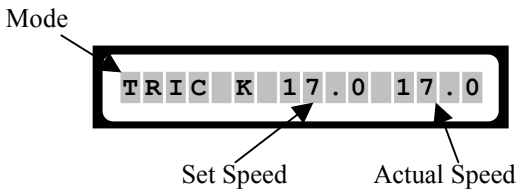
Typical Jump Settings can be found in the Appendix.

Section 4. TRICK MODE

USING TRICK MODE

The trick mode is controlled via the speed signal from the paddle wheel. (You simply select the desired speed and go. RPM values are not used and no other settings are required)

The main Trick screen will appear as:



Using Trick mode is relatively easy. Turn control ON, select the desired speed and drive smoothly to the Set Point so PerfectPass can seamlessly take over. *If you accelerate aggressively past the set speed, it will take the system several seconds to lock in the speed.*
You should keep your hand on the throttle to ensure it does not pull back and disengage the system. If you see the **"#"** sign on the screen, this indicates the system needs a little more manual throttle.

If the skier falls, pull back on the throttle to disengage system. Slowly return to skier and pull them back up again. System will take over automatically once set speed is reached. Speed changes can be made "on the fly".

When you are finished with the speed control, go to neutral and press the **ON/OFF** key.

Calibrate Digital Speedometer– If your digital speedometer is not accurate, you can go into the [SPEEDOMTER ADJST] feature in the menu. There are 2 calibration values: below 25 mph and 25 mph and above. Depending on the Set Speed the appropriate calibration number will be adjusted. This calibration is also used in the Wakeboard mode and vise versa.

> **Example**: If you are set and engaged at 17 mph, but the analog speedometer or GPS is reading 18 mph, menu to [SPEEDOMTER ADJST] on the screen and press the **DOWN** key several times until the boat speed drops to 17 mph so the PerfectPass Digital Speedometer matches the GPS or boat's speedometer. You should check and calibrate the speed in Wakeboard mode at 20 mph and again at 28 mph for accuracy.

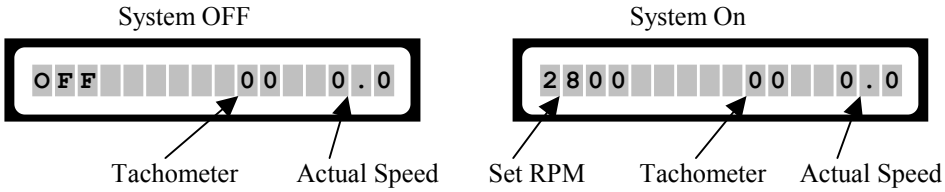
TRICK SETTINGS

Kd – This adjustable parameter controls the "firmness of the Pull". Higher the number, more aggressive the pull
(To access turn control OFF, then press **UP** & **DOWN** keys together while in Trick mode).

NN (Paddle Filter Factor) – NN is set at 120 and represents the "Filter Factor" of the paddle. The higher the value, the more speed samples are taken from the Paddle prior to speed adjustment. It is rare for NN to require adjustment from Factory setting. If you believe your system is more "nervous" than it should be, try raising the NN. If the speed is floating too much, try lowering NN.
(To access turn control OFF while in Trick mode, press **UP** & **DOWN** keys together, then press **MENU**).

Section 5. RPM MODE

In this mode, the screen will appear as follows:



Operating in this mode is very similar to using the Wakeboard mode, except the system is controlling to a set rpm, 2800 in this case.

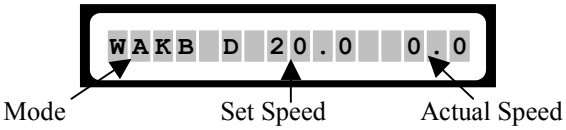
Prior to towing the rider / skier, select the rpm set point by using the **UP** or **DOWN** keys. Pull the rider up smoothly and continue to accelerate up to or beyond the set rpm point so the system can take control.

Rpm changes can be made on the fly to fine tune the rpm.

Section 6. WAKEBOARD MODE

USING WAKEBOARD MODE

In this mode, the screen will appear as follows:



Select the desired operating set speed by pressing the **UP** or **DOWN** keys. Pull the rider up normally and accelerate smoothly up to or slightly beyond the target speed. Once PerfectPass sees the actual speed reach the set speed it will automatically take control and will notify you of this with an audible beep. (Underlines will appear during engagement).

While in engaged the WakeboardPro should hold a smooth steady speed in a straight course down the lake. The driver should keep their hand on the throttle for safety, and to prevent it from pulling back on its own which will cause PerfectPass to disengage.

The key to driving is to smoothly drive to the set point so the system can seamlessly take control. If you accelerate aggressively past the set point it will hunt around for several seconds before settling in. You will hear an audible beep when the system automatically takes control. If the rider falls, simply pull back on the throttle and the system will disengage.

To Disengage System: If the rider falls simply slow boat down which will disengage speed control. Return to rider slowly and pull up again. System will once again take over when target speed is reached.

Speed Changes: Speed changes can be made prior to pulling up a rider or on the fly.

Turns / Over-riding the system: As the boat enters a turn, the engine rpm may increase to keep the craft at the set speed. If the driver would like less throttle (so the rider does not get whipped) then simply pull back some on the throttle and help the system maintain a safe speed. As you complete the turn, move the throttle gently forward and the system will re-take control. (The driver can override the system at any time by pulling back or advancing the throttle).

Wake Surfing in Wakeboard mode is excellent in the 9 – 11 mph range and can be programmed to go as low as 6 mph. Prior to using your boat for wake surfing, check with your boat builder or dealer to confirm it is safe for this sport.

Double Up – When approaching a "double up" turn, the driver can manually assist the system to maintain the desired speed.

Digital Speedometer Adjust (Calibrate) – If you believe the system is not controlling at an accurate speed, by pressing the **MENU** key, while in Wakeboard mode you can access [SPEEDOMTER ADJST].

> **Example**: You have the system set and engaged at 20 mph, but you believe the boat is actually traveling at 23 mph. While engaged, access [SPEEDOMTER ADJST] via **MENU** key, then press the **DOWN** key until the boat slows by 3 mph. Run the boat and fine tune if necessary. All wakeboard speeds should now be accurate. (A hand held GPS is ideal for confirming accuracy). You should check and calibrate the speed in Wakeboard mode at 20 mph and again at 28 mph for accuracy.

WAKEBOARD SETTINGS

KdW (Adjustable Pull Characteristics) - the pull can be quickly adjusted to tailor your boat, load and riding style. A typical value is 80. Boats with larger loads may require much higher values such as 100- 150. The higher the number, the more aggressive the system will control speed corrections.
(To access turn control OFF, then press **UP** & **DOWN** keys together while in Wakeboard mode).

NN (Paddle Filter Factor) – NN is set at 120 and represents the "Filter Factor" of the paddle. The higher the value, the more speed samples are taken from the paddlewheel prior to speed adjustment. It is rare for NN to require adjustment from Factory setting. If you believe your system is more "nervous" than it should be, try raising the NN. Typical values range 100 – 180.
(To access turn control OFF while in Wakeboard mode, press **UP** & **DOWN** keys together, then press **MENU**).

Section 7. INTEGRATED TIMING

USING INTERGRATED TIMING

An integrated timing system is another unique feature of PerfectPass. This timing system is set up for both the Slalom and Jump modes. For tournament skiing and in Jump mode **timing must be used and be interfaced into the Master Module** for PerfectPass to work properly.

The system has been loaded with the USA Water Ski / I.W.S.F. Record Capability time tolerance chart for the Slalom and Jump modes. At the end of each timed pass the display will briefly display the full course time. It will then show the 1st and 2nd segments and variance from actual. To review the times again, simply press the **MENU** button. The system always resets after a few seconds. If the skier has fallen or the run has ended early, PerfectPass will know and resets.

PerfectPass All Ball Timing – Our simplified "All Ball Timing" Method 4 is also loaded on this DigitalPro System. For operating details, see information in the Appendix at rear of manual. All Ball Timing is for tournament use only, and is not required for daily practice.

Hand Timer - The optional Hand Timer is used much like a stopwatch when you not have magnets in your course. As you enter the course press the button, then again at the ball three timing gate and again at the exit gate. If you have a Smart Timer & magnets, the timer will pick up each magnet automatically and an audible beep will be heard.

Smart Timer - If you have a Smart Timer magnetic sensor and magnets you will not require the Hand Timer. The Smart Timer plugs into Timer 1 or Timer 2 input jack on the Master Module. If you do not have magnets in your course, disconnect the Smart Timer and plug the optional Manual Hand Timer into Timer 1 or Timer 2. If you have magnets and a Smart Timer, you do not require the Hand Timer.

PLACING SMART TIMERS

The sensor should be placed as close as possible to the outside of the boat. Typically the sensor is beside and under the passenger seat in a dry location. The Velcro should hold it firmly on the carpet. Place the timer in the direction as indicated on the Timer label to match the polarity of the magnets. If you are using 2 Smart Timers they should be lined up evenly so they are across from each other in the boat.

In tournament use it is recommended that two Smart Timer pick ups be used. One will be plugged into Timer 1 and the other into Timer 2. Both Timers should be used to test the strength and polarity of jump magnets.

Note: For the jump event and for all buoy timing (ABT) you may require two Smart Timers, one located on each side of the boat. Both will plug into the Master Module. If using one Smart Timer you may have to move it to the driver's side depending on where your magnets are located.

Note: Some two way radios operating **from the tow boat** can activate the timing system. In tournament conditions **only** press the talk button and communicate with shore officials before the boat is up to set speed and after it has exited the course.

Note: Whether using the Hand Timer or Smart Timer magnetic sensor, they will not operate or register a signal unless the boat is up to set speed and system has engaged. This feature helps to avoid false triggering.

Note: Smart Timer is designed for tournament skiing under tournament conditions. In other conditions such as **lake cruising it will likely false trigger** if you engage the system in Slalom or Jump mode. In this case you may wish to disconnect the Smart Timer when not in tournament like conditions.

False Triggering - To reduce the chance of false triggering, drive a few miles per hour below the set speed after exiting the course and during the turning route between passes. If you are not dropping skiers between passes do not fully accelerate to set speed until you have passed through the boat wakes from the previous pass. (Smart Timer will not accept signals until speed control is engaged).**In the event the timer false triggers outside the course and system is engaged, press the UP key to clear timer.**

INSTALLING COURSE MAGNETS

Magnets should be placed as close to the surface as possible for the most accurate and reliable timing.

It is very important that all timing magnets in a given course have similar field strengths and all have the same polarity (north pole facing up). With the same polarity each magnet will generate the timing trigger pulse exactly at the centerline of the timing buoy. A reversed magnet causes this trigger point to move towards the oncoming boat, this change in trigger location can be as much as four feet. At the higher boat speeds these timing errors can cause a perfectly in tolerance pass to become an out of tolerance re-ride. With a reversed magnet this error is also affected by boat path, depending upon which magnet is reversed either one or both timing segments can be affected.
If you are unsure about the actual polarity of your magnets and are not getting the REV message, then make a pass with the Smart Timer arrow pointing towards the bow and make a note of the values displayed. Then reverse the direction of the Smart Timer sensor by pointing it towards the stern and make another pass in the same direction. The correct direction to point the Smart Timer is the direction, which produces the largest field strength values.

Jump Magnets: ***It is very important*** *that no other magnets are present in the course other than the official jump course magnets. For example, if the jump course runs next to the slalom course any slalom course magnets that could trigger the jump timer should be removed.*

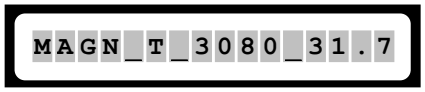
For quality magnets contact PerfectPass at (902) 468-2150.

Section 8. MAGNET TEST MODE / DEVICE TEST

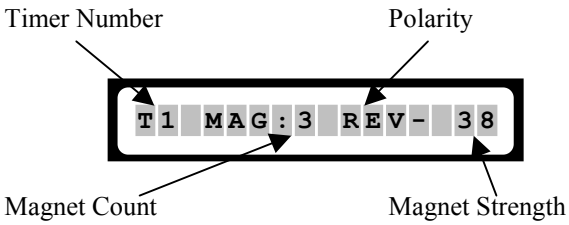
TESTING MAGNETS

This mode allows you to test the timing magnets in the slalom and jump course for field strength and polarity. This mode uses a set RPM value (approximately 3080 rpm) to control. If you are running "All Ball Timing" or are in the jump mode, you should check that both of the Smart Timers are detecting properly, to do this you may need to drive the boat beside the course to test each sensor alone. Your test can and should be done in both directions through the course.

The boat is brought up to the set RPM to engage the system and the boat is driven through the course. After engagement the screen should appear as follows:



Drive a split boat path and note the magnet strength readings. After passing a magnet the system will beep and display a message similar to the following:



Timer Number- indicates the timer which has been triggered (labeled on Master Module "Timer 1" or "Timer 2").

Polarity -the direction of the magnet. In the above example it is REVERSED. This indicates the magnet is pointing in the wrong direction relative to the Smart Timer. If the polarity is REVERSED or the negative sign appears you should review the 'Placing Magnets', Section 7 information and make the appropriate changes to the magnet. **NOTE:** A very large or strong magnet can saturate the sensor and cause the "Rev Pole" message to occur incorrectly. In this case move the sensor towards the middle of the boat by about 16 inches and retest. Your test can and should be done in both directions through the course.

Magnet Count - increments each time a magnet is detected. Counts from 0 to 7.

Magnet Strength – indicates the strength of a particular magnet. Acceptable values for magnetic strength are 30 or greater. Values below 30 may not produce accurate times. To have extremely accurate times, it is best that all magnets have a similar strength (usually within 5). You can drive back through in the opposite direction and should see similar readings. Sometimes you may need to unplug one sensor and test each one separately or run slightly wide and then slightly narrow in order to separate the sensor readings.

Understanding Magnet Test Results

One or more (not all) magnets are showing a low values or REVERSED polarity

-Check the depth of that magnet.
-Check magnet polarity. See 'Placing Magnets'.

All magnets are showing low values

-Check the depth of that magnet.
-If this course is known to be good, the Smart Timer may be failing.

All magnets are showing REVERSED polarity

-Check direction of the Smart Timer. Possibly needs to be reversed.

DEVICE TEST (Rope Switch, Fall Button, Servo Motor)

Other test features such as Jump Switch Testing, Voltage Supply Testing and Servo Motor Testing are found via Magnet Test mode. These tests can be performed with or without engine running. PerfectPass must be switched ON

Press **MENU** once while in Magnet Test mode and [DEVICE TEST ^=Y] will appear. Press the **UP** key to enter the Device Test.

Rope Switch Test – This feature allows you to test the rope switch to be used prior to a tournament and will appear as [ROPE SWITCH TEST]. Pull hard on the rope to close switch and it will change to [ROPE SWITCH ON] and there will be an audible beep to confirm proper operation. Since it takes 250 pounds of force to trigger a Slalom Switch, it is very difficult to do. The easiest way to confirm operation is to ski with it and watch the underline character beside the digital speedometer. It will move up & down as switch is activated.

Servo Motor Voltage Supply– This test will check the 12 V supply attached to the PerfectPass Servo Motor (via Master Module). Voltage level ranges will be slightly lower if the boat engine is not running. Press **MENU** to continue.

> **13.5 = OK SERVO OFF –** The system automatically powers down the servo motor and measures the supply voltage level. This level with engine running should be in the range of 13 to 14 V. If the voltage is below 13.0 V, this display will show it as low ("LO"). Press **MENU** to continue.
>
> **12.9 = OK SERVO ON –** The system turns the servo motor on to measure the power supply and resulting voltage. This level should be in the range of 12.5 – 13.5 with engine running. A reading below 12.1 V will produce a "LO" indication. Press **MENU** to continue.

The difference between the voltage readings of these two tests indicates the condition of the power connections. A difference of more than 1.2 V indicates a potential wiring problem.

Servo Motor Phase Test - The servo motor will slowly rotate and continually check all phase circuits (Green, Black, Brown, White, and Red). If a circuit is bad or "Open", the screen will change to [BROWN PHASE ??] which means the brown phase wire is open and should be investigated. The brown wire at both plug ends and at servo motor should be checked and also the motor lead connected to the brown wire at the six-pin servo motor connector. Press **MENU** and any other open phases will be displayed. If all phases test OK, then [PHASE TEST ^ =end] will appear. Press the **UP** key to continue.

Servo Motor Rotate Test - This test will continually rotate the servo motor back and forth one full rotation. This is usefully when tracking intermittent wire faults. Example: 'Servo Motor Phase Test' checks OK but throttle feels "limp" and boat engine is unresponsive after a few minutes of operation.

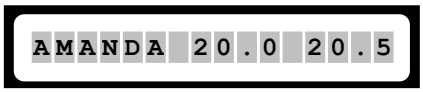
Note: The Servo Motor tests can be accessed by pressing & holding the **MENU** and **DOWN** keys **together** as you turn the boat key on to power the system. Keep holding both keys for a few seconds until you see the [SERVO TEST ^=Y] prompt. Press **UP** to run the servo motor tests.

Section 9. ADDITIONAL FEATURES

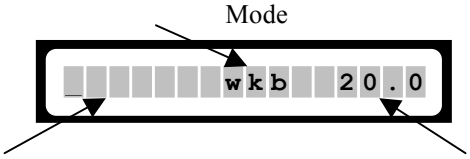
Additional PerfectPass features are accessed by pressing the **MENU** & **UP** keys together. The features available vary depending on the make and model of your boat. If a feature is not present on your PerfectPass then it is not available on your system. To move to the next feature press **MENU**.

QUICK LIST

This version of PerfectPass allows you to store up to eight names and their preferred speed.



Creating Names – While in neutral, press **MENU** & **UP** keys together and [QUICK LIST ^ =Yes] will appear. Press **UP** key and [MENU = list ^ = new] will appear. You will press **UP** key to enter new names, **MENU** key to access names already entered.
If you press **UP** key to enter new name, [NEW ENTRY ^ = Yes] will appear. Press **UP** key to enter new name. Screen will then appear as follows depending on mode you are in. Mode cannot be changed while entering a name. You must be in the mode you want before creating name.



Scroll through the alphabet using **UP** & **DOWN** keys, and then press **MENU** to move to next position. When the name & setting have been entered, exit via **MENU** key and entry will be saved.

Selecting Names – Press **MENU** & **UP** keys together to access [QUICK LIST ^ =Yes]. Press **UP** key and then **MENU** key to enter list. Once in the list, the **MENU** key is used to scroll through list. Once the name is on screen you wish to select, press the **UP** key.

Editing List – As you scroll through list of names, instead of pressing **UP** key to select that name, press the **DOWN** key to edit.

Note: Names can be changed by "Editing List" but can only be deleted by performing "System Reset".

LAKE TEMPERATURE

When the system is set to read in KPH, then temperature will be in displayed in degrees Celsius. To calibrate lake temperature press the **UP** & **DOWN** keys together when temperature is being displayed.

HOUR METER

The hour meter counts when rpm is detected by the Master Module, and is not RESET to zero after 'system reset'.

BATTERY VOLTAGE

Displays the voltage measured at the Master Module. If voltage drops below 10.5 V the system will shutdown.

Section 10. INSTALLATION INSTRUCTIONS

Step 1. Installation of Servo Motor

Using the two provided hose clamps, loosely mount the servo motor on top of the cooling water hose leading to drivers side exhaust manifold (starboard side on standard inboard engines). See Figure A. Tighten later after final positioning (or as specified in any Addendum photos).

Remove ball joint connector from throttle control lever and remove the coupling from end of Morse control / Teleflex cable. (See Figure B).

Position the servo motor throttle cable in line with the throttle control lever. Ensure the 10/32 locking nut is in place on Morse control / Teleflex throttle cable. Screw threaded brass hex connector on PerfectPass cable onto the end of the Morse control throttle cable. (Do **not** over tighten hex nut). Install L shaped brass throttle adapter to throttle control lever using identical hole as original ball joint. (L adapter must be able to swivel). Using an Allen key, tighten L shaped adapter-mounting bolt. (See Figure C). You may find it helps to move the Morse control lever into gear during installation to allow more clearance. Be sure the washer is next to the brass L-adapter and not under the nut.

Check and adjust position of servo motor ensuring the motor box cover closes properly and servo throttle cable is not in contact with any moving parts. Make sure the servo motor cable has 2 or 3 inches of free travel. Securely tighten hose clamps on servo motor. (Do not "tie wrap" the throttle cable as it must be able to move freely).

With the throttle in neutral position, adjust brass hex connector if necessary to ensure there is **no gap** between it and the end of the servo motor cable (any gap may cause engine to surge up and down in neutral). Adjust and snugly tighten all parts. (See photos, **DO NOT OVER TIGHTEN**).

Turn the black servo motor knob in a clockwise position until **snug**. With throttle in neutral, the linkage should appear as in Figure C.

Servo Motor / Cable Testing - It is vitally important that the stainless steel cable inside the plastic jacket has the ability to move freely or the system will not perform properly, may hunt and not settle down. The alignment of the PerfectPass cable and the boat's throttle cable should be straight.

Linkage Test - An easy way to confirm proper operation after installation is to perform the following quick linkage test. With key **OFF**, push the manual throttle lever to ¾ open position. Then take the black knob on servo motor and slowly wind the knob in a counter clockwise, then clockwise direction. As you do this, the engine throttle arm will slowly open and close. This should happen very smoothly and in no place shall the cable *"catch"* or *"hook"* which will cause the servo to hunt. If the cable does "catch", adjust servo & cable to eliminate this problem.

If the cable comes into any interference with the fuel rail, decorative engine cover or anything that causes this problem, adjust motor and cable accordingly.

The brass L bracket on the throttle linkage must be able to *swivel freely* for system to work smoothly.

IMPORTANT:
- Make sure all wires are tied away from hot or moving parts and there is adequate clearance.
- The manual throttle on your boat should operate and feel the same as before the PerfectPass was installed, or you may have to adjust hex nut.

If you have re-installed a decorative engine cover, with key "OFF" push the throttle down to full open and back to neutral. At no point should the PerfectPass cable "hook" or "jam". (Never tie wrap on restrict the PerfectPass cable from free movement).

Step 2. Installation of Master Module

Mount the Master Module under the dash normally on the bulkhead accessible behind and right of the passenger seat in a dry location. It can also be installed on the left side of driver's bulkhead. The wires from under the dash pod can be easily fed across the bulkhead.

Route servo motor power cable from Master Module to servo motor and connect. A wire snake is helpful. (Use tie wraps to keep cable away from moving parts). Make sure the tips **on the plug are facing up** towards the top of the Master Module box will.

Step 3. Mount Dash Display

Remove the right speedometer and install the **In Dash PerfectPass Display** and connect into Master Module. (If there is a speedo tube on back, it can be plugged using a golf tee).

If you have the standard **External Display**, install using supplied mounting post to the right of dash next to wind screen. In the event you have **5" gauges**, generally the PerfectPass 5" display replaces the tachometer. (On 5" gauges, refer to specific instructions sent with gauge).

Step 4. Connect Power Wire

Depending on the boat and model, there are a number of ways to connect to a switched (12 volt) power source.

1. On boats with traditional analogue gauges and posts on back of tachometer, there is a 12 volt (+) post often marked (IGN) which is an easy connection to the purple wire. The black wire end can attach to the ground (-) post marked (GND).
2. On boats with Borg Warner gauges with no posts, attach the PerfectPass purple power wire to the purple wire leading to the ignition terminal. The black wire can be securely grounded to the grounding bar or other suitable ground location.
3. **2000 – 2005 Nautiques** – There is a main wiring harness and large white plug located behind the dash pod. Connected to this plug is a purple wire carrying the switched 12 volts and a black wire which is a suitable ground connection.
4. **2002 – 2005 MasterCraft** – Power, RPM and Paddle Wheel speed is all located in the special plug and play harness supplied with each system. The MasterCraft supplied white connector is on every boat specifically for PerfectPass. You may have to remove the driver's foot panel to locate this connector in the boat's wiring harness.
5. **2005 Malibu** – The plug & play harness will provide RPM, Power and Speed signal.

Step 5. RPM Cable Installation

This connection will depend on the brand and year of boat you own.

(1) **Standard Installation** (Older boats and boats with traditional Analogue gauges with Posts on back)

The **Gray wire** with ring terminal can be easily attached to the "SEND" post on back of tachometer. This Gray wires picks up the raw engine rpm from this post. The **Black wire** ring terminal can be attached to any suitable ground, including the ground post on the tachometer. (If there is not a post, connect to the solid gray wire coming from the tachometer).

(2) **2002 - 2005 MasterCraft** – The custom wiring harness supplied by PerfectPass allows for plug & play for RPM, Power & Paddle Wheel.

(3) **1998- 2004 Malibu** (Borg Warner Gauge System)

In behind the dash pod on most models, Malibu has left a Gray (RPM) wire that terminates at a large female spade connector. If you can locate this, you can simply attach the Gray wire on the rpm sensor cable to this connector.
Alternatively, you can locate the solid gray wire in the main wiring harness that leads into the Borg Warner control box under the dash. Use a blue "Tee Tap" connector to connect to this gray wire. You can then attach the gray rpm sensor wire to this using a push on spade connector. The black wire can be securely connected to any suitable ground.

LS-1 On this engine (pre 2002 only), you only connect the Black wire on the RPM Sensor cable to the Gray wire leading to the Borg Warner control box. (Same as LT-R MasterCraft). The gray RPM sensor wire is left un-connected.

2005 Malibu - See Plug & Play Harness.

(4) **1999 – 2001 MasterCraft, 2000 Supra, 2000-2002 Infinity (All Other Brands Using Borg Warner Gauges)**

TBI & Multi Port Engines (except LT-R) – Locate the solid gray wire in the main wiring harness that leads from the engine into the Borg Warner control box under the dash. This solid gray wire carries the raw engine rpm. Use a blue "Tee Tap" connector to connect to this gray wire. You can then attach the gray wire on the rpm sensor to this using a push on spade connector. The black wire can be securely connected to any suitable ground.

LT-R / LT-1 - On this engine the Gray wire lead on the PerfectPass RPM Sensor cable is not used and can be taped off. The separate **Black wire** end must be connected to the Gray wire located in the main wiring harness leading into the Borg Warner MDC Control box. It is on the engine side of the box that the raw rpm is located. You can attach a blue "Tee Tap" connector to this Gray wire, and attach the RPM sensor cable end to this "Tee Tap" using a supplied spade connector.

(5) **2000 – 2002 Nautiques**

Same as standard #1 above, except the rpm signal can be picked from the Gray wire coming from the back of the tachometer.

(6) **2003 - 2005 Nautiques**

Located behind the dash pod is a large wiring harness with a large white plug. The Gray wire in this plug carries the raw rpm of the engine and has been brought to the pod solely for the PerfectPass system. This gray wire is not connected to any gauge. Use a blue "Tee Tap" connector or other splice method to attach the Gray wire on the PerfectPass rpm sensor cable to this Gray wire in the harness. The Black wire (ground) on the RPM Sensor cable can be attached to the black wire in this same boat harness.

Step 6. If you have a **Smart Timer Magnetic Sensor** connected into Timer 1 plug. The Smart Timer should be mounted on the floor, along the outside wall of the boat, generally under or beside passenger seat. With the arrow on the Smart Timer pointing forward. (If you have two Smart Timers, install the second one on floor beside driver seat along outside wall). If you do not have magnets in your course, connect the hand timer into "Timer 1" port so you can time manually. Only connect Smart Timer when you have magnets.

Optional Manual "Hand Timer". If you do not have magnets in your course, connect into "Timer 1". If you have a Smart Timer, do not connect hand timer.

Step 7. Install Paddle Wheel speed sensor and connect to Master Module. (See attached detailed instructions). (On some boat brands, paddlewheels are not included as the boat has a standard factory installed paddlewheel).

Following a short delay the Dash Display will become active.

(You will note each time the boat is started the system will perform an "Auto Tighten" function and servo will rotate clockwise).

Step 8. Your manual throttle should act and feel just the same as before PerfectPass was installed. If it does not feel normal, inspect throttle and linkage connection, particularly the brass hex nut adjustment.

For assistance call (902) 468-2150.

Installation and Setup Instructions
for PerfectPass Paddlewheel System – ST300 Paddlewheel

Tools and Material Required

2 inch hole saw, Sealant eg. GE silicone sealer

Installation

The 2 inch hole is placed approximately 6-7 inches (16 - 18 cm) perpendicular to the centerline of an inboard ski boat, beside the drain plug under the engine. Never install behind a strake, depth sounder, etc. Normally this is on the passenger side away from the bilge pump and other cables etc. Ensure there is sufficient room to pull the inner paddlewheel assembly from the housing when it is mounted under the engine. In this area of the bottom of the hull there is normally a flat surface away from the turbulence of the tracking fins and lifting strakes. The hole saw is used to cut the hole for the paddlewheel working from the bottom of the boat. (You may wish to drill a pilot hole with a drill bit from the inside to make it easier to locate from underneath)

Before disassembling the paddlewheel unit take note of the arrow on the bottom of the housing and on the top of the inner paddlewheel assembly near the cable exit, these arrows both point forward when the unit is installed. Disassemble the paddlewheel unit by unscrewing the locking cap until it is completely free to turn, then pull complete assembly up and separate from housing. Take care not to loose the paddlewheel itself and its stainless steel shaft which maybe free when the unit is disassembled.

Remove housing nut and rubber ring gasket. (This gasket will be installed later on the inside of boat). The sealant must be placed on the surface of the sealing flange on the housing and also on some of the lower threads of the housing to help lock the sealing nut in place. The bottom of the hull in the area of installation must be clean and dry for the sealant to seal properly; inside the bilge should also be clean to allow the seal nut to be properly tightened. Install housing from below boat with the arrow on the bottom surface of the housing pointed toward the <u>forward</u> direction of travel of the boat, parallel to the keel of the boat. Install gasket and seal nut should be tightened snuggly by hand so that the sealant is forced out of the sealing surface and the housing flange is as close as possible to the hull surface. The excess sealant <u>must</u> be wiped away from the housing to give the water flow a clear path. A final check of the location of this directional arrow and inside notch in housing should be made before the sealant is allowed to setup.

Reassemble the paddlewheel unit by sliding the inner unit into the housing with the arrow on the inner housing pointing toward the front. (Ensure paddlewheel assembly is properly centered in "notch" of housing, with arrow pointing toward bow). <u>Hand tighten</u> the locking cap.

The output cable should be run under the floor with the servo power cable so that it can be plugged into the master module.
(Included with this unit is a "Plug" and extra paddle and axle kit.)

V-DRIVE / WAKEBOARD BOATS / STERN DRIVES – The paddle is typically installed in front of the engine, just behind the gas tank. *(This area is generally accessible from the engine compartment or under rear seat.)* It is installed typically 7 – 8 inches off center, clear of any strakes in the hull, depth sounders, etc. Refer to any addendums that may be included. Never install behind a water intake or any other item that could cause turbulence.

The key to a good installation is to place the paddle in a location where there is nothing to disturb the flow of water in front of the paddle for 5-6 feet.

Section 11. TROUBLE SHOOTING / GENERAL INFORMATION

You can learn a lot from just turning on key and watching system start up. Every time PerfectPass is powered you will see the back light in Display glow green followed by a beep as the screen becomes active. When the Master Module sees a solid 12 volts +, the Intel processor starts which puts the data on screen and the servo motor will perform its "auto tighten" check.

A. NOT CONTROLLING

Servo Motor "Auto tighten" Test

Check: To confirm proper operation of the 4 phase servo motor, perform the following test. With key OFF, check to see if servo motor can be easily turned and that set screw in knob is snug. (It should turn freely, if not the motor may be seized) Turn knob in clockwise direction until snug, and then turn it back counter clockwise one full turn. Now turn key ON and servo should perform its "auto tighten" function and wind in the cable (approximately ¾ of a turn). (Every time system is powered, it will do an "auto tighten" which confirms all electrical phases are OK). Ideally, you should hold knob gently during "auto tighten" test to put a little extra load on the motor to check the connections.

Remember the servo motor will run very hot, particularly the gold resistor.

If motor does not wind in or just vibrates, then an electrical connection is likely bad. Unplug both connectors at servomotor and closely inspect the crimps and wiring. Gently pull on each wire to make sure the wire is securely crimped. Also check the connectors on the gray servo power cable at both ends (See servo testing in addendum for detailed testing).

If this test is OK, do a "Linkage Test" as described in section B.

B. Linkage Test - With key OFF, push the manual throttle open to ¾ position. Then take the black knob on servo motor and slowly wind the knob in a counter clockwise direction, then in a clockwise direction. As you do this, the throttle will slowly open and close with each step of the motor. In no place should the cable catch or hook as this will cause the system to surge. If the cable comes into contact with any part, fuel rail, cross over pipe or decorative engine cover, adjust cable and servo as required. (The cable should have a nice smooth bend and be in good alignment with the throttle connection. If you feel the cable is too long, contact PerfectPass)

The brass L adapter should freely swivel as the throttle opens & closes.
(If your boat has a plastic decorative engine shroud, you may wish to remove it temporarily and see if the problem disappears).

With key OFF, push manual throttle to full open and back to neutral. Does PerfectPass throttle cable move forward and back freely without jamming or rubbing against cover, fuel rails, etc?

C. System surging in neutral – Check gap between the PerfectPass cable & the Morse control / Teleflex cable. There should be No Gap. (See photo C in instruction manual).

D. System accelerates past set point – If the system accelerates past the set point and is very slow to work back to the set speed, the engine throttle return spring may be weak. PerfectPass can open the throttle, but depends on the engine return spring to bring it back towards neutral. A spring can be easily added. It may also be a throttle cable / mechanical problem. See Linkage Test, Section B above.

On Water Test – To confirm this, drive the boat carefully with engine cover open. Set speed at a lower setting (i.e. 20 mph) and have driver engage system and press throttle up to 25 MPH. As boat speed exceeds 20 mph, the servo should turn counter clockwise to let out cable and slow engine. If servo counter rotates, the return spring should pull throttle back towards neutral. If servo rotates but boat does not slow, the return spring is not pulling or something is preventing the throttle or cable from moving.

E. **No RPM tachometer reading** – If the display tachometer reading is 00, check to make sure rpm sensor is plugged into the correct port on Master Module. Check connections of rpm sensor. (Check installation as per instructions).

F. **Digital speed readout** – If the digital speedometer is not reading at all, check to make sure it is plugged in correctly. Check the paddle wheel to confirm the wheel is not damaged and is spinning freely.

G. **Blown Fuse (5 amp, 1.25 inch fuse)**

The most common reason a fuse will blow is if the red wire in the servo power cable is grounded or shorted. Inspect the wire for any breaks, pinches or failure especially near the gold resistor on the servo motor.

H. **System Reset** – If you would like to reset the entire system to original factory specifications, you can do so by **pressing & holding the ON/OFF & MENU Keys together as you power up the system.** After about 5 seconds the display will show [System Reset ^ = Y]. Press the **UP** key to continue with a reset.
The next question will be whether you wish to reset all your baseline rpm values. [Reset RPM @ ^ = Y] If you are happy with your baseline values, press the **DOWN** key and your settings will be maintained. On some systems, you will be asked to select the engine in your boat. It will then ask if you wish to run in just wakeboard modes [WAKBD ONLY ^=Y].

I. **Change Display from MPH to KPH/Wakeboard only –** If you wish to have the display read in metric or vice versa, you can move between modes by pressing and holding **MENU** & **Down** keys together as you power up the system. After selecting MPH or KPH, press **MENU** and it will ask if you wish to run Wakeboard only or three events.

J. **System surging in Trick or Wakeboard Speed Mode –**

Check: If your system works very well and controls smoothly in the rpm mode, but surges and hunts in the speed based mode, it is likely a paddle wheel related problem.

1. Does the paddle wheel impellar spin freely? (if not, change impellar)
2. Is the paddle wheel housing under the hull pointing straight forward. The arrow on the housing must be pointing straight ahead.
3. Is the impellar installed in the assembly in the correct direction?
4. Is the paddle insert fully and properly set in the housing?
5. Is the paddle wheel installed in the correct location? Call for details on your boat model. It can not be installed directly behind a strake, water intake, etc. which could disturb the flow of water.
6. Perform a System Reset. Press & hold the ON/OFF & MENU Keys together as you power up the system. Continue holding until you see the System Reset Prompt.
7. If it only surges when the boat is heavily loaded in a certain configuration, it may be a location problem.

If the problem cannot be corrected, it could possibly be a defective paddle wheel.

K. **Run in Wakeboard only Mode/Three Event Menu** – To run in just wakeboard modes or to return to the full event menu see (I) above.

APPENDIX

PerfectPass All Buoy Timing Version 4 IWSF Approved 2001

The All Buoy Timing Method (ABT) eliminates the need for a fall button. In Tournament Use, after a skier falls or misses during a pass, the boat is timed to the next set of boat gates. Because the boat travels only a relatively short distance before the time is measured, the boat speed does not change significantly. Thus the time is an accurate measure of the speed of the boat while pulling the skier.

If the skier runs a full pass, the full course time is used to determine if the boat speed was within tolerance. For scores less than six, a chart showing the timing tolerances for each buoy score is used. This method uses the cumulative time from the gates up to the last ball scored. With this approach, only one segment time is required.

After each pass, the PerfectPass system briefly displays the Full Course Time and then the two separate segments as in this 34.2 mph example. **[0.0 16.95 OK]** then **[7.13 9.82 OK]** If the score was less than six, then the ABT sub-menu is entered via the Down Key. The times are displayed in pairs preceded by the score identification and a colon. (Press any key to take you to the next set of scores). **For example:** if the score were four and a quarter, you would scroll through the ABT times until the 4 ID is found which would appear as: " **4: 12.50 5: 15.19** " The time of 12.50 would be called in. For a score of one and a half the display showing " **0: 1.77 1: 4.45** " is used and only the 4.45 time is reported. All of the existing rules for optional and mandatory rerides are applied to the ABT times. *(The guide is to always refer to the time segment corresponding to the score. Example: If the score starts with a 4 you look at the time following the 4 and call in that time only.*

Magnets: A minimum of eight magnets and two Smart Timers are required to run ABT, a course with ball one magnets had eight magnets already, two are on the entrance and exit gates and two Smart Timers are required for the jump event, so for many sites the equipment necessary to use ABT already exists.

(Check with our website at www.perfectpass.com for more details).

PerfectPass All Buoy Timing
36mph/58kph IWSF approved method 4

score	score id.	fast in	actual	slow in
0 to 0.5	0:	1.64	1.68	1.71
1 to 1.5	1:	4.15	4.22	4.28
2 to 2.5	2:	6.67	6.77	6.84
3 to 3.5	3:	9.20	9.31	9.41
4 to 4.5	4:	11.73	11.86	11.97
5 to 5.5	5:	14.25	14.40	14.53
6		15.92	16.08	16.22

PerfectPass All Buoy Timing
34.2mph/55kph IWSF approved method 4

score	score id.	fast in	actual	slow in
0 to 0.5	0:	1.73	1.77	1.80
1 to 1.5	1:	4.37	4.45	4.51
2 to 2.5	2:	7.03	7.13	7.23
3 to 3.5	3:	9.69	9.82	9.93
4 to 4.5	4:	12.35	12.50	12.64
5 to 5.5	5:	15.02	15.19	15.34
6		16.78	16.95	17.12

Jump Settings

New Times (Faster Second Segment)

Examples for when towing jumpers over 120 Feet.

Jump Settings	**S2%**	**S2 RTB**	**CT**
Ski Nautique	Faster 60 – 120	Faster 10	190
MasterCraft	Faster 60 – 120	Faster 10	190
Malibu	Faster 60 – 120	Slower 5	190
Others	Faster 60 – 120	Slower 5	190

WARNING
RELEASE OF LIABILITY – ASSUMPTION OF RISK

IMPORTANT
(Detach, sign and mail immediately)

YOU MUST READ THIS!

The PerfectPass Speed Control device is a high performance mechanism designed solely for use with competitive water ski and wakeboard boats operating under ideal, calm conditions utilizing a spotter and all other safety crew and requirements of tournament water skiing. The PerfectPass Speed Control device should not be used for any other purpose or under any other conditions.

YOUR USE OF YOUR PERFECTPASS SPEED CONTROL DEVICE IS CONDITIONAL UPON YOU ASSUMING ALL RISKS, LOSSES AND DANGERS RELATING TO USE OF THIS DEVICE.

Both purchaser and/or anyone utilizing the PerfectPass Speed Control device acknowledges that their purchase and or use of this device is conditional upon them releasing and forever discharging PerfectPass Speed Control Systems Inc., its directors, officers, employees, agents and/or dealers, their heirs, and assigns **from any and all liability for personal injury or property loss** and from any other claims, demands, losses or causes of action, whether occurring prior to, during, or subsequent to or directly or indirectly connected with the use of the PerfectPass Speed Control device, **and whether caused by any persons negligence or otherwise**.

The PerfectPass release of liability, and warranty agreement shall be interpreted in accordance with the laws of the Province of Nova Scotia, Canada, and **IT IS FURTHER AGREED** that any legal proceedings that either directly or indirectly relate to the PerfectPass Speed Control device shall be conducted within the Province of Nova Scotia, Canada, regardless of where arising.

The purchaser hereby agrees to inform any subsequent purchasers or anyone using the PerfectPass Speed Control device, of the conditions of this Release of Liability, Assumption of Risk Agreement. It is agreed that there shall be absolutely no alterations to this agreement whether by implication or otherwise.

_____ _____

Purchaser Signature Date

_____

Address

_____ _____

Serial Number (found on Master Control Module)

_____

Name (Please Print)

(Must be signed to affect valid purchase and activate warranty agreement, detach and mail immediately to PerfectPass Control Systems Inc., 14 Trider Crescent Dartmouth, Nova Scotia, B3B 1R6, Canada).

LIMITED WARRANTY

During the first 12 months from date of original retail purchase, any PerfectPass component that fails due to defects in materials or workmanship will be repaired or replaced at the option of PerfectPass at no charge.

All warranty claims must be authorized in advance and a Return Authorization (R/A #) issued. All packages, correspondence, documents and packing slips must reference this R/A #.

Warranty excludes components damaged my improper installation or improper use of boat. Servo Motors are water resistant, but not water proof. Servo motors may become damaged if excess water is run in a boats bilge and this may void warranty. Ensure your boat is properly "bilged" prior to operating.

Warranty Service:

1. If your PerfectPass was factory installed, any warranty issues should be directed to your authorized dealer. PerfectPass encourages all customers to contact us prior to visiting your dealer for "technical support" as many issues may be easily handled direct with customer.
2. If your PerfectPass was purchased and installed by a dealer you may contact your dealer direct or initiate a warranty claim with PerfectPass.
3. If your PerfectPass was purchased directly from the Company, contact us at the number below.

Warranty Service / Technical Support
PerfectPass Control Systems Inc.
14 Trider Crescent
Dartmouth, Nova Scotia
CANADA B3B 1R6
(902) 468-2150

(Hours: Monday to Friday 8:00 am – 4:00 pm EST)

PerfectPass®
WORLD LEADER IN SPEED CONTROL