

# **BASIC TROUBLE SHOOTING**

## **(PERFECTPASS FOR MECHANICAL ENGINES)**

### **How PerfectPass Works**

Through the in-dash display the driver sets the desired boat speed or engine RPM depending upon which mode of operation the driver has selected. The master module computer calculates the speed of the boat from the paddlewheel signal and the engine RPM from the engine tachometer signal. The servo motor control cable is connected to the throttle arm of the engine, which allows the servo motor to control the engine's power. This control cable operates the throttle in cooperation with the manual throttle cable so that both the driver and the servo motor are able to change the engine output.

As the driver advances the throttle handle to bring the boat up to speed, the servo motor prepares to take control, at the point where the boat speed or engine RPM has reached the desired level, the system beeps to indicate it is beginning to control and the driver stops moving the throttle handle. The servo motor adjusts the engine throttle as required to continuously maintain the set speed or RPM. The driver is able to change the set speed or RPM while the system is engaged by simply pressing the up or down keys for each ¼ mph change in speed or 25 RPM change desired. At any time the driver may pull back on the manual throttle to slow the boat down, the PerfectPass system immediately stops controlling the engine and the driver once again has full control.

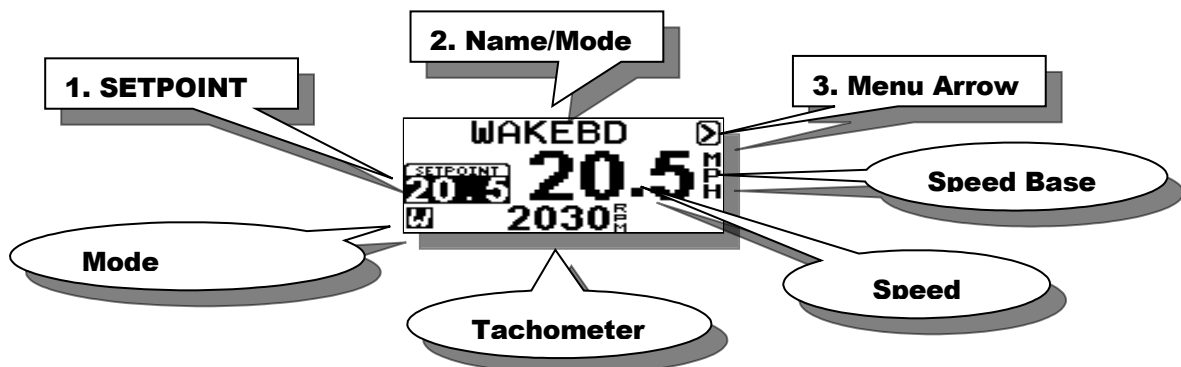
### **Start Up Procedure**

The Master Module is the heart of the system and requires a solid and continuous 12 volts before the "relay" will allow the Intel Processor to start. Upon proper start up, the Dash Display will become active and the servo motor will power up and perform an "auto-tighten" rotation check.

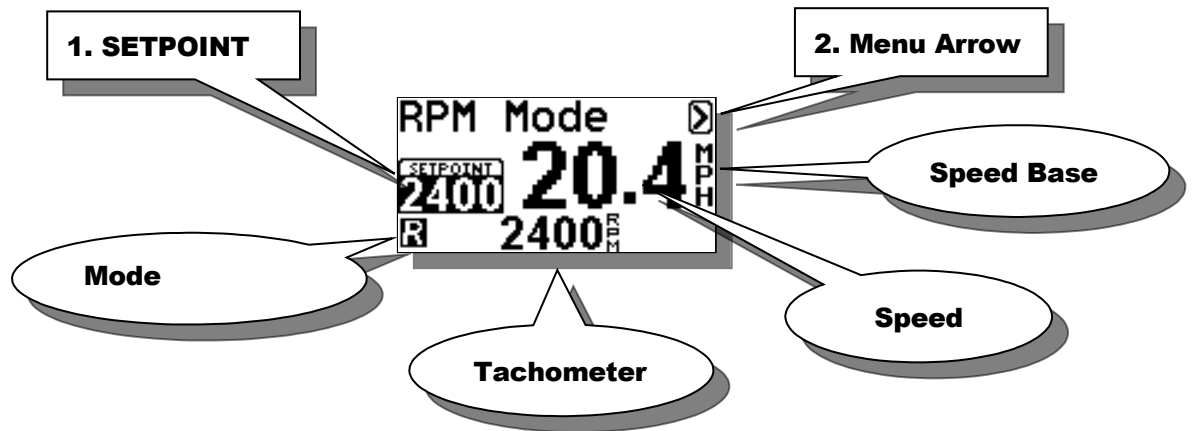
A great deal can be confirmed from visually watching this routine start up. If the key is moved to the on position, the PerfectPass Display should become active & beep and servo motor is powered. If you then spin the paddle wheel you should see a speed signal register on the PerfectPass Display confirming proper operation.

The WakeboardPro has two main operating modes:

1. Speed Based Wakeboard designed primarily for wakeboarding in the 15 – 25 mph range. User sets a speed on the main screen.



2. RPM Mode where the user sets an rpm value. Designed for higher speed use such as open water skiing or cruising.



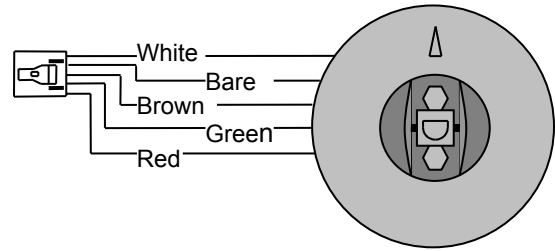
**IMPORTANT OPERATIONAL TIP:**

PerfectPass only controls one engine, therefore, it is important that the manual handle is not advanced too far or the PerfectPass controlled engine will need to drop the RPM significantly to slow the boat to desired speed.

If you see one engine slowing significantly compared to the other, you should slowly pull the handle back so both engines are more closely matched.



**Thru Hull Paddle Wheel** (Supplied by the Boat Manufacturer in most Boats Built Since 2002/2003).



Red – 12-V Power  
Bare – Ground  
Green – Speed  
White – Water Temp  
Brown – Water Temp

The Thru Hull Paddle Wheel (Model ST300) is manufactured by AirMar Technologies. Its primary purpose is to provide a digital speed signal to the boat speedometer, and shared by PerfectPass.

The paddle wheel impellar must be able to turn freely in order for an accurate signal to be produced. It must be properly installed in an area of the hull where the water flowing back over the paddle is clean and undisturbed. It must be installed facing straight ahead.

If any part of the paddle wheel or shaft becomes damaged or slightly bent, the speed signal will not appear on the screen or will be inconsistent. The impellar can be quickly changed.

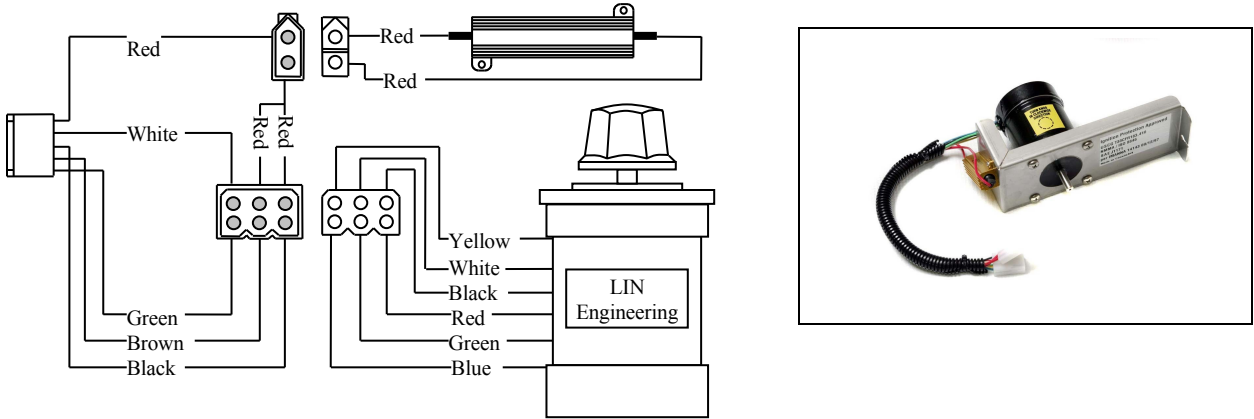
The paddle wheel is designed to be most accurate at speeds under 35 mph. At high speeds depending on trim position and hull dynamics, the speed displayed may not be accurate.

Wakeboarding is typically enjoyed at speeds in the 16 – 22 mph range. At higher speeds, and for skiing, users will typically find the rpm mode smoother.

If the displayed speed on the PerfectPass gauge is incorrect, ( ie: the system indicates 20, but actual speed is 22) this can be easily calibrated by pressing the Menu Key to highlight Menu Arrow Key, then press Down to enter Calibrate screen. Then press the down key to lower speed by 2 mph.

**Changing Impellar** – The life of the paddle wheel axle and bearing is designed for years of trouble free operation. In the event of damage to the rotating paddle or axle, ideally the boat should be removed from the water for inspection. (Clean debris if necessary.) If the paddle requires replacement, remove large housing nut and pull paddle assembly out of housing. (Note the direction of rotation of impellar so flat surfaces are toward bow as per arrow on assembly). Press the axle out of position and install new one. You may wish to install new “O rings” at this time as well. Re-insert paddle wheel assembly ensuring the unit is in the “notch”. Re-install locking cap. (If your digital speed readout is suddenly reading extremely low or not at all, check paddle assembly).

## Servo Motor



The 4 – Phase servo motor can make hundreds of adjustments per second to maintain the correct speed. It is vitally important that the throttle cable has free movement and the brass L Adapter (Volvo only) connecting the PerfectPass throttle cable to throttle arm can swivel and rotate smoothly.

If a servo motor is not installed in the correct location, the throttle cable may have too much of a bend or may jam against the engine cover which will cause improper operation.

Anytime you suspect the system is not controlling properly, A Servomotor Test should be performed as follows. If servo motor test is successful, perform a linkage test on page 10.

### Servo Motor Test / Auto-Tighten Test

Every time you return the boat to neutral when PerfectPass is on, the servo will wind in the cable until snug in a clockwise direct. This is the normal starting point for the servo.

Each time you turn the key on or start the boat, PerfectPass becomes powered and the servo will perform an “auto-tighten” function and will attempt to wind in the cable to confirm it is in normal position. (If in proper position, it will appear simply as a “click”, “click”, “click”).

To check servo & servo power wire, with key off turn black knob on servo motor counter clockwise  $\frac{3}{4}$  of a turn. Now turn key on and black knob should turn clockwise about  $\frac{3}{4}$  of a turn as part of auto- tighten. If it does, repeat procedure, except this time hold black knob gently to apply some resistance to auto tighten. If it rotates with good strength then it would appear servo & servo power cable are fine.

If it does not rotate or just vibrates, then a wiring phase coming to the servo may be loose or broken. Inspect all wiring around servo. Pull both white plugs apart at servo & inspect pins to ensure they are in place. Gently tug on each wire to ensure they are securely in crimp. Check at Master Module where cable is connected.

If you cannot locate problem, contact PerfectPass.

### **Important Notes:**

1. The gold resistor will run extremely hot. This is normal.
2. If system is new, make sure servo power cable is plugged into Master Module correctly and not upside down. Tips on plug should point up towards label on Module.



# Quick Reference Trouble Shooting Guide

## Problem

## Possible Cause (Action)

Display does not power up.

Is display plugged into master module. Check fuse. Check 12-volt power source, ground to PerfectPass.

No speed reading.

Is paddle cable connected to master module. Is paddle damaged? Does it spin freely? (Does boat speedo work?)

Very Low speed Reading.  
No Speed Reading

If paddle looks good and boat speedo works, perform a system reset. (Page 11)

Not controlling well.  
Not controlling at all.

Perform servo motor test, perform linkage test. (Page 4 & 10)

System beeps to confirm engagement, but continues past set speed and does not control.

Perform servo motor test, linkage test and return spring test.

Button on keypad does not work.

Unplug display connector at master module and check pins. Replace display.

System controls well in RPM mode, but not smooth in speed mode.

Is speed mode setting 25 mph or less? Is paddle wheel in good condition?

Paddlewheel impellar damaged.

Install new impellar kit available from PerfectPass.

Displayed speed not correct. i.e. system says 20, actual speed 22.

In Wakeboard mode, press menu button to highlight Menu Arrow, then press Down Key to access Speedo Calibrate". Quickly press down key and lower speed by 2 mph.

System disengages on its own and boat slows.

Is manual throttle handle pulling back on its own, if not perform servo motor test.

Blowing 5 amp fuse.

Inspect red wiring around servo motor for a ground or short.

## Troubleshooting Q & A.

**1. Condition:**

One engine runs much slower (lower rpm) than the other.

**Solution:**

*Only one engine has the PerfectPass installed (normally the starboard side). Since only this engine is controlled, it is very important that the throttle handle is not advanced too far or the PerfectPass controlled engine will have to reduce power significantly in order to control at the right speed.*

*Ideally, the operator should throttle up until the beep is heard. (The handle can be pulled back to better balance the two engines).*

- 2.** In both Speed & RPM Mode the system beeps to engage, but speed never settles in and hunts beyond & below target speed.

**Solution:**

*It appears that the PerfectPass throttle cable does not have free movement and is rubbing against engine cover or some other obstacle. A **Linkage Test** should be performed.*

**3. Condition:**

System beeps to confirm engagement, but boat continues past set speed and never locks in.

**Solution:**

*Computer is attempting to control, but servo not responding. Perform **Servo Motor Test**. (Servomotor could be seized). Page 4.*

**4. Condition:**

System hunting in speed mode only. RPM Mode working perfectly.

**Solution:**

- 1. Inspect paddle wheel for damage...does it spin very freely.*
- 2. Is paddle wheel fully seated in housing, is arrow pointing forward.*



## Troubleshooting Q & A. (Cont'd)

5. **Condition:**  
PerfectPass digital speed reading shows 22 mph, but GPS indicates boat speed is actually 24 mph.

**Solution:**

*Press menu key and highlight "Menu Arrow" then press Down Key and "Speedo Calibrate" will appear. Quickly press down key several times and drop calibration speed by 2 mph. (Can be done in the shop or on the water). Remember, the LCD screen simply shows the data from Master Module so there is no reason to suspect the Display is a problem.*

6. **Condition:**  
PerfectPass green light in display is on, but no data on screen.

**Solution:**

*Check to see if servo motor is powered, if not then the system does not have adequate voltage or is poorly grounded and will not start. (Measure voltage on PerfectPass power cable, which should be in excess of 12v).*

*Note: When key is off, the black knob on servo turns very easily. When powered, knob is stiff and is difficult to turn.*

*If servo is powered and performs auto tighten rotation but Display has no data, then Display should be changed.*

7. **Condition:**  
PerfectPass has no digital speed reading

**Solution:**

- 1. Check Master Module to ensure paddle wheel cable is properly connected and pins are in proper position and not bent.*
- 2. Does paddle spin freely.*
- 3. If all looks well, perform a "System Reset"*

8. **Condition:**  
Up key on Display does not respond.

**Solution:**

*Make sure all 10 pins on Master Module are in-line where display connects. If connection is OK, key pad switch is faulty, return to PerfectPass for repair.*



## Troubleshooting Q & A. (Cont'd)

9. **Condition:**  
Boat speed drops and throttle handle must be pushed far down to get acceleration.

**Solution:**

*Servo Motor is not holding and rotating properly usually due to a bad connection at servo. See Servo Motor Test, page 4.*

10. **Condition:**  
System is blowing the 5 amp fuse on 12v power cable.

**Solution:**

*Generally caused by a short or “grounding” problem with the red 12v power cable on servo motor. Closely inspect wiring particularly around gold resistor. (Remember, resistor & servo will run very hot which is normal).*

11. **Condition**  
Speed control sometimes disengages on its own.

**Solution:**

*Is manual handle pulling back. Does “#” sign appear on screen?*

12. **Condition**  
Boat Speedo Reads O.K., but PerfectPass Reads Very Low, ie. 1 or 2 mph.

**Solution:**

*Perform a “System Reset” to re-establish calibration points.*



## LINKAGE TEST

This test should confirm whether the PerfectPass throttle cable & linkage connection is properly working.

With key OFF, push the manual throttle to 1/2 open position. Now take black knob on servo and slowly turn the knob in a counterclockwise direction, and then in a clockwise direction.

As you rotate the knob back & forth, you should see the throttle lever on engine opening & closing very smoothly with each step of the motor. As you turn the knob counterclockwise, which lets out cable, the throttle will close back towards neutral. When you rotate it clockwise the throttle will open.

As you rotate the knob back and forth (slowly and quickly), the throttle should open & close very smoothly and the brass L Adapter at linkage should be rotating as well to follow cable. At no point should the throttle cable catch, hook or come into interference with any part that could disrupt the cable movement.

If the cable is rubbing against a decorative engine cover, fuel rail, motor box etc, adjust servomotor and cable to improve alignment. Many plastic decorative engine shrouds can cause this problem. Remove temporarily and run boat if you suspect this could be a problem.

Final Test: With key OFF, push manual throttle to full open position. Watch PerfectPass throttle cable to ensure it can move freely without binding or interference.

### **Boat Speeds Past Set Speed**

If the system beeps to confirm engagement, but continues past set speed, perform a Servo Motor Test and Linkage Test. If these tests indicate all is well, it could be a Throttle Return Spring problem.

**Throttle Return Spring:** PerfectPass can open the throttle (by turning clockwise), but relies on the engine return spring to close the throttle when the servo turns counterclockwise. (The return spring is always applying pressure against the throttle back towards the neutral position). If the servo turns counterclockwise to slow the boat, but the throttle lever on engine does not move or moves very slowly, the return spring could be weak, broken, etc.

If you feel the spring is weak or damaged, an external return spring can be added.

## Resetting a Wakeboard Pro (System Reset)

### Version 6.3/6.4/ 6.5

You can do a System Reset by pressing and holding the ON/OFF & MENU Keys together as you turn key on to power system. Continue holding as the Perfect Pass display goes through its normal start up procedure until [System Reset ^ = Yes] appears.

Press the UP key to continue the reset. It will then display [Reset RPM @ ^ = Yes]. Answer yes by pressing the UP key. Next on the display will be [Read in MPH ^ = Yes]. Answer yes by pressing the UP key. Next [Wakeboard Only ^ = Yes] will appear. Answer yes, by pressing the UP Key. For WakeboardPro, press Down for DigitalPro.

### Paddle Wheel Troubleshooting

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 impeller spin freely? (If not, change impeller).
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 impeller 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 cannot 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.

**TEST** – Drive boat in RPM mode at a value of 2800 RPM. When RPM is locked on, watch PerfectPass digital speed reading. It should only be varying by one or two tenths. If it is varying more than this, then the paddle signal to PerfectPass is not consistent.



## Adjusting KDW / NN

### KDW

If you wish to change this control parameter, highlight Menu Arrow and press Up Key. Wakeboard will now be on screen, press Down Key to enter KDW/NN. You can then change the KDW using the up or down keys. Higher values = more aggressive control response. Factory setting is 60. (Example: Heavily loaded boats may need a higher value to maintain a steady, crisp pull. Try 100 – 150). After adjustment, press MENU to process.

### NN

This follows KDW and represents the filter factor of the paddle wheel. Typical values (120 – 160). Higher values mean the system will sample more revolutions prior to making a speed adjustment. If you feel the system should be “smoother”, try raising the NN.

## Investigating Blown Fuse

### Fuse - 1.25” 5 AMP

Typically, a fuse will only blow if there is a short in the red wire found within the gray servo power cable, which carries 12 volts from the Master Module to the servo motor.

Closely inspect the servo motor power cable connector both at the Master Module end and at the servo motor and gold resistor end located at the engine. If the red wire is split, frayed, etc, it could be the cause of the “grounding out” of this 12 volt supply causing the fuse to blow.

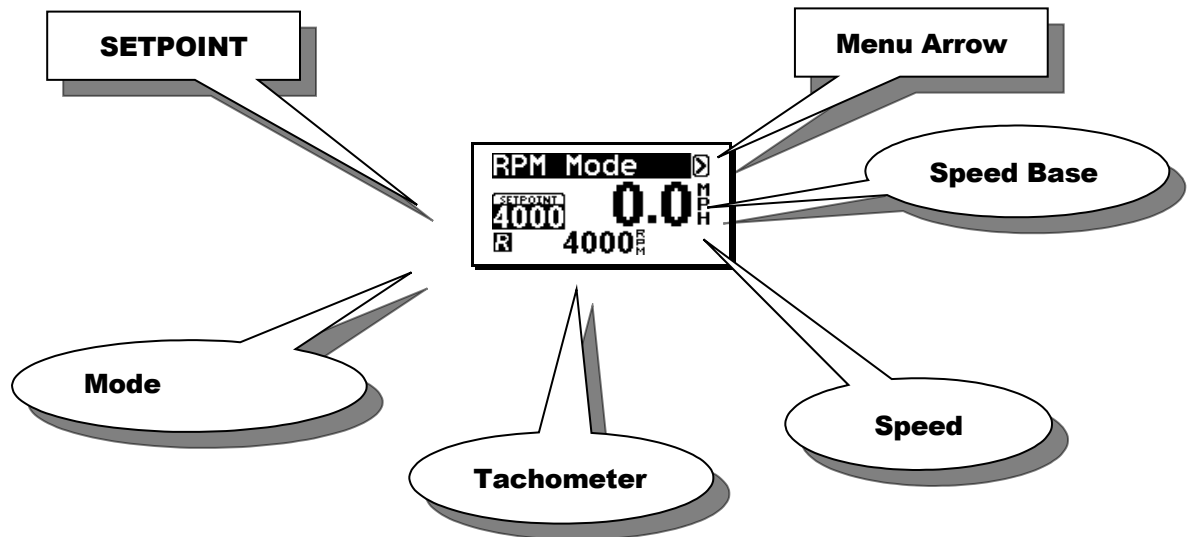
Pinching or crushing of this cable could also cause a “ground out” of the 12 volt supply and blow the fuse.

If after careful inspection of this cable, the problem has not been found then the following procedure can be followed to help identify the source of the blown fuse:

- Step.1 With the key off, unplug all plugs from the Master Module, except the Display.
- Step.2 Turn key on and go to the Battery Voltage reading on the PerfectPass Display. (Press Menu & Up Keys together, then press the Menu key. Make a note of the battery voltage displayed).
- Step.3 Now plug in the paddle wheel plug. The displayed voltage should not change.
- Step.4 Now plug in servo power cable with the servo motor connections intact. The voltage reading with a good cable should drop about 0.3 volts. [A significant voltage drop (1 volt or more) would confirm a problem with the servo motor or cable].
- Step.5 You can also perform this test with the servo motor and resistor unplugged. This would test the servo power cable independently, if no problem is found with the cable alone, then plugging in the servo motor will help identify the location of the problem.

## PerfectPass Tank Testing

1. Move screen function to RPM Mode. Highlight menu arrow at top right and press UP Key. Menu to RPM Mode and press UP Key.



2. With throttle locked in neutral, aggressively accelerate engine up and well beyond 4000. You will see the digital tachometer in center of screen. (You will feel a soft spot in throttle as you accelerate...continue pushing throttle up and past 4000.) When 4000 is reached you will hear a beep to confirm engagement and system should start controlling. The digital tach should settle in and hold steady at about 4000.
3. As system is controlling at 4000, you can press throttle handle forward which will cause engine to speed up briefly...it will then settle back at lock in again at 4000.
4. If you then bring throttle to neutral, servo motor will wind in cable clockwise to its normal starting position.
5. With key on, spin paddle wheel and a digital speed signal will register on screen.
6. Throttle on boat should feel the same as a boat without PerfectPass, it should smoothly go into and out of gear.

The key to a good installation is to ensure the PerfectPass throttle cable has a smooth alignment to where it attaches to boat throttle cable. There should be no excessive bends where cable could bind. Perform a Linkage Test if necessary.