PERFECTPASS®

World Record Speed Control

Service Manual

March 2004

PerfectPass Control Systems Inc.

14 Trider Crescent
Burnside Industrial Park
Dartmouth, NS B3B 1R6
Phone: (902) 468-2150
Fax: (902) 468-8837

Service Manual

Table of Contents

Page No.

Troubleshooting WakeboardPro / DigitalPro

General - In many cases, you can trouble shoot a system by simply turning it On. Every time the system is powered, the Display will first light up and following a brief pause the processor in the Master Module kicks in and the Display becomes active and the servo-motor is powered. When it first becomes powered, the servomotor will perform an "auto tighten" function to make sure it is turned snug in a clockwise direction.

(1)Problem - Not Controlling / System Running Past Set Speed

System comes up to speed, beeps to confirm engagement, but it runs past set speed.

SERVO-MOTOR TEST – (Auto Tighten Test)

Check: To confirm proper operation of servomotor, perform the following test. With key OFF, check to see if servomotor 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, 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, hold black knob gently during the "auto tighten rotation" to add a little resistance on the motor).

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. Also check the connectors on the gray servo power cable at both ends. (Pull lightly on the wires if necessary).

If it just vibrates and it is a new installation, make sure gray servo power cable is not plugged into Master Module upside down (tips on plug should face up towards label).

If this test is OK, do a "Linkage Test" as described on next page Item #2.

If the system runs past the set speed and is very slow backing down, check the **throttle return spring**. PerfectPass can open the throttle, but relies on this spring to constantly pull the throttle back towards idle. A weak or defective spring should be changed. (An external spring can also be added).

If you are on the water, set speed at about 20 MPH and watch servo motor as the boat is driven up to and past engagement speed. At 20 MPH, system will beep and since boat is likely going past this speed the servo motor will counter rotate to let out cable to slow boat back to 20 MPH.
Is the servo motor counter rotating? If it is, why is boat not slowing down? Either something is interfering with the free flow of cable or the return spring is weak or disconnected.

(2) Problem – System Surging in RPM Modes and Paddle Wheel Speed Modes

Check: If the system is surging in both modes, this is generally caused by a poor throttle cable connection. It is vitally important that the stainless steel cable inside the plastic jacket can move freely.

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 or 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 in to 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?

(3) Problem – System Surging in Trick / Wakeboard Modes. (Speed Based)

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. If it only surges when the boat is heavily loaded in a certain configuration, it may be a location problem.
7. On most new boats (MC, Malibu, Centurian) there is a factory paddlewheel on all boats that operate the boat speedometer. On these applications, PerfectPass shares the signal. If the boat speedometer is very smooth yet the PerfectPass digital readout is moving actively, you may have to check/replace the boat paddle assembly as a short or signal drop will affect PerfectPass.

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

(4) Problem – No Digital Speed Reading / Very Inaccurate Reading

Check: If the display shows 00 for a speed-reading, then it is likely one of two problems.
1. Check the paddle wheel connection at the Master Module. Is it plugged in?
   Check each wire on paddle plug to ensure they are intact. Are pins on Master Module bent?
2. Is the paddle wheel able to spin freely? In wakeboard / trick mode, you should be able to spin the paddle by hand and register 7 – 8 mph. If not, change the shaft and impeller.
3. Perform a "System Reset".

(5) Problem – No RPM Reading

Check: If you do not have a RPM reading, check the RPM cable connections at Master Module and follow the wires to ensure the connections are solid. A bad connection is likely the cause. It is very rare to see a bad RPM Sensor cable. (Remember, on some engines (LT-R, LT-1, Pre 2002 LS-1) only the black wire on the RPM Sensor is connected to the gray (RPM lead) from engine. The gray wire is not needed, see page 20 for details).
If the RPM sensor has been connected using "snap on connectors", make sure when the spade was pushed on that it slid into the groove correctly. It is possible to miss.

(6) Problem - System not Powering Up

Check*:* If the display light comes on, but there is no data then the processor has not started. This is usually due to low voltage as the Intel processor requires about 11.5 volts or more. Another symptom is just blocks on the Display or it may cut in and out and continually re-boot. Check all power connections including a solid ground. If possible, run the power wires direct to a battery to see if system starts, to confirm it is a wiring problem. Remember, the servo-motor does it's 'auto tighten" only after the processor kicks in. Therefore, if servo does not power and display is not active, you have a voltage issue.

Blocks on Screen – If there are just blocks on the screen, yet the servomotor is powered, the LCD display may be defective.

Troubleshooting WakeboardPro / DigitalPro (Continued)

(7) Problem – Blowing Fuses (5 or 10 amp, 1.25 inch fuse)

Check: 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 servomotor. (Do not use more than a 10 amp fuse).

If a Smart Timer Magnetic Sensor or Hand Timer is connected, check the wires to see if they were pinched or crushed causing a short, which will also blow a fuse.

(8) Problem - System Surging in Neutral

Check: Inspect the throttle connection for a gap when in neutral. (See photo C in installation manual) When the system starts up and performs the "auto tighten" it is opening the throttle. Adjust gap.

(9) Problem – In Dash Display Issues

Not Active - If the green back light is ON, but nothing else is active would indicate the relay in the Master Module has not closed to supply the logic power for the processor and display. (If you check servo, you will probably see that it is not powered). This is generally caused by lack of voltage. Check voltage at PerfectPass power cable to ensure it has in excess of 11.5 volts. If servo is powered and display is still blank, it is a display problem.

Display Key not working – If one of the membrane keys is not working, the keypad will need to be repaired by PerfectPass.

Beeper not working – If the beeper has stopped working, a new beeper can be easily installed on the back of Display. Contact PerfectPass for a "beeper replacement kit."

Displays have been quite trouble free. If one fails to power or work properly, check the 10-pin wire connector to ensure all wires are intact. Also, check the pins on Master Module where it connects to make sure all pins are "in-line".

(10) System Reset – If the entire system data / speed calibrations are not consistent or have been tampered with, a "System Reset" will reset the entire system to original factory values. To do this, press & hold the ON/OFF and MENU Keys together as you power up the system. Continue holding until you see the System Reset prompt.

(11) MPH<>KPH – If a system was somehow flipped into KPH, the boat will run much slower than would appear normal. (*Ex: A wakeboard set speed of 20 would run the* boat *at about 12 mph.)* To check or set it back to MPH, simply press & hold the MENU & DOWN Keys together as you power up the system. Continue holding until you see the [Read in MPH] prompt.

Troubleshooting WakeboardPro / DigitalPro (Continued)

(12) Voltage Tests (Servo Motor Phase Test) Version 6.3, 6.4

The servo motor and its associated cabling can be tested without the boat engine running. Press and hold the MENU key and the DOWN key while the system is being powered up on the WakeboardPro or via the device test found in Mag Test on the DigitalPro. Eventually the display will read:

[SERVO TEST ^ = Y]

If you then press the UP key, the system will enter a series of diagnostic tests that can help troubleshoot a system problem.

13.5 = OK SERVO OFF – The system automatically powers down the servo and measures the supply voltage level. This level with engine running should be between 13.0 and 14 volts. (If the voltage is below 13.0 volts, this display will show it is low.

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 between 12.2 – 13.2 with engine running. A reading below 12.1 volts will produce a "LO" indication.
Press menu to continue into **Servo Motor Test** function.

Servo Motor Phase Wire Tests

The display shows: [green phase 0.3]

Indicating the green phase wire from the master module to the servo motor is being tested. A voltage reading of 0.2 or so normally indicates a proper connection. The servo motor will be held firmly in place by the current flowing through this single phase connection.

Pressing the Menu key changes the phase from green to brown and the test is applied to the brown phase wire. In the same way the black and the white phases are tested The servo motor will make a small rotation each time a new phase is selected. The Menu key completes the phase tests.

As each phase is tested, check knob on servo which should be locked during each color phase test.

The motor is held firmly in position during each phase test by the current flowing in the wire under test. If there is an open circuit in the phase wire under test then the motor will be easy to rotate by hand, a poor connection will release and then grab the motor as the wire is wiggled. A problem with a phase wire is indicated by a voltage reading of 0.0 .

Beyond the 6-pin connector at the motor, the following wires are also checked as part of the phase tests:

Phase Wire	Associated Motor Phase Wire
Green	Red
Brown	Green
Black	White with red stripe
White	White with green stripe

Servo Rotation Tests

"IN NEUTRAL ^ = Y" will appear and you must confirm the boat is in neutral by pressing the Up Key to continue which will move the program into Servo Motor Test. **(THROTTLE MUST BE IN NUETRAL POSITION as a critical safety requirement)**

Next the screen will show **"ROTATE SERVO ^ = Y"** which means press the up key to start the servo motor test. The servo motor should perform one smooth complete rotation back and forth. *(A smooth rotation confirms the motor and servo power cable are OK)*

The screen will then change to **"RESET SERVO ^ = Y**" Press up to return servo to its initial position.

Servo Motor Phase Wire Tests 6.5 (2004 Software)

On newer systems with 6.5 software, the system can automatically check each wire phase.

Enter test by pressing and holding the Manu and Down keys together as you turn key on to power system. After a few seconds [Servo Test = Y] will appear.

Press Up Key to proceed with test:

[13.5 = OK Servo OFF] Will appear showing voltage at servo when off. Press Menu to proceed.

[12.9 = OK Servo ON] Shows OK voltage with servo off. Press Menu to proceed.

[Phase Test ^ = END] When this is on screen PerfectPass is automatically testing each servo power wire. If one is bad, it will indicate which one, ie. Green Phase.

(13) CALIBRATE TEMP - If the accuracy needs to be adjusted, press the Up and Down Keys together when Water Temp is on the screen. You can now calibrate the temp up or down.

Troubleshooting PerfectPass Cruise (RPM Based)

General: This system is relatively easy to service and much can be observed when the boat is powered. When the key is turned ON, PerfectPass becomes powered and when the Master Module sees 11.5 volts the processor starts which causes the red LED light on the 2 inch dash switch to flash once and turn off. At the same time the servomotor will become powered and locked after completing its "auto tighten" function. (Every time the system is powered the servo will check to make sure it is turned snug in a clockwise direction.)

If the red light did not flash and servomotor does not become powered, this would indicate the processor is not starting, likely due to low voltage. Check power and ground connections to ensure a solid power source. If in doubt, connect directly to the battery and try again.

(1) Problem – Not Controlling / System Running Past Set Speed

Check: To confirm proper operation of servomotor, do the following test. With key OFF, check to see if servomotor 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, then turn it back counter clockwise one-half (1/2) turn.
Now turn key ON and servo should perform its "auto tighten" function and wind in the cable. (Every time system is powered, it will do an "auto tighten" which confirms all electrical phases are OK).

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

If motor <u>does not</u> wind in or just vibrates, then an electrical connection is likely bad. Unplug both connectors at servomotor and closely inspect the crimps and wiring. Also check the connectors on the gray servo power cable at both ends. (Pull lightly on the wires if necessary).

If this test is OK, do a "Linkage Test" as described below in Item #3.

If the system runs past the set speed and is very slow backing down, check the **throttle return spring**. PerfectPass can open the throttle, but relies on this spring to constantly pull the throttle back towards idle. A weak or defective spring should be changed.

If you are on the water, engage system at about 20 MPH and watch servo motor as the boat is driven past engagement speed. Since boat is going past set speed, the servo motor will counter rotate to let out cable to slow boat back to 20 MPH.

Is the servo motor counter rotating? If it is, why is boat not slowing down? Either something is interfering with the free flow of cable or the return spring is weak or disconnected.

(2) Problem – Red Light on Dash Switch Turns On & OFF Automatically

Check: After you turn key ON, the red LED light should blink once to confirm system is powered and ON. If the light flashes ON&OFF on its own, the key pad may be faulty and should be replaced. (If a button on the key pad is stuck, it will act like the operator is constantly pressing the button).

(3) Problem – System Surging

System surging is generally caused by a poor throttle cable connection.

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 or 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 into 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).

Troubleshooting PerfectPass Cruise (RPM Based) (Continued)

(4) Problem – Customer Drives to Desired Speed, Presses Engage Button and System Turns OFF (Red light turns off)

Check: If the system was in the ready mode (slow blink) and turned off when the ENGAGE Key was pressed would indicate the system did not see an RPM value so it thought the driver was calling for it to turn off. Inspect RPM cable connections to ensure they are solid. (See page 20 for amended RPM connection instructions on certain boat models).

(5) Problem – Blowing Fuses

Check: 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 servomotor.

(6) Problem – System Takes Control, Then "Disengages" and Slows Down

Check: Is the manual throttle slowly pulling back? Try advancing the manual throttle more forward after engaging, this will provide the system with more cable to work with.

Operating Instructions - RPM Cruise

Operating Instructions

- With boat in neutral, turn system **ON**. (Light blinks slowly, indicating system is armed).
- Drive to desired speed, press **ENGAGE** and system takes control. (Light stays on steady).
- Pull back throttle and system disengages. (Light blinks rapidly indicating RESUME Function ready). System disengages when speed drops about 5 mph.
- Accelerate again and system resumes control automatically at last speed used.
- **RESUME KEY** feature will recall last speed used even if the system was shut off, completely powered down or the Disengage function was used. Turn system on, then press RESUME and drive smoothly to the desired speed. (Try not to "overshoot" the desired speed or it will take the system longer to lock in.
- Press both keys and the system will **DISENGAGE**, but remains armed. (Light blinks slowly). This feature may be used when the operator wishes to go to manual driving such as in the turn between passes. To return to last speed used, press the **RESUME KEY.** If the speed is to be changed, drive to that speed and press engage.
- **INCREASE/DECREASE** key can be pressed when the system is engaged to change speed in 25 RPM increments.
- The system can be turned **OFF** a few moments after returning to idle speed.

User Tips

Always leave your hand on the manual throttle for safety.

Always return to neutral before turning engine off.

In sharp turns, the driver may wish to "manually assist" the system to maintain the desired speed.

Warning: Only individuals competent driving high-powered boats should use this speed control system.

Troubleshooting Wakeboard Cruise (Paddle Wheel Speed Based Cruise)

General: This system is relatively easy to service and much can be observed when the boat is powered. When the key is turned ON, PerfectPass becomes powered and when the Master Module sees 11.5 volts the processor starts which causes the red LED light on the 2 inch dash switch to flash once and turn off. At the same time the servomotor will become powered and locked after completing its "auto tighten" function. (Every time the system is powered the servo will check to make sure it is turned snug in a clockwise direction.)

If the red light did not flash and servomotor does not become powered, this would indicate the processor is not starting, likely due to low voltage. Check power and ground connections to ensure a solid power source. If in doubt, connect directly to the battery and try again.

(1) Problem – Not Controlling / System Running Past Set Speed

Check: To confirm proper operation of servomotor, do the following test. With key OFF, check to see if servomotor 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, then turn it back counter clockwise one-half (1/2) turn.
Now turn key ON and servo should perform its "auto tighten" function and wind in the cable. (Every time system is powered, it will do an "auto tighten" which confirms are electrical phases are OK)

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

If motor <u>does not</u> wind in or just vibrates, then an electrical connection is likely bad. Unplug both connectors at servomotor and closely inspect the crimps and wiring. Also check the connectors on the gray servo power cable at both ends. (Pull lightly on the wires if necessary)

If this test is OK, do a "Linkage Test" as described below.

If the system runs past the set speed and is very slow backing down, check the **throttle return spring**. PerfectPass can open the throttle, but relies on this spring to constantly pull the throttle back towards idle. A weak or defective spring should be changed.

If you are on the water, engage system at about 20 MPH and watch servo motor as the boat is driven up to and past engagement speed. Since boat is going past set speed, the servo motor will counter rotate to let out cable to slow boat back to 20 MPH.

Is the servo motor counter rotating? If it is, why is boat not slowing down? Either something is interfering with the free flow of cable or the return spring is weak or disconnected.

(2) Problem – Red Light on Dash Switch Turns On & OFF Automatically

Check: After you turn key ON, the red LED light should blink once to confirm system is powered and ON. If the light flashes ON&OFF on its own, the key pad may be faulty and should be replaced. (If a button on the key pad is stuck, it will act like the operator is constantly pressing the button).

(3) Problem – System Surging

Surging is caused by either a poor throttle connection or a paddle wheel problem.

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 or 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 into 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).

Troubleshooting Wakeboard Cruise (Paddle Wheel Speed Based Cruise)

(Continued)

Check: If the linkage test appears O.K., then it is likely a paddle wheel location or installation problem.

1. Inspect the location of the paddle wheel. Is it in an area that has a smooth flow of water in front? i.e.: There are no water intakes, depth sounders, strakes, silicone or other items that could disturb the smooth flow of water. (See paddle wheel photos for details).
2. Is the paddle wheel able to spin freely? If not, replace the stainless steel shaft & paddle impeller (even slight damage to paddle can cause a problem). Is the paddle wheel impeller installed in the correct direction?
   If the problem cannot be corrected, it could possibly be a defective paddle wheel.

(4) Problem – Customer Drives to Desired Speed, Presses Engage Button and System Turns OFF (Red light turns off)

Check: If the system was in the ready mode (slow blink) and turned off when the ENGAGE Key was pressed would indicate the system did not see a speed value from the paddle wheel so it thought the driver was calling for it to turn off. Inspect paddle wheel cable connections to ensure they are O.K. Inspect paddle wheel impeller to ensure it spins freely. If not, change impeller.

(5) Problem – Blowing Fuses

Check: 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 servomotor.

(6) Problem – System Takes Control, Then "Disengages" and Slows Down

Check: Is the manual throttle slowly pulling back? Try advancing the manual throttle more forward after engaging, this will provide the system with more cable to work with.

Operating Instructions WakeboardCruise (Paddle Wheel)

Operating Instructions

- With boat in neutral, turn system **ON**. (Light blinks slowly, indicating system is armed).
- Drive to desired speed, press **ENGAGE** and system takes control. (Light stays on steady).
- Pull back throttle and system disengages. (Light blinks rapidly indicating RESUME Function ready). System disengages when speed drops about 5 mph.
- Accelerate again and system resumes control automatically at last speed used.
- **RESUME KEY** feature will recall last speed used even if the system was shut off, completely powered down or the Disengage function was used. Turn system on, then press RESUME and drive smoothly to the desired speed. (Try not to "overshoot" the desired speed or it will take the system longer to lock in.
- Press both keys and the system will **DISENGAGE**, but remains armed. (Light blinks slowly). This feature may be used when the operator wishes to go to manual driving such as in the turn between passes. To return to last speed used, press the **RESUME KEY.** If the speed is to be changed, drive to that speed and press engage.
- **INCREASE/DECREASE** key can be pressed when the system is engaged to change speed in .25 mph increments.
- The system can be turned **OFF** a few moments after returning to idle speed.

User Tips

Always leave your hand on the manual throttle for safety.

Always return to neutral before turning engine off.

The engine speed may accelerate in sharp turns. If towing skiers you may wish to manually assist the throttle and "feather" the throttle back as the boat returns to a straight path. You may find your boat turns more smoothly in one direction than the other.

Warning: Only individuals competent driving high-powered boats should use this speed control system.

Installation Instructions

Step 1. Installation of Servo Motor

Using the two provided hose clamps, loosely mount the servo motor on top of 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 from end of Morse control / Teleflex cable. (See Figure B).

Position servo motor throttle cable to throttle control lever. Ensure 10/32 nut is in place on Morse control / Teleflex throttle cable. Screw threaded brass hex connector on PerfectPass cable near the end of the Morse control throttle cable. Install L shaped brass throttle adapter to throttle control lever using identical hole as 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.

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 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 photo's, **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.

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 throttle 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 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).

Installation Instructions (Continued)

Step 2. Installation of Master Module

Mount 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.

Route servo motor power cable from Master Module to servo motor and connect. (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. A wire snake will be helpful.

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 which is an easy connection to the purple wire. The black wire end can attach to the ground (-) post.
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. **2003 Nautiques** – There is a main wiring harness and large white plug located behind the dash pod. The purple wire carries the switched 12 volts while the black wire is a suitable ground.
4. **2002 – 2003 MasterCraft** – Power, RPM and Paddle Wheel speed is all located in the special plug and play harness supplied with each system.

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.

(2) **2002 / 2003 MasterCraft** – The custom wiring harness supplied by PerfectPass allows for plug & play for RPM, Power & Paddle Wheel.

(3) **1998- 2003 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 and 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.

LS-1 On this engine (pre 2002 only), you just 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)

(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 and 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 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** connect into Timer 1 plug. 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.

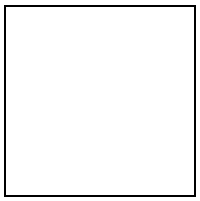
Step 7. Install Paddle Wheel speed sensor and connect to Master Module. (See attached detailed instructions). (On some boat brands, paddlewheels are not included as the boat has a standard factory installed paddlewheel).

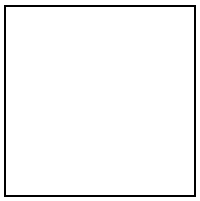
Following a short delay the Dash Display will become active.

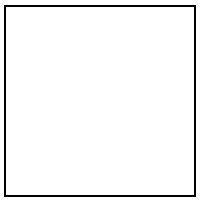
(You will note each time the boat is started the system will perform an "Auto Tighten" function and servo will rotate clockwise).

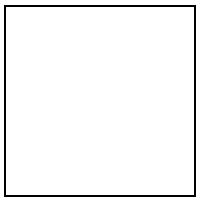
Step 8. Your manual throttle should act and feel just the same as before PerfectPass was installed. If it does not feel normal, inspect throttle and linkage connection, particularly the brass hex nut adjustment.

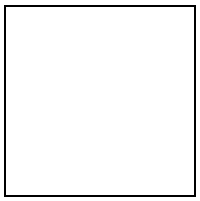
For assistance call (902) 468-2150.

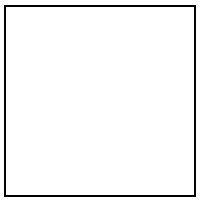












Installation and Setup Instructions for PerfectPass Paddlewheel System

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.

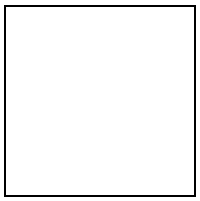
Remove housing nut and rubber ring gasket. (This gasket will be installed later on the inside of boat). The sealant must be placed on the surface of the sealing flange on the housing and also on some of the lower threads of the housing to help lock the sealing nut in place. The bottom of the hull in 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.

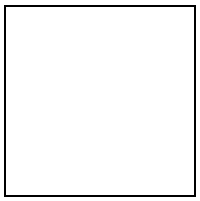
Reassemble the paddlewheel unit by sliding the inner unit into the housing with the arrow on the inner housing pointing toward the front. (Ensure paddlewheel assembly is properly centered in “notch” of housing, with arrow pointing toward bow). <u>Hand tighten</u> the locking cap.

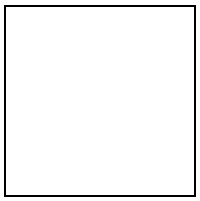
The output cable should be run under the floor with the servo power cable so that it can be plugged into the master module. *(Included with this unit is a “Plug” and extra paddle and axle kit.)*

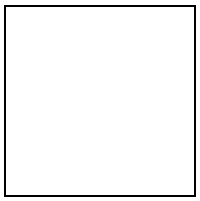
V-DRIVE / WAKEBOARD BOATS / STERN DRIVES – The paddle is typically installed in front of the engine, just behind the gas tank. *(This area is generally accessible from the engine compartment or under rear seat.)* It is installed typically 7 – 8 inches off center, clear of any strakes in the hull, depth 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.









Chip Replacement