

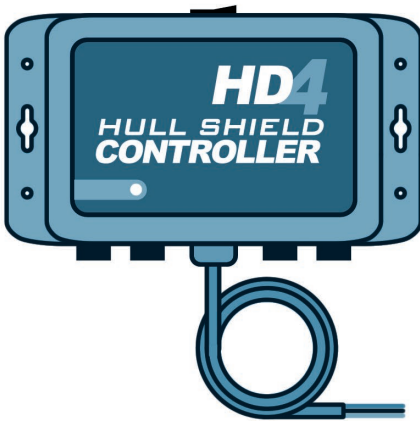
# HD4

## INSTALLATION & OPERATION GUIDE

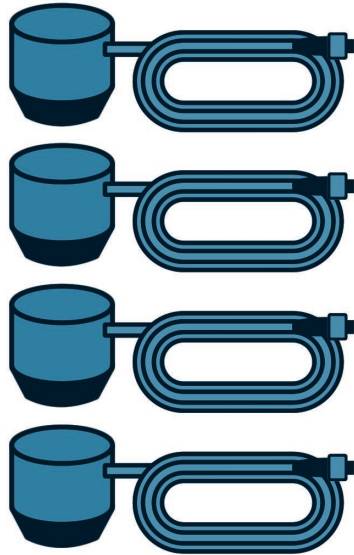
Your Hull Shield Ultrasonic System must be installed correctly for optimum performance. Hull Shield systems are designed to operate 24 hours a day. Your battery system must be maintained and charged to ensure your Hull Shield system continues to provide around-the-clock antifouling protection. Power to the watercraft can be supplied through a standard battery maintainer or a dedicated shore-power hookup. Alternative power sources include solar and wind energy; however, it is necessary to exercise additional precautions to minimize downtime when using intermittent alternative charging sources.

### HD100 SYSTEM CONTENTS

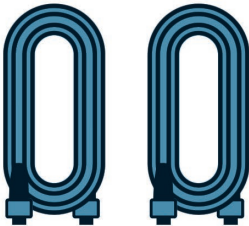
1x HD100  
Controller Module



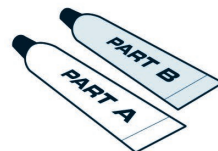
4x Ultrasonic  
Transducers



2x Signal Cable  
Extensions



1x Epoxy  
Adhesive Kit



## HULL MOUNTING LOCATIONS

Transducers are most often attached to the interior of the hull and should always be situated at an elevation below the waterline. Locations are chosen to maximize effectiveness and achieve even coverage. A properly fitted system will produce excellent antifouling results. Transducer placement is determined by hull shape, size, and the number of transducers to be installed.

These images provide a general guide for transducer placement. The final position you choose will depend on available access to these areas.

● Installation of Two (2) Transducers

●● Installation of Three (3) Transducers

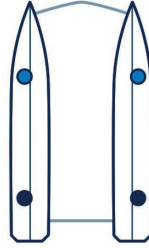
●●● Installation of Four (4) Transducers



MONOHULL



SAILING



CATAMARAN



PONTOON

**OPTIONAL EXTERIOR TRANSOM & PONTOON ATTACHMENT** - Hull Shield transducers are submersible and can be mounted to the exterior hull surface. This is required for pontoon boats. Exterior attachment can also be an ideal location for boats with hull liners (no hull access) and cored-hull boats under 32ft.

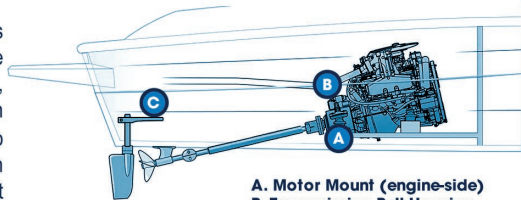
For exterior attachment on monohull transoms, two transducers are attached to the transom below the waterline - one per side.

For exterior attachment on pontoons, one transducer is attached to the rear fend-cap of each pontoon below the water.

## DRIVE & ACCESSORY ATTACHMENT LOCATIONS

The drive system and other peripherals (shafts, rudders, stabilizers, etc.) are isolated from the hull by sound dampening materials. Due to this isolation, each of these parts require an ultrasonic transducer dedicated to protecting them.

For **straight-drive** shafts and props, transducers can be mounted on the engine-side of the TRANSMISSION MOTOR MOUNTS (location A), or directly to the transmission bell housing (location B). Rudders are also isolated from the hull and also require a dedicated transducer. A transducer can be attached directly to the tiller arm/quadrant (location C). Please ensure the transducer does not interfere with tiller/quadrant rotation.



A. Motor Mount (engine-side)  
B. Transmission Bell Housing  
C. Rudder Tiller Arm

**Pod drives** only require one transducer per pod, attached directly to the pod on the hydraulic gear box.

**Stern drives** require one transducer per drive - mounted directly to the inner-transom bracket.

Attachment for props driven by **sail-drives** require one transducer mounted directly to the gearbox on the vertical intermediate shaft.

# TRANSDUCER INSTALLATION

**FOR HULLS** - Transducers must attach directly to the hull. Most watercraft will have composite stringer and bulkhead systems that provide structural support for the hull and decking. Composite materials **WILL NOT CONDUCT ULTRASOUND** and must be avoided (ultrasound will only transmit through solid/dense materials). Ultrasound is not transmitted through porous materials such as wood, foam, and air. **ACCEPTABLE** materials include solid FRP/GRP fiberglass, aluminum, & steel. **This system IS NOT COMPATIBLE with wood or plastic hulls.**



**REMOVE ALL PAINT** from metallic surfaces at the bonding locations.  
**EXPOSE BARE METAL** at all mounting locations.  
**SAND AND CLEAN** the base of the transducer prior to applying the epoxy.  
Have all **TOOLS & CLAMPS** prepared and ready before starting your installation.

## Transducers Step 1 - Surface Preparation

The bonding surface and the transducer must be flat, clean, and paint-free to achieve proper adhesion. Remove all dirt, grease, and other contaminants from the surfaces. Scuff both surfaces, including the base of the transducer with a medium-grit sandpaper to expose fresh material. Remove sanding dust and clean the surface again.

Surface preparation is critical when bonding the transducer to a metallic part. When bonding to engine components, **ALL PAINT MUST BE REMOVED** at the desired location to expose bare metal.

## Transducers Step 2 - Prepare and Mix Epoxy

**Epoxy resin will thicken after mixing - mix the epoxy when you are ready to attach the transducer.** Mix equal parts of A & B epoxy resin onto a disposable mixing surface - thoroughly mix both parts to an even consistency. Be sure to prepare enough to cover the base of the transducer.

## Transducers Step 3 - Apply Epoxy Resin

Apply the prepared epoxy resin to the base of the transducer. Spread the epoxy resin outward and away from the center until you achieve a uniform coverage on the entire surface.

## Transducers Step 4 - Position the Transducer

Place the transducer, epoxy side down, into the desired position. Twist the transducer while applying downward force to ensure the base makes even contact with the surface. It may be necessary to use an adhesive tape to hold the transducer firmly in place while the epoxy cures. When attaching transducers to motor mounts, a clamp can be used to secure the transducer in place - this is helpful when the transducer must be placed in a horizontal position.

## Transducers Step 5 - Wait for the Epoxy to Set

The epoxy resin must cure at least 24 hours prior to operation. Do not disturb the transducer during the cure process.

# CONTROLLER INSTALLATION

The Hull Shield Controller Module supplies the power and signals required to operate the ultrasonic transducers. The controller module has flanges with holes to facilitate various mounting methods using fasteners. Use fasteners that are appropriate for the substrate you are attaching to.

## Controller Step 1 - Attach the Power Cable to the Battery

**Be sure the controller is switched OFF when connecting to a power supply.** Determine whether the power cable will span the distance between the battery and the location where you plan to mount the controller. The power cable can be extended with 16 gauge 2-conductor wire.

**CONNECT THE BLACK WIRE TO THE NEGATIVE TERMINAL OF THE BATTERY AND THE RED WIRE TO THE POSITIVE TERMINAL.**

**OPTIONAL EXTERNAL INDICATOR** - The Hull Shield system cable includes a **YELLOW** signal wire that can be connected to an optional LED panel indicator lamp for monitoring the system status. If installing an optional panel light, connect the **YELLOW** wire to the positive terminal of a standard 12V self-regulated marine LED indicator. This wire is protected against fault conditions and is current limited to 20mA.

## Controller Step 2 - Signal Cables

Signal cables may need to be routed and chased through tight areas. The signal cables can be cut and spliced back together to facilitate cable routing. The cables can also be extended with 18AWG marine-grade multistrand speaker wire having a 300V rating. Ensure that splices are strong and are encapsulated in a waterproof junction box or other sufficiently waterproof insulator.

Connect the transducer cables to inputs on the bottom of the controller module. Twist the blue locking ring clockwise onto the threads to secure the connectors. **DO NOT OVER-TIGHTEN!**



# SYSTEM OPERATION

When used on hulls, this product is designed to work best with ablative bottom paint coatings. Copper-based traditional "hard" paints can be good option as well. For best results, please ensure your current application of bottom paint is not worn or depleted of ablative material. Once your Hull Shield system is installed, it will extend the life of ablative surfaces.

**All surfaces will need to be cleaned following the initial installation.** Hull Shield systems work by preventing fouling from attaching to surfaces. Existing fouling which has accumulated prior to your Hull Shield installation must be removed. ***Even if the surfaces look clean, microscopic fouling will already have attached to surfaces and become visible at a later time.***

Your new Hull Shield Ultrasonic Anti-Fouling System is designed to operate automatically and provide maintenance-free operation. After the bonding epoxy has cured for 24 hours and all of the signal cables have been connected to the controller, you can power your system on and start protecting your boat with ultrasound.

## AUTO CALIBRATION

When the system is first switched on, it will begin an initial calibration for each individual transducer. The LED indicator will blink rapidly during this process (both red and green) - the calibration can last up to one minute. After the initial calibration, the system will re-calibrate approximately every six hours to ensure that each transducer is receiving an optimal signal.

## AUTOMATIC RUNTIME

After calibration, the system will enter an automatic program that will transmit a custom pattern of ultrasonic signals to each transducer. During runtime, the LED indicator will emit a green blink for each transducer / ultrasound burst. The HD4 has four transducer ports - the LED blink pattern will be four steady blinks followed by a fast blink to denote the start of a new "four-count" blink cycle. If one or more of the four blinks is red, a fault is detected - See FAULT EVENTS below.

## POWER CONSERVATION MODE



Under normal circumstances (when docked or underway) the batteries should be maintained (charging) and the voltage will stay above 12.7V. However, if the controller senses that battery levels are being depleted, it will begin to conserve power by increasing the time between ultrasound bursts. Power conservation begins at 12.6V. If voltage levels continue to drop, the Hull Shield system will continue to increase the time between bursts until the voltage has dropped to 12.0V.

## LOW BATTERY INDICATOR

When the battery voltage drops below 12.0V, the system will enter an idle SLEEP MODE to conserve battery power for other essential boating operations. The system will automatically resume operation when the battery level rises above 12.2V. While in sleep mode, the LED indicator will briefly flash red every eight seconds and the controller will emit a short beep (similar to a smoke detector).

## FAULT EVENTS

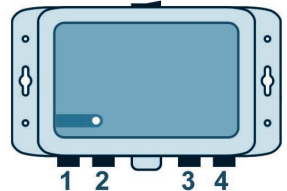
The HD4 controller can detect and mitigate fault events while continuing to operate the remaining transducers.

-  **NO TRANSDUCER DETECTED** - If the controller does not sense a transducer, or a connection to a transducer is interrupted, the system will ignore that port and continue to operate the remaining ports and transducers.
-  **SHORTED WIRES OR WATER INTRUSION IN A SINGAL CABLE** - If the controller senses an excessive current drain caused by water intrusion or a damaged signal cable, the system will ignore that port and continue to operate the remaining ports and transducers. The controller will emit an intermittent "BEEP" to alert this fault.

When the system flags a transducer fault, the LED indicator for the associated port will blink red instead of green to indicate the specific problematic port. The remaining operational ports will still be indicated by a green blink.

EXAMPLE: If the third transducer port has a fault, the LED blink pattern will be a short-green-blink (start of count) - then; green - green - red - green. The pattern will then repeat.

Please note that after the issue has been isolated and resolved, the system must be turned off, then back on, to reestablish the port connection.



# INSTALLATION SUPPORT

Check our online repository for additional installation guides and media: <https://hullshield.net/install>

**When in doubt, ask...**

We're here to help you acheive a successful installation.  
Contact us with questions you have about your specific installation.

PHONE: +1-843-580-2826

EMAIL: [support@hullshield.net](mailto:support@hullshield.net)

MAXIMUM INPUT VOLTAGE: **18.0V**  
PEAK CURRENT REQUIREMENT: **2.5A**  
AVERAGE CURRENT CONSUMPTION: **1Ah**

FULL POWER OUTPUT RANGE: **12.7V TO 18.0V**  
REDUCED POWER RANGE: **12.0V TO 12.6V**  
SLEEP / IDLE RANGE: **BELOW 12.0V**

FREQUENCY RANGE: **21kHz to 41kHz**  
ULTRASOUND BURST PERIOD: **400ms**

AUXILLARY INDICATOR OUTPUT VOLTAGE: **12V**  
AUXILLARY INDICATOR MAX CURRENT: **20mA**