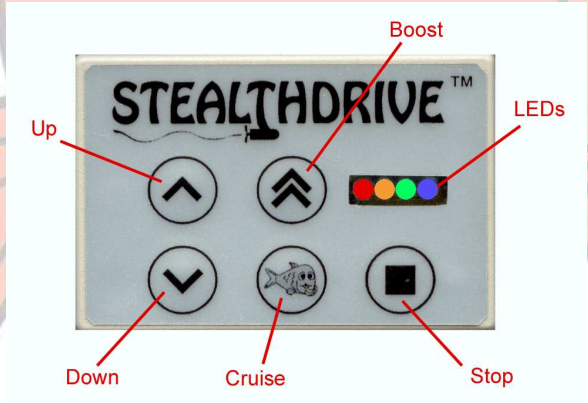
Operating Instructions: Stealthdrive™ SD30

Introduction

Stealthdrive™ uses the latest technology and state-of-the-art, high efficiency, MOSFET's and Schottky Diodes under direct microprocessor control to provide you with highly efficient electric propulsion to enhance your kayaking experience. It provides you with long battery life, precise, easy-to-use fingertip control and comprehensive, kayaking specific, safety features to protect you. A rugged build which includes the use of military specified circuit boards (MIL-P-13949GE GRN) ensures you have a product that will give many years of service. All systems are subjected to three separate quality and function computerised tests on proprietary Automatic Test Equipment (ATE) before shipping.

The Stealthdrive™ motor controller consists of a small Handset with a triple layer metallic laminated waterproof membrane for extra strength, buttons which have silver plated contacts and are good for at least 500,000 operations, a high impact ABS case with a high friction tactile finish for an easy grip even in the wet, and of course it floats should you drop it over the side! You control the entire system via the Handset, which may be cockpit-mounted or hand-held. The Main Unit contains the speed controller circuits along with the capsize detection and can be mounted anywhere convenient.

The Handset features five waterproof tactile buttons, designated Stop, Up, Down, Boost and Cruise. All aspects of the system are controlled with just these five buttons. The Handset also provides four extra-bright, daylight-readable LEDs, coloured (• red, • amber, • green and • blue) to indicate the system's status.



Your Stealthdrive™ can have a number of settings altered to suit your intended application or preferences, and all user settings are retained in non-volatile memory requiring no power source. This means that they are retained until you wish to alter them even if the main unit is disconnected from the battery; settings are retained for at least 100 years.

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If you take the trouble to register your Stealthdrive™, either on-line or by mailing in the supplied form, then should any Stealthdrive™ be recovered that has had its serial number removed, we can electronically interrogate the Main Unit and/or Handset at the factory and establish who the registered owner is.

Safety Cutouts

We take safety very seriously, and for this reason there are a number of fail-safes built into every Stealthdrive™; the two microprocessors cross-check each other 10 times per second and will shut down the system if there is a cross-check failure; this technology is more normally found in the aerospace industry. The software also self-checks at least 1000 times per second and will shut down the system if an internal fault develops. In addition we have provided for the following four external fault conditions which will cause an emergency stop. These are:

1. Capsize. If a capsize setting is enabled and the Main Unit is tipped out of the selected orientation by approximately ninety degrees, the motor will immediately stop and the LEDs will light in the combination • amber, • green and • blue to indicate a capsize. When this happens, the system locks up in order to call your attention to this (getting wet is another clue!); to return to normal operation, first return the unit to its correct orientation, then press and hold **Stop** for three seconds—then the • green LED alone will be showing and you can start the motor again. Environmentally-friendly tilt measuring devices are used which use gold instead of mercury. Capsize response is within 0.8 Seconds.

2. Overload. If the speed controller or motor is overloaded, such as by a short circuit or by stalling the motor in weed or other impact, it will immediately cut the motor power and lock up, with all four LEDs lit. To return to normal operation, press and hold **Stop** in the same way as restarting after capsizing. Be sure to remedy the problem before starting the motor again, otherwise the trip will operate again. The overload trip is designed to operate before the in-line fuse blows; this is to enhance the safety of the user so that you do no get stranded due to a blown fuse. Overload detection is typically 0.0004 Seconds with a 0.000006 Second cut-off time.

The Stealthdrive™ system records every overload event; this data can be accessed by the factory diagnostic software and may be useful in the event of a warranty claim. Damage caused by prop strike is not covered in your warranty.

3. External Cut-Out. An external cutout is fitted in the form of a 'man overboard' lanyard, this acts by cutting the power entirely when triggered. After correcting the situation (get onboard, spit out water), it will be necessary to re-start the Stealthdrive™ from standby after having replaced the lanyard safety switch cap. The safety lanyard MUST be attached to the user at all times when using the Stealthdrive™. Response time is within 0.1 Seconds.

4. Handset Disconnect. If the Handset becomes disconnected or the cable is severed the system will shut down. Response time is within 0.5 Seconds.

Starting Up

Before starting to use your Stealthdrive™ at the start of each session, check that the Handset cable is plugged into the Main Unit and its collar locked, that the Main Unit and battery are secure and that the lanyard switch is in the 'operate' position. The latter is particularly important because the system will not power-up if the external safety device is removed. ALWAYS WEAR A LIFE JACKET.

The Stealthdrive™ enters a Standby mode once connected to the battery, during which it consumes insignificant electrical power. The Standby mode is indicated by none of the LEDs being lit.

From Standby mode, you can choose to either 'switch on' and begin normal operation, or invoke various Setup functions to customise your Stealthdrive™ to your own preferences.

Normal Operation

To start up for normal operation, from Standby press and hold the Stop button; you will see the • amber LED flash, followed after about three seconds by the • green* LED lighting steadily. When the • green LED lights you can release the Stop button and the unit is ready for use.
*See Softlock™ in Options section.

Basic Manual Operation

In its simplest form, the motor speed is controlled using the **Up**, **Down** and **Stop** buttons.

The first press of the **Up** button will start the motor at minimum speed in the forward direction. Further presses of **Up** will increase the speed, or **Down** will decrease it; both keys have exponential — if held down the speed will continue to rise or fall according to which key is pressed; the rate of acceleration/deceleration will increase the longer the button is held. This means that you can quickly make large changes in speed by holding a button down, or make fine-step adjustments by repeated single presses. The **Stop** button immediately stops the motor.

The • red LED lights **whenever** the prop is turning and the • amber LED also lights when the speed reaches maximum.

If your Stealthdrive™ is fitted with the Reverse OPTION, you can start the motor in reverse from the stopped state by pressing the **Down** button. Reverse mode works similarly to forward mode except that the buttons are reversed, i.e. **Up** reduces speed and **Down** increases it, reflecting the backward motion that is in progress. If traveling forwards and you press **Down** until the motor stops but wish to continue into reverse you must momentarily take your finger off the button then press again, alternatively press **Stop** then **Down** to go straight to reverse thrust. Similarly going from reverse to forwards thrust requires the same procedure with the **Up** button or the use of **Stop** first.

The **Boost** button, when pressed, brings the motor rapidly up to its maximum speed, either forward or reverse (if installed as an option) according to the direction in which the motor is already turning (if the motor is not already turning the **Boost** button has no effect). The speed remains at maximum (with the • amber LED on to indicate maximum) while the **Boost** button is held, and reverts to the previous speed when **Boost** is released. If you wish the speed to remain at maximum rather than reverting, press either **Up** or **Down** while holding down **Boost** — this will cause the speed to stay at maximum when **Boost** is released, just as if the **Up** or **Down** button had been held down until maximum speed was reached. This provides a quick method of jumping to full speed.

Cruise Mode

Cruise mode is the simpler of the two 'automatic' modes (the Pulsetrolling™ option is the other). Cruise is available on all Stealthdrives™ but operates only in forward motion, not in reverse. The cruise function consists of two parts: a 'program' function which teaches the cruise controller your preferred cruising speed, and an 'execute' function that adopts and holds that speed.

To program the current speed as your preferred cruising speed, press and hold the **Cruise** button until the • blue LED lights (3 seconds), then release it. Note that you can only program a speed setting if the motor is turning in the forward direction - you cannot program a reverse or stopped cruising speed. The cruising speed is 'non-volatile', that is to say that your programmed cruising speed is retained in memory even without power, until it is explicitly over-written by you programming a new cruising speed.

To 'execute' a cruise function with a previously programmed speed, simply press and release the **Cruise** button. After a delay of about one second, the motor will accelerate or decelerate (depending on its current speed) to the chosen cruising speed. That speed will then be held until it is modified by pressing other buttons in the usual way. Note that you can only engage cruising speed if the motor is already turning and in the forward direction — if you wish to move from stopped to cruising speed, start the motor first with a single press of **Up** and then press **Cruise**.

Shutting Down

Once the Stealthdrive™ is started up in Normal Operating mode, it remains in that mode until one of the following occurs:

1. Manual Shutdown. This is performed by holding the **Stop** button down for three seconds. The • green LED starts to flash before the unit shuts down, and then goes out entirely when the unit returns to Standby.
**See Softlock™ in Options section.*

2. Non-use Timeout. When the system is left in the idle state (i.e. normal operation with the motor stopped and no buttons pressed) for ten minutes, the non-use timer automatically shuts it down to Standby mode. When the system comes within one minute of shutting down, the • green LED will start flashing to warn you; pressing any button will cancel the timer. This timer is intended to detect a Stealthdrive™ that has inadvertently been left activated at the end of a session and to switch it back to standby both for safety and to conserve power. Timer shutdown does not engage the Softlock™ if installed.

3. Power Failure. If the battery supply fails or is disconnected, the system will shut down. Once the supply is restored the system will revert to standby mode and will need to be switched on again by holding the **Stop** button. Shutdown due to power failure will not engage Softlock™ if installed.

Setup Modes

You can invoke various Setup modes from Standby. None of these modes permit the motor to operate, but instead let you adjust settings on the system. Setup modes are invoked by pressing and holding Stop as for normal operation, but holding some other button down at the same time—the combination of buttons selects the mode.

Setting Capsize Detection

Capsize detection makes the system perform an emergency stop if the Main Unit is tipped over from its normal position by approximately 90 degrees due to capsizing. The system may be set for the Main Unit to be mounted horizontally (label uppermost) or vertically (power cables uppermost), or the capsize detection may be defeated altogether which is for **EMERGENCY USE ONLY**. Intelligent G shock protection is built into the system to prevent false triggering due to rough conditions.

The capsize detection only works during normal operation; during Setup the Main Unit may be in any orientation.

To alter capsize detection settings, press **Stop** and **Up** together from Standby (with Softlock™ off if installed). After the usual three second delay, the • amber LED lights steadily. Now press one or other of **Up** (for horizontal mode), **Down** (vertical mode) or **Boost** (EMERGENCY OFF). The • amber LED will flicker to confirm a valid choice, and the system then returns to standby with the new capsize detection setting retained in memory.
Factory default: Horizontal mode.

Enabling Speed-Limit/Scrooge Mode

The Speed-Limit/Scrooge Mode limits the motor to a maximum speed setting of your choice and can be helpful to prevent children or guided groups becoming separated from supervisors whilst also increasing potential range/endurance. This limit defaults to 70% of full power as shipped from the factory but may be set to any speed of your choice (see below).

To set or cancel Speed-Limit/Scrooge mode, press **Stop** and **Down** together from Standby (with Softlock™ off if installed). After the usual three-second delay, the • blue LED lights steadily. Now press either **Down** (limited) or **Up** (unlimited). The • blue LED will flicker to confirm a valid choice, and the system then returns to standby.
Factory default: 100% power.

Setting Speed-Limit/Scrooge Value

This function allows you to set the actual limit imposed on motor speed when Speed-Limit/Scrooge Mode is engaged. Any value you set is remembered, whether or not Speed-Limit Mode is actually engaged, and can be used next time you engage Speed-Limit Mode. When setting the speed limit value, you have two choices: either a factory default of 70% power, or a limiting speed equal to a set Cruise speed, which therefore allows you to experiment to find the limiting speed of your choice while in normal operation and set the Cruise speed to that speed. You then use the Cruise-as-Limit option to set that speed as the limit. Thereafter, changing the cruising speed does not affect the speed limit, so the Cruise function is still perfectly usable.

To set a Speed-Limit value first set a cruise speed as normal, then shutdown to Standby, and press **Stop** and **Cruise** together to start up. After the usual three second delay, the • red LED lights steadily. Now press either **Down** (to 'learn' the current Cruise speed as the limit) or **Up** (to set the limit to the default of 70%). The • blue LED will flicker to confirm a valid choice, and the system then returns to standby with the new Speed-Limit value selected. Please note that a speed limit value only has an effect when Speed-Limit Mode (see above) is engaged. As with all user settings, the limiting speed value is remembered indefinitely until explicitly changed by you.
Factory default: 70%.

Options

Your Stealthdrive™ can have a number of optional features installed which you can choose to add at the time of ordering your system or at a later date.

As standard, Stealthdrive™ is supplied for forward-only thrust; you can opt to have a reversible unit, however.

Softlock™ is a valuable anti-theft and safety device which allows you to set a 'pass code' without which the Stealthdrive™ will not operate; this works very much like the security numbers used on many car radios, and makes a stolen Stealthdrive™ useless to the thief. Softlock™ also prevents unauthorised or dangerous use as may be the case if you have young children.

Pulsetrolling™ is a very powerful and unique automatic mode whereby you can 'teach' the Stealthdrive™ a series of steps during each of which it runs at a chosen forward speed (which can include stop) for a chosen time (up to 4 minutes per step). It can produce an arbitrarily complex speed/time pattern with up to 64 steps in a program which will continuously repeat. It may be used for trolling or for other purposes such as guided tours.

Hour Metering is an option which records the system power up and motor run times, this allows you to monitor usage of your Stealthdrive™. This is particularly useful in a boat-hire situation but other users may also like to keep a record for other purposes. Both counters are re-settable by the owner. All Stealthdrives™ also incorporate overall, cumulative time metering, which may only be accessed by the factory.

*Softlock™

If you wish to Softlock™ the unit to prevent unauthorised use (provided that you have ordered the Softlock™ option), whilst the motor is stopped but the system is switched on in normal operating mode, hold down the **Cruise** button at the same time as **Stop** — in this case, the • red LED flashes instead of the • green and then finally flickers for a second when shutdown is complete and the buttons are released to confirm that the unit is locked.
If the Softlock™ option is installed and you previously 'locked' the unit, it will refuse to start up as normal and displays a • red LED instead of • green. At this point you must enter your chosen 'pass code', consisting of six button presses (you can choose which buttons and in what sequence; see below). Once the six buttons have been pressed, the unit reverts to standby; if the code was correctly entered, the lock is removed, so the next attempt to start up will be successful. If a wrong code is entered, the unit remains locked. Once unlocked, the unit remains unlocked until you specifically lock it at power-down.
Factory default: Not locked.

Setting a Softlock™ Code

The optional Softlock™ anti-theft/safety option was described above. To choose a personal pass code, press **Stop** and **Boost** together from Standby (with Softlock™ off if installed). After the usual three-second delay, the • blue LED flickers and then lights steadily. Now key in your chosen sequence of six buttons (any buttons in any order). The • blue LED then flickers and lights again to prompt you to re-enter the code to verify that it was entered correctly; you must enter exactly the same button sequence. If your two entries match, the • green LED will flash and the unit returns to standby, accepting the new pass-code. If the two sequences fail to match, • red will flash instead and the pass-code will not be changed.

Note that setting a pass-code does not itself lock the unit. The unit must be locked explicitly when it is powered-down after normal use (see above). If you did not order the Softlock™ feature at time of purchase (or as an upgrade), this mode will not be available on your system.

Warning: If you set a pass code, lock the system and then forget the code, the only way to have the system unlocked is by returning it to the factory. For security reasons we will only unlock a unit once satisfactory evidence is provided showing you are the owner.
Factory default: Six presses of STOP button.

Pulsetrolling™ Mode

The Pulsetrolling™ option, if installed on your Stealthdrive™, adds a very powerful programmable, automatic operating mode to your system. It exists in addition to the basic Cruise mode, rather than replacing it, allowing you to program the Stealthdrive™ with a series of up to 64 steps consisting of different forward speeds* and time durations (of up to four minutes). When Pulsetrolling™ mode is activated the system performs that sequence repeatedly until you request manual control again. As with all settings on the Stealthdrive™, the Pulsetrolling™ program is non-volatile — it is retained indefinitely, even without power, until explicitly over-written by you with another program.

**A Pulsetrolling™ program can also include stops — periods of no motor activity.*

Setting a Pulsetrolling™ Schedule

A new Pulsetrolling™ schedule may be programmed at any time during normal operation by double-clicking and then holding **Cruise** until the • blue LED lights (three seconds). Upon releasing **Cruise**, the • blue LED starts to flash rapidly to indicate 'programming' mode (i.e. the action required on the **Cruise** button is press release-press-hold, then release when the • blue LED lights).

As soon as programming mode is engaged, the unit memorizes the current speed as the starting speed of the Pulsetrolling™ sequence. The unit then memorises one step each time Cruise is pressed: the press sets the duration of the step in progress to be the time elapsed since the previous press (or the start of programming mode if the first press), and then commences a new step at the now-current speed. Therefore speed changes do not become effective in the program until the next press of Cruise.

The unit acknowledges that each step has been programmed with a single long flash on the • blue LED, which happens just after the **Cruise** button is released. **Cruise** must be pressed once for each step in the user's program. A program with no steps programmed will not activate (i.e. Pulsetrolling™ mode will not engage), and a program with only one step will work as expected, though effectively will be no different from the standard Cruise function as it will simply hold a set speed indefinitely until cancelled. To be useful, a Pulsetrolling™ program must have at least two steps, thus **Cruise** must be pressed at least twice during the programming process with a different speed selected.

The programming process then continues in this manner until the user presses-and-holds **Cruise** (note: not a double-click) whereupon the • blue LED extinguishes to indicate programming complete. Up to 64 steps may be programmed (if that limit is reached the unit will not retain any further steps after the 64th) and each step may last up to four minutes (attempting to set a longer step will limit it to slightly over 4 minutes). During programming, the Stealthdrive™ operates as normal except that the basic Cruise mode is unavailable (because the Cruise button is used for programming); even if the motor is stopped this will be accepted and accurately reproduced in Pulsetrolling™ mode. The only exception is that any reversing is not programmed, since Pulsetrolling™, like Cruise, is a forward only feature. Attempting to program a reverse speed will result in the speed for that step being programmed as zero.

Pulsetrolling™ is a very powerful facility once the programming process has been mastered. We recommend that new users spend some time experimenting with the Pulsetrolling™ feature in order to get the best out of it.

Performing a Pulsetrolling™ Schedule

To execute a Pulsetrolling™ schedule that has already been programmed, double-click the **Cruise** button (after releasing the first press, you must press it again within 0.6 seconds, and then release it). The double click distinguishes Pulsetrolling™ mode from regular Cruise mode. The • blue LED will flash slowly (twice per second), indicating that the Stealthdrive™ is running in its pre-programmed Pulsetrolling™ mode, and it will obey the programmed steps, repeating them continuously from the beginning when it reaches the end of the sequence, until you press any other button, at which point the • blue LED goes out and control is returned to manual. If no Pulsetrolling™ program has been programmed, a double click on **Cruise** will be ignored.

Reading/Clearing the Hour Meters

This function is only applicable if you have ordered the Hour Metering option for your Stealthdrive™. To enter Meter Mode, press **Stop** and **Cruise** together at startup (with Softlock™ off if installed). After the usual three-second delay, the • red LED lights steadily. Now press **Stop** again to enter Meter Mode, which is indicated by the • amber LED lit steadily. From here, you can make four choices:

1. Press **Stop** to exit from Meter Mode and go to Standby.

2. Press **Down** to reset the Hour Meters; the • red LED flickers to confirm and the system returns to Standby.

3. Press **Up** to read the Power On meter, which records up to 999.9hrs and is flashed out on the four LEDs as described below. After flashing the current total the system returns to Meter Mode (with • amber LED on). After reaching 999.9hrs the meter recommences from 0.

4. Press **Boost** to read the Motor-On meter, which records up to 999.9hrs and is flashed out on the four LEDs as described below. After flashing the current total the system returns to Meter Mode (with • amber LED on). After reaching 999.9hrs the meter recommences from 0.

A meter reading is flashed out as follows: • Red flashes 0–9 times for the hundreds digit, then • amber flashes 0–9 times for the tens digit, then • green flashes 0–9 times for the units (hours) digit and finally • blue flashes 0–9 times for the tenths digit. There is a pause between flashing each digit to make the flashes easy to count, and if you miss a count you can re-read the meter by pressing the same key again when the • Amber LED returns.

Care and Maintenance

Wash the motor as soon as possible after use in salt water, to do this properly it is necessary to remove the prop. Do not use high pressure water jets near the shaft seal. A light application of a corrosion inhibitor will ensure your motor retains its good looks and help prevent build up of contaminants. We also strongly recommend that you wash your motor and hull thoroughly after use in fresh water, to prevent the spread of invasive weeds and algae.

An application of a corrosion inhibitor on battery loom connectors is required prior to use and periodically thereafter, on every occasion if used in a salt water environment.

Do not route cables where they are exposed to rubbing or chafing and ensure that they are kept clean and free of contamination.

To ensure that the main unit is protected from accidental reverse polarity connection to the battery it is ESSENTIAL to use the supplied connector that includes a 30A fuse. In the event that you inadvertently connect the battery with the polarity reversed the fuse will blow. Should this occur, correct the polarity and replace the fuse. Failure to use the supplied connector and fuse will void your warranty.

Avoid striking the prop on the bottom or on submerged objects/material, damage caused by prop strikes is not covered in your warranty.

Do not use sharp objects to operate the membrane buttons or use any solvents to clean the Handset or Main Unit as this may permanently damage the System; such damage is not covered in your warranty.

Your Stealthdrive™ has been developed so that the maintenance required from you is minimal. The Main Unit, Handset and Motor Assembly contain no user serviceable parts and are factory sealed to ensure they are fully waterproof. Any attempt to disassemble any component will void your warranty. Please return your Stealthdrive™ to the factory for service should it be required, a one year warranty applies to the original purchaser for recreational use which covers parts and labour for faulty materials or workmanship. Repairs and spares are also available at reasonable cost for accidental damage.

Your Stealthdrive™ System may be returned to the factory for Optional upgrades at any time, please contact us directly for pricing.

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Electrical Specifications

Main Unit Dimensions: 115 x 90 x 55 mm (excl. projections).

Handset Dimensions: 60 x 40 x 20 mm (excl. cable).

Power Supply, Nominal: 12 V DC.

Power Supply, Limits: 9 to 16 V DC.

Output Current, Nominal Max: 30 Amps.

Output Current, Surge Max: 100 Amps for 5 seconds max.

Fault-Condition Current, Max: 750 Amps for 20 milliseconds max.

Supply Current, Operating (excl. load): 60 mA (forward) / 150 mA (reverse) max.

Supply Current, Standby: 0.5 mA typ, 1 mA max.

LEDs: Red/Amber/Green/Blue hi-visibility 3mm.

Failsafes: Multiple embedded, see main text for details of user configurable.

Reverse Polarity Protection: Yes.

Ambient Temperature: –10 to +45 °C.

Environmental Protection: IP 67 or better.

Processor: 2 MHz / 4 MHz dual-processor RISCs.

Approvals: Meets relevant CE specifications.

Due to a policy of continuous product development we reserve the right to change specifications without notice or obligation.

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