Deep Trekker DTG2 User Manual

Version 1.2 - 2014
01-2013-01-01 to 01-2013-02-100
04-2013-01-01 to 04-2013-01-20

Warning

• Never operate your DTG2 in the presence of unaware swimmers or divers.

• Always use a Personal Flotation Device (PFD) and obey any laws pertaining to the operation of your launch vehicle.
NOTE: Because of the sharp running hardware included with this product, we do not recommend a rubber blow up raft.

• The DTG2 running hardware is very sharp. Be very careful when working on and around the parts.

• While the motor is running pay close attention to the propeller. Do not come in contact with the propeller at any time the system is turned on or serious injury will result.

• Deep Trekker products are to be used by people 16 years of age and over.

Contents

Safety Precautions

• Never attempt to swim after a stalled DTG2. Do not get in the water for any reason to retrieve your DTG2. Return the DTG2 by gently pulling it back to the boat by the tether. In a case where the tether is snagged or severed, contact a certified diver to perform the retrieval for you.

• Deep Trekker products are to be used by ages 16 and over.

• Do not touch the propeller when the motor is spinning. Pay equally close attention to items such as loose clothing, shirtsleeves, ties, scarves, long hair or anything that may become entangled in the spinning propeller. If your fingers, hands, etc. come in contact with the spinning propeller, you may be severely injured.

•Keep your launching and piloting area tidy and your tether neatly rolled to avoid tripping while operating the DTG2.

• The speed and mass of this DTG2 ROV can inflict property damage and severe personal injury if a collision occurs. Never run this ROV in the presence of unaware swimmers or boaters or where the possibility of collision with people or property exists.

• Be aware of the danger around you, including weather, and obey all applicable laws while using standard water safety procedures.

Manual Specification and Description Changes

All pictures, descriptions, and specifications found in this instruction manual are subject to change without notice. Deep Trekker Inc. maintains no responsibility for inadvertent errors in this manual.

Delivery and Inspection

Thank you for purchasing the DTG2 inspection and exploration system, the world's only fully portable, affordable and easy to use underwater ROV. We want the time you spend with your new remotely operated vehicle (ROV) to be fun and successful so please read the entire manual before using this product for the first time.

The DTG2 is ready for use as delivered from the factory. The unit has been fully tested and inspected prior to shipping, including a pressure test equivalent to the maximum dive depth.

The ROV and controller batteries will be low for shipping reasons and will require a full charge prior to use. Leaving the batteries fully drained for long periods of time risk their longevity, we recommend fully charging them as soon as possible. Fully inspect your ROV to ensure it has not been damaged during shipping. If you suspect a problem please contact Deep Trekker support or your authorized Deep Trekker Dealer for assistance. For more information regarding the charging, see the section in the manual entitled *Charging.*

The DTG2 is shipped to you with the two shipping set screws in the locked position, the DTG2 will not operate with these screws locked. This ensures that the rough motions associated with the delivery service do not damage the internal frame and the servo motor that turns it.

To release the shipping set screws the following steps must be taken.

1) Rotate ROV upside down with the handles facing downward. This will ensure it does not rotate until the screw is completely backed out. While in this position, turn both set screws using a flathead screwdriver counter-clockwise until the set screw heads are firmly against the cover plate.

DO NOT COMPLETELY REMOVE THE SHIPPING SET SCREW UNDER ANY CIRCUMSTANCES. THIS OPENS UP THE SEALED UNIT AND WILL LEAD TO IMMEDIATE FAILURE IF SUBMERGED

2) Slowly rotate ROV to its level position.

Fig. 1

System Overview

The DTG2 ROV is designed to operate in fresh or salt water between the temperatures of 0C [32F] to 45C [113F]. This unique ROV incorporates onboard batteries, so the system is completely portable with no top side generator or box required. The tether is also much smaller and lighter than a tether designed to carry power. Since there is no voltage drop down a long tether, there is no need to utilize a high and dangerous voltage. The ROV system operates at 19.2 VDC, and the separate system inside the controller is less than 14 VDC. The controller replicates a traditional game pad, reducing the learning curve of successfully operated the DTG2 significantly.

The use of magnetic couplers means that there is no dynamic shaft seal on board the DTG2. This feature dramatically increases reliability and requires no maintenance to grease or replace any seals on the ROV.

The patent pending pitch control aims the outer shell (thrusters) to any angle +/- 90 degree from center for a total of 190 degrees. This system which works entirely from within the hull eliminates the requirement of a third or fourth thruster and further increases reliability and ease of use.

The ROV and tether are 100% waterproof and should not take on water unless damaged. The controller is splash resistant, but should not be submerged or power washed at any time. Other optional viewing systems offered are not waterproof in any way and need to be taken care of in outdoor environments. The ROV charger and controller charger are indoor products that should never be operated near water or wet conditions.

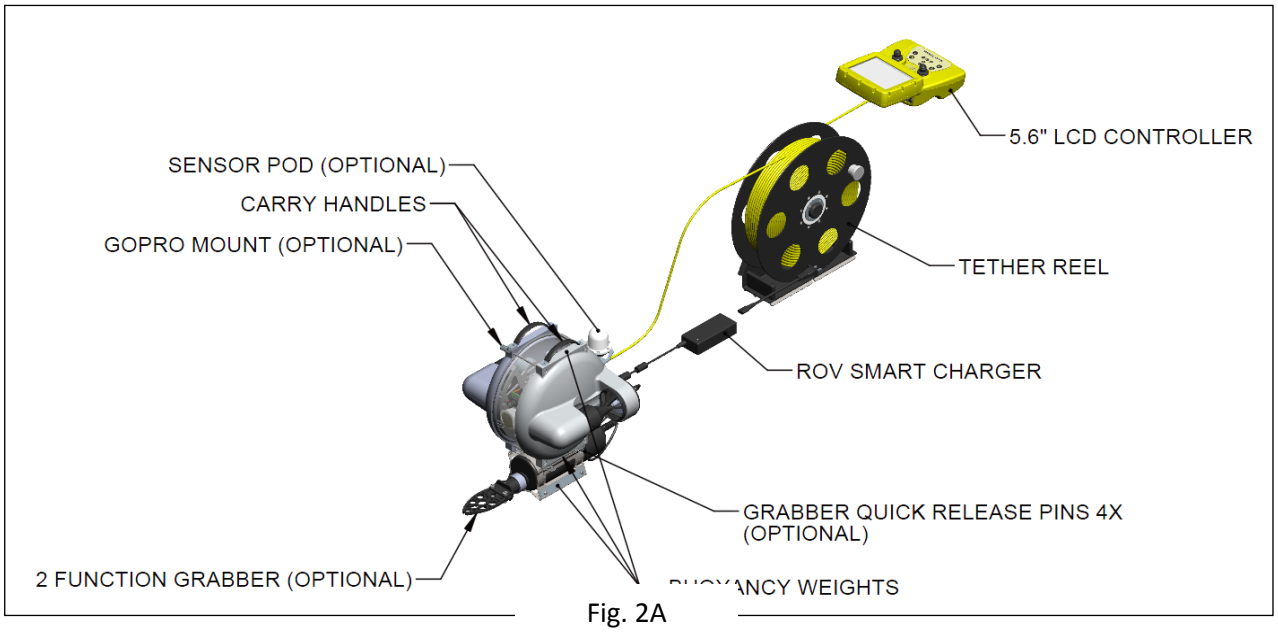


Fig. 2A

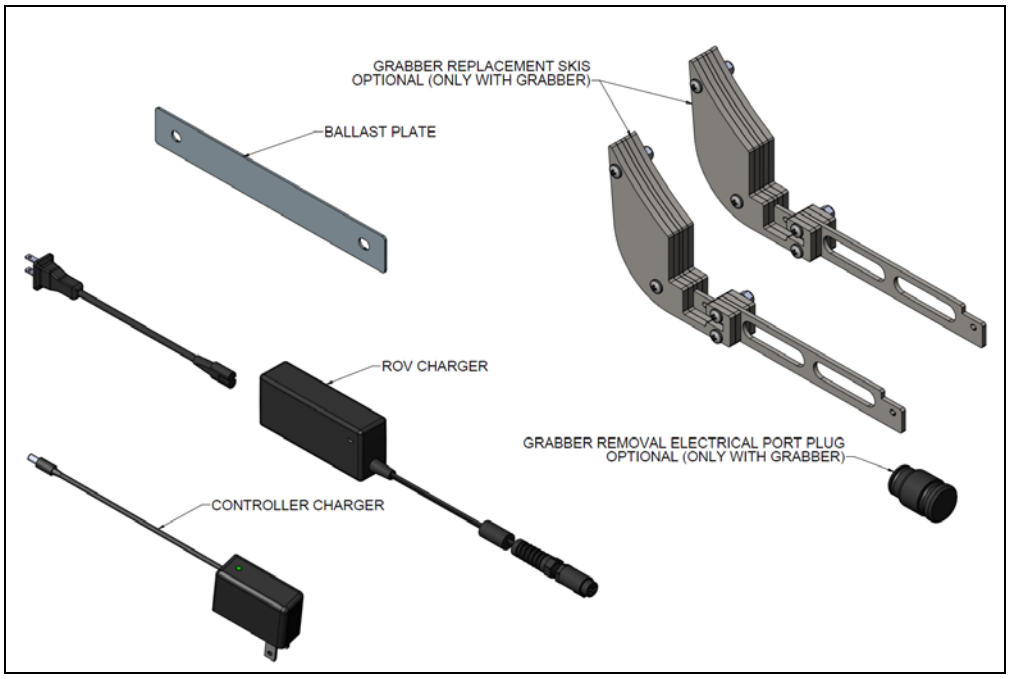

GRABBER REPLACEMENT SKIS
OPTIONAL (ONLY WITH GRABBER)
BALLAST PLATE
ROV CHARGER
GRABBER REMOVAL ELECTRICAL PORT PLUG
OPTIONAL (ONLY WITH GRABBER)
CONTROLLER CHARGER

Fig. 2B

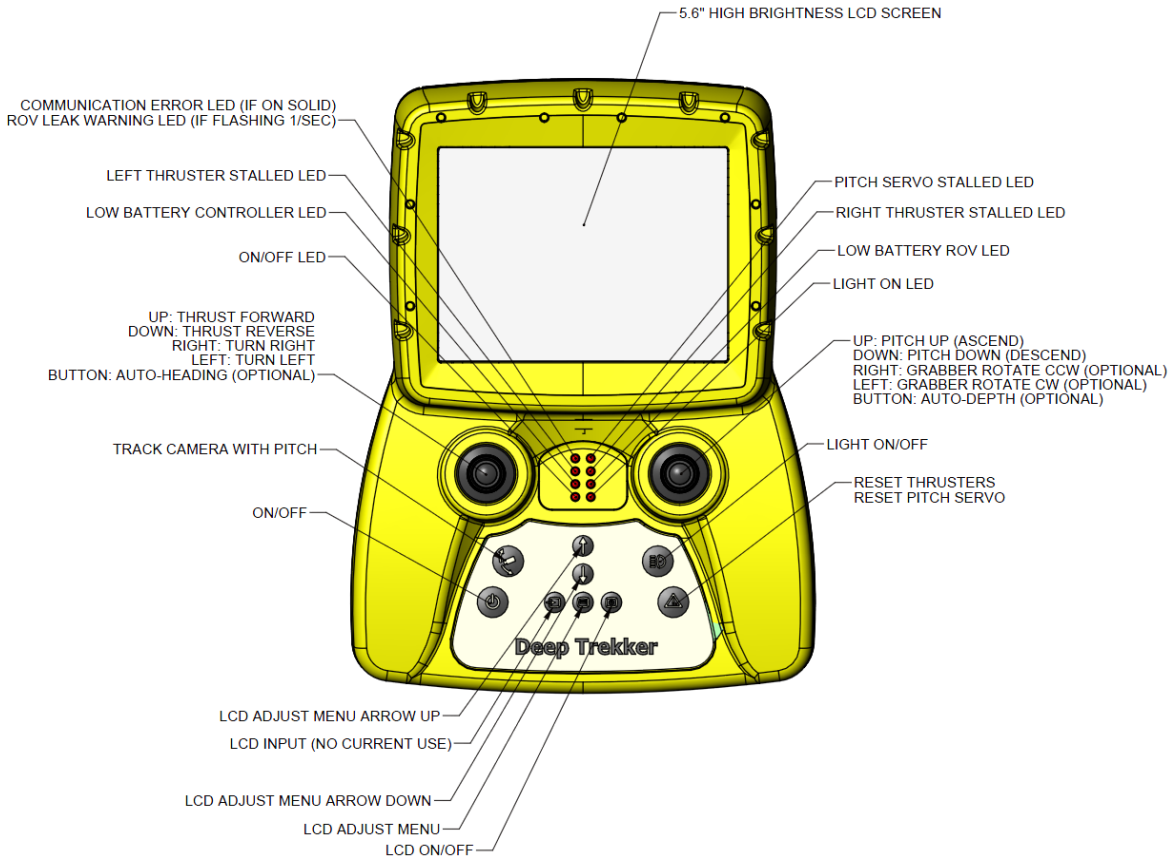

5.6" HIGH BRIGHTNESS LCD SCREEN
COMMUNICATION ERROR LED (IF ON SOLID)
ROV LEAK WARNING LED (IF FLASHING 1/SEC)
LEFT THRUSTER STALLED LED
LOW BATTERY CONTROLLER LED
ON/OFF LED
UP: THRUST FORWARD
DOWN: THRUST REVERSE
RIGHT: TURN RIGHT
LEFT: TURN LEFT
BUTTON: AUTO-HEADING (OPTIONAL)
TRACK CAMERA WITH PITCH
ON/OFF
PITCH SERVO STALLED LED
RIGHT THRUSTER STALLED LED
LOW BATTERY ROV LED
LIGHT ON LED
UP: PITCH UP (ASCEND)
DOWN: PITCH DOWN (DESCEND)
RIGHT: GRABBER ROTATE CCW (OPTIONAL)
LEFT: GRABBER ROTATE CW (OPTIONAL)
BUTTON: AUTO-DEPTH (OPTIONAL)
LIGHT ON/OFF
RESET THRUSTERS
RESET PITCH SERVO
Deep Trekker
LCD ADJUST MENU ARROW UP
LCD INPUT (NO CURRENT USE)
LCD ADJUST MENU ARROW DOWN
LCD ADJUST MENU
LCD ON/OFF

Fig. 3A

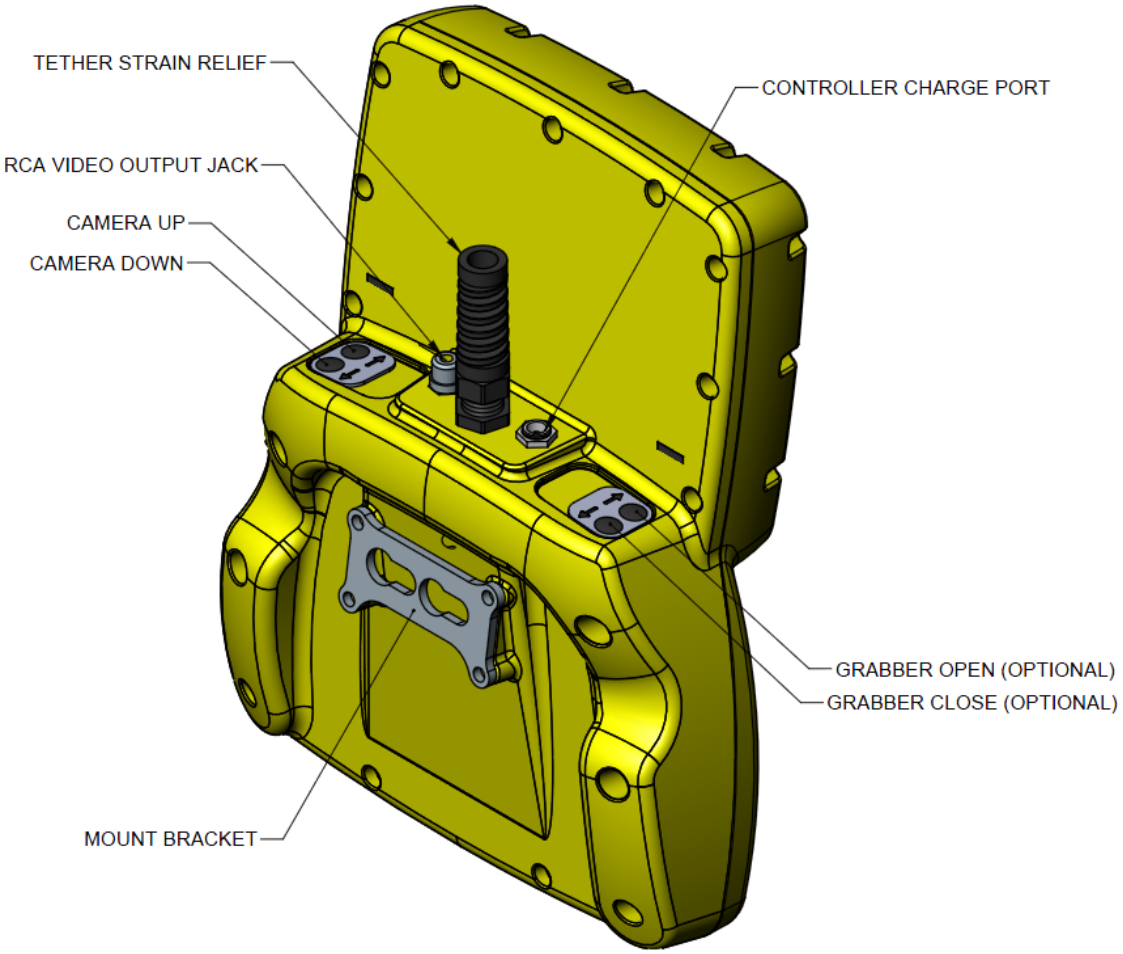

TETHER STRAIN RELIEF
RCA VIDEO OUTPUT JACK
CAMERA UP
CAMERA DOWN
MOUNT BRACKET
CONTROLLER CHARGE PORT
GRABBER OPEN (OPTIONAL)
GRABBER CLOSE (OPTIONAL)

Fig. 3B

Calibrating the Buoyancy

The DTG2 ROV is shipped from the factory calibrated for fresh water use. To adapt for saltwater, simply add the provided ballast plates as shown in Fig 4 evenly to the top mounting points or bottom mounting points. These weights can be added or removed as desired to gain the preferred buoyancy. It is most common to bias the buoyancy to a neutral or slightly positive setting.

Every body of water will have different density, generally when changing to salt water, we recommend adding 4 ballast plates to start. From there, small ballast plates can be added or removed to ensure neutral buoyancy.

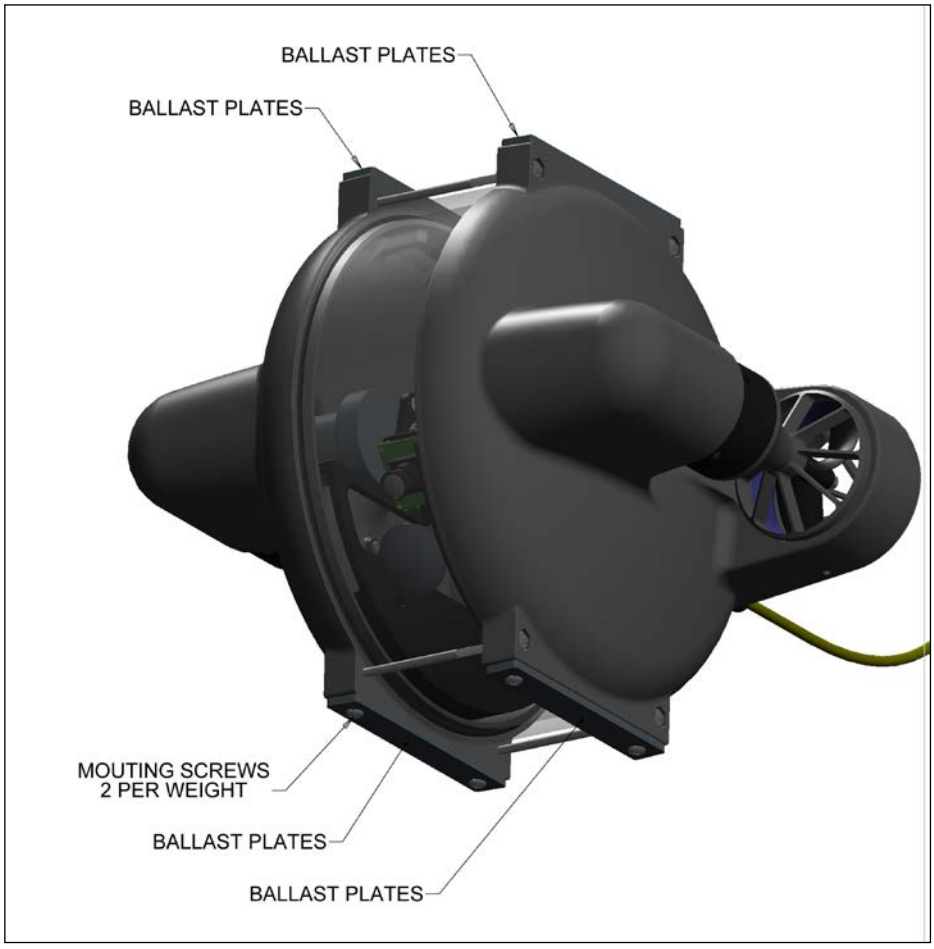


Fig. 4

Launching your First Dive

Prior to operating the DTG2 system, ensure you have read the entire operator's manual and fully understand it. Once fully charged remove the charger from the ROV and set it right side up on a secure surface. This is important because as soon as the system is active the pitch system will rotate to this level condition.
Turn the controller on with the ON/OFF button. The controller and ROV will enter the boot sequence that should last no longer than 5 seconds. The video camera will come out of its downward park position and point forward. The camera and light are now safe to use. The thrusters can be activated in dry conditions for no more then 60 seconds at a time. The pitch system should not be activated until the DTG2 is in the water.

Any dive should include a short inspection to ensure that everything is in order:

1) Check the thrusters for any debris that was left from the prior dive.
2) Inspect the tether to ensure it has not been worn or breached in any way.
3) Check for loose fasteners on the ROV.
4) Check the connection between the window and side bodies to ensure it is sealed.
5) Turn on the system and check functionality of the thrusters, lights and camera. Do not operate the pitch system while out of water. The lights can run indefinitely while the ROV is out of water, but the thrusters should not run for more then 60 seconds, as there is a waterproof bearing with a seal that relies on water for lubrication.

Once the inspection is complete prepare to launch using the following steps as a minimum:

1) Inform anyone else nearby such as divers, swimmers or boaters that you are deploying the DTG2 and its tether. Only deploy if you have their approval.
2) Ensure your launch and piloting area are clean.
3) Ensure your tether is neat and ready to deploy.

For a first trial run, choose a safe shallow and clear body of water that does not include obstacles capable of getting tangled in. There should be no wind or current present.
Lower the DTG2 into the water by the stainless steel tether bracket across the back, or gently lower it in by the tether. Do not throw the DTG2 into the water for fear of striking an object.
At this point it is advised to operate the ROV without the use of the camera and viewing system. Keep it near the surface for easy visibility and familiarize yourself with the controls.
Once you are familiar with the controls of the ROV, you may begin to use solely the viewing screen to maneuver the DTG2. We recommend having infrastructure or something in view to keep your orientation when learning.

Operation

On/Off

The on/off button as shown in Fig 3 acts as an ON button when the ROV is off, and an OFF button when the ROV is on. Pressing the on button starts a boot sequence that will last about 3 seconds.

If the ROV is turned off while diving, simply turn it back on. It does not have to be on dry land for a re-boot.

If the controls have not been activated on the controller for several minutes the system will automatically shut down. This will shut down the controller and ROV. If you are also using optional viewing systems such as the video glasses or digital video recorder – these will not shut down automatically.

Driving Controls

As shown in Fig 3, the motion of the DTG2 is accomplished with only 2 joysticks. The left joystick completely controls the thruster in an intuitive manner. Forward on the joystick is forward on the ROV. Back on the joystick is reverse on the ROV. Right and left on the joystick are right and left on the ROV.

The patent pending pitch system rotates the entire outer body up and down. This feature transforms the thrust motion from the primary thrusters into vertical motion. Like an airplane, if you point the jets up, it will climb, if you point them down it will descend. The DTG2 is essentially the same thing in water, except because it is the same weight as water (if you the operator calibrated it correctly) it will remain at the same depth until the thrusters move it up or down. Rotating the pitch system is accomplished with the right joystick. Forward descends into the water and pulling back ascends. Right and left on this right joystick do not affect the ROV motion in any way, they are used for grabber rotate which is optional equipment.

Drive Up

Drive Down

Thruster Trim

The right and left thrusters can be trimmed to ensure the ROV drives straight when the joystick is full forward. Small variances in the ROV can pull it slowly to one side. To adjust the thruster trim, place the ROV in an open body of water with no wave action or current. Descend the ROV below the water line slightly so it is fully submerged but still visible by eye. Throttle the thrusters full forward and observe the path it takes.

If the ROV pulls to the right side, press and hold the **reset button** and toggle the **grabber close button** several times until the ROV begins to drive straight. Each time the grabber close button is pressed and released it adjusts the difference by approximately 1%. It may be necessary to press the grabber close button several times before you achieve a straight heading.
If the ROV is pulling to the left side, press and hold the **reset button** and toggle the **grabber open button** several times until the ROV begins to drive straight. Each time the grabber open button is pressed and released it adjusts the difference by approximately 1%. It may be necessary to press the grabber open button several times before you achieve a straight heading.
Do not attempt to trim the thrusters with the auto-heading or auto-depth engaged.

Pitch Trim

The pitch can be trimmed to hold any angle without using the pitch joystick. This allows an operator to fine tune the "home" position of the tilt of the ROV to slightly up, perfectly horizontal, or slightly down, depending on the operator's preference.
It can also be used to hold the ROV body at certain fixed angles if a sonar scan is required of a fixed target above or below the ROV, or if you are attempting to grab something 45 degree below the ROV, the pitch trim will hold the ROV at that angle so that you can focus on grabbing the object.

To adjust the pitch trim, place the ROV in an open body of water with no wave action or current. Press and hold the **reset button** and toggle the **camera down button** several times to point the body more downwards, or the **camera up button** to point the body more upwards.

Each time the camera down button is pressed and released it adjusts the angle by a few degrees. It may be necessary to press the camera down button several times before you achieve the desired pitch angle.

Do not attempt to trim the pitch with the auto-heading or auto-depth engaged.

Camera

The camera and lights are controlled by the push buttons as shown in Fig 3. The camera track button will quickly reposition your camera to point in the same direction the thrusters are pointing. This feature is helpful because most often you want to look ahead when you are driving.

It is helpful to have objects other than the open water in the field of vision of the camera. This will give you your bearings on what the ROV is doing.

Camera Track-and-hold

The track-and-hold function allows the camera to move along with the movement of the exterior shell. It will always be in alignment with the thrusters so that when the ROV is ascending, the camera is facing up and when it is descending the camera is looking down. To activate **track-and-hold**, press the camera track button and reset button for 4 seconds, until you see the pitch stall LED flash for 1 second. Once the LED flashes, track-and-hold is active. This only needs to be set once and the setting will be saved.

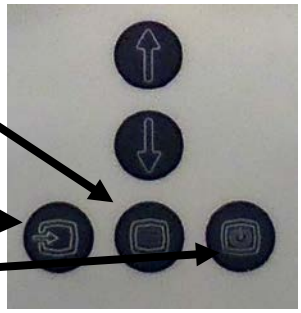
To shut off track-and-hold so that the camera remains independent of the exterior shell movements; hold the camera track button and reset again until the pitch stall LED flashes. Having the camera independent of the exterior shell movements means that the camera will stay looking in the direction you set it to. Allowing for detailed inspections. For example you can face the camera to look directly upwards towards the hull of a boat, and then drive the ROV straight down away from the boat; and the camera will continue to look up.

Descending and Ascending

Ensure on your decent that you do not crash into any sharp objects as you approach the bottom. While descending, ensure your camera is pointing down in order to show you the approach, and likewise on your accent, ensure the camera is pointing up to show you the possibility of an object, i.e. a boat hull in the way. The easiest way to ensure your camera is pointing in the correct position is to momentarily press the camera track button, while pitching to reposition your camera forward in line with the thrusters.

LCD Viewing Screen

The 5.6” LED viewing screen provides ultimate portability for the DTG2. You can adjust the brightness, contrast, and exposure of the screen by pressing the LCD adjustment menu (center button) and using the arrows to go through the menu.
The left button will transfer the video from the LCD controller to another monitor that you have hooked up to the controller through the RCA video out port.
The right button will turn on and off the LCD screen completely.



LED Indicators:

Check the controllers LED indicators often.
When the **ROV battery LED** it flashing, the ROV will slow down considerably. Return it to the boat and charge it when safely indoors.
When the low **controller battery LED** is flashing, you will have enough power to finish the dive, but must remember to charge it before the next. If the controller batteries are not charged, the LED will eventually completely turn on, and it will stop sending data to the ROV, rendering the system unusable. Once the system is safely back indoors plug the controller charger into the controller charge port as shown in Fig 3.
If the **thruster error LED** light is on, return the ROV to the boat and turn the system off. Inspect the propellers and magnetic couple for binding objects. Removal of the guards and propeller may be required. Once the debris is removed turn on the system again and test the thrusters in and out of the water. If the thruster error LED again turns on, contact Deep Trekker support or your authorized Deep Trekker Dealer for assistance.
If the **pitch stall LED** turns on simply press the reset thrusters/pitch button on the controller. The pitch can be stalled by excessive pull on the tether, by trying to pitch the system out of the water, or by not removing the shipping screws. If the pitch stall LED again turns on contact Deep Trekker support or your authorized Deep Trekker Dealer for assistance.
The **no communication LED** will turn on when the ROV is extremely low on batteries, or not plugged into the tether. If a full battery charge does not fix the problem, contact Deep Trekker support or your authorized Deep Trekker Dealer for assistance. See also the trouble shooting guide portion of the manual. The second function of the no communication LED is to warn of water ingress into the ROV hull. The communication LED will flash quickly if water is sensed. During this occurrence the ROV will become immobile, and you must pull it out of the water as quickly as possible and contact Deep Trekker support or your authorized Deep Trekker Dealer for assistance.

Tether:

It is advised to have an assistant managing the tether as the ROV demands more let into the water, or pulled back out of the water. Leaving too much tether in the water will cause excess drag on the DTG2, and not having enough will restrict the ROV manoeuvrability. The tether needs to be closely observed while in use as it poses a threat to swimmers and divers as well as boaters.
Do not bend the tether in a radius of 75mm (3”) or less. Do not kink the tether. Never drag the tether over a rough or sharp surface. This will quickly wear the outer protective jacket and eventually flood the cable.
Do not step on or drive over the tether. Crushing the tether in any way may damage it in a fashion that is non-repairable.
If your tether does get damaged please contact Deep Trekker support or your authorized Deep Trekker Dealer for assistance.

Entanglement:

Take extreme care in conditions that increase the chance of the tether being tangled. If the DTG2 does get tangled, assess the situation with the camera and manoeuvre the ROV appropriately to become free. Generally, you should be able to find your tether with the camera and follow it back out. Failing that, the tether can be pulled on lightly with a maximum force of 27 kilograms (50 pounds) to become free. If that fails it is advisable to find a certified diver who can manually untangle the system. Never dive in the water yourself to perform this manoeuvre. Under no circumstances is a lost or damaged system warrantable.

Shutdown

Once the dive has been completed, you may return the DTG2 to the boat by either using the thrusters or by gently pulling it back with the tether. Turn the system off and lift it out of the water by the tether support, or by gently pulling up on the tether. Once safely on shore and set on a sturdy flat surface, inspect the outer body for foreign objects and remove as necessary. Inspect the interior through the window for any sign of water and the inner window for fogging. If you see either of these problems you may have a breach in the hull at some point and need to contact Deep Trekker support or your authorized Deep Trekker Dealer for assistance.

Wipe the ROV down with a towel or rag. If the DTG2 has been used in salt water it is advised to rinse it with fresh water to ensure it does not corrode. After the fresh water rinsing, wipe the ROV dry. If the optional carry case is used, do not close the lid after use. Allow 1-2 hours for the ROV and tether to dry off 100% prior to sealing the case shut. Any significant amount of moisture left in the case will promote corrosion. If the DTG2 has been launched from a boat, stow it safely before moving on. Do not let the ROV bounce around the boat.

Charging

Charging the DTG2 ROV must be done when the unit is safely indoors in a dry environment. Never put the DTG2 ROV into the water or near water when it is being charged. The length of time it takes to charge depends on the condition of the battery packs. It should not take longer than 3.5 hours to charge after 5 to 8 hours of use. Remove the charge port plug and insert the charger plug into the ROV. The charger is charging when the LED on the charger is red. Charging is complete when the green LED appears on the charger. When the charger is plugged into the ROV, the ROV is unusable, and if the controller is turned on, there will be a no communication fault triggered. Be sure the charge port plug is returned into position before the next dive. The plug acts as a double seal at this opening and also protects the electrical pins from corrosion.

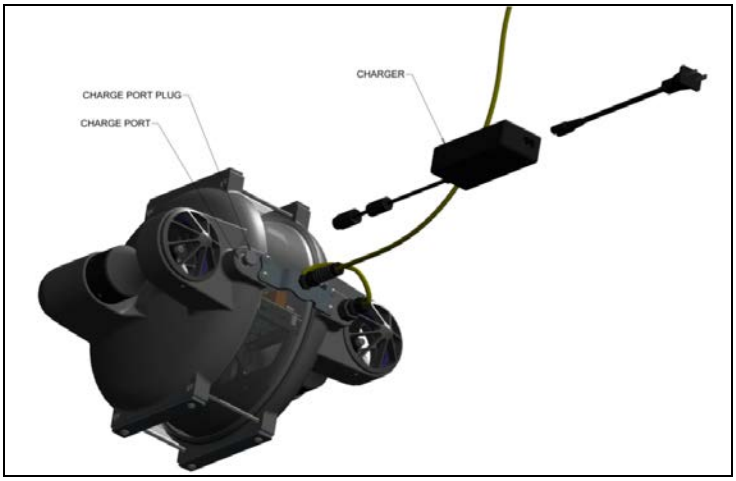


Fig. 5

Charging the DTG2 controller must be done when the unit is safely indoors in a dry environment. The controller is powered by a separate built-in battery pack that will require a charge approximately every 8 hours of run time. When the battery pack is low, the low controller battery LED will turn on. If a charge is not given within a few hours of the LED warning, the battery will reach a critically low level and communication with the ROV will stop.
To charge the controller, simply plug the controller charger into the charge port on the controller next to the tether. Note that the controller charger is different from the ROV charger. The difference in charger plugs makes it impossible to interchange.

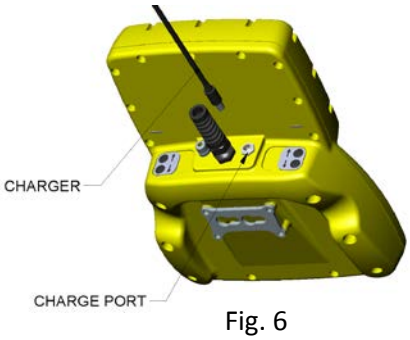


Fig. 6

Note both the ROV and Controller chargers are ‘smart’, meaning there will be no damage in leaving the chargers plugged in overnight, or giving your DTG2 a quick charge for some extra life on your next dive.

Storage

Store your ROV in a location that is safe from animals or insects that are capable of causing damage to the tether. One small hole in the tether will cause it to flood and could lead to a communication failure between the controller and ROV. Store in dry locations between the temperatures of -20C [-4F] and 40C [104F] out of direct sunlight. Storing in climates out of this range will lead to premature battery failure. It is recommended to charge the battery at least once every 6 months if the unit is not being used. If the ROV is stored in a sealed compartment such as the optional carry case offered by Deep Trekker Inc., the ROV and tether must be left to dry off 100% prior to sealing the case shut. Any significant amount of moisture left in the case will promote corrosion.

Transporting

***It is important to store and transport your DTG2 in a fashion that does not rock the pitch system back and forth. This will cause premature failure because it is working the gear motor and gear train. This sort of failure is 100% unwarrantable. An easy way to prevent the pitch system from rocking back and forth is to stow the ROV upside down such that the internal frame is resting against the mechanical stops located inside the hull. ***

For instances where the DTG2 cannot be safely stored in the upside down position such as during air travel or very rough boat travel, the use of the 2 shipping set screws may be required. These screws are found on the rear of the ROV behind the tether bracket. Their purpose is to mechanically hold the internal framework so that it is unable to move. To properly use the set screws, the following steps must be taken:

1) Slowly rotate ROV backwards (as if to ascend) to position the internal frame against the stops.
2) While in this position, turn the set screws using a flathead screwdriver clockwise until they are firmly against the internal frame and holding it in this position.

In this configuration the ROV is unusable and should not be turned on. If the ROV is mistakenly turned on, the pitch stall error LED will appear because the servo motor cannot override this mechanical connection.

To release the shipping set screw the following steps must be taken.

1) Rotate ROV upside down with the handles facing downward. This will ensure it does not rotate until the screw is completely backed out. While in this position, turn both set screws using a flathead screwdriver counter-clockwise until the set screw heads are firmly against the cover plate. ***DO NOT REMOVE THE SHIPPING SET SCREW UNDER ANY CIRCUMSTANCES. THIS OPENS UP THE SEALED UNIT AND WILL LEAD TO IMMEDIATE FAILURE IF SUBMERGED***
3) Slowly rotate ROV to its level position.

It is advised to only use the shipping screw when absolutely necessary. Overuse can lead to a worn o-ring and which in turn leads to a breach in the hull. Shifting the set crew in or out when debris such as sand is present in the cavity will lead to premature o-ring failure.

Although the DTG2 needs to be stored in moderate temperatures as outlined under the Storage section, it can be transported in climates as low as -40C [-40F] for periods of time not exceeding 24 hours. S Special care must be taken when handling the tether in these temperatures as the jacket will be very brittle.

Optional Equipment - Sensor System

The Deep Trekker sensor system adds significant intelligence to the DTG2 ROV. Included in this package are the following sensors:

Depth sensor	0 to 100 meters
Compass	0 to 360 degrees
Pitch sensor	-85 to +85 degrees
Roll sensor	-85 to +85 degrees
Camera angle sensor	-105 to 105 degrees
ROV battery level sensor	0-100%
Controller battery level sensor	0-100%
Turns counter	-32000 to +32000 turns
ROV hour counter	0 to 32000 hours
Water temperature	-20 to 80 Celsius

The information gathered by the Deep Trekker Sensor System is displayed via OSD (on-screen-display) to the video output. See the below figure for the placement of each piece of data.

Temperature
Turns Counter
Controller Battery Level
ROV Battery Level

Pitch
Roll
Heading
Depth
Camera Angle

Fig. 8

Using the readings from the depth sensor and the compass, the ROV is able to hold a depth and heading. These additional features are called auto-depth and auto-heading.

Auto-Depth

The auto-depth is activated by pressing the pitch (right) joystick directly down. As soon as this is pressed, the ROV will record the current depth and attempt to hold it until the auto-depth button (pitch joystick) is pressed again. The auto-depth feature is shown on screen by brackets around the depth reading. For example if the depth reading is <4m>, the auto-depth is active. If the depth reading is 4m, the auto-depth is not active. When the auto-depth is active, it adjusts the pitch angle of the ROV accordingly so that when the thrusters are in motion, the ROV will move to the desired level. If the thrusters are not active, the ROV will not automatically thrust itself to the desired level.

Auto-Heading

The auto-heading is activated by pressing the thruster (left) joystick directly down. As soon as this is pressed, the ROV will record the current heading and attempt to hold it until the auto-heading button (thruster joystick) is pressed again. The auto-heading feature is shown on screen by brackets around the heading reading. For example if the heading reading is <255>, the auto-heading is active. If the heading reading is 255, the auto-heading is not active. When the auto-heading is active, it adjusts the thrust level of each thruster accordingly. If the thrusters are not being activated by the operator, the auto-heading will automatically activate them accordingly in order to maintain a heading. For this reason, the auto-heading should not be activated while the ROV is on land or anywhere near people since the thrusters can turn unexpectedly.

The compass, depth and water temperature sensors are located in the sensor pod, which is mounted directly behind the ROV. They are mounted remotely in order to keep away from the magnetic interference and heat generated by the ROV. Do not strike the sensor pod with anything or drive backwards into hard objects.

Even with the pod mounted at the center rear of the ROV, slight magnetic interferences will be picked up that can skew the heading reading by +/- 15 degrees. This is an unavoidable dilemma when mounting a compass on a compact ROV. In addition to this, large metallic objects the ROV is working near can and will cause significant interference to the compass, which may or may not be noticeable. No error will be shown on screen, the heading reading indicated on the screen will be wrong.

Turns Counter

The turns counter records the number of turns an operator has made during the dive. It is a good idea to keep this number as close to 0 as possible and to return it to 0 before winding in the tether. If the ROV is powered OFF and ON again, the turns will reset to 0.

Date and time readings are not included in the Deep Trekker sensor system. This must be added using the recording device.

On Screen Display On/Off

If you would like to turn off the OSD (on-screen-display) for instances such as recording your dive, press both the Light and Reset buttons together. You may toggle between showing the OSD and having it hidden using these buttons again.

Optional Equipment – Two Function Grabber

The Deep Trekker two function grabber upgrades the DTG2 from an observation-class micro ROV into a working-class micro ROV. The grabber is equipped with an open/close motion and a continuous bi-directional rotate motion.
The open and close motion is activated using the two push buttons located at the front of the controller, where your left hand index fingers are - opposite the camera up/down buttons. The 360 degree rotate motion is activated using the pitch (right) joystick X (horizontal) direction.

Locking onto an object

The mechanical design of the two function grabber incorporates a self-locking feature. That is to say, once the claws are closed, they will not re-open unless the force is large enough to cause mechanical damage to the unit. This is a beneficial feature if the objects you are grabbing are very heavy. The down-side to this is that once the claws are locked closed, the rotate motion is also locked. The computer inside the grabber knows this and will slightly loosen the grip on the claws if the rotate is activated. This loosening is often enough to drop an object. The rotate should only be used to position the angle of the claws prior to grabbing.
The maximum weight that the ROV can lift and self-maneuver with is very small. Generally, if you are retrieving a large or heavy object, the grabber is used to lock the ROV into it, and the user then retrieves the ROV and object by pulling it back using the tether. The maximum weight the grabber should carry is 50 lb. The tether is also rated for up to 150 lb so it is capable of bringing up both the ROV and an object. **Please note that the weight of most objects will differ when it is pulled out of the water. Based on the density of the object, many objects will weight close to neutral while they are much heavier in air.**

Locking the Camera on the tips of the grabber

The grabber is fix-mounted to the exterior shell of the ROV. Due to the design of the DTG2 ROV and its ability to rotate the shell up or down, the two function grabber essentially gains an additional motion, allowing the user to grab below or above the ROV. This is a major advantage over a fixed shell ROV. The disadvantage is that the grabber can and will rotate into the view of the camera unexpectedly if the user is activating the pitch joystick. To help avoid this, and to lock the camera on the tips of the claw, the **track-and-hold feature** can be activated. This feature will force the camera to rotate with the motion of the exterior shell (thrusters) and grabber.
To activate **track-and-hold**, press the camera track button and reset button for 4 seconds, until you see the pitch stall LED flash for 1 second. Once the LED flashes, track-and-hold is active. This only needs to be set once and the setting will be saved.

To shut off track-and-hold so that the camera remains independent of the exterior shell movements; hold the camera track button and reset again until the pitch stall LED flashes. Having the camera independent of the exterior shell movements means that the camera will stay looking in the direction you set it to. Allowing for detailed inspections. For example you can face the camera to look directly upwards towards the hull of a boat, and then drive the ROV straight down away from the boat; and the camera will continue to look up.

Caution

The dual shaft seals used on the grabber shaft are rated for underwater and dry air use. Do not attempt to rotate the claws while the ROV sits on dry land. The tips of the claws, if opened at all can cause the ROV to tip over.

When the ROV is shut down after use, ensure the claws are fully closed and horizontal to the ground. Never attempt to close or rotate the claws by hand, this will cause damage to the unit.

Inspect your grabber for foreign objects that may cause binding or seal damage. Do not use the grabber in sandy environments that may seize the rotate sleeve bearings directly behind the claws.

Removing the Grabber Arm

When the grabber arm is not required, the ROV is slightly easier to drive. You may remove it when it is not in use with the following steps;

1) Shut down the ROV power.
2) Unscrew the electrical connector leading into the rear of the ROV. Do not allow the plastic bulkhead mounted to the rear of the ROV to turn. This will cause an immediate leak. If the plastic bulkhead appears loose, contact your authorized Deep Trekker Service center.
3) Plug the exposed (and electrically active) terminals using the provided plug. Never leave these pins exposed to the water as they are electrically active at 20 VDC when the ROV is turned on.
4) Remove the 4 pins that hold the grabber to the bottom of the ROV.
5) Install the skis on each side of the ROV using the same 4 pins.

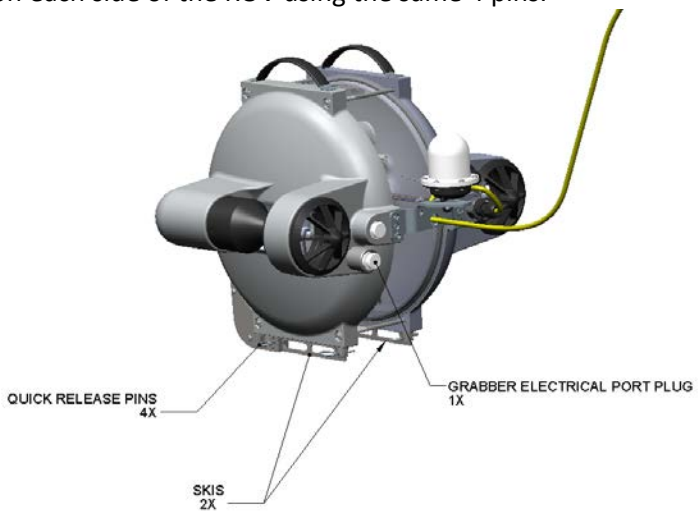


Fig. 9

To install the grabber take the following steps;

1) Shut down the ROV power.
2) Remove the skis on each side of the ROV.
3) Mount the grabber using the same 4 pins.
4) Remove the plug protecting the electrical terminals on the rear side of the ROV.
5) Check the O-ring on the electrical connector connecting into the rear of the ROV. If damaged, replace.

6) Plug in the grabber electrical connector and tighten by hand (not a wrench). Do not allow the plastic bulkhead mounted to the rear of the ROV to turn. If the plastic bulkhead appears loose, contact your authorized Deep Trekker Service center.
7) Turn ROV on and ensure proper functionality.

It is important to note that if the ROV power is not off during this procedure, major damage can occur to the ROV main computer circuit board.

Optional Equipment – Auxiliary Lighting

In addition to the 300 lumen LED flood light that tracks with the camera, auxiliary lighting adds an additional 900 lumens to the DTG2. 300 lumen LED flood lights are added on the front of each thruster and can be turned on and off when needed from the top-side controller. Press both the camera up and camera down buttons together found on the front of the controller with your right index finger to turn the auxiliary lights on, and again to turn them off.
(This option must be added at time of purchase.)

Optional Equipment – Laser Scaler

The Deep Trekker Laser Scaler provides fixed reference points 25mm apart by way of 2 laser beams. When the laser is pointed near perpendicular to an object less than 2 meters away, the two red dots are known to be 25mm apart With this aimed at a target, the user can simply make a reasonable estimate of the objects length based on how many times larger it is then the 25mm dot spread. The distance away from the camera is unimportant because both the reference dots and object scale equally. The lasers are mounted to the camera within the DTG2 and the dots are centred on the screen. This unique setup allows the laser to scale object in the full field of view of the camera which is mounted on a 270 degree tilting arm. Allowing for measurement of an object directly below or above the DTG2.
To turn on the lasers, press Grabber open and close together found on the front of the controller with the left index finger. Press the grabber open and close buttons together again to turn the lasers off.
(This option must be added at time of purchase.)

Optional Equipment – Crawler Wheels

When using the DTG2 for inspections of pipes, tight spaces, or ship hulls – the crawler wheels make maneuvering these small areas easy. The wheels can be attached on the top or the bottom of the DTG2. When mounting to the top of the DTG2, remove the handles using the Phillips screws and attached the crawler wheels with the pins provided. (Similar to mounting the grabber arm). The crawler wheels can be easily attached or removed depending on the task at hand.
(This option can be added at any time to all Deep Trekker models.)

Optional Equipment – DVR

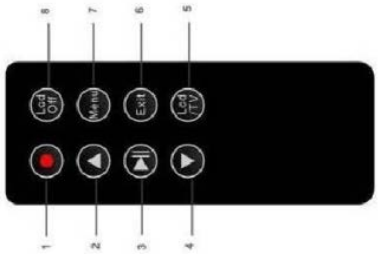
The Deep Trekker Portable DVR allows the live video stream from the ROV to be recorded to an SD card.

Hardware Orientation

I. DVR

1. Power On/Off
2. Charge Led
3. Internal Microphone
4. AV Input & DC Out jack
5. Low Power LED
6. Record / Stop Button
7. Power On/Record LED
8. DC5V In Jack 9. USB Port
10. AV Out& Alarm In Jack
11. Reset Button
12. Lock Switch
13. Internal Speaker
14. SD Socket
15. IR Sensor
16. Down Button
17. Up Button
18. Enter Button
19. Esc Button
20. Menu Button

Ⅱ. Remote Control



1. Record/Stop button
2. Up Button
3. Enter Button;
4. Down Button
5. LCD/TV Switch Button
6. Exit Button;
7. Menu Button
8. LCD Off Button;

Ⅲ. Accessories

AV Cable

AC Adapter

USB Cable

Setting Record Modes
There are three work modes for recording:

Record ----- for video and audio record, the record data will be saved in AVI files under the “Record Files” folder.
Photo --- for still picture capture, the photos will be saved in JPG files under the “Photo Files” folder.
Audio ----for only audio record, the record data will be saved in WAV files under “Audio Files” folder. This feature cannot be used with the DTG2 since the ROV has no audio capability.

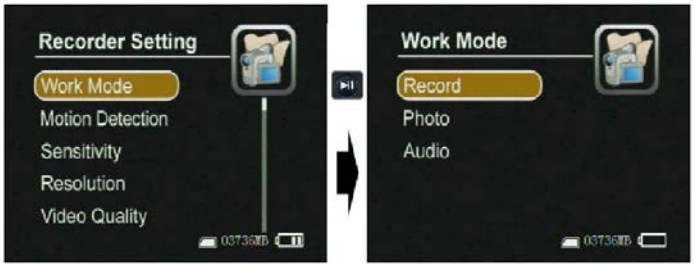
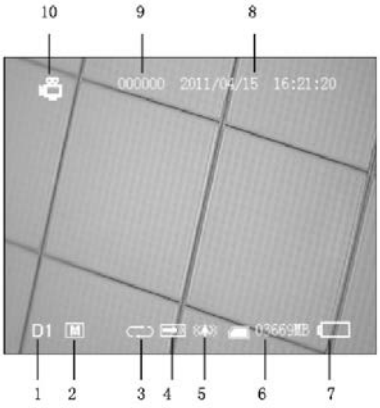


Fig. 10



Basic Operation
1. Image Size
2. Resoluton
3. Overwite On/Off
4. In/Out Microphone
5. Vibration On
6. SD card info
7. Battery Capacity
8. Date and Time Stamped
9. User ID
10. Mode

Record Video
1) Charge the DVR battery for at least 3 hours before you begin recording.
2) Select a correct record mode for your task by setting work mode.
3) Ensure the SD card is properly installed into the DVR.
4) Connect the AV cable from the AV-in port on the DVR to the RCA video output jack on the ROV controller.
5) Slide the Record / Stop switch to “Rec” to start recording.
6) Complete the recording as desired up to the maximum length of video that the SD card can hold.
7) Slide the Record / Stop switch to “Stop” to end recording.

Accessing the Videos for Playback on the DVR
1) Press the menu button.
2) Select Event Playback (camera reel icon).
3) Select Video Files.

4) Navigate to the desired file.
5) Press the select button to play back the video.

Fig. 11

Connecting with computer

1) Plug the USB cable into the DVR and an available USB port on your computer
2) The default password is 00000 for connecting to PC.
3) Navigate to the appropriate folder to access the recorded videos using Windows Explorer. The videos can be copied from the SD card onto your computer. The videos can also be deleted from the SD card using Windows Explorer in order to make room for new videos.
4) The DVR will power off automatically when you disconnect the USB from PC.

Optional Equipment – Video Glasses

The video glasses are a great addition when working in high sunlight. Although the LCD screen is 4 times brighter than a laptop screen, the video glasses block out all of the light and allow you to view what the DTG2 sees directly in front of your eyes like a TV screen.

The video glasses are plugged in from the AV in/out port on the video glasses into the front of the controller to the RCA Video out port.

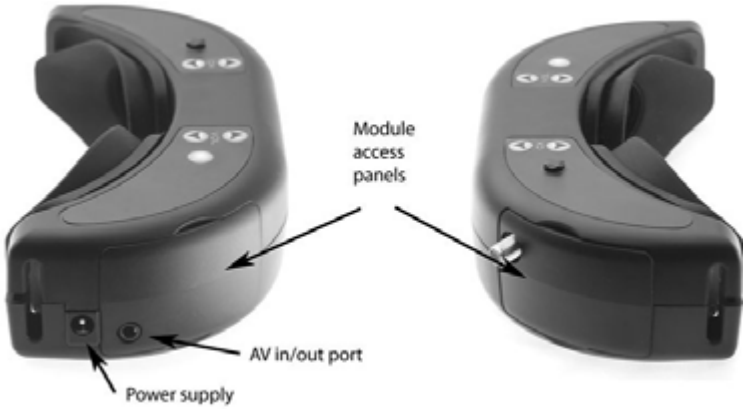


Fig. 12

The battery pack must also be plugged in for the video glasses to function. Plug the power cord from the battery pack into the power supply outlet on the video glasses.
Note: Whenever the battery is plugged into the video glasses it is using power. It is important to unplug the glasses when they are not in use to save the battery.

Fig. 13

To recharge the batteries, plug the power cord from the battery pack into the charger provided.

Mounting Provisions for Auxiliary Equipment

There are 4 threaded holes found in the top and bottom feet that can be used for mounting auxiliary equipment. It is important that the underwater weight of any added equipment should not exceed 40 grams or the fixed volume of the ROV will not be able to maintain neutral buoyancy. If the equipment is heavier than this, the user is responsible for adding buoyancy to the ROV to compensate. It is also advisable that this added equipment does not add significant additional drag to the upper or lower portion of the ROV, or it will affect the dynamic characteristics of the ROV movement. Too much drag at the top of the ROV will cause it to pitch up while in motion, and too much drag on the bottom of the ROV will cause it to pitch down while in motion. Below are the mounting dimensions of the provided holes.

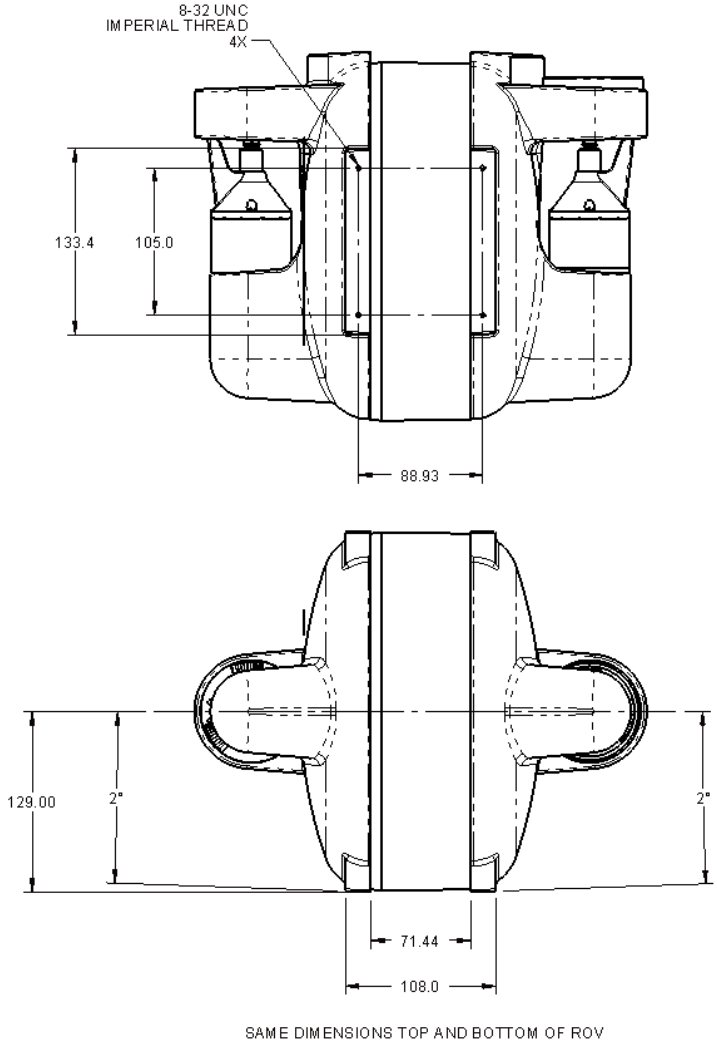


Fig. 14

Maintenance

The owner is responsible for the every day basic maintenance required in keeping the system in good working order. Ensure that the system is cleaned after every dive, and in the case of a salt water dive, ensure it is rinsed well in fresh water. Do not use any sort of a cleaning agent on the window other then fresh water. This high strength polymer window is sensitive to chemical attacks which will compromise the integrity of the structure. Never wash the ROV while it is being charged. The propeller guards and propeller can be removed only as required to pull out debris causing binding. Under no circumstance should the user unbolt a connection that includes an o-ring seal leading to the interior of the ROV. Warranty is void if these seals are breached. This level of service must be left to an authorized Deep Trekker Service center. The owner should not unplug the tether from the ROV unless absolutely necessary.

Trouble Shooting

Below is a trouble shooting guide. If none of the possible solutions work, please contact Deep Trekker support or your authorized Deep Trekker Dealer for assistance.

Problem	Possible Solutions
ROV turning left or right when attempting to drive straight forward	1) Adjust the thruster trim. See section Thruster Trim under Operation.
ROV sitting too forward or back when in water.	1) Adjust the trim of the pitch. In some instances you might want the ROV to hold a slight pitch forward when picking up an object. See section Pitch Trim.
window fogged	1) Move to better atmospheric conditions. 2) Possible breach in hull - contact Deep Trekker support or your authorized Deep Trekker Dealer for assistance.
water or water drops inside ROV	1) Possible breach in hull - contact Deep Trekker support or your authorized Deep Trekker Dealer for assistance.
LED – low ROV battery	1) Charge ROV battery using provided ROV charger.
LED – low controller battery	1) Charge controller battery using provided controller charger.
LED – pitch stall	**Press reset thrusters/pitch servo button to re-activate** 1) Ensure tether is not pulling on ROV. 2) Ensure ROV is in the water.
LED – right thruster stall	**Press reset thrusters/pitch servo button to re-activate** 1) Remove ROV from water and turn off system. Inspect propellers for debris that may be preventing rotation. Remove guarding and propellers as necessary to inspect. Ensure everything and everyone is clear of the propellers when the system is turned on again.
LED – left thruster stall	**Press reset thrusters/pitch servo button to re-activate** 1) Remove ROV from water and turn off system. Inspect propellers for debris that may be preventing rotation. Remove guarding and propellers as necessary to inspect. Ensure everything and everyone is clear of the propellers when the system is turned on again.
LED - no communication (on constantly or erratic flashing)	1) Look for damaged tether 2) ROV is currently charging and unusable 3) Batteries are low - charge ROV
LED - no communication	1) Possible breach in hull - contact Deep Trekker

(quickly flashing)	support or your authorized Deep Trekker Dealer for assistance.
thrusters weak	1) Inspect propellers and guarding for debris causing blockage of water flow. Remove as necessary. 2) Charge ROV
ROV floats or sinks	1) Add or remove ballast plates as outlined in the user manual. Adding extra equipment to the ROV is forbidden and may cause the overall weight of the unit to become too far out of range for the ballast plates to overcome.
video feed not working	1) Retrieve ROV from the water and test video again. Video footage of water with nothing in the background can appear black as though the video is not working. 2) Check connections between the controller and viewing system. Ensure all connectors are completely pushed in. 3) Charge the viewing system batteries. 4) Ensure a splitter is not being used. Composite video output on the controller is only capable of driving one monitor.
controller computer system frozen in 'ON' state or acting unusual	1) Reset the system by disconnecting the batteries for at least 10 seconds.
ROV computer system frozen in 'ON' state or acting unusual	1) Reset the system by disconnecting the batteries for at least 10 seconds. This is accomplished by plugging in the charger.

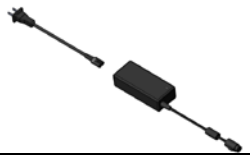
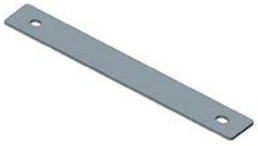
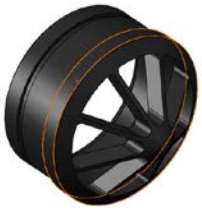
Parts and Service

To order replacement parts for the DTG2 exploration system, use the order numbers in the **Replacement Parts List** that follows. Replacement parts are available only as listed and can be purchased from an authorized Deep Trekker dealer or directly with Deep Trekker at Support@Deeptrekker.com.

Replacement parts for the system that are only repairable by an authorized Deep Trekker repair center are not listed in this user manual. If the DTG2 is in need of one of these parts please contact Deep Trekker support or your authorized Deep Trekker dealer for assistance.

The serial number of the DTG2 will be required when ordering parts. Locate the serial number on a label found on the inside of the hull.

Part Number	Description	Photo
0094	ROV,DTG2	
0314/5044	CONTROLLER, DTG2	
0058-XXX	TETHER	

0463	CHARGER, ROV	
0319/5032	CHARGER, CONTROLLER	
0036	WEIGHT, BUOYANCY ADJUSTMENT	
0041	BRACKET, TETHER	
0278	PLUG, CHARGE PORT W/O-RING	
0297	PROPELLER, 2 BLADE 63MM OD 3/16" SHAFT	
0307	GUARD, THRUSTER FRONT	
0308	GUARD, THRUSTER REAR	

Warranty

DEEP TREKKER INCORPORATED WARRANTY - LIMITED WARRANTY

Deep Trekker Incorporated ("Deep Trekker"), warrants to you, the first retail purchaser of this Deep Trekker exploration system, that it will repair or replace defects in materials or workmanship that occur and are reported to Deep Trekker or your factory authorized dealer within the applicable warranty periods set forth below, subject to the "What This Warranty Does Not Cover" section below. Warranty coverage is applicable only to products purchased from factory authorized Deep Trekker dealers. Your acceptance of delivery of the warranted Deep Trekker exploration system constitutes your acceptance of the terms of this limited warranty. This warranty gives you legal rights which may vary from region to region.

Factory Installed parts and components: Warranty Period runs for one (1) year of first retail purchaser.

The Warranty Period runs from the date of delivery to the first retail customer provided that the Deep Trekker exploration system is delivered within twenty four (24) months from the date of manufacture. For Deep Trekker exploration systems delivered more than twenty four (24) months after the date of manufacture, coverage will end at thirty six (36) months after the date of manufacture.

This warranty is extended to the original retail purchaser only. A purchase receipt or other proof of date of original purchase is required before warranty or service is performed.

This limited warranty is the sole and exclusive express warranty from Deep Trekker. Under the laws of certain states or provinces, there may be no implied warranties from Deep Trekker covering your Deep Trekker exploration system, and all implied warranties (INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE) are excluded and disclaimed where allowed by law. Any implied warranties arising under applicable law are LIMITED IN DURATION TO THE APPLICABLE PERIOD OF THIS WRITTEN WARRANTY AND ARE EXPRESSLY DISCLAIMED AFTER THE EXPIRATION OF THE WARRANTY PERIOD. NOTE: SOME STATES OR PROVINCES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU. There are no warranties which extend beyond the description on the face hereof.

What This Warranty Does Not Cover:

1. A product including its components that has been altered or modified so as to adversely affect its operation, performance or durability.
2. A product including its components that has been serviced by an unauthorized repair center.
3. Damage caused by improper maintenance or reassembly.
4. Damage or failure caused during shipment, or by acts of God, acts of war, or other such occurrence beyond either parties control.
5. Any damage resulting from an impact with another object.
6. Partial cuts of tether.
7. Severed tether and any resultant loss of the exploration system.
8. Any damage to components not designed for underwater use that has been breached by water, including viewing systems, controllers, battery packs, chargers, ETC.

9. Windows worn from normal use.
10. Windows that have experienced a chemical attack.
11. Window breakage due to the operation of a damaged window and the resulting damage to system. A damaged window would include deep scratches or a window that has experienced a chemical attack.
12. Hull breakage due to the operation of a damaged hull and the resulting damage to system. A damaged hull would include deep scratches, pits or dents.
13. Hull plating including blisters, cracks, peeling or scratches.
14. Any product which has been misused, used in a negligent manner, used without normal maintenance or operated contrary to any instruction furnished by Deep Trekker.
15. Loss of time, inconvenience, retail charges, travel expense, loss of use, loss of profit, loss of or damage to personal property, retrieval fees for lost systems, or other remedies not specifically allowed.

Repairs will only be authorized after Deep Trekker is satisfied that there is a defect in material or workmanship.

Your **sole and exclusive remedy** under this express warranty or any applicable implied warranty is the repair or replacement, at Deep Trekker's sole discretion, of parts and components covered by this warranty, and **does not include incidental or consequential damages**, which are specifically **DISCLAIMED AND EXCLUDED** from warranty coverage. **Note: SOME STATES OR PROVINCES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.** Any legal action alleging a breach of any applicable warranty coverage must be brought within one (1) year from the date the alleged breach first occurred.

Returning Goods

To obtain warranty service, you must **a)** return your Deep Trekker exploration system, including any alleged defective part, along with proof of purchase to an authorized Deep Trekker dealer or **b)** contact the Deep Trekker Factory direct, within the applicable warranty period to obtain warranty service.

a. The Deep Trekker dealer will carry out the warranty procedures on the owner's behalf. All warranty work will be performed at an authorized dealer. The owner is responsible for the expense associated with transporting the Deep Trekker exploration system to and from the repair facility.

b. Contact Support@Deeptrekker.com with a detailed explanation of the problem, including pictures and the product serial number. Once the problem has been determined to be warrantable, Deep Trekker will reply with an RMA (Return Material Authorization) number and an address to ship the related goods to. In this case the owner is responsible for the shipping expense to the repair facility only, while Deep Trekker will cover the return shipping to a maximum of 100 United States dollars.

This document contains the entire warranty given by Deep Trekker. Deep Trekker does not authorize any person or persons, including Deep Trekker dealers, to change the terms of this express limited warranty, which is Deep Trekker's only warranty. Deep Trekker reserves the right to change or improve the design or manufacture of Deep Trekker products without obligation to modify any products previously manufactured.

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