

REEFSCAN TRANSOM: STANDARD OPERATING PROCEDURE [SOP]

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Technology Development Engineering



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ReefScan Transom in use by the Queensland Parks and Wildlife Services (QPWS) rangers at Heron Island. Image: S Bainbridge.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence.
AIMS	Australian Institute of Marine Science [www.aims.gov.au].
App	Application – a program that runs on a phone or tablet.
GPS	Global Positioning System.
ML	Machine Learning – a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy.
MP	Megapixels – the measurement of the resolution of still and video cameras where 1MP is equivalent to 1 million pixels.
PPE	Personal Protective Equipment, safety equipment including a life jacket, hat and so on.
SOP	Standard Operating Procedure – a manual that details the preferred way of using equipment.

LINKS

AIMS:	www.aims.gov.au
Reef Cloud:	reefcloud.ai
Tablet:	https://sailproof.shop/rugged-tablet/

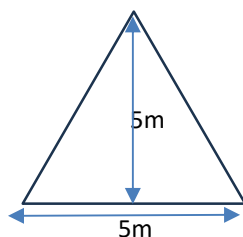
REEFSCAN SUPPORT E-MAIL

ReefScan@aims.gov.au

1 INTRODUCTION

1.1 About ReefScan Transom

ReefScan Transom (“the system”) is an image-based survey system for surveying and documenting shallow water habitats. The system records time and location-coded high-resolution still images of the bottom using a camera system mounted on the transom of a small boat. Typical operating limits are a survey speed of 2-3 knots and a depth range of 3-8m depending on the water clarity. Still 16MP images are collected at three frames per second to give continuous coverage of the sea floor. The camera angle means that the field of view is typically the same as the depth: that is in five metres of water the left to right field of view is also 5m (see example below).



The system contains an inbuilt battery, GPS and AI optimised computer that allows, with model development, for real time analysis of the collected images using Machine Learning Models. This allows the system to understand the images that are collected in real time allowing for the operator to be alerted.

ReefScan is integrated into the AIMS Reef Cloud Machine Learning platform which allows Machine Learning based analysis of the collected images in the Reef Cloud environment.

1.2 Introduction to the ReefScan Transom System

The ReefScan Transom system consists of the ReefScan Transom field survey unit, a custom bracket that secures it to the vessel, a tablet for system control and metadata capture, and software to download and analyse the captured images. The system uses industrial grade components and is designed as a sealed unit with no requirement to open it. This increases the reliability and serviceability of the unit. Ports are provided to re-charge the internal battery and to download the collected data.

The system is designed as an end-to-end solution for shallow water marine monitoring and includes real time Machine Learning capability that, with model development, allows for targets to be identified as the survey is being undertaken. These models can also be run after the survey to analyse the collected images.

The Machine Learning component is enhanced through integration with the AIMS Reef Cloud system which allows for new models to be developed, for existing models to be re-trained and for an assessment of the accuracy of the models to be gained. Finally, Reef Cloud includes a comprehensive dashboard for the presentation of the results.

1.3 Purpose of this Standard Operating Procedure (SOP)

This Standard Operating Procedure (SOP) details how to use the ReefScan Transom unit to undertake vessel-based image surveys of shallow water marine habitats, such as for coral reefs. The SOP details the steps required to undertake a survey, how to use the equipment, any potential safety points to consider, some tricks and tips and general information for the correct use and maintenance of the equipment. A two-page field quick-start sheet is also included: this can be printed double-sided and laminated to serve as a field guide.

2 ABOUT THIS DOCUMENT

2.1 Conventions used in this SOP

This document uses a series of breakout boxes to indicate particular use of the ReefScan system and how this may impact the safety of the users, what tips and tricks can be used to make the system more effective and to provide a summary of the following section.

2.1.1 Safety warnings:



This sign indicates a point that ensures safe use of the equipment

2.1.2 Important summary points:



A summary of the important points in the following discussion

2.1.3 Practical tips and Information:



Practical tips on using the system for real world surveys



NOTE: As the systems are being continuously improved some of the images may be slightly different to the unit that you receive.

2.2 Note about the Transom Bracket

The exact form of the bracket mount will depend on the boat that the unit is being attached to, as each will have differing mounting points and methods. The bracket mount design shown may not match your bracket in which case you may need to operate the transom bracket in a different way than indicated here.



The way the bracket is mounted and operated can impact the steering and stability of the vessel which may have safety impacts. The vessel should be tested in a safe location first to ensure that there are no impacts on the seaworthiness of the vessel with the bracket and ReefScan Unit attached.
In particular, check that the motor can swing through the normal steering range, that the motor can be raised and lowered as normal and that the ReefScan unit does not upset the balance or handling of the vessel. Also check that fuel lines, drainage outlets and any vessel wiring are not impacted.

3 REEFSCAN WORKFLOW

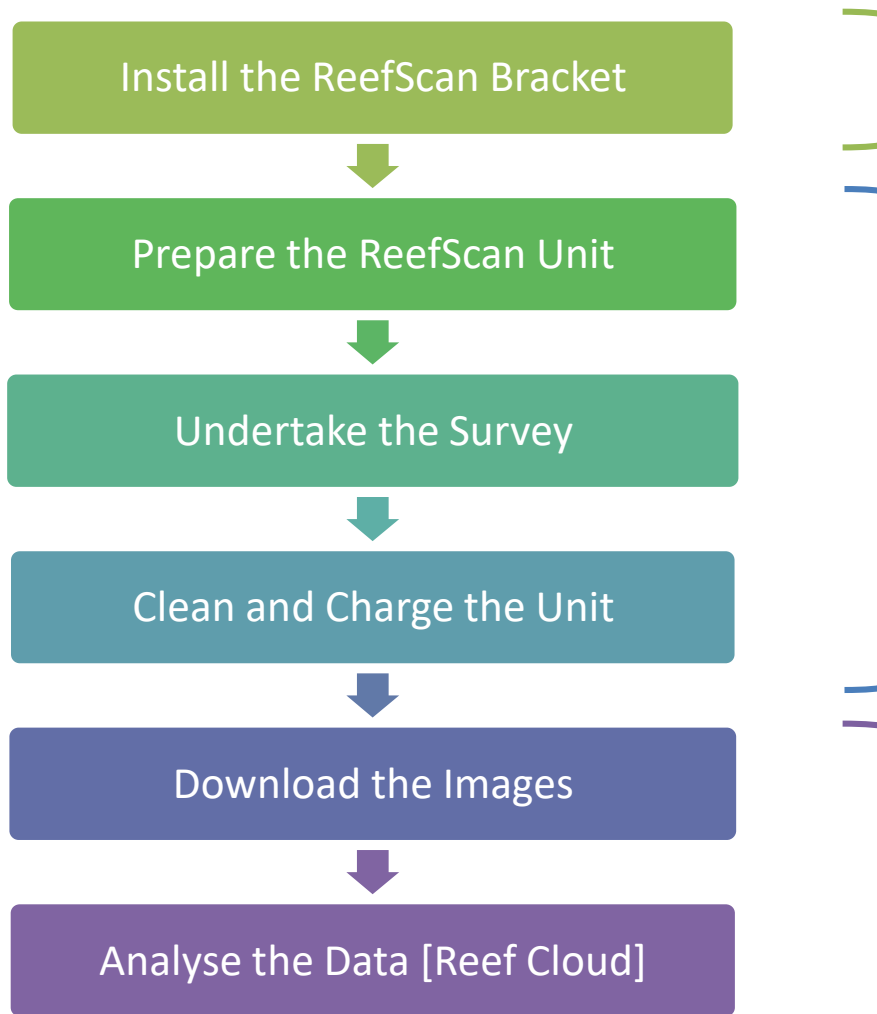
ReefScan is an end-to-end system for collecting and analysing benthic systems. The system is used via a series of workflows that ensures that high quality data is collected. The initial work is to install a bracket on the survey vessel that the ReefScan unit can in turn be attached to. This allows the ReefScan unit to be quickly attached as required and ensures that the unit is stable so that high quality images are collected.

The workflow for using the ReefScan Transom system is shown in Figure 1. There are three main parts to the workflow:

1. Installing the ReefScan Transom Bracket to the survey vessel
2. Using the Reef Transom unit to undertake a survey by first preparing it (charging and checking the unit), doing the survey, and then cleaning the unit after the survey.
3. Downloading the data off the unit and then analysing the resulting images.

This SOP includes a section on how the AIMS Reef Cloud platform can be used for automated Machine Learning analysis of the data. The SOP covers how to transfer the data to the Reef Cloud system but not the use of Reef Cloud itself.

Figure 1. Workflow for the ReefScan Transom Unit



4 BEST PRACTICE USING REEFSCAN TRANSOM

4.1 Introduction

ReefScan Transom is a camera-based system that is mounted on the transom or side of a small vessel that is then used to undertake the survey. The camera is typically located 1m below the water surface facing directly downwards. It collects high resolution still images at a rate of three to four images per second and so for survey speeds up to 2-3 knots this gives complete coverage of the bottom. A GPS on the system is used to put the location and date/time of each image into the image metadata. The collected images are JPEG formatted with EXIF 2.3 metadata.

The optimum environments to survey are shallow water systems from 3-8m depth depending on the water clarity. In clear waters the system can image down to 10-12m but in turbid waters this may be less than 5m. The optimum survey speed is between 2-3 knots and no more than 4 knots as the images will have motion blur and so will not be as useful. The best time to survey is when there is plentiful light, so typically between 9am and 4pm.

The optimum survey method for coral reefs is to drive the survey vessel along the reef edge where the water depth is 3-8m, that is the shallow reef slope, at a speed of 2-3 knots. Areas that are relatively flat or gently sloping will be surveyed better than areas such as vertical walls or canyons where the downward facing camera is unable to capture the required area.

4.2 Survey Design

Surveys are typically done as linear transects much like a Manta-tow survey. Each transect should be 500m long and multiple continuous transects can be done along the survey path. A GPS can be used to set start and end points as well as other way points to assist navigating the survey path. The ReefScan unit displays the current vessel speed, and this should be used to ensure the survey speed is maintained at 2-3 knots.

4.3 Best Practice

ReefScan Transom works best in the following manner:

- Shallow water habitats typically 3-8m deep
- Flat habitats where the downward facing camera can capture the area of interest, the system will not be optimal where there are vertical walls or canyons that you want to survey
- Survey speed of 2-3 knots
- Surveys undertaken between 9am and 4pm
- Good calm weather where possible
- Surveys completed as a set or multiples of 500m long linear transects
- GPS used to mark start and end points and way-points along the survey path
- Use of a small manoeuvrable vessel to best follow the reef edge or survey path
- Use of at least two people – a driver and an operator / observer

4.4 Safe Use

It is important that the equipment is used in a safe manner to protect the safety of the operators and to protect the equipment. It is important that a full Risk Assessment is done before the unit is used and before each new deployment. A draft Risk Assessment is included in this SOP as a starting point for developing survey specific ones.

The following potential risks have been identified:

- The mounting of the unit may interfere with the operation of the vessel such as the operation of the motor and it may result in uneven drag that may alter the sea-keeping of the vessel.
- It is possible for the camera to hit the bottom or an underwater object, in this case it may break off the bracket, flip up or result in the vessel becoming unstable. An impact may also damage the ReefScan system.
- If the vessel is operated at speed with the ReefScan unit deployed it may result in the ReefScan coming out of the bracket and then it can be damaged or may hit personnel in the vessel.
- Any work in reef fronts and reef crests can be dangerous due to waves and currents and so suitable vessels should only be used in suitable weather conditions with experienced operators.
- While the unit uses low power it is possible for the internal battery to overheat or be damaged and so care needs to be taken to ensure that the equipment is not exposed to extreme sun or other conditions.
- The bottom camera unit is fully water-proof but the top part and the tablet are only splash-resistant and so should not be immersed in water.

To deal with these the following is suggested:

- The system is operated by at least two people, the vessel driver / captain and a dedicated ReefScan Operator who can also work as an observer to monitor the system. A third person, an observer, is recommended for where the survey location is not well known or where the conditions are rough.
- The operator / observer needs to monitor the camera clearance, that is the distance between the camera and the bottom, to make sure that the camera is not going to hit the bottom.
- The driver needs to use a GPS or the ReefScan display to maintain a speed of 2-3 knots.
- The system is to be used only under good weather and environmental conditions.
- The system is not used in rough conditions or areas with large swells or currents.
- The system is checked for damage before each use and not used if any damage is found.
- That Personal Protective Equipment be used (e.g. life jackets) and standard safety equipment be carried.
- That a risk assessment is done to reflect the expected use before any field collection is started.

In this document the following break-out boxes are used to high light potential safety issues or ways that the system can be used safely.



This sign indicates a point that ensures safe use of the equipment

5 EXPLORING THE REEFSCAN UNIT

5.1 ReefScan Transom Survey Unit

The **ReefScan Survey Unit** consists of a bottom camera and sensor pod (**Bottom-Pod**) that is underwater when undertaking a survey, a top computing and control pod that is above the water and which contains the GPS, control computer, screen and control buttons (**Top-Pod**), and a pole that joints the two pods.

A custom **Bracket** connects the ReefScan Survey Unit to the vessel. Depending on the design of the bracket the bracket may allow the ReefScan unit to swivel to a horizontal position where the ReefScan is out of the water for times when the vessel is transiting from site to site, and then a way to swivel this to a vertical position with the Bottom-Pod in the water for doing the survey. The bracket may also have a ‘kick-up’ mechanism so that if the camera pod strikes the bottom the unit swivels up to reduce damage and protect the equipment. The exact form of the bracket will depend on the survey vessel being used and in many cases the bracket may be provided by the organisation doing the survey and not by AIMS. AIMS can provide design documents to allow custom brackets to be manufactured.



Depending on the design of the bracket it may not implement a kick-up function or the ability to have the ReefScan unit held out of the water to allow for faster transit speeds. **The operational of the ReefScan unit should reflect the capabilities of the bracket used.**

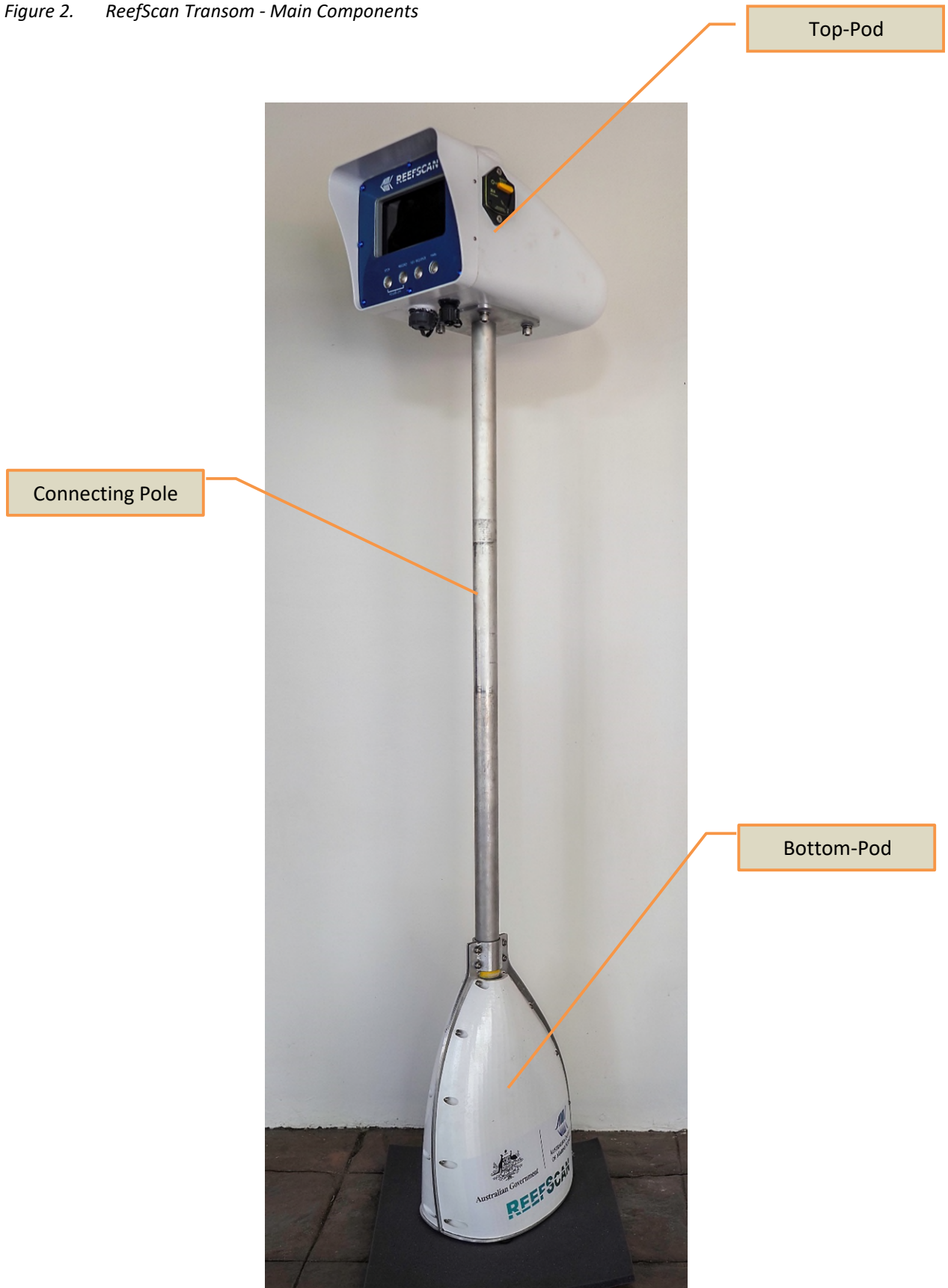
A **Tablet** connects to the ReefScan Unit using Wi-Fi and can be used to control the system and to view the collected images in real time. The tablet also helps with collecting data about the survey and in marking points of interest for later analysis. The Tablet is splash-proof (IP67 rated) and can be used in small vessels but is not fully waterproof.

5.2 What’s in the Box

You should receive the following:

- 1 x ReefScan Transom Unit and travel case
- 1 x ReefScan Transom Bracket (note this maybe provided separately)
- 1 x ReefScan Standard Operating Procedure (SOP) (bound) and 2 x Field Guides (laminated)
- 1 x Accessories Case containing:
 - 1 x ReefScan Charger with charge cables and local power adaptor
 - 2 x Data Download cables
 - 1 x ReefScan Tablet, tablet charger (USB) and tablet field case
 - 2 x external hard drives (2TB each)
 - Microfibre cleaning cloth
 - 1 x Safety strap

Figure 2. ReefScan Transom - Main Components



Top-Pod

Connecting Pole

Bottom-Pod

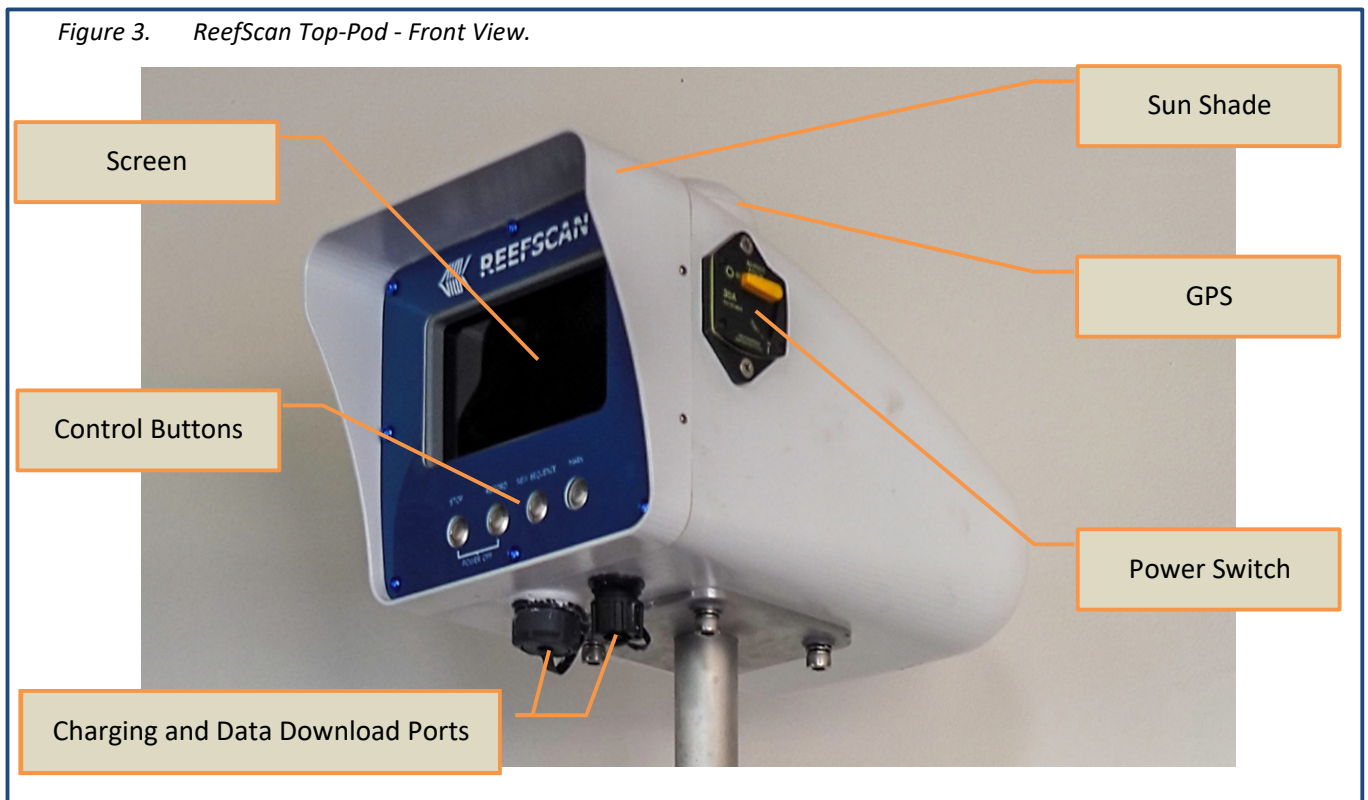
5.3 Top-Pod

The **Top-Pod** contains a screen that shows the functioning of the unit when in use along with the images being collected (which can also be seen on the tablet), a set of buttons to control the unit (the unit can be run without the tablet if needed), the GPS, and splash-proof ports to charge the unit and download the data.

Front View:

On the front of the Top-Pod is the screen and the control buttons. On the top is the GPS unit with the Power Switch located on the side. On the bottom of the unit are the charging and data download ports.

Figure 3. ReefScan Top-Pod - Front View.



Side View:

On the right-hand side is the power on / off switch, this also has a fuse / breaker in the event of an electrical or power malfunction.

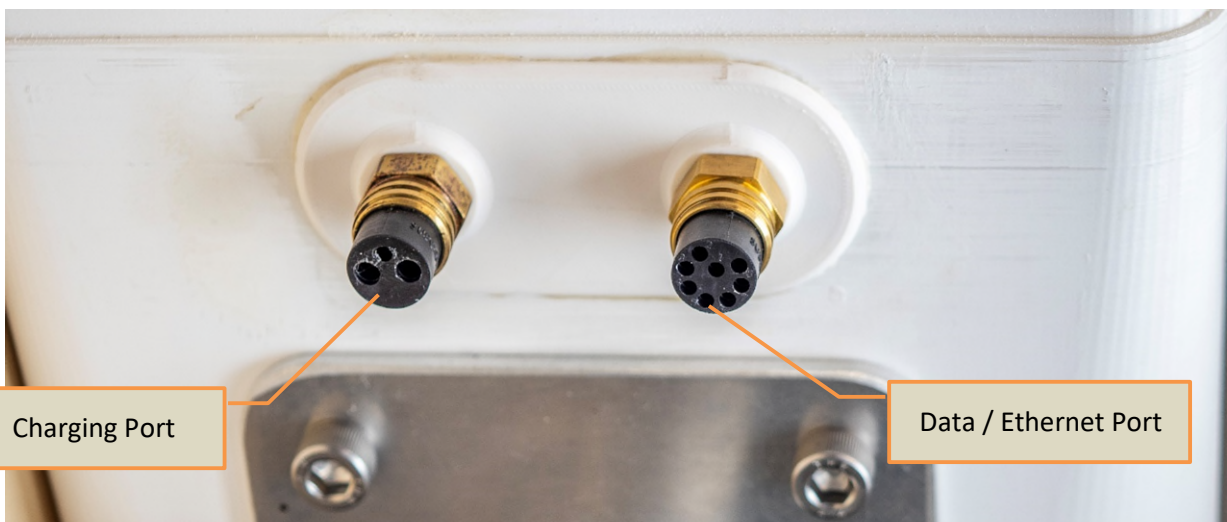
Figure 4. ReefScan Top-Pod - Right Side View, Power Switch



Bottom View:

On the bottom of the Top-Pod are the charging port (connector that has two large holes and one small locator hole) and the data / ethernet port (connector with eight larger holes around the outside and one smaller locator hole in the centre). Note that while these connectors are fully waterproof the top pod is only splash-proof.

Figure 5. ReefScan Top-Pod - Bottom View



Screen:

The screen shows important information about the current survey conditions including the GPS Status, the distance between the camera and the bottom (the **Clearance**), the current survey speed in knots as well as the current image being collected. **Note that the camera images will be displayed even if the camera is not currently recording.**



- All of the data shown on the Screen is also available on the Tablet which may be more convenient to use in rough weather or bright sunlight.
- Images will appear on the screen even if the system is **NOT RECORDING** – you need to make sure you start recording using the Record Button on the Unit or on the Tablet.



While the screen is splash-proof the **Top-Pod** should not be submerged or subjected to intense water spray or pressure.

Screen vs Tablet:

The information on the Tablet and the Unit Screen are the same in that the tablet receives the data from the ReefScan unit and displays it. The tablet is often easier to use in a small vessel and can be positioned to reduce glare and to allow the operator to be positioned away from the unit.

Importantly you can only enter Metadata using the Tablet, not using the Screen, as this has no way to enter data.

Function	Screen / ReefScan Unit	Tablet
Start Stop Recording	✓	✓
View System Status	✓	✓
View Location Speed Depth	✓	✓
Enter Metadata	✗	✓
View Images	✓	✓
View GPS Path	✗	✓
Mark Location	✓	✓
Enter Mark Description	✗	✓
Shut-Down System	✓	✗

Figure 6. ReefScan Top-Pod - Screen



Control Buttons:

The ReefScan Unit has the following Control Buttons:

- Stop: If the unit is currently recording this **Stops** the recording
- Record: **Starts** Recording images
- New Sequence: Creates a **New Folder** or **Survey** and if recording puts the new images into this, if not recording it creates the folder and starts Recording.
- Mark: Puts a Location **Mark** into the data for later analysis, if using the Tablet then you can also add a description of the point of interest, if using the Screen Buttons then you cannot add a label to the Marked point.
- Stop + Record: Hold both buttons down for **Six Seconds** to shut-down the system, once shut-down use the side Power Switch to turn the unit off.

Figure 7. ReefScan Top-Pod - Control Buttons



As the Top-Pod contains a computer ensure you SHUT-DOWN the system using the **Control Buttons** (press the STOP + RECORD Buttons for **SIX** seconds and then release) first before powering off using the **Power Switch**, this prevents data loss or corruption.



Remember to power off the unit once shut down to avoid flattening the battery.

Power Switch:

On the right-hand side of the Top-Pod is the main Power Switch that is used to turn the unit on and off. The switch also operates as a breaker in that if the system has an electrical problem the switch will turn itself off removing power from the unit.

The horizontal position is **Off** while the vertical is **On**. To turn the switch **On** move it **LEFT** (counter-clockwise) from horizontal to vertical, to turn **Off** do the reverse (see below).



If the switch trips or goes to the **Off** position while operating this indicates a major electrical fault. Immediately stop using the ReefScan Unit and return to base as soon as possible. Remove the unit from the vessel and store in an area away from combustible materials.



It is possible to bump the Power Switch by accident so be careful when handling the unit.

Figure 8. ReefScan Top-Pod - Power Switch shown on the **OFF Position**

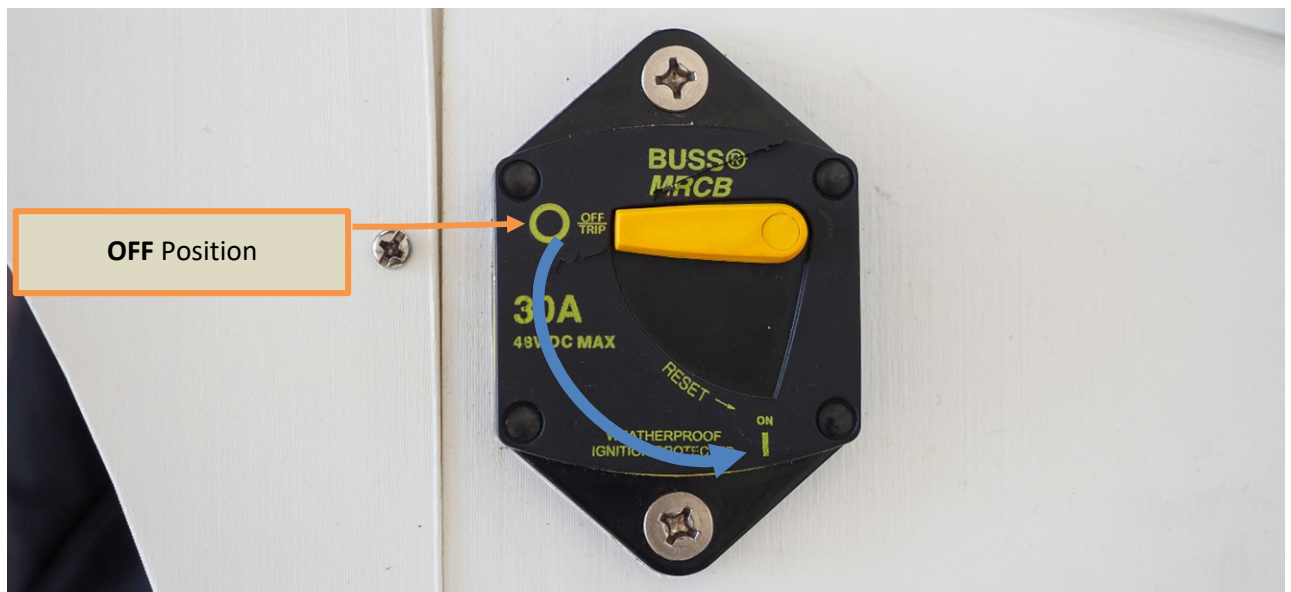
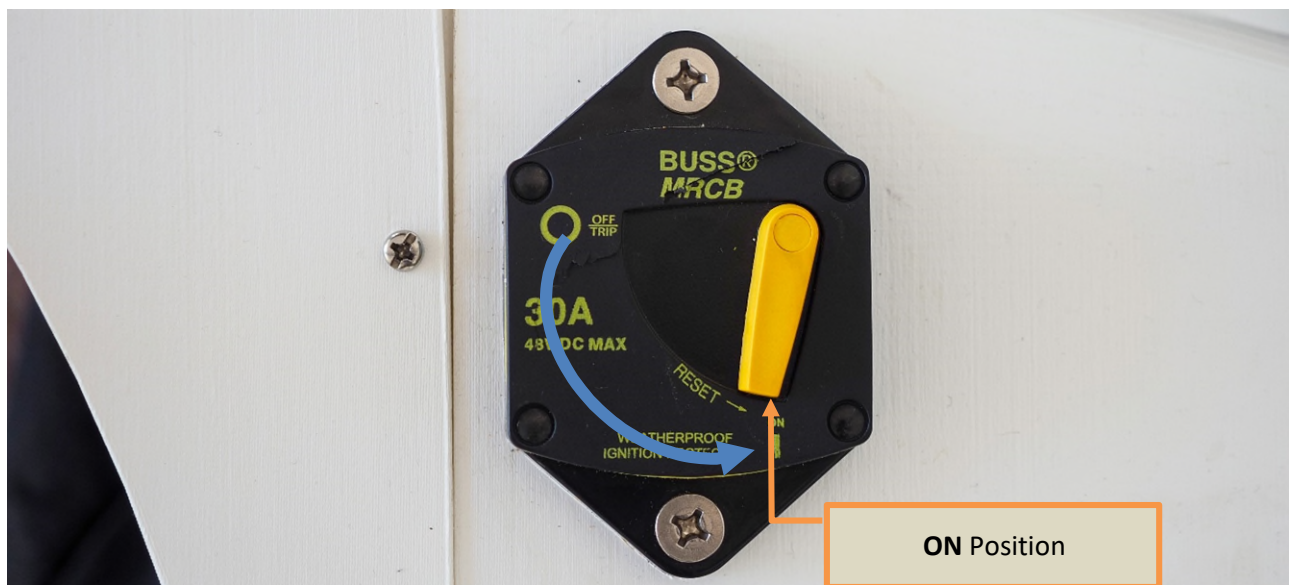


Figure 9. ReefScan Top-Pod - Power Switch shown on the **ON Position**



Charging Port:

On the bottom is the port where the charger connects. The connector on the ReefScan has two power holes and one for the locating pin while the connector on the charger has two large power pins and one smaller locating pin.

To plug the connector in make sure the silver locating pin is aligned with the locator hole and the two power pins are aligned with the power holes. There is only one way this can align so double check. When the pins are aligned firmly press the plug into the socket, it will be a tight fit.



Double check that the plug is aligned the correct way before inserting!



Always charge the unit in a dry location and make sure the ReefScan Unit has been dried so that no water can get onto the charging port or the charger.

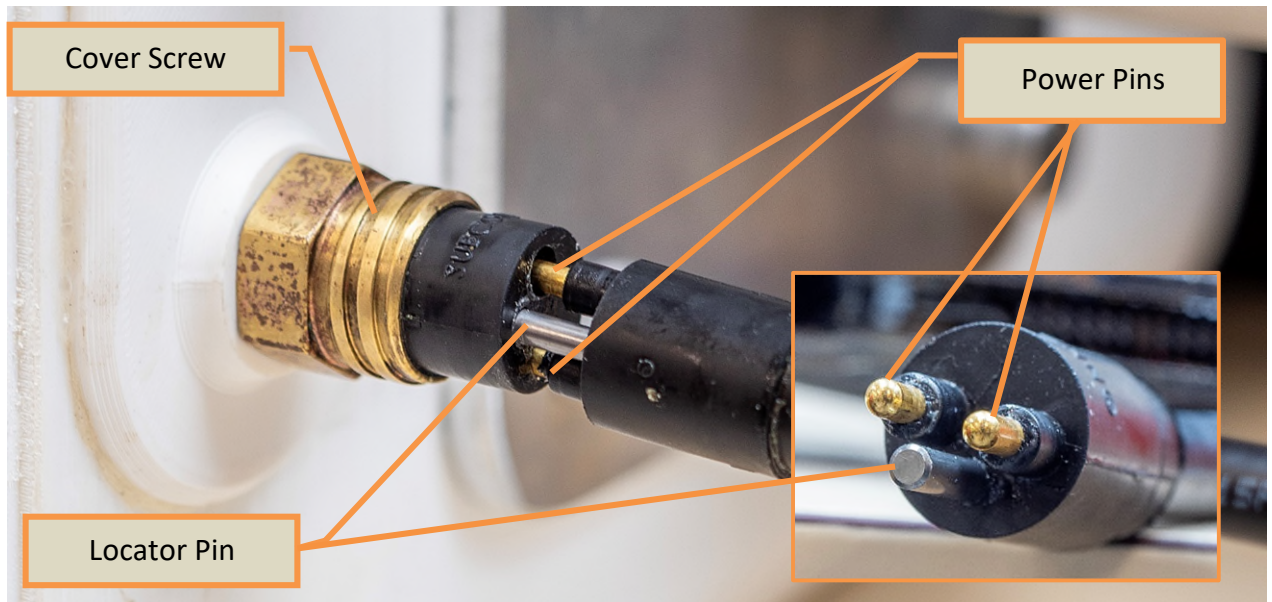


Always use the charger that comes with the Unit as this is specifically for the ReefScan. DO NOT USE ANOTHER CHARGER.

Figure 10. ReefScan Top-Pod - Charging Port

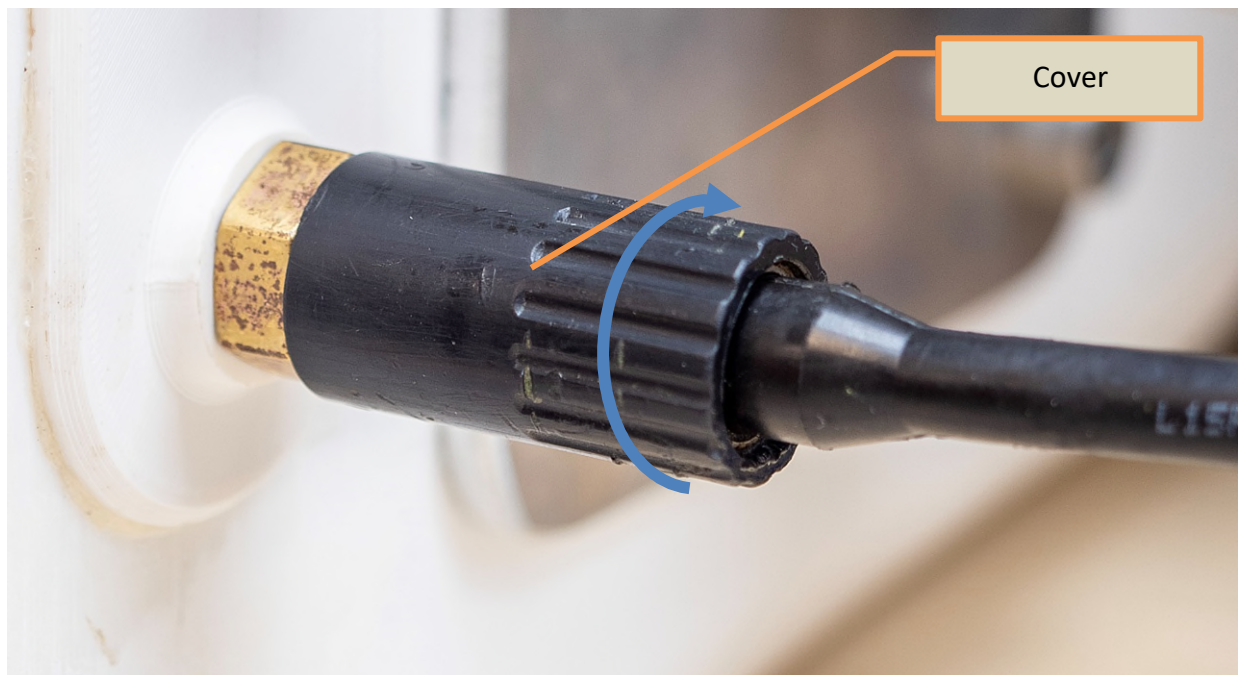


Figure 11. Charger plug aligned and ready to be inserted; inset end of the plug showing the pins.



Once the plug has been pushed firmly in, use the screw cover to secure. Removing is just the opposite, unscrew the cover and pull this back and then firmly pull the connector out of the port.

Figure 12. Cover screwed to secure the cable to the charger port, arrow shows direction to secure the cover.



Data-Download Port:

Next to the Charging Port is the Data-Download Port that is used to download data from the device onto a computer. The port looks similar to the charging port but has more connectors and so has more holes for the pins. This connector does not have a locating pin but rather the pins are arranged in a pattern that allows them only to be connected one way.

The download cable has a standard ethernet (network) plug at one end that goes into a laptop and a round plug at the other. This connects to the data download port on the ReefScan unit. You need to align the eight data pins which are arranged as seven pins in a circle with the eighth pin in the centre. This means the plug can only be connected one way. Once you have the pins aligned gently press the connector in and then firmly seat it. Once the plug is inserted you can screw on the cover to secure the connection.



As the port has a lot of pins it can take a bit to get them all aligned, make sure that they line up before inserting the plug. It can also be hard to insert so you may need to push firmly.

Figure 13. ReefScan Top-Pod - Data / Ethernet Download Port showing locator and data pin holes.

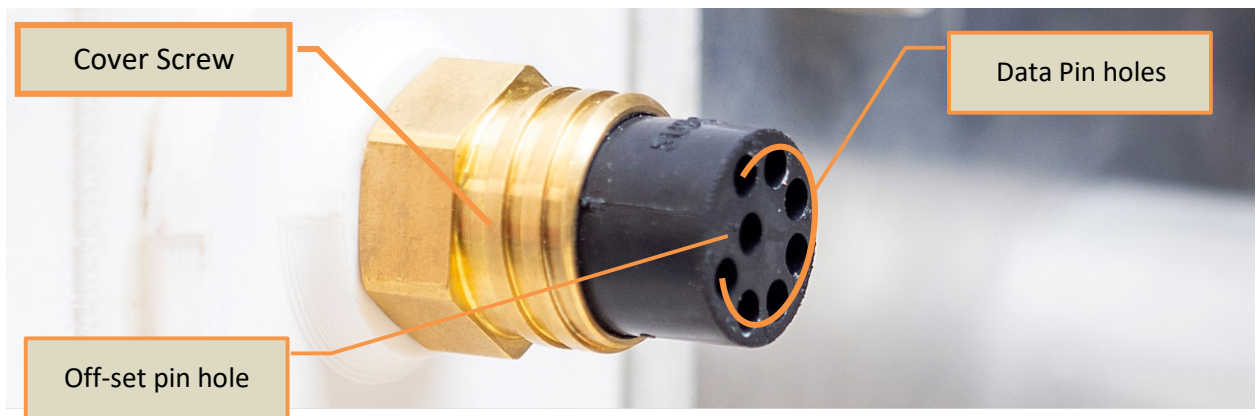
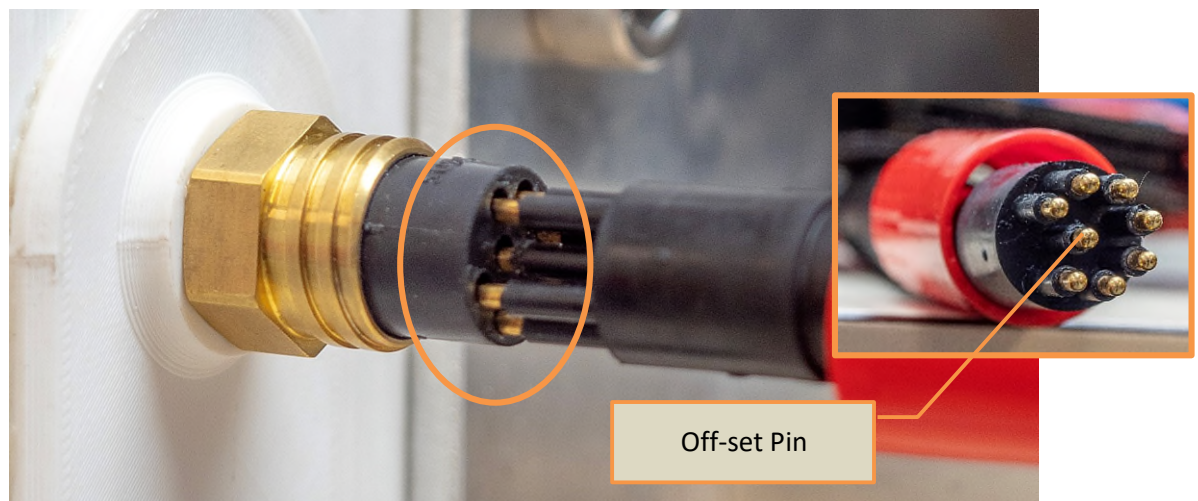


Figure 14. Data Cable plug aligned and ready to be inserted.



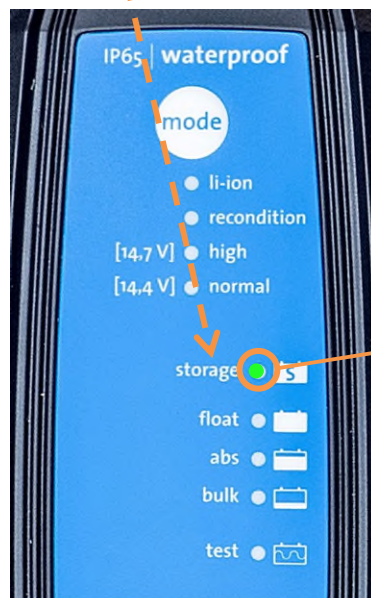
ReefScan Charger:

To re-charge the ReefScan unit only the provided charger should be used.

The charger consists of the charger itself, the cable to attach this to a standard 110-240v wall power outlet, a charge meter that indicates the voltage of the battery in the ReefScan unit, and the cable that goes from the charger to the ReefScan unit.

i The unit is fully charged when the charge meter reads 14.2v and when the storage light green.

Figure 15. ReefScan Charger Unit.



Fully Charged Indicator (Green)

5.4 Bottom-Pod

The Bottom-Pod contains the camera and the underwater sensors (pressure and sonar altitude sensors). Unlike the Top-Pod, this unit is designed to be fully emersed and so is fully waterproof. The camera dome is made of GLASS and so should be protected at all times. The shrouds are user replaceable should they get damaged in use.

The pressure sensor measures the depth of the camera, that is the distance between the water surface and the camera. The sonar altitude sensor measures the distance between the camera and the bottom, this is also called the Clearance as it is a measure of how close the camera is to the bottom. The total water depth is just the depth from the pressure sensor added to the altitude measured by the sonar sensor. Note that these sensors do not give valid readings in air, only in water.

Figure 16. ReefScan Bottom Pod



Cover

Camera and Sensors

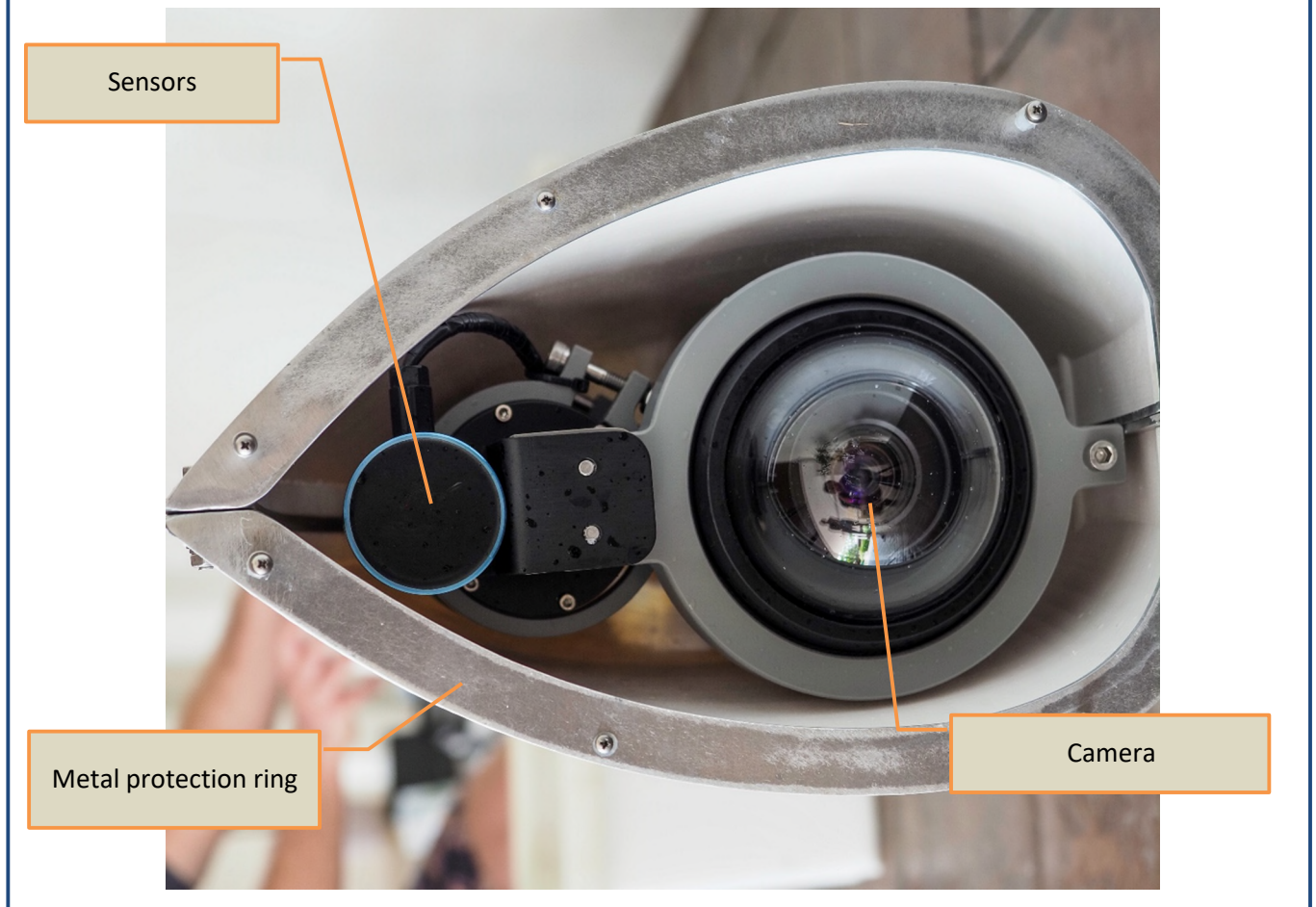
Camera and Sensors

Inside the shroud are the camera and the depth and altitude sensors. These are covered by the **Travel Cover** when not in use to protect them.



Leave the **Travel Cover** in place until just ready to deploy the unit to protect the camera.

Figure 17. Camera and Sensors



When washing with fresh water make sure the water drains from around the camera and that the camera and sensors are dry. Use a clean soft cloth to dry the area.

Travel Cover

The Travel Cover is a simple piece of plastic that attached via elastic straps to the lower part of the Bottom-Pod. It protects the cameras and sensors and so should be left on until the unit is to be deployed. When cleaning the unit remove it so that you can flush around the camera and when dry replace it.

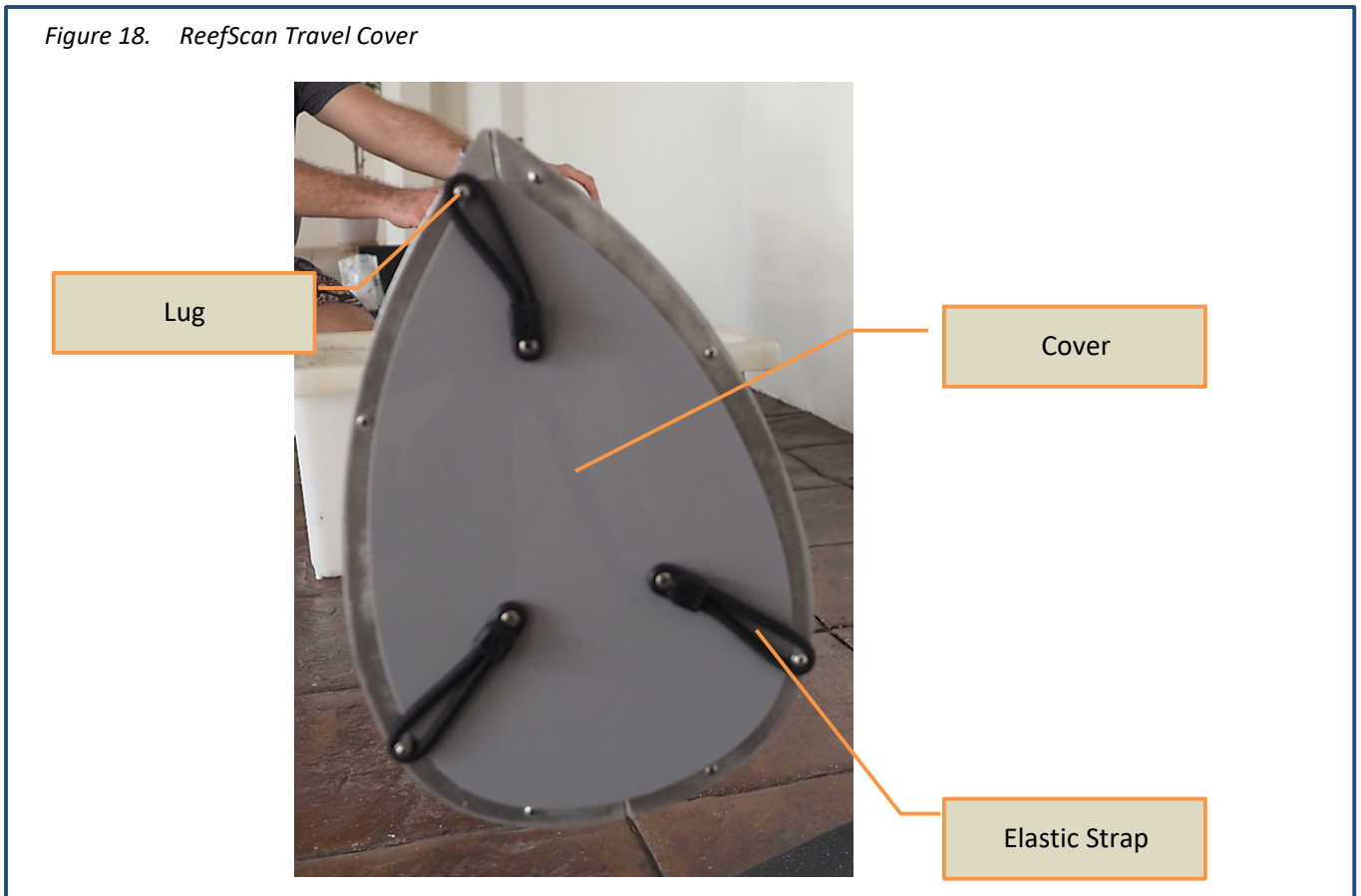


Before doing a survey make sure it has been removed and securely stowed – check that you can see the bottom with the camera before starting the survey.



The ReefScan Unit will 'stand' on the **Travel Cover** but is not stable and so with the **Travel Cover** installed it is possible to rest it vertically for short periods but only while being held.

Figure 18. ReefScan Travel Cover



5.5 Tablet

The supplied Tablet is a standard Android Tablet pre-configured to connect to and work with the ReefScan Unit. There is a ReefScan App on the unit that is used to control the system, to check the images being collected, to enter metadata and to help the vessel driver collect good data. The App uses the ReefScan Wi-Fi connection to communicate with the ReefScan Unit. See later for instruction on how to set up the tablet.



- The provided tablet is pre-set for the ReefScan unit and so you do not need to install or configure the supplied Tablet.
- Most of the functions of the ReefScan unit can be done using the buttons on the ReefScan Unit **OR** via the App. In bright sun or in rainy conditions it may be easier to use the Tablet to view images and control the system.

The Tablet is splash-proof (IP67) and so can be used in the field under most conditions but should be protected from being underwater or from intense spray. A fully waterproof field case is provided, and this should be used to store the tablet when not in use. The tablet should be wiped cleaned with a cloth moistened with fresh water after use.

The Tablet can be charged using the USB cable (using a suitable power adaptor) or with the provided charger connected into the charge port.

A separate manufacturers manual is provided for the Tablet.

The use of the Tablet is covered in subsequent parts of this SOP.



- While the tablet is splash-proof, water on the screen can interfere with the controls, in this case carry a cloth to dry the screen.
- You may also need to press firmly in the screen to activate buttons, as the screen is splash-proof it is less responsive than most tablets.
- If the screen reverts back to the home screen just press the ReefScan icon to go back to the ReefScan Application, this can happen when the screen is wet.

Figure 19. Tablet



Source: <https://sailproof.shop/rugged-tablet/>

5.6 Bracket

The bracket supplied will be for the vessel to be used and so may vary from the images and description here. The basic functionality should be the same and so this section will be generic to cover the range of actually provided components.



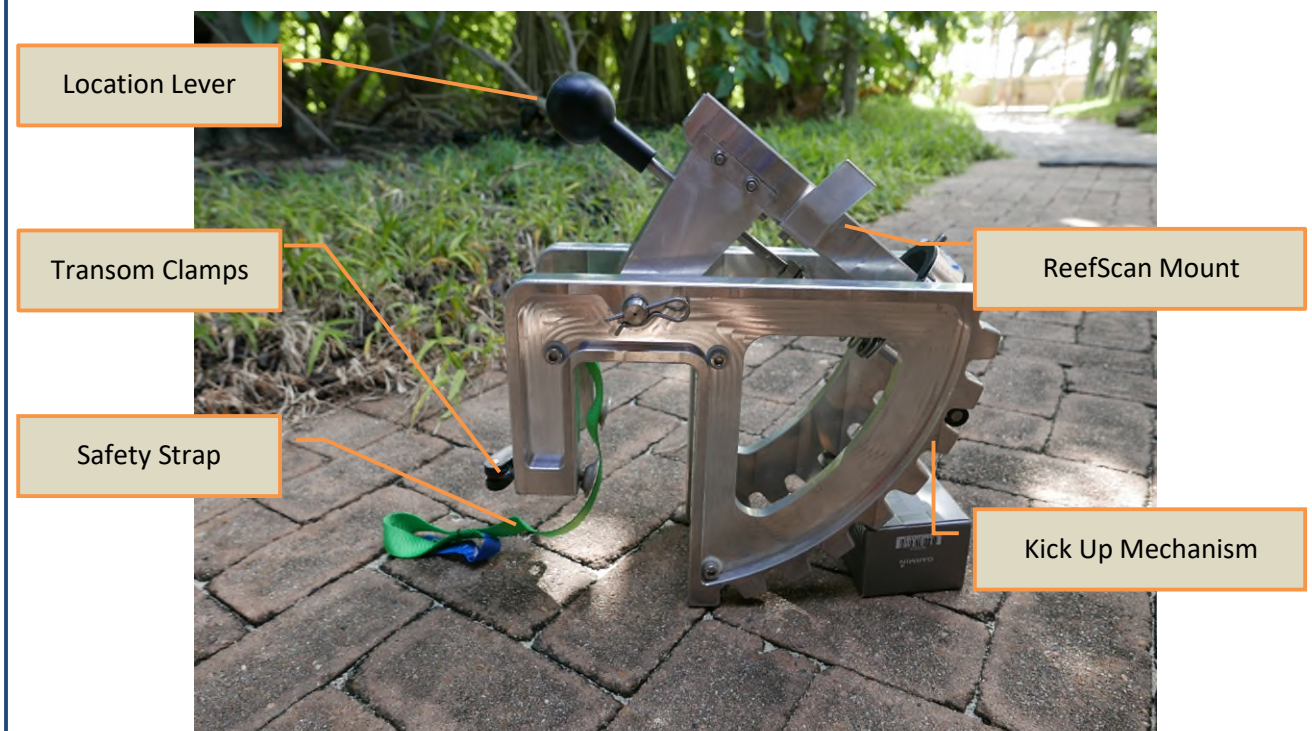
Depending on the design of the bracket it may not implement a kick-up function or the ability to have the ReefScan unit held out of the water to allow for faster transit speeds. **The operational of the ReefScan unit should reflect the capabilities of the bracket used.**

The main components of the Bracket include the clamps that actually attached it to the vessel, the mount on which the ReefScan Survey Unit is attached and the mechanism for swivelling the survey unit from a horizontal **Transit Location** to a vertical **Survey Location**.



To change the angle of the ReefScan Unit in the bracket push **DOWN** on the black knob (not up).

Figure 20. ReefScan Bracket - Generic



Transom Clamps

The bracket clamps to the transom of the vessel using clamps similar to an outboard motor, that is dual screw in clamps that tighten against the top of the transom near the edge. Care should be taken to ensure that the clamps do not interfere with the motor articulation, any fuel lines, lifting points or other equipment such as sounders.

ReefScan Mount

This part of the bracket accepts the ReefScan Unit with the pole lying against a cradle and being locked in place by an upper collar on the ReefScan Survey Unit and a lower clasp on the bracket.

Figure 21. ReefScan Bracket – Mount for the Survey Unit showing the lower clasp.



Location Lever

The black Location Lever can be **PUSHED DOWN** to change the angle of the ReefScan Unit relative to the bracket.

There are two main positions:

- Horizontal: In this position the ReefScan Survey Unit is out of the water and horizontal, this is the **Transport Location** and is used to allow the vessel to move quickly from place to place without the ReefScan unit causing drag or interference
- Vertical: In this position, the **Survey Location**, the ReefScan Unit Bottom-Pod is in the water and approximately 20cm below the propellor and is as vertical as is possible. As the bracket will fit differently on each vessel the exact position of the bracket will be different but in the intent is to get the ReefScan pole as vertical as possible.

Figure 22. ReefScan Bracket showing the bracket in the **Transport Position**

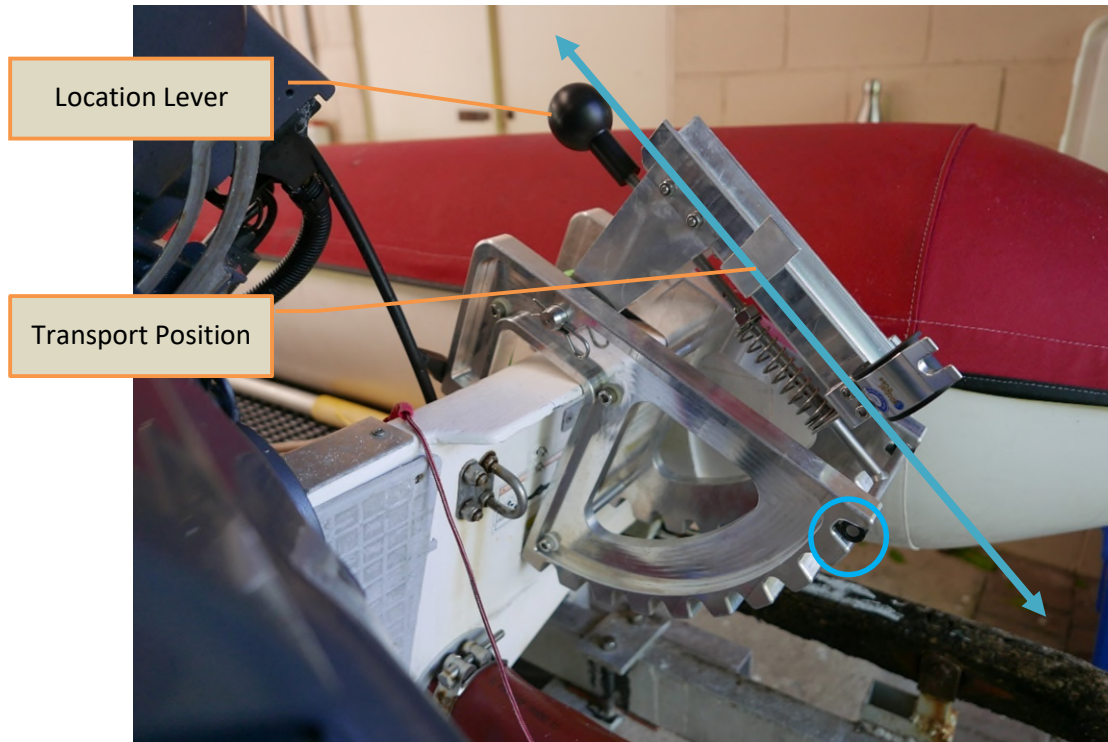
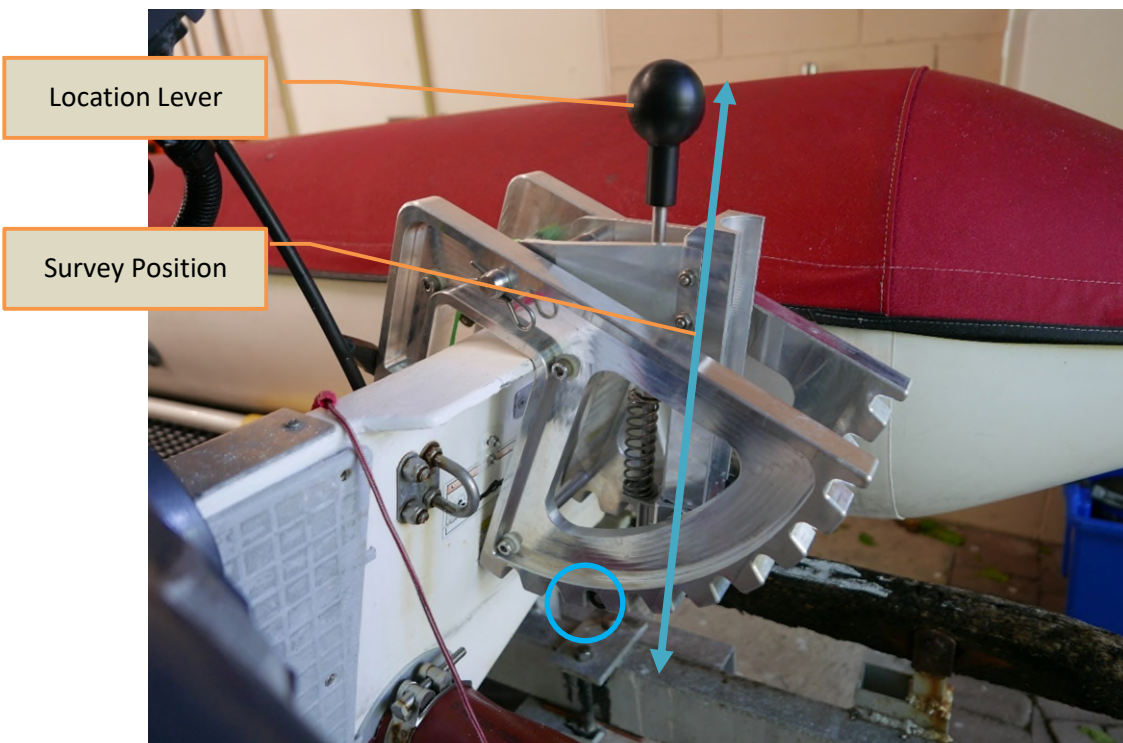


Figure 23. ReefScan Bracket showing the bracket in the **Survey Position**



6 FIELD DATA COLLECTION

6.1 Installing and using the ReefScan Bracket



The way the bracket is mounted and operated can impact the steering and stability of the vessel which may have safety impacts. The vessel should be tested in a safe location first to ensure that there are no impacts on the seaworthiness of the vessel with the bracket and ReefScan Unit attached.



The Bracket described in this SOP maybe different to that provided as each vessel is different. Please use this SOP as a guide only to the Bracket operation.

Installing the Bracket:



- The ReefScan system uses a customised bracket to attach the unit to the vessel. The bracket must be installed first before the survey as this may need some work to get a good fit.
- It is important that the bracket does not interfere with the operation of the motor both when the ReefScan unit is in the travel position and when it is in the survey position.
- The bracket is designed that if the unit hits an obstacle, then it will pivot up to reduce the impact, this will be controlled by the spring and is designed for an impact over about 7 knots.
- The best approach is to leave the bracket on the vessel once fitted so that subsequent use is simple and quick.



If the quick release mechanism does not release on impact at speeds greater than 3 knots, remove the bracket and check the quick release mechanism and T-Pin for signs of damage. If damaged, do not use the bracket and replace the part.

To install the bracket, do the following:

1. With the vessel moored or on dry land check that the transom of the vessel has enough space for the bracket and that any cables, fuel lines and ropes are out of the way.
2. Test fit the bracket and tighten the two clamps, check that the bracket does not interfere with any fuel lines, ropes, self-draining scuppers and so on.
3. Check that the operation of the motor does not interfere with the bracket, especially check the full rotation of the motor including the rotation of the propellor.
4. Check that the motor can be raised and lowered correctly with the bracket installed, check this through the full set of movement required.
5. Install the ReefScan pole unit and check that the unit fits and can be moved from the horizontal travel position through to the vertical survey position.
6. Check that the propellor and motor will not interfere with the unit as the motor is moved through its full range of movement from side to side and raised and lowered. Do this carefully so as to not damage either the motor or ReefScan Unit.
7. Adjust the bracket location and the depth of the ReefScan Unit if needed to make it work.
8. Once a suitable location has been found tighten the clamp screws and check that the unit is secure.
9. Attach the safety strap to a fixed point on the transect or motor.



- If the bracket and ReefScan Unit interfere with the movement of the motor this may impact the sea worthiness of the vessel and so the impact of this needs to be understood and compensated for.
- Make sure that if you are moving the motor or steering rack while the ReefScan Unit is installed do this slowly so that the two do not hit each other as this may break the ReefScan Unit.
- Make sure the bracket is secure and that it cannot come loose.
- Make sure the bracket does not interfere with the operation of the vessel including the ability to come along side other craft.
- Always attach the safety line from the Bracket to the vessel.
- The bracket may be designed to flip up in the event of an impact or collision, this maybe rapid and so make sure that when in operation people stay clear.
- Where the bracket is mounted on the side of the vessel this may interfere with the ability of the vessel to come along-side other vessels and so before coming along-side a vessel, jetty or dock, ensure that the ReefScan unit and / or bracket is not in the way. If so remove.

Moving the Bracket to the Travel Position / Survey Position



- The bracket allows for a range of locations of the ReefScan Unit relative to the vessel. The location is changed by pressing **DOWN** on the black knob while swinging the unit up or down.
- To travel with the unit out of the water move the bracket so that the unit is as horizontal as possible, this is called the **Travel Position**.
- To do a survey first stop and then lower the unit until the unit is vertical, this is the **Survey Position**.



The quick release mechanism can move during operation and may pinch hands or fingers. Take care to keep hands free of the bracket and side of the clamps when moving the bracket to travel or survey position, and during the survey.

To change the angle of the bracket, do the following:

1. Supporting the bracket press **DOWN** on the black knob against the spring and swing the bracket up and down.
2. When you have the desired angle release the black knob and check that the locking arms lock into the teeth of the brackets and that these are sitting square.
3. Shake the Bracket to test that the Bracket is secure and locked in the required position.

6.2 Before the Survey - Preparing the ReefScan Transom



- The unit has an in-built battery that needs to be charged before each use, estimated battery run time is around two (2) hours with a charge time of about three hours.
- Always check the unit visually to ensure there is no damage or other issues before using.
- Make sure the **Travel Cover** is installed before moving.

Charging the ReefScan Unit:

1. Lay the ReefScan unit down on a dry secure flat surface near a power point.
2. Make sure the ReefScan unit is dry and that the charge port is dry.
3. Align the charger cable with the charging port noting that the locating pin needs to be aligned with the smaller hole in the socket and firmly push the plug into the socket.
4. Screw the plug cover onto the ReefScan unit socket and make sure it is secure (no need to over-tighten)
5. Connect the electrical plug on the charger to a domestic power socket.
6. Switch on the charger, leave charging until the charger shows a **green** light and the charge meter shows 14.2v or greater [see Figure 15], this should take about **three hours**.
7. When fully charged, remove the charging cable by unscrewing the cover and gently pulling the plug out.
8. Unplug the charger from the wall outlet and stow away.



- DO NOT re-charge near water, when the unit is wet or in damp conditions.
- Make sure the ReefScan unit is DRY before re-charging.
- Make sure that no water can contact the charger or the ReefScan Unit while charging.
- Charge only in dry secure locations using mains power.
- **Only use the provided charger.**



While the charger is IP65 rated (splash-proof) **DO NOT immerse the charger** or expose it to water



Don't touch the Mode Button on the Charger as it is pre-set for the type of battery being used.

Charging the Tablet:

1. The Tablet is a standard Android tablet and charges from any USB power source.



A full manual for the Tablet is included, please refer to this for how to use and re-charge the tablet.

Checking Operation:

Before using check the following:

1. Remove the **Travel Cover** and inspect the camera, make sure the lens / dome is not damaged and that there is no residual water or other material around the camera, if so clean, dry and inspect.
2. Replace the **Travel Cover**



The camera dome is made of GLASS and so while scratch resistant can be damaged by impact or rough handling. If the dome is damaged **DO NOT USE THE UNIT**. We can provide a spare dome.



Small scratches on the dome do not impact the image quality but do mean that a replacement dome should be organised.

6.3 Before the Survey – Uploading any way-points to the handheld GPS

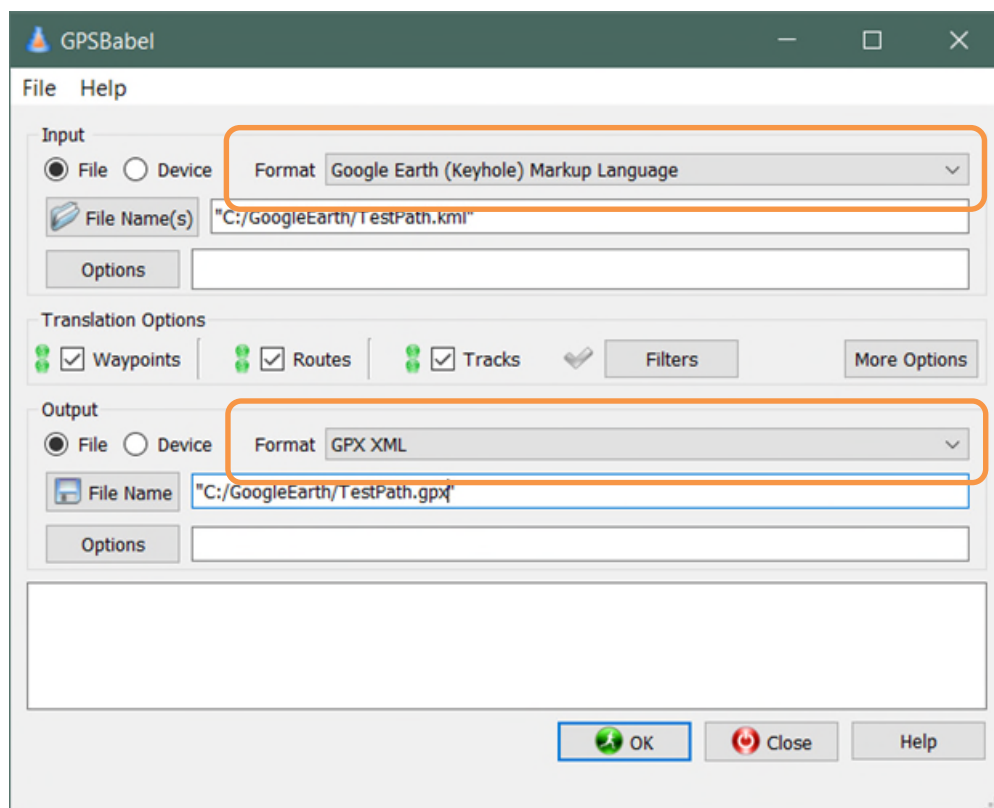
Before doing the survey, you should plan the set of surveys you want to do. One useful tool is to use Google Earth to set way-points for the start and end points of the survey as well as points along the survey to ensure the vessel driver knows the survey path.

The points on Google Earth can then be entered into a GPS either manually or by exporting the Google Earth points as a KML file, converting this to a GPX file and then importing this into the GPS.

The steps to do this for a Garmin GPS are:

1. Put all the points you want to export into a common folder in Google Earth
2. Right click the folder and select ‘Save Place’ and save to a KML file (NOT as a KMZ file)
3. Use a program to convert this to a GPX file, one example is GPS Babel: <https://www.gpsbabel.org/> another is a free web site such as : <https://mygeodata.cloud/converter/kml-to-gpx> [Note this has not been tested]
4. Plug the GPS into your computer and open the GPS storage in Windows Explorer and then copy the GPX file into the GPX directory of the GPS (for Garmin GPS units)

Figure 24. Example of using GPSBabel to convert KML files to GPX files



Note that the instructions for your GPS maybe different to this, see the manual that came with the GPS for the best way of copying way-points and routes onto the GPS.

6.4 Undertaking a Survey



For the Survey you will need:

- The ReefScan Unit including the **Camera Travel Cover**, this should be fully charged.
- The ReefScan Bracket – **this should be already installed on the vessel.**
- The ReefScan Tablet – this should also be fully charged.
- A GPS to locate and follow the survey path if needed.
- A dry cloth to dry the tablet and ReefScan screen if they get wet
- A wet towel to cover the ReefScan unit if it is stored in direct sunlight to keep it cool
- A notebook or slate to record any survey data or to make notes
- Your PPE and safety equipment (including life jackets) and normal vessel equipment.
- The laminated **Field Quick Start Guide.**



Normal operation requires **TWO people**, a Driver who should focus on driving the vessel, and an Operator who is responsible for ensuring the ReefScan unit is functioning properly and who advises the driver the current speed and depth so that the driver can adjust course and speed as needed.



At the end of this SOP is a two-page Field Quick Start Guide – if you print this double-sided and laminate it you will have a good field guide to use in the survey vessel.



The ReefScan unit can be installed in the bracket before leaving for the survey or installed at the start of the survey. How you do this depends on the most secure way to transport the unit.

Locate the ReefScan unit into the Bracket:

1. Lay the ReefScan unit down in the vessel, if sunny cover the top unit with a wet towel to keep cool.
2. Check the bracket that is already attached to the vessel is secure and that you can access it.
3. Make sure you bring the tablet, put it in its case and stow securely.
4. Transit to the survey site, if rough **position the vessel so that it is safe** so that the ReefScan unit can be attached safely. **Make sure the motor is in neutral or turned off before working near the Transom.**
5. Make sure the bracket is in the fully up or **horizontal** position (see Figure 22).
6. Open the clamp (see Figure 21).
7. Remove the **Camera Travel Cover** from the ReefScan unit and stow this securely.
8. Using two people, pick up the ReefScan unit and located it on the bracket.
9. With one person supporting the unit, close the clamp and tighten. **Attach the safety strap.**
10. Using the Black bracket button, press **DOWN** and move the ReefScan to the survey or **vertical** position.



The vessel should be moved to a safe location and stopped with the motor in neutral or turned off before any work to install or remove the ReefScan Unit is started.

Start the ReefScan Unit:

1. Turn the main power switch on, the unit will take **two minutes to fully start**, when it does the display will look like the image below:



The unit can take up to two minutes to start so make sure you start the system a bit before needing to start the survey, so you have time to check that the unit is functioning correctly.

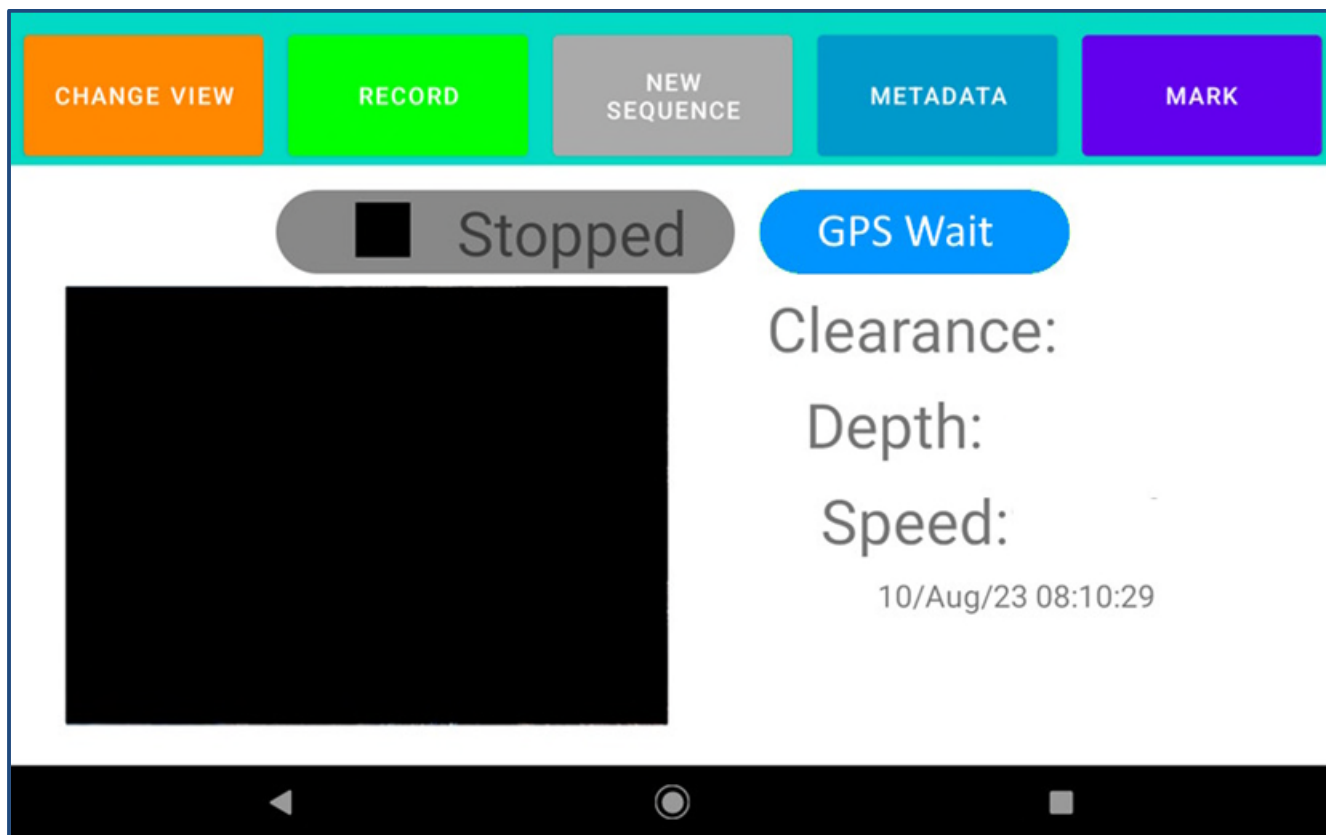


Note that the unit MAY NOT have a GPS lock (the image above shows that the system is still waiting for a GPS position).



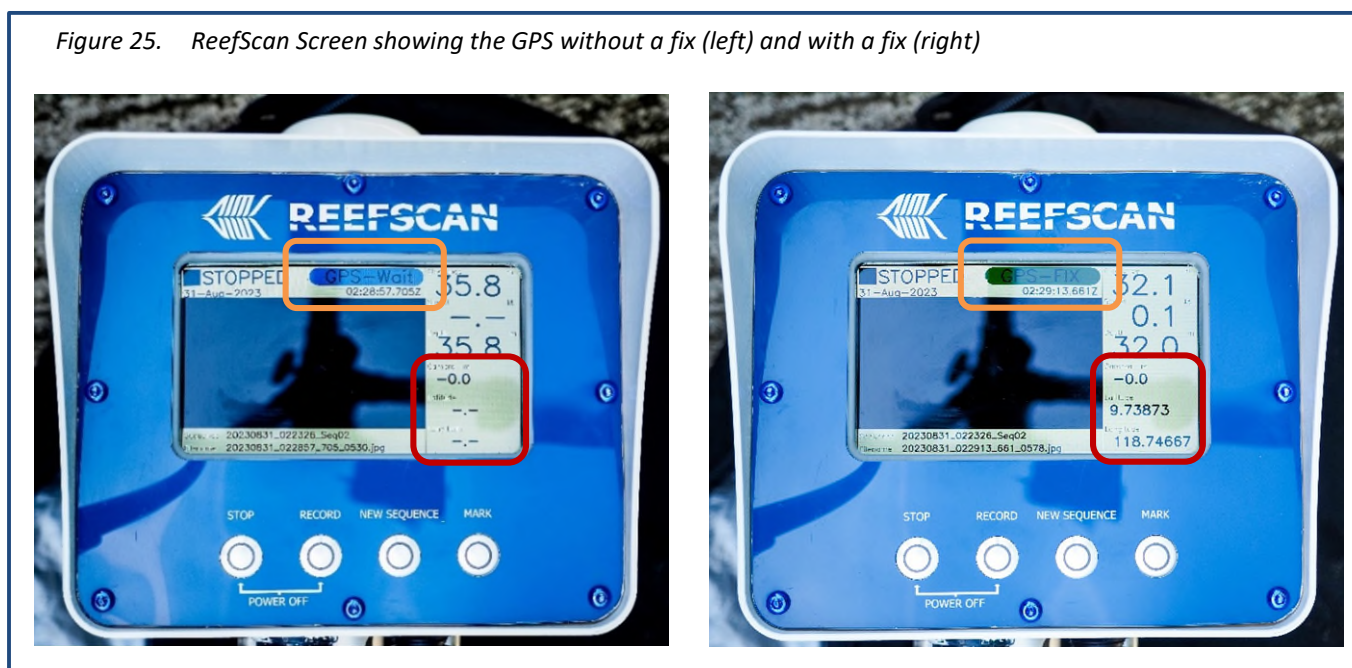
Note that the display values for the camera depth and location / speed will not be valid until the unit is deployed as the depth sensors only work in water and the speed value requires a GPS fix.

- Turn on the Tablet and start the ReefScan App (AIMS icon on the Tablet main screen), make sure it can connect to the ReefScan unit. It should look like the screen shot below.



- Wait until the GPS status display goes from blue to green to show that it has a GPS lock. You can check this on the ReefScan Unit or the Tablet. From the Figure below, the GPS-Wait indicator (orange boxes) has changed to GPS-Fix and the latitude and longitude are now shown (red boxes).

Figure 25. ReefScan Screen showing the GPS without a fix (left) and with a fix (right)





The GPS lock can take a few minutes if you are in a new location, allow time for this to happen before starting the survey.

4. Check that you can see an image from the camera, you may have to remove the **Camera Travel Cover** first to give the camera an object to focus on (it should already be removed).



If the system doesn't start as expected see the Trouble-Shooting and Field Check-List sections later in this SOP

Start the Survey:

1. Make sure the ReefScan unit is in the survey position:
 - a. The Camera Travel Cover has been removed and stowed.
 - b. Make sure the safety strap between the bracket and the vessel is secured.
 - c. The safety strap between the ReefScan Unit and the vessel or bracket is attached and secured.
 - d. Bottom-Pod is underwater with the camera at a depth of 60-80cm.
 - e. The pole is vertical or as vertical as possible.
 - f. You can see images on the ReefScan screen or on the Tablet.
 - g. The images look well-lit and in-focus.
 - h. The ReefScan unit is not interfering with the operation of the motor.



You should see images of the bottom on the ReefScan screen and on the Tablet, if not check that the Travel Cover has been removed and that the system has started normally.



If the images are of poor quality due to water clarity, then you may want to consider doing the survey at another time. The state of the tide and currents can change the water clarity.

2. Move the vessel to the survey start point (for example to a way-point in a GPS).
3. Review the images from the camera with either the ReefScan screen or the tablet (tap on the change view button on the App to go to the screen with the images), you should have clear images of the bottom, if not check that the **Camera Travel Cover** has been removed!
4. If the images are not clear then check your depth and the turbidity, if the images are unacceptable then consider if the survey is worth starting.
5. When ready to start press the **Record Button** on the ReefScan unit or on the tablet.
6. Start the survey keeping a speed of 2-3 knots and a depth of 3-8 metres noting the values on the screen and tablet.



The NOTE: The maximum speed with the ReefScan unit in the survey position is 4 knots and the shallowest depth you should be in is 2m.



- The screen on the ReefScan and the Tablet both display your current speed in knots, the total water depth, the distance between the camera and the bottom (clearance) as well as the GPS location and time. **Use these to stay at 2-3 knots of speed and a clearance of 3-8m.**
- You can use the buttons on either the Tablet or on the ReefScan Unit to start and stop recording.
- If you want to Mark a location you can do this either with the **Mark Button** on the ReefScan unit or via the Tablet, if you do it via the Tablet then you can enter a description for the point.



The screen and tablet both display the **clearance depth**, that is the depth between the camera and the bottom – you want to keep this to around 3-8 metres for optimum images.



The **Mark Button** on the ReefScan Unit and on the App allow you to mark points of interest and identify the images around that point later, use this functionality to tag or mark parts of the survey that are of interest or where you see unusual objects.

Using the Tablet:

All of the information on the ReefScan screen is also shown on the Tablet so the Observer can use this to see the current images and to help the vessel Driver navigate. The Tablet is also used to enter the Metadata about the survey including the survey name and the environmental conditions.

Enter the Metadata / Recording points of interest:

1. Using the tablet enter the metadata for that survey (tap the 'Change View' screen button until you get to the metadata screen):
 - a name for the survey or site.
 - the wind speed in knots.
 - the cloud cover in octas (0 is no cloud, 8 is full cloud, 4 is half cloud cover).
 - the tide state.
 - the visibility (typically the depth you can clearly see down to).
 - Save the data.
2. If you see anything of interest press the 'Mark' button on the ReefScan unit or on the tablet, on the tablet you can enter a description of what you saw or what was of interest.

Ending the Survey:

1. At the end of the survey press the **Stop Button** to stop recording or press **Stop** on the tablet
2. If you want to do more surveys move to the start of the next survey, if you need to travel quickly to the next site raise the ReefScan unit so that it is as horizontal as possible and lock in place (**Travel Position**). Now transit to the next site. Come to a stop and lower the ReefScan unit back into its survey location (**Survey Position**).
3. Press the **'New Sequence'** button to create a new survey
4. Press the **Record Button** on the ReefScan unit or on the tablet to start the next survey.
5. Continue until done.

Doing more Surveys:

If you want to do another survey after the previous one, then you can use the 'New Sequence' button on the ReefScan Unit or the New Sequence button on the Tablet. A sequence is the same as a survey with all of the images for that sequence being put in the same folder.

If you are already recording images and want to quickly start a new survey, then:

1. Press the **'New Sequence'** button on the ReefScan Unit or the Tablet

The unit will continue to record but the images will go into new folder.

If you have already stopped recording or want to move to a new site to start the second survey then:

2. At the end of the survey press the **Stop Button** to stop recording or press **Stop** on the tablet
3. Press the **'New Sequence'** button on the ReefScan Unit or the Tablet
4. Press the **Record Button** on the ReefScan unit or on the tablet to start the next survey.
5. Start the next survey.

Shutting down the System:

1. Once you have done the final survey press the **Stop Button** to stop recording.
2. On the ReefScan unit, press the **Stop Button** and the **Record Button TOGETHER for 6 SECONDS** and then release, the display will indicate that the unit is shutting down.
3. Once the display shows 'No-Signal' the side Power Switch can be used to turn the system off.
4. The Tablet App can be exited, and the Tablet turned off.



You should always shut the system down using the button-press method first and NOT by using the side power switch, the system contains a computer that needs to shut-down properly to preserve the collected data. Only once the system has shut down should you turn the power switch off. Note that you have to use the buttons on the ReefScan unit NOT on the tablet to shut the system down.

Removing the ReefScan unit from the Bracket:

1. Move the vessel to a **safe location** where the vessel can be stopped, and the unit removed.
2. Stop the vessel and put **the motor in neutral** or turn off the motor.
3. If the unit is not already in the **Travel Position**, then use the Bracket to move it to this position so that the unit is horizontal or nearly horizontal.
4. Remove the safety strap.
5. With one person supporting the top of the unit, loosen and unclip the clamp.
6. Remove the ReefScan unit and lay it down on the floor of the vessel, re-tighten the bracket clamp.
7. Cover the top box with a wet towel if the day is hot.
8. Return to base.



The motor MUST be in neutral or turned off when the ReefScan unit is installed and removed to ensure that there is no hazard to the operator.



Check that the Unit is switched off using the side **Power Switch**.

6.5 After the Survey



- The Top Pod should only be lightly washed and **not immersed in water** as while it is water resistant it is not waterproof.

Cleaning and Protecting the Unit:

1. Once back at base remove the ReefScan Unit from the vessel and wash with particular care given to:
 - a. Take off the camera **Travel Cover** and, with freshwater, wash in and around the bottom of the unit (a fresh-water hose works best).
 - b. Lightly wash the top of the unit with fresh water making sure not to put too much water over the Charging and Data / Ethernet ports or the screen.
 - c. Towel dry the top part and let the rest dry, make sure the top part is not exposed to too much sun or heat (dry in the shade for example).
2. Inspect the unit for any damage especially around the camera dome.
3. When dry re-attach the **Camera Travel Cover** and put the dried unit back in the carry case.
4. Store under controlled conditions (inside and air conditioned if possible).



It is possible for water in the camera pod to not fully drain so raise the unit to drain any remaining water in this area to ensure it fully dries.

7 SETTING UP AND USING THE TABLET

7.1 Installing and Configuring the App

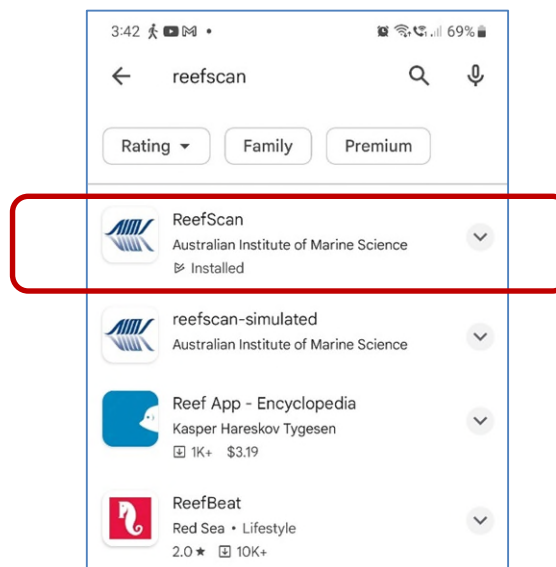
The supplied Tablet comes with the ReefScan software pre-installed and configured. As you can run this App on any Android phone or tablet these instructions are for a new installation, there is no need to re-install the App on the supplied tablet.



- The App is not supported on Apple phones or tablets.
- The supplied Tablets already have the App installed so there is no need to do this step except if you want to use a new Phone or Tablet with the system

1. Install the ReefScan app from Google Play Store, search for 'ReefScan' and Install the App (see below).

Figure 26. ReefScan App in the Google Play-Store



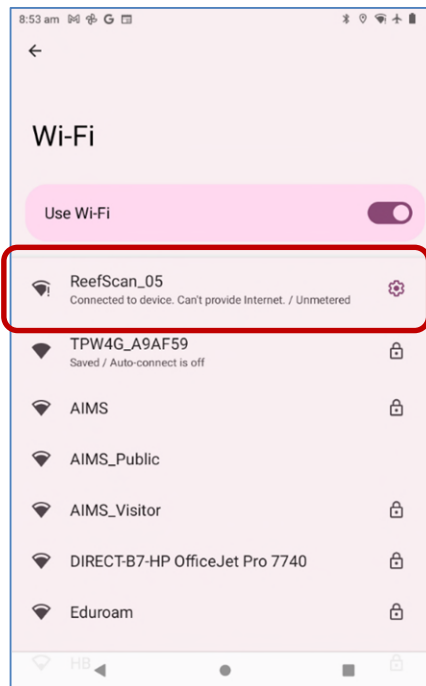
2. Start the ReefScan unit (this can be done inside with the ReefScan unit on a table), the ReefScan unit has inbuilt Wi-Fi that the tablet or phone needs to connect to.



- The way to set up wireless will vary from tablet to tablet so your screens may look different to these.

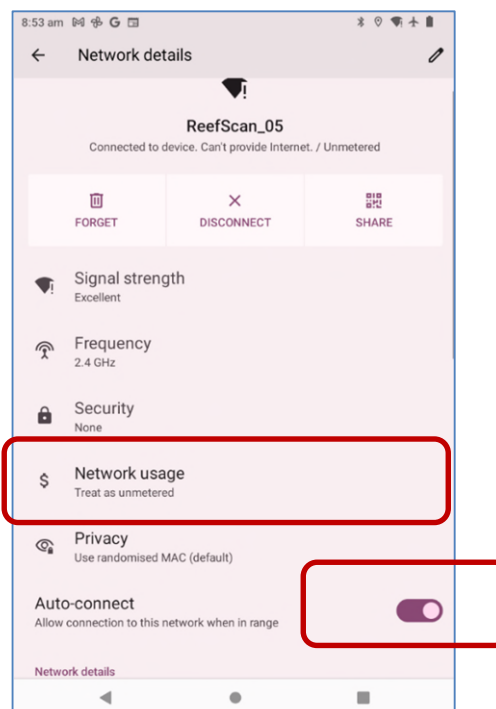
3. In the Tablet or phone go to 'Settings' and then 'Connections' and 'Wi-Fi' and connect to the network that starts with 'ReefScan...'

Figure 27. Turn on Wi-Fi and select the ReefScan connection (ReefScan_05 in this example).



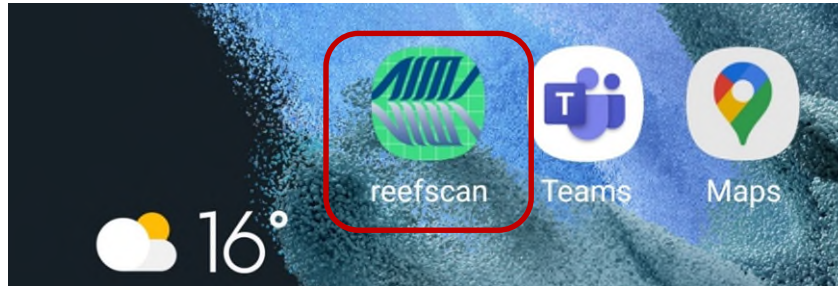
4. Ensure "Auto-connect" is on and "Network usage" is set to "Treat as unmetered".

Figure 28. Wi-Fi parameters



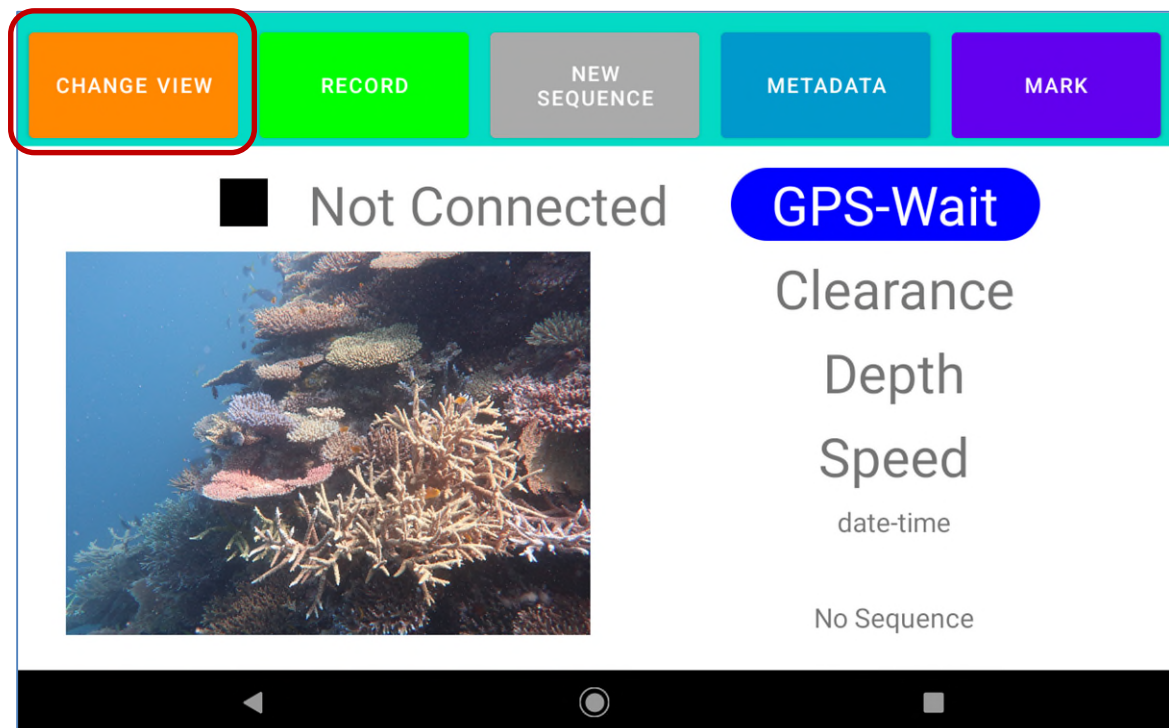
7.2 Using the ReefScan App

Start the App by tapping on the ReefScan icon on the main screen:



The App screen has a button-bar across the top with a series of action buttons and an information screen below. Use the **'Change View'** button to change between the screens.

Figure 29. App Screen Layout



The buttons do the following:

- Change View:** Changes the information displayed in the bottom part of the screen. Press to cycle through the screens available: Main Screen -> Navigation Screen -> Image Screen -> Metadata Screen -> About Screen -> Main Screen.
- Record:** Starts the unit Recording.
- New Sequence:** Starts a new Survey.
- Metadata:** Allows for the entry of Metadata.
- Mark:** Allows the user to set points of interest for later analysis.



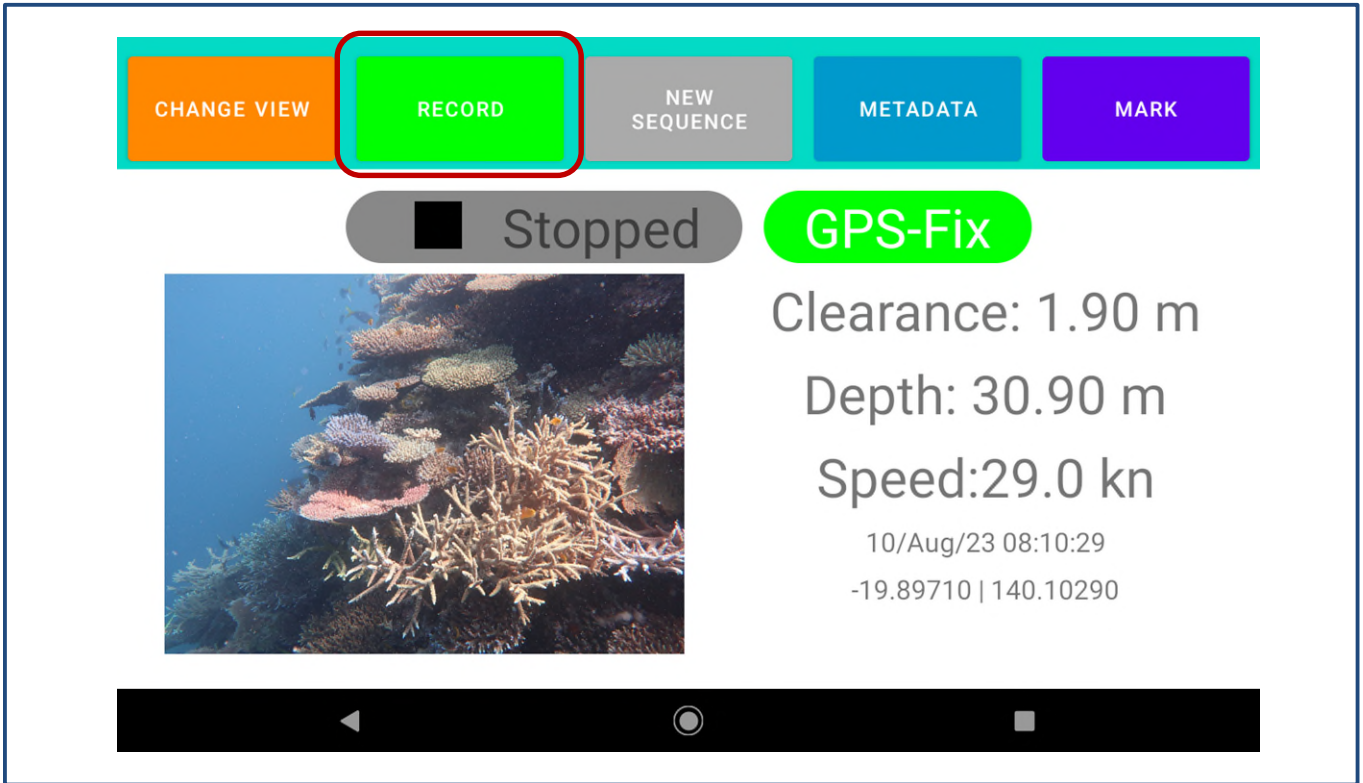
The buttons do the same things as the buttons on the ReefScan unit so you can use either to control the survey.



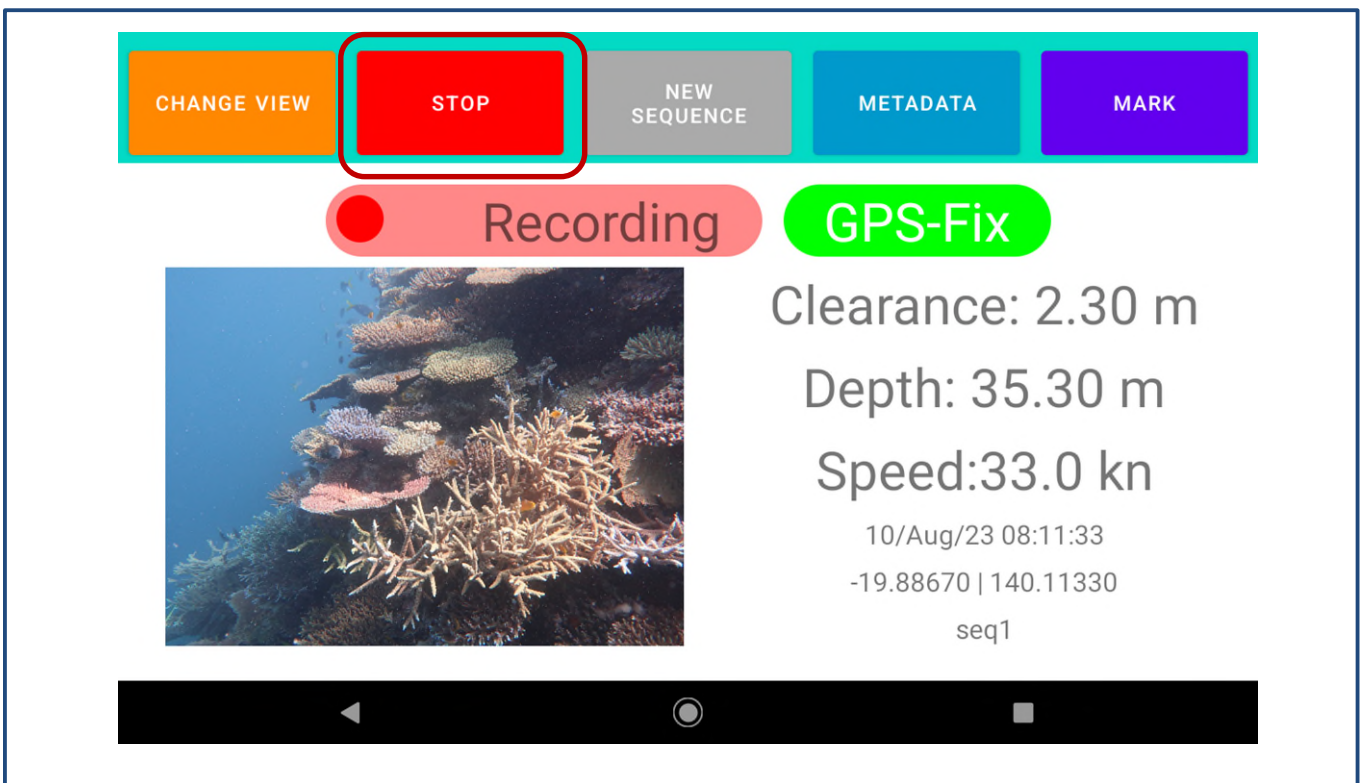
The ReefScan unit can only be shut-down using the physical buttons on the unit NOT the tablet.

7.3 Controlling the ReefScan Unit

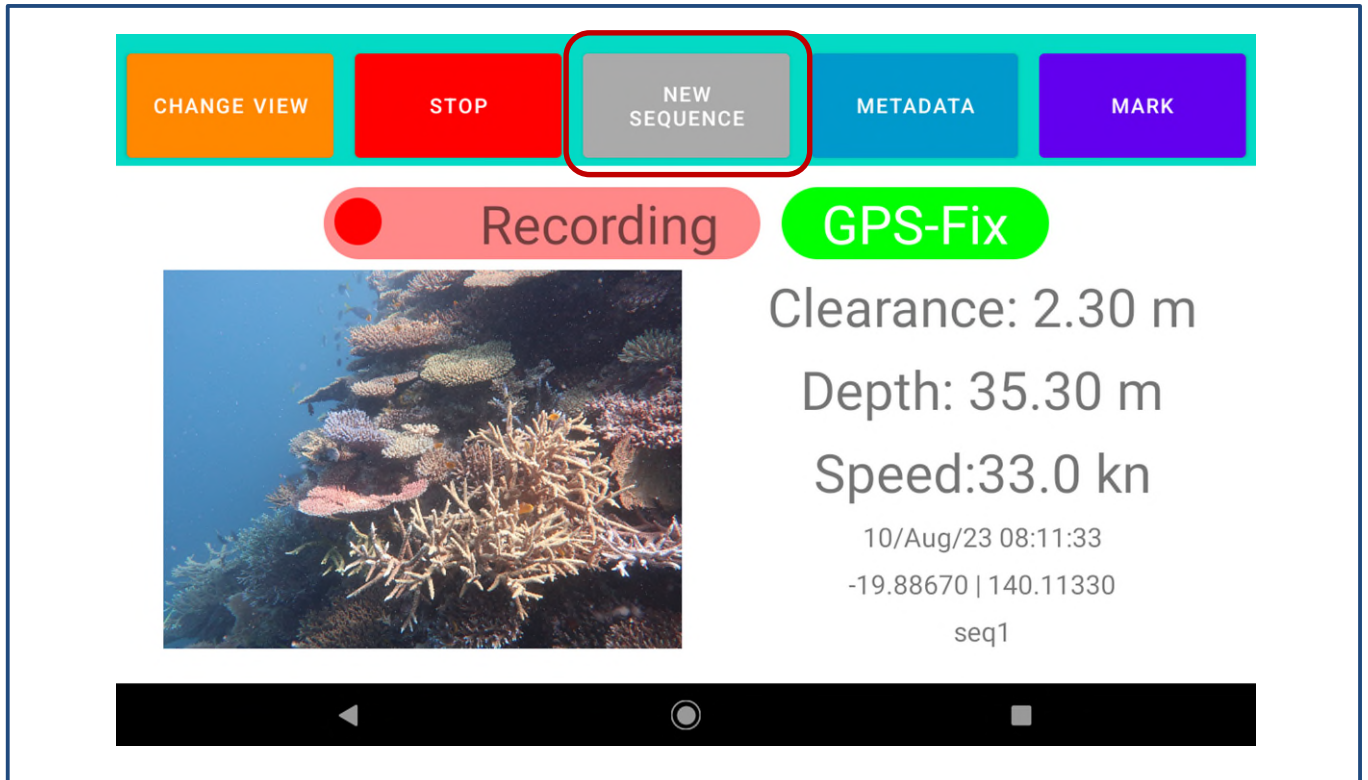
Press the RECORD button to start recording:



Press the STOP button to stop recording:

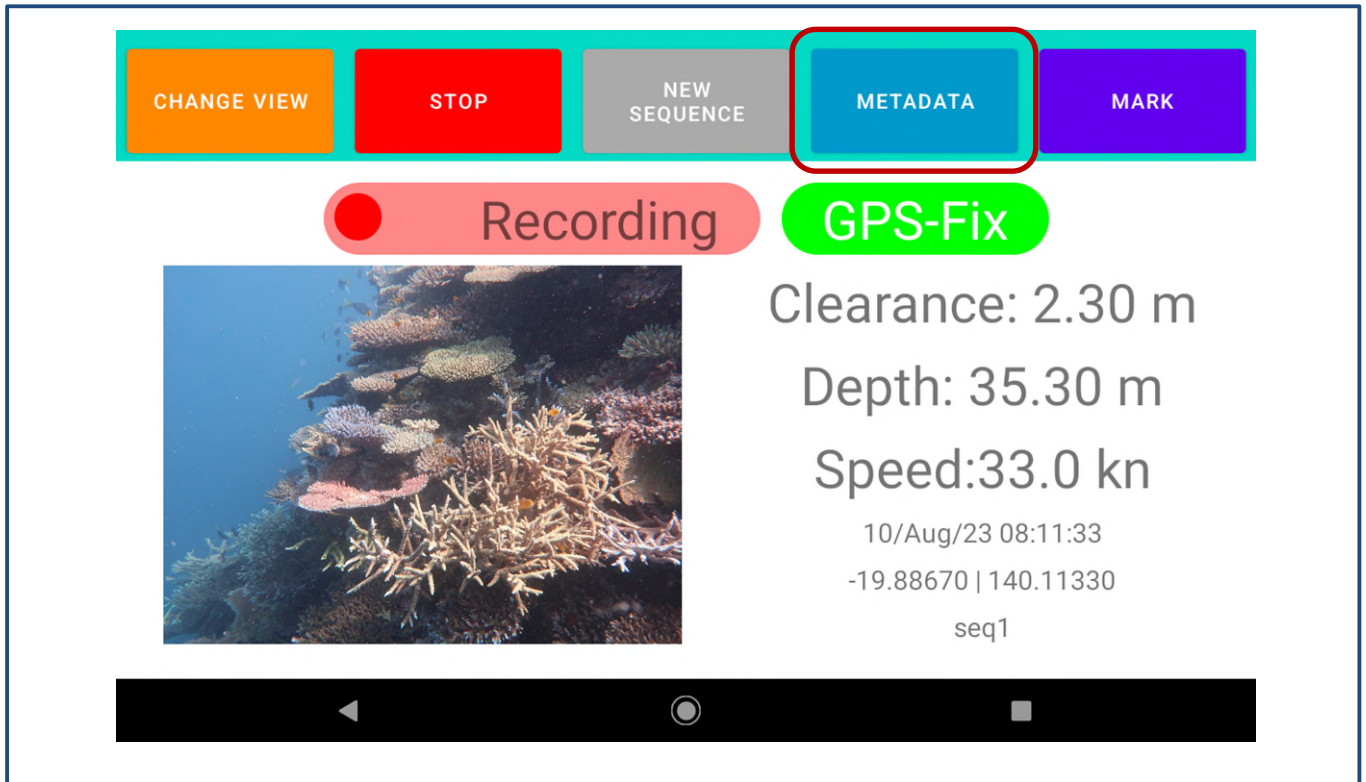


Press the NEW SEQUENCE button to create a new sequence:

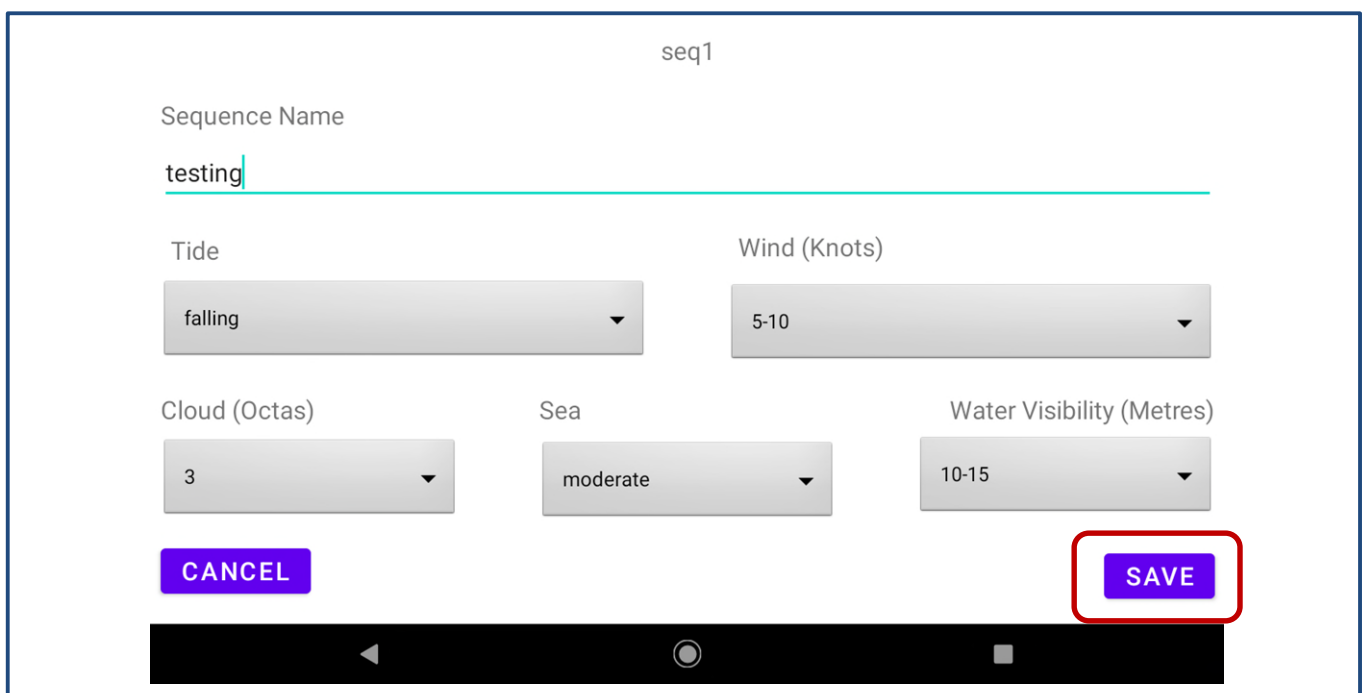


7.4 Entering Metadata

Press the METADATA button to edit the Metadata for that current recording:



Edit the metadata and press the SAVE button:



8 DOWNLOADING AND ORGANISING THE DATA



To download the data, you will need:

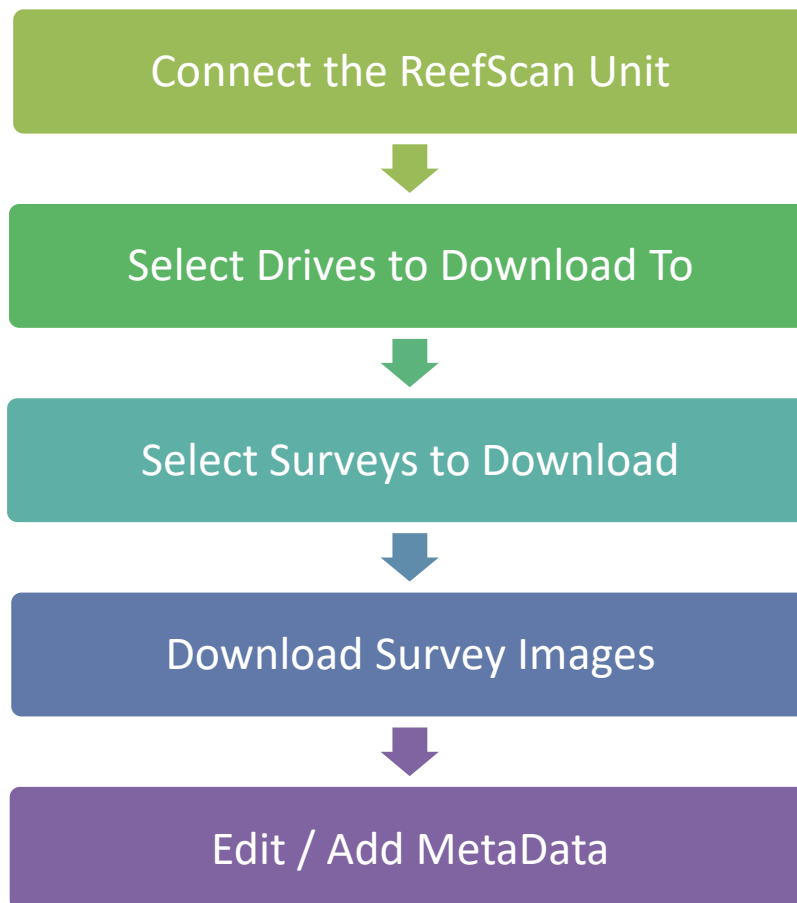
- The ReefScan Unit with the survey data, this should be fully charged.
- An Ethernet cable long enough to reach between a computer and the ReefScan Unit
- A Windows PC, preferably running Window-10 or later.
- The ReefScan Desktop software (supplied as an executable that does not need to be installed).
- One or more external hard drives – prefer using two, one for primary and one for backup.



Make sure the ReefScan unit is dry, and that all data work is done in a controlled environment.

8.1 Steps / Workflow

Figure 30. Workflow for downloading the data.



Note that by default a copy of the data is kept on the ReefScan Unit and so it is possible for the ReefScan Unit to not have enough space for new surveys. You should always delete data from the Unit once you are happy you have a copy and an additional backup.

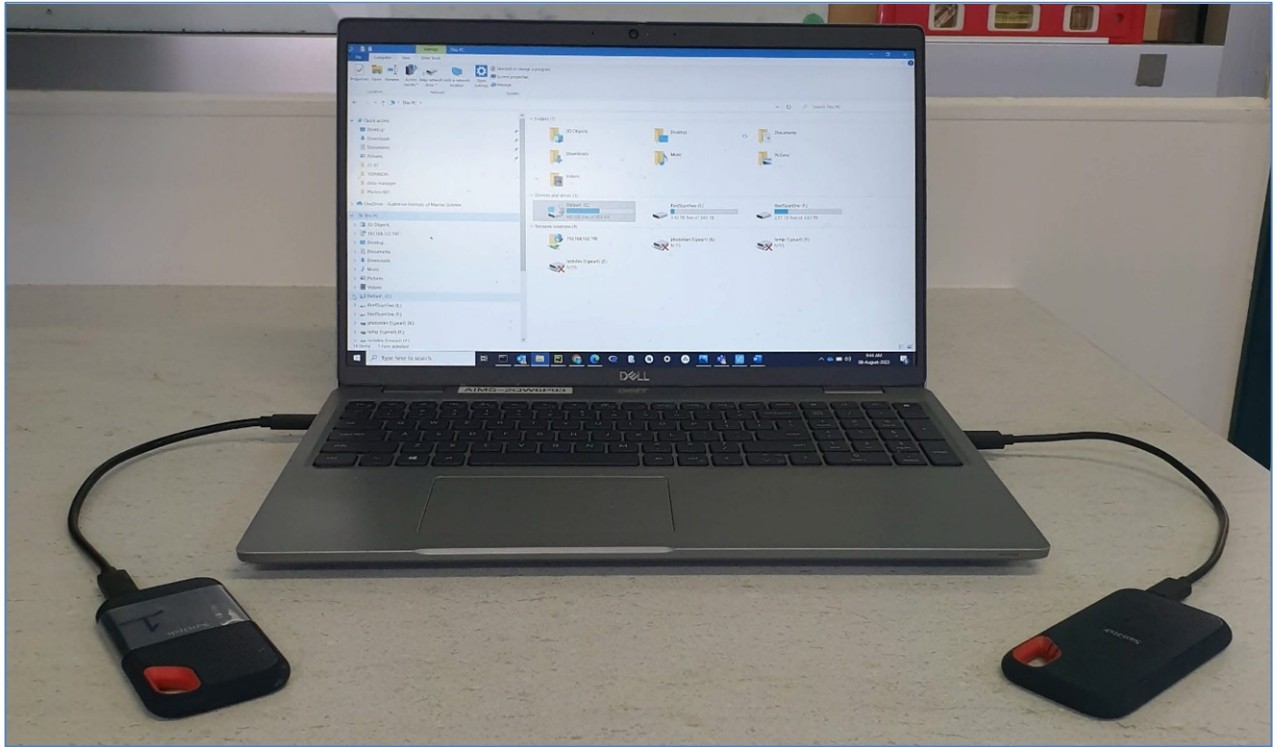


It is strongly recommended that TWO copies of the data are downloaded onto external drives so that you have a primary and back up copy and so these can be stored safely or the data transferred to a permanent backup location.

8.2 Connecting the ReefScan Unit to a computer

1. Connect the two external disk drives to the computer via their USB cables:

Figure 31. Computer set up with two external drives (recommend configuration)



2. Connect the data download cable to your computer:

A special cable is provided that links the ReefScan Unit to a computer. The ReefScan end has a special round connector (see Figure 14 and Figure 32) while the computer end is a standard network connector (RJ-45).

Figure 32. Data cable that connects the ReefScan Unit to a computer



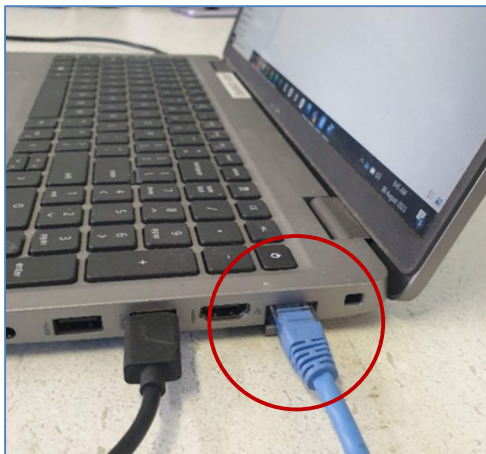
3. Connect the Laptop to the ReefScan Unit

To connect the data cable so the following:

1. Make sure the ReefScan unit is fully charged or is on charge (charger plugged in and switched on)
2. Make sure the laptop or computer is fully charged or plugged in.
3. Make sure the ReefScan Unit is turned **OFF**.
4. Connect the computer end of the cable to the network port of your computer as per Figure 33 below.
5. Connect the other end to the ReefScan Unit and secure with the screw cover.
6. Turn on your computer and let it start: Note that you need to do a full start NOT a recover from Hibernation or Sleep as the system needs to set the computers network configuration to talk to the ReefScan unit.
7. Turn on the ReefScan unit using the side power switch.

Figure 33. Connecting the Data cable between the ReefScan Unit and a computer

Computer End



ReefScan End



Note that it is important that the computer is turned on and connected to the ReefScan BEFORE the ReefScan Unit is turned on. If the computer can't find the ReefScan Unit most likely it is because the start-up sequence was not correct. Turn everything off and make sure you re-start in the correct sequence (**Attach Cable -> Turn on Computer and wait to boot -> Turn on ReefScan**).



Note that your computer needs to do a full boot NOT a recovery from Hibernation or Sleep mode. To ensure this shut down the computer fully via Windows before connecting it to the unit.



These instructions are for a Windows 10 / 11 based computer and may be different for an older Windows computer or a MacOS computer.

8.3 Starting the ReefScan Software



The ReefScan Desktop Software is provided as a single executable file (reefscan-transom.exe) that is located on the hard drives provided. If you delete or don't have a copy then please contact AIMS for a copy.



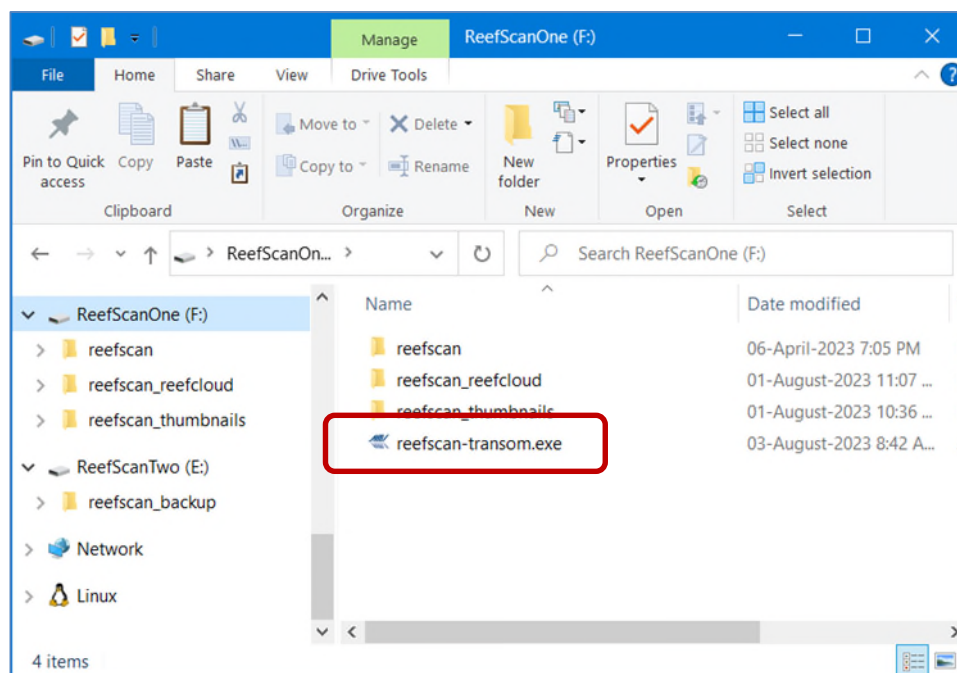
Note that some organisations security policies may not allow for execution of some files. If this is the case, please contact AIMS for help. The following instructions are for Windows based computers.

1. Start the Computer and Connect the computer to the ReefScan Unit:

Follow the instructions in Section 8.2 to make sure your computer is correctly connected to the Reef Scan Unit and the ReefScan Unit is turned on.

2. Find reefscan-transom.exe on one of the external disks:

Figure 34. ReefScan Software executable



3. Start reefscan-transom.exe by double clicking on it.



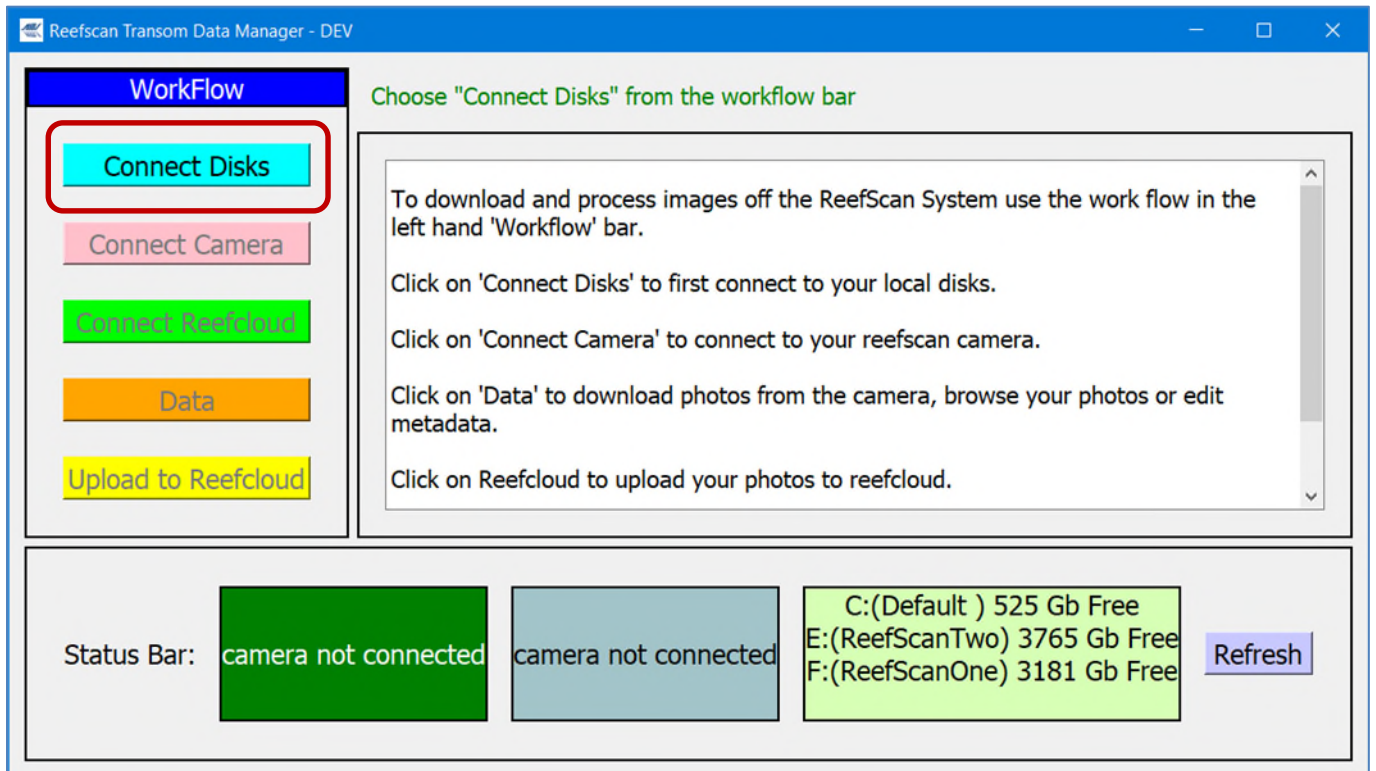
Note that the first time the program it starts it needs to install files so it can take some time.

8.4 Downloading the Data

1. Set the location for the downloaded files to be stored.

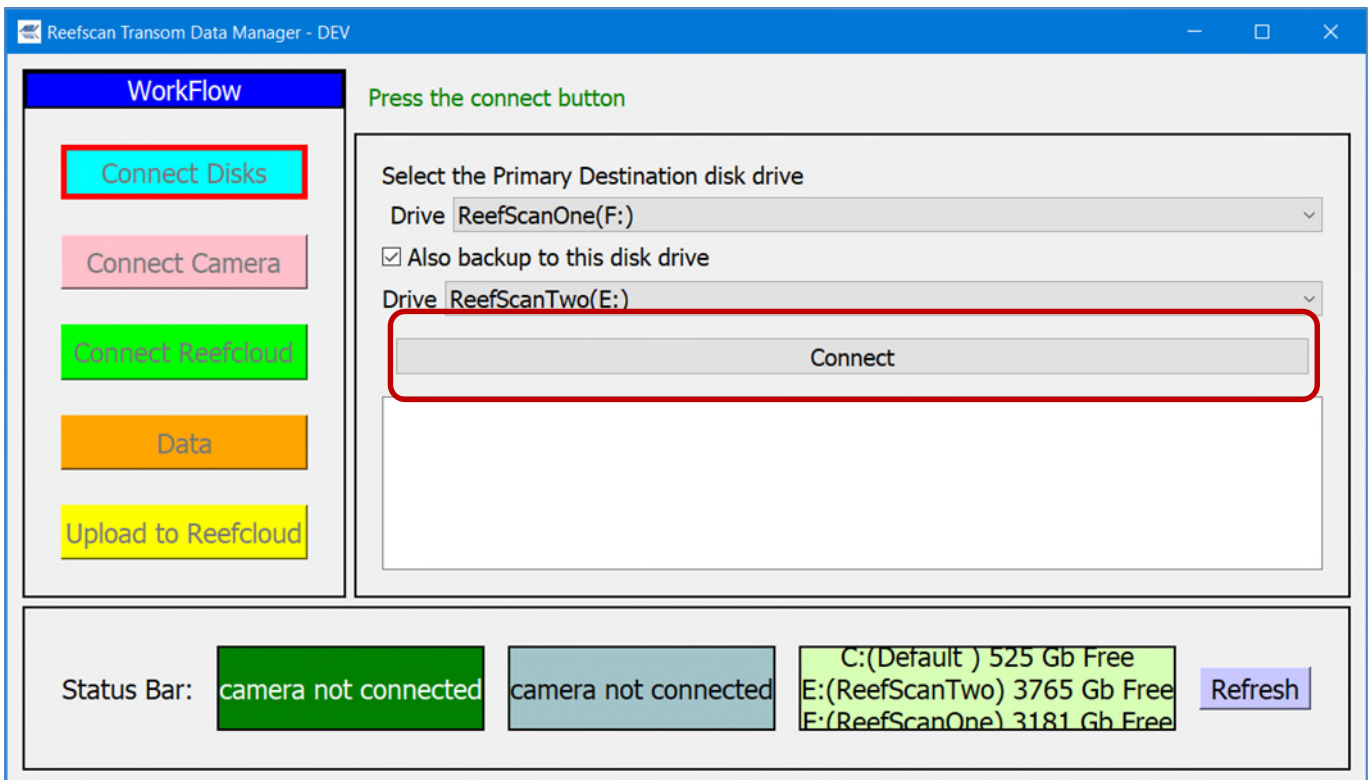
1. Press the “Connect Disks” button on the software (see below)

Figure 35. Connecting disks to the ReefScan Desktop Software



2. For “Primary Destination” choose “ReefScanOne”
3. Tick “Also back up to this drive” and choose “ReefScanTwo”
4. Press “Connect” (Grey Button) to connect to the disks

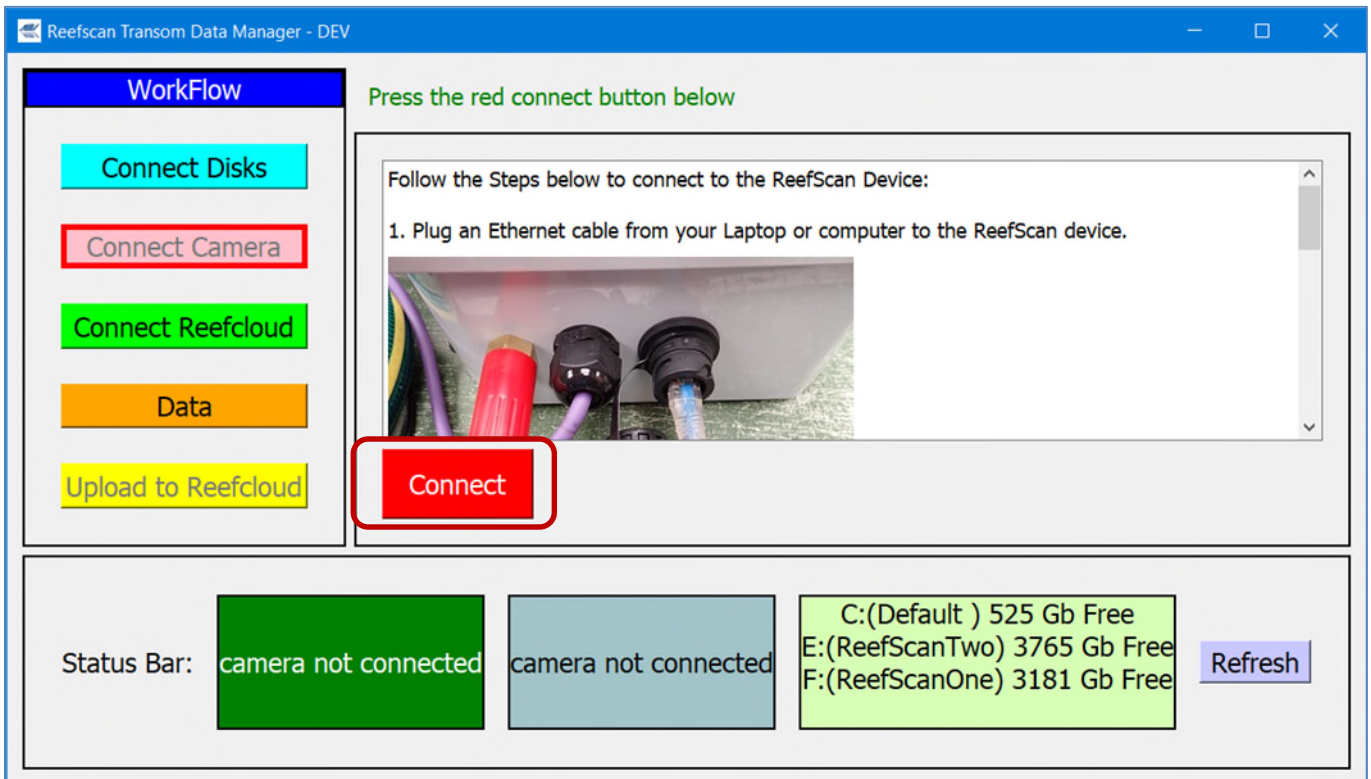
Figure 36. Connecting external drives



2. Connect the software to the ReefScan Unit.

1. Select the 'Connect Camera' button on the workflow pane on the left of the software screen
2. Press "Connect" (Red Button) to connect the camera.

Figure 37. Connecting the camera to the software



Note if the software says it can't connect you may need to re-do the data connection to the ReefScan Unit as per Section 8.2. The order of turning on the equipment is important as the computer and the ReefScan Unit form a network over which the data is transferred. To do this the computer needs to be turned on BEFORE the ReefScan Unit.

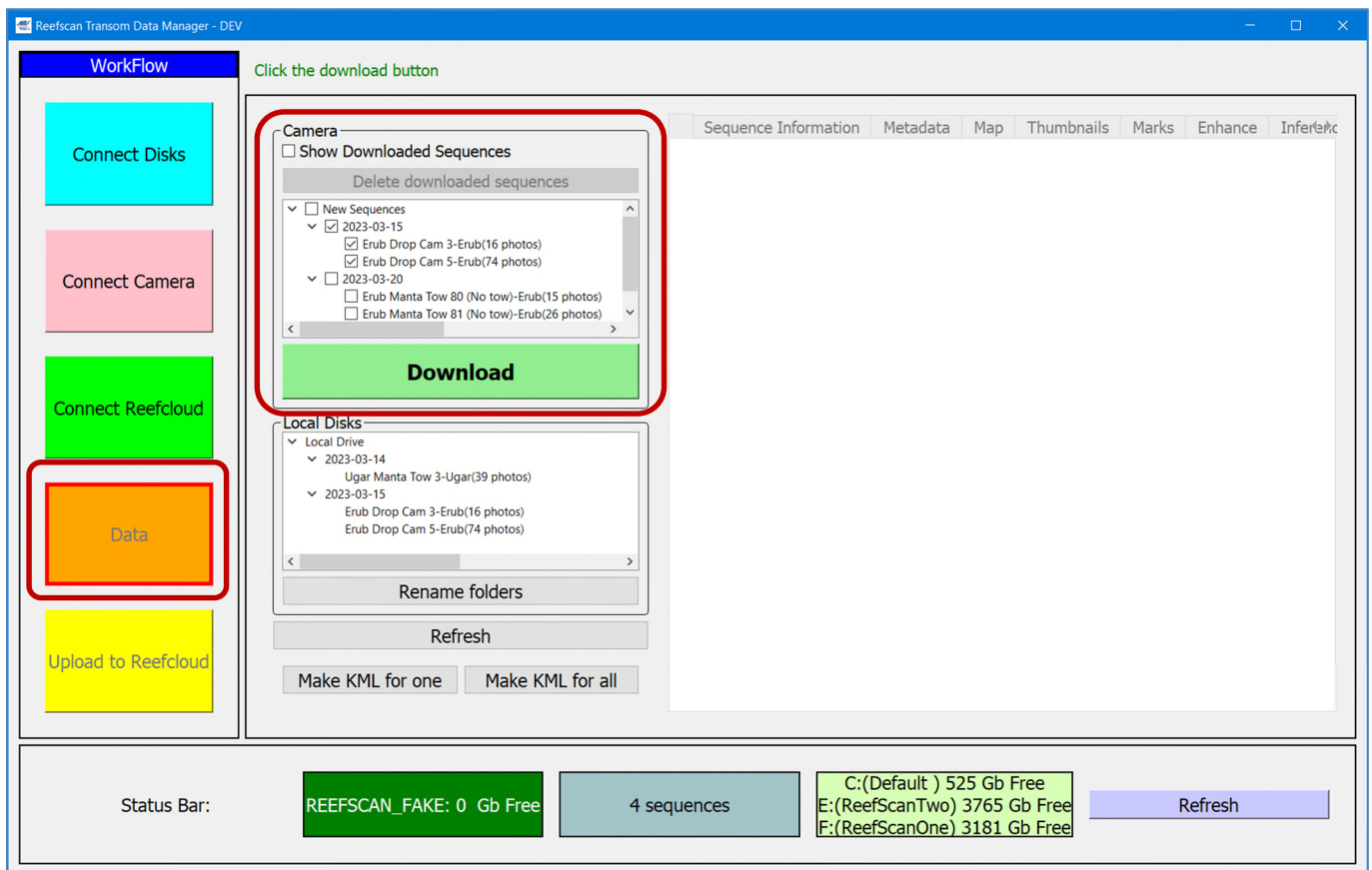
3. Select the 'Data' button from the workflow pane.

On the left of the screen is the workflow pane, click on the 'Data' button to explore the data both on the camera and that downloaded to disk.

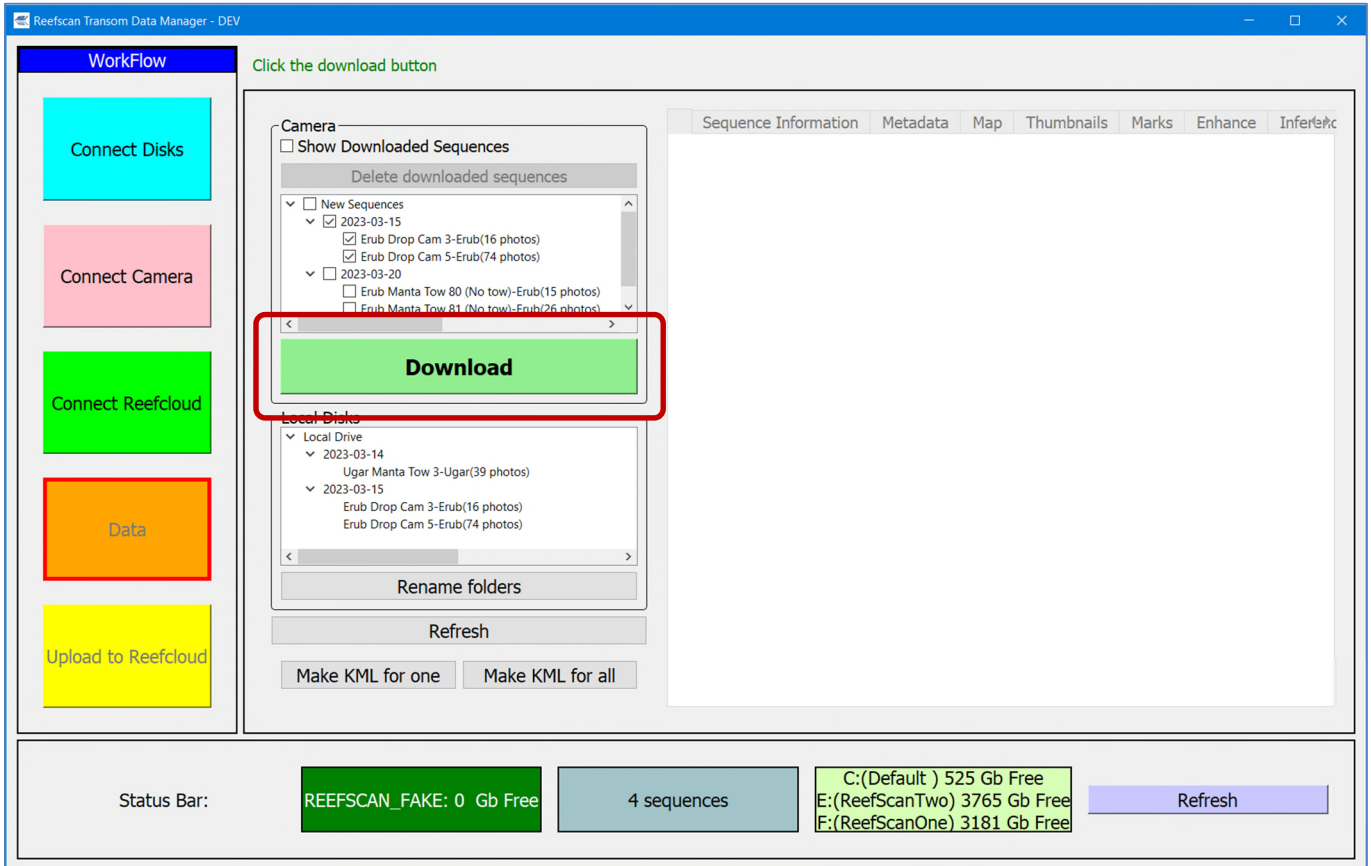
4. Select the Surveys you want to Download

1. On the Camera pane of the software tick the check-boxes for the surveys you want to down-load.

Figure 38. Selecting surveys to download



2. Press the Download button to download the selected surveys.



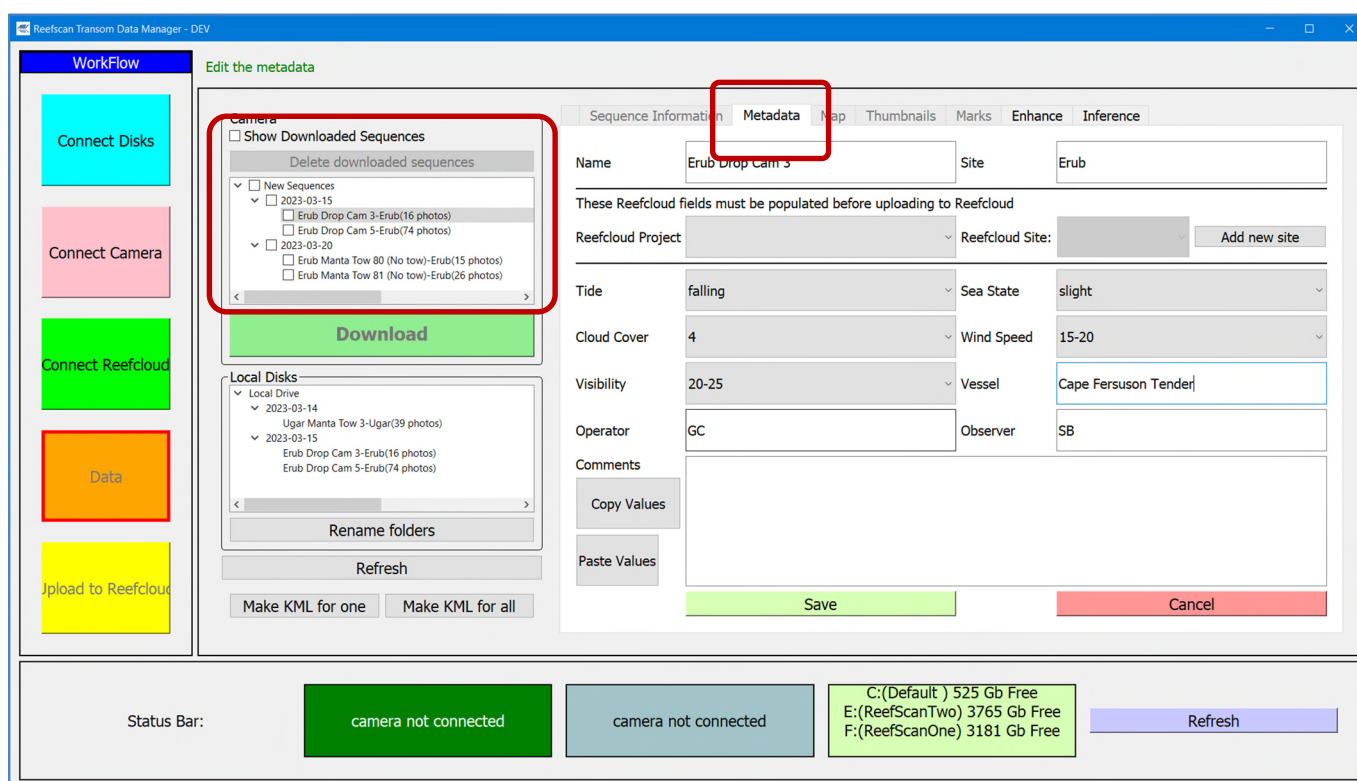
Note: This may take some time so make sure that the ReefScan unit is on the charger so that it doesn't run flat, and that the computer also has enough charge.

8.5 Entering Metadata:

1. Select the Survey you want to enter or edit the metadata for.

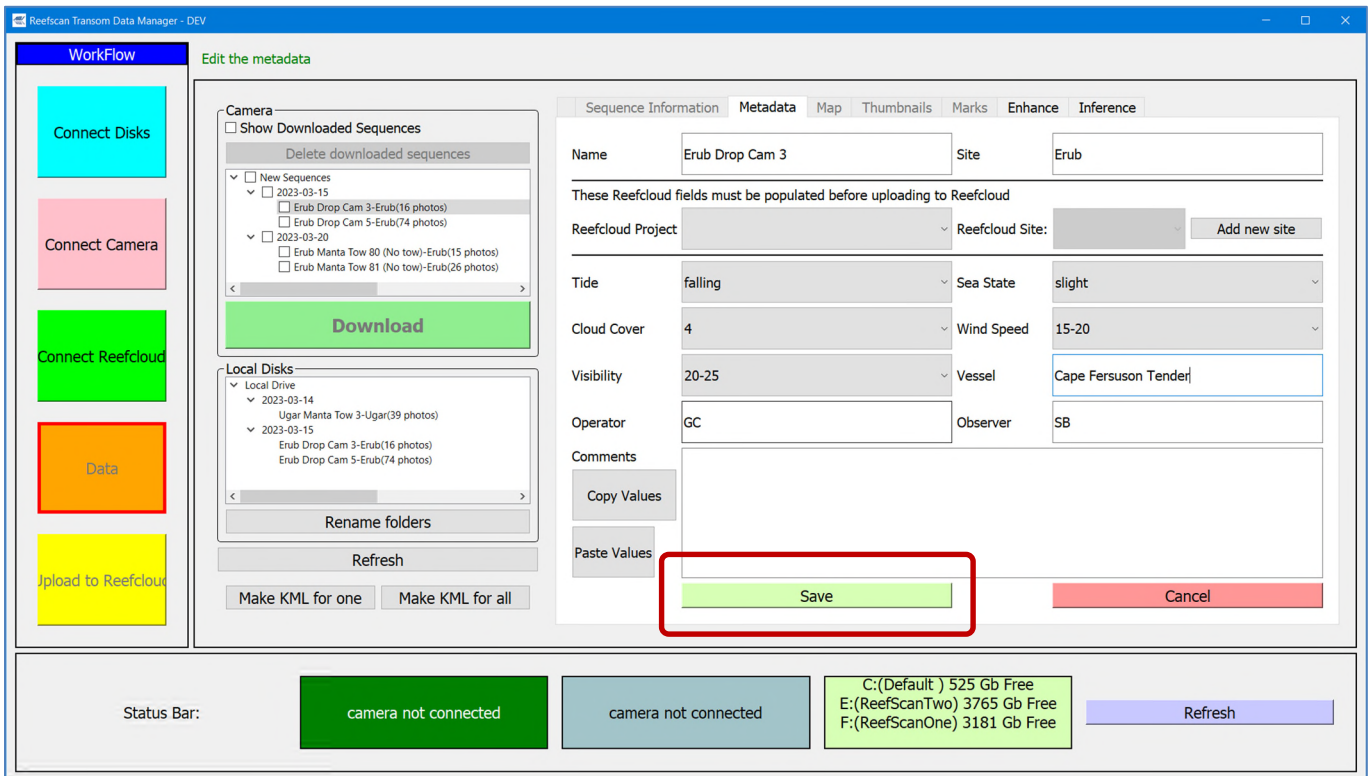
1. Select the 'Data' button on the workflow pane on the left of the software screen
2. Click on the Survey or Sequence you want to enter or edit the metadata within the Camera Pane
3. Click on the 'Metadata' Tab and enter or update the Metadata for that Survey.

Figure 39. Metadata Entry / Edit form.



2. Enter or Edit the Metadata for that survey / sequence.

1. Enter or edit the Metadata using the drop-down lists and form.
2. Click the 'Save' button once done.



The screenshot shows the 'ReefScan Transom Data Manager - DEV' application. The main window is titled 'Edit the metadata' and has several tabs: 'Sequence Information', 'Metadata', 'Map', 'Thumbnails', 'Marks', 'Enhance', and 'Inference'. The 'Metadata' tab is active, displaying a form for editing sequence information. The form includes fields for 'Name' (Erub Drop Cam 3) and 'Site' (Erub). Below these fields, there is a section titled 'These Reefcloud fields must be populated before uploading to Reefcloud' with several dropdown menus: 'Reefcloud Project', 'Reefcloud Site', 'Tide' (falling), 'Sea State' (slight), 'Cloud Cover' (4), 'Wind Speed' (15-20), 'Visibility' (20-25), and 'Vessel' (Cape Fersuson Tender). There are also input fields for 'Operator' (GC) and 'Observer' (SB). A 'Comments' text area is present, along with 'Copy Values' and 'Paste Values' buttons. A green 'Save' button is highlighted with a red box, and a red 'Cancel' button is also visible. On the left side of the interface, there is a 'Workflow' panel with buttons for 'Connect Disks', 'Connect Camera', 'Connect Reefcloud', 'Data', and 'Upload to Reefcloud'. Below the main window, a status bar shows 'camera not connected' for two cameras and a drive status for C:, E:, and F: drives. A 'Refresh' button is located in the bottom right corner of the status bar.



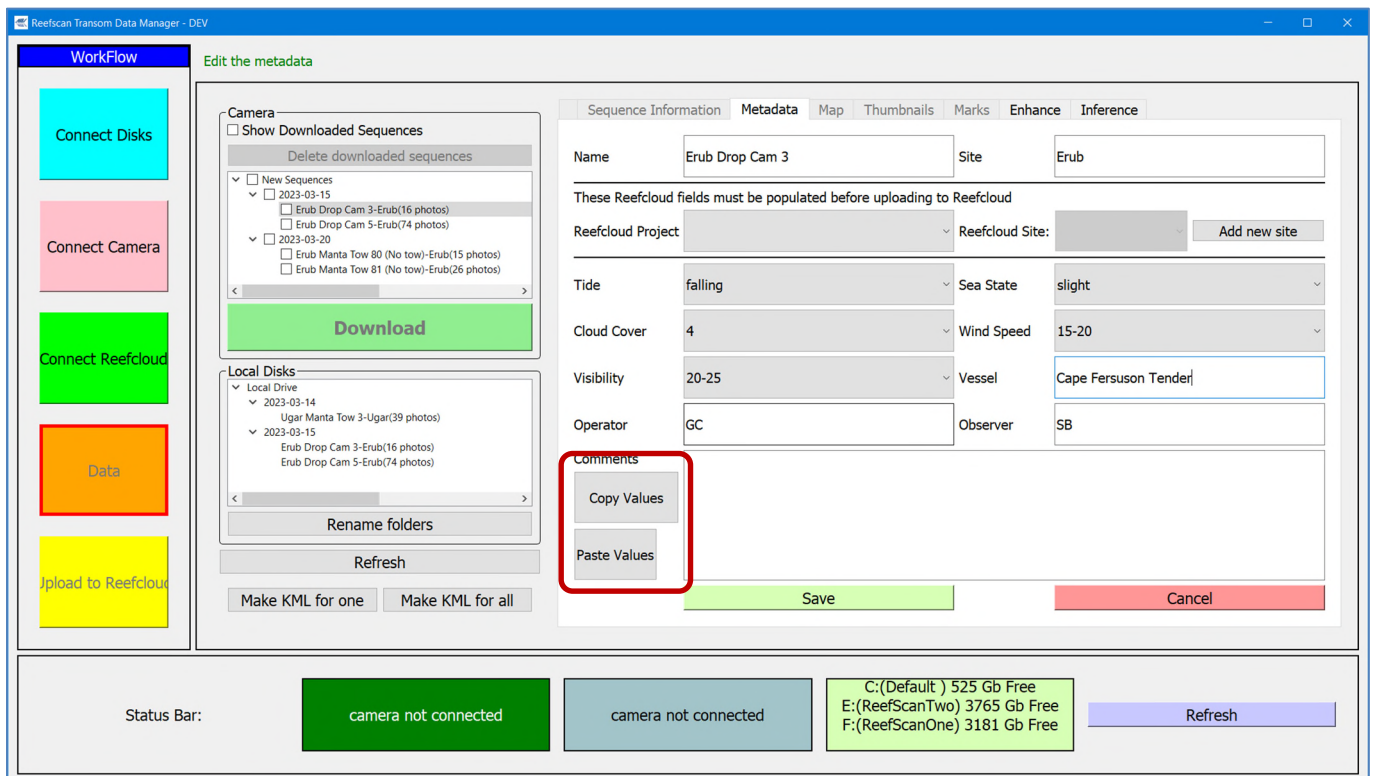
Don't worry about filling in the Reef Cloud Project and Site boxes as these will be filled in when uploading to Reef Cloud.

3. Copying Metadata from one survey to another

If you have surveys without metadata, then you can easily copy from one survey to another by:

1. Select the source record and make sure the Metadata is up to date.
2. Click the 'Copy Values' button.
3. Now select the destination Metadata record.
4. Click the 'Paste Value' button.
5. Continue with the other surveys until all surveys have valid metadata.

Figure 40. Copy / Paste buttons for copying Metadata from one survey to another.



8.6 Backing up the Data

The data is automatically copied to two hard disks if it is configured to do so on the “Connect Disks” page. The data is also retained on the ReefScan unit until it is explicitly deleted.

At the end of the trip, we recommend that you copy the contents of the folder “reefscan” on the primary disk to a safe location.



Note: The data is stored on the external drive in the N:\reefscan folder where ‘N’ is the drive letter for the external hard drive. It is worth backing this up to a safe place for long term storage.

8.7 Checking space on the ReefScan Unit / Deleting Data

By default, the images collected by the ReefScan Unit are retained on the Unit memory even if the images have been downloaded. This gives you a second copy if the download doesn't work.

This can mean that the ReefScan Unit can fill up the available memory and so you won't be able to undertake any new surveys. You need to manually delete the old images off the device to make sure you have enough space for new surveys.

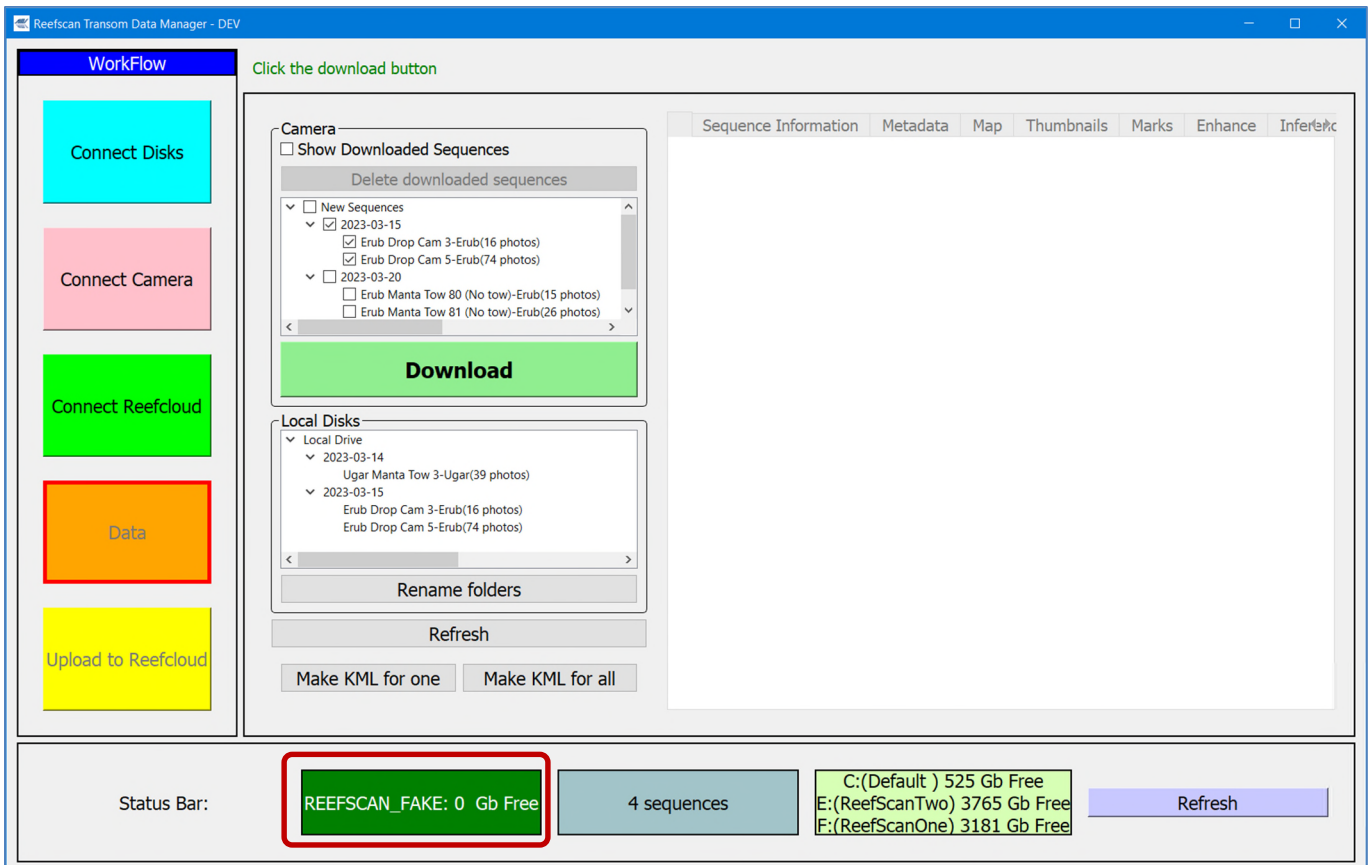


If the ReefScan unit runs out of memory you will NOT be able to undertake new surveys. You need to delete old data before a survey to make sure you have enough space for the new data.

1. Checking how much space is on the ReefScan Unit

If the camera is connected you will see the remaining space in the software by clicking to the 'Data' pane, as a rule you need 500GB free for a full day of surveys.

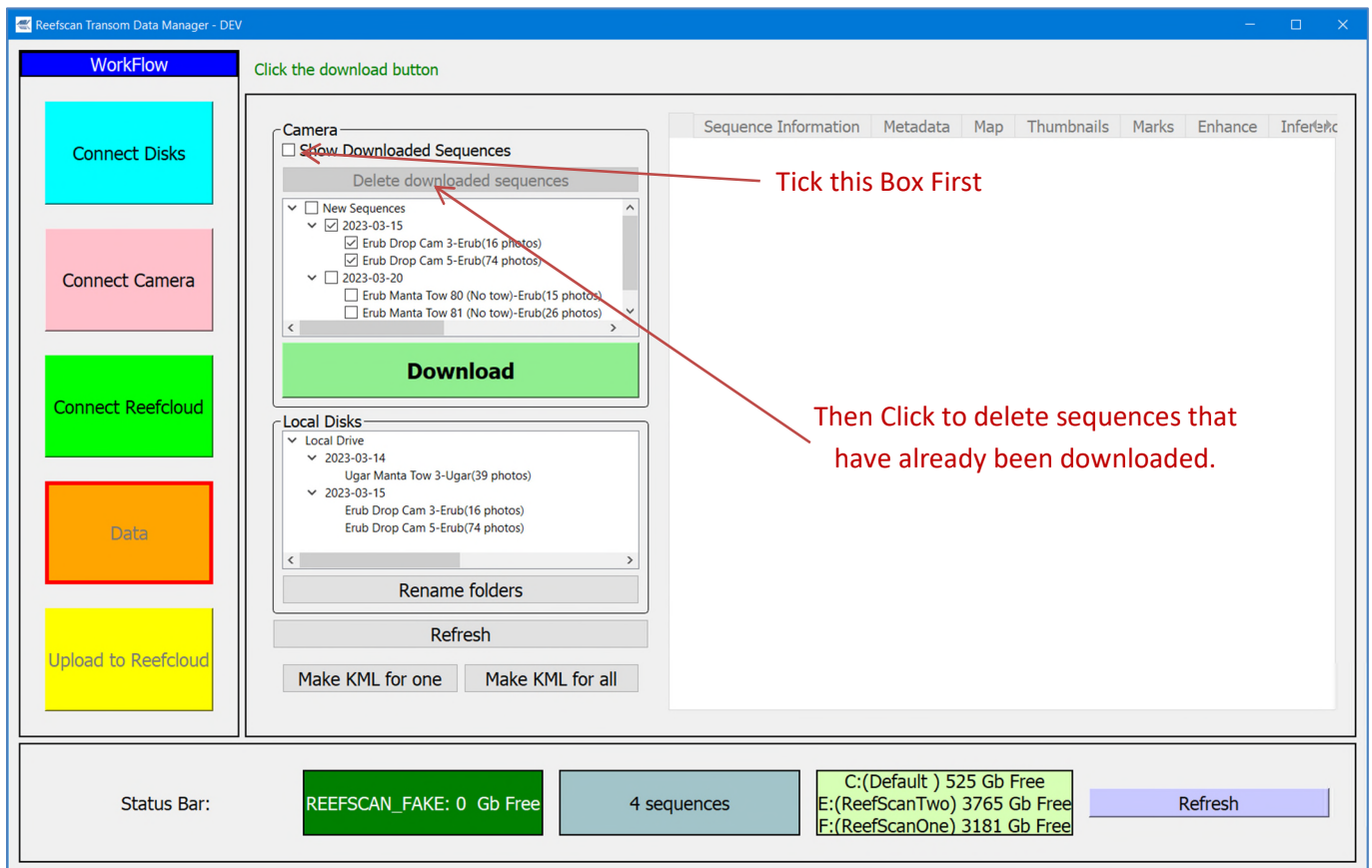
Figure 41. Free space on the ReefScan Unit




2. Deleting data off the Unit

1. Click on the Data tab in the workflow pane.
2. Tick the 'Show Downloaded Sequences' check box
3. Click the 'Delete Downloaded Sequences' button to delete all of the downloaded data
4. Check the Status Bar that you now have enough space.

Figure 42. Selecting surveys to delete



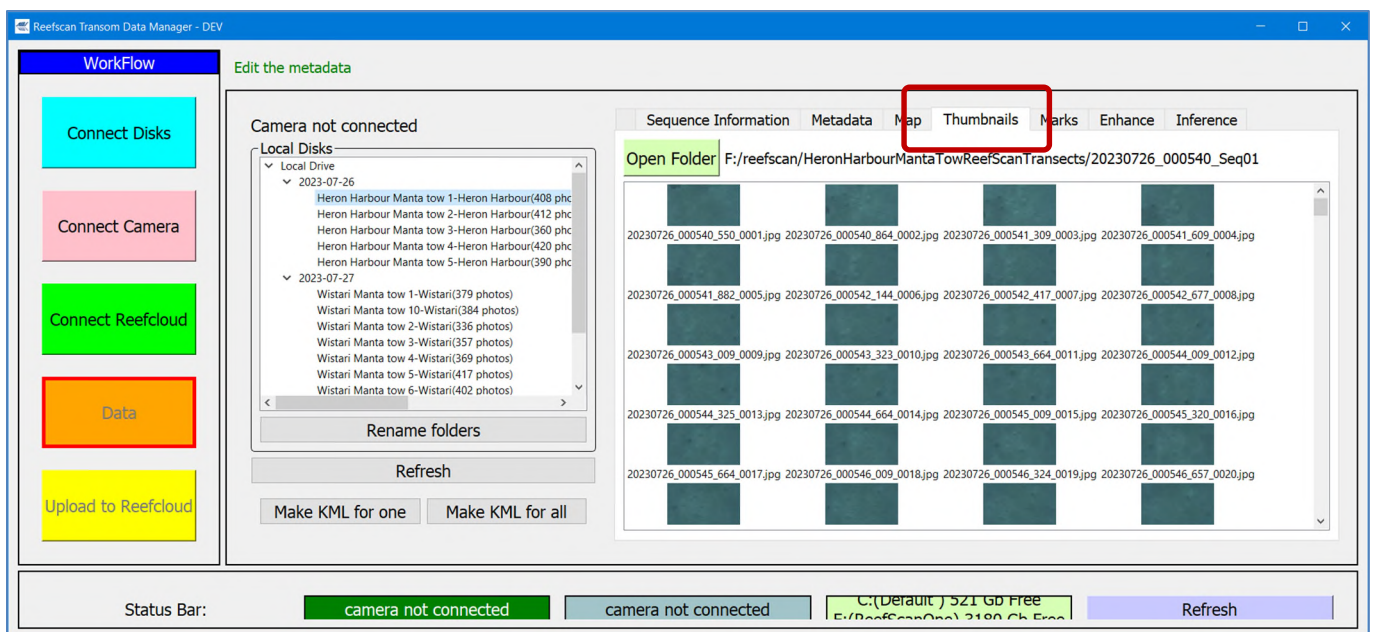
 Note: You CAN'T delete data that has not yet been downloaded so if you still don't have enough space then download the data first and then you will be able to delete it off the Unit.

8.8 Viewing Images

The software includes a built-in viewer that allows you to view the collected images:

1. Connect the local external hard drives with the data to the computer
2. Start the ReefScan Software
3. Connect to the attached external drives
4. Click on the Data tab in the workflow pane.
5. Select the survey to view
6. Use the 'Thumbnails' tab to view the survey images
7. Double-click on an image to view it full size

Figure 43. Viewing collected images



Note: You can view data without connecting the camera using the data on the local drives. Just plug in the drives, start the software, connect to the disks and then go to the 'Data' tab in the workflow pane and then you can select the sequence and view the images.



Note: The software also allows you to view images associated with Marks and to enhance the images to make it easier for viewing them.

9 UPLOADING TO REEF CLOUD

9.1 Survey Design and Reef Cloud Integration

Reef Cloud uses a slightly different organisation of the data to that of ReefScan. A **Sequence** in ReefScan is equivalent to a **Survey** in Reef Cloud and is normally defined as the images collected along a 500m long survey path. Reef Cloud also requires that each survey is assigned to a **Site** and a **Project** which are created within the Reef Cloud web interface. **Sites** can be created in the Reef Cloud web interface or from the ReefScan Desktop software.

Sequences should therefore be designed so that they form a series of 500m long surveys that each can be allocated to a **Project** in Reef Cloud as a series of **Sites**.

The uploading of data from ReefScan to Reef Cloud is done by linking the ReefScan **Sequence** to the Reef Cloud **Project** and **Site** through the survey metadata. The upload can be to an existing **Site** in Reef Cloud, or the ReefScan Desktop software can create a new **Site** for the upload. The method used (upload to an existing **Site** or create a new **Site**) is selected from the Metadata Tab in the Desktop Software where the user has the choice of uploading to an existing **Site** or creating a new **Site** for that **Survey**.

ReefScan	->	Reef Cloud
Reefcloud_Project	->	Project
Sequence	->	Survey
Reefcloud_Site	->	Site

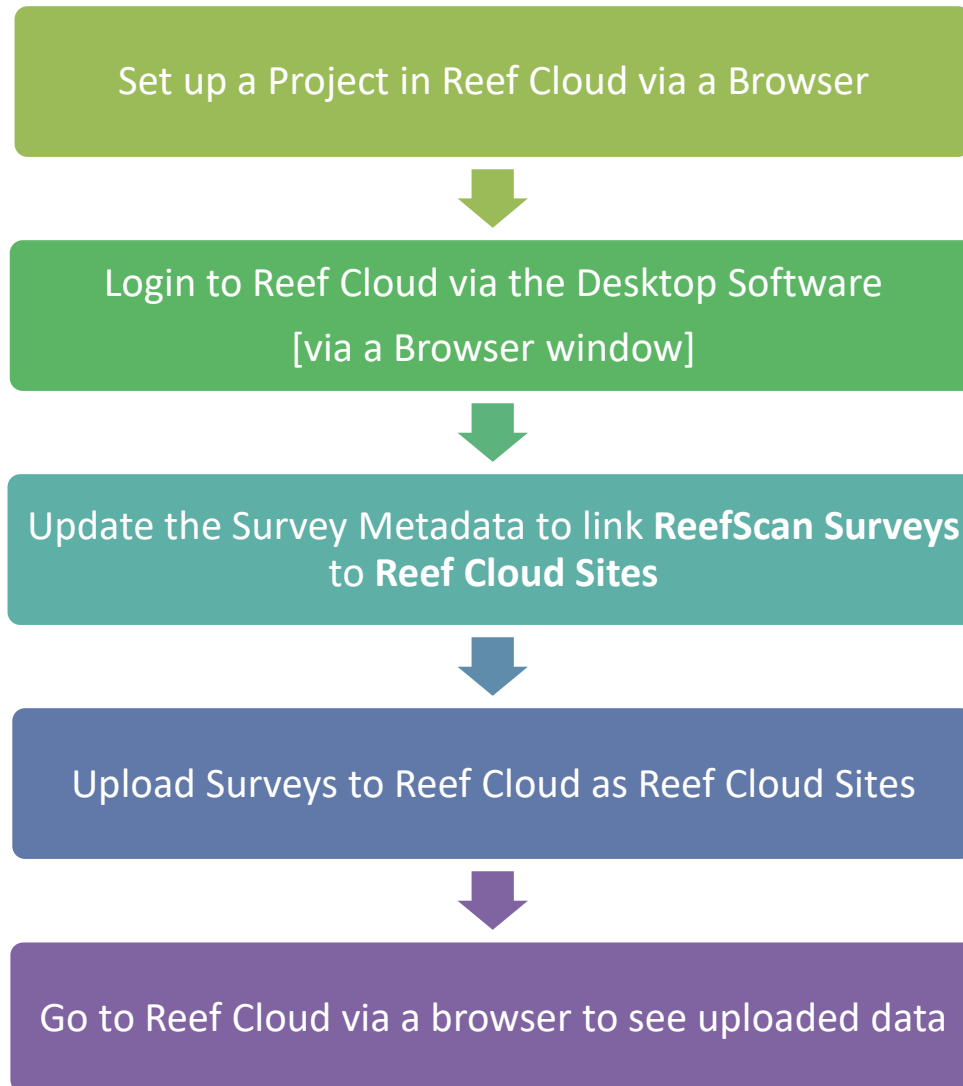
To link the two the ReefScan Desktop Software needs the user to Log into Reef Cloud via a browser window, once this has been done and the user authenticated the Desktop Software can download the existing **Projects** and **Sites** from Reef Cloud and the user can then assign Reef Cloud Sites and Projects to ReefScan **Sequences**.



It is important to understand how the Surveys collected in the ReefScan Desktop Software link to Sites in the Reef Cloud system and that Reef Cloud is browser based and ReefScan is Desktop based.

9.2 Steps / Workflow

The following workflow is used to link the ReefScan data to reef Cloud and then upload the images.



9.3 Setting Up Reef Cloud

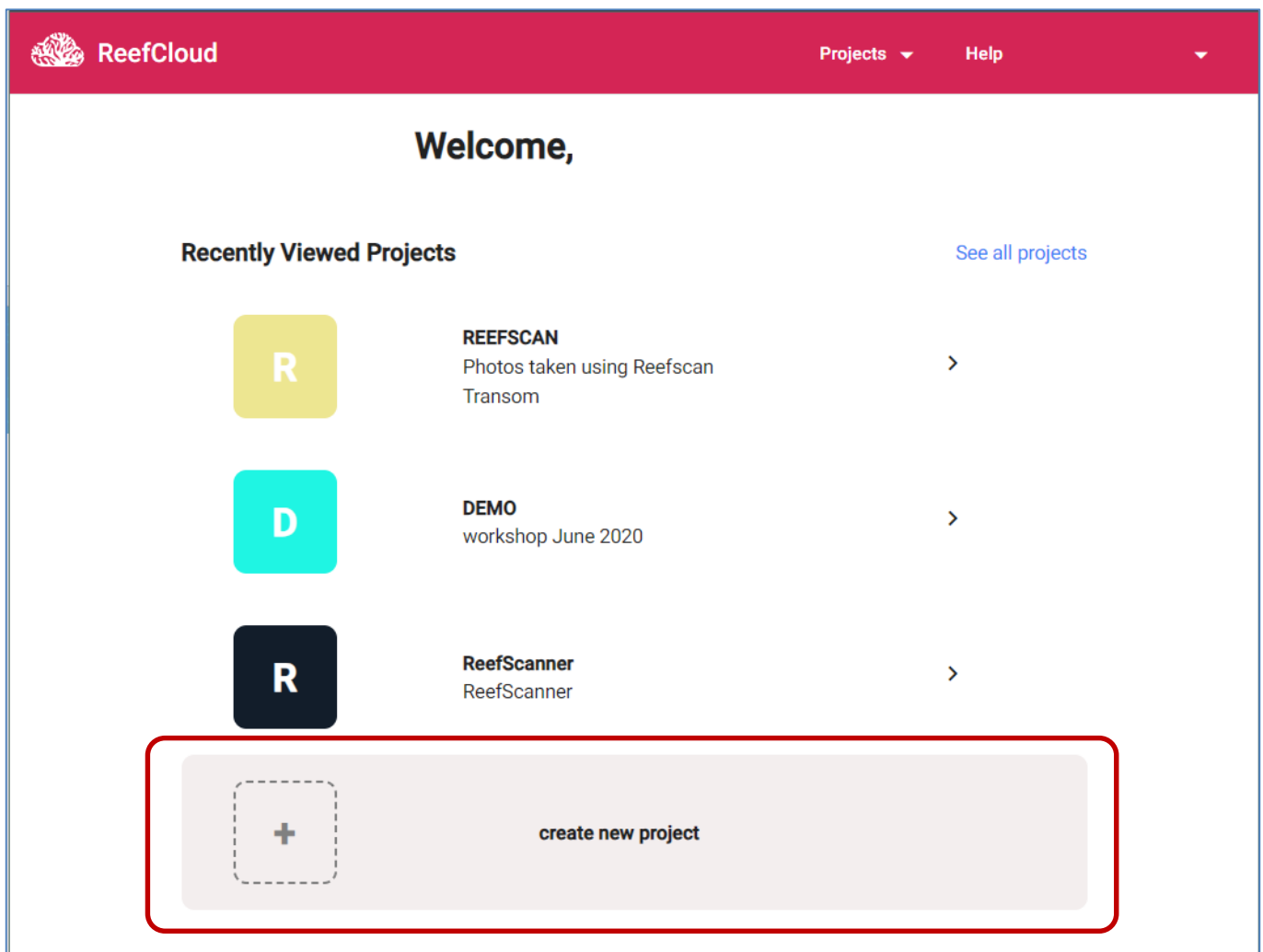
1. Creating a Project in Reef Cloud

In order to upload data to Reef Cloud you first need a valid account on Reef Cloud (these are free) and you need to create a project that the images can be uploaded to.

To do this:

1. Go to: <https://reefcloud.ai/>
2. Log onto the Data Portal
3. Enter your Username and Password, if you don't have an account then create one
4. On the welcome page, select 'Create new project'

Figure 44. Creating a Project within Reef Cloud



5. Fill in the basic details for the project.
6. Go to the next page and select the options below:

What sampling protocol is used? ⓘ

- Photo transects
- Photo quadrats
- Geo-referenced transects
- BRUVS
- Other

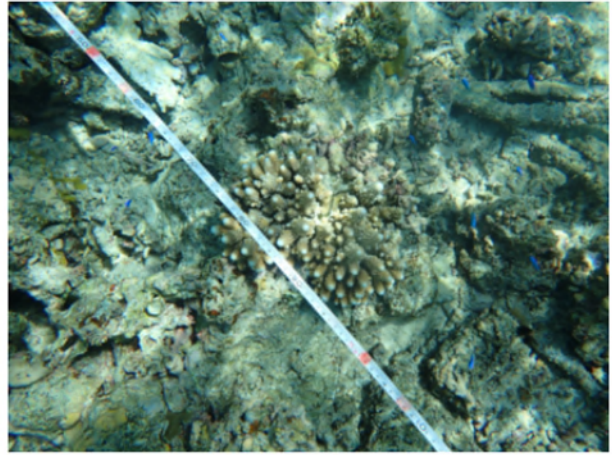
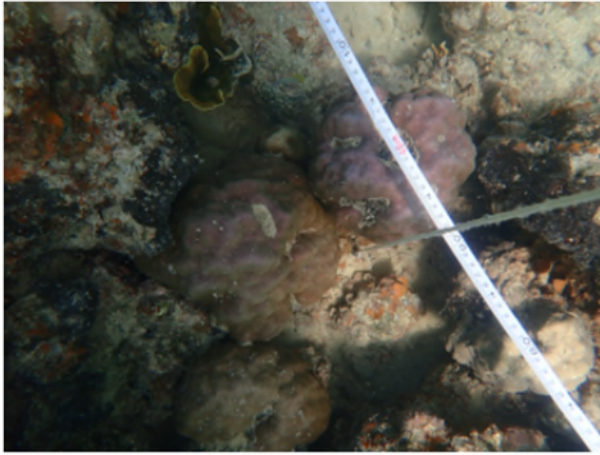
Email support@reefcloud.ai to request to add a sampling protocol

Data Collection Method

- Dive
- Snorkel
- Towed Camera
- Drop Camera
- AUV (Autonomous Underwater Vehicle)
- ROV (Remote Operated Vehicle)
- BRUVS
- Other
- Reef Check
- ReefScan

How much reef will you capture in each image?

Providing a field of view value here will help us estimate the footprint of your images to standardise the information we feed to the machine learning algorithm (AI). We understand that this value can be standard where as in other cases varies from image to image and we may not know the exact value. So, we ask for an estimated **image width in cm** as reference.

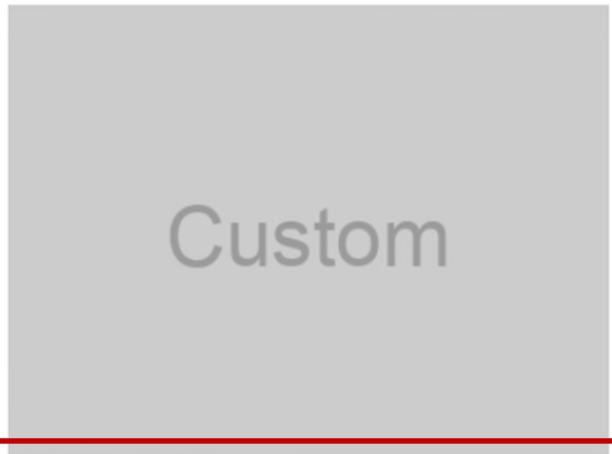


0-50cm

50-100cm



100-200cm



Custom

200-500cm

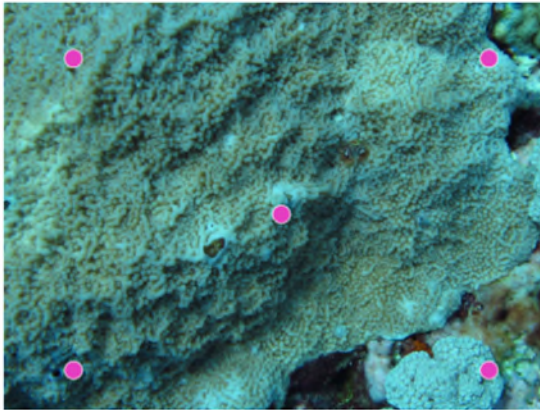
7. Go to the next page, select the options below:



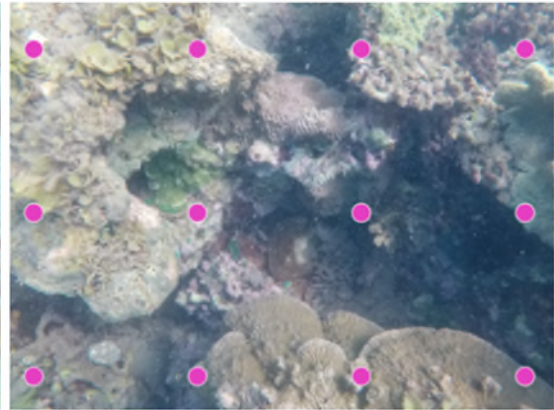
Note that the choice of label set and point grid should be determined by the project goals and so you should review this as part of the experimental design for the work.

Select a verified label set to copy or import a new set

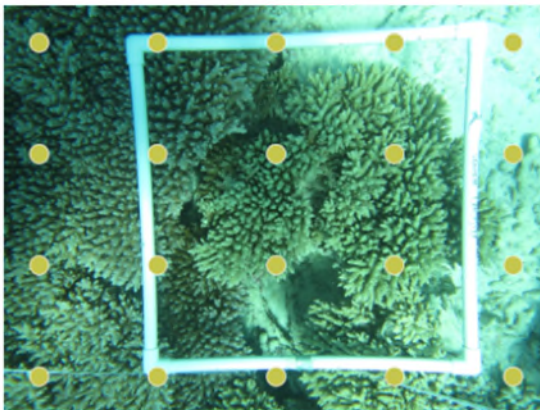
Template	Upload your own		
Name	Description		
GBRMPA Eye on the Reef Benthos	Benthic categories of coral, macroalgae and benthos matching Eye on the Reef survey methods, with additional benthic categories.	Preview	Select
kercodes-08-10-12	AIMS Ker Codes	Preview	Select
Mermaid	Marine Ecological Research Management Aid full benthic labelset	Preview	Select
ReefCheck Australia	ReefCheck Australia's standard line intercept benthic categories, adapted for photoquadrats in ReefCloud	Preview	Select
T1 - Essential labelset	Essential benthic reef labels for users beginning reef monitoring.	Preview	Select
T2 - General growth-form labelset	General growth-form based labels for users with familiarity with coral growth forms and other common reef taxa.	Preview	Select
T3 - Taxon-specific labelset	Taxon-specific labels for users with higher levels of taxonomic identification skills for corals and other reef benthic taxa at the genus-level.	Preview	Select



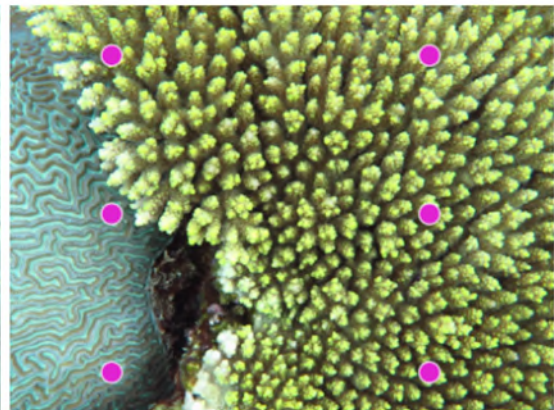
- Fixed: 5 points**
Recommended if you have a larger sampling effort



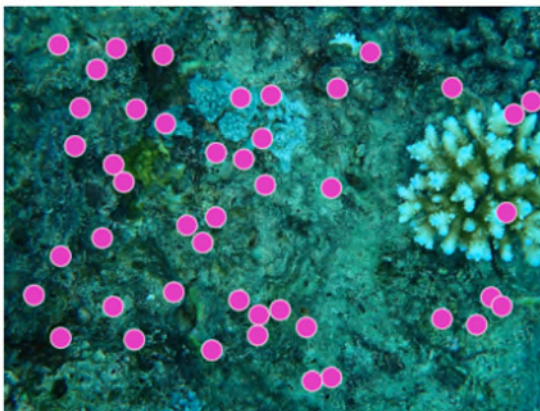
- Grid: 12 points - 4 x 3**
Recommended for most photoquadrat datasets, including BRUVs stills



- Grid: 20 points - 4 x 5**
Higher number of points per image are recommended for smaller datasets



- Line Spaced Grid: 6 points - 2 x 3**



- Random**

Finish off the Project details and save the Project.

2. Create Sites to Up-load the data to



Note that you can create the sites in Reef Cloud OR in the ReefScan desktop software but each survey needs a site to upload the images into.

1. If you want to do this in Reef Cloud then login to Reef Cloud, select the project to upload to and then select Sites from the side menu and Add Site.

Figure 45. Adding a Site in Reef Cloud

The screenshot shows the ReefCloud interface. On the left, a sidebar menu has 'Sites' highlighted with a red box. At the top right, the 'Add Site' button is highlighted with a red box. The main content area displays a table of sites with the following data:

Site Name	Reef Name	Position	Depth	Survey Count	Action
Lizard Island		-14.66, 145.46	7	2	[Icon] (926)
Aukane Raw	Aukane Raw	-10.00, 142.00	9	1	[Icon] (10)
John Brewer Reef	John Brewer	-18.63, 147.03	5	0	[Icon] (0)
Davies Reef Site 1	Davies	-19.00, 140.00	9	2	[Icon] (10)
Aukane Enhanced	Aukane Enhanced	-10.00, 142.00	9	1	[Icon] (15)
Mer	Mer	-10.00, 142.00	9	1	[Icon] (10)

2. Enter the site details including a unique site name and code, click Submit once done (note the image below does not show the entire form, scroll down on the browser to see all the fields).

Add Site

Site Name*

Site Code

Position*

Latitude *	Longitude *
<input type="text" value="-18.45675"/>	<input type="text" value="146.47563"/>

Reef

Reef Name

Reef Zone*

Reef Type

Habitat

Exposure Level

Depth*

[Cancel](#) [Submit](#)

3. Continue for all of the sites you wish to create.

9.4 Uploading Data to Reef Cloud

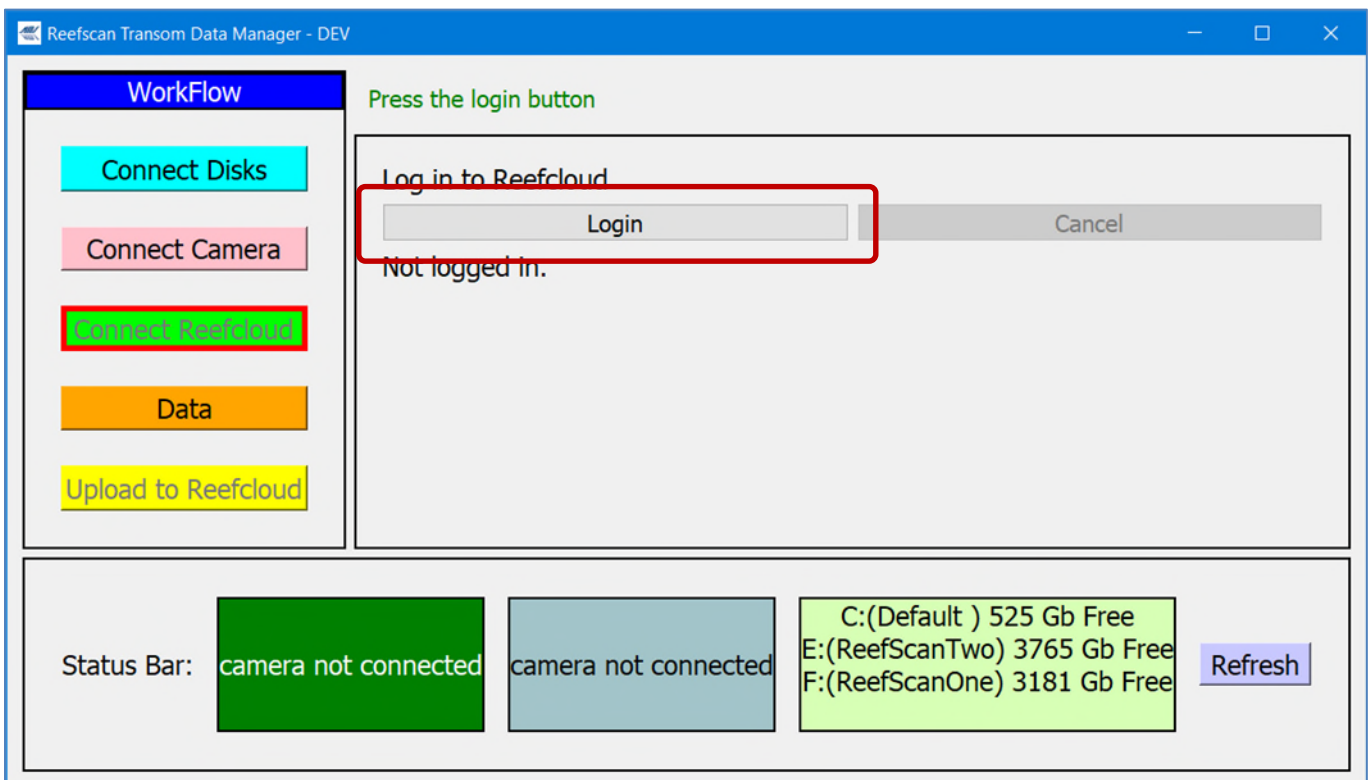
1. Start the ReefScan Desktop software, connect the external drives

Follow the previous steps to start the software (no need for the ReefScan Unit to be attached or powered on) and connect the local drives.

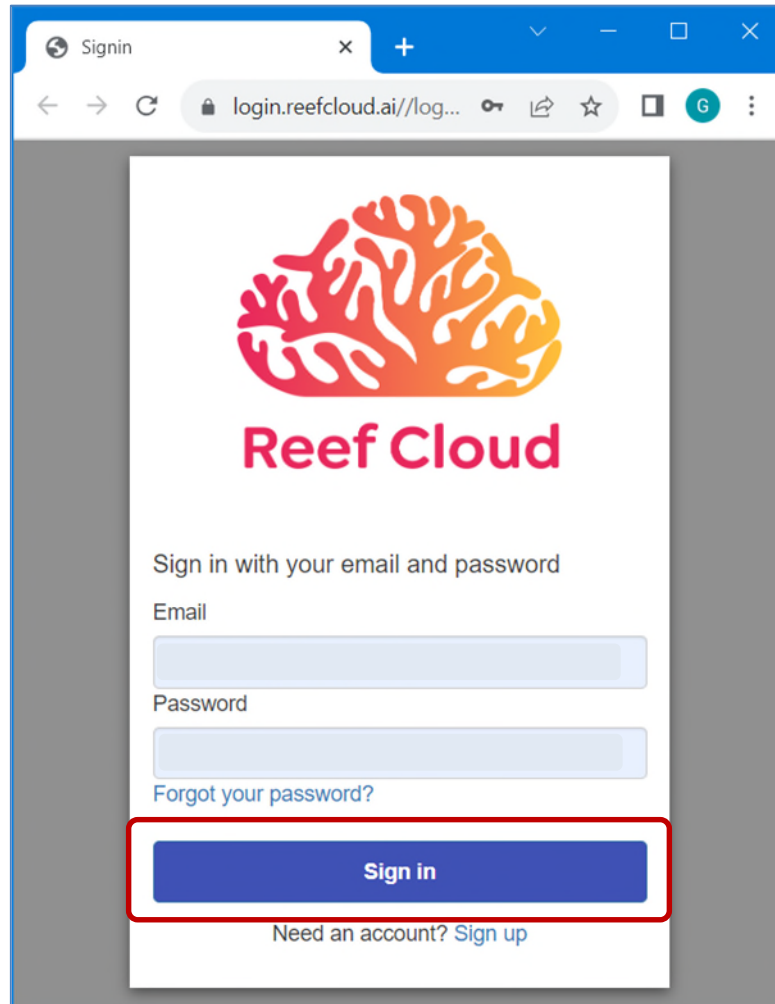
2. Use the software to log onto your ReefCloud account

1. Click on the Connect Reefcloud tab in the workflow pane
2. Click the 'Login' button

Figure 46. Logging into Reef Cloud from ReefScan Desktop



3. A browser window will pop up, enter your Reef Cloud account Username and Password



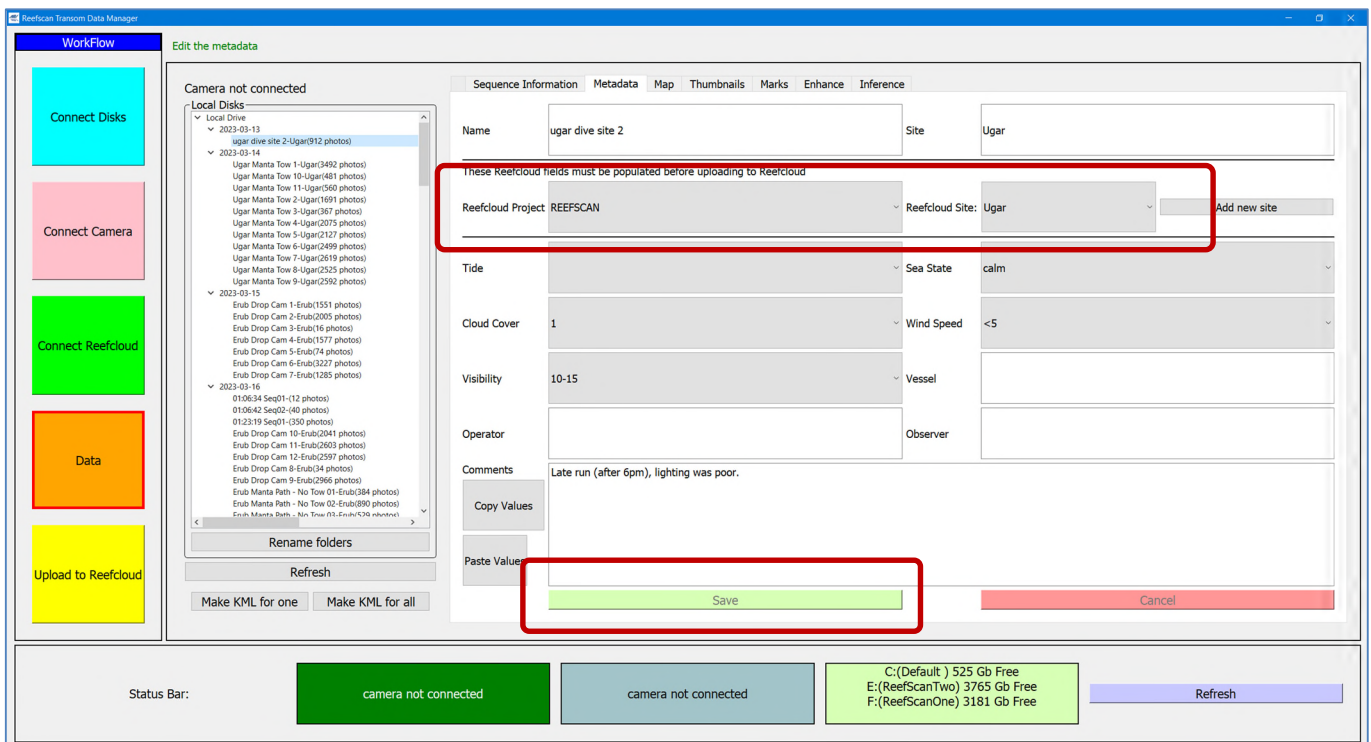
3. Link the ReefScan surveys to the Reef Cloud Project

Once you have logged into Reef Cloud then go back to the 'Data' tab on the workflow pane and for each survey or sequence edit the metadata to link the survey data to a Reef Cloud Project and Site.

To do this:

1. Select the survey / sequence in the Local Data pane
2. Using the drop down lists set the project in Reef Cloud that the data will be uploaded to
3. Then set the Site in Reef Cloud that the data should be uploaded to
4. Save the Metadata
5. Do the same for each survey that you want to upload

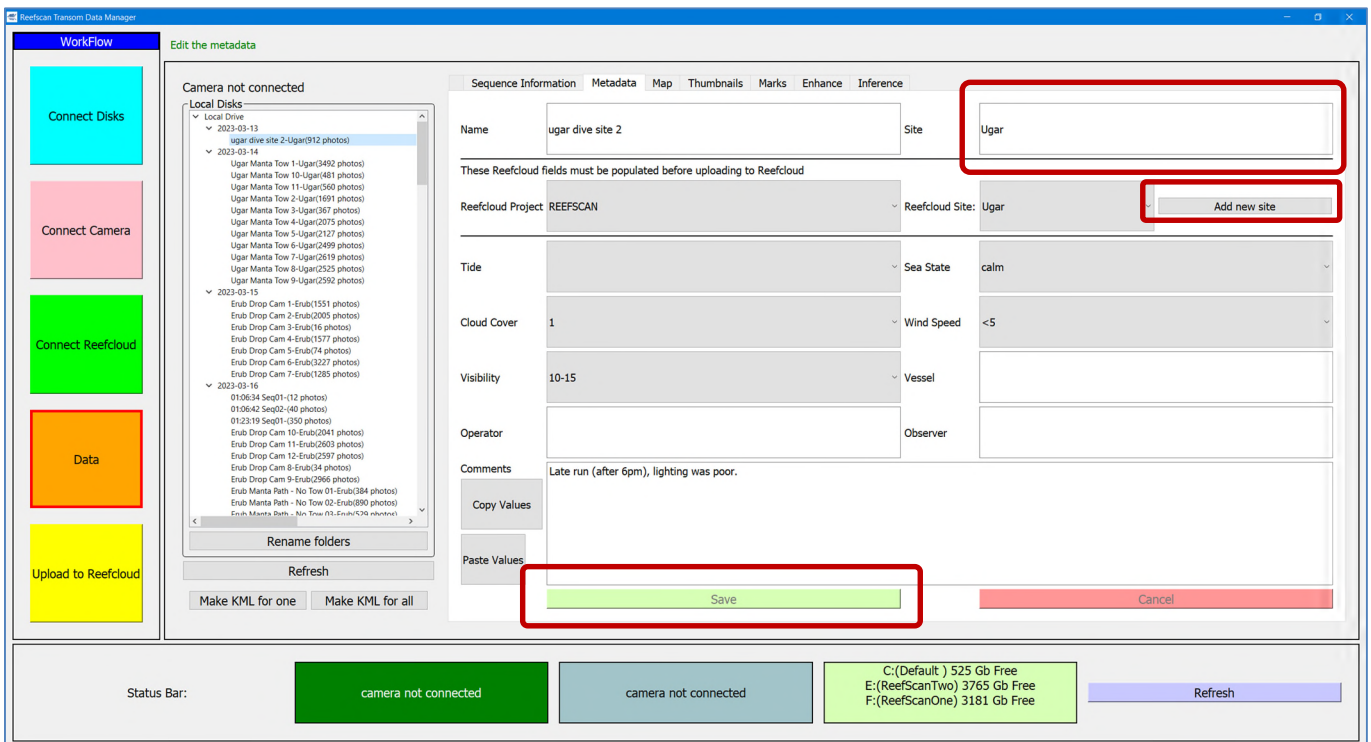
Figure 47. Linking Projects and Sites in ReefScan Desktop to Reef Cloud



If you want to use the ReefScan software to create the site in Reef Cloud to upload the data then:

1. Make sure the Site Name in the Metadata is correct, if not Edit and then Save the update. This will be the Site name once the data is uploaded.
2. Set the Reef Cloud Project using the drop down box
3. Click the 'Add New Site' button
4. Save the Metadata

Figure 48. Creating sites in Reef Cloud from within ReefScan Desktop



5. Continue with the other surveys you want to upload.



Note that if you use the same Site Name for two or more surveys or select the same site name in Reef Cloud to upload the surveys to then all of the surveys with the same site name will be uploaded into a **single Site** in Seef Cloud.

4. Upload the Surveys to Reef Cloud

Now that there is a link between the ReefScan Surveys and the Reef Cloud Project and Sites the image data from the surveys can now be uploaded.



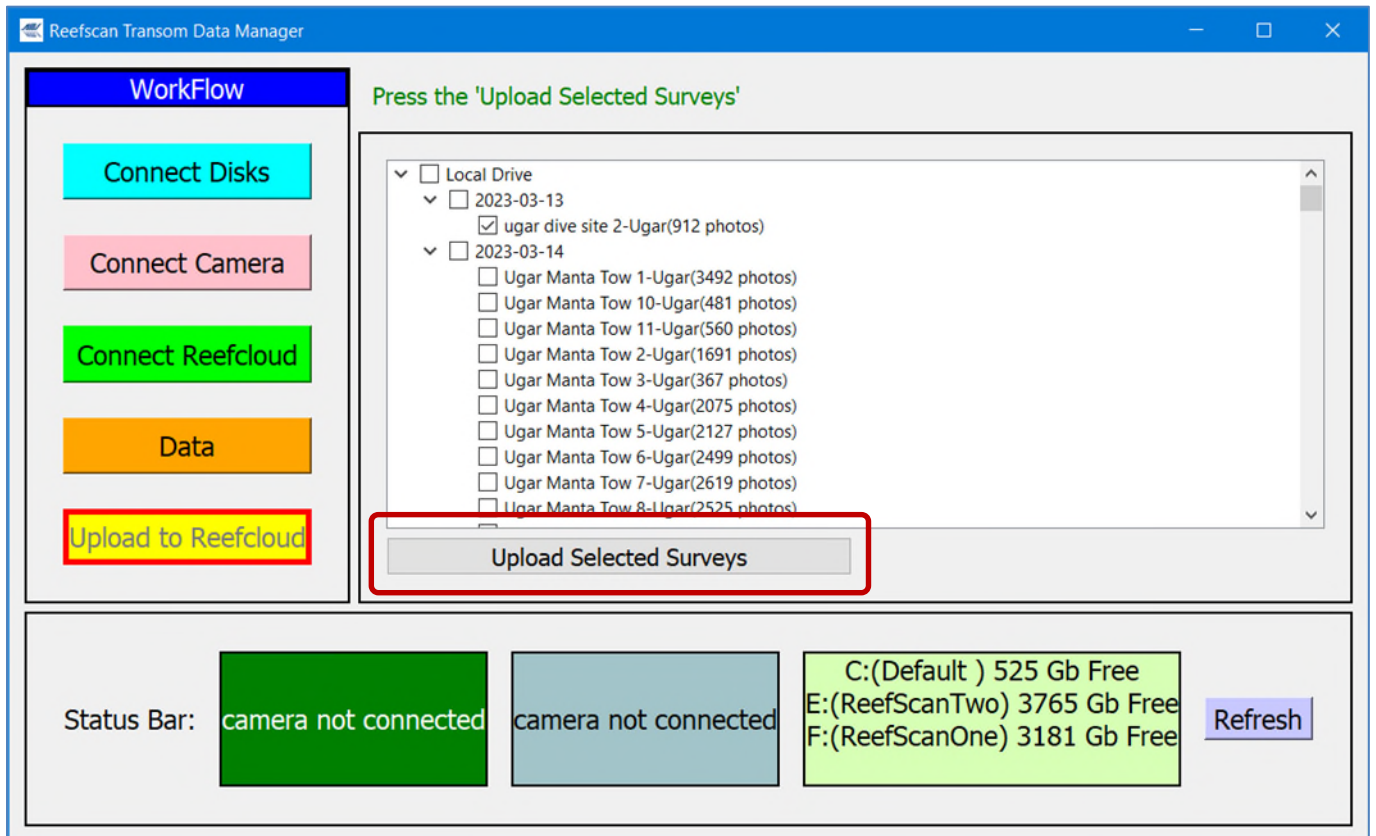
Note that you need to be connected to the Internet for the upload to occur. The speed of your connection will impact the speed of upload, so it is best to either start the upload with plenty of time or to upload from a location with a good Internet connection.

To upload do the following:

1. Click on the Upload to reef Cloud Button on the Workflow pane

2. A window will pop up, select the surveys you want to upload and then click the 'Upload Selected Surveys' and the image data will be uploaded.
3. Once completed you can view the images in your Reef Cloud account under the Project and Sites that they were uploaded to.

Figure 49. Uploading images from ReefScan Desktop to Reef Cloud



10 TROUBLE SHOOTING

Issue / Problem	Symptom	Resolution / Solution
Preparation:		
ReefScan System does not start	<ul style="list-style-type: none"> No display on the ReefScan screen No ReefScan wi-fi network visible 	<ul style="list-style-type: none"> Make sure the Unit is OFF (side-switch) and then recharge the ReefScan unit for at least FOUR hours using the provided charger Check that the side switch turns on and does not reset or flick off, this indicates an electrical fault and the system should not be used Check the unit for damage or faults See if the ReefScan wi-fi network is available (check with a mobile phone or laptop), if so the unit is starting Ok but the screen maybe damaged Take the unit into a dark area to check that the problem is not with a dull screen Contact AIMS using the reefscan@aims.gov.au e-mail address
Side Power switch will not stay in the On-Position	<ul style="list-style-type: none"> Side power switch re-sets to the off position when turned on 	<ul style="list-style-type: none"> This indicates an electrical fault, DO NOT USE the Unit, contact AIMS
Camera appears to be damaged	<ul style="list-style-type: none"> Camera dome is cracked or scratched Water or moisture in the camera 	<ul style="list-style-type: none"> If the dome is broken or there is water in the camera housing DO NOT USE the Unit, contact AIMS Note: Slight condensation in the camera housing maybe normal depending recent sudden changes in temperature, allow the unit to come to ambient temperature and re-check Note: Small scratches on the dome do not impact the use of the device, contact AIMS for a replacement dome.
Camera cowling or bottom pod is damaged	<ul style="list-style-type: none"> Cracks or other damage in the bottom pod cover / cowling 	<ul style="list-style-type: none"> While this does not impact the function of the device, a spare set of cowlings are provided, and these should be swapped for the damaged ones as soon as possible. Contact AIMS for additional spares.

Issue / Problem	Symptom	Resolution / Solution
Operation:		
GPS does not get a Lock or Position	<ul style="list-style-type: none"> • GPS indicator on the ReefScan Screen is Blue NOT Green. • GPS indicator on the Tablet is also Blue NOT Green. • Date and Time are wrong. • Latitude and Longitude have no values 	<ul style="list-style-type: none"> • Make sure you are outside and have a clear view of the sky. • Give the GPS unit some time (up to 10 minutes) to get a lock. • Make sure the ReefScan unit is vertical as possible, stand up if needed. • Check that a hand-held GPS can get a lock. • Move the unit to another location to see if GPS coverage improves. <p>If the unit still fails to get a lock then:</p> <ul style="list-style-type: none"> • Re-Boot the unit [hold both the Stop and Record buttons for six seconds, once it shuts down use the power switch to switch the unit off, wait 20 seconds, and switch the unit back on]
No image from the Camera	<ul style="list-style-type: none"> • Image is black or blank on ReefScan Unit Screen and on the Tablet 	<ul style="list-style-type: none"> • Check that the Camera Travel Cover has been removed. • Check that there is light getting to the Camera and that the camera is exposed • Check that the ReefScan unit has started normally
Tablet does not connect to the ReefScan Unit	<ul style="list-style-type: none"> • ReefScan App says 'Not Connected' 	<ul style="list-style-type: none"> • Check that the ReefScan Unit has started normally by checking the ReefScan Unit Screen • Check that the Tablet is on, has Wi-Fi enabled, and can see the ReefScan network • Manually connect to the ReefScan network if the tablet has not automatically connected • Re-start the ReefScan App
ReefScan unit does not start or does not start normally	<ul style="list-style-type: none"> • ReefScan screen does not look as it should. • No display on the ReefScan Screen 	<ul style="list-style-type: none"> • Check the side power switch is on correctly, it can get bumped, if so turn again • Recharge the ReefScan unit as the batteries maybe flat • Re-Boot the unit [hold both the Stop and Record buttons for six seconds, once it shuts down use the power switch to switch the unit off, wait 20 seconds, and switch the unit back on]

Issue / Problem	Symptom	Resolution / Solution
Images are dull or blurry	<ul style="list-style-type: none"> • Images on the ReefScan Screen or ReefScan Tablet are dull • Images on the ReefScan Screen or ReefScan Tablet are blurry 	<ul style="list-style-type: none"> • Make sure the Travel Cover has been removed • Check that the camera dome is clean and you can see the camera lens through the camera dome • Check that you are not too deep, if possible move shallower • Check the water clarity – can you see the bottom from the vessel, if not then unless you can go shallower or to a place with better water quality the survey will not produce good results • Check that there is not just sand or rubble under the camera, move to a better place.
Data Download:		
Computer cannot connect to the ReefScan Unit	<ul style="list-style-type: none"> • ReefScan Desktop software says the camera is not connected when you try and connect 	<ul style="list-style-type: none"> • Check that the computer and ReefScan Unit are connected with a network cable • Try another cable or test the cable used • Check the connections into the computer and the ReefScan Unit • Re-start the computer and ReefScan in the correct order: <ul style="list-style-type: none"> -> Turn everything off (computer and the ReefScan Unit) -> connect computer to ReefScan with the network cable -> turn the computer on, wait for it to boot up and log on -> Turn the ReefScan Unit on using the side switch, wait for it to start -> Start the ReefScan Desktop software -> Try connecting again.
ReefScan Unit memory is full	<ul style="list-style-type: none"> • ReefScan Desktop software indicates the internal memory is full • Unit will not record any new images 	<ul style="list-style-type: none"> • Use the ReefScan Desktop software to delete the data off the ReefScan Unit
Cannot download the ReefScan data	<ul style="list-style-type: none"> • ReefScan Desktop software connects to the camera Ok but there are no sequences to download 	<ul style="list-style-type: none"> • Check that the sequences have not already been downloaded: <ul style="list-style-type: none"> -> Start the ReefScan Desktop Software -> Connect to the camera (see Section 8.4) -> Click on the Data Tab in the workflow pane -> Tick the box to show already downloaded sequences -> Select and download the sequences



11 RISK-ASSESSMENT

The following Risk Assessment is provided as a guide only and is not comprehensive so should not be relied upon. This is provided as a guide and should be incorporated into existing risk and safety systems. AIMS takes no responsibility for any omissions or errors in this Risk Assessment.

Risk	Risk Type	Likelihood	Impact	Mitigation	Residual Risk
ReefScan unit strikes the bottom or an obstacle	Equipment Damage	Possible	<ul style="list-style-type: none"> Damage to the ReefScan Unit Damage to the environment 	<ul style="list-style-type: none"> Operator to watch depth and clearance Use of kick-up bracket Operate at recommended speed and in recommended depths Use of an Observer to monitor use 	Medium
ReefScan unit strikes the bottom or an obstacle	Safety	Possible	<ul style="list-style-type: none"> Unsettling of the boat Boat overturns Drowning / Death 	<ul style="list-style-type: none"> Operator to watch depth and clearance Use of kick-up bracket Operate at recommended speed Use of approved PPE including life jackets Use in appropriate weather and sea conditions 	Medium
ReefScan bracket interferes with motor or vessel operation	Safety	Possible	<ul style="list-style-type: none"> Bracket stops motor moving through normal movement Reduced sea worthiness Boat unstable Person overboard, drowning 	<ul style="list-style-type: none"> Check bracket before use Only use in safe conditions Test in controlled conditions before use Experienced vessel operators 	Medium
ReefScan unit comes off the bracket	Equipment Loss	Unlikely	<ul style="list-style-type: none"> Loss of equipment 	<ul style="list-style-type: none"> Use of safety strap Operator to check bracket before use Use of an Observer to monitor use Operate at recommended speed Use in good weather and sea conditions 	Low

Pinch points when deploying and receiving unit	Personal injury	Possible	<ul style="list-style-type: none"> • Injury to fingers and hands • Loss of digit 	<ul style="list-style-type: none"> • Only install and remove in good conditions • Use of gloves where required • Use of two people with one person stabilising the unit 	Low
Battery fire when recharging Unit	Equipment Damage Safety	Unlikely	<ul style="list-style-type: none"> • Damage to ReefScan • Damage to other equipment • Burns, injury 	<ul style="list-style-type: none"> • Only use provided charger to recharge • Recharge in an open, dry, area away from combustibles • Appropriate fire extinguishers available • Always monitor equipment when being recharged 	Low
Work in a small vessel	Safety	Possible	<ul style="list-style-type: none"> • Capsize • Person overboard • Drowning / Death 	<ul style="list-style-type: none"> • Use appropriately sized vessel • Use of PPE including life jackets • Use in good weather and sea conditions • Use experienced operators 	Medium
Manual Handling	Safety	Possible	<ul style="list-style-type: none"> • Strains • Minor injuries 	<ul style="list-style-type: none"> • Two person lifts where possible • Use in good weather and sea conditions • Use lifting devise such as trollies 	Low

Risk Matrix:

			Consequence					
	Frequency (Continuous Exposure)	Probability (Single Activity)	Likelihood	Negligible	Minor	Moderate	Major	Severe
LIKELIHOOD	Very high probability of occurrence, could occur several times during the coming year/project	>1 in 10	Almost Certain	Medium	Medium	High	Extreme	Extreme
	Likely to occur less often than once per year but more often than once in five years/within the life of a specific project.	1 in 10-100	Likely	Low	Medium	High	High	Extreme
	Possible, likely to occur less than once in five years but is expected to occur at least once over the expected life of the asset (30 years)	1 in 100-1,000	Possible	Low	Low	Medium	High	High
	Plausible, unlikely, frequency of failure of less than once in 30 years but more than once in 100 years	1 in 1,000-10,000	Unlikely	Low	Low	Low	Medium	High
	Very low likelihood, but not impossible, frequency is expected to be less than once in 100 years	1 in 10,000-100,000	Rare	Low	Low	Low	Medium	Medium

12 MAINTENANCE GUIDE

Regular inspections and general maintenance at intervals are required to ensure the ReefScan is safe and fit for purpose. If maintenance support or spare parts are required, contact AIMS.

12.1 General Equipment Inspection:

Prior to departure on a field trip, complete the Pre-Field Trip Test in Section-13 to ensure the system is fully functional.

Prior to starting your survey, inspect the unit for damage or deformation.

- Top pod:
 - Check for cracks or warping in the plastic.
 - Inspect the seals.
 - Check all fasteners are in place.
 - Inspect for signs of water ingress.
 - Inspect the data and charging ports for signs of rust, ensure the covers are secured.
- Pole:
 - Check the pole for signs of bending or cracking.
 - Check all fasteners are in place.
 - Check for signs of rust.
- Bottom pod:
 - Inspect the camera for signs of water ingress or damage to the dome.
 - Check the Ping Sonar is secure.
 - Check the shroud is secure, all fasteners are in place and there are no signs of damage.
 - Check for signs of rust.

In the event that there are signs of damage to the shroud, it is recommended that the shroud is replaced prior to use to ensure the camera is protected.

If a fastener is loose or missing, the user can tighten or replace it as required. All fasteners are secured to HAND TIGHT only. Take care when changing fasteners on plastic surfaces to reduce the likelihood of damaging the plastic. If a fastener was missing from the top pod, check all seals thoroughly and check for signs of water ingress prior to use.

If there are any signs of water ingress, damage to the top pod or deformation in the pole are identified, do not use the system, and return to AIMS for maintenance.

12.2. AIMS Maintenance:

The ReefScan requires regular maintenance by AIMS to update software and ensure the system is operating safely and effectively. It is recommended the ReefScan is returned to AIMS every two (2) years or every 1000 hours of operation (whichever comes first).

12.3 Damage Caused by Extenuating Circumstances

High Speed Impact:

The ReefScan Pole unit is designed for use at a recommended speed of 2-3 knots. While it is safe to operate up to 4 knots, any impact on the camera above the recommended survey speed of 3 knots may cause damage to the pole. If the ReefScan experiences an impact above 3 knots, return the unit to AIMS for maintenance as the pole may need to be replaced.

Overheating:

The screen on the ReefScan can display a fault if exposed to high temperatures. If the screen starts to turn black (this will typically start from one corner), turn off the ReefScan and cover the top box and transport it to a cool location away from direct sunlight. Allow the system to return to room temperature and turn on to confirm the fault has disappeared. Contact AIMS if overheating faults have occurred, please provide details including the length of time the survey was run for, the temperature and cloud cover at the time of the survey to assist with troubleshooting.

12.4 Transom Mounted Brackets:

The ReefScan Transom Clamp Bracket includes a spring-loaded mechanism. Inspect the spring and t-pin regularly for signs of wear or damage and replace parts as required.

It is recommended that the spring is inspected regularly, looking for signs of wear such as:

- The spring is broken, cracked, or deformed,
- It has not returned to its original length,
- There is rust on the spring, or
- The quick release is kicking up at normal operating speeds.

Replace the spring prior to use if any of the above has occurred.

Bracket Maintenance:

Always wash the bracket with fresh water after use to prevent corrosion.

Inspect the pole clamps regularly for signs of rust or deformation, particularly the pins and fasteners. Replace the pins and fasteners with Stainless Steel parts if signs of rust occur.

If the ReefScan experiences an impact above 3 knots and the quick release has failed (the ReefScan unit did not kick up), remove the bracket and inspect it, particularly focusing on the t-pin. If there are any signs of damage, do not use the bracket. Replace parts as required.

Warnings:

The ReefScan mounting bracket includes a spring-loaded quick release which can swing. Take care when using this bracket not to pinch your hands or fingers. Only swing the bracket into place using the handle. Keep the area directly in front of the ReefScan mounting bracket free in case the ReefScan kicks up unexpectedly.

Do not sit directly in front of the ReefScan bracket while surveying to protect the user in case the quick release kicks up during operation.

13 REEFSCAN PRE-FIELD TRIP CHECK-LIST

Print the following three pages as a check list to test the operation and use of the ReefScan Unit **before** going into the field. This guide can also be used to trouble-shoot the unit.

ReefScan Pre-Field Trip Test

It is recommended these tests are conducted prior to departing on the field trip to ensure the ReefScan is fully functional and all required equipment is prepared.

Trip:		Checked by:
Date:		

Item	Test	Process and Criteria	Pass/ Fail	Comments
1	Electrical / Software Tests			
1.1	Power on ReefScan Unit	Start-up procedure for Rudi NX is visible on the screen and completed.		
1.2	ReefScan Program Startup	ReefScan program screen is displayed.		
1.3	Camera Image	With the cover removed, the current camera image is displayed		
1.4	Depth and Pressure sensor function	Depth and altitude are visible on the screen and show a value. Fail if the value is -0.1 m.		
1.5	GPS	If the ReefScan is outside or has access to a GPS connection, the GPS fix notification is Green.		
1.6	Date and Time	Once a GPS fix is achieved, the date and time displayed is correct to the current date and time.		
1.7	Button Function	1. Press Record button, confirm recording sequence begins by checking the sequence number is changing. 2. Press Stop button, confirm recording sequence stops by checking the sequence number has stopped changing. 3. Press Sequence, check the sequence number has changed to the next integer.		
1.8	App function	Confirm the app has connected to the ReefScan and is showing the current image and data as per the ReefScan Unit.		

1.9	App Buttons Function	<p>1. Press Record button, confirm recording sequence begins by checking the sequence number is changing on the app and ReefScan unit.</p> <p>2. Press Sequence, check the sequence number has changed to the next integer on both the app and ReefScan Unit.</p> <p>3. Press Stop button, confirm recording sequence stops by checking the sequence number has stopped changing on both the app and ReefScan Unit.</p> <p>4. Edit metadata, change the survey name and save. Confirm the survey name has updated on the main screen.</p>		
1.10	Power off ReefScan Unit	After holding down the Stop and Record buttons for 5 seconds, the ReefScan begins the power off sequence.		
1.11	Battery Charge Test	Connect battery charger to the ReefScan. Confirm the charger has tested the battery and is displaying the correct voltage (full charge is 14.2 V).		
1.12	Data Port	Connect data cable to ReefScan Top box and computer. Confirm you are able to connect to the ReefScan Software.		

2	General Checks			
2.1	Fasteners	Inspect the ReefScan Unit and mounting brackets, confirm all fasteners are fitted and secure.		
2.2	Leaks or damage	Inspect the top pod and the camera dome, check for signs of water leaks.		
2.3	Prior Damage or Rust	Inspect the ReefScan unit and mounting brackets, check for signs of damage or rust.		
2.4	Protective Covers	Confirm camera cover and sunshade are fitted. Check Data port and charging port covers are fitted.		
2.5	Equipment	<p>Check the following Equipment is packed:</p> <ul style="list-style-type: none"> - ReefScan Pole Unit - ReefScan Charger - ReefScan Data Download Cable - Data Storage Devices - Computer with ReefScan Software - ReefScan Tablet in Case - ReefScan Tablet Charger - Mounting Brackets - Safety Strap 		

14 FIELD QUICK-START GUIDE

Print the following two pages as a single double-sided sheet, laminate and take into the field.

ReefScan Transom - Field Quick-Start Guide

Note for full details see the ReefScan Transom Standard Operational Procedure (SOP)

V1.06 February 2024

1. Preparation (before the survey):

1. Make sure the tablet and the ReefScan unit are fully charged.
2. Make sure there is enough free memory for the survey images (need at least 500GB)
3. Make sure the ReefScan Bracket is installed on the boat, check that it is secure.
4. Lay the ReefScan unit in the vessel, lay on side with the power switch upwards, cover with a wet towel if hot or sunny, transit vessel to the survey location.

2. Install the Unit (in the field when ready to do a survey):

1. Bring the vessel to a stop in a safe location and put the motor in neutral.
2. Make sure the bracket is in the Travel Position.
3. Remove the Camera Travel Cover, stow securely.
4. Using two people, one to support the top and the other to support the pole, put the unit in the bracket and tighten the bracket. Make sure it is secure.
5. Attach the safety strap to secure the unit to the bracket.
6. Check that the unit is secure and does not interfere with the motor and steering.
7. Slowly move to the start of the survey area.

3. Do the Survey:

1. Move the ReefScan to the Survey Position (vertical), check that the unit is locked in and secured.
2. Check that the pole is vertical, and the camera is underwater – best depth is around 60-80cm below the surface.
3. Turn on the ReefScan unit using the side Power Switch.
4. Wait for the unit to start, this will take 2 minutes, when started, you should see images from the camera on the ReefScan screen.
5. Check that the GPS has a lock, the GPS light will change from Blue to Green, if not then wait for the unit to get a GPS lock (can take a few minutes in a new location).
6. Start the Tablet and start the ReefScan App, make sure you can connect to the ReefScan Unit.
7. Move to the start of the survey, stop and check the images from the camera using the screen on the ReefScan unit or on the Tablet.
8. If there is no image check that the camera Travel Cover has been removed!
9. When ready press the 'Record' button on the ReefScan or on the Tablet App.
10. Start the survey, use a hand-held GPS to navigate from a start to end way-point or as required.

The best speed is 2-3 knots, the best depth is 3-8m deep, see the screen or the App to see the current speed in knots, the water depth in metres and the clearance between the camera and the bottom in metres.

DO NOT SURVEY FASTER THAN 4 KNOTS OR SHALLOWER THAN 2 METRES

11. Use the Tablet App to **enter information about the survey** (metadata) including:
 - A name for the survey
 - The Wind Speed in knots
 - The Sea Condition
 - The Tide State
 - The Cloud Cover as octas (0 = sunny no clouds, 8 = overcast total cloud cover)
 - The Water Visibility as an estimate of the depth of water you can see through.
12. Use the '**Mark**' Button on the App or ReefScan Unit to mark points of interest.
13. If you want to create a new survey without stopping, then just press the '**New Sequence**' button, the system will create a new folder and identifier for the next set of images.
14. Once the survey is complete, or you want to pause the survey, press the '**Stop**' button to stop recording.
15. To continue with the current survey, press the '**Record**' button on the ReefScan Unit or the App.
16. To do a new survey at a new location: press the '**Stop**' button to stop recording, raise the ReefScan Unit to the **Travel Position** so you can travel faster, move to the new location and ensure the vessel comes to a **STOP with the motor in neutral**. Lower the Unit to the **Survey Position** and check it is secure. Press '**New Sequence**' to create a new survey and press '**Record**' to start recording the survey.

4. After the Survey:

1. Bring the boat to a stop and make sure it is in a safe location.
2. Make sure the **motor is in neutral** and the **vessel is safe**.
3. **Press and hold both** the '**Record**' and '**Stop**' buttons for **six seconds** to shut down the system.
4. Once the screen is blank [no-signal], power the unit off by moving the power switch to **Off**.
5. Shut down the tablet and stow safely.
6. Use the bracket to move the ReefScan Unit to the **Travel Position**.
7. Using two people, remove the safety strap and while one person supports the top of the unit the other undoes the clamp enough for the clamp to release.
8. Remove the ReefScan Unit and lay it on the floor of the vessel or in another safe place, if exposed to the sun or heat cover the top of the ReefScan Unit with a wet towel.
9. Make sure the bracket is tightened and secure.
10. Replace the **Camera Travel Cover** to protect the camera.

5. Cleaning and Storage:

1. Once back on land remove the ReefScan Unit (but NOT the bracket) and lay it down on its side on a protective mat, power switch upwards, near a fresh-water hose.
2. Remove the **Camera Travel Cover** and hose the camera and sensor with fresh water.
3. Lightly wash the rest of the unit with fresh water making sure not to put too much water near the screen, buttons and charging / data ports.
4. Let the unit dry, preferably in the shade or out of the direct sun.
5. Replace the **Camera Travel Cover**.
6. **Download the data and re-charge the unit** as per the Standard Operating Procedure (SOP).
7. Store in a controlled environment, preferably horizontal, inside, and air conditioned.