

Neptune Navigator



User Manual

Underwater Camera Team 1

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1 Introduction

The information in this document will instruct the user on how to power, use, terminate, and troubleshoot the underwater camera system. This system will provide users the ability to safely navigate through debris-filled waters in order to assess any structural damages seen below water and see what is happening in real-time. The 2 portions of the system include the water resistant camera box that will be attached to an E.M.I.L.Y. Rescue Robot or mounted on a bridge, and the controller that will be operated by the user from a distance.

2 Getting Started

This section explains how to turn on both ends of the system

2.1 Startup Camera System

2.1.1 Powering on Camera System

In order to start up the camera system we have two source connections that must be made. The first connection is for the Raspberry Pi battery pack (Figure 1). For this power supply, the switch must be flipped on, and the white USB connector must be plugged into the battery pack. This will supply power to the Raspberry Pi, camera display, and the LoRa module.



(Figure 1: Battery Pack Switch for RaspberryPi)

The second connection that is made will power: the motor, First Person View Transmitter (FPV), and the fish camera (Figure 2). In order to power this subsystem the white alligator clip must connect to the black terminal and the red alligator clip onto the red terminal of the 12 V battery.



(Figure 2: 12V Battery's Terminal Connection)

2.1.2 Waiting for Controller Connection and Response

Once the camera system has been powered on, the Raspberry Pi will boot up and begin its starting script. While the system is starting up, you may see the fish camera light up as well as the camera display. Once the script has started, the LoRa setup confirmation sequence will begin.

This setup is incredibly important in order to confirm that the LoRa module is working properly, and you will be able to see on the display the LoRa setup responses being confirmed (Figure 3).



(Figure 3: Display Showing LoRa Connection Responses)

Once the system confirms that the LoRa is successfully connected, the system will move into the waiting phase. Here, the display will show the text “Connecting...”, and continuously wait for Controller’s LoRa to ping a “CONNECT” response (Figure 4).



(Figure 4: System Waiting for Connection)

After the controller is set up and successfully connects to the camera system, the camera display will show “Connected” (Figure 5).



(Figure 5: System Connected)

Then the camera system will move into the Command phase, and will be ready for commands to be sent (Figure 6).

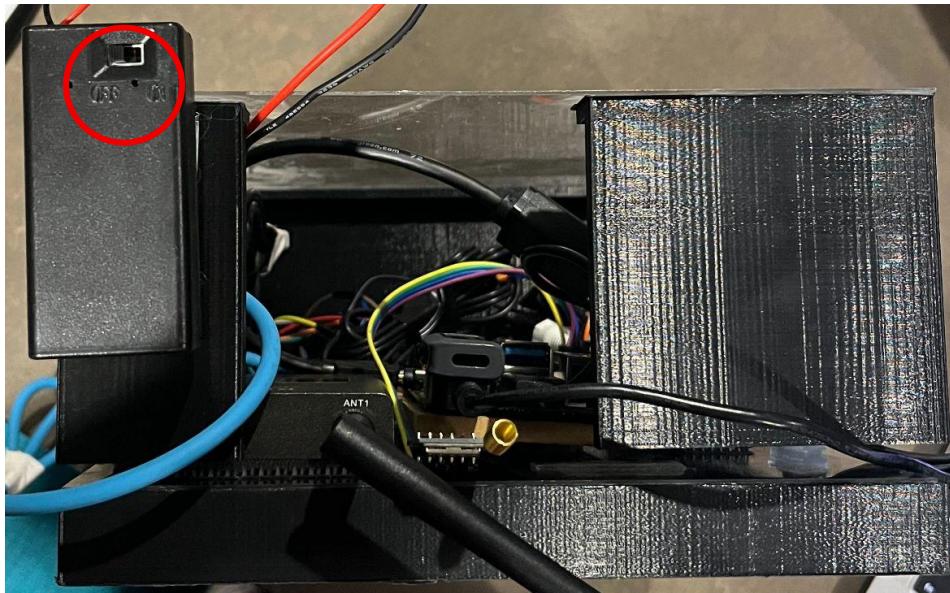


(Figure 6: System Waiting for Commands)

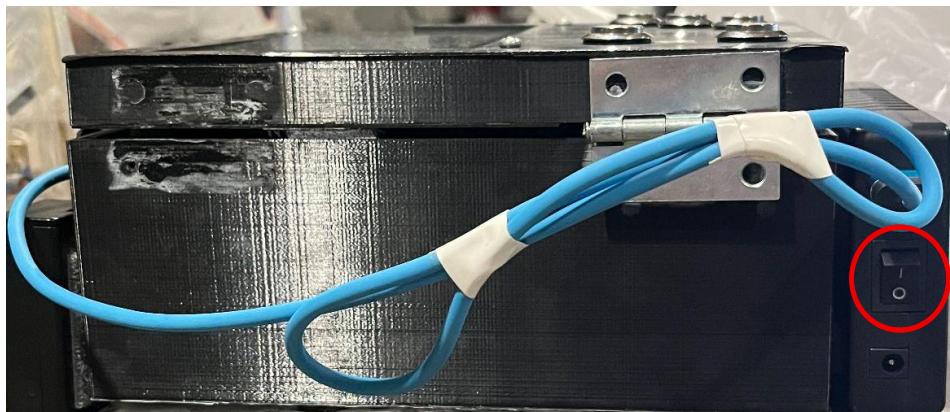
2.2 Startup Controller

2.2.1 Powering on Controller and FPV

In order to start up the controller, the user must flip 2 switches to power on the FPV receiver and portable battery pack that delivers power to the raspberry pi. The FPV switch is located on the top of the controller while the switch for the battery pack is located on the bottom of the controller.

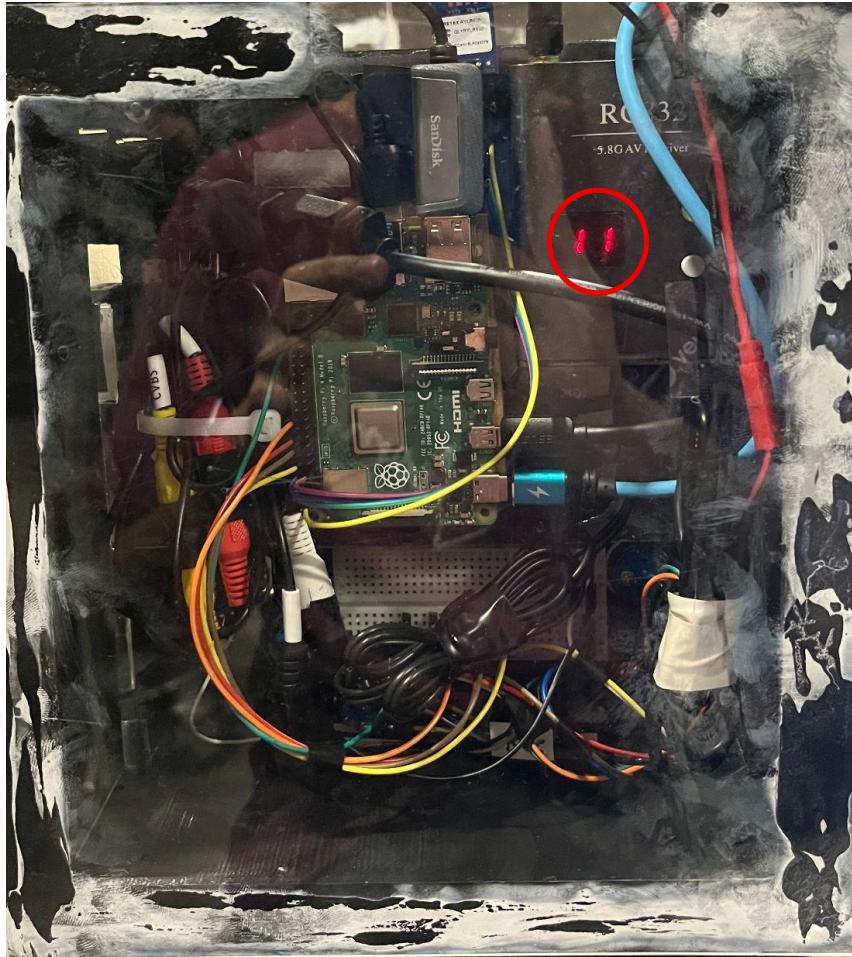


(Figure 7: Switch for FPV receiver)



(Figure 8: Switch for controller battery)

The user can verify if the FPV receiver is powered on correctly, by either opening the controller case or looking through the acrylic see-through back and observe that the FPV receiver has red lights indicating the specified channel/frequency.



(Figure 9: FPV successfully powered on)

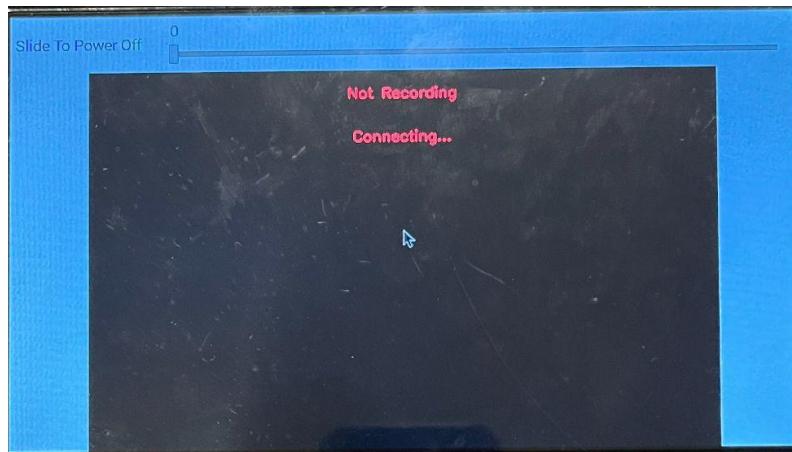
The user can verify if the controller has been powered on successfully by seeing that the display screen flickers on and then continues with the initial startup procedure.



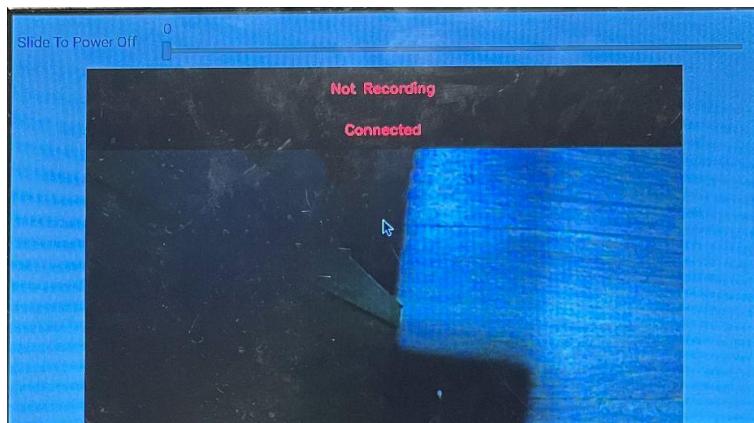
(Figure 10: Initial bootup displayed on the controller's screen)

2.2.2 Waiting for Camera Connection and Response

After both the power switch on the controller's portable battery is flipped on, the controller will proceed with initial bootup procedures that can be monitored as the controller's display will turn on. The user will be presented with a black screen initially, with red text displayed at the top of the screen that updates the user on the connection status with the camera system. While the user waits for the controller to establish a proper connection, the text at the top will display the word "Connecting" and will update to "Connected" once the controller successfully connects to the camera system.



(Figure 11: Controller attempting to establish connection with camera system)



(Figure 12: Controller has successfully connected to camera system)

3 User Interface

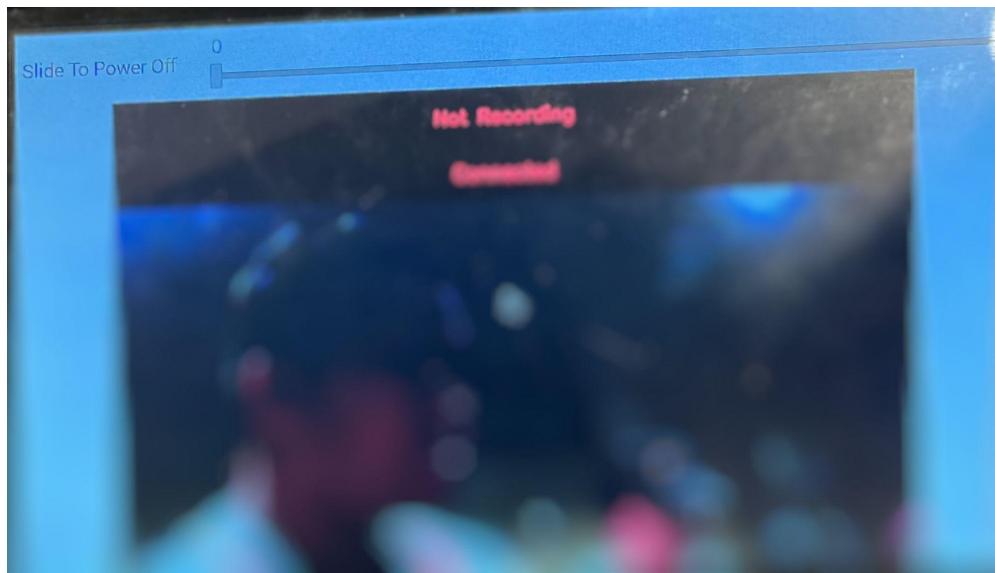
This section will walk you through what both ends of our system look like and where to look for important information.

3.1 Camera Response Display

On the Camera System there is a text display at the top of the rig that will show different messages to allow you to see what is going on with the system. During the initialization phase it will show messages such as setting up LoRa and information regarding the LoRa's configuration. From there it will display a message that says connecting. From there we will move into the active use phase, in which immediately after a connection with the controller is made the display will display a message letting the user know the connection was successful. From there, anytime a command is sent from the controller to the camera system, the action corresponding to the command will be shown on the display. For example, if the controller pushes the move up button the display will show text letting the user know the camera has moved up. This text will also only be displayed once the system has processed the command, allowing the user to know that the command has been successfully completed.

3.2 Controller Display

The display on the controller is a LED display that will show the user a lot of important information regarding our system, but the most important thing you will see on here is the live feed from the camera. At the top of the screen, you will first see a slider that lets you power off the system.



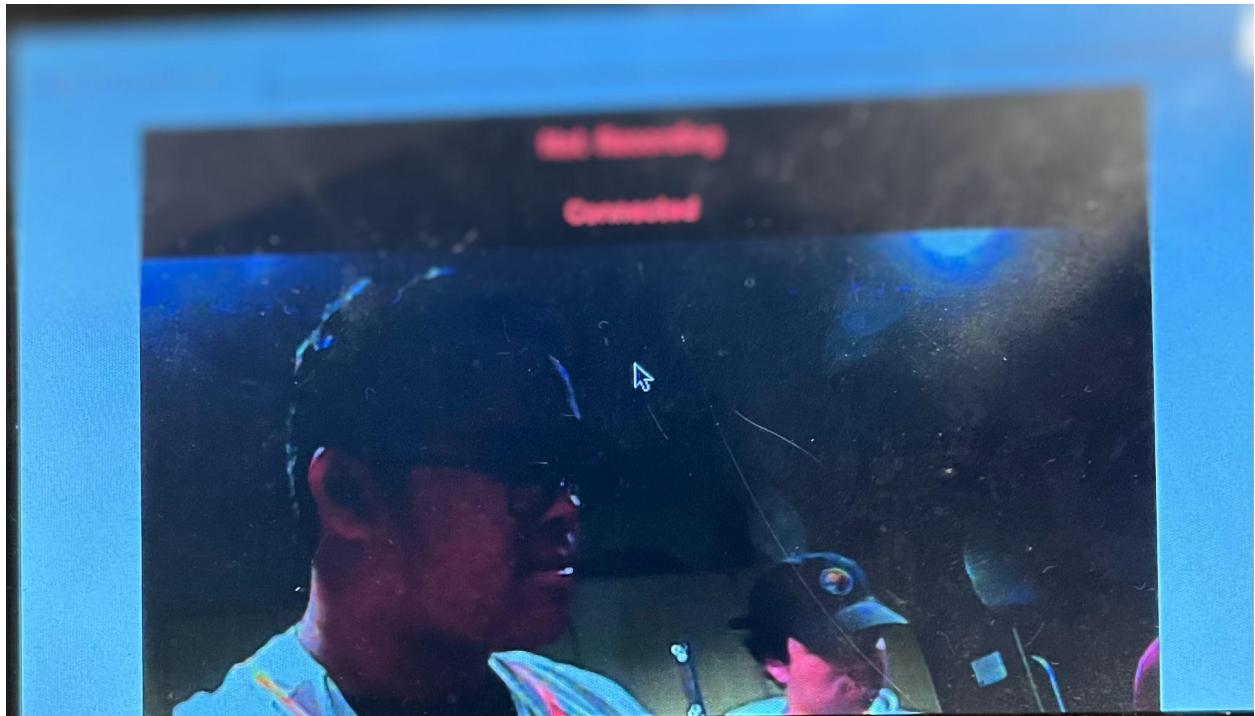
(Figure 13: Termination Slider)

From there, you will see two sections of text where we will be displaying important messages regarding our system. In the first section it will either say recording or not recording, depending on if the user has hit the recording button yet or not. In the next section you will see all other messages related to our device. During the initialization phase, this section will keep saying connecting until a connection is made. Once the connection is made, this section will change to saying connected. Once the connection has been made and we move onto the active use phase, this section will display either a confirmation or failure message to whatever command the user sends to the camera system. If the camera system is able to perform the command, the display at the top will confirm the command was completed, otherwise it will give you an error message and ask you to try again.



(Figure 14: Text Display)

In the third section of our display you will see the live feed from the camera. Here you will be able to see whatever the camera is pointed at and will be able to use it to get a better understanding of what is occurring under the water. You will also be able to see exactly what you are making recordings of and/or taking screenshots of.



(Figure 15: Live Feed on UI highlighted)

3.3 Controller Buttons

The following section will give a brief overview of all the buttons on our controller and their corresponding functionality

3.3.1 Up Button

When this button is pressed, it will send a command to the Camera System to pull the camera up and out of the water.

3.3.2 Down Button

When this button is pressed, it will send a command to the Camera System to lower the camera into the water.

3.3.3 Light Button

This button will allow you to toggle the light on the camera. The camera's light has 4 modes: Off, Only Light, Light and IR, and Only IR. These different modes allow the user to choose whichever light mode helps them see the best in their current environment. Everytime the button is pressed, it will toggle through these different modes. To get to a certain one, you will just keep pressing it until you get the desired look.

3.3.4 Screenshot Button

This button will allow the user to take screenshots and save them to a USB device that will be plugged into the controller. It will take a screenshot everytime the button is pressed.

3.3.5 Recording Button

This button will allow the user to start/stop recordings and save them to a USB device that will be plugged into the controller. Pressing the button once will start the recording and pressing it again will stop it. Immediately after the recording is stopped, it will be saved to the USB device.



(Figure 16: Picture of Buttons)

4 Termination

4.1 Power off Camera System

- Power off Rasp
- Power off the rest of the System

When powering off the camera system, the operator will remove the lid and turn off the portable battery that connects to the raspberry pi. To stop all power to the system and completely shut off the entire system, they will need to remove the clamps on the 12V battery in the middle. Once these steps are done, the entire system is terminated.

4.2 Power off Controller

- Power off FPV
- Power off the rest of the Controller

When shutting down the custom controller, the operator will need to utilize the touchscreen display and slide the bar across the top of the screen.

This will safely eject the flash drive so that no data is corrupted and turn off the raspberry pi. To cut all power to the system, the operator will flip the switch off on top of the controller where the 9V batteries

are. Then also flip the portable battery off at the bottom of the controller as well. After these steps are all complete the system is completely terminated and the flash drive can be safely taken out.



(Figure 17: Picture of Termination Slider)

4.3 File Retrieval

Once the custom controller's slide bar has been used to shut down the system, the operator can safely extract the flash drive. Once they extract it, they will need to plug it into a computer and navigate to the flash drive folder. In the folder they will find a VIDEOS and IMAGES folder that will contain all the recordings and screenshots taken during their expedition.

5 Maintenance

5.1 Camera/Motor/FPV Battery in camera rig

The camera, motor, and FPV in the camera system is powered by a 12V battery, which will be drained as the system runs. This battery will have to be charged periodically in order to keep the system powered. In order to do this, an AC wall adapter can be used as shown in figure 18 in order to recharge the system.



(Figure 18: Picture of 12V battery being charged)

5.2 Portable Battery Pack on camera rig and controller

Both the camera rig and controller use a portable battery pack. Both components use the pack to power the raspberry pi that is associated with them. In order to ensure that the systems work properly, the operator should make sure that both batteries are fully charged before attempting to use the system.

5.3 FPV battery on controller

The controller uses a 9V battery to power the FPV receiver which will be drained as the system is used. In order to ensure that the controller can receive video to be displayed, be sure to switch out the 9V battery before any session.