User manual for the UKCEH Autonomous Monitoring of Insects (AMI) System

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UK Centre for Ecology & Hydrology

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1. Safety Information

Warnings in this manual or on the instrument must be observed during all phases of service, repair, installation and operation of the instrument. Failure to comply with these precautions violates the safety standards of design and the intended use of the instrument. UKCEH assumes no liability for the customer's failure to comply with these requirements.

Unit Tested to:

- Safety testing of Autonomous Camera System to the requirements of IEC 62368-1:2018, including pdf test report. Includes CENELEC UK/EU Deviations, EN 62368-1:2020+A11:2020

- Ingress Protection testing of Autonomous Camera System to the IP65 requirements of EN 60529:1992 +A2:2013*

- Provision to include USA/CAN deviations, CSA/UL 62368-1:2019*

- Provision to include AS/NZS deviations, AS/NZS 62368.1:2022*

- IECEE CB Certification

The following safety symbols are used in the manual or on the instrument to highlight where certain hazards arise. Warnings are given where failure to observe the given instruction could result in injury / death to persons or damage to the equipment.

Symbol	Description
	Warning: this symbol indicates hazardous voltage may be present
	Warning: this is a general warning symbol, indicating that there is a potential health or safety hazard.
	Warning: This symbol indicates that fragile glass hazard may be present.

	Warning: this symbol indicates that electrical hazard may be present.
	Warning: this symbol indicates that crushing hazard from moving parts may be present.
	Warning: this symbol indicates that Ultraviolet (UV) light hazard may be present.
	Warning: this symbol indicates that hot surfaces may be present.
	Warning: UN3481, the package contains a lithium ion 18650 battery within the watchdog system. UN3480, a standalone lithium ion 18650 battery can be accessed in the electronics box

Table 1 list of hazard symbols

2. Introduction

The autonomous monitoring system (UKCEH AMI-system) is composed of a number of electronic components illustrated in Figure 1 and Table 2. The Raspberry Pi 4 is the central computer system that controls the image capture and characteristics, data handling and data transfer to storage. This is operated by a 12v power supply that is then stepped down to 5v, supplied by either a 3rd party IEC approved benchtop or a 12v battery. Whilst the Raspberry Pi may be able to accept up to 16v, the LED's and UV light can't, so no power supply higher than 12v is permitted. A 12v timer relay is installed in the electronics box, this can be configured to operate the system at set times and days of each week, autonomously.

The AMI-system will always capture images when the system is powered ON, and insect motion is detected in the camera field of view. Images are saved directly to the 500GB SSD with camera settings stored on the 64GB SD card inserted into the Raspberry Pi.

The hardware Real Time Clock (RTC) on the Raspberry Pi ensures that the time doesn't drift over time when the system is not powered. The Raspberry Pi also has a watchdog connected to ensure safe shutdown, preventing the risk of file corruption due to sudden power loss to the system. This also allows the system to be shut down by external means, such as a timed relay. To read and view the captured images you must remove the SSD from the system and connect it to another computer to access the images, being sure to replace before the next operation.

The following sections describe how to connect, configure, set programs, and manage the operations of the system. Please be mindful of deploying an autonomous instrument in an uncontrolled environment in that local laws/legislation is adhered to regards warnings and signage.

The system is not to be operated in temperatures above 40 deg C, or at altitudes above 2000m.

Electronic Components	Description and weblink
UV Light	LepiLED Standard
USB Camera	Logitech BRIO 4K ULTRA USB camera
LED lights	U8818-6 MOTH LED BOARD V2 from Newbury Electronics
Raspberry Pi	Raspberry Pi 4 Model B, 8GB
SSD	Portable SSD T7 500GB

SD Card	Sandisk Extreme 64 GB Micro SD Card
12V DC - DC regulator	Farnell 12V DC-DC regulator
18650 Lithium-ion battery	Sony_Murata_18650_Battery
Super Watchdog Timer with battery holder	Super Watchdog for Raspberry Pi with Battery Backup (sequentmicrosystems.com)
RTC Clock	Adafruit ds3231
12V timer control relay – if supplied	https://uk.rs-online.com/web/p/products/8966891

Table 2 - Description of AMI-system Electronic Parts

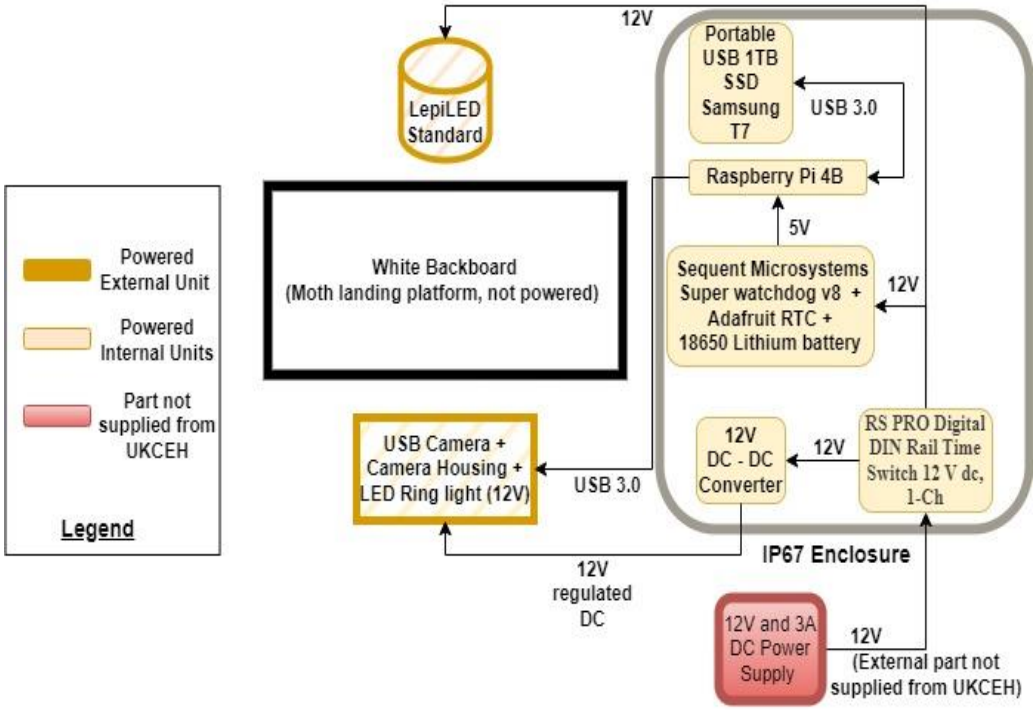


Figure 1: Block diagram of AMI-system components

3. System Components and Assembly

	Warning: General warning, all users should be appropriately trained in : • Manual handling • Using required tools
	Warning: Fragile glass parts, handle with care to avoid breaking and then cutting with injury.
	Warning: Although all circuitry is considered low voltage, take care when dealing with electrical terminals and use correct/insulated tools where appropriate.
	Warning: Risk of electrical shock, ensure all power is switched off before any work on the electrical enclosure.
	Warning: UV light tube present. When system is powered on avoid eye exposure, avoid looking directly at light. Wear proper eye and skin protection.

AMI system photos and diagrams

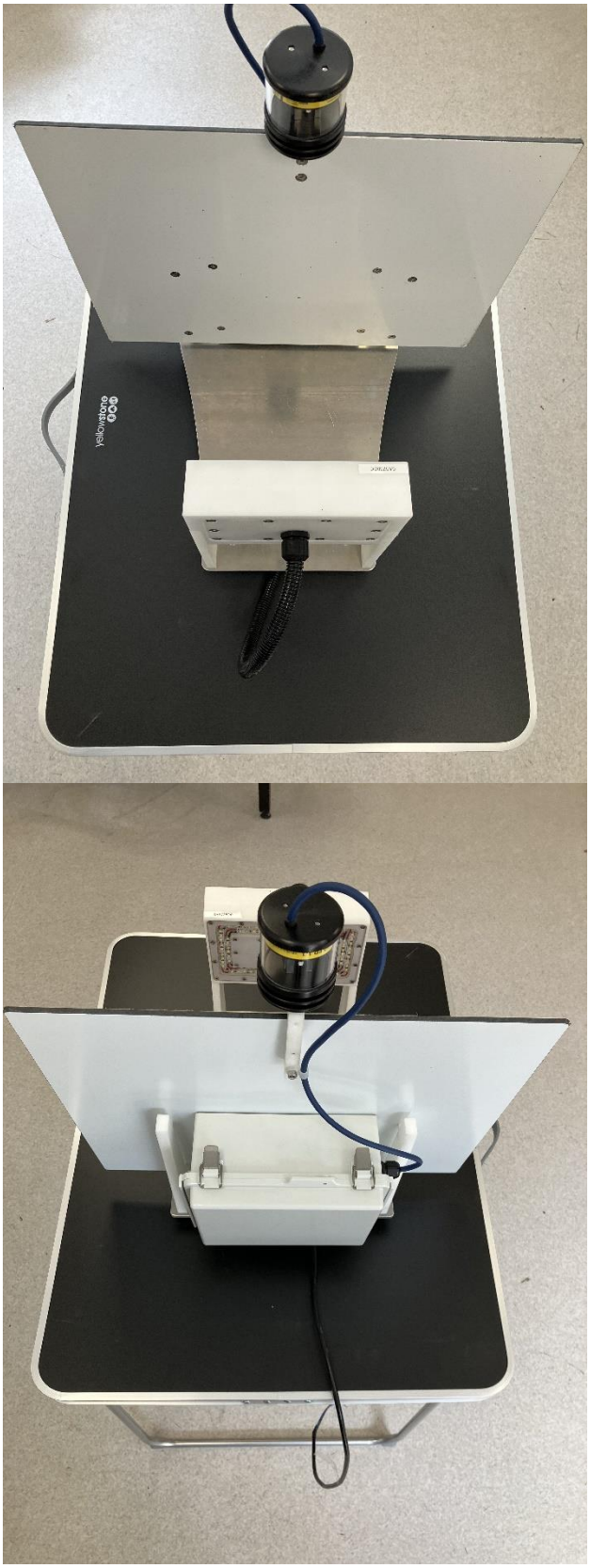


Figure 2: Front and back photos of an assembled AMI

Modular Components

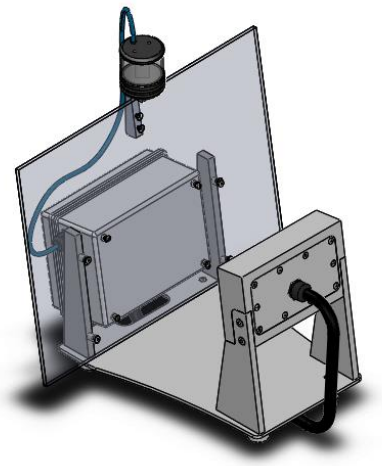
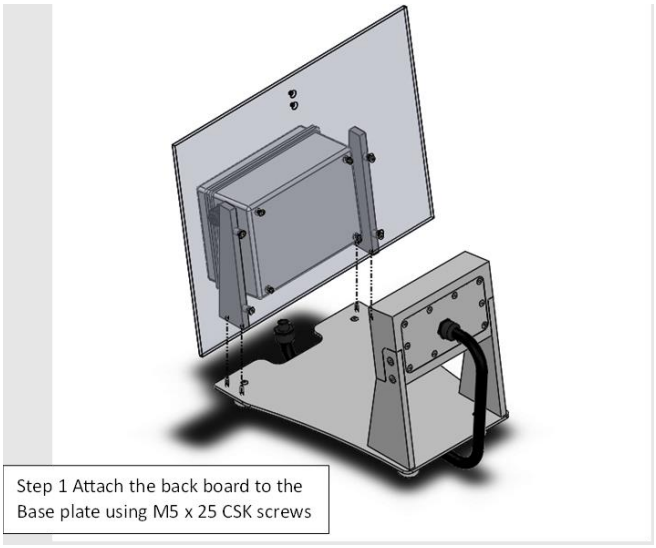
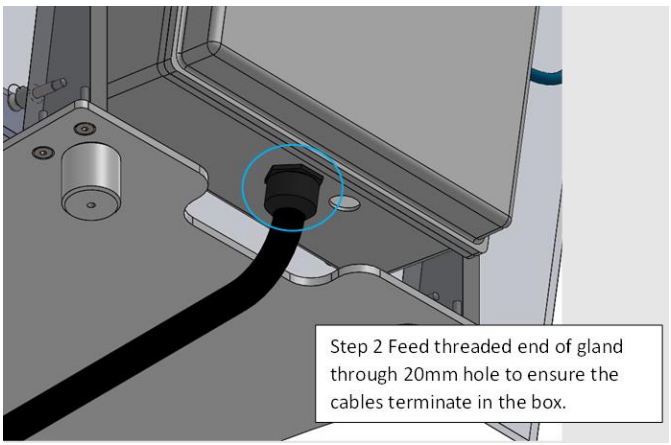


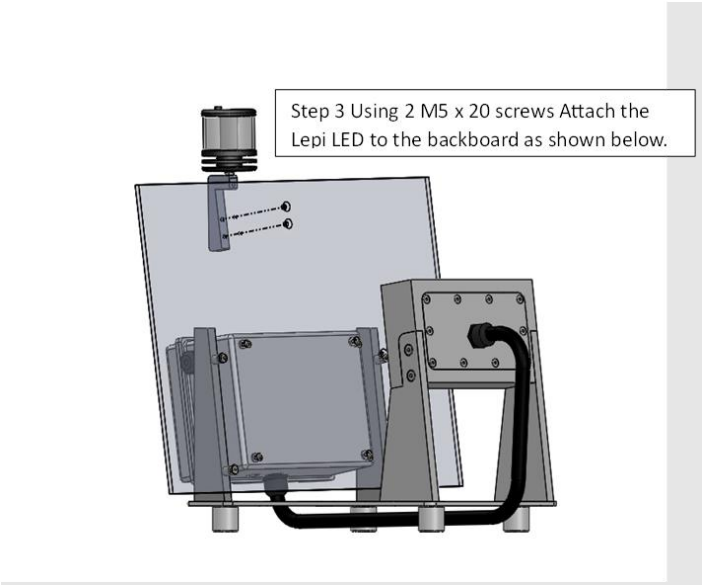
Figure 3: Illustration of an assembled AMI

Assembly Instructions

Please be aware once the instrument is connected to a power supply, if the lights come on this will mean the UV light is also on. This contains ultraviolet rays and can be harmful to look at. Please take extra caution, covering the lamp or wearing UV protective glasses. The light can be de-activated or switched off, but if the system is live and all lights are on, the UV light will also be on.







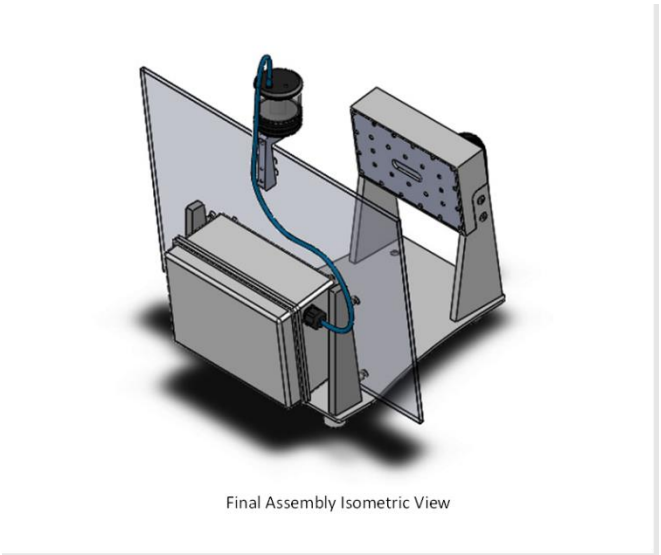


Figure 4 Constructing AMI-system out of the box

The legs of the base plate can be attached to the lid of the battery box (if purchased), by using the flat head screws and washers to mount the legs to the lid

through the predrilled holes. Please take care when opening the box if the camera is mounted to the lid, the box will need a counterweight, such as the battery, in the box to prevent it from toppling over and damaging the system.

Connecting Camera and Light Ring

The camera and lighting cables can be seen in Figure 5. They are coming out of the end of the protective conduit from the back of the camera box. To thread and connect the cables into the electronics box and connect the conduit to the box then please follow the steps below:

1. Following the cable coming out of the back of the camera box, unscrew and remove the thin black plastic conduit connector nut (step 1 in Figure 5)
2. Thread the USB and power cables through the hole in the electronics box (step 2 in Figure 6)
3. Push the conduit and connector as far into the hole (same as step 2) as it will go, then replace the nut removed in step 1, passing it over the USB and power cables, then screwing it onto the conduit connecting until tight, this should be slightly more than hand tight so use a spanner. (Step 3 in Figure 7)
4. Connect the USB into the port shown in Figure 6.
5. You need to connect the black and red exposed wire from the conduit to the top of the 12v converter, located on the right hand side. To do this use a small flathead screwdriver unscrew the left and right screw on the front of the top of the 12v converter. Place the metal part of the black wire into the left hole and red wire in the right hole. The middle hole remains empty. Then screw tight again, once tightened give the wire a light tug to check it is securely in place. (step5 in Figure 7)
6. You need to feed the LepiLED cable (blue cable with blue and brown wires exposed at the end) into the box through the hole on the right hand side (figure 9 ‘UV light power’). First remove the nut from the inside of the gland, fitted to the hole (figure 7 step 6a). Second, pass the blue LepiLED wire through the gland from the outside. Finally pass the nut over the wire and tighten to the inside of the glad, this will secure the wire in place. Connect the blue and brown wires from the end of the blue LepiLED cable to the red and black terminal block at the bottom of the box (figure 7 step 6b). The blue wire to the right-hand side of the bottom black terminal block, there will be one space free, do not remove the wire already connected. To do this use a small flathead screwdriver unscrew the screw on the front of the bottom black terminal block. Place the metal part of the blue wire in the free hole on the right side of the bottom black terminal block and then screw tight again, once tightened give the wire a light tug to check it is securely in place. Repeat this procedure for the brown wire, placing it into the right hand side of the bottom red terminal block.

Figure 5: Wiring instructions

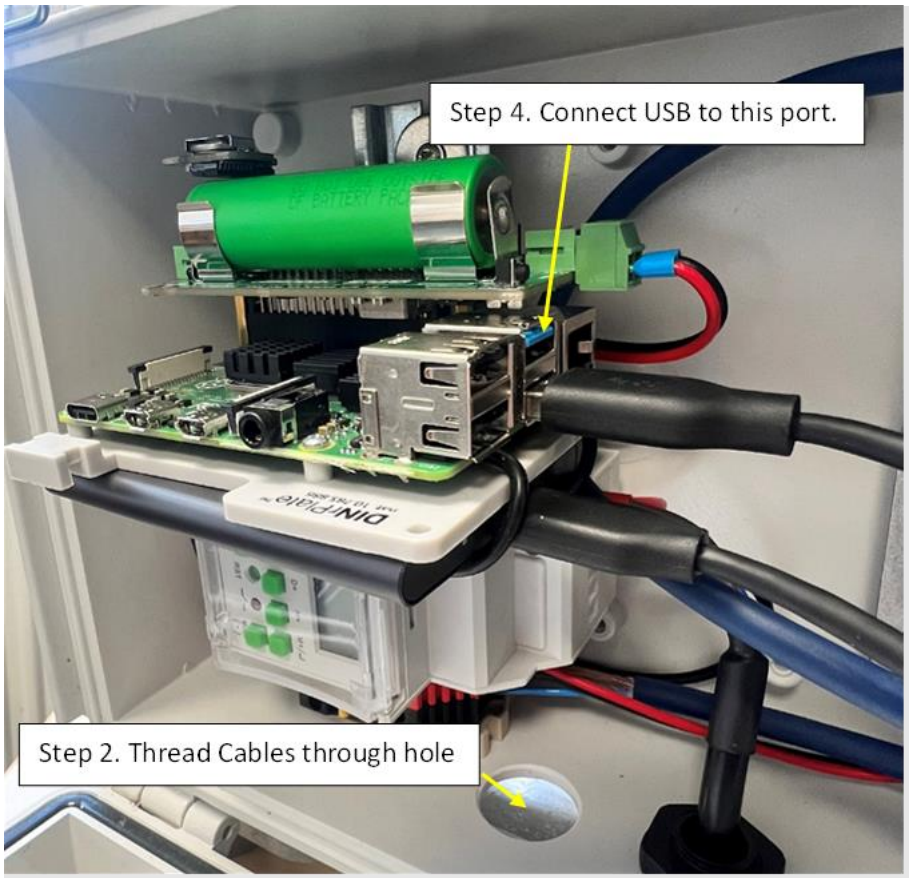


Figure 6: Wiring instructions

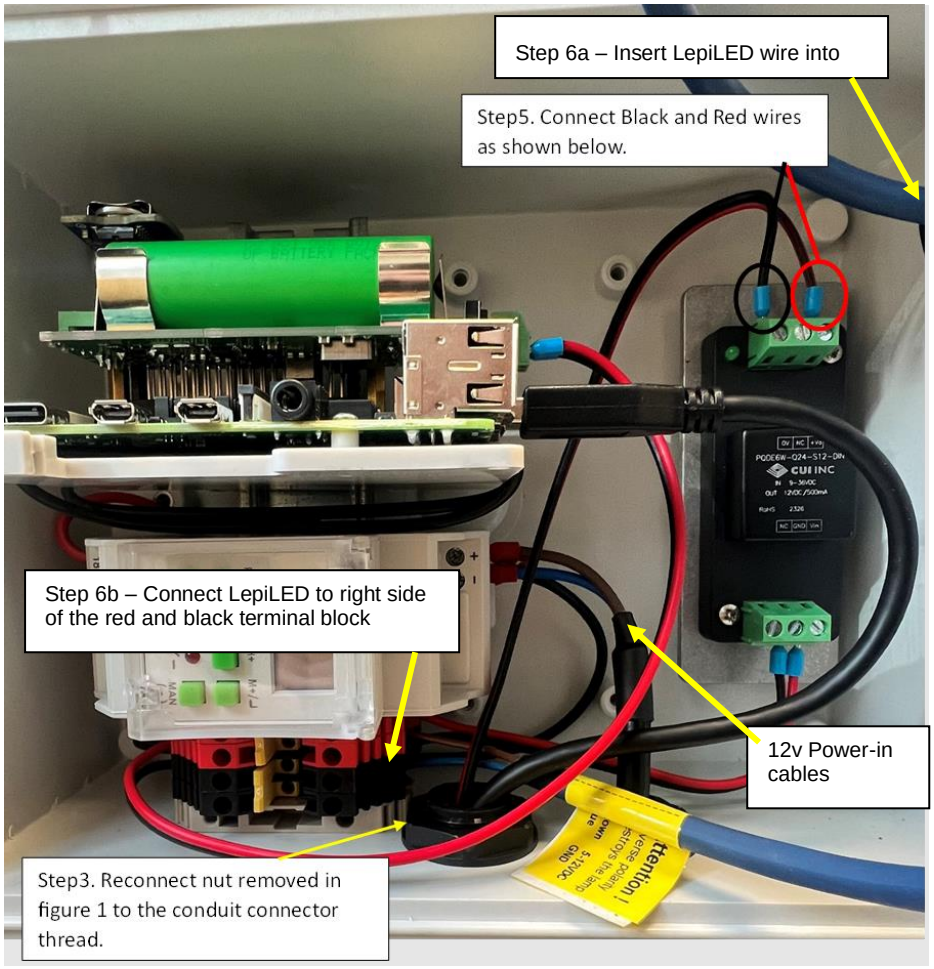


Figure 7: Wiring instructions

Connecting to power – benchtop and / or power box

The 12v power-in cables are seen in Figure 7. These can be connected to the 5amp fuse in the battery box by passing them through the single loose piece of conduit in the box, connecting the conduit to the bottom of the electronics box and pre-cut hole in the back of the battery box. To secure the conduit to the box you can find a nut in the bag, along with the rubber gasket that sits on the outside of the box around the thread, use the nut on the inside of the box to secure the thread in place. The other ends of the 12v power cables can then be connected to the DIN rail mounted terminals in the battery box, labelled Output 1+(Brown cable into beige plastic terminal) and 1-(Blue cable into black plastic terminal), as seen below in Figure 8.

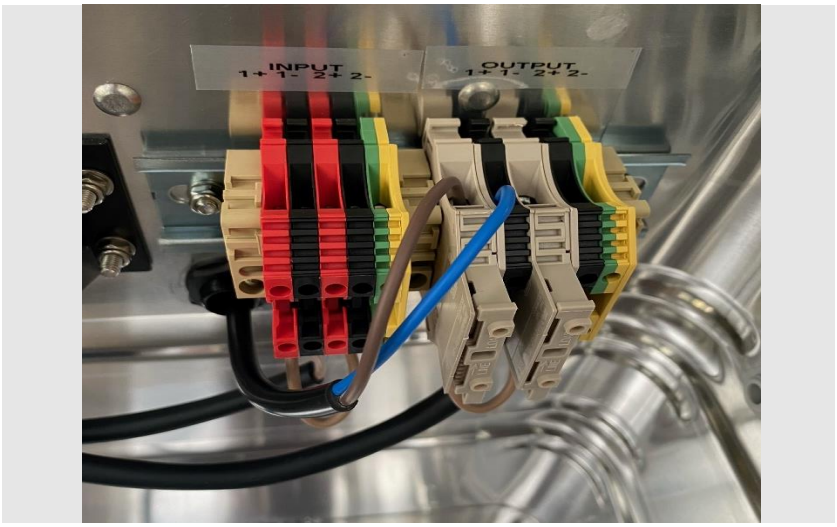


Figure 8: Terminal cabling for power supply

You will then connect the battery cable from the SunSaver 20L charge controller to the terminals on the battery, this cable should be included in the box and already have a 5amp inline fuse.

If the AMI-system being connected to a 12v power supply instead of the battery box, please ensure the power supply can control the amperage to no more than 5amps or use a 5 amp inline fuse.

Raspberry Pi (Linux)

Figure 9 shows an annotated image of the AMI-system housing where the Raspberry Pi and other components are placed.

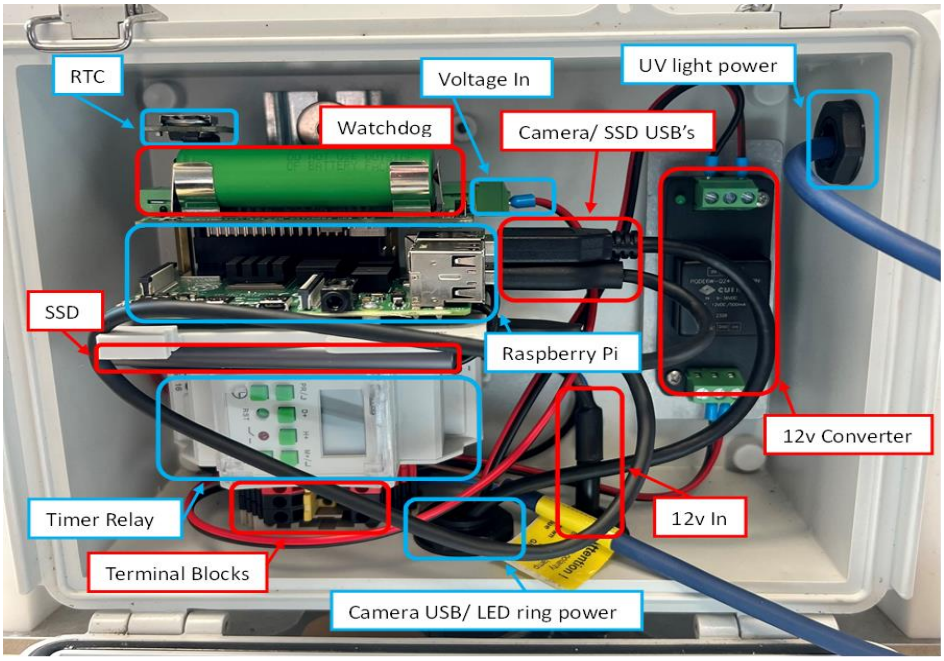


Figure 9: Annotated image of different components inside the AMI

Connecting to the Pi

If ever asked to sign into the pi use the beneath details. It is advised to change this.
Username: "`pi`"
Password: "`Nature17`"

Keyboard, mouse, and monitor
The simplest way to use the Raspberry Pi is to connect a USB keyboard and mouse to the USB 2.0 hub and to a monitor via a micro-HDMI to HDMI cable.

Linux Basics

Process	Description	Command
Change directory	Change what location you are in.	`cd [location]`
Print working directory	Return the directory you are currently in.	`pwd`
List	List all contents of the location you are currently in	`ls`
Superuser do	Give the command the permission of root super user.	`sudo`
Edit and view a text file	View any text file with the option of editing it (no need to use sudo if you are not editing)	`sudo nano [filepath]`

Figure 10: Basic Linux commands needed for raspberry Pi configuration

Steps for setting the real time clock (RTC)

Make sure the RTC (Adafruit DS3231) is plugged into the correct position on the headers. There will only be 6 available slots which are raised for the RTC (Figure 11). Make sure battery (CR 1220) is inserted into the Real time clock, this should last for 5 years with an accuracy of around +/- 2 seconds per day, however we recommend replacing every year as we have seen some batteries run out after a single year.

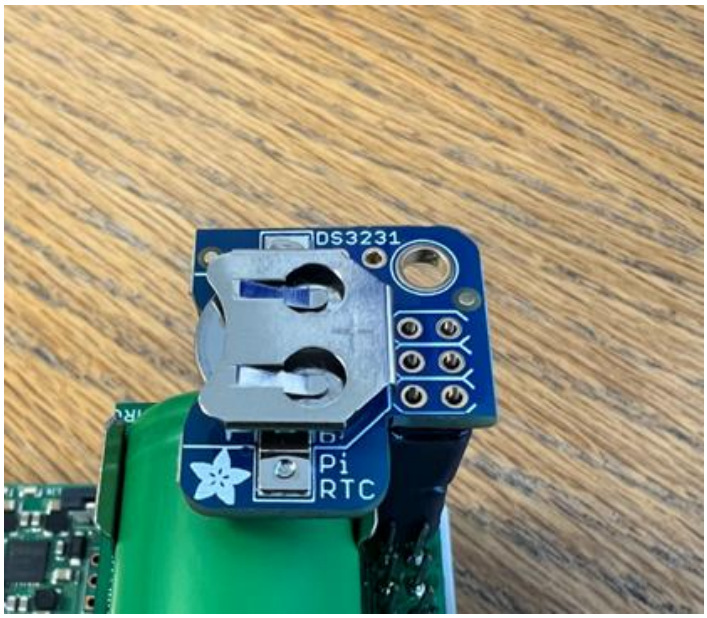


Figure 11: Image of RTC installed on the raspberry pi and super watchdog

Out of the two methods described beneath, the most effective way of setting time on the RTC is to connect the Pi to the internet, doing so will sync the Pi's time automatically. The offline method should only be used if internet connection is not available.

In the Terminal

- Check the Current Time Zone:
  ```
  timedatectl
  ```
- If necessary, update the Time Zone:
  ```
  sudo timedatectl set-timezone Europe/London
  ```
  Note: You can review available time zones using:
  ```
  timedatectl list-timezones | grep Europe
  ```
- If you updated the time zone, verify it has been updated correctly:
  ```
  timedatectl
  ```
- Update the system's date and time:

sudo date -s "2023-11-03 14:52"

- Verify the date and time:
  date
- Then you need to write the time into the RTC battery with the following command:
  sudo hwclock -w
- Confirm the RTC battery time is correct:
  sudo hwclock -r

Start-up scripts

rc.local is a text file that runs on start-up before a user is logged in. Bash, shell and python scripts can be run here, but it does not report any errors so any scripts should be tested thoroughly. Currently, the motion software and the camera settings are initiated on boot (Figure 12), but other scripts can be easily added. Enter the beneath code to edit or view rc.local.

```
sudo nano /etc/rc.local
```

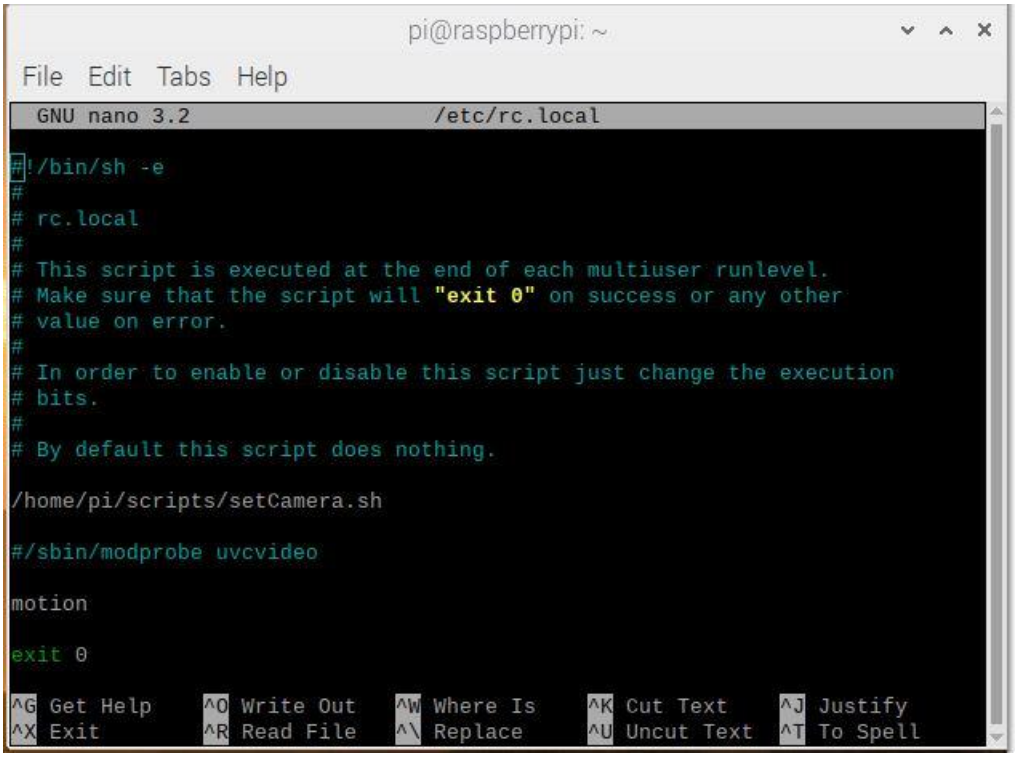


Figure 12: Screenshot of rc.local.

Crontab

Crontab is used for running code at specific times. For example, you can run a script every other day at 21:00 or you could run something every 30 seconds.

Currently, only the watchdog reset script (ups-debug.sh) is run via crontab. Crontab can be accessed via the below code and is pictured in Figure 13. Other scripts can be added to the text file following the same format.

```
sudo nano /etc/crontab
```

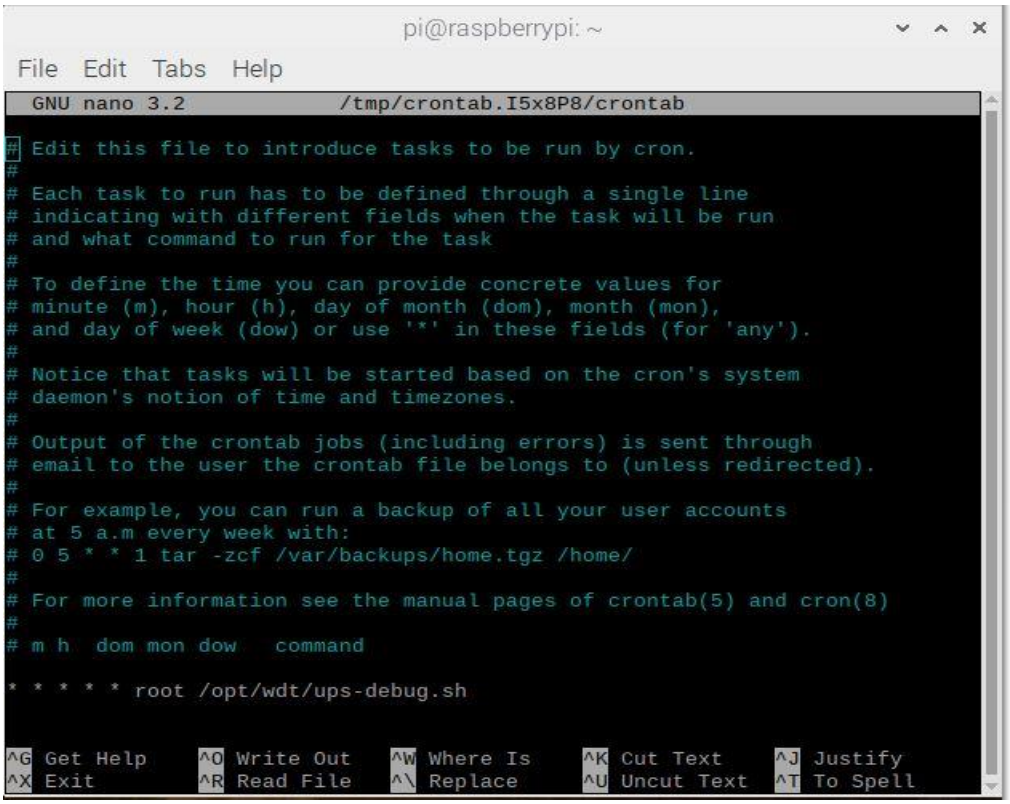


Figure 13: screenshot of crontab showing the ups debug script

Watchdog

	Warning: UN3481, the package contains a lithium ion 18650 battery within the watchdog system. UN3480, a standalone lithium ion 18650 battery can be accessed in the electronics box

The watchdog is pictured beneath (Figure 14) and is a device which detects when power from the main battery is removed. When it detects this change it runs a script that stops the motion software and safely shuts down the Raspberry Pi, greatly reducing the risk of SD card corruption.

In the case that the battery has been removed from the watchdog, be sure to insert the battery with the + and – terminals in the correct way, reverse polarity of the watchdog will result in short circuiting causing permanent damage requiring a new component.

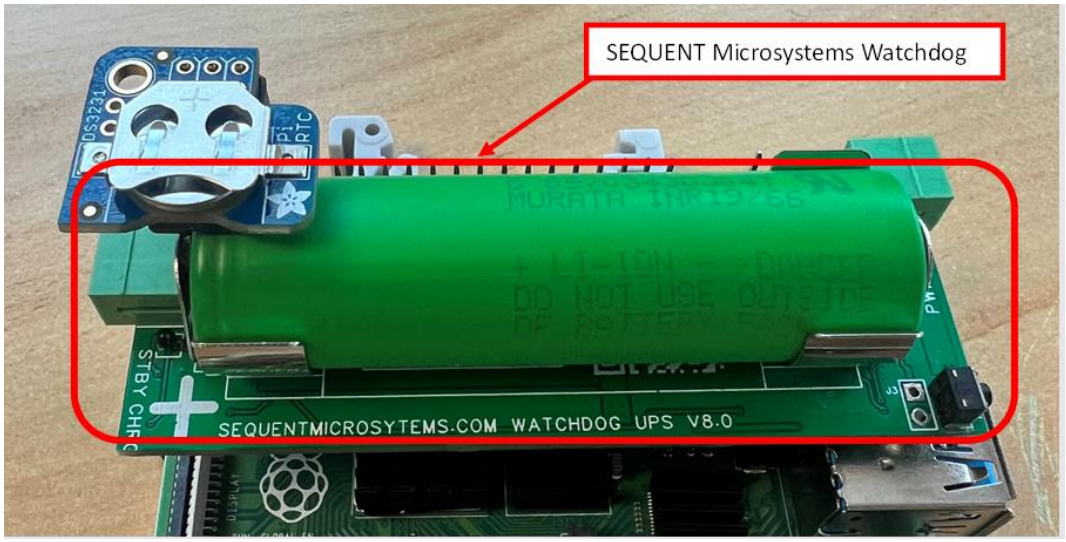


Figure 14: Image of the super watchdog-V8 with 18650 Battery installed

The points beneath explain in greater depth the process the watchdog goes through.

- The watchdog is set to countdown from 270 seconds.
- A crontab job is set to run every 60 seconds which either resets the countdown or shuts the Pi down.
- The script that is ran does the following:
    - Checks charge status. If it is not receiving power, then:
        - Sets the watchdog to not power on until the main power is resumed.
        - Starts a timer of 25 seconds to allow for the script to fully complete.
        - Stops the motion software.
        - Writes to a shutdown log.
        - Shuts down the Pi safely.
    - If it is receiving power, it resets the watchdog counter to 270 seconds.
- If the script does not run in 270 seconds due to the pi freezing or similar the raspberry pi will restart.

The watchdog script can be easily changed to suit your needs and can be seen in Figure 15 and the location of the script is shown below.

```
/opt/wdt/ ups-debug.sh
```

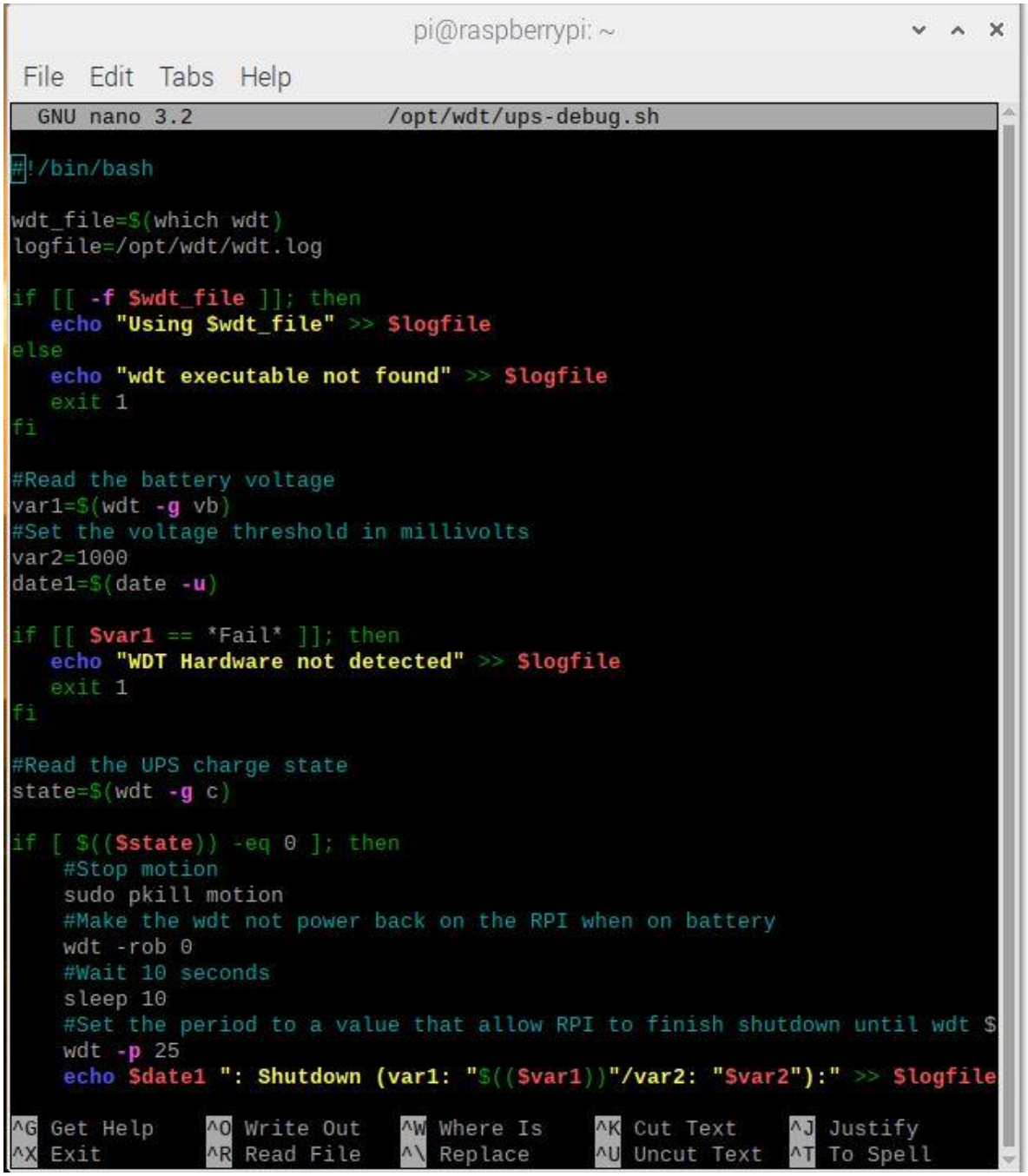


Figure 15: screenshot of the watchdog script

Setting up the Camera

The current settings for the camera can be viewed with the beneath code. This can easily be changed with the following command:

```
sudo nano /home/pi/scripts/setCamera.sh
```

All possible settings for the camera that can be changed in same way as in setCamera.sh are listed in Figure 16

```
brightness 0x00980900 (int)    : min=0 max=255 step=1 default=128
contrast 0x00980901 (int)    : min=0 max=255 step=1 default=128
saturation 0x00980902 (int)    : min=0 max=255 step=1 default=128
white_balance_temperature_auto 0x0098090c (bool)   : default=1
gain 0x00980913 (int)    : min=0 max=255 step=1 default=0
power_line_frequency 0x00980918 (menu)   : min=0 max=2 default=2
white_balance_temperature 0x0098091a (int)    : min=2000 max=7500 step=10 d
efault=4000
inactive  sharpness 0x0098091b (int)    : min=0 max=255 step=1 default=128
backlight_compensation 0x0098091c (int)    : min=0 max=1 step=1 default=1
exposure_auto 0x009a0901 (menu)   : min=0 max=3 default=3
exposure_absolute 0x009a0902 (int)    : min=3 max=2047 step=1 default=250
exposure_auto_priority 0x009a0903 (bool)   : default=0 value=1  pan_absolute 0x
009a0908 (int)    : min=-36000 max=36000 step=3600 default=0
tilt_absolute 0x009a0909 (int)    : min=-36000 max=36000 step=3600 default=0
focus_absolute 0x009a090a (int)    : min=0 max=255 step=5 default=0
focus_auto 0x009a090c (bool)   : default=1 value=0  zoom_absolute 0x009a090d
(int)    : min=100 max=500 step=1 default=100
```

Figure 16: camera settings available for user configuration

Using Guvcview

One way to set the camera is to use an application called Guvcview, this allows you to change the settings and see in real time the difference in picture quality. Guvcview can only be used via connecting a monitor, mouse and keyboard to the Raspberry Pi. To use Guvcview, use the steps outlined below.

- Connect to the Internet.
- Enter the below code to install the application.

```
sudo apt-get install -y guvcview
```

- Open the program by clicking the Raspberry Pi logo on the top left bar of the home screen, then sound and video and finally Guvcview.
- You can now change settings individually (Figure 17).

- You can also take an image by clicking the “Cap. Image” button (Figure 17).

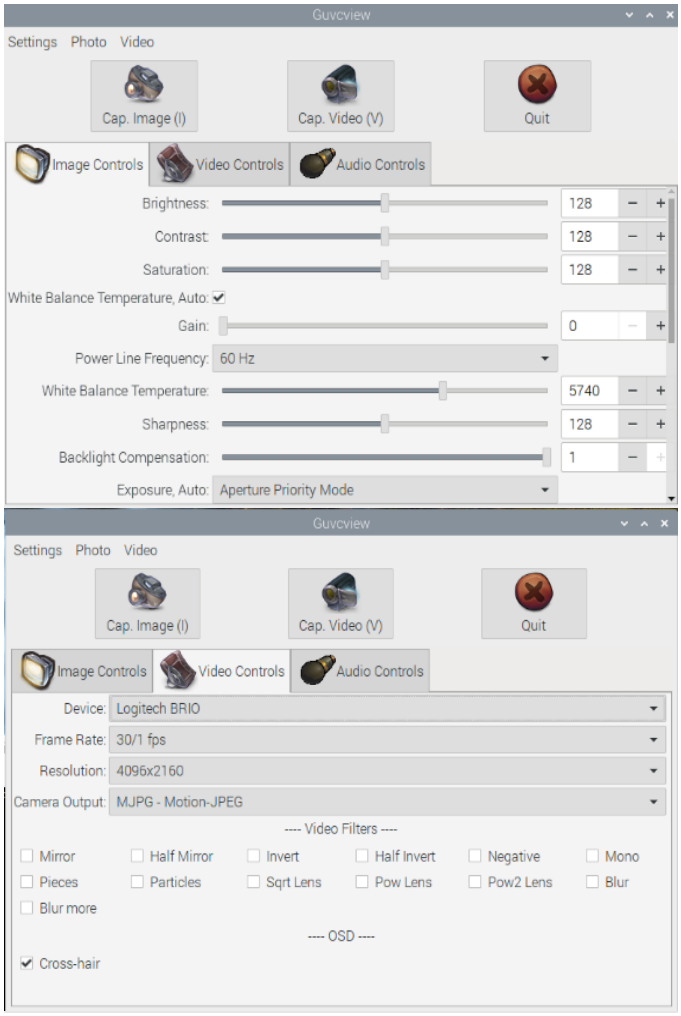


Figure 17: screenshot from the guvcview tool, a gui based camera setting tool

Motion software

The motion software is called ‘motion-project’ and detects when a threshold number of pixels has changed. More details about the motion project can be found here (https://motion-project.github.io/).

Starting and stopping the motion software.

- To manually start the motion software, use the code below.

```
sudo motion
```

- To manually stop the motion software, use the code below.

```
sudo pkill motion
```

Motion and camera configuration files.

- The motion configuration file can be found at the location below.

```
sudo nano /etc/motion/motion.conf
```

- The camera configuration file can be found at the location below.

```
sudo nano /etc/motion/camera1.conf
```

Linking the camera to the motion software

All systems provided are set up with the correct camera ID, this will only need to be changed if a new camera is used. The camera needs to be specified in the configuration file for the motion software to know which one to use. The default name has not been used as errors have been witnessed with the correct device not being named by the default name. The motion software is currently set up to refer to devices by their id (serial number) which, will be different for all cameras. To find the correct id, navigate to the directory shown below.

```
ls -l /dev/v4l/by-id/
```

In this directory there will be up to 4 devices (the BRIO is recognised as 4 devices), one of which will end in “index-0” (figure 18).

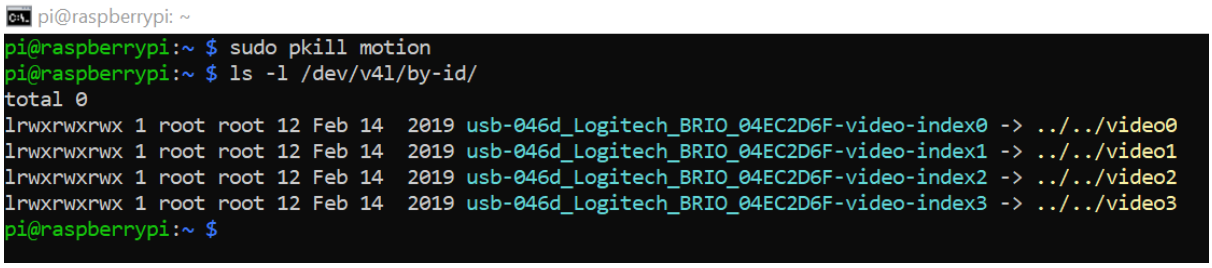


Figure 18: screenshot of the four camera ‘devices’ that represent the BRIO camera

The full file path of the device ending in index-0 will need to be used as the input for the camera in the motion configuration file, this is shown below (figure 19). The same is also true for the camera1.conf file.

```
# Videodevice to be used for capturing  (default /dev/video0)
# for FreeBSD default is /dev/bktr0
videodevice /dev/video0
#videodevice /dev/v4l/by-id/usb-046d_Logitech_BRIO_BEF510C3-video-index0
```

Figure 19: screenshot of the motion.conf file where the camera ID is specified

The motion configuration file contains many settings that can be changed, a select handful are shown below.

- Width and height
  - The resolution can be selected by changing the width and height in the configuration file.

    - This is directly related to both image quality and file size, so may need to be changed depending on your needs. Example resolutions are shown below:
        - 4096x2160
        - 3840x2160
        - 2560x1440
        - 1920x1080
        - 1280x720
        - 960x540
- Threshold
    - Threshold is the number of pixels that need to change before an event is captured.
    - The default selected is 3000, but this may need to be changed depending on if you are capturing too many or missing events.
- Filename
    - The current filename selected is “%Y_%m_%d/%Y%m%d%H%M%S”
    - This saves each image in a folder depending on the day with the filename as the full timestamp followed by the event number.

Data transfer

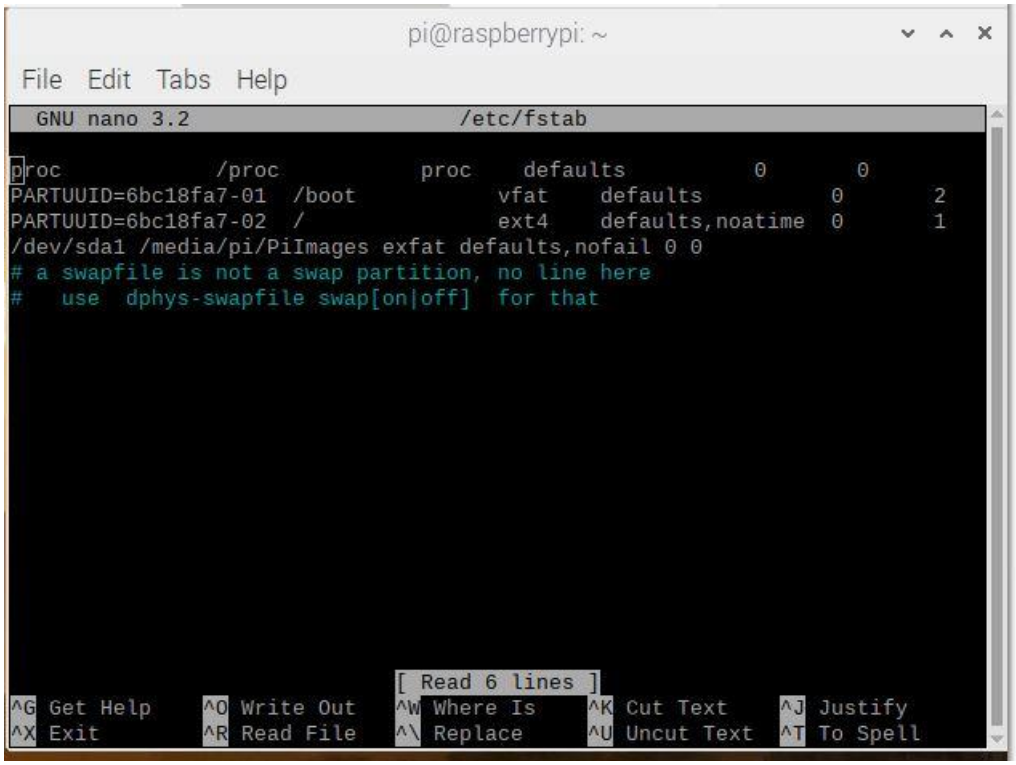
The images are currently saved onto the SSD hard drive, this is to reduce the amount that is written on the SD card, and the likelihood of corruption. To transfer data safely from the SSD to a pc, follow the instructions beneath.

- Power off the Raspberry Pi by removing the main 12v power to the stepdown.
- Wait until the Raspberry Pi is powered down, this may take a couple of minutes.
- Plug the SSD into a PC, ignore any error messages and do NOT scan drive.
- Copy and paste then delete all files copied.
- Try not to format the drive unnecessarily. It may be unavoidable, so in that case please refer to the section beneath.
- You MUST eject the drive properly when finished, this makes sure the buffer is synced.
- Plug back into the Raspberry Pi (USB 3.0 hub) and then power the Raspberry Pi on.
    - If you wanted to confirm (it is not necessary) enter the below code and check the mount point on the correct drive.

```
lsblk
```

```
pi@raspberrypi:~ $ lsblk
NAME        MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
sda           8:0    0 465.8G  0 disk
└─sda1        8:1    0 465.8G  0 part /media/pi/PiImages1
mmcblk0     179:0    0  29.7G  0 disk
├─mmcblk0p1 179:1    0   256M  0 part /boot
└─mmcblk0p2 179:2    0  29.5G  0 part /
pi@raspberrypi:~ $ sudo blkid
```

The Pi automatically mounts the SSD on boot using fstab, this increases the robustness of the system considerably rather than mounting once before the system is set up in the field.



4. Power Budget

System power consumption when:

1. LEDs on
2. Raspberry Pi on
3. Motion detection operational
4. UV light on.

24W (2.0Amps)

With the power budget in mind, the recommended battery and solar panel specifications are as below. We use the Sunsaver-20L charge controller (12V):

Solar Panels and Battery sizing recommendations as below:

- 2 x 100-watt solar panels in parallel (12V panels)
  - Max open circuit voltage (Voc): 25 V
  - Max short circuit current (Isc): 25 A

- 2 x AGM Lead Acid deep cycle / marine batteries in parallel (12V)
  - 120AH 12V Absorbed Glass Mat (AGM) or Marine Lead Acid Battery

This would support an operational program turning the instrument on for 10 hours a night every 3rd night.

If required UKCEH can advise on the most efficient solar panels and batteries for the operators preferred deployment method, contact ami-trap@ceh.ac.uk.

5. 12V Timer relay Configuration

	Warning: UV light tube present. When system is powered on avoid eye exposure, avoid looking directly at light. Wear proper eye and skin protection.
	Warning: raspberry Pi can get hot when in operation, heat sink is present on the circuit board. Handle with care when adjusting timer relay.

The 12V timer relay is procured directly from RS Components, part number 8966891 with the instruction manual https://docs.rs-online.com/8558/0900766b815859bb.pdf

We have found the manual supplied with the timer relay a little confusing and so have included our own interpretation of the manual in the annexs of this manual.

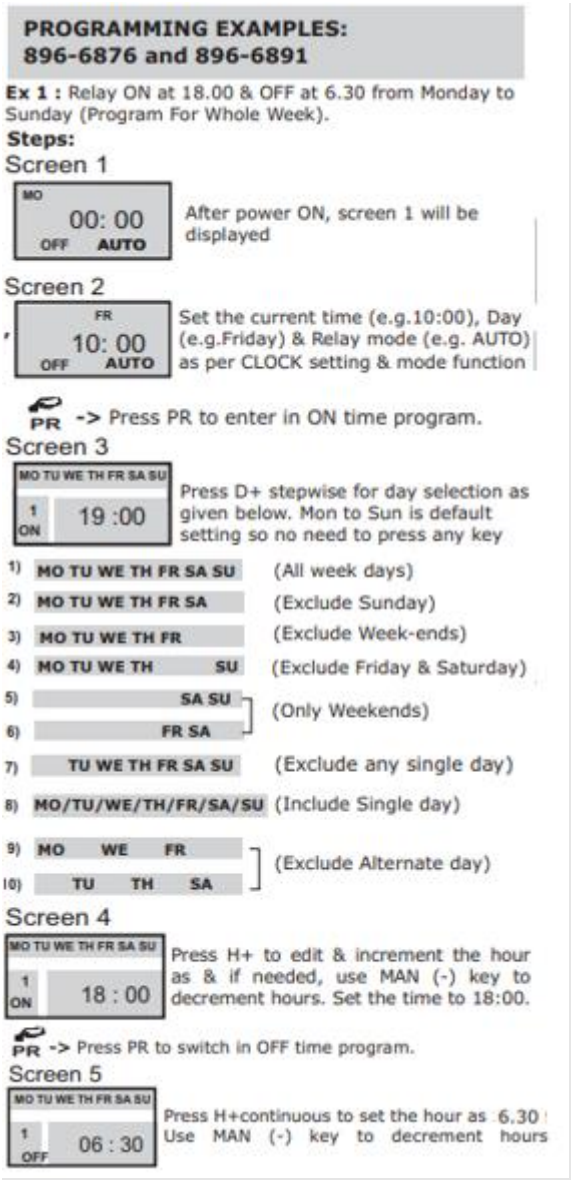


Figure 19 programming example for switching AMI-system on at 18.00 and off at 06.30 from Monday to Sunday

6. Service items

The below list itemises several parts in the system that should be changed periodically to prevent system failure.

1. Real Time Clock (RTC) battery. As shown in the electronics box. Battery type CR1220. Expected life cycle: 5 years. Suggested to change every 1 year as it's not worth the risk of it failing, and failures have been observed. Once this is replaced, please follow the steps for checking and setting the RTC to the current time for the area of deployment. https://www.batterystation.co.uk/battery-types/button-cells-coin-cells/cr1220-coin-cells.html
2. Super Watchdog V2 battery. Rechargeable Li Ion 3.7V 2500mAH. Expected life cycle 3 years, however if this is left unused for long periods of time (i.e a winter), we would suggest removing from the system and charge it during the off season then re install it in the system at the beginning of each seasonal deployment. https://thepihut.com/products/18650-lithium-ion-rechargeable-cell-2500mah-3-7v
3. Timer relay is battery powered, this has a shelf life of 6 years, the relay would need to be replaced after 6 years.
4. Desiccant bags for electronics box, always have 1 in the box, replace yearly. (silica gel packs or humidity absorption packs)
5. 12v car battery. When the system is not deployed for periods longer than weeks, maintain best practice to ensure battery life stays good, place on a trickle charge or keep charged periodically.

7. Disposal and recycle of parts

Before any disposal of the instrument at the end of use / life you can speak with UKCEH about the return of goods or re-purposing of material. Where possible it is preferred to re-use or re-purpose the instrument or its components prior to recycling, with refuse being the final option. The metal components can be recycled, along with the enclosures, and the electronic components can be repurposed, or transferred through WEEE waste.

8. Tests list prior to deployment

- Refer to the above description on “12V Timer relay Configuration” and set the timer relay to the correct time.
- Using the timer relay, turn on the system.
- Cover the UV light/LepiLED (Optional).
- Once the AMI is ON, trigger motion manually (i.e. by waving your arm in front of the camera if using motion detection) and wait around 10 minutes.
- Using the timer relay turn off the system.
- Once the AMI is OFF, wait until the watchdog finishes switch OFF the Raspberry Pi.
- Take the SSD out of the AMI system and connect it to your computer to see if the images have been taken properly and the filenames have the correct time.

9. Troubleshooting

The Raspberry pi is not turning on.
Check that the stepdown cable is connected between the terminal block and the watchdog. Check that the timer relay is programmed correctly.

The time on my images is not the correct one.
Make sure that you had follow the instructions on how to set up the system date and time correctly. Also, follow the instructions on how to program the timer relay.

The images are grey, and it says unable to connect.
First, make sure that the camera USB cable is connected properly. If the problem persists, revise the instructions related to the camera and make sure you are writing the correct camera ID.

The battery supporting the real-time clocks has gone flat. How can I replace this battery?
Please see Section 6 above. The expected life cycle for this battery is 5 years, but it is recommended to replace the battery every year to prevent the risk of failure.

AMI traps with a Raspberry Pi should use this battery:
https://www.batterystation.co.uk/battery-types/button-cells-coin-cells/cr1220-coin-cells.html
AMI traps with a Rock 4 SE Pi should use this battery: Rockpi4/hardware/rtc - Radxa Wiki

Instructions on replacing the battery are included on page 17 above.

Please visit our website for a maintained list of frequently asked questions (FAQs):
https://www.ceh.ac.uk/solutions/equipment/automated-monitoring-insects-trap

If you require further support, please send an email to: ami-trap@ceh.ac.uk

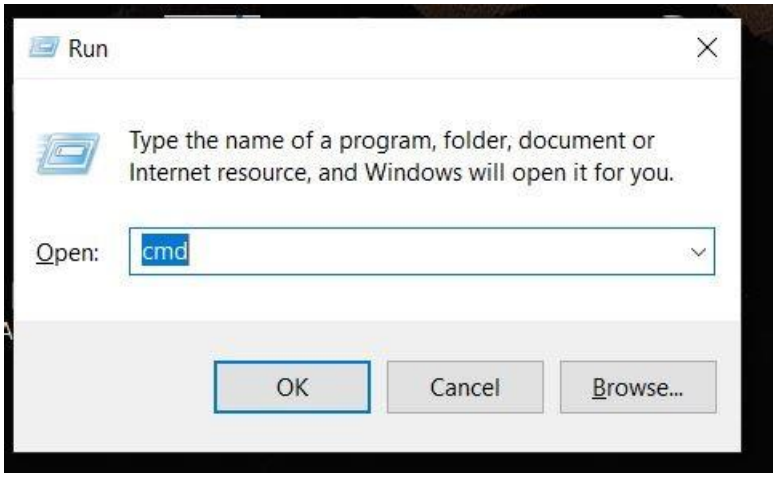
10. Annexes

10.1 SSH connection for Windows

Switch on the AMI system and connect it to your computer using an ethernet cable and choose one of the following options to connect to it.

Option 1:

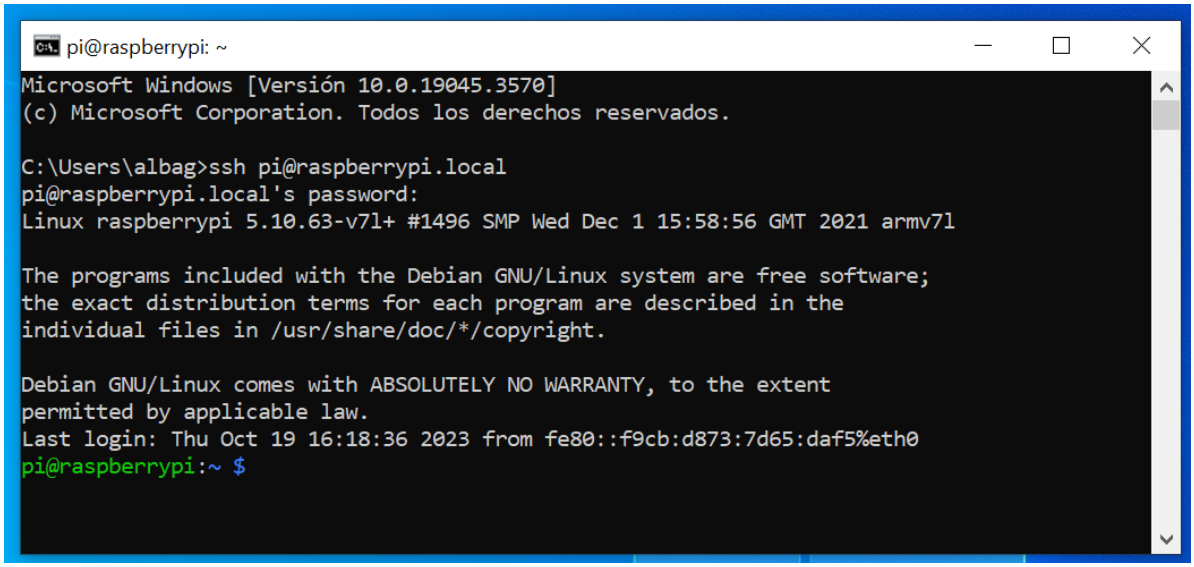
If you use version 1809 or later Windows 10, your system already comes with OpenSSH. Meaning that you can use the native SSH Client from Windows.
All you must do is open the command prompt by pressing the Windows key + R to open the Run window, then type “cmd” and click OK:



Once the terminal is open type the following command:

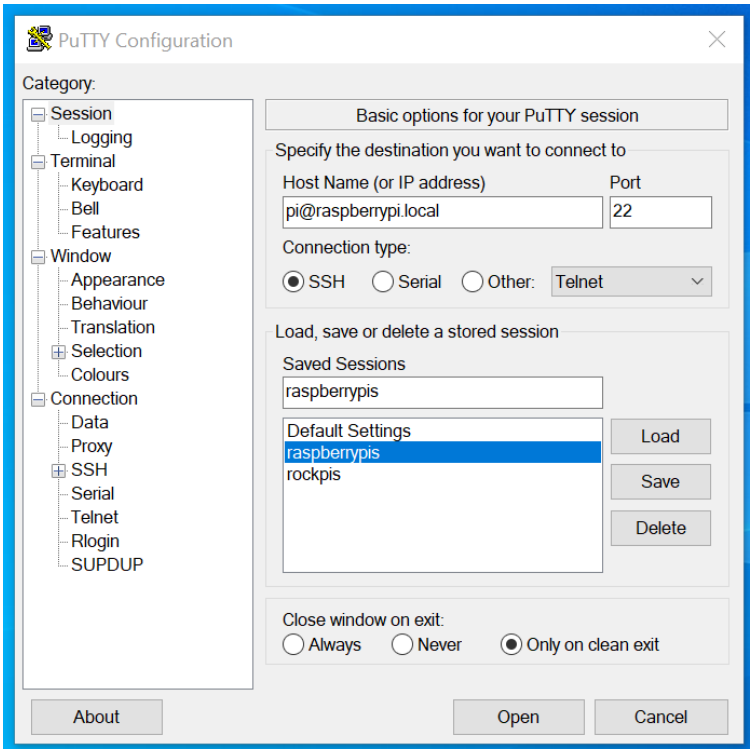
ssh pi@raspberrypi.local

And press enter. Type the password “Nature17” and press enter again, you will see the following welcome screen:



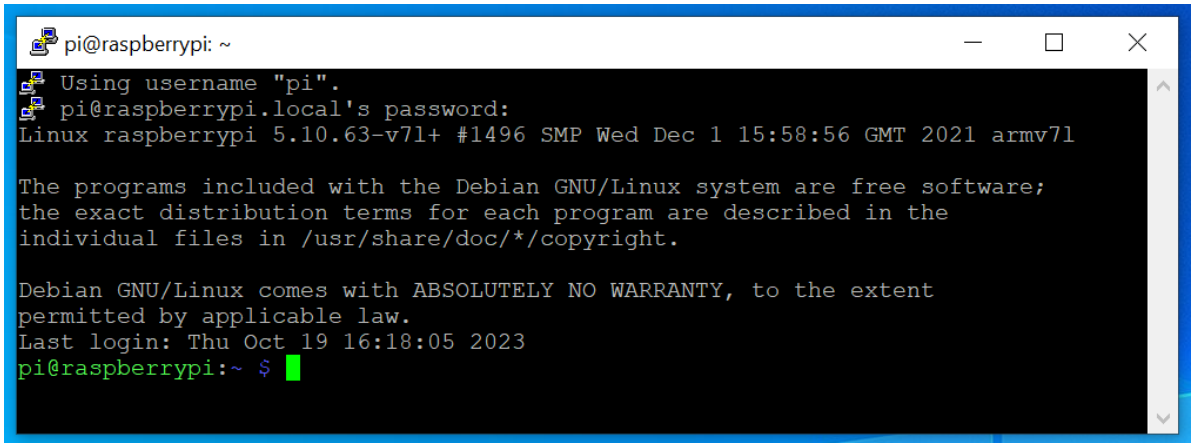
Option 2:

Otherwise, you'll need to download an SSH client. We recommend you use PuTTY. Download PuTTY from this link and run the installer. Once installed, open the PuTTY and fill out the form as below.



And press “Open”.

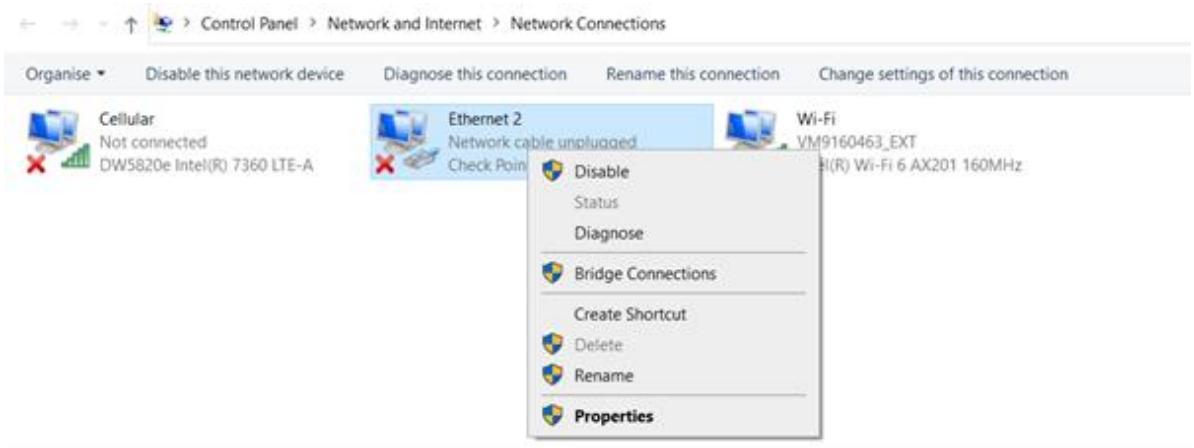
A new terminal will pop-up, type the password “Nature17” and press enter again, you will see the following screen:



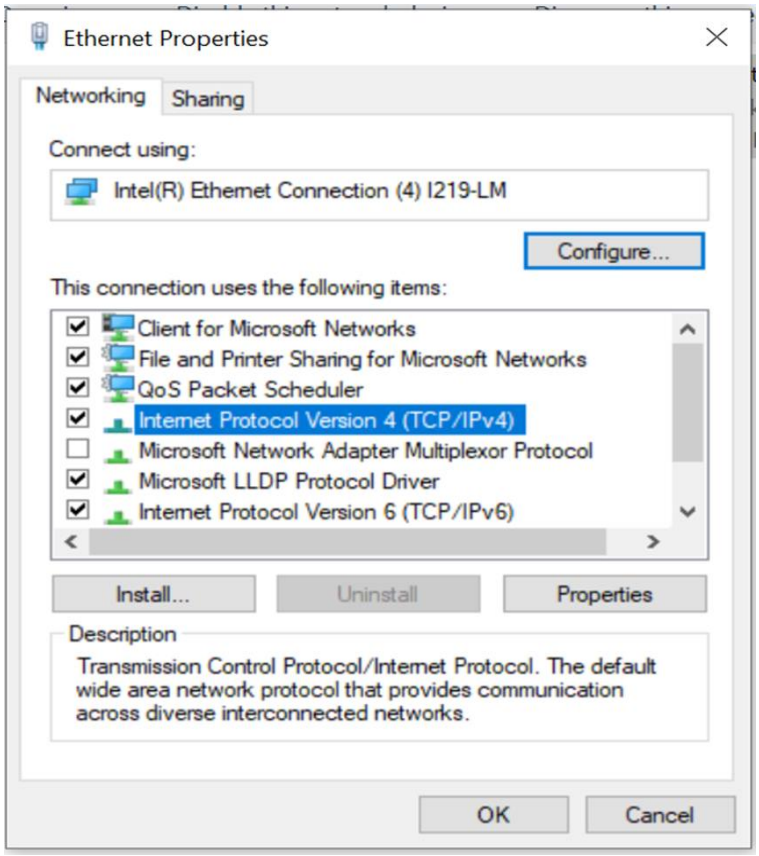
Note: The first time before opening the connection, you can save your configuration by pressing "Save", so next time you can load it and open directly.

Option 3:

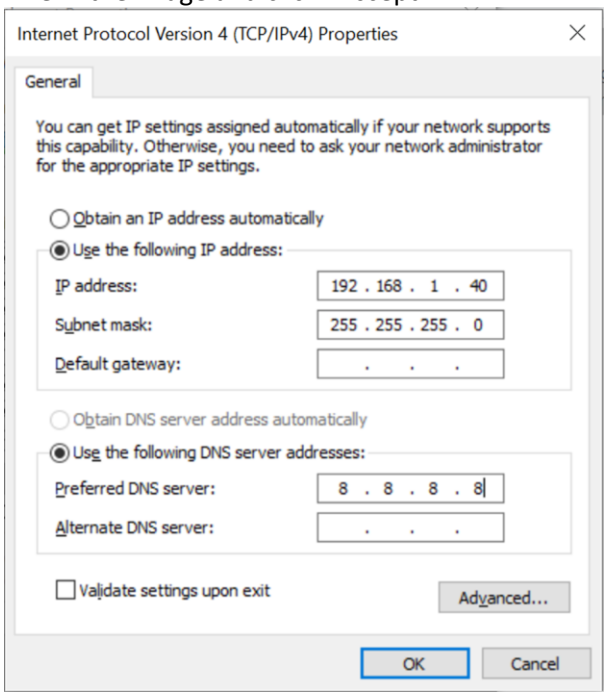
On your computer open the "Network & Internet Settings". Under "Advanced network settings" click "Change adapter option" and right click on the ethernet and select "Properties":



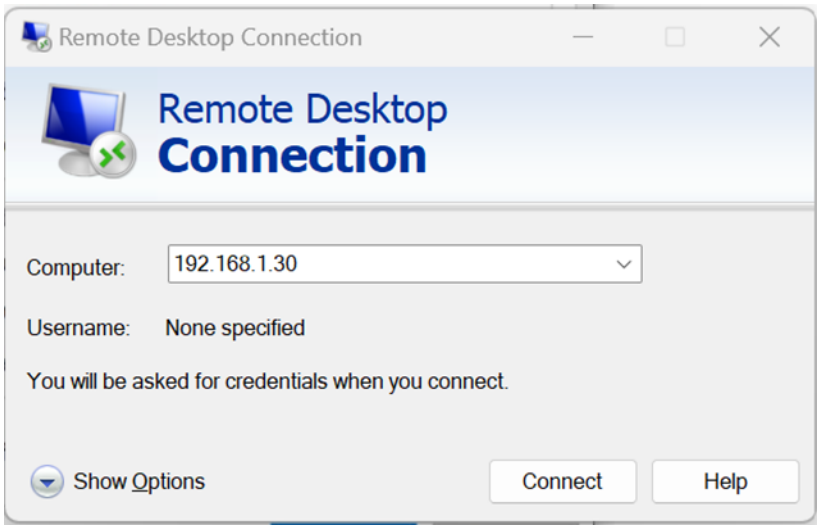
The next pop-up will show up:



You need to select “Protocol of Internet version 4 (TCP/IPv4)” and click properties. The next pop-up will show, define your IP like in the image and click “Accept”:



Open the program “Remote Desktop Connect”:



The IP for the pi should be the same one, and then connect. A new window should open first asking you to log in:
User: pi

Password: Nature17

And finally, you will see the pi desktop.

Note: When you finish, remember to change your Protocol of Internet version 4 (TCP/IPv4) configuration back to default.

10.2 12V Timer Relay configuration

Setting the day and time

To modify or update the date and time in the timer relay you must keep pressing the clock key and then use the day, hour and minute keys to update each one.

CLOCK SETTING: **Figure 1**

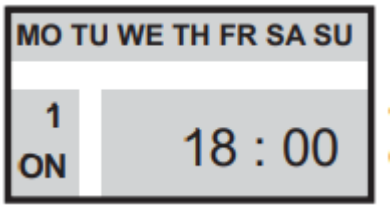
+ MAN	Press clock key & MAN key simultaneously to toggle between 12/24 hour clock mode. AM / PM
+ D+	Keep the Clock key pressed & then press the D+ key to set day. MO/TU/WE/TH/FR/SA/SU
+ H+	Keep the Clock key pressed, then press the H+ key to set hour. 00- 23 - in 24 Hour Mode 01- 12 - in 12 Hour Mode
+ M+	Keep the clock key pressed, then press M+ key to set min. 00- 59

Creating your own schedule

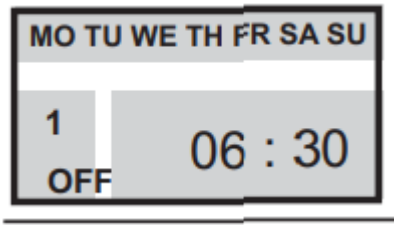
The recording schedule determines when each day the AMI system will switch on and when it will go off. While it is on, the system will take picture of moths every time it detects motion and snapshots every 10 minutes. It will save those images into the SSD drive.
You can create your own schedule using the PR key:

Now, we will see different types of schedules that the timer relay supports.

Example 1: Single schedule to run the system every night between 6pm to 6:30am next morning:
Press the PR key one time and schedule number 1 appear. Set when the system needs to be ON using the day, hour and minute keys (D+, H+, M+):

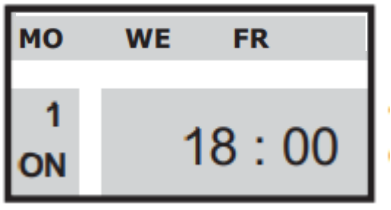


Press the PR key one more time to set when the schedule number 1 should be off, again using the day, hour and minute keys (D+, H+, M+):

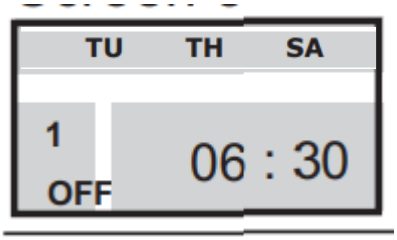


Press the clock key one time to go back to the main screen.

Example 2: Single schedule to run the system every other night on Mondays, Wednesdays, and Fridays between 6pm and 6:30am next morning:
Press the PR key one time and schedule number 1 will appear. Set when the system needs to be ON using the day, hour, and minute keys (D+, H+, M+):



Press the PR key one more time to set them the schedule number 1 should be off, again using the day, hour and minute keys (D+, H+, M+):



Press the clock key one time to go back to the main screen.

Example 3: Multiple schedules to run every night between 9pm to 5am next morning in periods of 2 hours and leaving the system off for 1 hour between each period. This means the system will be on every night between 9pm to 11pm, 12am to 2am and 3am to 5am.

For this example, we need to set up 3 different schedules.

Schedule 1: Press the PR key one time and schedule number 1 will appear. Set when the system needs to be ON using the day, hour and minute keys (D+, H+, M+):

Press the PR key one more time to set them the schedule number 1 should be OFF:

Schedule 2: Press the PR key one more time and schedule number 2 appear. Set when the system needs to be ON using the day, hour and minute keys (D+, H+, M+):

Press the PR key one more time to set them the schedule number 2 should be OFF:

Schedule 3: Press the PR key one more time and schedule number 3 will appear. Set when the system needs to be ON using the day, hour and minute keys (D+, H+, M+):

Press the PR key one more time to set them the schedule number 3 should be OFF:

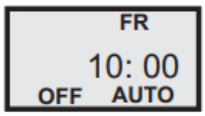
Finally, press the clock key one time to go back to the main screen.

Switch on and off the system using the timer relay

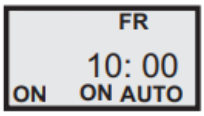
The key MAN will navigate between the different modes, by pressing this key several times you will see all the different modes.

Here you can find the different mode descriptions:

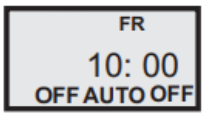
Press MAN key to toggle between-



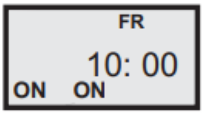
1. AUTO: As per set program.



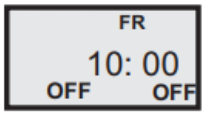
2. ON AUTO: Manual ON up to next ON event. (Not Applicable for Pulse)



3. AUTO OFF : Manual OFF up to next OFF event. (Not Applicable for Pulse)



4. ON: Manual ON (Continuous).



5. OFF: Manual OFF (Continuous).

Testing the system
For testing the system, we can use the modes ON (number 4 from above) for switching on the system and OFF (number 5 from above) for switching off the system.

Deploying the system
When deploying the system is very important to leave it on mode AUTO, this could be number 1 or 2 from above depending on what time it is when we are deploying the system.

For example, imagine you have program the system to be on from 09:00pm until 04:00am. In this case, if you deploy the system after 04:00am and before 09:00pm we you must set the mode to AUTO (number 1 from above). However, if when you deploy the system is after 09:00pm and before 04:00am then you should leave the system on mode ON AUTO (number 2 from above).

Normally, you will deploy the system outside of the hours it is schedule to run, so it would be mode AUTO, but it is important to understand the different mode.

10.3 Writing a new Operating System (OS) 'image' to your Raspberry Pi

Add software to the SD card.

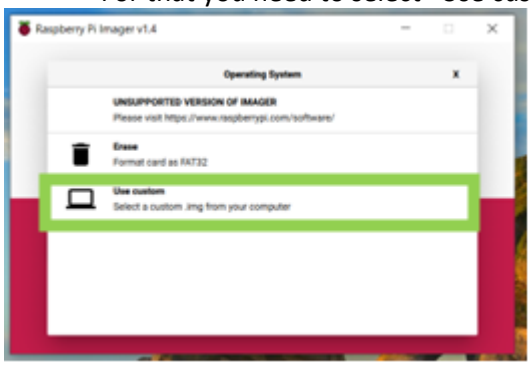
1. Download the new operational system (OS)
2. Download the software for writing the OS into the SD card:

https://www.raspberrypi.com/software/

3. Connect the SD card to your computer and open the “Raspberry Pi Imager” program:

4. Chose the Operating System, which is the file that you downloaded:

For that you need to select “Use custom”:



And then select the file from your computer. Afterward, you need to select the SD card:

And then “Write”.

When it finished you can take the SD card and put it back to the Pi.

If further assistance is needed, please review the supporting resources available at https://www.ceh.ac.uk/solutions/equipment/automated-monitoring-insects-trap or contact UKCEH at ami-trap@ceh.ac.uk

Contact

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