

Skipper's Mate Assembly Notes

Version 1.0.7

18 April 2019

Additions to 1.07

Links and details for obtaining/configuring your own equipment

Additions to 1.0.6

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Additions to 1.0.5

Shore Power Sensor Control Unit

Barometric Pressure Sensor Control Unit

New barrel connectors

New diagrams using Fritzing

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Skipper's Mate Assembly Notes

1. Welcome !

This document is intended to help you get your Skipper's Mate modules up and running quickly.

Errors and Liability

No documentation is without errors. If you find any, please post on the via the Forum on the web site at <https://www.skippersmate.co.uk> and accept our apologies. In particular, hardware specs vary so do check carefully where hardware is labelled for wiring.

Please note that wiring the equipment is your responsibility. No liability is accepted for this documentation or any assumptions made.

Horried by the number of pages ? Don't be - the instructions in each section are simple but we have added illustrations wherever possible with the intention of making life easier, not harder.

Since we try to soak test all equipment before we despatch you may find that some of the assembly has already been carried out.

IMPORTANT NOTE - although the kit may be partially assembled PLEASE check it all carefully. In particular, connections and screws may be loosened or dislodged in transit.

This document may refer to items which you have not ordered, in which case please ignore them. In particular, if you have ordered a TESS Edition then please start at **Section 5 - TESS** and then look at things like Sensors (Section 3).

Fritzing diagrams

We have recently adopted Fritzing diagrams and will, gradually, replace the photographs with these. New items (e.g. Shore Power and Barometric Pressure) are shown as Fritzing diagrams.

General Notes

Sensor Control Units - Arduino - IMPORTANT ! - when we prepare Sensor Control Units an individual software sketch is loaded onto each unit. DO NOT mix up the Control Units. This also applies if you have several SCUs of the same type - e.g. Temp/Humid/Dew Point - the sketch is customised.

Jumper wires

Jumper wires may be supplied in any colour. The colours in the diagrams are intended purely to distinguish the function of the jumpers.

If you are using jumpers (e.g. Sensors, Relays, TESS) you may wish to apply the enclosed superglue ONCE YOU ARE HAPPY IT'S ALL TOGETHER CORRECTLY.

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Jelly Connectors

Since some sensors may need to be sited at a distance from the Sensor Control Unit, you may find jelly connectors (which usually don't even require wires to be stripped) are useful for this purpose.

Barrel connectors for Sensor Control Units

We have recently started shipping Sensor Control Units with separate barrel connectors with screws for wire connection to the VOUT/GND side of the voltage step-down which powers the Sensor Control Units. Any references to the cable with the barrel connector/jack plug may also refer to the separate barrel connectors. If you receive a barrel connector rather than a cable with a barrel connector already in place, simply add your own cable - typically this will then be attached to the VOUT/GND on the variable step-down for the Sensor Control Units to provide appropriate power to the Arduino/SCU.

NOTE due to the uncertainty engendered by Brexit we no longer supply hardware so it is your responsibility to source it. This also means that you will be responsible for loading the Arduino sketches. Information on the hardware required is included in each section and, where relevant, details of the appropriate sketch. Details of how to load a sketch can be found on www.arduino.cc.

2. Comms Edition - Boat Control Unit (BCU)

List of Items required

Boat Control Unit board - Raspberry Pi 3B or 3B+

Source from your favourite supplier. We've had good service from The PiHut - <https://thepihut.com>

Micro-SD card for BCU

At least 8GB.

Voltage step-down - 12V or 24V to 5V - 4 port preferable

Should be 5amp output. Available from Ebay. We've had good results with units similar to these - <https://www.ebay.co.uk/itm/4-Port-USB-DC-12V-To-5V-5A-Step-Down-Power-Supply-Module-Mobile-Tablets-Charger/252989250623?epid=25011026118&hash=item3ae7559c3f:g:QyAAOSwmE9cHRGW>

Power cable (USB to micro USB) for BCU

3G/4G mobile broadband dongle (unlocked)*

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This should be of the HiLink type i.e. presenting as a pseudo ethernet device.

Wi-Fi dongle with removable antenna (reverse SMA connection)

Many available on Ebay. Should be Linux compatible. Example - <https://www.ebay.co.uk/itm/Dual-Band-600Mbps-USB-WiFi-Dongle-Wireless-LAN-Adapter-802-11ac-a-b-g-n5-2-4Ghz/143007027382?hash=item214be210b6:g:894AAOSwLNxcCIeg>

2 off USB extension cables - 25cm**

Box

* *SIM not supplied*

** *if the order contains a Powered USB hub these will be omitted*

In some instances, a Powered USB hub may have been added, free of charge, to ensure adequate power provision for the number of devices supplied.

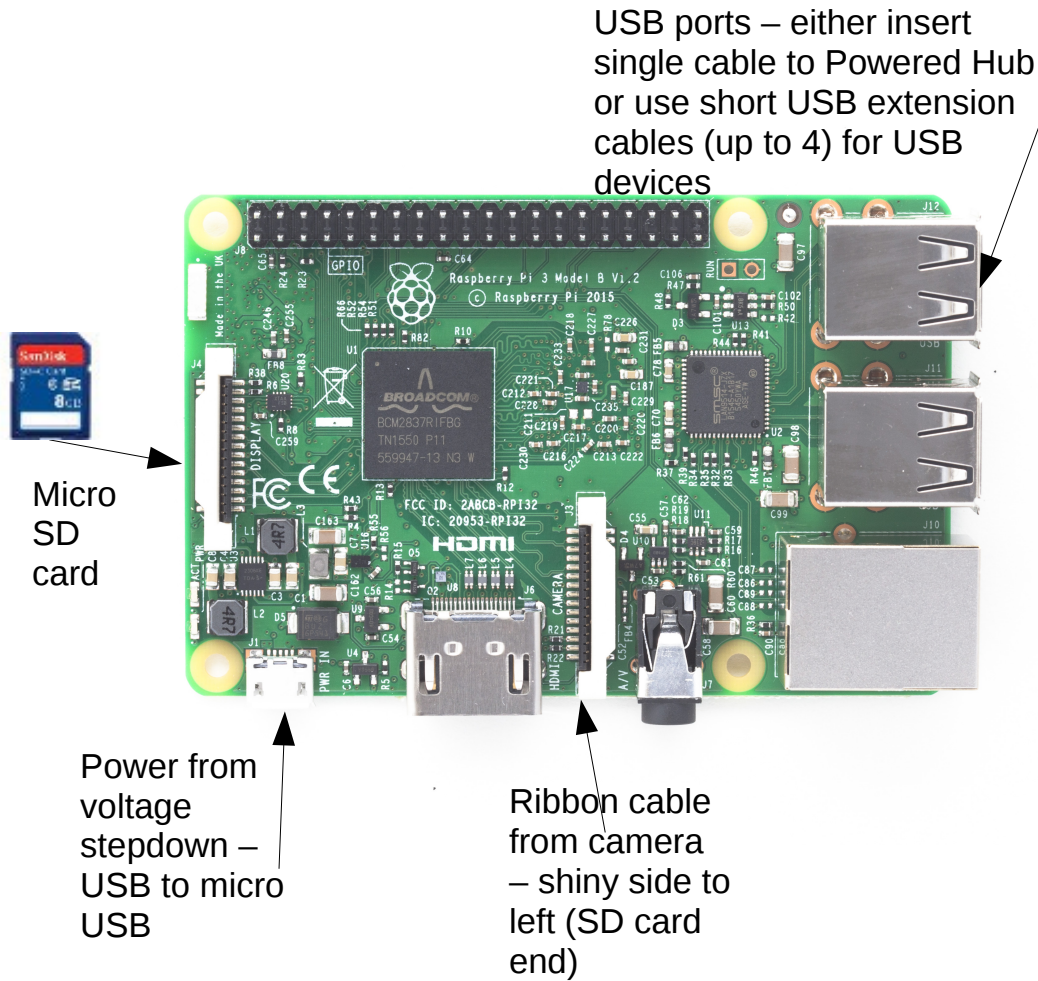
Assembly Steps

IMPORTANT NOTE - all assembly should take place before applying power

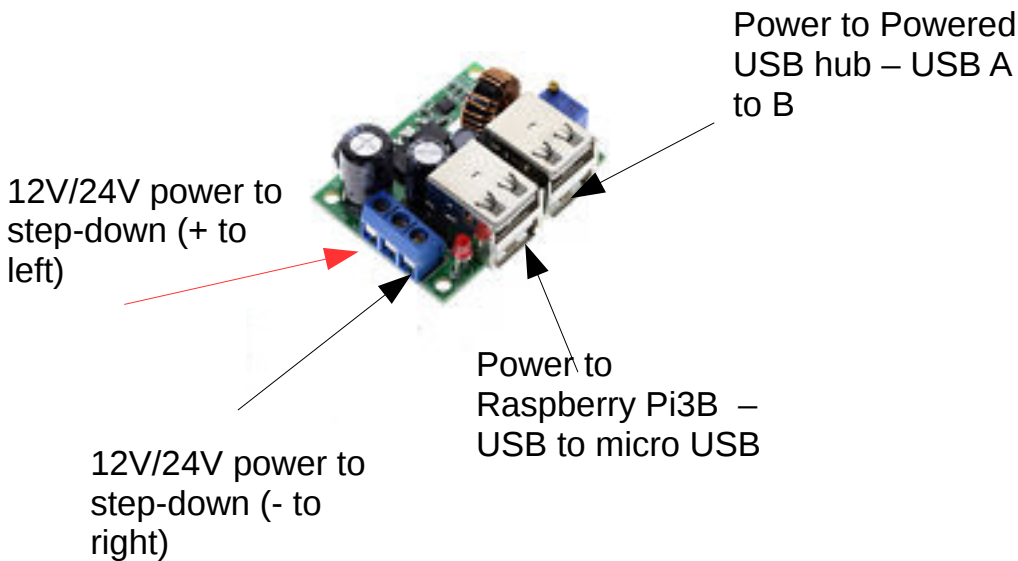
- 1. Insert micro SD card into Boat Control Unit (BCU) - Raspberry Pi 3B**
- 2. Provide 5V BCU Voltage stepdown with 12V or 24V power**
- 3. Connect USB to micro USB cable from Voltage stepdown to BCU to provide BCU with power**
4. *Optional* - if you have a powered USB hub :
 - a) , provide it with power - by using the USB to barrel jack cable from the Voltage stepdown to the hub . The hub can also be powered by a 240V transformer).
 - b) attach the hub to the BCU using the USB A-B cable
5. *Optional* - if you have an external Wireless device, insert it into the BCU or powered USB hub
6. *Optional* - if you have a 3G/4G dongle, insert it into the BCU or powered USB hub
7. *Optional* - if you have any Sensor Control Units, insert the half-moon Bluetooth USB device into the BCU (note that you can use a short USB extension cable if necessary but the Bluetooth master MUST be directly into the BCU and NOT a USB hub)

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BOAT CONTROL UNIT (Raspberry Pi 3B)



VOLTAGE STEP-DOWN TO 5V FROM 12V OR 24V



Skipper's Mate Assembly Notes

3. Security Edition

List of Items included

Camera (which may have a connecting cable or Wi-Fi capability)*

Recommend the Pi camera module available from PiHut. Cheaper versions are available on Ebay. Linux compatible USB cameras are also suitable.

GPS dongle

Ublox GPS/Glonass dongles work well. Available from Ebay.

USB extension cable - 3 metre - for GPS

** USB camera and ribbon cable cameras will be supplied with the appropriate connecting cable. Wi-Fi cameras (IP) will be supplied ready-configured to use with the Skipper's Mate Wi-Fi Hotspot*

Assembly Steps

IMPORTANT NOTE - all assembly should take place before applying power

- 1. Insert GPS dongle into BCU or hub, using the 3 metre extension cable if you need it.** Siting the GPS in a good position is often easier with an extn. Cable.
- 2. Optional* - if you have a USB camera, insert it into the BCU or USB hub
- 3. Optional* - if you have a ribbon cable camera, insert it into the BCU (before applying power)
- 4. Optional* - if you have a wireless IP camera, provide it with a power source

GPS

Plug into 3 metre extension cable ; plug other end into Powered Hub or Boat Control Unit. Site GPS where it should get a good view. On first use the GPS can take several minutes to find satellites - it should flash regularly (roughly 1 second frequency) when it has found satellites. Once into the Skipper's Mate system you can check via the menu option **GPS / GPS - Real-Time Update** to see how many satellites it has found. You will need **at least 3 or 4 satellites** to get a decent fix.

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Cameras

Various camera options available - and more cameras can be added. See website.

IMPORTANT NOTE - any camera which is to be used for motion detection **SHOULD NOT** be sited facing direct light or a window. Camera motion detection (separate from PIR detection) is dependent on the number of changed pixels in the camera's field. The level at which motion is determined to have occurred can be altered but if you have frequent changes of light (such as sunlight, reflections from water) then it may be very difficult to configure the camera sensibly. How many pixels determine a burglar and how many a shaft of sunshine? Total pixels = width x height (e.g. 320px x 240px = 76,800 pixels). If, for example, you set the threshold before an alert is sent to, say, 10,000 (a suggested outdoor level) you might still find that figure to low - thus generating spurious alerts. If you have curtains, we suggest leaving them closed when you leave the boat in "security" mode.

USB camera - comes with own USB A cable - plug into Powered Hub or Boat Control Unit directly (hub preferable - depends on number of USB devices drawing power directly from the Boat Control Unit (Raspberry Pi)).

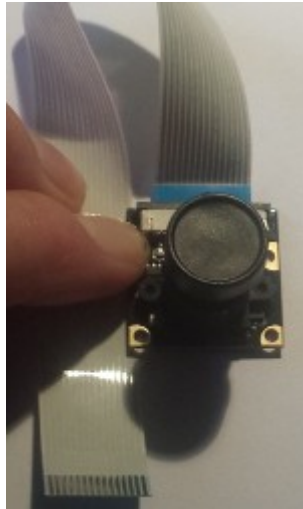
Ribbon cable cameras - these are either daylight viewing or night/day viewing (latter have 2 lights).

1) If the camera has lights, attach these first, using the screws provided. Make sure that the lights are firmly attached as they have metal contacts onto the camera board.



2) Attach cable to Boat Control Unit - At the bottom left of the picture below is the shiny silver connector on the ribbon cable (the other side is blue). Make sure that this shiny connector is facing the HDMI connector and SD slot and away from the Ethernet and USB ports. See **Section 2. Comms Edition** for illustration of the Raspberry Pi (BCU) board.

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Wireless IP cameras - these should have been pre-configured for the system, including wireless communication with the Boat Control Unit. We suggest you power them up (they come with 240V power supplies) adjacent to the Boat Control Unit, check they're recognised by the system using the **Viewing** menu, and then site them where you wish them to be - and re-check.

If you find that there are obstructions to the wireless signal or the distance is too great there are other options - please see the web site **Forum** questions and answers for more details.

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4. Sensor Control Unit (SCU)

Important Note : the **Shore Power Sensor Control Unit** requires 2 Arduinos and uses a variation on the standard method of connecting an SCU. Please refer to section 4.6

List of Items included

Sensor Control Unit microcontroller board - Arduino Uno*

Arduinos and clones are available from many sources. Ensure they are Uno compatible.

Voltage step-down - 12V or 24V to 9V **

Search for DC-DC buck converter. They are usually variable output.

Power cable with jack plug to connect voltage step-down & SCU / or barrel connector/jack plug to which you can add your own wire to connect to the voltage step-down

Bluetooth adapter

Search for mini bluetooth dongle.

Jumper wires

Selection available from any electronics store.

Sensor - each SCU will have one sensor - see sections below for details on how to work with each type of sensor

* Colour of Arduino Uno boards may vary

** Variable voltage step-down has been calibrated for 9V - you may wish to check this yourself before use.

Assembly Steps - FOR EACH SCU

IMPORTANT NOTE - all assembly should take place before applying power

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1. Voltage Stepdown

- a) Provide boat power (12V/24V) to the SCU Voltage stepdown
- b) Attach the barrel connector lead to the SCU Voltage stepdown

2. Attach Bluetooth board to SCU

Either HC05 or HC06 bluetooth module.

3. *Optional* - attach a Temperature/Humidity/DewPoint sensor to the SCU

Use a DHT11 (tempsense sketch) or DHT22 (dht22 sketch) sensor.

4. *Optional* - Voltage Sensor

Search for Arduino voltage sensor and voltsense sketch.

- a) attach a Voltage sensor to the SCU
- b) provide boat power to the Voltage sensor

5. *Optional* - attach a Make/Break sensor to the SCU

Search for reed sensor (often used on window frames) and reedsense sketch.

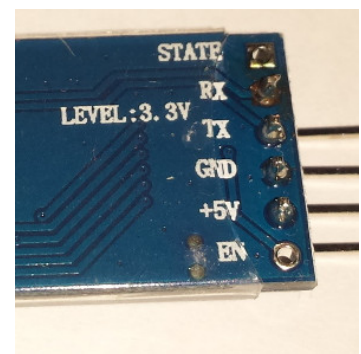
6. Power up the SCU by inserting the barrel connector from the Voltage Stepdown into the SCU

4.1 Enabling Bluetooth Connections

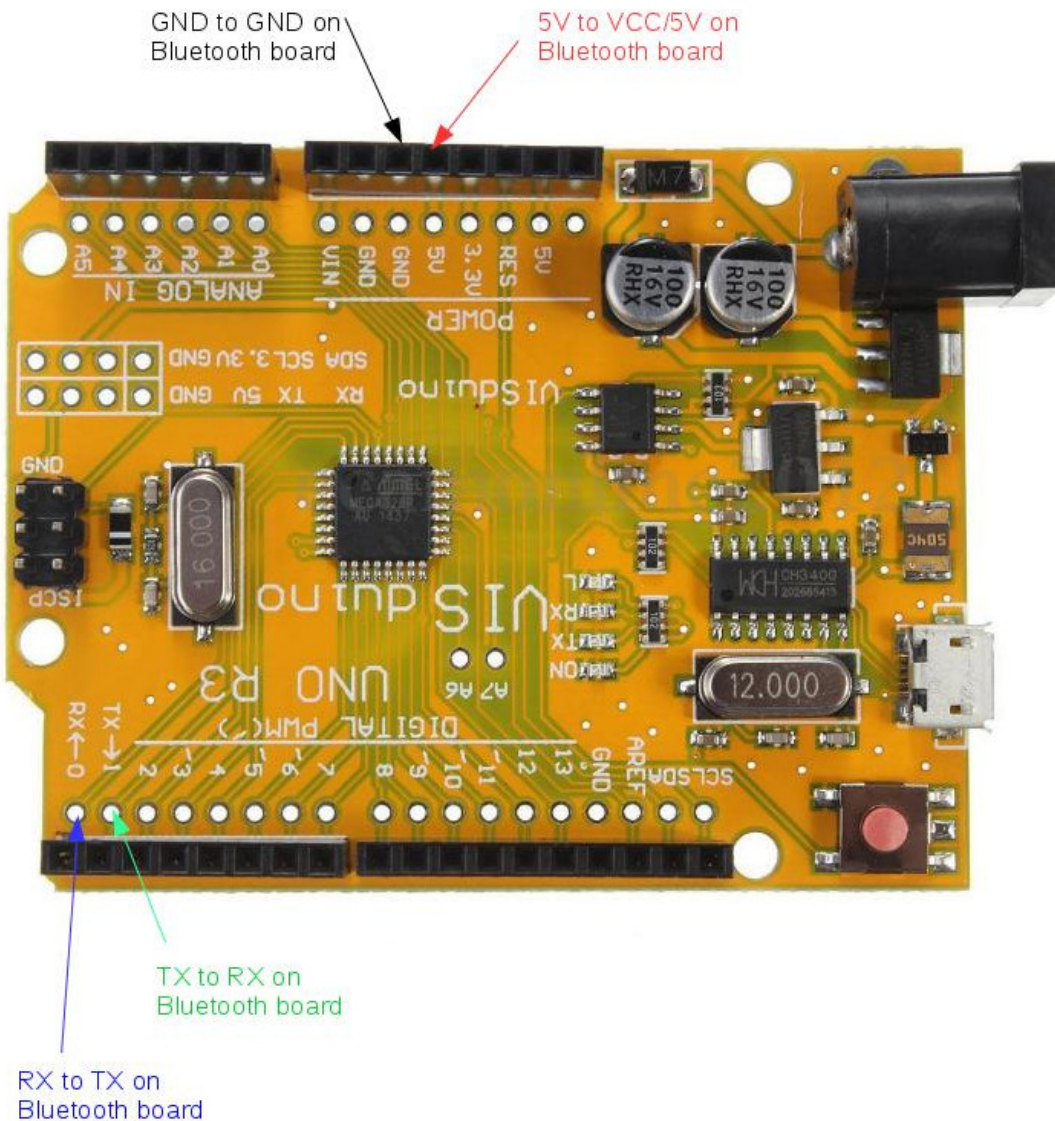
All Sensor Control Units require Bluetooth Communications.

- 1) You should ensure that the main Bluetooth device on the Boat Control Unit ***is plugged directly*** into a USB port on the Boat Control Unit (not the hub).
- 2) Each Sensor Control Unit must have a Bluetooth board attached - see below
- 3) Each Sensor Control Unit will have one (and only one) sensor. Details of the connection methods are described later in this section.

Attaching the Bluetooth board



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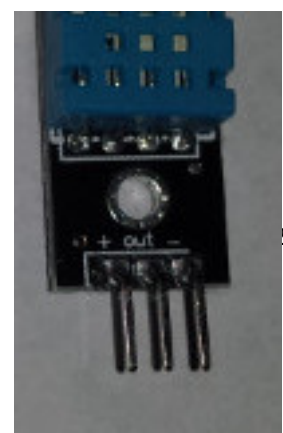
The 4 pins - RX, TX, GND and +5V (sometimes labelled VCC) should be

connected via the enclosed jumper wires to the sockets shown below on the Arduino Uno/Sensor Control Unit. Ignore STATE and EN .

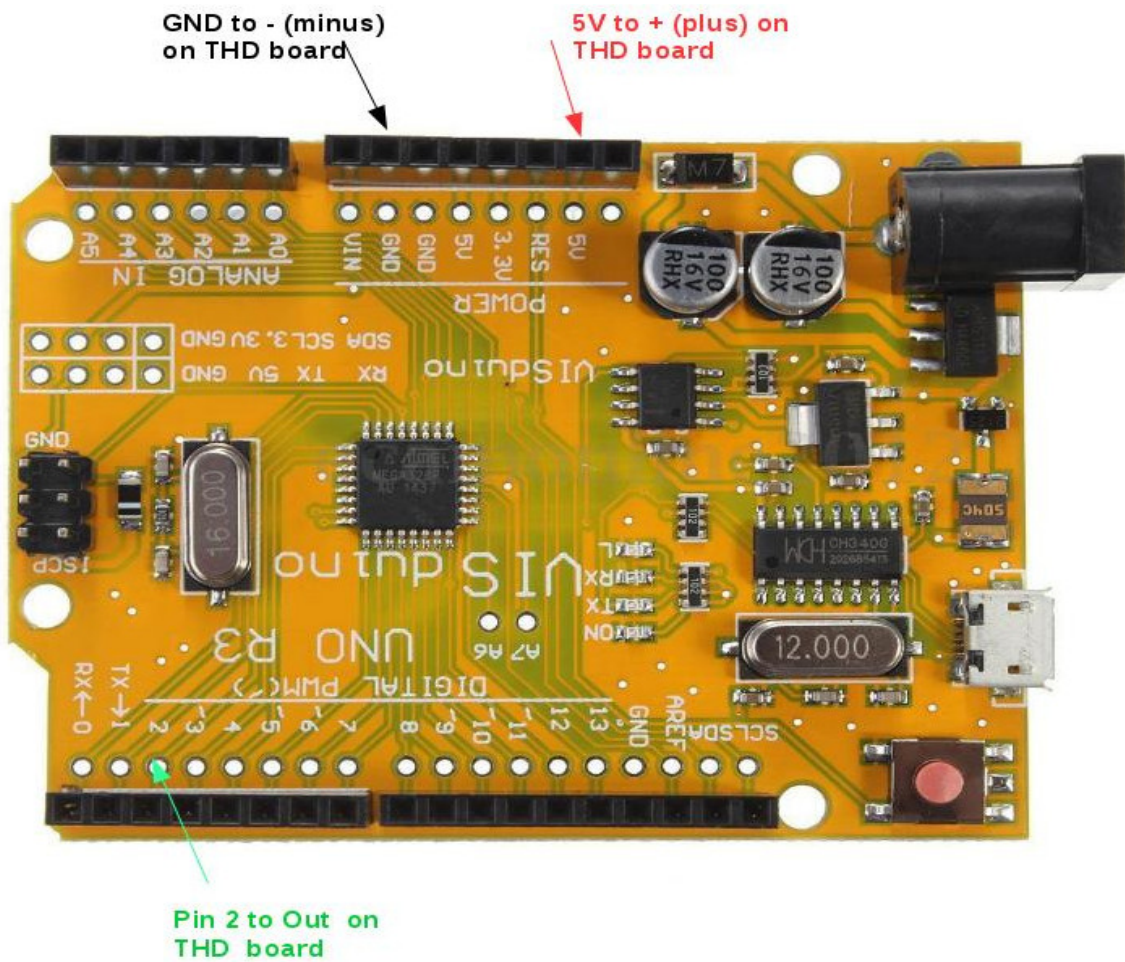
4.2 Attaching a Temperature/Humidity/Dew Point Sensor

This sensor has 3 pins : + **OUT** -

Use the enclosed jumper wires to the sockets shown below on the Arduino Uno/Sensor Control Unit.



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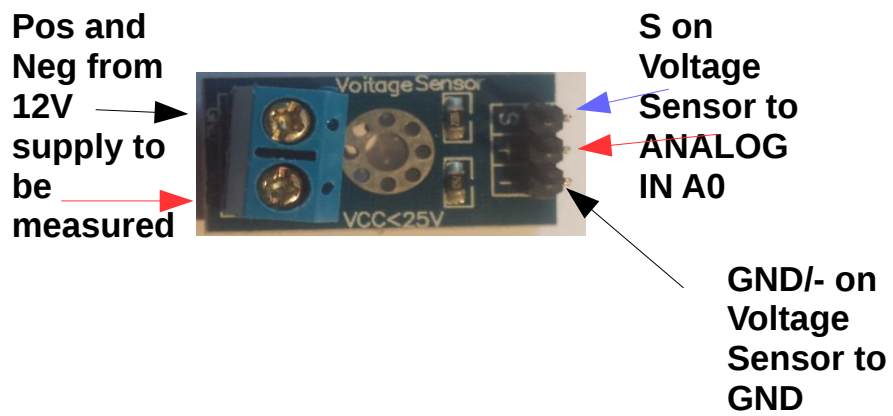
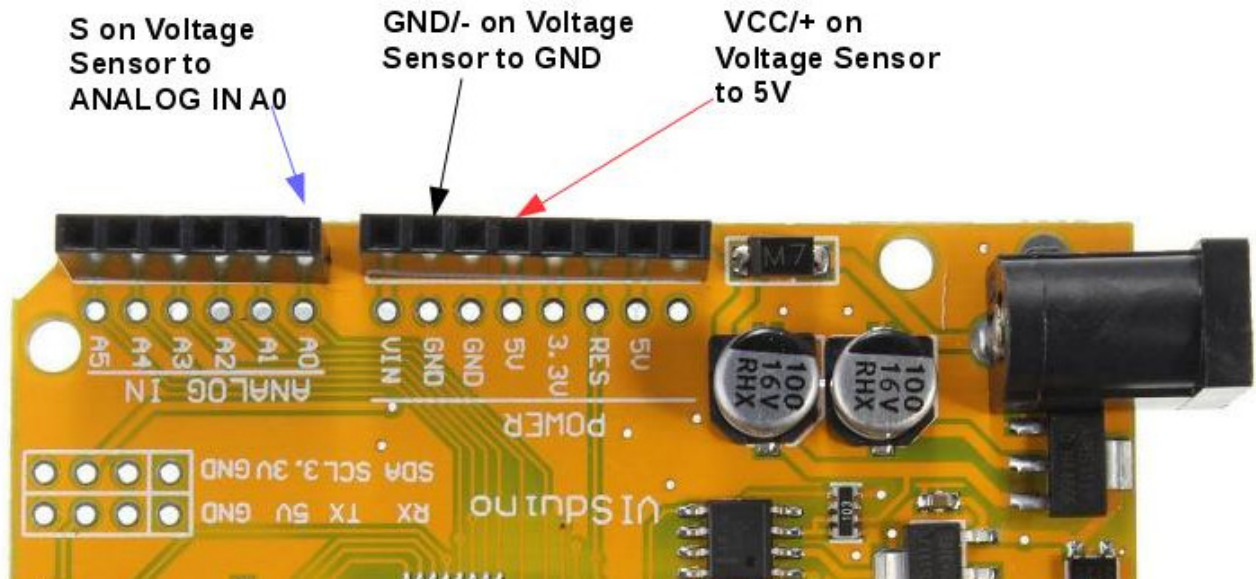
4.3 Attaching a Voltage Sensor

This sensor has 3 pins : S + -

It also has two screw terminals to accept positive and negative from the 12V supply you wish to measure/sense.

Use the enclosed jumper wires to the sockets shown below on the Arduino Uno/Sensor Control Unit.

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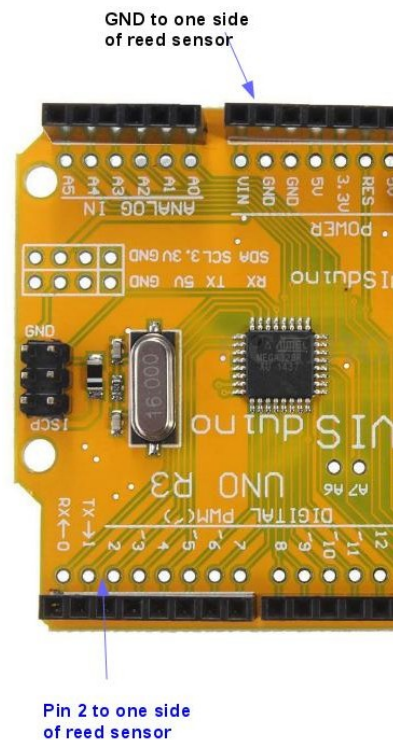
Skipper's Mate Assembly Notes

4.4 Attaching an Make/Break (Reed) Sensor – Bilge, Hatch/Door, PIR etc.

These make-break sensors typically have 2 wires which can be wired in either way.

Note - the wires on these can be extended for convenience.

Bilge/Float Sensor



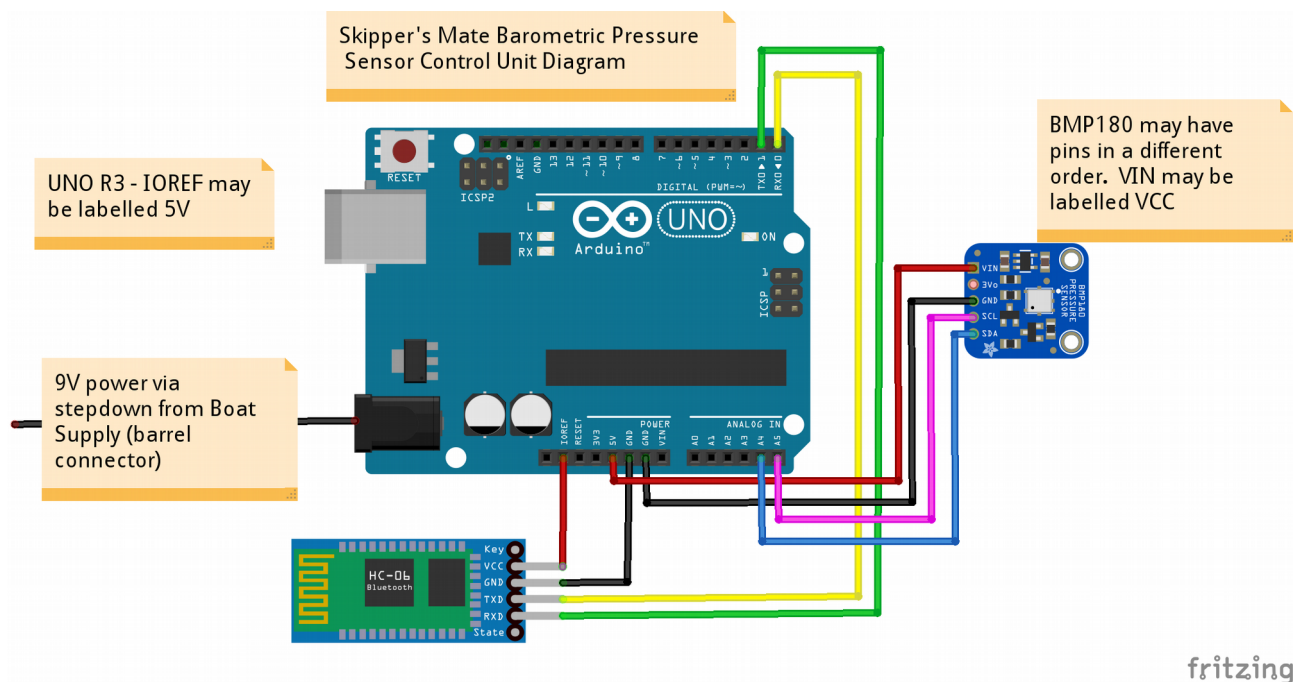
Skipper's Mate Assembly Notes

4.5 Attaching a Barometric Pressure Sensor

These utilise the standard method of attaching a Bluetooth communications sensor as documented in Section 4.1. The new Fritzing diagrams make it easier to show the entire SCU wiring – so this is now included for each SCU.

Uses BMP 180 sensor and pressure sketch.

This diagram can be seen in a browser by clicking on this link or pasting it into a browser : https://www.skippersmate.co.uk/skippersmate/images/fritzing/scu_with_bt_bmp180.png



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4.6 Attaching a Shore Power Sensor

List of Items included

Shore Power – Mains Power

Sensor Control Unit microcontroller board – Arduino Uno*

9V/240V transformer to power board

Relay (a single channel relay is required – if a multi-channel one is supplied, just use one channel and ignore the other)

Search for Arduino relay.

Jumper wires

Shore Power – Sensor Control Unit – Boat Power

Sensor Control Unit microcontroller board – Arduino Uno*

Power cable with jack plug to connect voltage step-down & SCU / or barrel connector/jack plug to which you can add your own wire to connect to the voltage step-down

Bluetooth adapter

Jumper wires

* Colour of Arduino Uno boards may vary

** Variable voltage step-down has been calibrated for 9V – you may wish to check this yourself before use.

Assembly Steps – For each part of the Shore Power Sensor Control Unit

IMPORTANT NOTE - all assembly should take place before applying power

Shore Power – Mains Power

1. Arduino to Relay

Connect 5V and GND on the Arduino to VCC and GND on the Relay

Connect Digital Pin 2 on Arduino to IN1 (or IN2) on the Relay

2. Arduino Power

When the remainder of the Shore Power Sensor is complete, power the Arduino from the Mains/9V adapter.

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Shore Power – Sensor Control Unit Boat Power

1. a) Provide boat power (12V/24V) to the SCU Voltage stepdown
b) Attach the barrel connector via a lead to the SCU Voltage stepdown
2. Attach Bluetooth board to SCU (see 4.1 above)
3. Connect GND and Digital Pin 3 on Arduino to Relay as shown in the Fritzing diagram below (Note : correction 1.0.7 from Pin 2 to Pin 3)
4. Power up the SCU by inserting the barrel connector from the Voltage Stepdown into the SCU

These utilise the standard method of attaching a Bluetooth communications sensor as documented in Section 4.1. The new Fritzing diagrams make it easier to show the entire SCU wiring – so this is now included for each SCU.

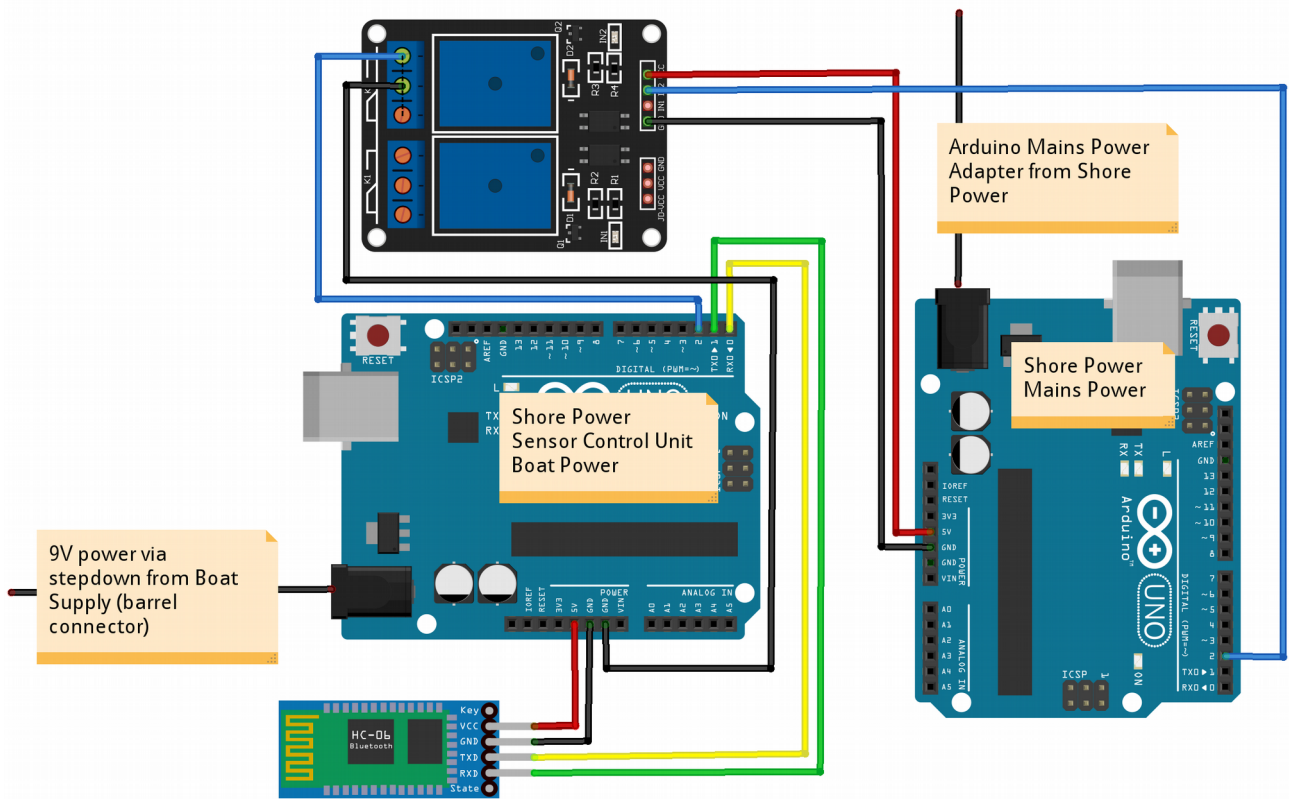
Like the other Sensor Control units listed above, the **Shore Power Sensor Control Unit** is powered by 9 volts from the Boat Supply. It also has a Bluetooth communications dongle.

The Shore Power Mains Power side differs from the other Arduinos. It has a Relay which is kept open whilst Mains Power (via the 9V transformer) is supplied. If Mains Power fails the relay will close and the value of Pin 2 on the Sensor Control Unit changes – this is then picked up by the sketch on the Shore Power Sensor Control Unit – Boat Power – and transmitted via Bluetooth to the Boat Control Unit.

This diagram can be seen in a browser by clicking on this link or pasting it into a browser :
<https://www.skippersmate.co.uk/skippersmate/images/fritzing/shorepower1.png>

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Skipper's Mate Shore Power Sensor Control Unit Diagram



fritzing

NOTE 1.0.7 Bottom right of diagram showing digital pin 2 should actually be **digital pin 3**.
Correction.

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5. The Essential Security System (TESS)

TESS differs slightly from the remaining Skipper's Mate Editions - although able to share the sensors etc.

TESS is intended to provide :

- Boat Control Unit (Comms Unit with optional comms - 3G/4G and/or external wireless
- built-in PIR
 - Use HC-SR501 pir module.
- LED light
 - LED daytime driving lights work well.
- wired relay to initiate LED light
- ribbon cable camera*
- GPS

* The standard TESS will have a daylight ribbon cable camera - this will be able to take night footage lit by the LED light which will be triggered by the PIR. A night-vision camera is available as an alternative but this does not fit neatly into the TESS enclosure by virtue of its infra-red lights. These infra-red lights which are permanently on during the hours of darkness and will consume more power than the daylight version (Note that the day/night camera has a light sensor which can be adjusted). Other cameras (e.g. wired USB and wireless IP cameras) can also be substituted/added).

List of Items included

TESS Enclosure

Boat Control Unit board - Raspberry Pi 3B

Micro-SD card for BCU

Voltage step-down - 12V or 24V to 5V

Power cable (USB to micro USB) for BCU

3G/4G mobile broadband dongle (unlocked)*

Wi-Fi dongle with removable antenna (reverse SMA connection)*

GPS with 3 metre USB extension cable

Relay unit - 2-channel**

2 off USB extension cables - 25cm

* TESS is available either with a 3G/4G dongle or an external wireless dongle, or both - please see web site for details.

** The relay unit is intended to connect the LED light and leave one channel available for other items (e.g. siren, strobe light). It can be wired to accommodate all three since the current draw on these items of equipment is not large. These relays are intended for

Skipper's Mate Assembly Notes

light use only - 12V or 24V. If you wish to run heavier equipment then use this relay to drive a more powerful relay.

Assembly Steps

IMPORTANT NOTE - all assembly should take place before applying power

1. Insert micro SD card into Boat Control Unit (BCU) - Raspberry Pi 3B (Sect.2)

2. Provide 5V BCU Voltage stepdown with 12V or 24V power (Sect.2)

3. Connect USB to micro USB cable from Voltage stepdown to BCU to provide BCU with power (Sect.2)

4. Camera (Sect.2 & 3)

a) *optional* - if you have a day/night ribbon cable camera, fit the infra-red lights

b) *optional* - if you have a ribbon cable camera, insert it into the BCU

c) *optional* - if you have a USB camera, insert it into the BCU

d) *optional* - if you have a wireless IP camera, provide it with a power source

5. Connect PIR to BCU with jumper wires (below)

6. Connect up TESS Relay Unit (below)

a) *optional* - connect LED light to Channel 1 on TESS Relay Unit

b) *optional* - connect any other device(s) (e.g. strobe, siren) to Channel 2 on TESS Relay Unit

c) Connect TESS Relay Unit to BCU

7. Insert BCU, daylight ribbon cable camera, and PIR into TESS Enclosure, screwing in camera

8. *Optional* - if you have an **external Wireless device**, insert it into the BCU (with or without a USB extension) **(Sect.2)**

9. *Optional* - if you have a **3G/4G dongle**, insert it into the BCU (with or without a USB extension) **(Sect.2)**

10. Insert GPS dongle into the BCU using the 3 metre extension cable if you need it. Siting the GPS in a good position is often easier with an extn. Cable. **(Sect.3)**

11. *Optional* - if you have any **Sensor Control Units, insert the half-moon Bluetooth USB device** into the BCU (note that you can use a short USB extension cable if necessary but the Bluetooth master **MUST** be directly into the BCU and **NOT** a USB hub) **(Sect.2)**

Skipper's Mate Assembly Notes

Note that the illustrations for some items may be found in previous sections – Section 2 Comms. Edition and Section 3 Security Edition, the remainder are shown below if illustration seems useful.

FLASHES AND CLICKS AT BOOT TIME

WARNING ! - If you have a relay i.e. a TESS BCU or a Wi-Fi Relay Control Unit the relay will reset at boot time. This will cause the relays to 'click' and any lights attached (e.g. LED lights, strobe lights) to flash. This is normal.

PIR to TESS

TESS is designed to have a PIR built-in to the TESS enclosure and wired directly to the BCU. (Note that other PIR units can be sited elsewhere around the boat using a Sensor Control Unit with PIR.)

The PIR needs 3 jumper wires :

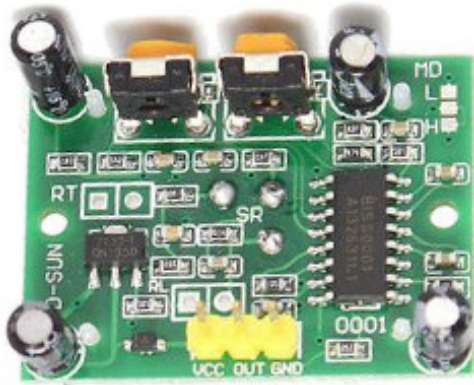
VCC - to BCU 5V

Output - to BCU Pin 12

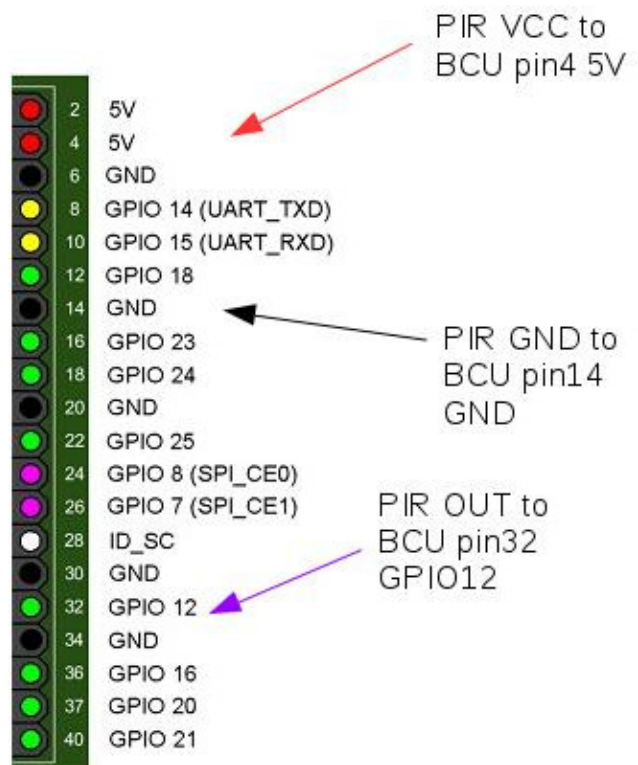
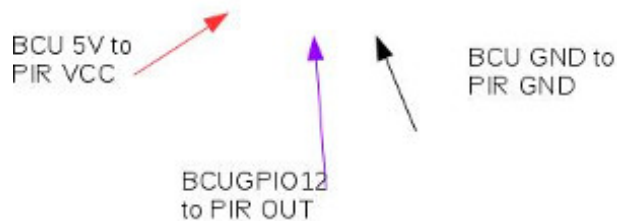
GND - to BCU GND

A full pin diagram for the Raspberry Pi3B (which is currently our BCU board) is shown in Appendix B. The relevant areas, with the PIR are shown below.

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Note : PIR units frequently have no markings to indicate VCC/Out/GND. This way up, with the yellow pins towards you, VCC is on the left.



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TESS Relay Unit and Relay Devices

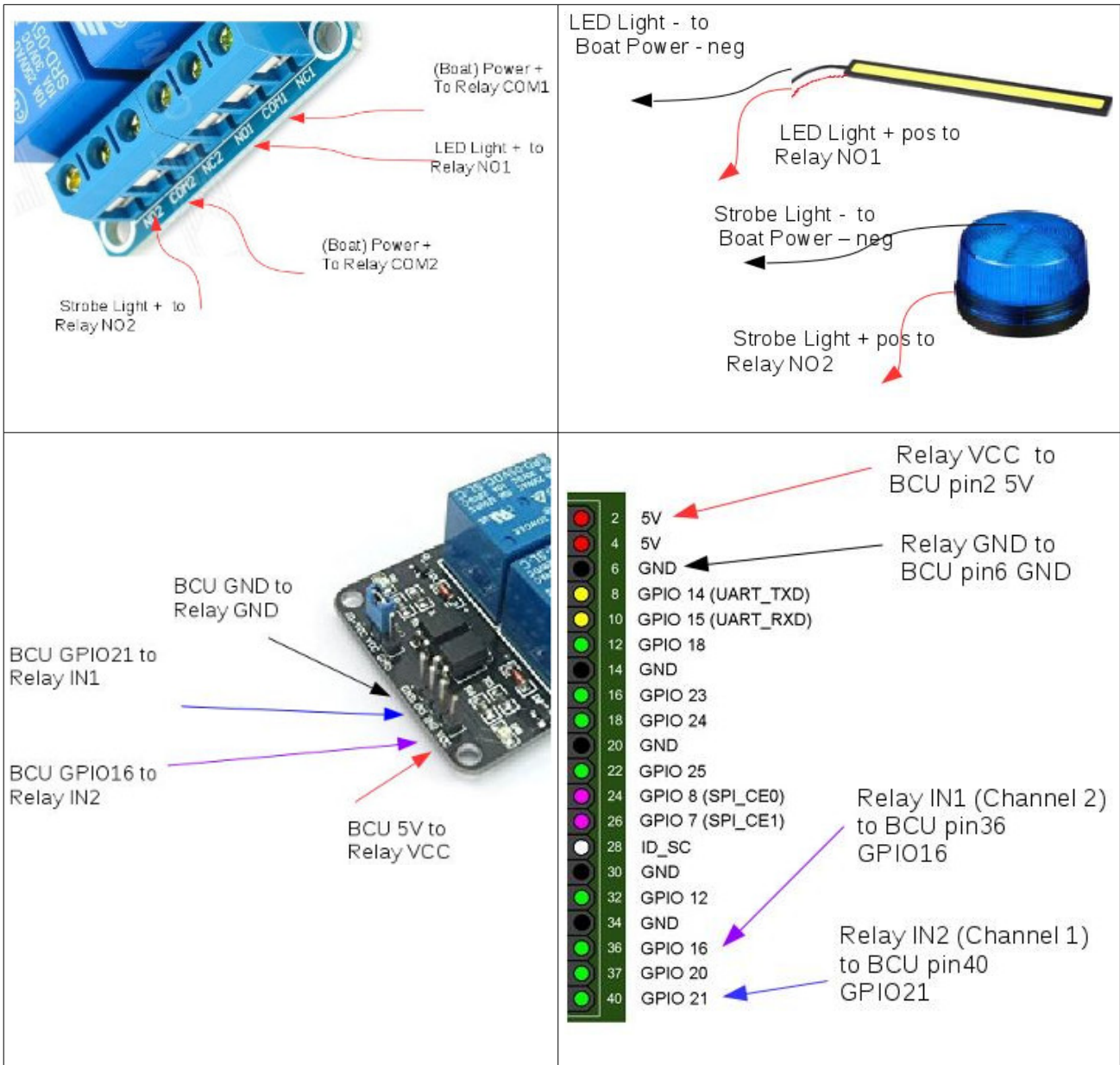
TESS is designed to have a 2-channel relay unit wired directly (although the distance between the TESS BCU/Enclosure and the relay can be extended by you, if you so wish). (Note that other Relay Control Units using Wi-Fi connections to a BCU can be sited elsewhere around the boat.

A full pin diagram for the Raspberry Pi3B (which is currently our BCU board) is shown in Appendix B. The relevant areas, with the PIR are shown below.

TESS Relay to LED Light and to Strobe Light

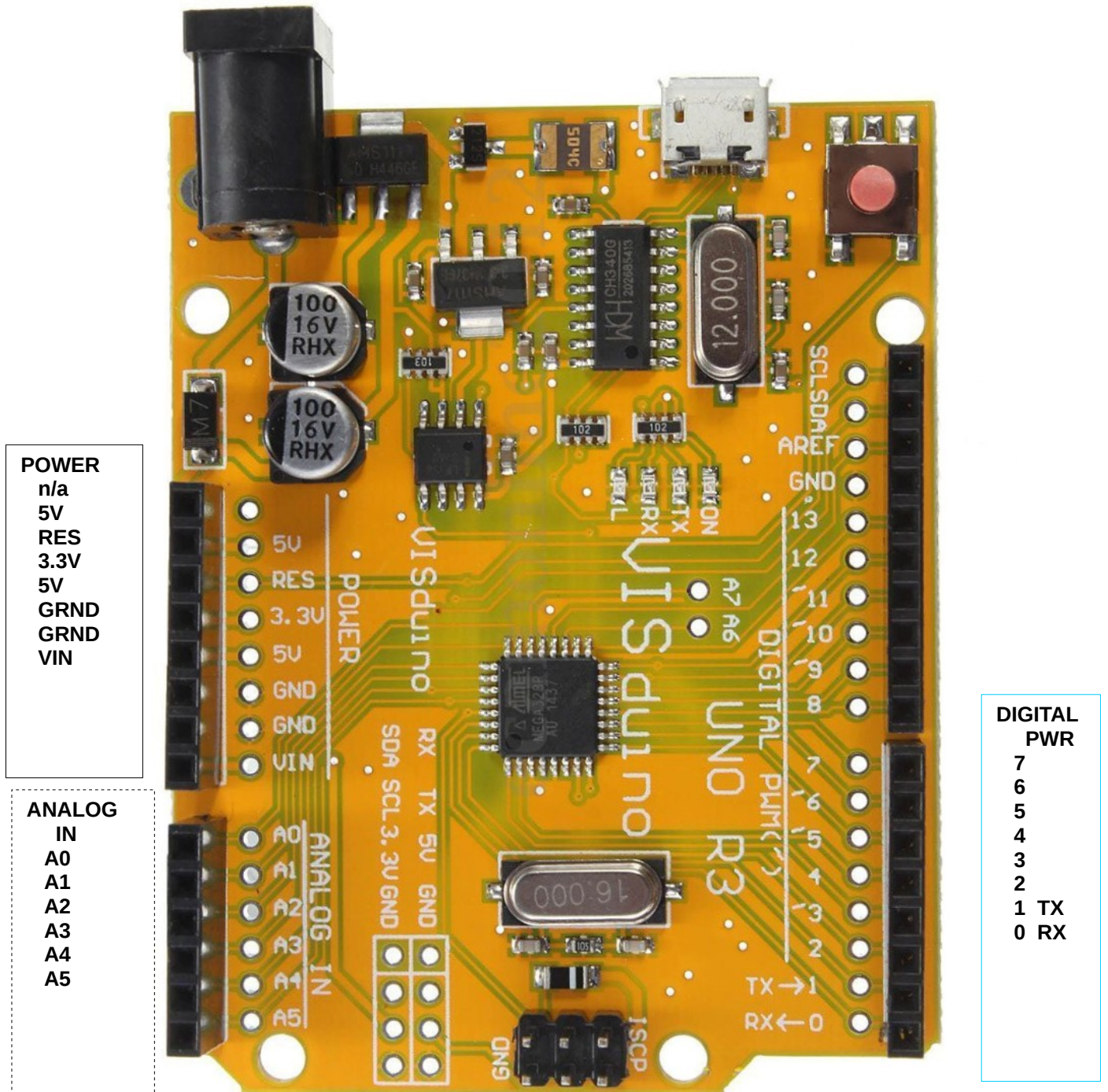
The relay units used for Skipper's Mate have 2 channels. The first is intended for use with an LED light (or you could set it up to trigger your cabin lights) and one is left free for any other use you wish. The example below shows the LED light on Channel 1 and a Blue Flashing Strobe light attached to Channel 2.

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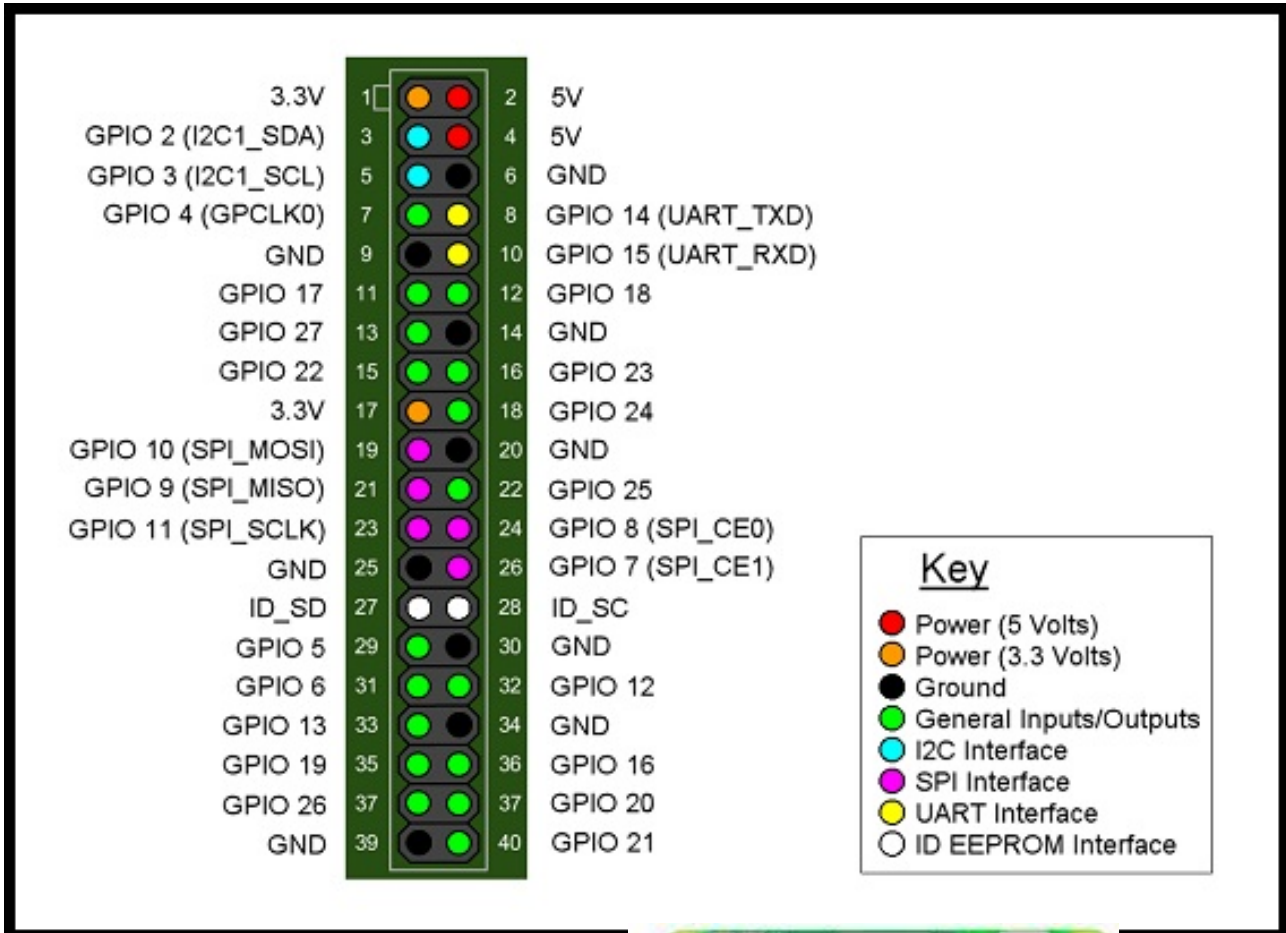
Appendix A. Sensor Control Unit (SCU) Pin Diagram



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Appendix B. Boat Control Unit (BCU) Pin Diagram

This diagram is replicated courtesy of rs-online.com



Top right is the 5V pin - the numbering starts at the end furthest away from the USB/Ethernet ports



Skipper's Mate Assembly Notes

Acknowledgements

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