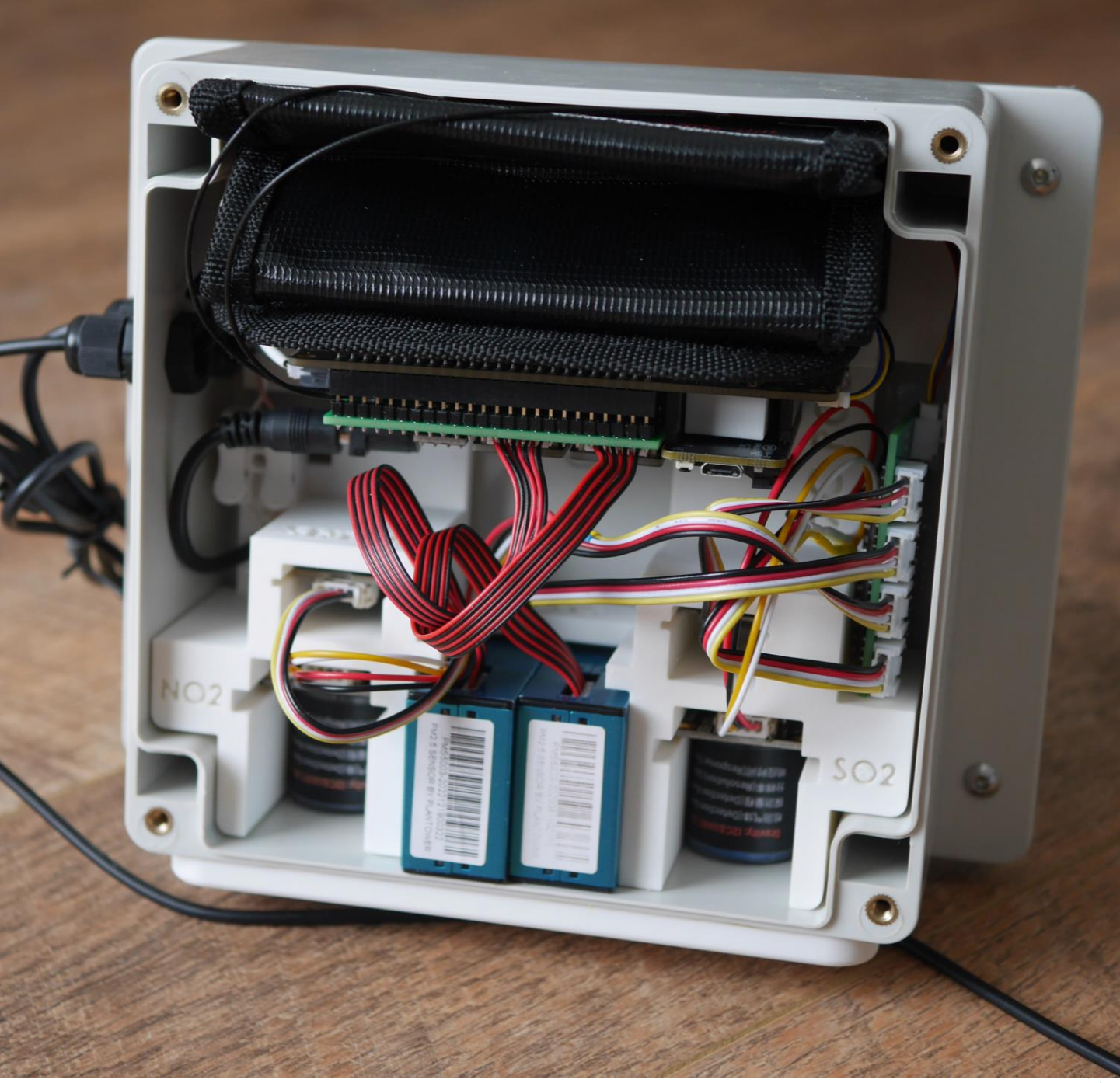
Chronova Engineering

SUSTRANS AIR POLLUTION MONITORS

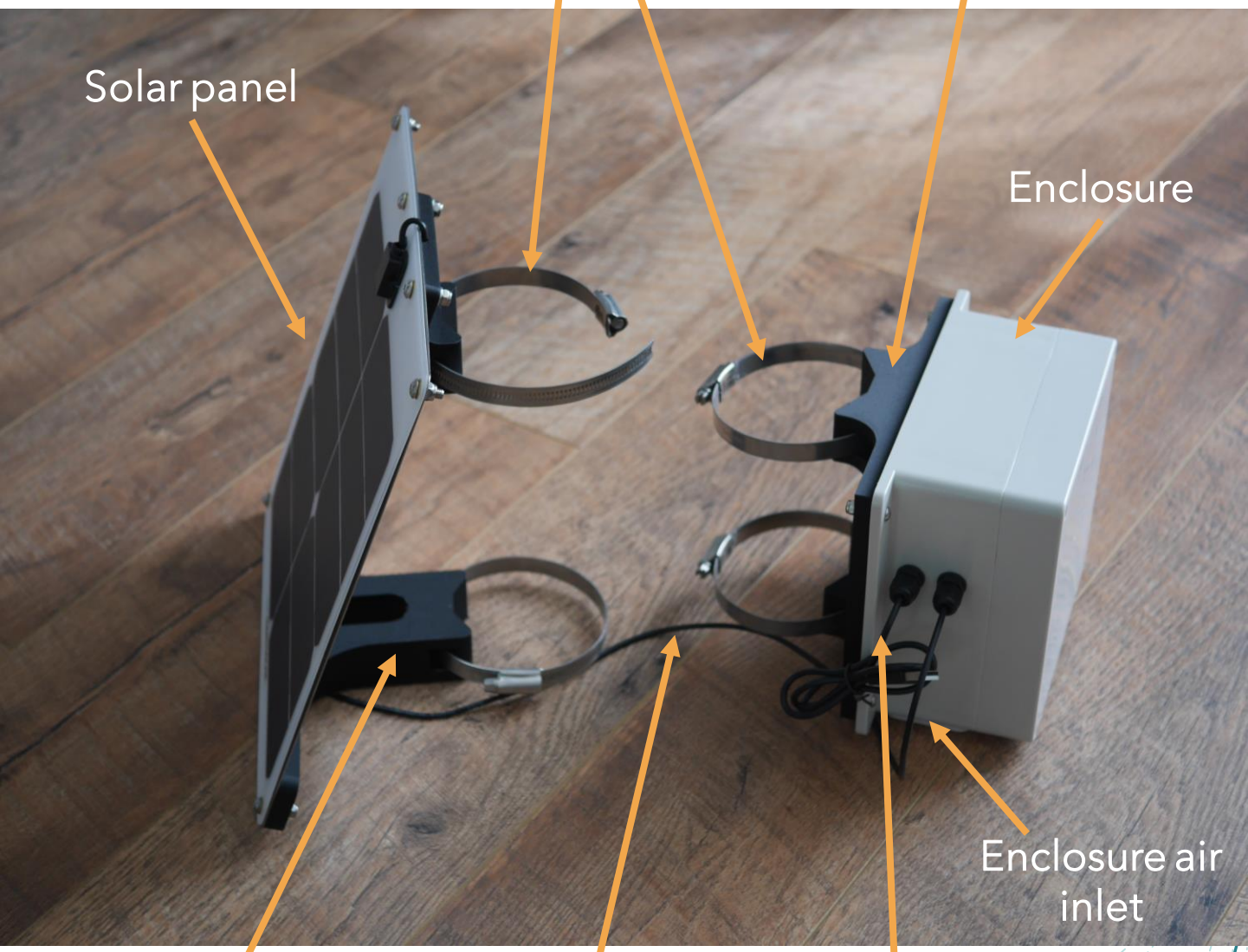
USER MANUAL

5 July 2024

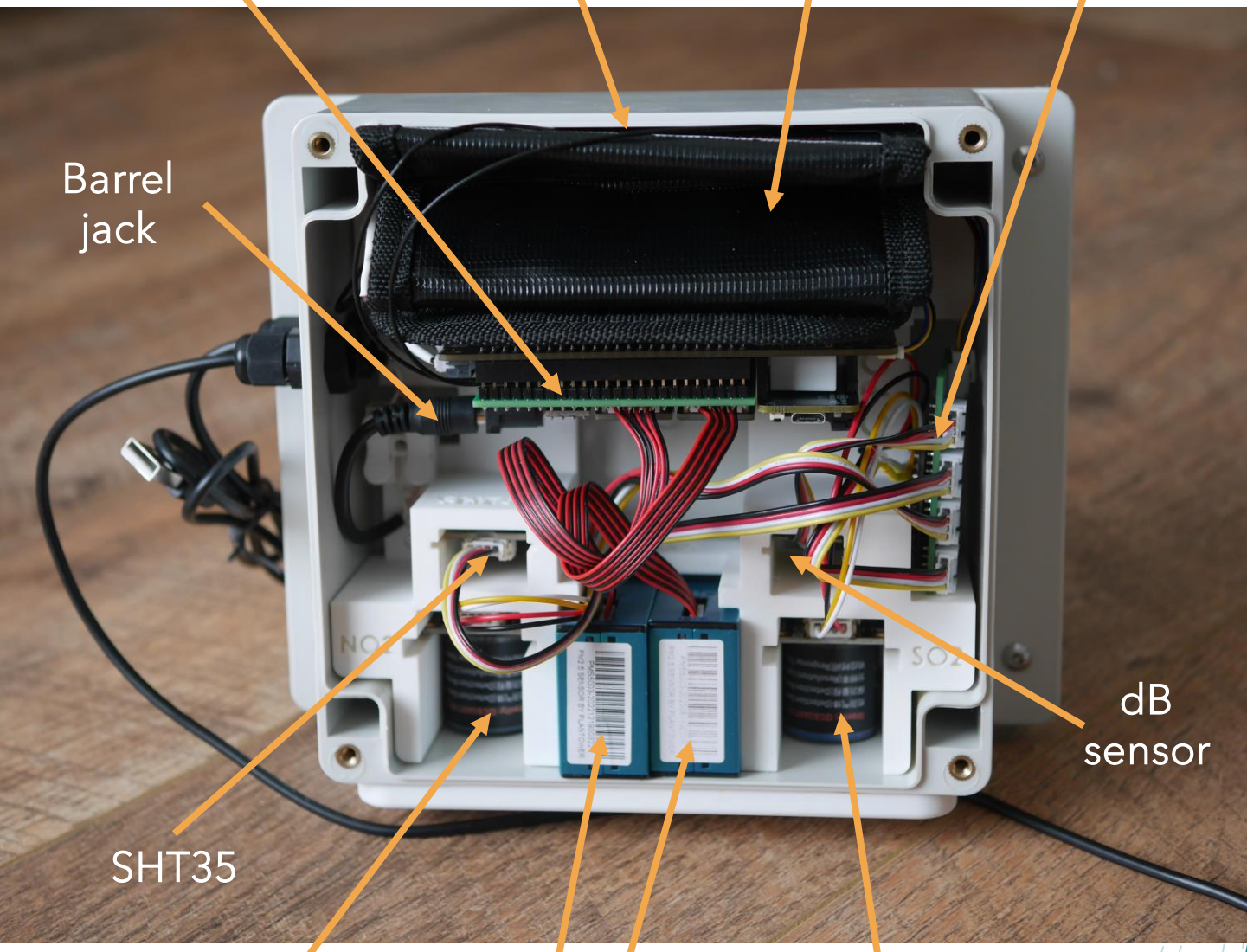


DEFINITIONS

ENCLOSURE & SOLAR PANEL

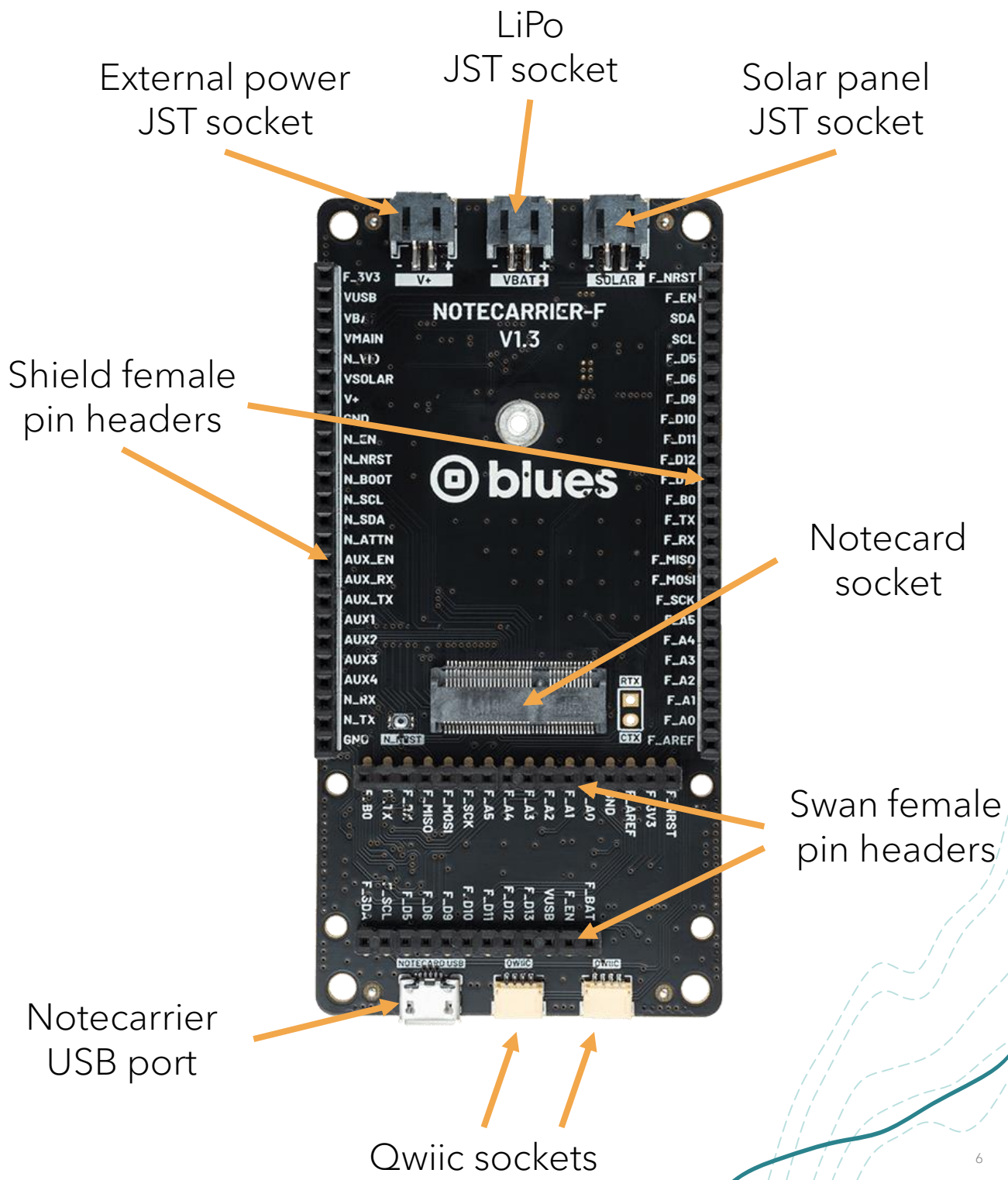


ENCLOSURE INTERNALS

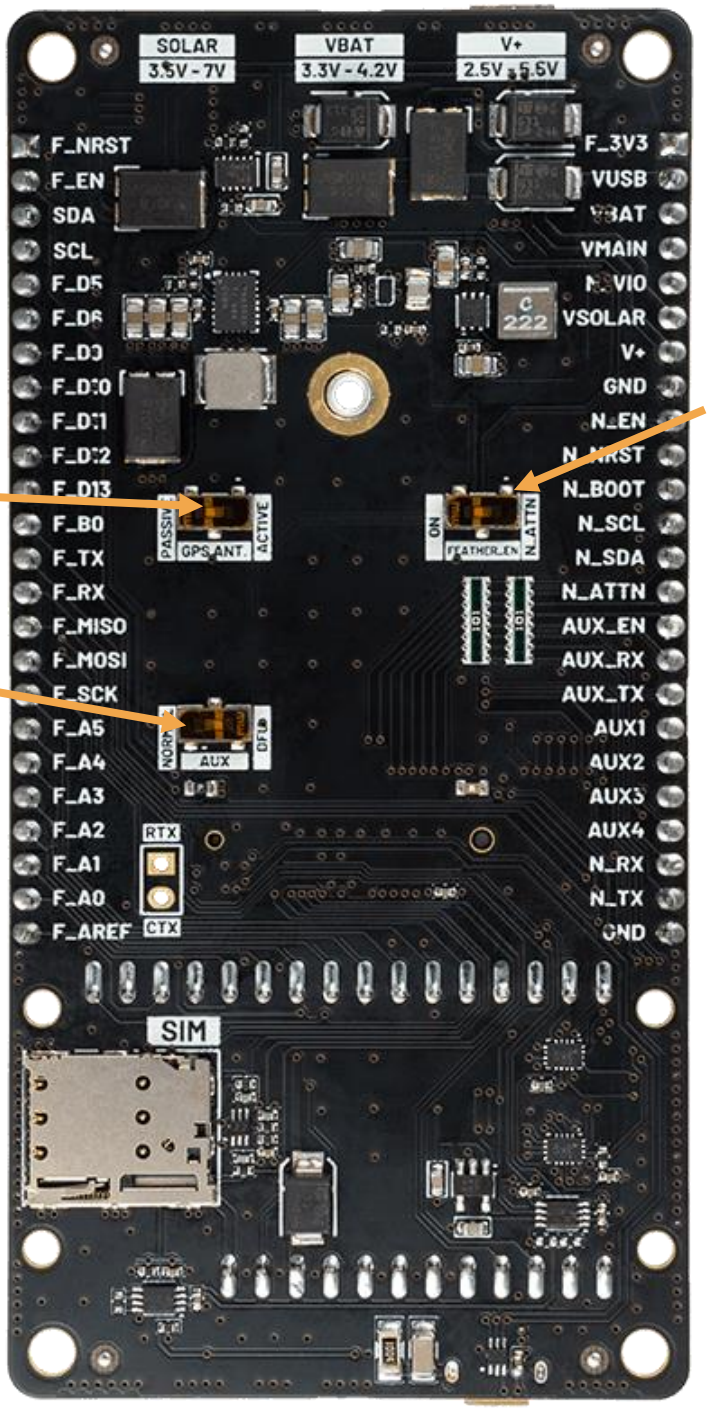


NOTECARRIER (FRONT)

The Notecarrier is the large black PCB. It distributes power and data between the Swan microcontroller, Notecard and sensor shield.



NOTECARRIER (BACK)



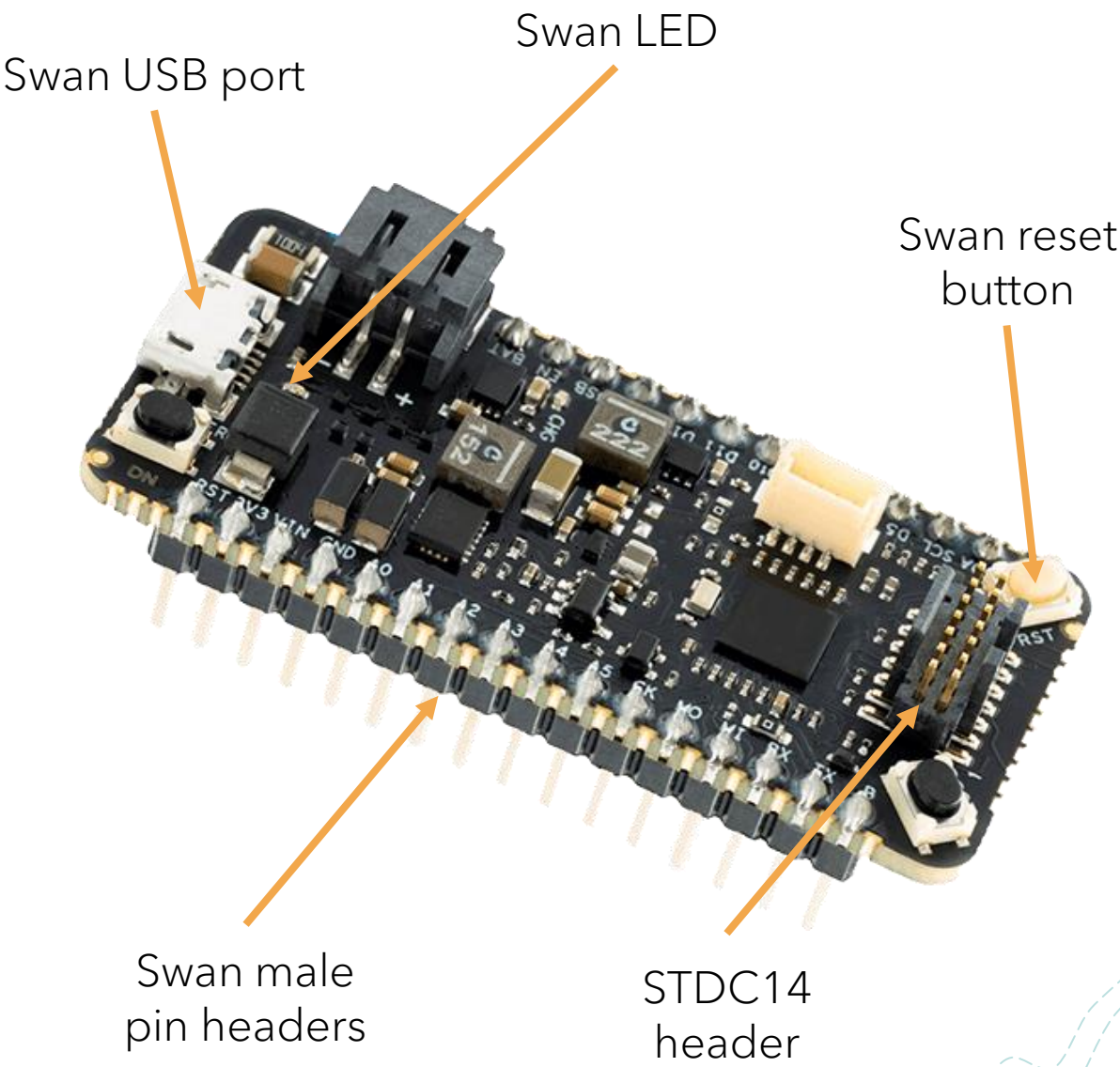
GPS antenna switch

Aux switch

Feather enable switch

SWAN MICROCONTROLLER

The Swan microcontroller is the smaller black PCB. It controls most of the monitor operations.



NORMAL OPERATIONS

During normal operation, the following processes will occur:

1. The Notecard will activate the Swan microcontroller.
2. The red Swan microcontroller LED will turn on.
3. The sensors will warm up for 5 minutes before taking a reading. The fan in the particulate matter sensor should be running.
4. The particulate matter sensors will turn off.
5. The sensor readings will be queued to the Notecard.
6. The Swan microcontroller and its LED will turn off for another 15 minutes.

7. Depending on battery charge, the Notecard will transmit queued sensor readings every few hours. When this occurs, a high-pitched whistling noise may be heard from the Notecard.

POWER SUPPLIES

The monitors can be powered in 4 ways during deployments:

LiPo Only

- Not recommended but can be used for a few days at a time
- Weather station not supported

LiPo + Solar Panel

- Recommended for standard use & short-term storage
- Weather station not supported

LiPo + External Power

- Not recommended unless solar power is unavailable
- 4.5V to 21V input voltage via barrel jack OR screw terminal
- Weather station supported

LiPo + Solar Panel + External Power

- Recommended for winter or with the weather station add-on
- 4.5V to 21V input voltage via barrel jack OR screw terminal

DISCONNECTING THE SOLAR PANEL

1. Open the monitor enclosure by unscrewing the 4 lid bolts.
2. Gently lift out the Notecarrier assembly.
3. Unplug the solar panel JST connector from the Notecarrier with the aid of a JST removal tool.
4. Unscrew the outermost plastic dome of the solar panel cable gland until it comes off.
5. Pull the solar panel JST connector out through the cable gland. The rubber tubing may come loose with the JST connector – if so, remove it from the JST connector and push it back into the gland.
6. Screw the cable gland dome back onto the gland assembly.
7. Push a cable gland cap into the gland from the outside, then tighten the gland onto it so it seals.

DISCONNECTING THE EXTERNAL POWER CABLE

1. Disconnect the power cable from any external supply voltage (i.e. wall sockets/USB sockets).
2. Open the monitor enclosure by unscrewing the 4 lid bolts.
3. Gently lift out the Notecarrier assembly.
4. Unplug the barrel jack from the Notecarrier.
5. To uplug the wires from the white connection block, press down on each white tab and gently pull out the corresponding wire.
6. Remove the barrel jack end of the power cable.
7. Unscrew the outermost plastic dome of the power cable gland until it comes off.
8. Pull the power cable out through the cable gland. The rubber tubing may come loose with the cable – if so, remove it from the cable and push it back into the gland.
9. Screw the cable gland dome back onto the gland assembly.
10. Push a cable gland cap into the gland from the outside, then tighten the gland onto it so it seals.

EXTERNAL POWER OPTIONS

An external power supply must be used to enable the weather station add-on, as this requires continuous power. There are 2 options for doing so:

Barrel Jack (Default)

The monitors are fitted with a standard 2.1mm DC barrel jack on the Notecarrier shield PCB. This input can be supplied with 4.5 to 21V DC. The default configuration uses a 5V USB A input, which is connected to the barrel jack via a 2-pin connection block.

Screw Terminal Block

Next to the barrel jack socket on the Notecarrier shield PCB, there is a pair of unpopulated holes for fitting a screw terminal block. This may be used **instead of** the barrel jack but **not at the same time**. This input can be supplied with 4.5 to 21V DC. Ask an experienced electronics engineer or technician to solder in an appropriate terminal block if desired.

Notecarrier USB port

The Notecarrier is also fitted with a micro-USB port (5V). This is unlikely to be suitable for field use but may be useful for debugging purposes or for supervised recharging of the LiPo battery. ***This does not provide power to the weather station add-on.***

LIPO SAFETY

These monitors contain Lithium Polymer (LiPo) batteries. If mistreated, LiPo batteries may pose a fire risk, so they must be handled with care.

Never pierce, crush, bend, drop or otherwise attempt to open or damage LiPo batteries.

Never short or connect together the two wires from the LiPo battery. Never cut both wires at the same time – this will cause a short circuit.

Always store LiPo batteries in a fireproof bag.

Never expose LiPo batteries to extreme temperatures (>49 °C) or direct sunlight for prolonged periods.

Always store LiPo batteries at room temperature (4 - 21°C).

If you notice that a LiPo battery is swelling or punctured, cease using it immediately and dispose of it in accordance with local guidelines.

INSTALLATION

1. Check that the bolts on each of the black brackets are secure and gently tighten with an Allen key and spanner if required.
2. Open each of the jubilee clips using a flathead screwdriver or 7mm socket.
3. Orient the solar panel with the larger mounting bracket at the bottom, and the enclosure with the air inlet at the bottom.
4. Starting with the uppermost jubilee clip, close each clip around the lamppost and tighten the jubilee clip bolt until it grips firmly and the bracket cannot be rotated relative to the post. Do not tighten the clip beyond this point as doing so may damage the mounting brackets.
5. Slightly loosen the solar panel clips and rotate the panel to face southwards. Retighten the clips when the desired position is set.

Note: the cable connecting the solar panel to the enclosure cannot bear the full weight of the enclosure. Ensure that the enclosure and solar panel mount are always supported directly and that any cables remain slack.

STORAGE

Short-term storage

These monitors use a specialised communication protocol to minimise power consumption and data usage. Part of this protocol requires the devices to be continuously powered. Removing all power from a monitor and turning it back on requires it to reestablish its connection with the mobile data network, which is a power- and data-intensive process.

As such, when storing the monitors for short periods, it is recommended to leave the LiPo battery and solar panel connected and to place the solar panel in a sunny location.

Long-term storage

If the monitors will not be used for a long time (>1 month), it may be preferable to turn them off fully to minimise wear on the sensors. In this scenario, first detach any external power supplies, followed by the solar panel connector and lastly, the LiPo battery connector. Any connectors with a JST fitting (solar panel & LiPo battery) should be gently unplugged with the aid of a JST removal tool, to avoid damaging the wires.

When restoring power to a monitor, always connect the LiPo battery first. The polarity of connectors must always be observed (red = positive, black = negative). Never attempt to force a connector into a socket.

When turning a monitor back on after a long time, the battery charge may have dropped too low to sufficiently power the device during the network reconnection process. In this scenario, it is recommended to connect a 5V USB supply to the Notecarrier USB port and supervise the device whilst the battery recharges for a few hours. Check that the monitor is transmitting data and has a battery voltage >3.6 V on the device's health webpage before attempting redeployment.