SKYVIEW WAGA DISPLAY

USER AND INSTALLATION MANUAL

Please read this manual carefully before using the device. This manual is an essential component of the device and should be kept in a safe place so that it may be referred to when required.

This manual is specific to the version 1.0 of the SkyView WAGA Display.

Never fly with a SkyView display without extensive familiarisation on ground. Train on the ground, before flying, on how to interpret and react in case of a Flarm Alarm warning. Observe restrictions and safety instructions detailed in this manual

WARNING AND CONDITIONS OF USE

The pilot is ultimately responsible for all flight decisions and for operating the aircraft safely at all times.

Pilots must maintain good visual lookout to avoid collision.

The SkyView WAGA Display can only display traffic equipped with a limited range of electronic conspicuity device types and electronic systems are fallible, therefore the display may not show all aircraft in the proximity and must not be relied upon as a traffic warning device.

For situational awareness only. Never make safety critical decisions based on displayed information.

No liability is accepted by the producers of the SkyView WAGA Display or its software.

Terminology used in this manual:

EC	Electronic Conspicuity. An aviation electronic device that transmits and receives radio signals with the intention of improving situational awareness and collision avoidance. Eg FLARM, ADSB Mode-S, SoftRF. Comprises a transceiver and a display, which may be integrated but are more usually separate components.
FLARM	An aviation EC system. The registered trademark of FLARM Technology AG.
FLARM Alarms	Alarm levels assessed by FLARM EC devices giving a warning of time to impact. Defined by FLARM.
NMEA	National Marine Electronics Association standard protocol for data encoding.
PowerFlarm	The processor chip set with FLARM propriety software which is built into different manufacturers EC devices. Successor to the 'Classic' FLARM chip set.
SoftRF	A "DIY, multi-functional, compatible, sub-1 GHz ISM band radio-based proximity awareness system for general aviation". Open-source software.
SkyView	An aviation electronic conspicuity display from the SoftRF open-source project
SWD	SkyView WAGA Display. A development of the SoftRF SkyView EZ. Subject of the manual. Produced not-for-profit.
ThisAircraft	The aircraft in which the SWD is installed.
Threat	The traffic with the highest level of Flarm Alarm or, if no Flarm Alarms, then the closest traffic.
Traffic	Aircraft detected and available for display on the SWD.
WAGA	Western Australia Gliding Association (WAGA) Inc. Producers of the SWD and WAGA Flarm.
WAGA Flarm	An EC transceiver based on the PowerFlarm Atom. Produced not-for-profit.
WebUI	Web User Interface, the application used on a smart phone to configure the SWD

Contents:

1 General

1.1 System status

The SkyView WAGA Display (SWD) is a development of the SoftRF EZ SkyView and is an open-source project, meaning:

- It is a development by multiple authors and designers.
- It is not a commercial product and must not be produced or sold for financial profit.
- No warranty is provided and no liability accepted by the producer.
- Technical support may be limited or not available from the producer.
- All information required to produce, maintain or develop it, on a DIY basis, is publicly available.

WAGA is the Western Australia Gliding Association. The SWD is the WAGA version of the SoftRF EZ SkyView. It was developed in January 2025 by and for the use of its members as a low-cost display,

primarily to be coupled with the WAGA Flarm - a not-for profit PowerFlarm based EC transceiver.

The SWD is an Experimental Device, subject to continuing evaluation and improvement.

1.2 System Description

1.2.1 SkyView EZ Display

The SkyView EZ is a small and affordable aircraft cockpit display for traffic conspicuity information, with designs originated by Linar Yusupov as part of the SoftRF open-source project.

SkyView EZ shows traffic information provided by a FLARM NMEA or Garmin GDL90 data source device.

SkyView can display traffic data from any device that passes suitable data in the NMEA Flarm sentence formats sentence, plus valid NMEA GPS fix format sentences. Data sentences must end with a valid Error Checksum or are discarded.

When connected to a suitable EC transceiver functioning correctly, the system aids situation awareness of other traffic by presenting a radar like picture of detected traffic within the selected zoom level.

The system does not provide traffic avoidance instructions.

The system does not provide obstacle warnings or airspace warnings.

Data input to the SkyView can be via a hard-wired serial interface, Wi-Fi UDP connection, Bluetooth SPP or Bluetooth LE.

The SkyView EZ is only a display device therefore it must be paired in ThisAircraft with a working EC transceiver. Examples of types of suitable aviation EC transceivers for pairing with the SkyView EZ in a glider are: SoftRF, Classic Flarm or PowerFlarm.

1.2.2 Electronic Conspicuity Transceivers

EC systems rely on aircraft having transceivers (a combined transmitter and receiver) that communicate with our similarly equipped aircraft within range. Most systems use GPS to encode an aircraft's own position which they broadcast to other aircraft and receive similar broadcast data from other aircraft. This data can be displayed and may be processed to identify potential collision threats.

The three main systems of aviation EC transceivers in use are:

- FLARM - Widely used by gliders and glider tugs
- ADSB - Increasing used by General Aviation (GA) small aircraft
- Mode-S - This is secondary radar. Used by General Aviation and commercial aircraft.

NOTE: SoftRF mimics FLARM and provides FLARM NMEA data sentences but may not match all FLARM's capabilities.

Unfortunately, these three systems cannot communicate directly with each other. There are EC transceivers that have dual or multiple system capability. For example a PowerFlarm may have an ADSB processor built in which provides for ADSB-IN only (no ASDB-OUT).

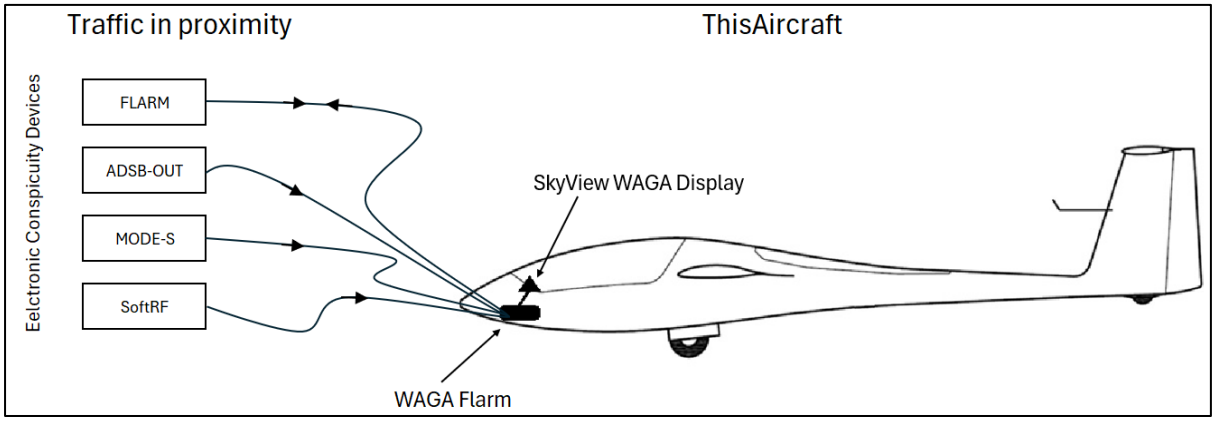

Illustration: Traffic in the proximity equipped with EC devices sending/receiving data with ThisAircraft

An EC transceiver usually processes the signals it receives from the traffic's transceivers and may filter out some data. It is essential to understand how ThisAircraft's EC transceiver may be limiting the traffic data passed to the SkyView display. For example, a PowerFlarm may be set to only show traffic within a specified range, or the selection of the PowerFlarm data port protocol may turn-off a data stream or limit the fields of data passed. Refer to the EC transceiver's manual.

For traffic to be detected, they must be in range of ThisAircraft's transceiver. The range achieved depends on the transmit power output, reception sensitivity and is influenced by the altitude of the aircraft and obstacles blocking radio signal 'line of sight'.

Thus the key factors are:

- Correctly configure ThisAircraft's EC transceiver
- Ensure ThisAircraft's antenna performance is good

1.2.3 SkyView WAGA Display

The SWD was developed from the SkyView EZ. It is designed for use with the WAGA Flarm and to meet the WAGA members' needs. There is nothing preventing its use by others.

The SWD displays traffic and alarms differently to the SkyView EZ and there are additional features.

A key difference is how the SWD displays FLARM alarms and information that warn of likely collision. The intent is to prompt the pilot to quickly lookout in the direction of the threat so he/she can scan a segment of the sky to identify the threat and take evasive action if needed.

A basic navigation feature has been added to assist aero retrieves of gliders.

The SWD has been designed for partnering with a PowerFlarm EC transceiver (preferably with ADSB-IN) and inter-connection via a hardwired serial data and power cable. Connectivity to other EC transceivers and via non-hardwired connection has been retained but not tested.

1.3 System components

The SWD comprises a 85 x 50 x 18mm plastic case with a 2.7" (diagonal measurement) screen. The case encloses a printed circuit board with integrated E-Paper screen and space for a battery. The circuit board runs a software program derived from SoftRF written in the C++ coding language.

1.3.1 Software

The SWD uses a development of the SoftRF SkyView EZ software code originated by Linar Yusupov (copyright © 2016-2025). He describes SoftRF as a "DIY, multi-functional, compatible, sub-1 GHz ISM band radio-based proximity awareness system for general aviation". He has written code and produced designs for a family of traffic continuity receivers and displays. He has generously made the software available as open-source software on the website GitHub, subject to a licence which applies to the SkyView WAGA Display software and developments thereof, as below.

The original author of the SoftRF software has given the following licence:

(ref https://github.com/lyusupov/SoftRF/blob/master/software/firmware/README.md as at 29 March 2025)

License

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Revision 0.12 of the SoftRF SkyView software was modified by Moshe Branner to provide extra functionality. His developments and code can be found on Github at:

https://github.com/moshe-braner/SoftRF/tree/master/software/firmware/binaries/ESP32/SkyView

The SWD software version 1.0 has been further developed by a WAGA member from the Moshe Branner version MB07C. Key features introduced in the SWD include:

- Additional choice of Landscape screen orientation, increasing installation flexibility.
- Addition of a selectable Nav_View screen with GPS calculated bearing and distance to a small list of waypoints (eg local airfields) to aid gliders reporting outlanding and tugs undertaking aero retrieves.
- FLARM alarm ‘look-out’ indicator on the radar screen.
- Parsing of the ‘Source’ field from the $PFLAA string, enabling ADSB and Mode-S targets to be identified as such (requires FLARM protocol 9 or higher).
- Distinctive representation on the radar of gliders, tugs, ADSB and Mode-S traffic.
- More relevant and useful information shown in Nav Boxes.

1.3.2 Circuit board and screen

The circuit board is the LILYGO® TTGO T5S V2.8 ESP32 with 2.7 Inch E-Paper screen. This is a Chinese commercially component readily available on Amazon. Other than loading the SkyView WAGA Display software, no modifications are required to the board.

This component may be subject to unannounced changes by the manufacturer and there is no certainty that this will remain in production.

The SWD uses an E-Paper screen showing black text or graphics on a white background, mimicking the appearance of ordinary ink on paper. They use a different technology to conventional LCD screens and rely on ambient light to be read. One characteristic of E-Paper is that they continue to display the last image prior to power being stopped, which can make a system appear frozen.

There is no luminance adjustment available.

1.3.3 Case/enclosure

The 2-part case is produced by 3D printing in plastic. There are currently no known sellers of a pre-printed case. DIY or contracted bespoke production is required using STL files found at:

https://github.com/lyusupov/SoftRF/tree/master/case/SkyView

1.3.4 Battery

The SoftRF EZ SkyView is designed to have a 3.7V battery within the case. When hardwired to a Flarm device, the SWD is powered by the aircraft power system therefore the internal battery is not required. An internal or external battery may be installed if desired.

1.3.5 Buzzer

A small buzzer is connected to the circuit board and located with in case. The buzzer has an irregular sound because of the way the program turns it on and off so as not to add delays in the program loop. It is not Morse code!

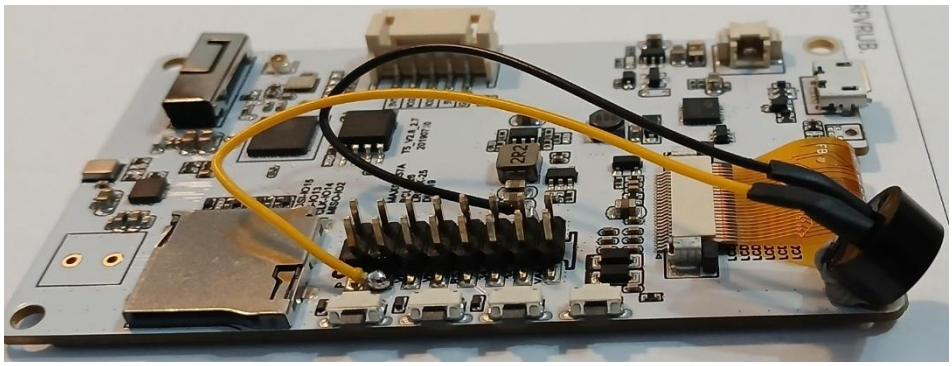


Illustration: Buzzer fitted as standard in SWD

2 Physical controls and connections

2.1 Control buttons

There are 4 press buttons on one long side of the case:

Button	Name	Description
1	Mode	Long press = SkyView on/off. Short press = cycle through screen modes.
2	Prog 1	In Radar and Nav modes, increases radar zoom. In Text Mode = cycle through detected traffic information (one page per traffic)
3	Prog 2	In Radar and Nav view modes, decreases radar zoom. In Text Mode = cycle through detected traffic information (one page per traffic)
4	Reset	System reset. Avoid pressing this button. The system will be inoperable whilst the reset is in progress and until aircraft data is reacquired.

2.2 Connections

2.2.1 USB micro-B socket.

Used for software updates or powering the device only. SWD Version 1.0 is not capable of data in/out by this socket as this capability was not present at the time of code branching.

2.2.2 Side socket

Connection point for data from/to conspicuity transceiver using TTL level signals. Do not apply RS232 or USB level signals as they may permanently damage the PCB. Also power connection pins.

The WAGA Flarm has a TTL level data and 3.3V power output that can be directly hardwired to this socket.

2.2.3 Rear socket

Used to connect speaker and/or buzzer. The SWD has a built-in buzzer as standard.

3 Description of display screens

3.1 Screen modes

Screen modes can be cycled through using one or other of the side centre two buttons.

The screen mode at start up can be configured and saved via the WebUI.

The screen mode layout orientation can be set as Portrait or Landscape via the WebUI.

3.1.1 Radar_View

Intended as the normal view used by glider and tug pilots. The screen displays a square Radar Panel and four NavBoxes for information. The host aircraft is at the centre of the radar. The zoom level of the radar is shown in the bottom left corner of the radar and can be changed at the centre.

3.1.2 Nav_View

Intended to aid tug pilots undertaking paddock retrieves. Can also be used for glider pilots for emergency navigation back to their base. The Radar Panel performs as per the Radar View but the NavBoxes display data.

3.1.3 Text_View

Provides detail of aircraft detected. This view is retained from the original SoftRF software but is unlikely to be used often.

3.2 Screen layout and view mode contents

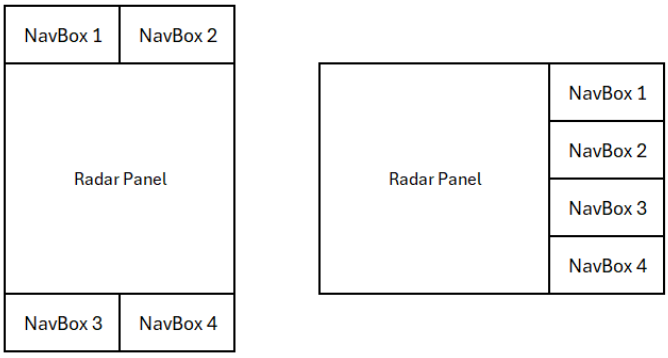


Diagram: Portrait and Landscape layouts

3.3 Radar Panel

The radar like panel will only show traffic that has been detected using EC interaction. Whilst it is referred to in this document as the Radar Panel, it does not use conventional radar detection (ie radio waves reflected by the reflected) and thus may not show all aircraft in the proximity.

The Radar Panel is a square area of the screen used to show detected traffic and, in the event of a FLARM Alarm, where to look-out for threat aircraft.

ThisAircraft is always shown as a small aircraft icon in the centre of the Radar Panel.

The Radar Panel can be configured as North-Up or ThisAircraft Track-Up:

- In Track-Up mode, the ThisAircraft icon always points up and the current track is shown at top centre of the Radar Panel.
- In North-Up Mode, 'N' is shown at top centre of the Radar Panel and the ThisAircraft icon will be rotate to an angle according to its track bearing.

It is recommended that Track-Up is used as this is the easiest to comprehend where other aircraft are located relative to the pilot sitting in the ThisAircraft.

The Radar Panel scale/zoom level may be set at 4 different levels and has metric and imperial options. There is always a large circle shown with radius matching the current scale setting as stated bottom left of the Radar Panel.

Proximate traffic is displayed as a standard target icon which is an elongated triangles usually pointing in the direction of the traffic's heading. A small + or – beside the triangle indicates if the aircraft is above or below ThisAircraft's altitude. No '+' or '–' means the traffic is approximately at the same altitude as ThisAircraft.

If ThisAircraft's EC transceiver passes the required sentences to the SWD then:

- Tugs are shown with a single circle around the standard icon.
- ADSB derived traffic information is shown with 2 circles around the standard icon. This traffic is likely to be GA aircraft. Note A
- Mode-S traffic direction and altitude cannot be determined so is shown as a circle of dots at a radius corresponding to the approximate range. Note A.

Note A; Requires FLARM data port Protocol 9 or higher.

The SWD assess the traffic information for threat. If there are no Flarm Alarms active, a line is drawn from the centre of the radar to the closest traffic.

Detail on how the display screens react to FLARM Alarms is detailed in this manual.

3.4 NavBoxes

NavBoxes are used on the Radar_View and Nav_View screens as follows:

NavBox	Radar_View Mode	Nav_View Mode
1	Threat: Distance to Threat or Flarm Alarm Level	Threat: Distance to Threat or Flarm Alarm Level
2	Acfts: Number of aircraft detected	Brg: Bearing to waypoint. Waypoint selected.
3	Vert: Threat relative height	Dist: Distance to waypoint
4	ID: Flarm ID/Comp ID	GS: Ground Speed

3.5 Voice output

The SkyView can produce preset audio warnings by selecting Voice as the Sound settings in the WebUI and provided the wave files are held on a micro-SD card installed in the SkyView.

Voice announcements delay the indication of traffic alarms on the radar screen by up to 1.4 seconds. The Buzzer causes no delays.

An external speaker or connection to the tug radio is required to hear the audio output.

There is no volume control configuration setting.

3.5.1 Audio speaker

An external 4-ohm speaker can be connected to the SkyView rear socket as shown at Annex A. An 8-ohm speaker will normally work satisfactorily and not cause harm to the SWD but will deliver less power. Polarity is not usually an issue for a speaker.

3.5.2 Audio connection to tugs

For audio to a tug pilot's headset, the speaker should be replaced with a direct connection to the tug radio. Most GA radios have a connection point for an audio or intercom input so consult the manufacturers installation manual. A preset potentiometer is likely to be required to set the maximum gain and a potentiometer accessible to the pilot for headset volume control.

Polarity must be considered if connecting directly to other aircraft systems. Impedance matching is not likely to be critical but an impedance transformer is often the best solution for eliminating 'ground loop' interference noise.

If some tug pilots use Bluetooth equipped headsets, then a Bluetooth module could possibly be added to SkyView to enable audio connection. This would need to be a different Bluetooth module to the built-in data Bluetooth.

4 Configuration

Configuration of the SkyView setup is required during installation or if a change is required. The Setup is saved in memory so whenever the SkyView is started, it reads and applies these settings.

Configuration is set via the SkyView built-in local internet host using a Web User Interface (WebUI) usually on a smart phone. There is no requirement to connect to an internet router or smartphone

hotspot with worldwide web access. This does not require a special application on the smart phone since it is merely acting as a browser and opening a HTML page received from the SkyView. This works on Android and iPhone.

4.1 Accessing the WebUI

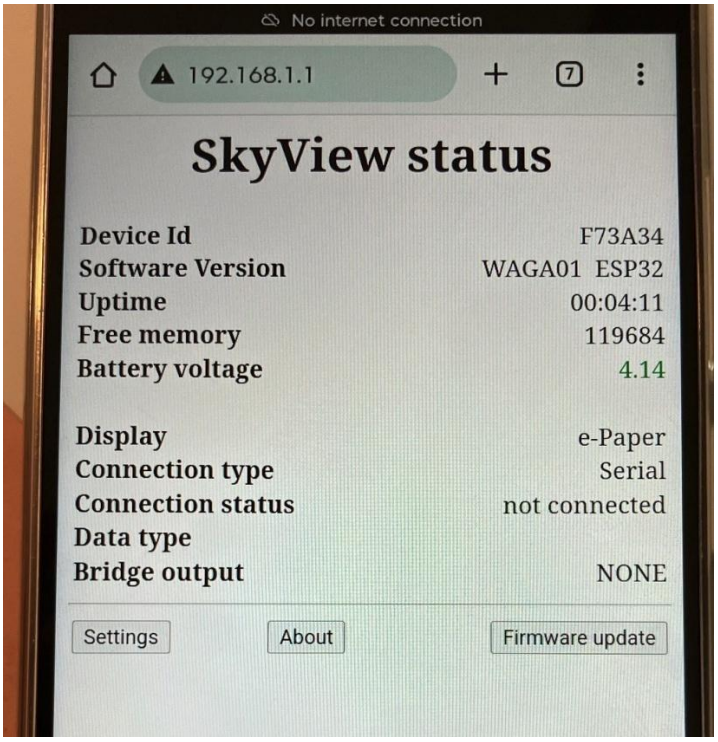
4.1.1 Making the connection Smartphone to SkyView

Power up the SkyView. Using a smartphone 'WifFi Connections', identify the SkyView device which should be visible in the format 'SkyView – abc123'. Connect using the code/password 12345678.

Then use a smartphone web browser to search for and display IP address 1.192.168.1.1. Tips:

- It may be necessary to clear the browser cache before browsing.
- It may be necessary to ignore security warnings before this IP address will load.

The SkyView acts as an internet host and will send the WebUI 'SkyView status' page shown below to the smartphone bowser screen.



Settings - Settings menu with options as described below.
About - about the SkyView software and a credits list of contributors.
Firmware update - not tested for SWD

Note the SkyView has a Device ID in same format as a Flarm or ICAO ID, but this is not disclosed to other traffic or used for any significant purpose other than identification from the list or available Wifi sites.

4.2 WebUI Settings Menu and options

Setting	Setting options
Display Adapter	e-Paper TTG T5S ← use this for SWD e-Paper Waveshare ESP32
Connection type	**Serial** - wired connection. ← default for SWD. **WiFi UDP** - WiFi wireless connection **Bluetooth SPP** - 'Classic' Bluetooth wireless connection **Bluetooth LE** - Bluetooth LE connection (HM-10 compatible).

Setting	Setting options
Protocol	**NMEA** - NMEA-0183 with (some) FLARM extensions **GDL90** - Garmin GDL90 .
Baud rate	of Serial connection. 4800 9600 **19200** ← Default rate for most FLARM devices 38400 57600 115200 2000000
Source ID	For a Wi-Fi connection - SSID of Wi-Fi UDP NMEA or GDL90 data server (Access Point) ; For a Bluetooth connection - advertised 'Name' of a Bluetooth device you want to connect to. Typically, the "server" is a PowerFlarm but can be other sources such as SoftRF Edition, SkyEcho, PilotAware, Stratux or similar equipment.
Key	For a Wi-Fi connection - Wi-Fi AP PSK key; Usually '12345678' For a Bluetooth connection - 'Pin' of the Bluetooth device mentioned above. * *- only Bluetooth 'Simple Pairing' (no key) method is currently supported.
Bridge Output	Data received by the SkyView is resent (without filtering or processing) to the selected port for sharing with other devices **None** **Serial** ← use this for SWD **WiFi UDP** **Bluetooth SPP** **Bluetooth LE**
Units	**metric** - display and say information in metric system **imperial** - display and say information in imperial system **mixed** - almost the same as **metric**, but all the altitudes are in feet.
Screen layout	**Portrait** **Landscape** Radar Panel and NavBox functionality is identical but arranged in different positions.
View mode	An option to choose from four different display views. **Radar** - radar-like view. Intended default screen for gliders. **Nav** - radar-like view. Intended default screen for tugs **Text** - plain text representation of traffic information. You can change the view in runtime by pressing the **MODE** button.
Radar orientation	**Track Up** - ThisAircraft's track over the ground is up. SWD recommended. **North Up** - GNSS North is up
Zoom level	Initial value of radar panel zoom level (scale factor). **lowest** 5 nm or 10 km **Low** 2.5 nm or 5 km **medium** 1 nm or 2 km **high** 0.5 nm or 1 km You can change the zoom level in runtime by using the **UP** and **DOWN** buttons.
Nav Waypoint	3 waypoints in Western Australia. In SWD V1.0 this is hardcoded in an array. **YBEV** **YCUN** **YNRG**
Aircraft data	The preferred database for decoding unique aircraft's ID code. **Auto** - selection is to be made based upon aircraft's NMEA "ID type" value (when available) **FlarmNet** **GliderNet** ← SWD can only use OGN data in CDB format **ICAO** This option makes sense only when there is a valid memory card in SkyView's micro-SD slot.

Setting	Setting options
ID preference	When an aircraft's record is found, "**Text view**" will show text identification of this aircraft as: **Registration** - registration number of this aircraft **tail/CN** - tail / competition number (when available) . ← Only valid option for SWD. **make & model** - make and model of the aircraft (when available) ; You can choose which particular field of the record will be displayed there. If no records are found, then the hexadecimal ID value will be shown.
Sound	Pilot is made aware of traffic alerts by voice or buzzer. **Off** - no voice or buzzer traffic alerts **Voice*** - voice traffic alerts active, as described in this manual **Buzzer** - only when a buzzer is connected *This option only applies when there is a correctly loaded memory card in the micro-SD slot.
e-Paper 'ghosts' removal	Periodic full e-Paper screen refresh. Typically takes 1-2 seconds. **off** - do not apply this full screen refresh **auto** - **2 minutes** - enforce full screen refresh every 2 minutes (counter against heavy 'ghosting' effect); **5 minutes** - enforce full screen refresh every 5 minutes **10 minutes** - enforce full screen refresh every 10 minutes (little or no 'ghosting') It helps to remove residual traces of previous information, so-called 'ghosts'. 'Ghosts' are known to be temperature and UV dependent.
Traffic advisories filter	**Off** - do not apply any filters **by Altitude (± 500 metres)** - process air traffic that is not higher and not lower than 500 metres relative to your aircraft's altitude **Alarm Only** - advisory voice messages and those outside Altitude criteria are suppressed
Power save	**Disabled** - do not use any of power saving methods **WiFi OFF (10 min.)** - turn SkyView Wi-Fi AP off in 10 minutes after last client has closed its connection
Team Member Id	**Team Id** is a 6-digit hexadecimal unique identifier of your team member's device *(SoftRF, ICAO, FLARM, Skytrax, OGN, PAW, etc ...)* SkyView will depict this team member on the Radar Panel in a different manner.

4.3 Default settings

Illustration: Default settings for SWD firmware Version 1.0

4.4 Settings backup and restore

To **back-up** your settings - take a screenshot of the WebUI settings page.

To **restore** your settings - manually set all necessary selectors, buttons and knobs of the WebUI settings page while using earlier saved screenshot as a reference.

4.5 Voice files

Voice announcement of FLARM Alarms is an important aspect of the anti-collision action initiation.

The correct sound files must be continually present on the SkyView micro-SD card in a directory ‘audio’ directly off the drive root. It is recommended that owners keep a backup of the sound files.

Instructions for obtaining the sound files can be found at:

https://github.com/lyusupov/SoftRF/wiki/SkyView.-SD-card

4.6 OGN Database file

This is optional. SDW is able to lookup traffic IDs in an OGN database file held on its micro-SD card.

It enables the display of FLARM Competition IDs, usually the last 2 or 3 letters of the registration (eg “DGZ’), rather than the unintelligible ID Hex code (eg ‘ABC123’).

The presence of an aircraft in the OGN database is dependent on the owner registering it, thus not all traffic will yield a Comp ID.

Remember to register your own FLARM or SoftRF EC transceiver with OGN at:
http://wiki.glidernet.org/ddb

The OGN database was created for glider information exchange and thus ADSB information (eg for GA aircraft) is not normally found there.

4.6.1 Obtaining and saving the OGN data file

A daily updated copy of the OGN database in .cdb format file is available from:

http://soaringweather.no-ip.info/ADB/data/

The .cdb file should be loaded onto a micro-SD card in a directory 'aircrafts' immediately off the root directory. The micro-SD card must remain in the SkyView.

The micro-SD card is inserted with the connectors in the same direction as the display face. Click into lock position.

It is recommended this file is updated regularly and whenever a new EC transceiver ID operating regularly in your proximity.is identified.

5 Operational use

5.1 Start-up

If the SWD closedown sequence was used, a 'sleep screen' will be on screen. Otherwise the last image displayed immediately prior to power shutdown will still be evident (this is a characteristic of E-Paper displays).

- Apply power to the SWD and press the Mode Button to switch on.
- A startup screen which includes the software version will briefly appear.
- If Audio is configured in the settings and a speaker or headphones active, a short tune followed by a male and then female voices saying "Notice" should be heard. This confirms the audio system is working.
- The next screen will be according to the View mode configured in the Settings.

5.2 Pre-flight checks

5.2.1 No Data

The SWD requires a valid data stream and a GPS fix from the conspicuity transceiver.

Radar Panel will briefly show 'No Data' and the SWD's current connection type and baud rate settings (enumerated). For SWD, this is normally '1 / 2', meaning 'serial / 19200'.

If no data is available, this message will persist. Check that data is connected and the EC transceiver baud rate matches the SWD.

5.2.2 No Fix

The SWD requires a valid GPS fix for ThisAircraft. If no fix is available, the Radar Panel will show 'No Fix' and the current detected data protocol. For a SWD connected to a PowerFlarm, this should be 'NMEA'.

If this message persists, it usually means the GPS has not been able to get a fix. Ensure the EC transceiver GPS antenna is not obstructed from satellite signals (eg in a hangar) and check the GPS antenna is properly connected.

5.2.3 View mode selection

If a Fix is found, the View Mode held in the Settings will commence. If a different view mode is required for the flight, use the Mode Button.

Glider pilots are likely to choose to fly with the Radar_View and tug pilots the Nav_View. Both screens share the same Radar Panel functionality and FLARM Alarm warnings.

5.2.4 Track-up / North-Up

Check whether the Radar is Track-Up (recommended) or North-Up. This can only be changed via the WebUI.

5.2.5 Radar Zoom level

Select the desired zoom level of the Radar Panel using the two selection buttons.

Your SWD is now ready for flight.

5.3 Normal use

Monitor the SWD as part of your instrument scan.

You may wish to change the Radar Panel Zoom level using the selection buttons as appropriate to your stage of the flight.

A summary guide explaining the screen displays is at Annex A.

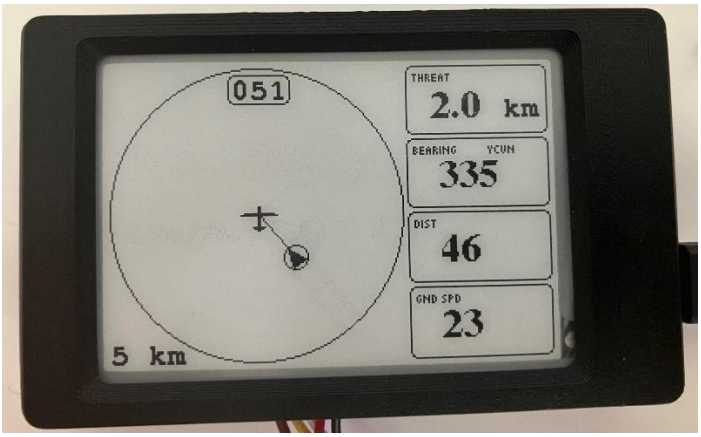


Illustration: Nav_View. YCUN is 335 degrees 46 km away. Current threat a tug at 2.0km which appears to be heading toward ThisAircraft.

Note that aircraft on the ground may not be visible if the EC transceiver has been set to filter out such traffic. This may affect the ability of a tug to see an aircraft in a paddock that it is seeking.

Displayed directions relate to the ThisAircraft and traffic movement relative to ground (GPS) track. Strong wind and system computer processing time may falsify displayed heading directions significantly.

If the Reset button is accidently pressed, it will take a few seconds before the SWD resumes normal operation using the configuration settings.

At the end of the flight it is best to shut down the SWD using a long press on the Mode Button. However, no harm will be done if power is simply cutoff.

5.4 Traffic Advisory voice messages

When Voice is active, a male voice will announce traffic giving its information: where, how far and relative elevation. Eg. Traffic, 2 o'clock, 4 km, above".

For non-directional traffic (eg mode-S), 'where' is spoken as "aware".

An announcement will not be repeated for a specific traffic until 5 minutes later.

Advisories may be stopped by selecting 'Alarms only' as the Filters configuration setting.

5.5 FLARM Alarms

If your EC transceiver can receive FLARM Alarms and send them to the SWD, then the SWD should alert the pilot to FLARM Alarm levels 1-3.

FLARM Alarms are defined in FTD-012 and provide a time-based estimate until impact. In this manual, one second has been deducted from FLARM definitions to allow for the SWD processing time.

When a Flarm Alarm is encountered, only take a short look at the SkyView display and immediately look outside to find and identify the collision threat. Never try to look inside the cockpit or at the display when planning traffic avoidance manoeuvres.

If ThisAircraft is turning or thermalling when a FLARM Alarm is encountered, the ‘Look Out’ indicator will move around the radius ring showing the changing relative angle to the threat.

Note: There is no means of cancelling the alarms.

When FLARM Alarms are received by the SWD, it assists the pilots as follows:

5.5.1 FLARM Alarm Level 1 = (14-19 seconds to impact)

If Voice is active, a female voice will announce an ALERT, eg “Alert. . 6 o’clock, below).

If Buzzer is active, a single short buzz will sound and repeat at a slow rate as long as the threat continues.

NavBox1 will show ‘ALARM 1’.

A ‘look-out’ indicator in the form of a large black triangle is shown just inside the radius ring pointing in the relative direction of the aircraft causing the alarm. Note that this indication will always be relative to ThisAircraft’s current heading even if the Radar Panel is set to North-Up.

Inside the look-out black indicator will be shown + or – if the threat aircraft vertical relative height is more than 50ft above or below ThisAircraft.

5.5.2 FLARM Alarm Level 2 = (9-14 seconds to impact)

If voice is active, a female voice will announce a WARNING, eg “Warning. . 8 o’clock, level).

If Buzzer is active a single short buzz will sound and repeat at a medium rate as long as the threat continues.

NavBox1 will show ‘ALARM 2’.

A triangle outline will be added closer to the centre of the radar along the ‘look-out’ indicator line. It signifies the increased Alarm Level, not necessarily the position of the threat.

5.5.3 FLARM Alarm Level 3 = (0-9 seconds to impact)

If Voice is active, a female voice will announce DANGER, eg “Danger. . 11 o’clock, above).

If Buzzer is active a single short buzz will sound and repeat at a fast rate as long as the threat continues.

NavBox1 will show ‘ALARM 3’.

Another triangle outline will be added closer to the centre of the radar along the ‘look-out’ indicator line. It signifies the increased Alarm Level, not necessarily the position of the threat.

All FLARM Alarm warnings will cease when the FLARM Alarm level returns to zero. The threat assessed traffic will then become the one that is least distant and be indicated with a line to its position on the Radar Panel.

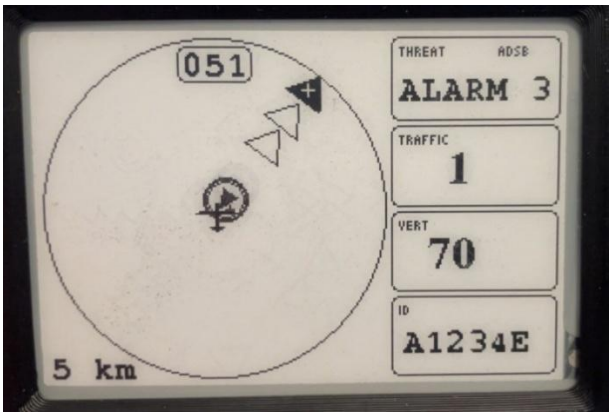


Illustration: Radar_View. FLARM Alarm Level 3 at 1 o’clock relative bearing, above. ‘LOOK OUT!’

6 Installation

Installation and operation must comply with applicable local official regulations and requirements. It must be on the basis of non-interference or hazard to the existing suite of other equipment necessary for safe flying operation.

SkyView EZ and SWD do not have an ETSO or FAA-TSO airworthiness certification. Make sure that it is legal to install it in your aircraft.

6.1 The SkyView case

Install the SkyView where it can easily be seen. Readability largely depends on the viewing angle so make sure that the viewing angle is as perpendicular to the line of sight as is possible.

A SWD can be mounted in portrait (buttons on right) or landscape (buttons on top) orientation and the appropriate orientation setting selected in the config.

Plan sufficient space for connecting/disconnecting cables. The SkyView display should not be installed at a distance less than 30cm to a magnetic compass else it may contribute to compass errors.

The SkyView case/enclosure is not watertight. The ingress of solid particles or liquids is to be strictly avoided. If the unit gets moist, dry it before further use. If the unit gets wet, please consult an expert / repair facility to adequately clean the unit before further use.

SkyView displays do not contain a security glass front. Mechanical force applied to the display will destroy the display

It is suggested that adhesive tape, glue or Velcro is used to secure the case. It may be possible to disassemble the SkyView to drill and bolt the case to a panel but be careful that bolt/screw heads do not physically interfere or cause electrical shorts on the circuit board.

When installing cables, make sure to comply with basic rules of cabling in aircraft regarding to EMI minimization. Wrong routing may disturb critical systems like e.g. the aircrafts radio system. Aviation grade wire is recommended.

Ensure that cables do not interfere with control movement or emergency procedures. In particular, the canopy jettison/release must not be constrained.

6.2 Power and data cabling for the SWD

If power is switched off (eg end of flight) fails without shut down of the SWD, no harm will be done but the E-Paper screen will freeze ie maintain the display that was current immediately prior to power loss.

Make sure that all requirements regarding power supply are being met. Using. Wrong polarity may permanently destroy the device. There is no internal fuse.

For the SWD, the usual point of connection for power and data is the 5-pin connector on the long side. Then:

- When connected to a WAGA Flarm: Use the Flarm's special purpose permanently attached fly-lead which provides 3.3V power and TTL level data signals. No conversion of the data signal format is required.
- When connected to any other PowerFlarm device: Use the Flarm's RJ12 or RJ45 socket which provides 3.3V power and RS232 level data signals. Warning: To connect to the SWD 5-pin serial port requires a RS232 to TTL data format converter lead. This is easily made using a small and inexpensive converter board. There are different formats of this type of converter board. Poor quality versions are known to overheat and burnout.

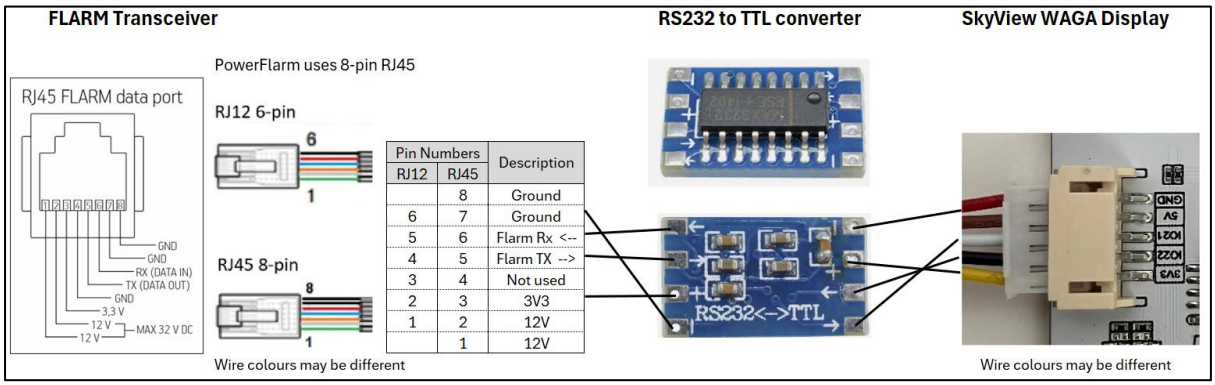


Diagram RJ45 pinout, RS232 -> TTL lead

Connection of non-FLARM EC devices which provide data Tx/Rx via a USB socket, is possible directly to a SkyView display if it has enabling software code. SWD Version 1.0 does not have an enabled USB socket for this purpose.

For clarity, the differences between TTL, RS232, USB data signal schemes are shown below.

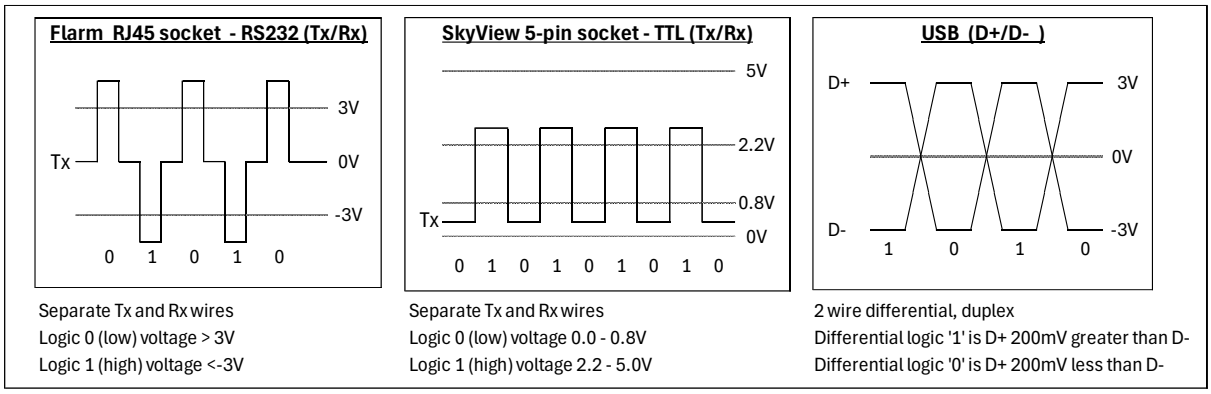


Diagram. The different data signal protocols

6.3 2x Displays in a tandem glider

2x SWDs may be installed in a tandem glider with hardwiring as follows:

- WAGA Flarm – wire the two SWDs in parallel to the WAGA Flarm's TTL data/power tail.
- PowerFlarm with 2x RJ45 sockets, provided both provide power – plug one SWD into each socket. Each SWD lead requires its own RS232<->TTL converter.
- Flarm with only one RJ45 or RJ12 socket proving power – using a simple 6P6C RJ45 Y-splitter. Only one RS232<->TTL converter is needed if fitted between the Flarm and Y-splitter.

Note: Only one of the SkyView should be allowed to transmit data to the EC transceiver. SWD Ver 1.0 does not transmit data.

It may be possible to connect 2x SkyView displays using Wifi UDP or Bluetooth with the EC transceiver as the host. This has not been tested with the SWD and PowerFlarm

7 Support

7.1 Software Updates

To update your display requires some knowledge of programming and uploading software.

Connect the SWD's USB micro-B port to a PC USB port and then use one of the following methods:

- Memory flashing using a flash download tool for the ESP32 and the binary files from Github.
- Loading the source code C++ files from Github into Arduino IDE which must then be compiled and downloaded to the SWD. See Github for IDE settings.

Source code can be found at: https://github.com/Bumpff/SoftRF_Skyview.

7.2 Technical Assistance

The SWD hardware and software is provided without warranty or guarantee of continuing support.

WAGA members using a SWD should contact their Club designated ‘WAGA Flarm and SWD Super User’.

No technical assistance is provided for any software version other than the original WAGA release versions. Support for non-WAGA members may be very limited or not at all.

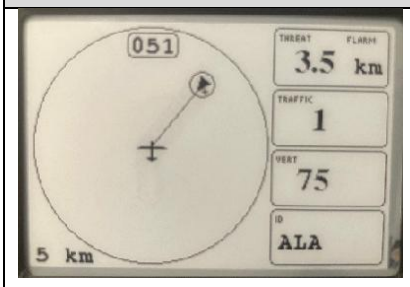
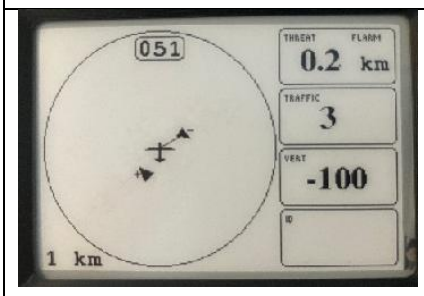
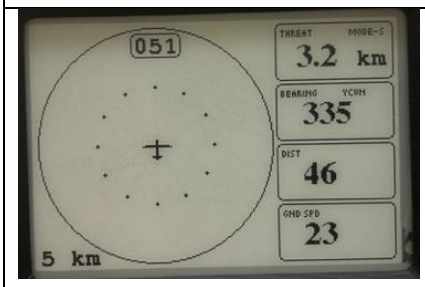
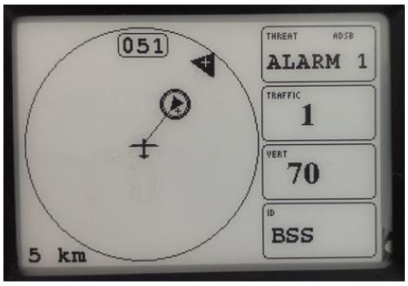
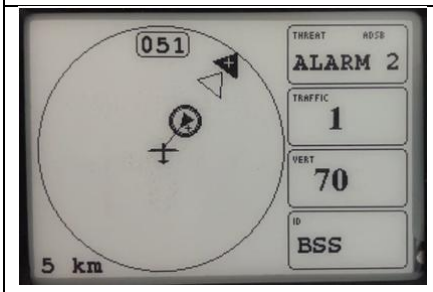
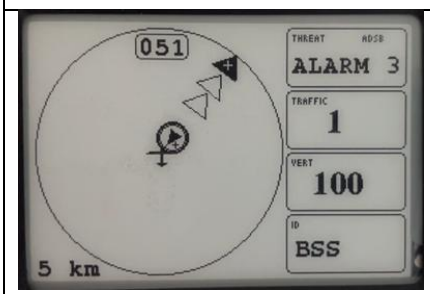
8 Further information

Flarm FTD-012 : Data port interface control document

Flarm FTD-014 : Flarm configuration specification

9 Acknowledgements

A comprehensive acknowledgement list can be found on the Github references above or the WebUI.

Radar Panel Examples	Description
	Radar Panel is set on Track-Up. Scale ring is 5 km radius. This Aircraft is the aircraft icon in centre of Radar Panel and current track is 051 degrees. Radar_View mode. Line from centre of radar to one of the traffic indicates traffic assessed as highest threat (no Alarms, so is the closest). Current threat is a Tug (single circle around standard traffic icon) at 3.5km, heading towards ThisAircraft, 75ft relative height above. Threat ID is Comp ID 'ALA'.
	Scale ring is 1 km radius. 3 traffic identified within range. Traffic shown is 2 standard icon, likely gliders. Icons point in traffic's approx heading. +/- indicates above or below ThisAircraft. Threat is the closest glider which has FLARM, is 200m away and -100m vertical height. ID is blank, indicating threat is unregistered in OGN database (or database is not up to date!).
	Non-directional Mode-S traffic is current threat but no Flarm Alarm. 3.2 km approximate distance but no direction info. Nav_View mode (NavBoxes 2, 3 and 4 are different) Waypoint set in Settings is YCUN. Bearing 335 degrees and 46 km to waypoint. Ground speed 23kts.
	**FLARM Alarm 1. 14-20 seconds until collision.** Black triangle just inside scale ring is Look-Out Indicator. Look-Out Indicator always shows relative direction of the threat. Buzzer or female voice. Eg "**Alert**.1 o'clock, above". +/- in black triangle indicates threat is above or below. Double ring around traffic and 'ADSB' in top right of NavBox 1 shows it is an ADSB equipped aircraft. Threat is glider with Comp ID 'BSS'.
	**FLARM Alarm 2. 9-14 seconds until collision.** Look-Out Indicator always shows relative direction of threat. Buzzer or female voice. Eg "**Warning**. 1 o'clock, above". Clear triangle indicates Alarm 2 and threat direction, not position of traffic. Threat is 70ft above ThisAircraft.
	**FLARM Alarm 3. 0-9 seconds until collision.** Look-Out Indicator always shows relative direction of threat. Buzzer or female voice. Eg "**Danger**. 1 o'clock, above". 2nd clear triangle indicates Alarm 3 and threat direction, not position of traffic.

TTGO T5A diagrams ANNEX A to SkyView WAGA Display manual

Buttons location

Buttons function

MODE

Short press and release - change view mode

Long press (>2 sec.) and release - soft power off

UP

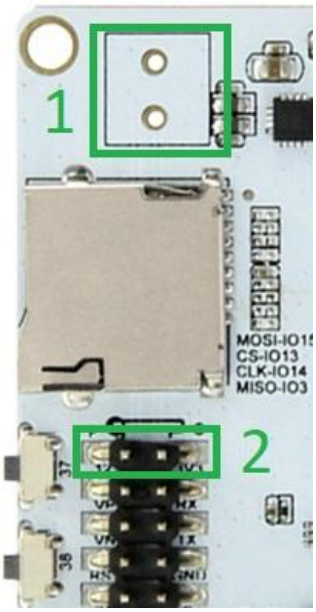
Radar view - zoom out
Text view - previous aircraft info

DOWN

Radar view - zoom in
Text view - next aircraft info

RESET

Speaker



Use pads **1** when you need to solder or pins **2** if you want to plug.

Serial connection wiring