Nesis Installation Manual

Revision 4.1.1

August 2025

Contact Information

Publisher and producer:
Kanardia d.o.o.
Lopata 24a
SI-3000
Slovenia

Tel: +386 40 190 951
Email: info@kanardia.eu

A lot of useful and recent information can be also found on the Internet. See `http://www.kanardia.eu` for more details.

Copyright

Credits

This document was written using TeX Live (LaTeX) based document creation system using Kile running on Linux operating system. Most of the figures were drawn using Libre Office Draw, Inkscape and QCad applications. Photos and scanned material was processed using Gimp. All document sources are freely available on request under the licence mentioned above and can be obtained by email. Please send requests to info@kanardia.eu.

Some open source code is used in the Nesis software:

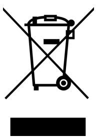
- https://angusj.com/clipper2/
- https://flatbuffers.dev/

- https://www.oberhumer.com/opensource/lzo/
- https://rapidxml.sourceforge.net/
- https://www.sqlite.org/index.html
- https://www.nayuki.io/page/free-small-fft-in-multiple-languages
- https://rapidjson.org/
- https://design.ubuntu.com/font

Legal Notice

Garmin and *AERA* are registered trademarks of Garmin Ltd. or its subsidiaries.
SkyDemon is a registered trademark of Divelements Limited.
Qt is a registered trademark of Qt Group Plc and its subsidiaries.
Microsoft Excel is a registered trademark of Microsoft Corporation or its subsidiaries.
Google Earth and *Android* are registered trademarks of Alphabet Inc. or its subsidiaries.
Rotax is a registered trademark of BRP-Rotax GmbH & Co KG or its subsidiaries.
ULPower is a registered trademark of ULPower Aero Engines N.V. or its subsidiaries.
Flarm is a registered trademark of FLARM Technology AG or its subsidiaries.
LibreOffice is a registered trademark of The Document Fondation.

WEEE Statement



Disposal of Waste Electrical and Electronic Equipment. This electrical item cannot be disposed of in normal waste. Check with your local authority for kerbside collection, or recycle them at a recycling centre.

Revision History

The following table shows the revision history of this document.

Rev.	Date	Description
4.1.1	Aug 2025	Added support for SkyDemon, Garmin AERA, AirAvionics ACD57 and some changes in echoUAT.
4.1	Jun 2025	Manual revision is now in sync with the SW version.
4.0	Jun 2025	Modifications related to SW 4.x and new Nesis IV.
2.2	Jan 2024	Metal particle support.
2.1	Feb 2023	OAT pin correction, UPSU additional fuse on battery, alarm lamp support on the service port, updated to SW 3.11.
2.0	Oct 2022	Manual rework, chapters introduced, screen customization, SW 3.10.
1.4	Mar 2022	Engine layout feature, SW version 3.9.
1.3	Mar 2021	RS232 port clarification.
1.2	Oct 2020	Changes and clarifications for SW version 3.7.
1.1	Mar 2020	Changes accumulated from SW versions 3.4 - 3.6.
1.0	Apr 2019	Complete manual rework.

Contents

Chapter 1

Introduction

First of all we would like to thank you for purchasing our product. Nesis is a complex instrument and we strongly recommend reading manuals before installation. You may be interested in reading:

- Nesis Installation Manual (this manual),
- our web site `https://www.kanardia.eu`; search for `SUPPORT` from the top menu and select `Documentation | Nesis` to access many additional documents and drawings.
- Nesis User's Manual,
- Daqu Installation Manual,
- Magu Manual,
- Autopilot Installation Manual,
- Boxi (Boxi II) Manual,

This manual assumes that you are familiar with the Nesis user interface system.

1.1 Icons Used Through the Manual

A few icons appear on the side of the manual, which have special meanings:

This icon denotes information that needs to be taken with special attention. An injury or even death is possible if instructions are not obeyed.

Failing to follow the instructions may lead to the equipment damage.

This icon denotes background information about the subject.

This icon denotes a tip.

1.2 Warnings

The following warnings and limitations apply during installation.

- Software based fuel flow and software based fuel level can be very dangerous and misleading. They affect also range and endurance calculation. Never trust any of these values. Make sure that you have some reliable way to check the actual fuel level during the flight.
- Before installing the instrument, you shall carefully read and understand this manual and any other supplementing manual.
- The manual is not a substitute for an approved aircraft specific maintenance manual, installation or design drawing. Attempting to install Nesis and corresponding equipment by reference to this manual only (without planning or designing an installation specific to aircraft) may compromise the safety and is not recommended.

1.3 Minimal System

Nesis minimal system consists of two components: Nesis PFD and Daqu (engine management box). They are sold together as a kit.

This manual starts with the installation instructions for the minimal system and then adds separate sections for optional components.

Some components have their own installation manuals.

Chapter 2

Installation

2.1 Display

This section covers the installation of the Nesis display.

There are several considerations which affect the display position on the instrument panel.

- The display must be in direct view field of the pilot without any obstructions.
- The display supports landscape orientation only. Portrait orientation is not possible.
- The display has a modest power consumption. It is cooled through top and bottom openings in the housing. Please make sure that cooling air will be able to circulate through the housing openings.
- Avoid to place the display next to the heater vents or into any kind of direct stream of hot air.
- Monitor the internal display temperature. It must not exceed maximal internal rated temperature of the display. If this temperature comes close or even exceeds maximal rated temperature, a cooling system must be built into the instrument panel compartment, to keep the compartment temperatures low enough.

- The display housing extends behind instrument panel and some extra space must also allocated for the connectors, cables and tubes. See Figure 2.1 for more details.
- The display does not need special harness for the installation. It is mounted directly to the instrument panel.
- Fix/glue mounting nuts behind the instrument panel for simple instrument removal.
- The instrument panel must be flat. If instrument panel is not-flat, internal stresses will appear and they may damage the bezel.

2.1.1 Nesis III 8.4” Display

The display main dimensions are shown in Figures 2.1 – 2.3.

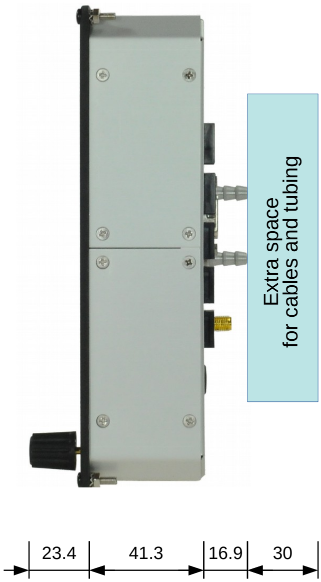


Figure 2.1: Nesis side view with dimensions.

The knob and part of the bezel protrude 23.4 mm in front of the instrument panel. On the back side, the housing requires 41.3 mm space. This space already includes thickness of the instrument panel. Pito-static connectors protrude extra 16.9 mm backwards. At least 30 mm is also required for the cables and pito-static tubing.

Figure 2.2: Back view with dimensions.

The bezel width is 214.3 mm and the height is 174.9 mm. Back side housing width is 210.3 mm, height 168.9 mm.

Figure 2.3 shows Nesis top view. Cooling openings are clearly visible. Same cooling openings are also on the bottom side. It is very importnat that bottom and top cooling openings are not obstructed – cooling air must freely circulate.

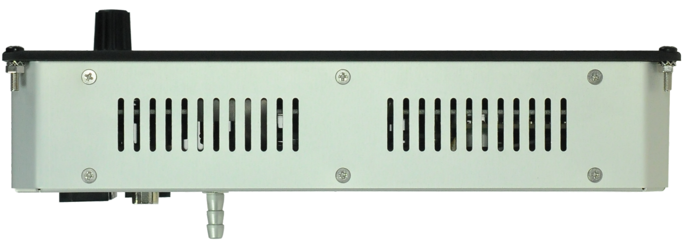


Figure 2.3: Nesis top view.

2.1.2 Nesis IV 10.1” Display

Figures 2.4, 2.5 and 2.6 show Nesis IV 10.1” display side, back and top view, respectively. Here the instrument is mounted from the back side of the instrument panel. The bezel is 5 mm thick, with 2 mm recess for the instrument panel and 3 mm extending behind the panel. The optimal instrument panel thickness is 2 mm.

At least 30 mm (probably more) is needed for tubing and cabling behind the back.

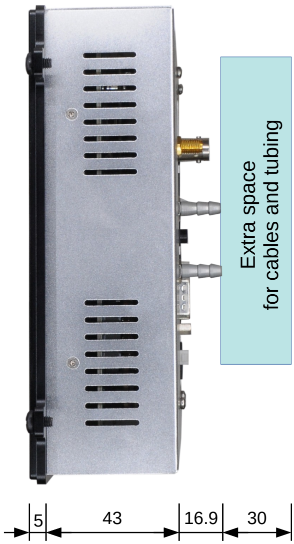


Figure 2.4: Nesis IV 10.1” side view with dimensions for landscape orientation.

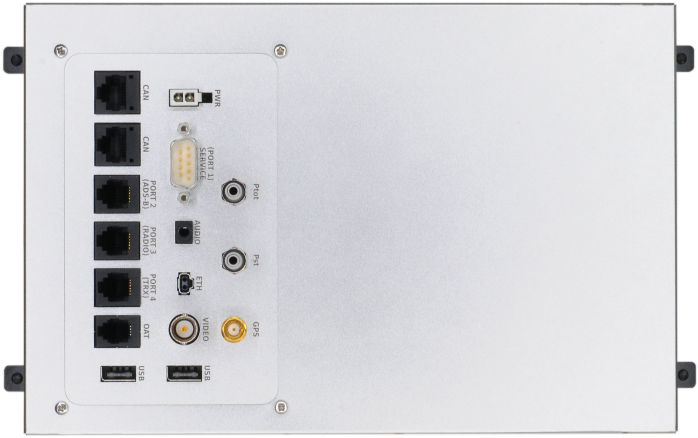


Figure 2.5: Nesis IV 10.1” back view, landscape orientation.

Figure 2.6: Nesis IV 10.1” top view, landscape orientation.

2.1.2.1 Kliky

Nesis IV 10.1” and Nesis IV 7” are equipped with a `Klicky` control panel, Figure 2.7. The panel connects to one of the two USB ports at the back side. Kliky panel can be mounted anywhere in any orientation. Chose whatever it suits you best.

Kliky hosts three push buttons and a push-knob that are used to manipulate Nesis. In addition, it has also a USB port, which can be considered as a Nesis’s integral USB port.

Figure 2.7: Kliky control panel.

Note: Kliky does not support hot plugging. If you connect Kliky while Nesis is running, it will not be detected. You must turn Nesis off and then back on to activate it.

2.1.3 Cutouts and 3D Models

Various drawing can be obtained from our web site `www.kanardia.eu` Locate the `SUPPORT | Documentation` menu and search for the `Nesis` folder.

For almost all variants we provide files with the following extension:

`step` is a 3D model. It can be used in detailed cockpit design.

`dxf` is a cutout, which can be used for CNC processing. In the cutout line we already included some tolerances.

`pdf` is a file where the cutout is accompanied with bezel outline for better overall view.

2.2 Mounting Procedure

Once the appropriate opening is made in the instrument panel, test mount the display. Adjust the opening if necessary. Some mounting notes:

- The Nesis III 8.4” model is mounted from front, while others are mounted from the back side of the instrument panel.
- The display is shipped with a set of mounting hardware. You can replace screws and nuts with more appropriate ones, but check that screw heads do not interfere with the bezel.

- Do not re-drill holes in the bezel.

Print the template on a hard paper. After printing, take a precise ruler or measuring tape and make sure that printed sizes are correct. This procedure is necessary, because some printers or PDF rendering software may slightly adjust the document size, producing wrong cut-out dimensions.

If possible, make a cutout with a CNC equipment. You can use the *dxf* file to program the CNC. This will make excellent results.

2.2.1 Mounting from the Back Side of the Panel

Nesis IV 10.1" and Nesis IV 7" are both mounted from the back side of the instrument panel. Once cuts in the instrument panel were made, the Nesis is simply fixed with screws. The bezel screw holes are threaded, which means no extra nuts are necessary.

Kliky is mounted following same principles.

2.2.2 Mounting from the Front Side of the Panel

Only Nesis III 8.4" mounts from the front size. Others mount from the back.

There are several ways to fix the Nesis into the panel:

- using supplied M3 nut and lock washer,
- using self-clinching nut insert,
- using threaded rivet nut insert,
- using spacer stud and epoxy.

Details are shown in next subsection.

2.2.2.1 Fixation with Supplied M3 nut and Lock Washer

This is the most straightforward method of fixation. Figure 2.8 shows an example.

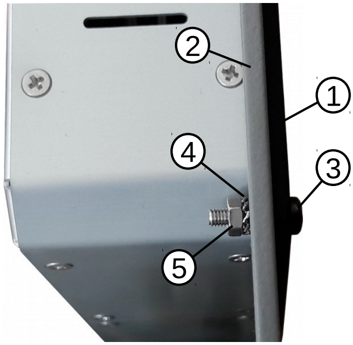


Figure 2.8: An example of fixation using supplied M3 nut and lock washer.

① Nesis plastic bezel – made of ABS plastic.

② Instrument panel plate.

③ M3 bolt with head colored black.

④ External teeth lock washer.

⑤ Standard M3 nut.

Please do not use excessive force on M3 bolt/nut to avoid damage of plastic bezel.

This fixation principle has one disadvantage – it makes Nesis service removal a bit difficult as nut on the back side may be difficult to access.

2.2.2.2 Fixation with Self-Clinching Nut

Instead of using standard nut and lock washer, a self clinching nut may be used. They come in various forms, which depend on the instrument panel material. Some special tools like arbor press may be required.

For instrument panels made of aluminum, a nut like shown on Figure 2.9 can be used. The nut must be pressed into the panel before installing the instrument. Once pressed, the nut shall not turn when Nesis is removed and this makes servicing easier.

The hole size needs to be as accurate as possible. It is recommended to do a few tests on a scrap part first.

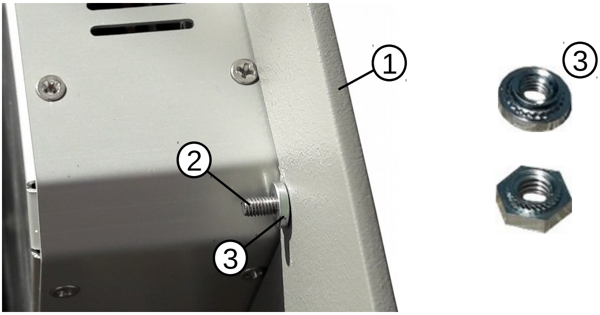


Figure 2.9: Self-clinching nut suitable for instrument panels made of aluminum.

① Instrument panel plate.

② M3 bolt.

③ Self-clinching M3 nut. (Two nut examples are shown in the figure.)

2.2.2.3 Fixation with Threaded Rivet Nut Insert

Threaded rivet nut inserts (a.k.a. *rivnuts*) may be also used, especially on the composite and thin panels. Again, they come in various forms. Some special riveting tool is needed to fix the threaded rivet.

Get some aluminium M3 rivnuts. Drill a hole into the panel, as it is required by the rivnut used. Then use the rivnut tool to fix the inserts. Be gentle, as there is only minimal panel material between hole and the cutout chamfer. Figure 2.10 shows an example.

There is a small disadvantage using rivnuts. As the rivnut head has some minimal thickness, the Nesis bezel will probably not mount flush with the panel – there will be a small gap.

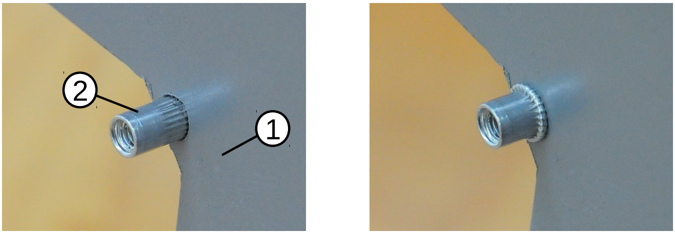


Figure 2.10: Example of rivnuts inserts. Left: a rivnut before compressing. Right: a compressed rivnut. (1) – instrument panel, (2) – rivnut.

2.2.2.4 Fixation with Spacer Stud and Epoxy

As another alternative, a M3 nut can be epoxied to the back of the instrument panel. Standard M3 nut is a bit too small to be epoxied successfully. Thus a M3 spacer stud at least 6 mm in length shall be used instead.

1. The spacer surface shall be made rough using coarse sandpaper. If spacer is coated, the coat shall be removed. A dremel tool comes handy.
2. Sand the back side of the panel where epoxy will be applied. Surface must be dull.
3. Mix a small batch of epoxy together with some cotton flox or with milled glass fibers. These add strength and also increase viscosity, which makes epoxy application easier.
4. Apply a tiny amount of oil or grease on bolt thread. This will prevent strong bond between epoxy and thread if epoxy is applied over the bolt thread by accident. But be careful not to put any grease on the surfaces where epoxy must be applied.
5. Fix spacers in place using M3 bolts and apply the epoxy mix around the spacers.
6. Wait for epoxy to cure.

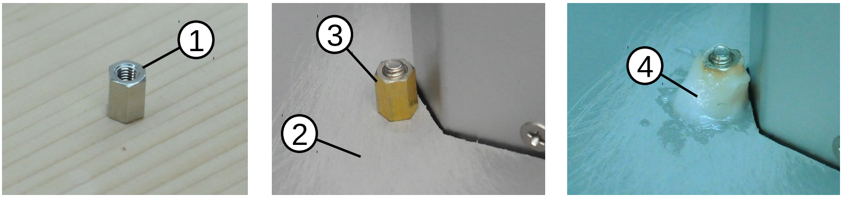


Figure 2.11: Example of spacer stud fixed with epoxy: ① – spacer stud, ② – panel surface sanded with 60 grid sandpaper, ③ – spacer stud sanded with dremel tool, coat removed, ④ – spacer stud fixed with epoxy mixed with cotton flox.

This fixation principle is a bit messy, but works very well in practice.

2.3 Power

Nesis power input requirements are compatible with 12 and 24 V aircraft power systems. Nesis accepts 10 – 30 V range.

The supplied power cable have two unterminated wires. The red wire must be connected to the power (+12V or +24V) terminal. The blue wire connects to the ground terminal. The other side of the power cable has a plastic connector. This connector has a hook next to the red cable. Insert the connector into Nesis at the back. The notch and the hook must match – they prevent wrong cable orientation, see Figures 2.12 and 2.13.

Both Figures denote:

① hook on the power cable connector

② notch on Nesis back.

When a slave Nesis is also connected to the system, it is powered with its own power cable.

Please note that two different power cable solutions are used for Nesis III 8.4” models. Displays delivered until mid Summer 2025 are shown in Figure 2.13 while later models are using very similar solution shown in Figure 2.12.

2.3.1 Current Variant

This variant of power connector is used on all Nesis IV 10.1” and Nesis IV 7” models and later Nesis III 8.4” models.

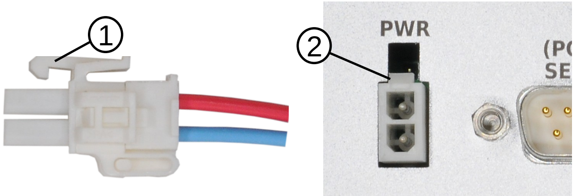


Figure 2.12: Current power solution for all models. Left: The power connector on a cable. Right: Power connector on Nesis back.

The cable side of actively used power connector variant – (1) in Figure 2.12 consists of the following parts:

- plastic part with a hook . . . Würth Elektronik, PN 794184-1,
- two female crimp terminals . . . Würth Elektronik, PN 794229-1,
- 0.75 mm^2 (about 18 AWG) red and blue teflon leads.

2.3.2 Older Variant

This variant is only used in older Nesis III 8.4” models.

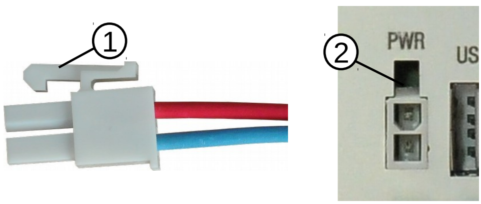


Figure 2.13: Older solution for Nesis III 8.4” models. Left: The power connector on a cable. Right: Power connector on Nesis back.

The cable side of older power connector variant – (1) in Figure 2.13 consists of the following parts:

- plastic part with a hook . . . Würth Elektronik, PN 649 002 113 322,
- two female crimp terminals . . . Würth Elektronik, PN 649 006 137 22,
- 0.75 mm^2 (about AWG 18) red and blue leads.

The terminals have a finite number of mating cycles. They belong to the 25 mating cycles quality class.

2.3.3 Circuit Breaker

The power input must be routed through a circuit breaker. Nesis consumes about 800 mA at 12V on full brightness. Various peripheral devices (Daqu, Magu, Indu, etc.) are powered via Nesis and they add to total consumption. A rough estimate is 250 mA per device.

So a circuit breaker rated at 1.5 to 2.5 A is needed for the systems with one Nesis. In the case of two Nesis connected to the same circuit breaker, use 2.5 to 3.5 A rated circuit breaker instead.

It is recommended that each Nesis gets its own circuit breaker.

2.3.4 Aircraft Master Relay

Please make sure that aircraft master relay (in fact all relays) have a protection diode (a flyback diode)[1], which protects against voltage spikes. A coil in relays without this diode may cause spikes that exceed 100 V and they propagate on the system bus. Such spikes may cause permanent damage on Kanardia equipment and other avionics.

2.3.5 Backup Battery

This backup battery solution works only on 12V systems.

Nesis may be powered via an optional external backup battery system called UPSU. The backup system consists of electronic circuit UPSU, a simple lead VRLA AGM battery (1.2 Ah is typically used) and a DPDT (or DPST) switch. Figure 2.14 shows the schematics.

The Nesis system is switched on/off by a double pole switch. This switch turns on/off two circuits at the same time. The first one brings system power into UPSU and the second one brings backup battery power into UPSU. When there

[1] Wikipedia: `https://en.wikipedia.org/wiki/Flyback_diode`

is enough voltage present on the system bus, system power is used and if there is no voltage on the system bus, backup power is used. UPSU will switch between both sources automatically. UPSU also charges the backup battery when system voltage is high enough (13V or more).

Both positive terminals (the system bus and the backup battery) must be protected each with its own fuse. Use a fuse in 1 – 3 A range.

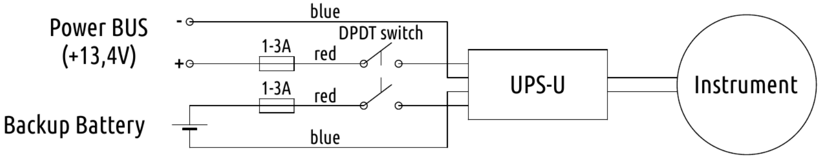


Figure 2.14: Schematics of the UPSU backup system.

The electronics part of the UPSU is shown on the Figure 2.15.

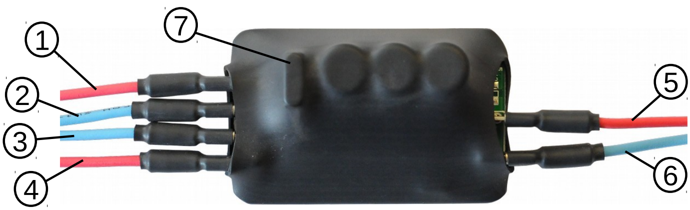


Figure 2.15: UPSU electronics. Input power leads from system bus and backup battery are on the left and the output power leads are on the right.

1. Input power lead from the system 12V bus. Make sure to install a fuse on the system bus side.
2. Ground from the system bus.
3. Ground from the backup battery.
4. Input power lead from backup battery. Make sure to install a fuse on the battery side as well.
5. Output power lead towards Nesis.
6. Ground lead towards Nesis.

(7) Internal 10A fuse electronics fuse.

The following table shows approximate elapsed backup times[2] that were obtained from 1.2 Ah 12 V battery for some typical configurations. Longer elapsed time can be achieved by using a battery with larger capacity (2 Ah, 2.7 Ah, 3.4 Ah, ...) at the expense of weight increase.

Configuration	Time
Nesis and DAQU	37 min
Nesis, DAQU, Digi	TBD

Table 2.1: Backup times achieved on a full 1.2 Ah battery at 22°C. All instruments running at 100% brightness.

Reducing the LCD brightness significantly increases backup times.

2.4 GNSS Antenna

The GNSS system in Nesis consists of two parts: the GNSS module and GNSS antenna. The module is an integral part of the AD-AHRS-GNSS device, which is built in the Nesis and the antenna cable connects to the back side of the Nesis.

Standard SMA male connector is used on the antenna coaxial 50 Ω cable to connected to the Nesis, Figure 2.16.

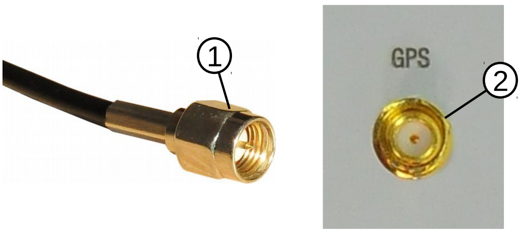


Figure 2.16: GNSS antenna connection: (1) – SMA male connector of GNSS antenna cable, (2) – SMA female connector on the Nesis back side.

For the most reliable performance, the antenna requires a clear view of the sky. The supplied antenna shall be mounted inside the cockpit on a place, which

[2] Elapsed time when equipment is running solely on the power from backup battery.

will give the best 360° view of the sky. Top of the instrument panel, below the windscreen is a typical place. Try to meet the following recommendations:

- The mouning location shall be level, clean and flat.
- Try to avoid other transmitting antennas – the location shall be at least 1 m away.
- Avoid placing it next to other active GNSS antennas as they may cause interference.
- Take care for correct orientation, see Figure 2.17.

You may use double sided self adhesive tape to fix the antenna. The actual fixation principle depends on the surface material.

Although the general rule is that the antenna shall be unobstructed, good results were also obtained for antennas placed under the instrument panel covers made of *thin* fiberglass. This does not work with metal of carbon fiber covers.

Nesis comes equipped with a passive antenna as shown on Figure 2.17.

Figure 2.17: GNSS antenna orientation: (1) – this side must face upwards, towards the sky.

The GNSS receiver is capable of SBAS enhancement from EGNOS, WASS, etc. system. When SBAS signal is being received, this gives additional precision to the calculated GNSS position.

The GNSS module usually starts cold. This means that it will take about 30 s to obtain first fix, but no more than 60 s in the worst case.

2.4.1 GNSS Signal Check

`Main menu | Options | Info | GNSS details`

Nesis shows the GNSS satellite constellation and quality of the reception. A window like shown in Figure 2.18 appears.

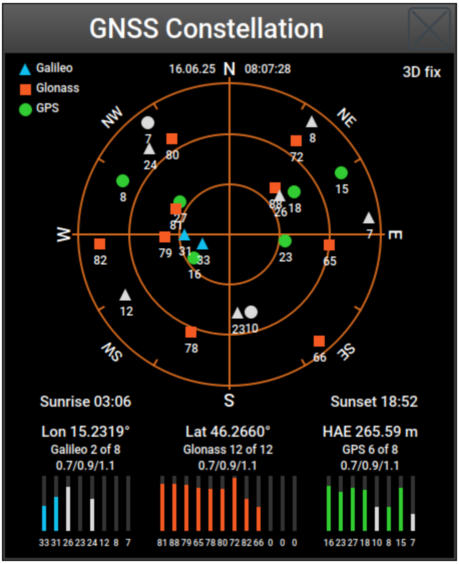


Figure 2.18: An example of Galileo, GPS and Glonass constellations.

The window shows positions of the satellites on the sky. GPS constellation is represented with green disks, Glonass with red squares and Galileo with blue triangles. All tracked satellite positions are shown. Satellites which are being tracked but not used in the position calculation are colored white.

HDOP, VDOP and PDOP[3] values indicate quality of the solution. The meaning of the DOP values is given in Table 2.2. In general, HDOP shall be always be less than 5.

Vertical bars at the bottom of the screen indicate quality of the signal reception. Below each bar is satellite PNR number. A colored bar indicates that the satellite is used in position calculation.

[3] DOP – Dilution of precision, HDOP – horizontal DOP, VDOP – vertical DOP and PDOV – combined DOP.

Solution fix is shown in the top right corner. It can be one of the following values:

`Error` – there is no communication or data is not available yet.

`None` – there is no fix. Position is not known.

`2D fix` – only 2D fix is obtained. The position measurements are poor.

`3D fix` – 4 or more satellites are used in the solution. The position quality should be good. See also DOP table.

`3D+SBAS` — 3D position is further enhanced with the SBAS system.

DOP	Rating	Description
< 1	Ideal	Highest possible confidence level.
$1 - 2$	Excellent	Positional measurements are considered accurate.
$2 - 5$	Good	Still acceptable for route navigation.
$5 - 10$	Moderate	Position can be used, but it should be improved.
$10 - 20$	Fair	Position indicates a very rough location.
> 20	Poor	Inaccurate measurements.

Table 2.2: Meaning of the DOP values.

2.5 OAT – Outside Air Temperature

2.5.1 Installation

Outside air temperature (OAT) probe is shipped with the Nesis primary display. This is a digital temperature sensor inserted into a threaded aluminium housing. Default OAT cable length is 1.5 meters, but other lengths are available on request.

OAT information is required to calculate the true airspeed from the indicated airspeed and altitude.

In order to provide accurate measurements, the OAT probe must be installed on a proper place, where the probe is not exposed to the disturbing sources of heat:

- engine heat and exhaust heat,

- direct sunlight,
- heated air exited from cabin.

It is not recommend installing the probe in the heated cabin area, since the elevated temperature in the cabin may influence the back side of the probe (aluminium housing conduction).

Please follow these steps to install the OAT probe:

1. Locate a spot in the aircraft taking into account the considerations from above and drill a ϕ 8 mm hole.
2. Remove the external nut from the probe, but keep the washer, internal nut and plastic insulation sleeve on the probe.
3. Install the probe into the hole *from the interior*. Guide the cable through the aircraft to the Nesis display back side.
4. Apply some thread-lock liquid and thread the external nut to the probe. The liquid is necessary to avoid losing the cap due to vibrations.
5. Tighten the internal nut so that the probe sits firmly and apply thread-lock liquid on the nut. Do not over-tight it.
6. Slide the plastic sleeve over the exposed threads of the probe and cover as much threads as possible. Shrink the sleeve using hot air blower. Do not use open flame. Plastic (shrink) sleeve mainly serves as thermal insulation from cabin heat.

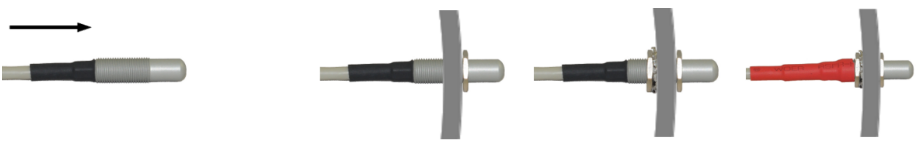


Figure 2.19: Inserting the OAT probe (left), cap is in place, tighten the internal nut, slide the insulation shrink sleeve (right).

2.5.2 Connection

The digital thermometer in the tip of the probe is type DS18S20+. OAT connector is standard 4P4C type (four pins), as shown on Figure 2.20. Description of individual pins is given in Table 2.3.

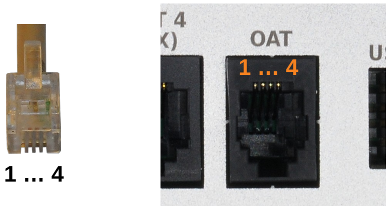


Figure 2.20: Designation of the pins.

Pin	Description
1	Not connected
2	GND
3	+3.3V
4	Data

Table 2.3: Description of the OAT pins.

The cable can be extended or shortened as needed.

You can also build your own probe. Use DS18S20+ sensor and connect it according to Figure 2.20, Table 2.3 and the sensor datasheet.

2.6 Audio

Nesis can be connected to the audio system (audio out) and video (video in). These two have nothing in common – audio and video are not associated.

Nesis is equipped with an audio output. Audio output is used to play audible messages and warnings to the pilot.

Nesis is shipped with an audio connector cable. One end of the cable has a male 3.5 mm mono audio jack which fits into Nesis master unit. You shall cut off the connector on the other end and peel of the insulation to get the situation as it is shown in Figure 2.21. Now, the open ended end connects to the radio station. Alternatively, if you headset permits such connection, you may connect the cable directly to the headset.

Figure 2.21: Audio cable: (1) – audio signal, (2) – GND

Audio output from the Nesis is 1.5 V peak-to-peak. Output is isolated with an audio transformer, so both signal and ground must be connected. Use of shielded cable is preferred.

Next we provide schematics for most widely used radio stations. Please refer to the radio manual first. The radio manual supersedes any information given here.

2.7 Video

Please note that audio and video are not associated. Video is used to show some video image from an on-board camera on the Nesis screen.

Nesis comes equipped with a BNC video connector. In general, any video camera with analog composite video signal in PAL or NTSC format can be connected. The SECAM format is not supported.

The input on Nesis has impedance 75 Ω and is expecting video signal with amplitude 1.5 V peak to peak. The video signal source must be connected to Nesis with 75 Ω coaxial cable.

Nesis does not recognize video format automatically. In order to configure the format used by video camera, execute:
`Main menu | Options | Service | Settings | Video input`
and change to the appropriate video format.

Nesis does not support `USB` based video cameras.

The last step is illustrated on Figure 2.22.

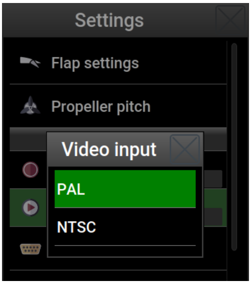


Figure 2.22: An example of video input format selection.

Chapter 3

Ports

3.1 USB

Nesis III 8.4" has two USB ports. One at the back and one at the front. The front one is typically used with USB memory stick for data transfers and software updates. The back USB port is typically used for WiFi module, as a charger or as a cable tethering.

Nesis IV 10.1" and Nesis IV 7" have two USB ports at the back. One is used for Kliky, which is actinga as a remote panel and USB extention at the same time.

3.1.1 Kliky

One USB port on the back side (either one) is used to connect Kliky remote panel, see Figure 2.7

Note: Kliky does not support hot plugging. If you connect Kliky while Nesis is running, it will not be detected. You must turn Nesis off and then back on to activate it. Once Kliky is connected, it behaves as an integral part of the system.

3.1.2 USB Memory Stick

On order to transfer data between the memory stick and Nesis, the memory stick must meet the following requirements:

- Max supported capacity is 32 GB.
- The stick must be formatted as FAT32 (Windows).

One memory stick is supplied in the kit.

In some occasions Nesis does not detect the USB memory stick properly. Removing the stick and inserting it back again usually solves the problem.

If the problem persist, try with a memory stick made by a different producer or try to insert it into the back port.

3.1.3 WiFi Module

When a suitable WiFi module is connected to Nesis and the module is properly configured and connected to some WiFi network with the Internet access, then Nesis also gets access to the Internet. One such example is the WiPi module shown on Figure 3.1.

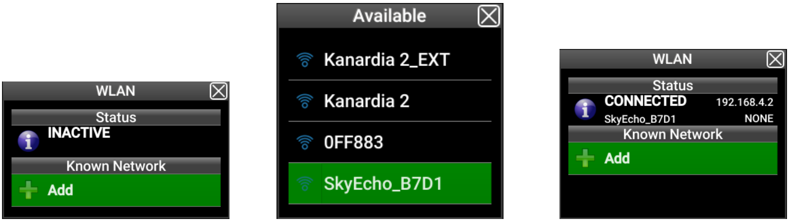
Please note that not all modules are compatible. For time being, we are supporting modules with the RTL8188CUS and RT5370 chipsets only.

Figure 3.1: En example of small WiFi module, called WiPi.

1. Plug the module into Nesis USB port. Back port shall be used, but it should work well also with the front port.
2. From the `Options` page select `Wireless` icon. Figure 3.2a shows an example screen.
3. Select the `Add` item. A list of detected networks appear. An example is shown on Figure 3.2b. You will see a different list.
4. Select a network where you want to connect to. In the example, `SkyEcho_B7D1` will be selected. This is an ADS-B receiver/transeiver[1] produced by uAvionics.
5. Enter the network password. Keep it empty when password is not required by the network.

[1] This device is specially suited for the UK market.

6. After a few seconds, Nesis will connect to the network. See figure 3.2c.



(a) Initial window (b) Network list (c) Success

Figure 3.2: WiFi connection sequence example.

3.1.4 USB Cable As Charger

Standard USB cable may be used to charge some devices. The maximal charge current is 500 mA at 5V, which yields about 2.5 W. This is pretty limited power and it may not be adequate for most modern mobile devices.

Never connect power banks - the reverse current from power banks may permanently damage Nesis.

3.1.5 USB Cable As Tethering

Standard USB cable can be also used to connect a smart phone and Nesis. When *tethering* is enabled on the phone and the phone has Internet connection, then Nesis is connected to the Internet as well.

Please check your mobile phone documentation on how to enable the tethering mode. Usually, the procedure is as follows:

1. Connect Nesis and smart phone with a USB cable.
2. On the smart phone, select the settings icon.
3. Then select the connections item.
4. Search for the mobile hotspot and tethering option.
5. Enable the USB tethering option.

No actions are required on the Nesis side.

3.2 CAN Bus

Nesis has two CAN bus ports. CAN bus is the main communication bus between Kanardia devices. CAN bus is a very robust vehicle bus. The communication is message based and connected devices communicate without the host computer. See `https://en.wikipedia.org/wiki/CAN_bus` for more details about the bus.

3.2.1 Connector and Plug

We are using standard Ethernet computer cable with RJ45 connector on each side. Communication leads are central twisted pair leads – pins 4 and 5, while other pins are used as a power supply for connected devices. Table 3.1 show the details.

The cable can be bought in almost any computer shop. Although the connector seems a bit *cheap*, it is very reliable. We do not remember any plug/connector contact problem or failure in last 10 years.

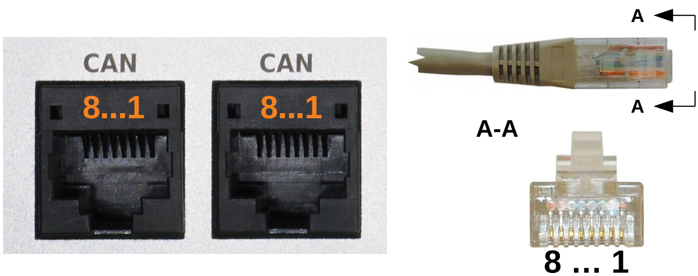


Figure 3.3: Designation of the CAN bus pins.

Our CAN bus system is running at 500 kBit/s.

For the time being, only Kanardia CAN devices are compatible with our CAN system. Never connect a third party CAN device to our CAN bus. A serious damage may occur in the hardware. Some third companies also use RJ45 plugs and you may be tempted to connect them with our CAN system. However, they are using different pinout and different/conflicting message protocol.

3.2.2 CAN Topology

CAN system can be used in different topologies. We are using line/bus type topology. Figure 3.4 shows schematic of this topology. It consists of one main

Pin	Description	Schema ①	Schema ②
1	System voltage output	orange-white	gray
2	typ. either 12 or 24 V	orange	yellow
3	max 1.5 A, non regulated	green-white	blue
4	CAN low	blue	red
5	CAN high	blue-white	white
6		green	pink
7	GND – Ground	brown-white	brown
8		brown	green

Table 3.1: Description of the CAN bus pins. The given color schema ① is the one we predominately use, schema ② is used less often. Note however that other valid schema may also exist.

CAN bus line and several devices (also referred to as nodes) are connected to the main bus via short connections. The connecting lines shall be short – up to 30 (50) cm, while the main line can be up to 40 meters long. Each side of the main bus line must have a terminator, which is a 120 Ω resistor.

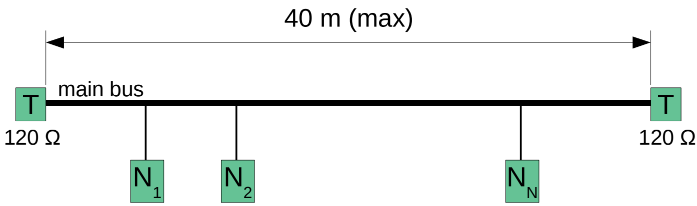


Figure 3.4: CAN line/bus topology principle used by Kanardia

Most of the Kanardia devices have two CAN bus ports that allow devices to be daisy-chained to each other. Main bus enter in one port and exits in the other. Port order is not important – both are equal. Inside device housing there may be more internal modules. In the case of Nesis, there is AIRU module (AD-AHRS-GPS module) and Nesis electronic board module. Both are internally connected to the main CAN bus.

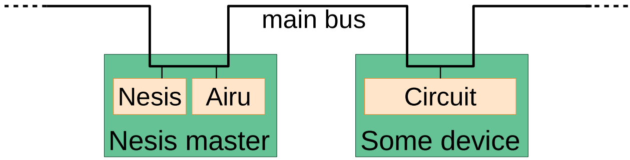


Figure 3.5: Device daisy-chaining, where devices has two CAN ports.

Daqu and Magu devices are a bit special. They usually appear on each end of the main bus. They have a built-in 120 Ω resistor which effectively makes them terminators, see Section 3.2.2.2.

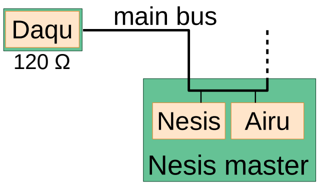


Figure 3.6: Topology of Nesis basic kit – Daqu also serves as a bus terminator.

⚠ If Daqu is omitted from the bus, then CAN communication between Nesis and Airu module does not work as there is no terminator present. In this case a terminator plug must be inserted instead.

3.2.2.1 T-Junction

T junctions are obsolete and shall be avoided in new systems. They are only needed when old `Seru V1` devices are part of the CAN bus. Seru V1 has only one CAN port and it can't be daisy-chained. In this case, a T-junction is needed. T-junction is a simple element with three RJ45 ports.

`Seru V2` has two CAN ports and it daisy chains into the bus. Hence T junction is not needed.

⚠ Never use T-Junctions to built a tree like CAN bus network. This will create a subtle CAN bus communication issues, which will be hard to detect and debug.

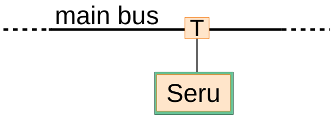


Figure 3.7: Seru V1 has only one CAN connector and requires T-junction.

3.2.2.2 Terminator Plug

CAN bus needs one 120 Ohm terminator on each end of the bus, as it is illustrated in Figure 3.4. `Daqu` and `Magu` are our CAN devices, which have a 120 Ohm resistor integrated and they automatically act as terminators. They should be placed on the start or on the end of the CAN bus line. In such a case, an extra terminator is not needed. However, if either Daqu or Magu is not part of the bus, then a special terminator plug shall be placed into the free CAN bus slot. A plug example is shown in Figure 3.8.

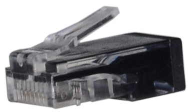


Figure 3.8: An example of a CAN terminator plug. It has 120 Ohm resistors inserted between pins 4 and 5.

The terminator is nothing but a simple 120 Ω resistor between CAN high and CAN low leads – pins 4 and 5 on Figure 3.3 and Table 3.1. A standard 1/4 Watt resistor will do.

3.3 Service Port – D-SUB 9

The service port consists of a D-SUB 9 pin connector. It is a multipurpose port. The port supports several roles: terminal communication with the built-in computer, auxiliary RS-232 port for general use, external push button command and alarm output signal. All functions can be used in parallel, although this is seldom needed.

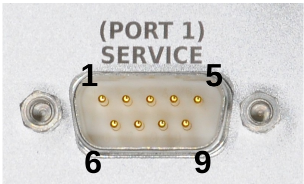


Figure 3.9: Service port D-SUB 9 male with designated pins.

Figure 3.9 and Table 3.2 define role of individual pins.

Pin	Description
1	External push button input.
2	Terminal RX (RS-232)
3	Terminal TX (RS-232)
4	System voltage output (typ. 12 or 24 V), max 500 mA, not regulated.
5	GND – ground
6	Port 1 auxiliary RX (RS-232)
7	Port 1 auxiliary TX (RS-232)
8	Alarm switch – reserved for future use.
9	GND – ground

Table 3.2: Description of the service port pins.

3.3.1 Service/Terminal Communication

Terminal connection is used for service communication with the main Nesis computer. This is a classic RS-232 connection at 115200 bit/s, 8 bits data, no parity bit, one stop bit. Figure 3.10 illustrates the connection.

A communication with a terminal shall be used only during production and factory maintenance or repair.

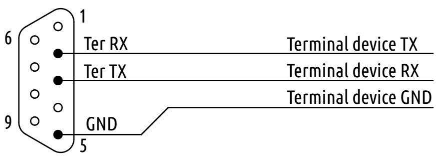


Figure 3.10: Connection schematics for service terminal.

3.3.2 RS-232 Port 1 – Auxiliary

Nesis has three RS-232 communication ports used to connect to third party devices, see page 48. We recommend to use them first. However, if needed, an additional RS-232 communication can be established through the service port. Figure 3.11 shows the connection schematic. If Nesis and device are both connected to the same power source, the GND connection may be omitted.

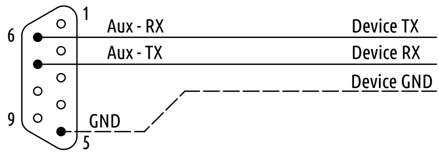


Figure 3.11: Connection schematics for auxiliary RS-232 port 1.

3.3.3 External Push Button

Nesis allows connection of one external push button. The external button has two events: a normal push event(or short press) and a long push event (long press). In most cases an external button is used together with the autopilot system and events are associated with one of the AP commands.

Figure 3.12 shows the connection schematic.

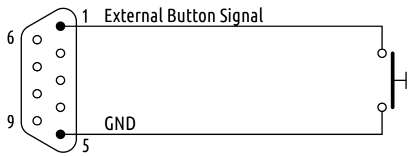


Figure 3.12: External push button schematics

In normal operation the circuit is open. When the button is pressed, it closes the circuit and connects pin 1 with the ground. This is detected by Nesis either as a short press or a long press event. Nesis will execute associated command.

Short press event is executed on button release (if the release comes soon enough). A long press is executed when button is kept pressed long enough.

3.3.3.1 Configuration

`Main menu | Options | Settings | User`

Execute the command to open the user settings window, scroll down the window and search for the `External` and `External long` items. Assign them functions of your choice. A typical example is shown on Figure 3.13. `External` represents the short press event on the external button and the `External long` represents the long press event.

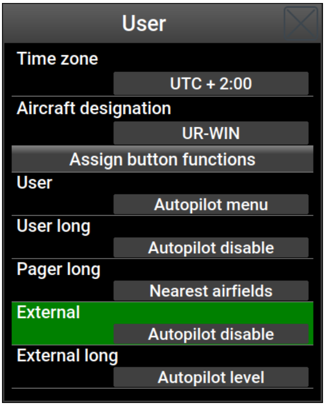


Figure 3.13: External push button configuration. The example shows autopilot settings, but any other functions can be used instead.

3.3.4 Alarm Switch

When Nesis detects some parameter outside operational limits, an output signal may be raised. This depends on the parameter alarm settings. The alarm line can be used to trigger some other device, an alarm lamp on the instrument panel, for example.

Figure 3.14 illustrates schematics for small load connected to pin 8. When alarm is on, optocoupler internally connects the line to ground (GND) and closes the circuit – the current starts flowing through the load. The load must be externally powered with the system bus voltage.

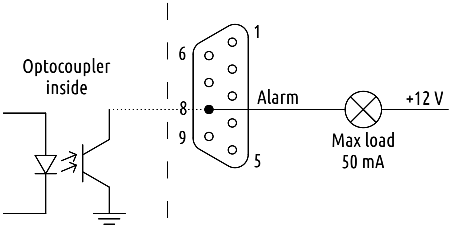


Figure 3.14: Alarm switch schematics with the load on the line.

Figure 3.15 illustrates solution for a larger load. This load must be connected via relay and the circuit must be protected with a flyback diode. (Some relays have this diode already built-in.) When alarm is on, the circuit is closed by optocoupler and coil in the relay gets energized. This, in turn, activates the relay switch and closes the load circuit.

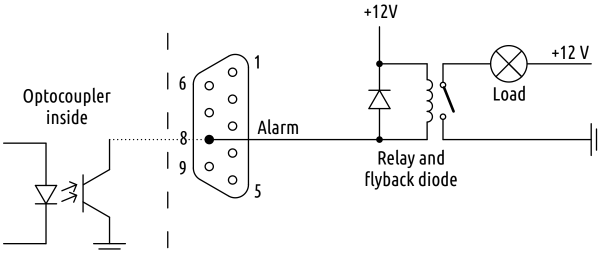


Figure 3.15: Alarm switch schematics with the relay solution for larger loads.

3.4 RS-232 Ports 2–4, RJ12

Nesis has three RJ12 connectors at the back, which are intended for three independent RS-232 communications. An additional auxiliary RS-232 can be established through the service port. Figure 3.16 shows these ports. They are labeled as:

`Port 1` – is auxiliary port on the service D-Sub 9 connector, see Section 3.3.2.

`Port 2` – recommended for ADS-B In or Flarm.

`Port 3` – recommended for radio.

`Port 4` – recommended for transponder.

All these ports are independent. Designations in parenthesis are merely recommendations – you can connect any supported device instead.

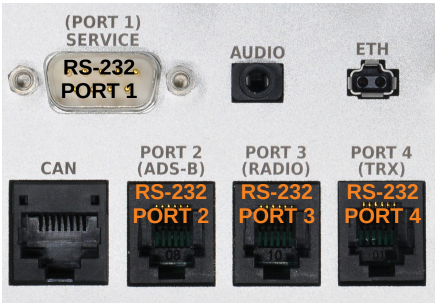


Figure 3.16: All RS-232 ports at the back side of the Nesis.

3.4.1 Pinout

This section describes ports 2, 3 and 4 only. See section 3.3.2 on page 46 for the port 1 description.

A standard RJ12 (6P6C) plug is needed to connect to the port. Table 3.3 defines the pinout and Figure 3.17 illustrates pin ordering on connector and plug. Pin 1 is used only when you use Nesis as a power source for connected device. When we provide a connection cable, then the color schema shown in the table is used.

Never connect external power source to pin 1. This will damage the internal circuit. Output current on pin 1 is limited. The maximal current must not exceed 500 mA.

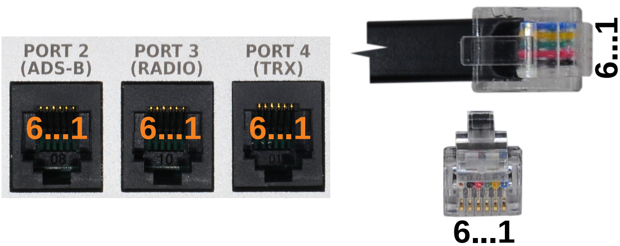


Figure 3.17: RS-232 ports with RJ12 connectors and their pin numbers.

Pin	Description	Schema
1	System voltage output (typ. 12 or 24 V), max 500 mA.	blue
2	Not used.	yellow
3	Not used.	green
4	RX – receive data. Connect with TX on the remote device.	red
5	TX – send data. Connect with RX on the remote device.	black
6	GND – ground.	white

Table 3.3: Description of RJ12 pins for the serial RS-232 communication. With Kanardia made cables, colors from the schema column are used.

3.4.2 Configuration

`Main menu | Options | Service | (password) | Settings | Serial ports`

Once some external device is connected, port must be also properly configured. Execute the command above and you should see something like shown in Figure 3.18.

1. Select the port where device was connected and choose one of the options described next.
2. Close all windows. Nesis will reboot and the communication with the device should be established.

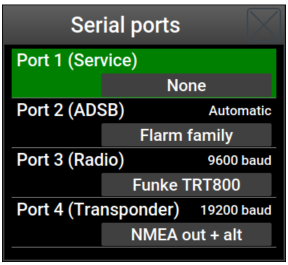


Figure 3.18: Serial port configuration window.

The options for each port are as follows:

`None` the port is not in use.

`TQ KRT2` the port is connected with a KRT2 radio. Nesis will send KRT2 specific commands to the radio.

`Funke ATR833` the port is connected with an ATR 833 radio. ATR 833 specific commands will be sent to radio.

`Funke TRT800` the port is connected with an TRT 800 transponder. TRT 800 specific commands will be sent to transponder.

`Trig radio TY` the port is connected with a Trig TY91/TY92 radios. Trig's slightly modified SL40 protocol adapted for 8.33 kHz channel spacing will be used for communication.

`Transponder KTX2` Use this to connect to the KTX2 transponder. This option will transmit NMEA RMC message only. Some early KTX2 transponders were not working of other messages (like GGA) were also present.

`Flarm family` the port is connected with a device from Flarm family. Automatic baud rate detection is used for Flarm devices. Nesis expects one of the following baud rates: 4800, 9600, 19200, 28800, 38400, 57600, 115200 and 230400. We recommend using rates 57600 or higher, when possible and supported by device.

`GDL90 family` the port is connected with a device from GDL90, which is quite common for ADS-B In devices.

`NMEA out` the port will send out GNSS data in NMEA format at specified baud rate, N-8-1[2]. RMC, GGA and GSA sentences are sent every second.

`NMEA out + alt` same as NMEA out, but altitude is also encoded in the data stream.

`TQ KTX2` the port will send out GNSS data in NMEA format adjusted for TQ KTX2 transponder. We suggest that you use NMEA out first and of this does not work, try with this option.

`NMEA in` the port listens to some external navigation device. In particular we expect RMB sentence (used to drive autopilot) and/or RTE, WPL sentence pairs used to import navigation routes.

`Kanardia CO` is obsolete and is kept for compatibility with old Kanardia CO devices.

[2] N-8-1 – no parity, 8 bit data, one stop bit.

`FDS GD-40` is used to connect to Flight Data System's GD-40 CO monitor. See section A.10.1 for connection details.

Please see Appendix A for more details about individual connections.

Chapter 4

Service Options

`Main menu | Options | Service | (password)`

Service options are special options, which should not be accessed in normal flight operations.

1. Activate the main menu by pushing the knob.
2. Select the `Options` item. This will open the user opetions page.
3. Select the `Service` icon and enter the access password, when asked for it.

When Nesis is delivered, the access is NOT protected by any password. However, one can assign the password in order to prevent accidental access to these options. See Section 4.1.10 for more details.

Figure 4.1 appears. Each of the icons shown is explained in following subsections or in separate chapters.

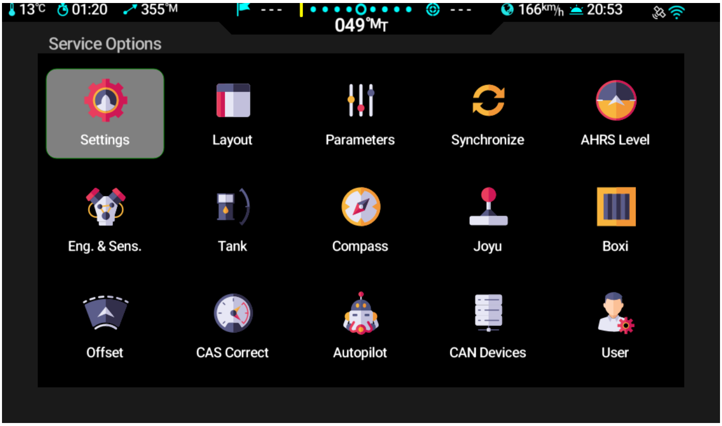


Figure 4.1: Service options icons screen.

4.1 Settings

The `Settings` icon is a gateway for some further options, Figure 4.2.

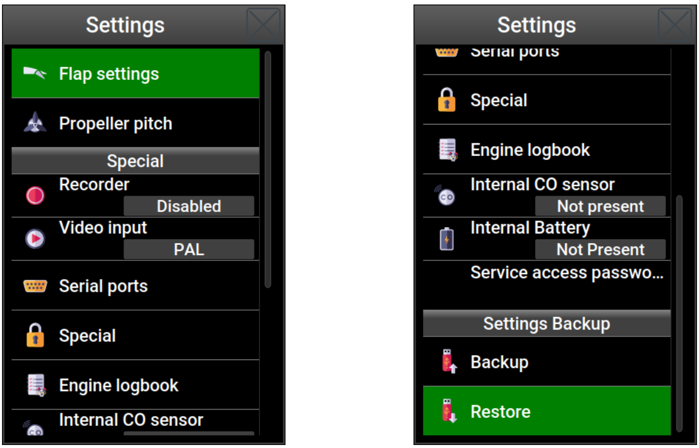


Figure 4.2: List of additional options under `Settings`.

4.1.1 Flaps Settings

`Main menu | Options | Service | Settings | Backup | Flaps settings`

Before you can proceed with the flap settings, please make sure that flap sensor was correctly connected to Daqu (see Daqu manual), Daqu channel was correctly configured (see section 4.6.3) and `Min-Max` position was determined (see section 4.6.3.2).

Flaps may have several fixed positions between fully retracted and fully extended. This window is used to define visual flap stops markings, which are relative to the full flap travel. Typically, flap stop 0 corresponds to 0% of travel and full flaps to 100%. Nesis allows setting up to five different position. Figure 4.3 shows an example.

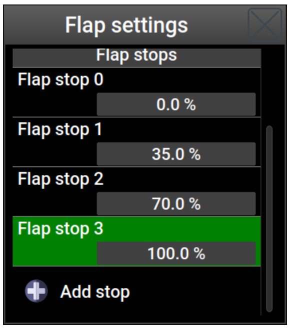


Figure 4.3: Example of flap stops window for an airplane with three extended flap positions.

`Time of travel` defines approximate time of flap from 0 to 100%. This value is used with combination of flap position sensor to detect the flap movement and also to prevent sporadic flap movement messages.

If flap movement window appears on the screen, but flaps are not moving, increase this value. If flap movement window does not appear on the screen, or appears too late and the flaps are moving, reduce this value.

`Remove all` removes all flap stops.

`Flap stop ...` define flap position in percentage of full travel range. Setting the percentage to zero deletes the stop.

`Add stop ...` use to add additional flap stop position.

Note: Currently, the system does not allow to set *negative* flap positions.

4.1.2 Propeller Pitch

`Main menu | Options | Service | Settings | Backup | Propeller pitch`

This feature is seldom used. If your propeller is equipped with a position sensor, which in turn is compatible with one of Daqu channels, then you shall configure Daqu first for this sensor. Once this is done, use this command to tell the minimal and maximal propeller position limits in degrees. Figure 4.4 shows an example.

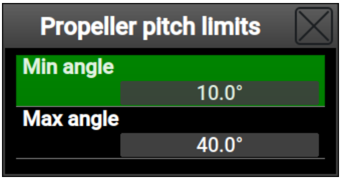


Figure 4.4: Properller pitch limits example.

4.1.3 Recorder

`Main menu | Options | Service | Settings | Backup | Recorder`

In normal operation the options shall be set to *Disabled*. This means that no special recording takes place.

Sometime, moststly due to software development purposes, a recorder may be turned on. The record option appear on the top left area of the Modern screen. Only one recorder can be active at the same time. The following recorders are possible.

`GDL90` can be used to record all information received from some GDL90 defice to a USB memory stick. Such records come handy for development and debuging TIS-B and FIS-B services of ADS-B systems.

`CanData` records complete internal CAN bus traffic to USB memory stick.

`Kalman` records sensors information from AD-AHRS-GPS module. It is used for post processing, debugging and simulating AHRS behaviour.

4.1.4 Video Input

`Main menu | Options | Service | Settings | Backup | Video input`

Certain Nesis models have a composite video input connection. Nesis must know the format of this analogue video input. It can be either PAL or NTSC. Only these two formats are supported. Please check which format is used in your camera and set it accordingly.

Nesis does not support USB cameras.

4.1.5 Serial Ports

`Main menu | Options | Service | Settings | Backup | Serial ports`

Nesis has several serial (RS-232) multi purpose ports at the back. Please refer to the section 3.4 starting on page 48 for details.

4.1.6 Special

`Main menu | Options | Service | Settings | Backup | Special`

In very rare cases, some special system commands may be issued. These commands are needed neither during installation nor during operation. They may come handy in the case of instrument malfunction or during low level factory setup.

Each of these commands is protected by unique password. The command opens a window shown on Figure 4.5. If correct password was entered, the appropriate command is executed.

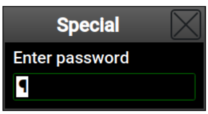


Figure 4.5: Each special command is protected by password.

The *special* commands are not listed. They are provided on request only.

4.1.7 Engine logbook

`Main menu | Options | Service | Settings | Backup | Engine logbook`

This option comes handy when some ground engine run was performed one would like to extract engine parameters from the logbook for this particular run.

The options works similar to the standard logbook. Standard logbook filters out entries, which do not have any flight time or if the total flight time is too short. Here, all entries are shown even very short ones. It takes about 10 seconds for an engine run to be detected. Figure 4.6.

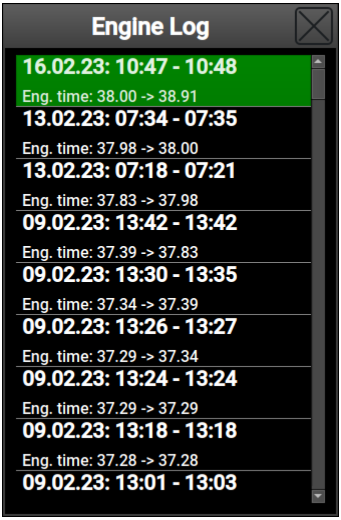


Figure 4.6: Engine logbook example.

1. Insert an USB memory stick into Nesis.
2. Select the engine run you would like to copy.
3. A file with `tab` extension will be made on the USB memory stick.
4. View the content with on a spread-sheet. Check the Logbook section of the Nesis User Manual for more details.

4.1.8 Internal CO Sensor

`Main menu | Options | Service | Settings | Backup | Internal CO sensor`

This option is for backward compatibility only. It will be removed in future versions.

Since 2019 we do not equip Nesis with internal sensors anymore. We use external CO sensors instead. An external sensor is connected to one of RS-232 ports at the back of the Nesis. Please see 3.4 starting on page 48 for details.

Some older Nesis may have a build-in internal CO (carbon monoxide) sensor. You can chose from:

`Not present` sensor is either not present or it is disabled.

`Internal CO v1.0` sensor is enabled.

`Internal CO v1.1` sensor is enabled.

4.1.9 Internal Battery

`Main menu | Options | Service | Settings | Internal battery`

This option is obsolete. It is used for backward compatibility and it will be removed in future versions.

4.1.10 Service Access Password

`Main menu | Options | Service | Settings | Service access password`

By default no password is assigned and the service options screen is always accessible. However, access to service options can be protected with a password. Assign some password as shown in Figure 4.7. Next time you access the service options screen, you will have to enter the assigned password.

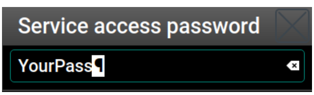


Figure 4.7: Password used to protect service options access.

There is a fair chance that you will forget the assigned password. In this case, enter `TRESPASS` as the password. This clears the access password and brings back the default behavior - no password is required. Example is given in Figure 4.8.

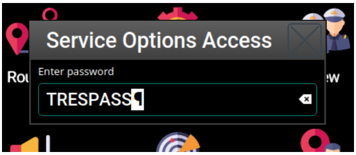


Figure 4.8: Access password reset.

4.1.11 Backup

`Main menu | Options | Service | Settings | Backup`

This command saves internal settings to a USB memory stick. The saved information can be used to transfer the same settings to a different instrument or to restore settings to an existing one. It is also valuable in problem reporting and debugging.

A valid USB memory stick must be inserted in a USB port before the command is issued. On success, `Nesis.SN-XXX.tgz` file is created on the stick. Here SN stands for serial number of your Nesis, XXX is a number which is incremented for the each backup (001, 002, ...). It depends on the previous backups found on your memory stick. The one with the highest number is the last one.

4.1.12 Restore

`Main menu | Options | Service | Settings | Restore`

This command restores information from a backup file located on a USB memory stick. A window prompts you to select the appropriate backup file. If successful, the information is copied to the system and Nesis restarts.

Important note: The Nesis software version is important. The restore will fail if the backup was created with newer version. For example: Backup was created with Nesis running SW version 4.1 and a restore attempt is made on Nesis with SW version 3.9. This restore will fail without a warning and it will leave Nesis in an undetermined state.

Please also note that restore across major versions are in principle not supported. For example, you can't use a backup made with version 3.x and restore it in version 4.x.

4.2 Layout

`Main menu | Options | Service | Layout`

The *Layout* command opens a window where Nesis screens layout is organized. Figure 4.9 illustrates the window.

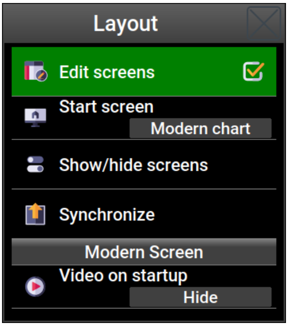


Figure 4.9: Nesis screen layout configuration window example.

Several options are given:

`Edit screens` enables the screen editing. On all screens which allow editing, a new menu option `Edit screen` is included. Details are provided in Sections 6 and 6.1.

`Start screen` allows start screen selection – this is the screen that appears on the instrument startup.

`Show/hide screens` allows you to enable or disable individual screens. Nesis comes with all screens enabled. If you find too many screens variants, you may disable those which you do not need. Figure 4.10 illustrates an example, where the engine screen was disabled. Please note that different Nesis models have different screens and your situation may differ.

`Synchronize` is used for layout synchronization between two displays – screen layouts from this display will be transferred into the other display. Only layout related information will be synchronized. Other settings will remain untouched. See also section 4.4 for full synchronization. If second Nesis is not detected, this option is not shown.

`Video on startup` is used to show or hide the video window used on the modern screen.

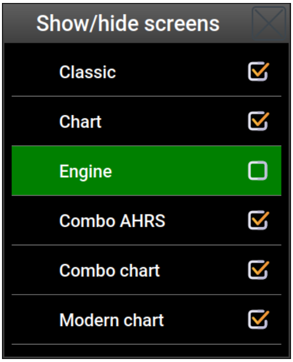


Figure 4.10: Nesis screen layout configuration window example.

4.3 Parameters

`Main menu | Options | Service | Parameters`

Parameters have a section of its own. Please see section 5, starting on page 92.

4.4 Syncronize

`Main menu | Options | Service | Synchronize`

This option is useful when two Nesis displays are used. Once the first display is properly set, use this command to synchronize the second display accordingly. Devices of other types are not affected (e.g. Emsis, Horis, Digi . . .).

We recommend that the master display is completely configured/setup first and once you are happy with the setup, use this command to transfer the setup to the slave display.

The command works in both ways. This means that you can also transfer slave display setup (configuration, layout, parameters, etc.) to the master as well.

It may happen that you will still have to make some minor adjustment on the display after the synchronization. As master and slave displlays have some differences, a small subset of the setup can't be synchronized.

The command may have undesired effects. Never use it in-flight. It shall be used as a part of the configuration/setup process only.

If screens do not run the same software version, the results are not predictable. Make sure to use the same software in both screens.

For partial synchronization see sections 4.2 and 5.2.2.

4.5 AHRS-Leveling

`Main menu | Options | Service | AHRS level`

A window similar to one shown on Figure 4.11 appears on the screen.

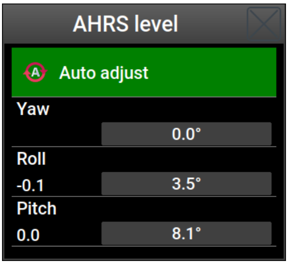


Figure 4.11: AHRS leveling window.

During the assembly of the `AD-AHRS-GNSS` unit called `Airu` into the primary Nesis and during the installation of the Nesis display into the instrument panel, a small misalignment may appear. This means that internal axes of Airu are not parallel to the airplane axes – the unit is slightly rotated. Such misalignment can be adjusted without loss of precision using the procedure described in this section.

Please note that the attitude can't be adjusted when the airplane is flying or engine is running.

Please make sure that aircraft is in cruise attitude and is level for both, roll and pitch. Lift tail or nose if necessary. Make also sure that Nesis is turned on for at least ten minutes – this warms up the internal electronics and stabilizes numerical filters.

Before the automatic alignment is made, the yaw misalignment shall be determined.

4.5.1 Yaw Misalignment

When the instrument panel is perfectly flat and perpendicular to the airplane x-axis (longitudinal axis) than there is no yaw misalignment and the correction angle is zero. This perfect situation is illustrated in Figure 4.12 left.

Some instrument panels or Nesis installations are rotated regarding the airplane x-axis (longitudinal axis). In this case the misalignment angle Ψ must be measured and its value entered into Nesis. Figure 4.12 defines positive and negative Ψ angle.

When Ψ is known, enter its value into *Yaw* item as shown in Figure 4.11. Then you can proceed with the pitch and roll adjustment, which are automatic.

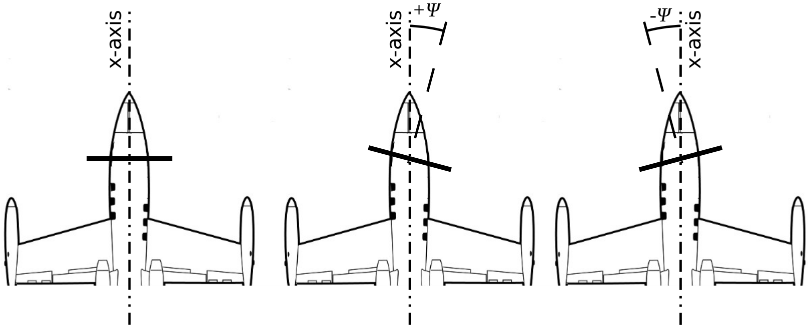


Figure 4.12: Top-down view illustration of possible yaw misalignment: perfect position (left), positive yaw misalignment angle (middle), negative yaw misalignment angle (right).

Yaw correction affects the roll and pitch correction as well. Hence it is important to set yaw before roll and pitch adjustments are made.

4.5.2 Roll and Pitch Adjustment

Once yaw correction is known (in most cases it is zero), roll and pitch can be adjusted automatically. Press the *Auto adjust* item on the window from Figure

4.11 and wait for the progress bar to finish. Observe roll and pitch values. At the end, they should be close to zero.

In some cases aircraft ground position differs from the cruising position significantly. In such cases a manual pitch adjustment shall be used.

If necessary additional manual adjustments can be made by selecting `Roll` or `Pitch` item and changing the correction angle manually. The correction is applied once the window is closed. Usually, some experimenting is needed to get the proper value.

4.6 Engine & Sensors – Daqu

`Main menu | Options | Service | Eng. & Sens.`

This section refers mostly to the engine sensors and other aircraft sensors (trim, flap position, fuel level, rotors,... which are connected to Daqu.

It is highly recommended to read and understand the Daqu manual before doing any changes. Almost any change described in this section will directly affect Daqu. Changes made on Nesis are transmitted to Daqu, which needs some time to respond. Therefore we recommend not to work too quickly – give the system some time for changes to propagate.

To display sensor readings on the screen, complete the following tasks:

1. Sensor/transducer/probe must be connected either to Daqu or to some ECU. Details depend on the engine model. This topic is extensive and quite complex. It has a manual on its own. Please refer to the `miniDaqu` or `Daqu` manual for more details.

2. Correct engine model must be selected.

3. For each sensor that connects to Daqu a corresponding channel must be configured. This is covered in sections 4.6.1 and 4.6.3.

4. Each sensor is associated with certain function, which in turn is associated with a parameter. Parameters can be enabled/disabled, have green, yellow, red ranges and some other specific values. These ranges and values must be set properly in order that Nesis can display it on the screen. Please refer to section 5 for more details.

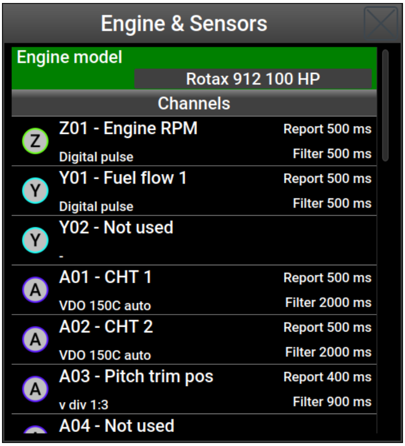


Figure 4.13: Daqu channels and engine model selection window.

Figure 4.13 shows an example of Daqu channels and engine model selection window. On the top the engine model together with some additional information can be set while the rest is sued to list Daqu channels. You may have to scroll down to see all the channels.

The window is accessible only when Daqu is properly connected to the CAN bus.

4.6.1 Engine Model

Engine model shall be selected first. This tells Daqu if this is a classical engine or it has some kind of ECU (Rotax iS, UL-Power, D-Motor, . . .). Nesis uses this info to load default parameter settings for the engine, section 5. For some engines it also tells which software fuel flow calculation models shall be used when a fuel flow sensor is not present.

The `Generic engine` option can be used for any engine and is typically used with Lycomming, Continental . . .

Some ECU base engines provide fuel flow information. For all others, a fuel flow sensor is recommended even for engines where a software fuel flow model exists.

Engine	ECU	FF-Model
Generic engine (any engine)		
Rotax 582 65 HP		∘
Rotax 912 80 HP		∘
Rotax 912 100 HP		∘
Rotax 914		∘
Rotax 912 iS	•	•
Rotax 915 iS	•	•
Jabiru 2200		∘
Jabiru 3300		∘
Geiger Wankel A 2-74	•	
MW fly with CC-m	•	•
UL Power RS-232	•	•
UL Power CAN 125 kb/s	•	•
UL Power CAN 500 kb/s	•	•

Table 4.1: Engine models, ECU connectivity and fuel flow availability (• from ECU, ∘ from software model).

4.6.2 Switch Function

The `switch function` option is available only when miniDaqu is connected to the CAN bus. Standard Daqu does not have this possibility.

MiniDaqu has one auxiliary digital port, which is acting as a switch. This switch function can be set to:

`Not used` the switch is not in use.

`Alarm light` turns on the switch (alarm line), when an alarm condition is met. The alarm must be also properly configured.

`ECU start` can be used in conjunction with Rotax iS engine only. It is used to automatically engage/disengage the start button switch as a part of the engine start sequence.

When the `ECU start` option is in use, an additional option appears. It is labeled as `iS start switch RPM threshold`. This defines the RPM threshold value that must be reached in order to automatically disengage the start switch.

4.6.3 Channels

Nesis lists all channels available on Daqu. Channels types are designated with letters, which define the hardware capabilities of each channel. Channels labelled with Z and Y are digital channels, while channels labeled with A, B, C, D, E and F are analogue channels. Please refer to the Daqu manual for more details.

Selecting a channel opens a small selection window, Figure 4.14. Some of the commands listed depend on the channel function or sensor type.

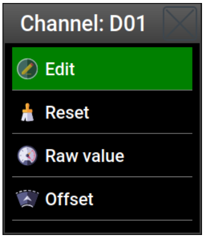


Figure 4.14: Example: List of options for the `D01` channel and `Fuel pressure`.

`Edit` Opens the channel editor window, which allows tuning the channel details: function, sensor type, filter, etc. See Section 4.6.3.1.

`Reset` clears all the channel data and set the channel as not used.

`Raw` opens a window, which shows the raw, unprocessed readings of associated sensor. It typically shows value in ohms or voltage. This option comes handy in problem solving.

Figure 4.15: Example: Raw value for pitch trim position – resistance in ohms.

`Min/Max` is used to define the sensor limits, required for some functions like trim and flap. See Section 4.6.3.2.

`Offset` is used to slightly adjust the sensor's zero settings. This option is not available for some sensors.

`Tank` is used to set additional details for the fuel level sensors.

In order to access the last three options, channel must be first properly set with the *Edit* command.

4.6.3.1 Channel Editing

The channel editor window depends on the channel type and also on the selected function and sensor. Bottom part of the window changes dynamically, but the first four items are the same for all channels. Figure 4.16 shows an example of channel editing window.

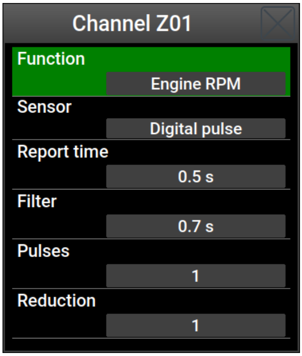


Figure 4.16: An example of channel Z editing. Z is typically used for the engine RPM.

`Function` A list of available functions for this type of channel is shown. The function tells what the channel is measuring.

`Sensor` A list of sensors available for the selected channel and selected function is provided. Select one from the list. This tells Daqu what kind of signal is to be expected on this channel.

`Report time` defines how frequently Daqu sends measurements to the CAN bus. This is defined as a time interval between two measurements being sent. Small value means that measurements are send frequently.

`Filter` defines a low level filtering. This is a low pass filter time constant. A larger value means that more time is needed for a measurement to react on a sensor change. The optimal value depends on the sensor and function type.

`Pulses` value is specific for digital channels (Z,Y). It defines how many digital pulses are required for one event. For example, some rotor sensor may issue 12 pulses per one rotor revolution.

`Prop reduction` is specific to Engine RPM function. Some engines have reduction gear boxes (Rotax for example). If the reduction ratio is entered, then the propeller RPM will be shown instead of the engine RPM. This value is typically set to 1.0, which results in engine RPM.

Figure 4.17 shows another example. In this case an oil pressure sensor is connected to channel D1. As a generic family of sensors is selected in the *Sensor* item, an additional items appears at the bottom – *Max value (at 20 mA)*.. This value is used to define the sensor range. In the example the value is set to 10 bar, which is typically used with Rotax engines.

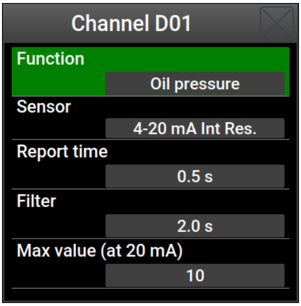


Figure 4.17: An example of channel D editing. Certain sensors require additional value, which defines the sensor range.

Another, slightly different example is shown on Figure 4.18. In this case sensor is a thermocouple and this type requires a selection between isolated or non-isolated type.

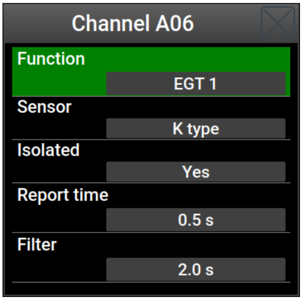


Figure 4.18: An example of channel A editing. An EGT sensor is connected to the channel.

Note: The functions can't repeat themselves. When one specific function was assigned to one channel and then the same function is assigned to the other channel, the first assigned function will be reset and the last assigned function will be kept.

4.6.3.2 Min/Max

Functions like trim position, flap position, throttle position, etc. require two additional parameters. After defining basic channel parameters, these two parameters are available through the *Min/Max* window. These two parameters are raw sensor values at both extreme positions.

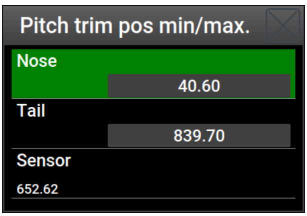


Figure 4.19: An example of extreme positions for the flap position sensor.

Example in Figure 4.19 shows the following elements:

`Nose` holds the value of the pitch trim sensor when trim is at the full forward – nose down position. The value can be also entered manually.

`Tail` holds the value of the pitch trim sensor when trim is at the full backward position – tail down position. The value can be also entered manually.

`Sensor` is the raw pitch sensor value currently detected. When the sensor is measuring voltage, then the voltage is shown, if the sensor is measuring resistance, the resistance is shown. Selecting the sensor item allows copying current sensor value either into *Nose* or *Tail* fields.

In typical scenario, aircraft is trimmed full forward and once sensor value is stable, sensor value is copied to *Nose*. Then it is trimmed fully backward and once sensor value is stable it is copied to *Tail*.

4.6.3.3 Offset

The sensor offset can be adjusted for specific functions. This is used in cases, when the correct sensor value is known, but the actual value shown by the sensor is slightly incorrect – it has some offset.

Example on Figure 4.20 shows a MAP sensor. The known (reference) pressure value is 0.96 bar. The initial sensor value was 0.92 bar. The *Offset* value was adjusted to 0.04 bar until the MAP sensor also shows 0.96 bar.

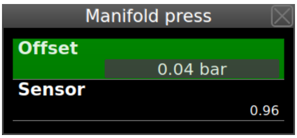


Figure 4.20: An example of manifold pressure offset – situation after the offset was set.

4.6.3.4 Tank

The tank action is shown only for fuel level sensors. See Section 4.7 for more details.

4.7 Tank

Nesis supports two options for the fuel level indication. The first option is based on fuel level sensors. It is covered in Section 4.7.1. The second options is a software simulated tank, see Section 4.7.2.

Please note that you have to complete this section (4.7) before you start adjusting tank color ranges – red, yellow, green.

4.7.1 Fuel Level Sensors

`Main Menu | Options | Service | Tank`

After the fuel level sensor has been connected to Daqu and correspinding channel has been configured, the tank must be calibrated. By the nature, tanks typically have pretty complex shape, which often results in non-linear sensor - volume behaviour.

Three different approaches are supported to match the tank shape:

- Linear – linear curve is assumed and only min and max value are needed. This is similar to the *Min/Max* procedure for trim sensors. See Section 4.7.1.1.
- User – up to 20 tank points can be given to define the shape. This is the most precise way. This is covered in Section 4.7.1.2.
- Predefined shapes – nominal curves are predefined and the selected curve will be scaled between min and max value. This is good for serial production, Section 4.7.1.3.

4.7.1.1 Linear Shape

This is the simplest tank calibration solution. It only requires a few additional values. Figure 4.21 illustrates the main tank window and figure 4.22 illustrates situation with the empty and full tank.

`Shape` must be set to `Linear`.

`Tank capacity` defines the total tank capacity.

`Empty/full` define fuel level sensor values at empty and full tank.

`Parameter` is a shortcut to the associated parameter editor.

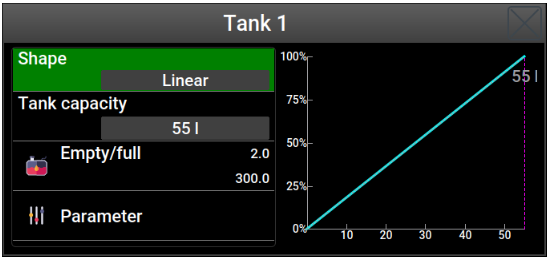


Figure 4.21: An example of linear fuel tank.

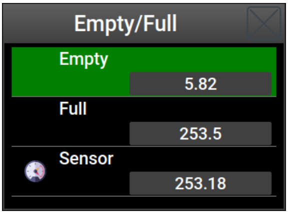


Figure 4.22: Linear fuel tank – empty-full procedure.

Typically, the tank is completely drained and a value shown by the fuel level sensor is copied to the *Empty*. Then, the tank is filled with fuel and the sensor value is copied to the *Full*.

We recommend taking notes. If something goes wrong, the empty and full values can be entered directly (from notes) - without messing with a fuel again.

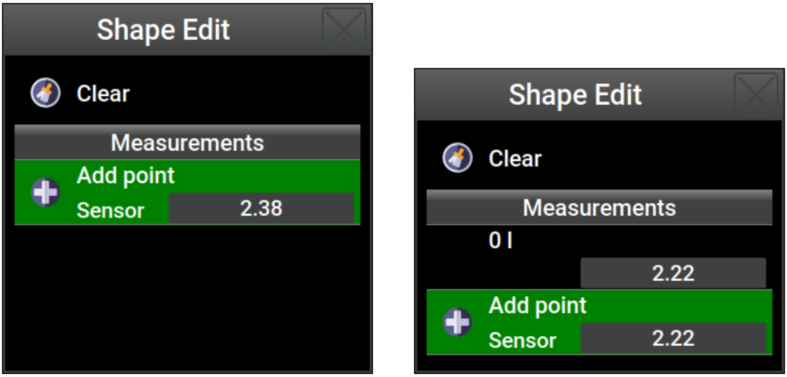
4.7.1.2 User Shape

This is the most complex solution, but also the most precise one. It allows up to 20 calibration points per tank. 20 points are an overkill, 5-8 points are usually more than enough. Fuel level sensors precision and resolution are quite limited and sometimes also fuel type dependent. Having too much points in calibration is not beneficial.

In order to define a user shape for tank, set the `Shape` parameter to `User`. The window will change slightly. Then select the `Edit` item. This opens a window, where tank measurements are manipulated.

A typical procedure is described next. Taking notes on paper about every measurement point is highly recommended.

1. Make sure that aircraft is in level position for a cruise flight.
2. Make the tank empty – drain all fuel out. Select proper fuel sensor (or tank) and set `User` shape. Select the `Edit` item and issue the `Clear` command to remove any existing points. Figure 4.23a shows the situation. There are no points in the *Measurements* list. *Sensor* value is informative and shows the readings from the sensor. This value is either voltage or resistance detected by Daqu – this depends on the sensor type.
3. Slowly pour some fuel into the tank and observe when the *Sensor* value starts changing. Usually sensors will not react immediately, as they can't reach the true low fuel point. Select the *Add point* item and set the *Fuel Quantity* value to zero[1].



(a) Starting situation. (b) First point was added.

Figure 4.23: Editing tank measurement points.

4. Pour more fuel in known steps. 5-20 liter steps are usually fine. Use larger steps for very large tanks. Wait for sensor value to stabilize. Then select the *Add point* and set the cumulative fuel quantity for this step.

[1] Here, in fact are two possible approaches. You can set the value to zero and then starting counting fuel from this point on. Any amount of fuel poured into tank before this point is a kind of reserve. During flight, if you reach the zero, you still have some *reserve* in tank. But do not count on this.
The other alternative is not to enter zero, but correct amount of fuel. In this case, tank indication will never reach zero during flight, but only the value at the low sensor position even though the true fuel quantity will be smaller. This can be misleading, so we advocate NOT to use this approach.

5. Repeat the previous step until the sensor value stops changing. When this happens the upper sensor limit point has been reached. Putting more fuel into tank will have no effect on the sensor. Sensors in many aircraft reach this point way before true fuel tank capacity is reached.

6. Close the editing window. The fuel tank has been calibrated and the tank specific shape will be shown on the window.

During measurement, calibration point can be edited – quantity and sensor values can be adjusted. Also, points can be deleted. Simply click on a measurement point and select appropriate action.

Figure 4.24 shows an example of complete tank list. The sensor stopped changing at 253.5 ohms and 60 liters. Initially, during first step, 3 liters were needed for a sensor to react. So, the real tank capacity is 63 liters, but Nesis will show values between 0 and 60.

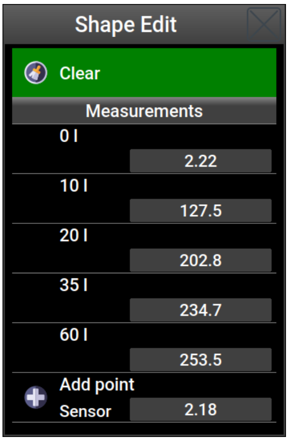


Figure 4.24: An example of situation after all points were measured.

Figure 4.25 shows the final situation. The cyan line on the chart shows tank non-linearity. The curve is a typical shape for tanks in low wing airplanes.

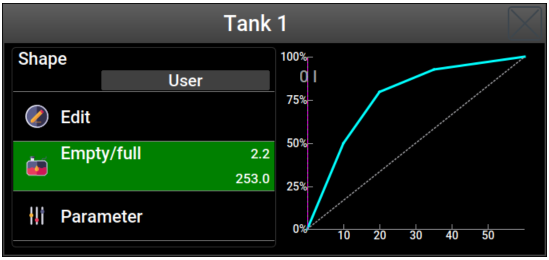


Figure 4.25: An example of user specific tank shape curve. Note significant nonlinearity of the curve.

4.7.1.3 Predefined Shapes

Solution with predefined shapes is suitable for the cases, where the shape of tank is known in advance. In this case, correct shape is slected and only *Empty/Full* procedure is applied. This is similar to the *Linear* case.

This works well, when fuel sensor mounting position do not vary from case to case. Typically, tanks of larger depths has less problems and give better results. For wing based tanks, we recommend user shape approach even if the *shape* is known.

1. Make sure that aircraft is in level position for a cruise flight.
2. Select one of the predefined shapes from the list.
3. Make the tank empty – drain all fuel out.
4. Select the *Empty/Full* option and set the sensor value for the empty tank.
5. Fill up the tank and then set the full case.
6. Close the window.

There is also an alternative way for this. It can be used when sensor values for empty and full are known and you are sure that they do not vary from sensor to sensor. In this case:

1. Select a predefined shape,
2. Select the *Empty/Fuel* option.
3. Select the *Empty* and enter the min (empty) sensor value.

4. Repeat this for the *Full* and enter the sensor value.

5. Close the window.

The tank shape has now been defined and scaled to empty and full sensor position.

Predefined shapes also support the *Edit* option, where individual points can be adjusted. Since this alters the shape, the shape name will change to *User* automatically.

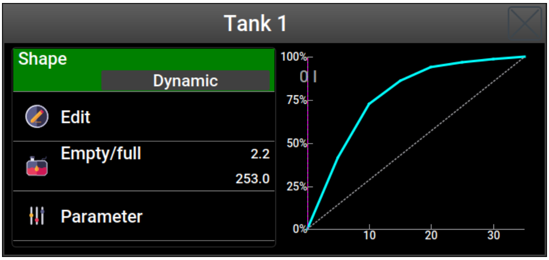


Figure 4.26: An example of a predefined tank shape after the *Empty/Full* were set. Non-linearity in this case is pretty severe.

4.7.2 Simulated Fuel Tank – Software Tank

Software fuel tank simulation is used when no fuel level sensors were configured. Selection of the *Tank* icon opens editor for fuel level 1 parameter which is used in the *software* tank case.

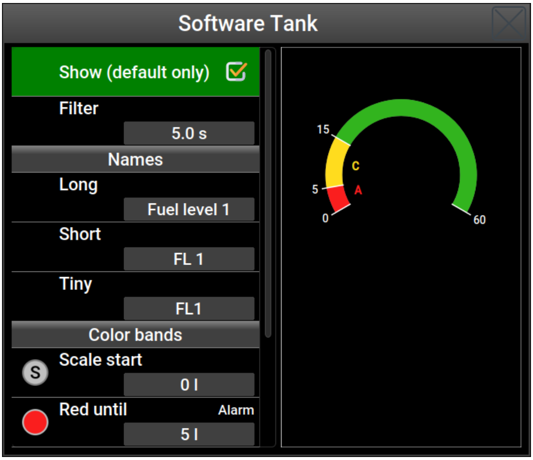


Figure 4.27: Software tank capacity set to 60 liters. The capacity is defined by the last (max) value of the parameter.

Using simulated fuel tank can be dangerous. The fuel remaining is calculated from initial estimated fuel quantity and fuel consumption. Both, initial estimate and fuel consumption can be wrong, which may lead to indicate more fuel remaining that it really is.

When the simulated fuel tank is used, a high quality fuel flow meter is recommended. Do not use the simulated fuel tank with software based fuel flow.

4.8 Compass – Magu

Compass installation and calibration is a complex process which is described in a separate manual. Please refer to the Magu manual (Magu i.e. electronic magenetic compass) for more details.

The manual is accessible from our web site.

4.9 Joyu

Joyu has a pretty complex system of push buttons, rotation/push wheel and direction stick. To each of these some special function can be assigned.

Furthermore, one Joyu can be used to command several devices connected to the same CAN bus. For example, Nesis, Emsis, Boxi and Joyu are connected to the CAN bus. Some of Joyu buttons can be configured to command Nesis and some to command Emsis and some to command Boxi. The same is true also for the case, where second Joyu is on the same CAN bus.

4.9.1 Device/Action Pairs

Joyu supports devices listed in this section. Each device supports specific actions. A device and action form a device/action pair. A device/action pair can be assigned to one of Joyu buttons or Joyu wheel. Devices are identified by their serial numbers. This makes it possible to distinguish between devices of the same type connected to one CAN bus.

The following device/actions are available:

- Nesis & Aetos

  `Wheel` ...same as rotating the knob.

  `OK` ...same as pushing the knob, which equals to the OK button.

  `Cancel` ...same as pushing the *Cancel/Back* button.

  `User` ...same as pushing the *User* button.

  `Pager` ...same as pushing the page switching button.

  `AP Menu` ...opens the autopilot main menu.

  `AP Level` ...issues a autopilot *Level* command.

- Boxi

  `PTT` ...radio transmition command – connects the PTT pin to GND.

  `AUX` ...AUX command – connects the AUX pin to GND.

  `Motor 1+` ...moves the motor 1 in the positive direction.

  `Motor 1-` ...moves the motor 1 in the reverse direction.

  `Motor 2+` ...moves the motor 2 in the positive direction.

  `Motor 2-` ...moves the motor 2 in the reverse direction.

- Horis

  `OK` ...same as the OK button.

  `AP Level` ...issues a autopilot *Level* command.

- Emsis

  `Wheel` ...same as pushing up/down arrow.

  `OK` ...same as the OK button.

  `Cancel` ...same as pushing the *Cancel/Back* button.

  `Pager` ...same as pushing the page switching button.

- All devices

  `AP Disable` ...disables the autopilot function. The command is sent to all devices on CAN bus.

4.9.2 Configuration

`Main menu | Options | Service | Joyu`

Configuration is a process where some device/action pair is associated with each Joyu button. Nesis detects which devices are present on the bus and includes actions for these devices, too.

Figure 4.28 shows an example of Joyu without any functions assigned. Illustration on the right enumerates the buttons.

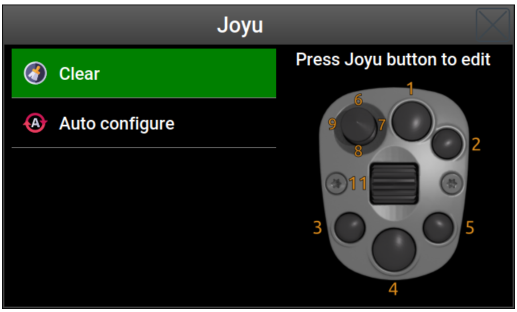


Figure 4.28: Initial, empty Joyu configuration window.

4.9.2.1 Automatic Configuration

Maybe the fastest and simplest way to configure Joyu is to use the `Auto configure` feature. This opens a simple window (when necessary) and asks for some additional information about the system. Based on the anwers it generates device/action pairs for all buttons automatically. Figure 4.29 illustrates an example. The actually form of the window depends on the devices which were detected on the CAN bus.

`Pilot Joyu` We need to identify the Joyu device used on the pilot side of the cockpit. To do so, simply press any button on the Joyu located on the *pilot* side. Note: This option will not appear if the system detects only one Joyu.

`Pilot Display` When multiple displays are present, identify the display assigned to the pilot. Select the serial number corresponding to the display positioned directly in front of the pilot.

`Copilot Display` Do the same for the copilot display.

`Boxi` Nesis reports if `Boxi` was detected on the bus.

`AP servos` Nesis reports if autopilot was detected on the bus.

`Configure now` executes the automatic configuation based on the data you have selected.

`Exit - no change` closes the window without any changes made.

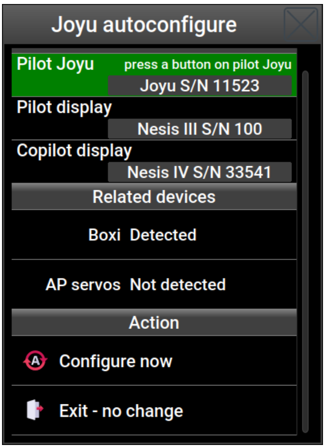


Figure 4.29: Auto-configure window example.

Once the window is closed, you may continue to adjust device/action pairs manually. See Section 4.9.2.2

In particular, you may pay attention to the direction of trim. Nesis has no way to know about the actual direction of trim movement. After the procedure is complete, you have to check that trim motor is moving in proper direction. If the trim is moving in the opposite direction, use the manual configuration option and swap the connections for `Motor+` and `Motor-` on the affected trim. Note: If two Joyus are installed, verify the configuration on both devices.

4.9.2.2 Manual Configuration

To assign a device/action pair to a Joyu button, either select the button from the list (if it is already listed), or simply press the corresponding button on the Joyu device. Here is a typical procedure:

1. Press a button or turn the wheel on Joyu. A window appears and asks which device/action pair shall be assigned to this button.
2. Assign a device from the list and its action to the button pressed in the previous step. Figure 4.30 shows an example for button 6 – hat forward.

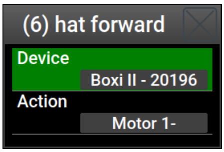


Figure 4.30: Joyu forward direction button (6) was assigned to `Boxi II` with serial number 20196. It will drive motor 1 in negative direction.

3. The process is repeated for all buttons. Some of the buttons may remain unused.
4. Rotate a wheel. Same window appears, but with less options. Figure 4.31 illustrates an example.

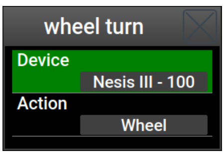


Figure 4.31: Joyu wheel movement was assigned to Nesis with serial number 100. Action in this case is knob rotate action, which equals to wheel.

Please note that it is possible to assign same action to different buttons. Joyu will not complain, but this is probably not what you want. Be extra careful with the *motor* positive and negative directions.

An example of final situation is shown on Figure 4.32. When the window is closed the configuration is sent to all devices on the CAN bus. They all receive a complete command/action list.

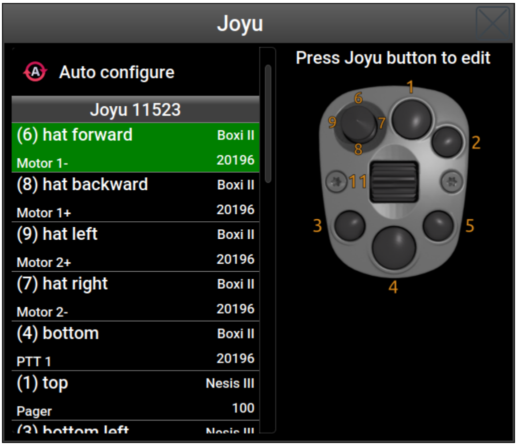


Figure 4.32: An example of the final configuration. Only part of the list is visible.

Same principles apply when two Joyus are connected to the CAN bus. Each Joyu lists assinged commands in its own section.

Note: Joyu is a very powerful command device. It efficently combines different devices and their actions. The same principles as with all powerful tools apply here as well. It is very easy to create a complete mess, especially when two Joyus are in use. Please make a paper plan first and then start assigning device/action pairs to the individual buttons.

4.10 Boxi

Boxi details are covered in a separate manual. Please take a look at:

- Boxi II User and Installation Manual or

- Boxi User and Installation Manual (older models).

Both manuals are accessible from our web site.

4.11 Offset

`Main menu | Options | Service | Offset`

Some sensors and counters may require occasional adjustment. The offset window allows adjustment for static and dynamic pressure sensors, CO sensor, fuel flow correction and time counters adjustments.

Please make sure that Nesis is running for at least 10 min before any sensor adjustments are made. This is not necessary for counter adjustments.

`Static (altitude)` allows for static pressure offset. A precise reference static pressure must be known. Adjust the correction, so that indicated static pressure will shown the same value as reference static pressure. The pressure is adjusted in 0.1 hPa steps. One steps corresponds to about 0.8 m (2.7 feet) at sea level.

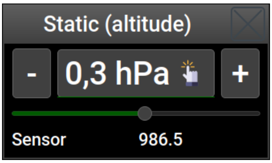


Figure 4.33: An example of the static pressure offset. You need a valid reference pressure source for comparison.

Alternatively, when reference pressure is not known, a reference altimeter can be also used. Set the reference altimeter and Nesis baro-correction (QNH) to 1013 hPa. If Nesis altimeter is too high regarding to the reference altimeter, increase the correction. If Nesis altimeter is too low, decrease the correction.

For example, Nesis shows 15 feet too high regarding to reference altimeter. Increase correction for about $15 : 2.7 \approx 6$ steps = 0.6 hPa.

`Dynamic (airspeed)` allows for dynamic pressure offset. Make sure that pitostatic system is not covered/blocked and that no wind is present. We recommend doing this in a closed hangar on a non windy day. Adjust the correction, so that dynamic pressure sensor will show zero (bottom line). We recommend doing this at least once per year – say at the start of every season.

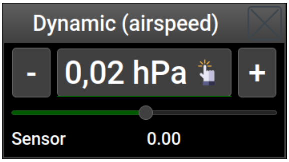


Figure 4.34: An example of the dynamic pressure offset. The value next to the `Sensor` shall show zero.

`Engine total time` changes the engine total time counter to a new value. This comes handy when there is a difference between engine total time in aircraft books and Nesis logs. The engine total time change is visible from the logs. The change will not correct the existing logs. It will only affect new ones. It takes about 10 seconds for the change to become permanent. Do not close/reboot Nesis for 10 seconds after the change.

`Flight total time` changes the flight total time counter to a new value. The change will not correct the existing logs. It will only affect new ones. It takes about 10 seconds for the change to become permanent. Do not close/reboot Nesis for 10 seconds after the change.

`Fuel flow factor` affects `software based fuel factor` only. It does not affect sensor fuel flow factor. It is used to correct fuel flow indication for the cases where fuel flow is computed from engine RPM and manifold pressure for a known engine. Increasing the factor will also increase the calculated fuel consumption.

Use software based fuel flow with great care. The indications may be incorrect and this indication will also impact the software based fuel tank, range and endurance, when used. Never trust the software based fuel flow and software based fuel level. Make sure that you have some reliable way to check the actual fuel level during the flight.

`Carbon monoxide` allows for the CO sensor offset. Note that most Nesis models do not have CO sensor installed. With the engine turned off and in a good ventilated area with a cabin opened, adjust the CO indication so that it will show about 0 ppm. Note that some populated and polluted surroundings may have significant amount of CO in the air. Normal values in clean environment are up to 2 ppm.

Some other sensors connected to Daqu can be adjusted as well. However, they are offset trough the appropriate channel function. See Sections 4.6 and 4.6.3.3.

4.12 Calibrated Airspeed – CAS Correct

When corrections for the calibrated airspeed are known, they can be entered into the system. Up to seven correction points can be entered. Let's illustrate this with an example. Table 4.2 shows calibrated airspeed values.

IAS	km/h	90	110	150	200
CAS	km/h	94	115	152	195
Δ	km/h	+4	+5	+2	-5

Table 4.2: Example: Table with IAS and CAS. Differences are entered into Nesis.

1. Select the `CAS Correct` icon from the `Service Options` page.
2. Enter points as shown in the Figure 4.35.
3. Close the window. At that moment the calibration table was sent to Airu (AD-AHRS-GPS) and from this point on CAS, TAS and wind calculations will take this correction into account.

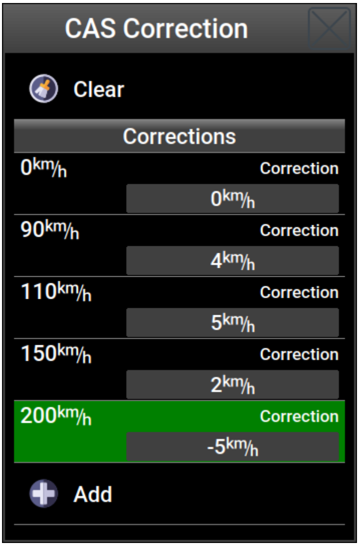


Figure 4.35: An example of the CAS correction table.

Please note that the first item is always set to 0. This can't be changed. Corrections between entry points are interpolated. When IAS value exceedes the last value in the table, the last given correction is used without any extrapolation.

Nesis does not display CAS on any parameter. CAS is only used as an intermediate hidden value between IAS and TAS. Thus, the table directy effect TAS calculation.

4.13 Autopilot

`Main menu | Options | Service | Autopilot`

Autopilot installation and tuning are described in a special manual. The manual can be found on our web site.

4.14 CAN Devices

`Main menu | Options | Service | CAN devices`

The *CAN Devices* icon opens a list of devices connected to the CAN bus, Figure 4.36. The list is mostly informative and serves mostly for troubleshooting purposes.

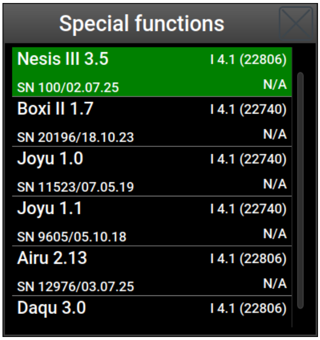


Figure 4.36: An example of the devices detected on the CAN bus.

Select a device to proceed. The related options are explained in the subsections below.

4.14.1 Console

The `Open console` command shows a special window, where each device displays some messages, which are normally hidden. These messages does not tell you much, but they can be very helpful in troubleshooting and debugging.

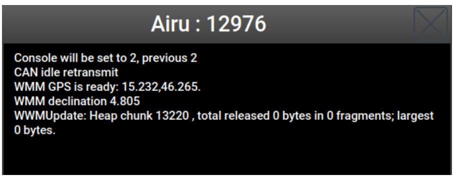


Figure 4.37: An example of the hidden messages.

4.14.2 Force Update

As the title suggests, this is not something you should be tempted to use. In very rare cases and only in special circumstances the `Force update` option may be used to force a software update of some specific device. The option is password protected. Contact `support@kanardia.eu` to get the password.

4.14.3 Indu/Digi – Layout Change

Nesis can upload a new LCD layout file to all devices from the *Indu* group (round instruments with a needle and LCD display and Digi). The LCD layout is stored in a binary file with the *isb* extension.

1. The new LCD layout file for some specific devices is typically obtained from Kanardia customer support as an email attachment.
2. The file is copied to an USB memory stick.
3. From the list of devices on the CAN bus, the target Indu/Digi device is selected. Special care must be taken if more than one Indu devices are connected.
4. Nesis lists the files with the *isb* file extension found on the USB memory stick. Select the file from the list (it will be probably only one). The file will be transferred to the flash memory on the selected Indu device, device will reset and new LCD layout will become active.

4.14.4 Airu

Airu (AD-AHRS-GNSS) module allows some primitive vibration analysis. This can be useful for cases, where there are problems with the AHRS indication – unstable AHRS. Vibrations could be the cause for this and this option may help locating the problem.

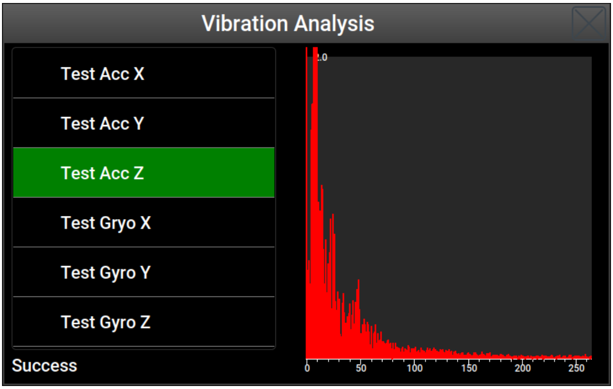


Figure 4.38: An example of the vibration analysis.

In the rare case of the vibration problem, please contact `support@kanardia.eu` and we will try to resolve the problems together. We will probably ask for photos of the vibration analysis screens.

Chapter 5

Parameters

`Main menu | Options | Service | Parameters`

We used a term *parameter* to define some on screen flight, engine, electric value that may appear in a form of a gauge, bar, arc, value box, status light, . . . A typical parameter consists of:

1. Several names of different length: normal, short and tiny. They are used to describe a parameter.
2. Filter value is used to smoothen response on a change.
3. Several color bands may be used to define warning, caution and normal use limits.
4. Alarms (warning and caution) may be associated with certain color bands.
5. Attributes are used to define special points for specific parameters like indicated airspeed (Vx, Vy, Vref, . . .) or RPMs.

It is recommended that engine sensors and corresponding Daqu channels are set before parameters are being edited. See section 4.6 and `Daqu` or miniDaqu manual. The same is true for the tanks. Their corresponding Daqu channels shall be set and tank shall be configured before editing their parameters here. See section 4.7.

Some parameters are related to *functions* in Daqu channel settings. This relation is weak. If a Daqu channel is configured for some engine function, it does not automatically mean that it is also enabled and used by Nesis parameter. You may have to enable and configure it manually. For example, if you configure some Daqu channel for a *carburetor temperature*, you will also have to enable and configure corresponding Nesis parameter and then perhaps also perform some screen customization.

5.1 Parameter Editing

`Main menu | Options | Service | Parameters`

There are two ways to edit a parameter:

- Service options have a dedicated icon with general access to individual parameters.
- Various screen customization items have a direct shortcut to an individual parameter.

This chapter describes the first option, while the Chapter 6 deals with the second option. Nevertheless, both are similar.

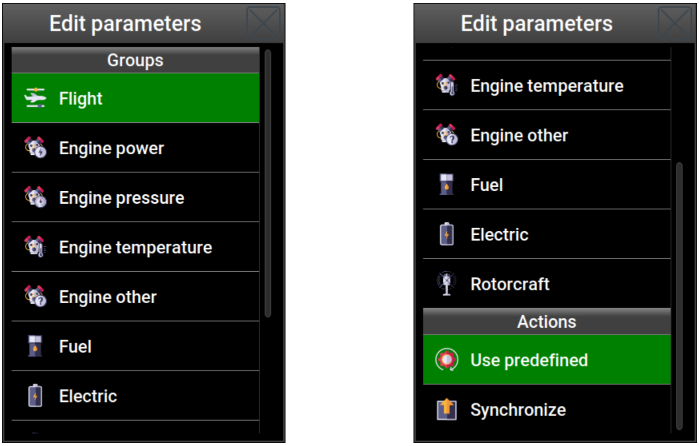
In order to access the main parameter editing window, issue the `Options | Service + (password) | Parameters` command. This opens a window similar to Figure 5.1. It is divided into two parts. The top part shows parameter groups and the bottom part gives access to special actions.

5.2 Actions

The following actions are available at the bottom of the window. You may need to scroll down to access them.

5.2.1 Use predefined

This command will load predefined parameter values (color arcs) for most engines parameters. It will ask for the engine model and after the engine selection, it will redefine engine parameters. Please note that these are not official parameter values. Always consult your pilot's operating handbook or your engine manual for correct values and adjust parameters as needed.



(a) Parameter groups (b) Actions

Figure 5.1: Entry point for the parameter editing.

5.2.2 Synchronize

This command transfers all parameter values to other devices found on the CAN bus. This comes handy, when you set all parameters on Nesis and then you want that all other devices use the same parameter color bands, names, etc. It is up to the receiving device to accept this command. At the time of writing Nesis and Aetos are fully supported, while Digi and some other Indu devices are partially supported. Emsis is also partitaly supported since version 3.11. Horis is not supported.

5.3 Groups

There are more than fifty various parameters that are supported by the system. This number is too large for a one large list to appear on the screen. For this reason parameters are organized in groups. Some parameters appear in more than one group, for convenience. Figure 5.1a illustrates group names. After a group was selected, a list of group parameters appears. Some examples are given in Figure 5.2.

A selection of parameter name gives access to individual parameter details.

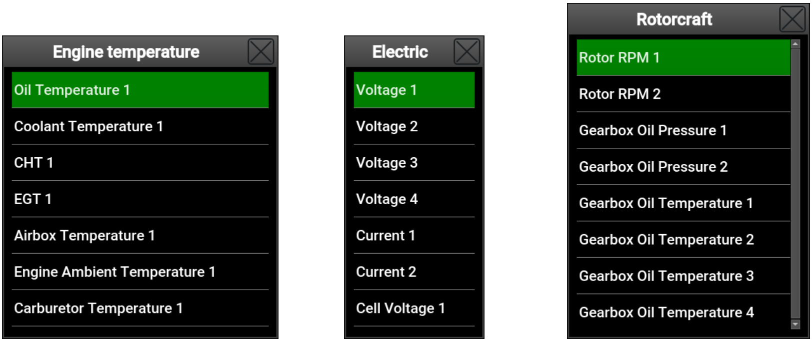


Figure 5.2: Parameter lists examples.

5.4 Parameter Details

Parameter details are defined in a window similar to Figure 5.3. The window shows a situation for the oil pressure parameter. Most of other parameters follow the same logic.

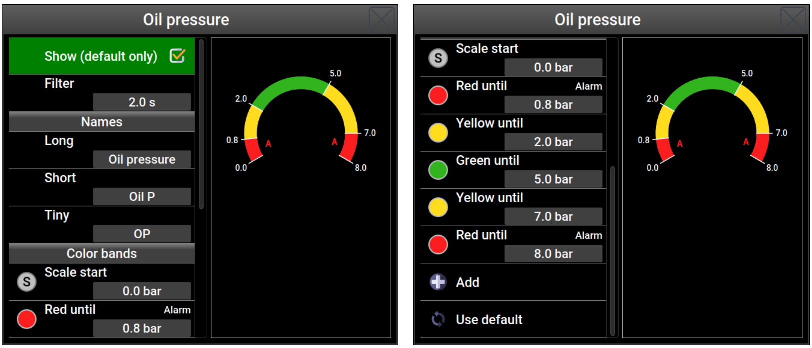


Figure 5.3: Parameter details in oil pressure example.

`Show (default only)` check is used in combination with the automatic screen customization. This check only works if default configuration is used. It tells the system that this parameter shall be shown on the screen. You can override this with manual screen tuning.

`Filter` defines a time filtering constant – low pass filter constant. It is used to smoothen the screen response of a parameter change. The value is given in seconds. It can be described as a time needed for a parameter to adapt to about 63% of the change. Small values (0.5 seconds or less) lead to a vivid response and larger values (2 seconds or more) to a lazy response.

Each parameter is different here and some experimenting is needed to find correct value. For example, engine RPM requires swift response and lower value while the fuel level (or fuel tank) parameter will perform better with a slow response – higher value.

Please also note that `Daqu` already applies a similar filter. If you want a quick response and you set your filter low but you still get a slow response, please also check the Daqu channel setting for this parameter. This means that in the case of Daqu related parameters, the filter is applied twice. First in Daqu and then also in Nesis.

`Names` allows definition of three different names for each parameter. In fact, there are four different names:

- System name can't be changed. It is shown in the window title.
- Long name is used where there is enough space available to display it.
- Short name is used in scale and gauge titles where space is limited.
- Tiny name is used where space is very limited and only two, maybe three characters are available.

Please note that these names may still be overridden with names specified by gauges and other visual elements.

`Color bands` are used to identify parameter range limits represented by green, yellow, red and also transparent color. The later is also called *no color*. Alarms can be associated with red and yellow bands.

`Attributes` are limited to some specific parameters like indicated airspeed and RPMs.

5.4.1 Color Bands

A parameter may have some associated color bands which together form a scale. These bands are typically used to define green, yellow and red operation areas. They can also define a transparent area, where no colors are used.

Figure 5.4 illustrates an example for an indicated airspeed parameter. First the start point `Scale start` is defined. It was set to `70 km/h`. Then a green band spans until `170 km/h`, followed by a yellow band until `220 km/h`. This is also a VNE limit. However, some extra red band is given above VNE and it is set to `240 km/h`. VNE is not explicitly given. It is derived from the yellow/red border value `220 km/h`, automatically.

On the right side of the window scale is automatically updated. Bands are shown in the arc form together with their limiting values. Some parameters may take additional attributes. They appear below the arc.

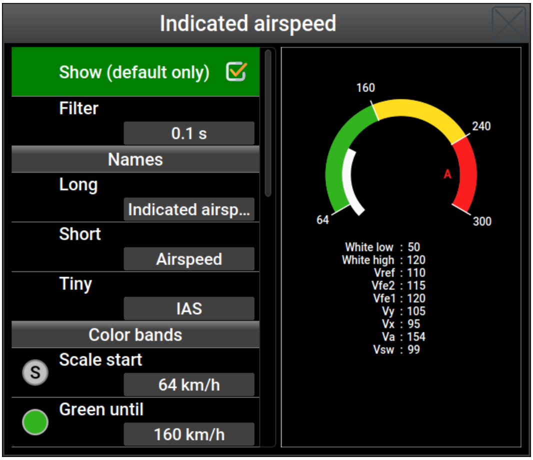


Figure 5.4: Color bands example for indicated airspeed. Many airspeed related attributes were also defined.

Another example is given in Figure 5.3 where oil pressure is defined. The scale starts at `0 bar` and then various band spans are added until the end of the red band is defined. The values shown in the example are typical for Rotax engines.

Add

The `Add` item appends a new band to the last one. The end of previous band is taken for the start of the new one. End ot the new band must be specified as well as the band colour, Figure 5.5.

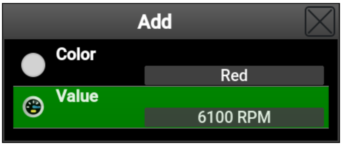


Figure 5.5: The last, red area band for the engine RPM example. End of the band is given. The band start is taken from the end of previous band, automatically.

Edit

Selecting an existing band opens a window with the following options:

`Range & color` opens editing window for the existing band. Band color and its end value can be changed.

`Alarm` is used to set alarm related options.

`Insert` allows to insert a new band in-front of the selected band.

`Remove` removes the selected band.

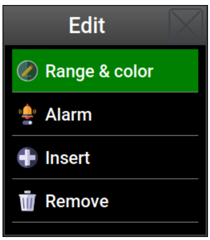


Figure 5.6: Band edit options.

5.4.2 Attributes

Attributes are special values that are combined with some parameters. An attribute takes only a single value and has a special meaning. Any attribute is optional. When an attribute is zero, it is considered not to be used.

Indicated Airspeed

Indicated airspeed uses the following special attributes:

`White low` defines the lower point of the white arc, which is used for allowed flap extension airspeed range.

`White high` defines the upper point of the white arc.

`Vref` defines landing reference speed or threshold crossing speed.

`Vy` defines speed where the best rate of climb is achieved.

`Vx` defines speed that allows for the best angle of climb.

`Va` defines design maneuvering speed.

`Vsw` defines the speed where stall warning alarm will be shown. Please note this is typically significantly higher than actual stall warning speed.

`Vfe1` defines marking for first degree flap position.

`Vfe2` defines marking for max flap position (smaller than Vfe1).

Engine RPM

Sometimes engine RPMs are shown as percentages rather than as actual RPMs. This is usually case in helicopter applications. In order to convert actual RPMs into percents two values shall be defined. Linear interpolation (and extrapolation) is then used for the conversion.

`RPM at 100%` is 100% RPM threshold.

`RPM at 0%` is optional and is set to zero by default. Non zero values are seldom used.

Rotor RPM

Rotor RPMs behave similar to the engine RPMs, see the previous subsection. Gyrocopters may use two extra attributes which are related to a prerotation phase:

`Prerot. red/yellow` defines the rotor RPM threshold where pre-rotation status indication light changes from red into yellow (amber). A typical value is around 180 RPM.

`Prerot. yellow/green` define the rotor RPM threshold where pre-rotation status indication light changes from yellow (amber) into green. A typical value is around 200 RPM.

Pre-rotation status light indication is optional. For the time being the indication light only appears on gauges which are in the `Reset to default` mode.

5.4.3 Alarms

Alarms can be assigned to red (warning) or yellow (caution) bands only. To configure an alarm, first select the appropriate band, then select the Alarm option. Alarm assignment is not permitted for green or unassigned (empty) bands. An example is provided for the Fuel Level parameter, Figure 5.7.

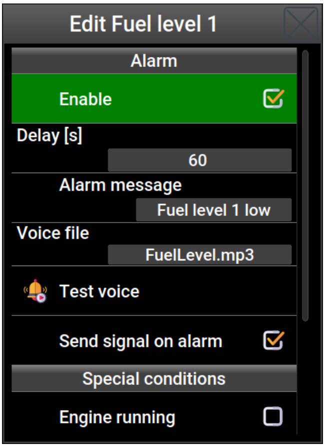


Figure 5.7: Alarm edit options.

`Enable` this must be checked for alarm to be active. If you uncheck it, the alarm will not appear on the screen.

`Delay` defines the duration (in seconds) that the alarm condition must persist before the alarm is triggered. The appropriate delay value depends heavily on the nature of the monitored parameter. For instance, an engine

RPM alarm typically requires a short delay of only a few seconds, whereas a fuel level alarm may use a longer delay – up to one minute – to avoid false triggers due to gradual changes or sensor fluctuation.

`Alarm message` is a message shown on the screen when alarm is triggered.

`Voice file` specifies the audio file to be played when the alarm is activated.

`Test voice` plays the selected audio file.

`Raise signal on alarm` when enabled, this option raises (activates) the alarm output line on the service connector when the alarm condition is triggered. The signal remains active as long as the alarm condition persists, regardless of whether the alarm has been acknowledged or dismissed by the pilot. See also Section 3.3.4.

Additionally, the alarm can be constrained by special conditions that must be satisfied for the alarm to be triggered.

`Engine running` condition ensures that the alarm is active only when the engine is operating. For example, a low oil pressure alarm is only meaningful while the engine is running; triggering it while the engine is off would result in a false alarm. Therefore, this condition should be enabled for parameters like oil pressure.

`During flight` condition ensures that the alarm is active only when the aicraft is flying.

`Rotor turning` condition ensures that the alarm is active only when rotor is turning.

`Collective pulled` condition ensures that the alarm is active only when the collective lever is pulled.

More than one alarm conditions can be assigned to some alarm. In this case all conditions must be fulfilled.

5.5 Special Alarms

A few alarms do not fit nicely into the *parameter* yellow, red band category. They are based attributes, special values or external devices.

For the time being these alarms can't be edited or disabled. Try are enabled automatically when conditions are met.

5.5.1 Engine Status - ECU

When the ECU of a Rotax iS or UL Power engine sends a warning or caution message on the bus, Nesis automatically triggers the corresponding alarm.

5.5.2 Flap Overspeed

When a white band is defined for the indicated airspeed (IAS) parameter, and the flap position sensor is correctly installed and configured, an alarm will be triggered if the flaps are extended while the airspeed exceeds the white band limit.

5.5.3 VNE

A VNE alarm is triggered if either indicated airspeed or true airspeed enters into the red band.

5.5.4 Stall

When a `Vsw` attribute is defined for the indicated airspeed parameter a stall speed warning appears when indicated airspeed drops below the Vsw value.

5.6 EGT And CHT

These parameters are a bit special in their index nature. Namely they behave like a normal parameter but more of them appear at the same time – each for its own cylinder. The `Count` defines how many sensors are in use. This must be set for each parameter individually as not all cylinders may be equipped with sensors.

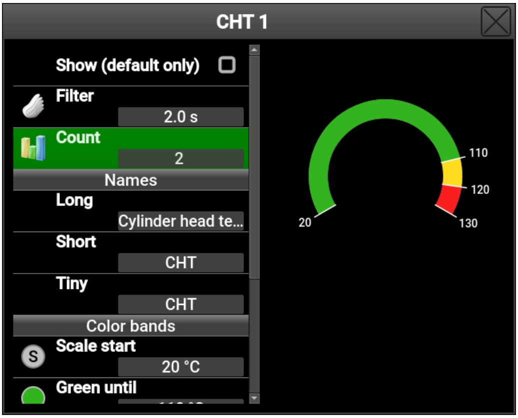


Figure 5.8: `Count` appears for certain parameter. An example is given for Rotax engine, where there are four cylinders, but only two sensors are used for CHT/CT.

This number must match number of actual connected sensors. These sensors must also be configured properly – their corresponding channels must be set in the most cases[1]. At the time of writing, Nesis does not cross check this requirement.

For example, when `Count` is set to 4 for EGTs, then the system expects that 4 sensors will be installed and their corresponding channels configured.

Another special example is Rotax 912 CHT case. Rotax 912 has four cylinders, but it installs only two sensors; one in cylinder 1 and the second one in cylinder 3. So, `Count` is set to two. You can't use indices 1 and 3, but you have to use indices 1 and 2. Namely, an index number can't be higher than the count value.

[1] This is not the case for the Rotax iS, ULPower engines and other engines equipped with ECUs.

Chapter 6

Screen Customization

Since software version 3.9 customization of engine part on *modern* screens is possible. In addition, since version 3.10 *classic* and *engine* screens can be customized too. The customization is done with a help of an on-screen editor. Editing can be done with touchscreen or with mechanical knob and buttons.

In order to edit a screen, you have to:

1. Enable editing fist,
2. enable the edit mode on the selected screen.

Note that some screens (map screen, for example) or screen parts are not editable.

6.1 Enable Editing

The screen editing is not enabled by default. The main reason for this is to prevent unintentional editing when least needed – during the flight. In order to enable screen editing, select:

1. `Main menu | Options | Service | Layout`.
2. Check the `Edit screens` options, see Figure 6.1.

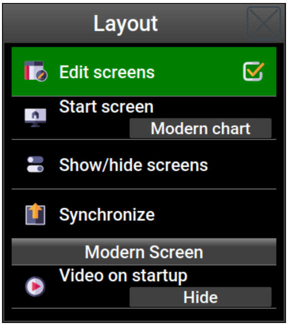


Figure 6.1: Option that must be enabled before screen editing.

Please note that this option must be enabled each time Nesis restarts. This can be a bit annoying, but it prevents accidental editing during the flight.

3. Once editing is enabled use the `Pager` button to switch to the screen you want to edit. Then push the knob and select `Edit screen` from the menu, Figure 6.2. Alternatively, long touch on the screen.

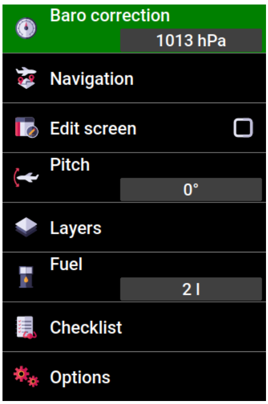


Figure 6.2: Main menu with `Edit screen` option which must be enabled to start editing this screen.

6.1.1 Edit Menu

Once screen is in the `edit mode` a push on the button or a touch in the top right corner of the screen opens a menu as it is illustrated in Figure 6.3.

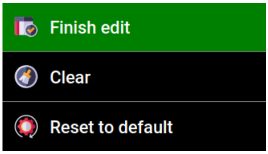


Figure 6.3: Edit menu actions. Some screens do not have the `Clear` option.

`Finish edit` stops editing this screen and also saves any potential changes. Basic edit mode is still active and you may start editing again or switch to another screen and start editing there.

Alternatively, editing mode can be closed by pressing the `Close` button a few times.

`Clear` is used on modern screens only. It completely empties engine part of the screen and allows for the fresh start.

`Reset to default` looks at active parameters, resets current screen and assign gauges, bars, . . . automatically. This is a very powerful command and in most cases it generates correct layout. It is essential that parameters are defined properly before this command is used.

6.2 Classic Screen

A classic screen consist of the following items that can be edited, Figure 6.4:

- Central section. Here you can select one of several forms of the central section.
- Two mini panels, the first on bottom left and the second on bottom right. Several different mini sections are available to choose from. One of them can be also edited in detail. Please note that the mini sections are available on 8.4“ models only.
- Four round gauges, two by two on each side. Each gauge can be edited to a great detail.

Figure 6.4: A typical example for automatically generated classic screen on 8.4” display.

6.2.1 Central Section

Enable editing mode first, see Section 6.1. Touch or select the central section. A window as shown in Figure 6.5 appears. Select the layout you want.

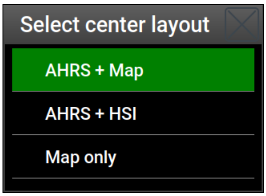


Figure 6.5: Classic center options to choose from.

Figure 6.6 illustrates the options.

6.2.2 Left And Right Mini Panels

This selection is only available on `8.4"` version of Nesis.

Enable editing mode first, see Section 6.1. Touch or select one of the mini panels. A window as shown in Figure 6.7 appears. Select the layout you want.

(a) AHRS + Map. (b) AHRS + HSI. (c) Map only.

Figure 6.6: Illustration of options for the central section of the Classic screen.

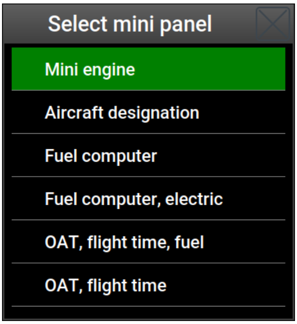


Figure 6.7: Classic mini panel options to choose from.

Figure 6.6 illustrates the mini panel options:

`Mini engine` is the default option for the left panel. It shows mini vertical bars for some engine parameters. Bars are typically shown in green/yellow/red colors for quick indication of any potential engine problem. This panel can be further edited. See Section 6.2.2.1 for the details.

`Aircraft designation` will display some text on the panel. This text is typically aircraft registration number.

`Fuel computer` is the default option for the right panel. Is shows a small compact fuel computer.

`Fuel computer, electric` combines major fuel computer parameters with some major electric values.

`OAT, flight time, fuel` shows OAT, flight time and fuel level only.

`OAT, flight time` shows OAT and flight time only.

6.2.2.1 Mini Engine Panel

A mini engine panel is organized into up to four groups. You can use less groups than four, but not more. Each group consists of a title and one or more parameters, which are shown as vertical bars and short two letter name under the group title. By default, the name is defined by the `tiny` parameter name, but a user name can be also given. An example of mini engine panel is shown in Figure 6.8.

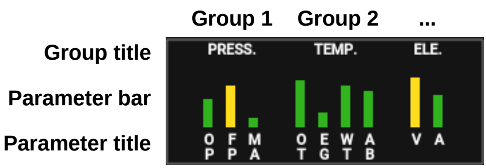


Figure 6.8: Layout organization of a mini engine panel.

The mini engine groups, individual parameters and parameter names can be configured in more details by selecting the mini engine panel and then choosing the `Edit mini panel` option. This brings up a situation similar to Figure 6.9. The window lists a summary of all groups on the top and also allows `Reset to default` at the bottom. Groups names are shown on the top right, while group parameters are listed on the bottom right of each item.

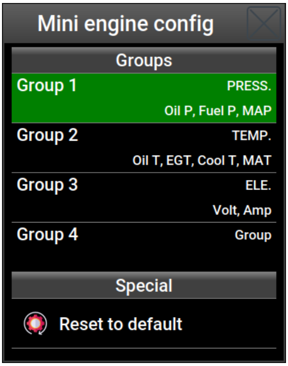


Figure 6.9: Configuration window of the mini engine panel.

`Group 1, ...` will open another window, where group details can edited. More details are given below.

`Reset to default` will try to figure out groups based on the current list of active parameters. It is important to properly set individual parameters before you issue this command. Enable parameters you use and disable unused ones. See section 5 for more details.

Mini Panel Group Editing

Figure 6.10 shows an example of group editing window.

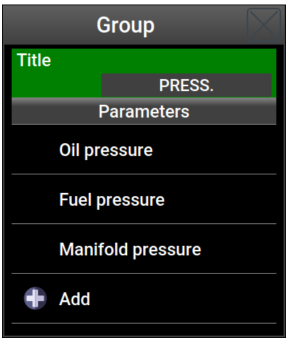


Figure 6.10: Group editing window example.

`Title` defines the group title. Do not make this name too long. Figure 6.8 shows an example.

`Parameters` lists parameters that are included in the group. Selecting a parameter opens yet another window, which allows further changes explained next.

`Add` will ask you to append a new parameter into the group.

Mini Panel Parameter Editing

When a parameter was selected a window appears, which allows for some parameter changes. Figure 6.11 shows an example.

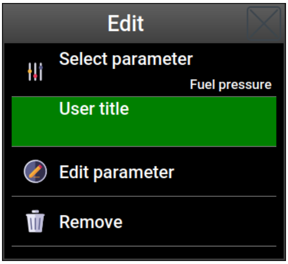


Figure 6.11: Parameter editing window example.

The following options are available:

`Select parameter` shows current parameter in use. Selecting this option will ask you for a new parameter that will be shown instead.

`User title` allows user to define a special name for the parameter. Although parameter defines three names (normal, short and tiny), these may not be always appropriate. Here you can give a name explicitly. Remember that only first two letters will be used as the space is very limited. See Figure 6.8. When `User title` is left empty (default) the first two letters from the parameter's tiny name will be used automatically.

`Edit parameter` opens parameter editor window, where parameters color ranges can be edited as well as parameter names. See Figure 5.1 for an example.

`Delete` removes parameter from the group.

6.2.3 Round Gauges

Classic screen has four round gauges, two on left and two on right. Each gauge can be edited in detail.

Enable editing mode first, see Section 6.1. Touch or select one of gauges. This opens a window similar to example in Figure 6.12. Gauges like this also appear on the *engine* screen. They work on the same principle. Thus gauge editing was put into separate section 6.5 starting on page 125.

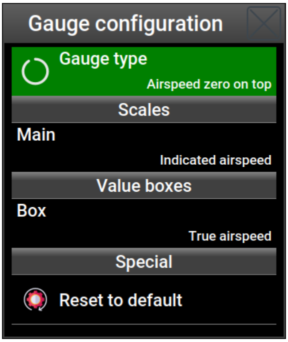


Figure 6.12: Gauge editing window example.

6.3 Engine Screen

The engine screen consist of six gauges that can be edited. There is also a part of the screen at the bottom (8.4" version) or on the right side (7" version), which can't be edited at the time being.

Enable editing mode first, see Section 6.1. Touch or select one of gauges. Gauge editing is explained in Section 6.5 in detail.

Figure 6.13: A typical example for automatically generated engine screen for Rotax engine on 8.4" display.

In addition to the gauges, the bottom part can be also configured. The bottom shows trim and flaps positions, engine status an some other information. Click on the bottom part to open a window as shown in Figure 6.14.

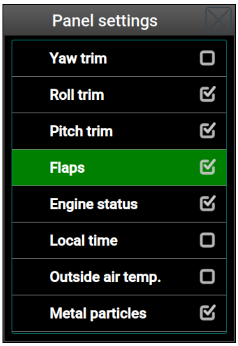


Figure 6.14: Check the indicators to show at the bottom or at the side of the engine screen.

Nesis does not check or warn if selected items fit into the designated area.

6.4 Modern Screens

Only a part of the modern screen can be edited. Figure 6.15 shows the editable part. Sometimes two modern screens are used: one with AHRS and one with a moving map. They both share the same editable part.

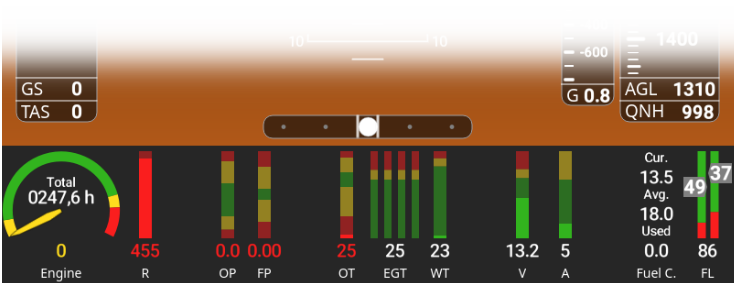


Figure 6.15: Part of the screen which is editable.

Enable editing mode first, see Section 6.1. Touch or select one of items in the editable section.

After the `Edit screen` option is selected from the main menu the appearance of the page changes as shown in Figure 6.16. Note that your case may be significatly different. Items that are marked have the following meaning:

1. An arc shapped item.
2. A sub-group of items marked with a thing yellow line.
3. Currently selected item. In this case, it appears in the sub-group.
4. A vertical bar.
5. A combination of several vectical bars belonging to the same parameter, EGTs or CHTs, for example.
6. A stretch space. Its width varies automatically.
7. A combination of two arches into one visual item.
8. A fuel computer item.
9. A fixed space between two items.

⑩ A fuel level item.

Figure 6.16: Illustration of main items used for editing the bottom part of the screen. Not all possibilities are shown.

Every item is placed inside a group. A group can be horizontal or vertical. Each group typically contains ordinary items like bars and arcs and sometimes also sub-groups.

6.4.1 Navigation and Editing

Navigation between items in a group can be done with the touchscreen or with the knob. Selected item is marked with a yellow box. See Figure 6.16 where EGTs are marked with a yellow box.

A touch or a push of the knob opens a selection window as shown on Figure 6.17. Actual options depend on a situation.

`Insert` inserts a new item like a bar, an arc, a space, a stretch or something similar into the currently active group.

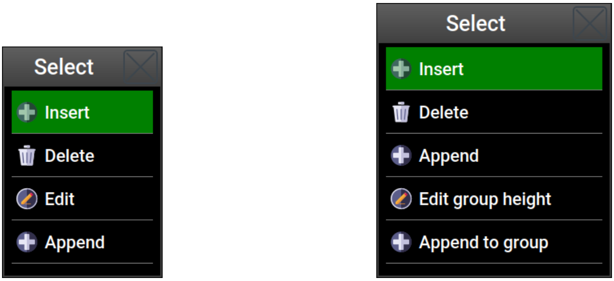
`Delete` removes currently selected item or an empty sub-group.

`Edit` opens an edit window for currently selected item.

`Append` appears only when the last item in a group is selected. It works in the same way as insert but the new item is appended at the back.

`Edit group width` appears only when a sub-group is selected. It asks for a subgroup size[1]. The size is given in percentage of the parent group.

[1] This can be either width or height, depending on the parent group and the display size



(a) An item is selected. (b) A sub-group is selected.

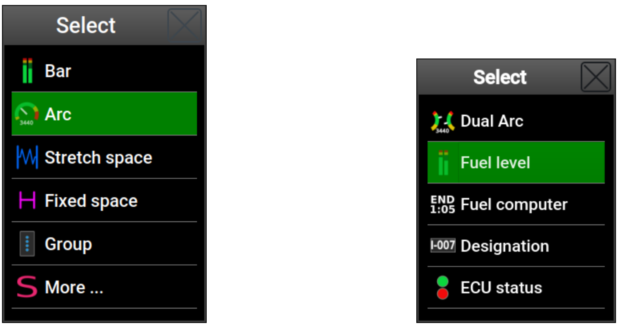
Figure 6.17: Selection window and its options. Some options may be hidden, depending on a situation.

`Edit group` selects the first item in the subgroup – it *enters* into the subgroup.

`Append to group` is similar to `Insert` but the new element will be put at the back.

6.4.2 Insert and Append

The `Insert` and `Append` commands work in a similar way. They ask you which item to create and then this item is either inserted or appended to the active group. Figure 6.18 illustrates selection options.



(a) Basic items. (b) More special items.

Figure 6.18: `Insert` and `Append` item options. In some cases, not all options are shown.

`Bar` inserts either a vertical or horizontal bar. Orientation is automatic and depends on the active group. Nesis also asks for the parameter to shown in the bar. If parameter is not selected, a placeholder is used instead. A placeholder means that it is not associated to any parameter yet. More in Section 6.4.2.1.

`Arc` inserts an arc element. This is similar to bar, just the shape is different. A placeholder arc is created. More in Section 6.4.2.2.

`Stretch space` inserts a special *elastic* element, which visually separates individual items. Nesis will automatically calculate the size in a way to populate underlying group evenly. More in Section 6.4.2.8.

`Fixed space` defines a fixed amount of space between two elements. The space is defined in pixels. More in Section 6.4.2.9.

`Group` inserts a subgroup into current group. This allows group nesting. Such nesting is only allowed to a certain level. More in Section 6.4.2.10.

`More` gives access to more special items, Figure 6.18b. Some of them may not appear in certain group orientation and may be omitted from the list.

`Dual arc` inserts special two arc combination. It is usually used in rotorcraft for rotor and engine RPM combination, but you can also use it elsewhere. More in Section 6.4.2.3. Here Nesis does not ask for parameters and uses two placholders instead. After the item was created, select it and use the `Edit` command to change parameters to something meaningful.

`Fuel level` is special item, which displays fuel level bars in a bit specific way. It also shows total fuel level. More in Section 6.4.2.4.

`Fuel computer` combines numeric fuel computer items into one element. More in Section 6.4.2.5.

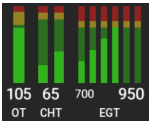
`Designation` shows user specific designation text, usually aircraft registration. More in Section 6.4.2.6.

`ECU status` shows engine ECU status indication. At the time being, it is limited to Rotax iS and ULPower engines only. More in Section 6.4.2.7.

6.4.2.1 Bar

Most parameters are shown in the form of bars. Some parameters (EGT, CHT) allow multiple bars on the same parameter. Example in Figure 6.19 illustrates the case where CHT has `Count` set to 2 and EGT to 6. Maximal numerical value is always shown, while the minimal value is shown only in smaller font if there is enough space (vertical bars only).

Bar orientation depends on the underlying group. When the group lists its items horizontally, bars are vertical and vice versa.



(a) Vertical bars.

(b) Horizontal bars.

Figure 6.19: Example of bars. Orientation depends on the group they belong to.

6.4.2.2 Arc

Any parameter can be also shown as an arc. An arc consumes significantly more space and must be used wisely not to overcrowd the group, Figure 6.20.

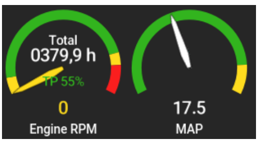


Figure 6.20: Arc examples. Left arc is associated with engine RPM and thus it is a bit special. The right arc shows MAP and is a standard one.

When an arc is associated with the engine RPM parameter, it becomes a bit special as it shows total time and throttle position value over the same arc. The total engine time value is shown while engine is not running. It can be also shown on demand for about 10 seconds by touching the arc. When throttle position information is available, it is shown slightly below the needle center.

In the case of Rotax iS engines, the throttle position also changes color for easier engine start. The color depends on oil/coolant temperature. See Rotax manual for more details.

6.4.2.3 Dual Arc

This item combines two parameters into one visual element. Usually it is used in rotorcraft to combine engine RPM with rotor RPM. Figure 6.21 shows two examples. On the left, engine and rotor RPMs are combined. On the right, system voltage and DC current (Amps) are combined. Dual arcs come handy where bars would be boring and arcs would use too much space.

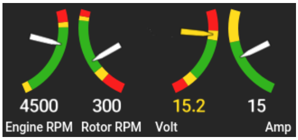


Figure 6.21: Dual arc examples.

6.4.2.4 Fuel Level

Fuel level shows one or two vertical bars, depending on how many fuel tanks parameters were configured. There is a small confusion here as fuel tank parameters are not directly connected to fuel tank sensors and fuel tank calibration shapes. Fuel level item here only takes a look at fuel tank parameters and ignores others.

For the time being, up to two fuel tanks are supported. Also, fuel level item can only appear in horizontal groups.

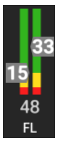
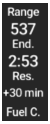


Figure 6.22: Fuel level bars example.

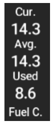
6.4.2.5 Fuel Computer

Fuel computer combines five different parameters into one item. Figure 6.23 illustrates the case. As the space is limited, it is organized into two sets. The first set contains range and endurance with reserve, while the second set contains current fuel flow, average fuel flow and used fuel.

Fuel computer shows one set for about 10 seconds and then it switches to another set. A touch on the fuel computer will change the set immediately.



(a) First set.



(b) Second set.

Figure 6.23: Fuel computer example.

6.4.2.6 Designation

Designation is usually a registration number. An example is shown in Figure 6.24. A designation is entered by the `User options | Settings | User | Aircraft designation` command.

Figure 6.24: Designation marking example.

6.4.2.7 ECU status

Rotax iS and ULPower engines are equipped with ECUs, which are sending their general status all the time. This status can be shown on screen in a form of two check lights and a short status string.

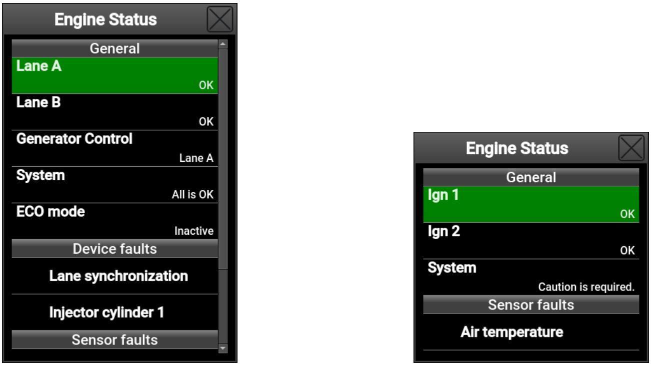
The official engine documentation on ECU/engine status is very sparse. We tried our best to decode the information. In the case of any caution or warning, do not relay on our information or our interpretation. Always consult official engine service facility and official engine documentation.

(a) Rotax iS

(b) ULPower

Figure 6.25: Engine ECU status examples.

A touch on the status area opens a window with more detailed information.



(a) Rotax iS (b) ULPower

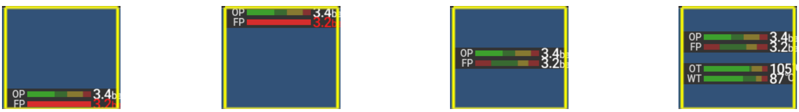
Figure 6.26: Engine ECU detailed status examples.

6.4.2.8 Stretch space

`Stretch` space is a special, dynamic item which adapts its size automatically. It is used to visually separate items like bars, arches.

Each stretch is associated with a `stretch factor`. The default factor value is 1 and in most cases you do not need to change it. However, a larger value can be assigned. A larger value means a more greedy stretch. For example, if there are two stretch spaces used, one with factor 1 and the other with factor 2 and they both have to accommodate for 90 pixels, the stretch with factor one will get $\frac{1}{1+2} \times 90 = 30$ pixels, while the greedy one (factor 2) will get $\frac{2}{1+2} \times 90 = 60$ pixels. Don't let the math to confuse you, experiment instead.

Let's take a look at few examples, Figure 6.27.



(a) Top only. (b) Bottom only. (c) Top, bottom. (d) Variable.

Figure 6.27: Some examples of stretch placements.

Figure 6.27a shows effect when a stretch is placed at the top. It takes all available space and pushes other items to the bottom.

Figure 6.27b does the opposite. The stretch is placed at the bottom. It will take all the space at the bottom and two remaining items are pushed to the top.

Figure 6.27c has two stretches: one at the top and one at the bottom. They both have the same default value. They share the available space equally, which places other items to the center.

Figure 6.27d is using three stretches.The top and bottom stretches have their value set to 2 and the middle stretch is set to value 1. Thus, the top and bottom stretch take more space than the middle stretch.

These illustrations were done on a vertical group. Similar effects are obtained in horizontal group, where items are pushed left or right instead.

6.4.2.9 Fixed space

This items inserts a fixed amount of pixels between two elements. It is useful, when you want to precisely control some space between two items.

6.4.2.10 Group

`Group` is a special item, which creates a new group within the parent group. It is often called a sub-group. When a parent group is horizontal, then a sub-group is vertical and vice versa. Figure 6.16 on page 115 illustrates a sub-group used in a horizontal group where items in the sub-group are distributed vertically.

A touch on a sub-group item will start editing the selected item directly. Press the `Close` button once or twice in order to select a sub-group instead.

For the time being a sub-group can't have additional sub-groups.

6.4.3 Delete

Selecting the `Delete` command from the menu removes currently selected item. See Figure 6.17 on page 116 for the illustration.

6.4.4 Edit

Selecting the `Edit` command opens a new window where selected item can be edited. The window depends on the item type. Note that some items do not support this option.

6.4.4.1 Bar and Arc

Bars and arcs are associated with one parameter only. The `Edit` command opens window as shown in Figure 6.28. It has two options:

`Select parameter` allows for parameter selection. This is a two step selection. First a group is selected, then a parameter within the group.

`Edit parameter` is used to change some parameter settings. Usually parameter color ranges are changed or parameter names.

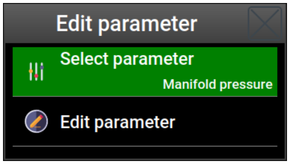


Figure 6.28: Parameter selection and editing window.

6.4.4.2 Dual Arc

Dual arc is nothing but a combination of two arcs. Hence two parameters are associated with it. In principle editing is similar to arc and bar, where a left or right parameter (arc) must be selected first, Figure 6.29. Once the parameter is selected, it follows the logic of Section 6.4.4.1.

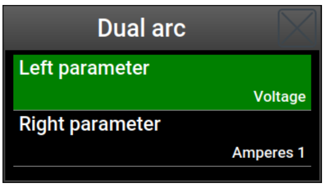


Figure 6.29: Dual arc combines two parameters.

6.4.4.3 Stretch

Stretch factor can be adjusted. Default factor is 1 and it usually gives good results. If you feel that certain stretch requires more space, you can increase its factor, Figure 6.30.

Figure 6.30: Stretch factor editing.

6.4.4.4 Space

Fixed space is defined in screen pixels and the exact amount can be prescribed. Figure 6.31 illustrates an example.

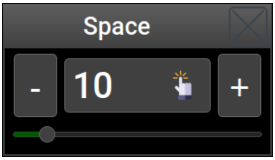
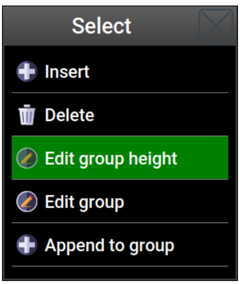


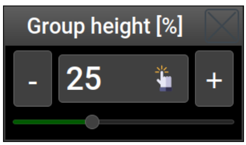
Figure 6.31: Fixed space editing.

6.4.4.5 Group

When a sub-group is selected without any of its internal items being highlighted, the `Edit group width/height` command allows for the group resize. The group size is defined as percentage of parent width or height. This depends on the parent orientation.



(a) Edit on group.



(b) Group height/width is specified in percentage of its parent.

Figure 6.32: Editing a group height/width.

6.5 Gauge Editing

Classic and engine screens contain several gauges. These gauges can be edited quite in detail to meet different needs.

Gauge editing starts in a windows similar to examples shown in Figure 6.33. For the illustration, actual gauges that belong to these windows are shown on the top.

(a) Airspeed. (b) Electric, CO as scales. (c) Temperature as bars.

Figure 6.33: A few examples of gauge editing windows on the bottom and their correspond gauges on the top.

A gauge configuration window has three major elements:

- `Gauge type` defines basic shape of a gauge. More than a dozen shapes are available and more are expected to be added in the future. Please note a symbol on the left. It mimics the basic underlying shape of the gauge.
- A list of `Scales`, `Value boxes`, `Bars`, `Fuel` allows for parameter selection and customization. These lists and their elements vary on a gauge type.

- `Reset to default` is a command, which resets the gauge type and associates list values to default settings for this particular gauge. The default settings depend on the screen, current parameter values and gauge position on the screen. It ignores parameters currently used by the gauge and takes all *enabled* parameters into consideration.

6.5.1 Gauge Type

A gauge type defines a combination of scale arcs, value boxes, bars and fuel elements. They are listed in the following table. The first few options are a bit special, as they only allow for a limited customization.

`Altimeter` is a gauge which corresponds to a classic altimeter. It combines the main scale and the baro-correction value box. It only allows limited customization – the `user title` for the main scale and the baro box.

`Airspeed zero on top` corresponds to a classic indicated airspeed indicator whose zero speed scale starts on the top. In addition it also has a value box for true airspeed. It allows for limited customization of user defined titles for the scale and the value box.

`Airspeed zero on bottom` corresponds to a classic indicated airspeed indicator whose zero speed scale starts on the bottom. In addition it also has a value box for true airspeed. It allows for limited customization of user defined titles for the scale and the value box.

`Vertical speed` corresponds to a classic vertical speed indicator. It is combined with the acceleration value box. It allows for limited customization of user defined titles for the scale and the value box.

`Scale` defines a gauge with only one scale arc spanning over complete gauge. The scale can show any active parameter.

`Scale, box` defines a gauge with one scale arc spanning over complete gauge combined with a value box on the bottom. The scale or box can show any active parameter.

`Scale, two boxes` defines a gauge with one scale arc spanning over complete gauge combined with two value box on the bottom. The scale or boxes can show any active parameter.

`Scale top, bottom` defines a gauge with one scale longer arc spanning on top and one shorter arc on the bottom. Scales can show any active parameter.

`Scale left, right` defines a gauge with two symmetric scales, one on the left and other on the right side. Scales can show any active parameter.

`Scale left, right, box` defines a gauge with two symmetric scales and additional value box on bottom. Scales and box can show any active parameter.

`Three scales` defines a gauge with two symmetric scales combined with a scale on the bottom. Scales can show any active parameter.

`Scale left, bars` defines a gauge with a scale on the left side and a set of horizontal bars on the right side. Scale and bars can show any active parameter.

`Bars, scale right` defines a gauge with a set of horizontal bars on the left and a scale on the right. Scale and bars can show any active parameter.

`One column of bars` defines a gauge with a centered set of horizontal bars. Bars can show any active parameter.

`Two columns of bars` defines a gauge with two sets of horizontal bars. Bars can show any active parameter.

`Scale, fuel` defines a gauge with a scale on the left and a fuel group on the right. The scale can show any active parameter, but the fuel group is bound to fuel level. The shape of the fuel group depends on the number of tanks in use. If only one tank is in use, some other gauge type may give better results, `Scale left, right` for example.

`Two scales, fuel` defines a gauge with a two scales on the left (top, bottom) and a fuel group on the right. Scale can show any active parameter, but the fuel group is bound to fuel level. The shape of the fuel group depends on the number of tanks in use. If only one tank is in use, some other gauge type may give better results, `Three scales` for example

`Rotor scales, boxes` defines a special gauge usually used by rotorcraft mostly. The left scale and left value box are usually set to the same parameter. The same is true for the right scale and the right value box. Boxes 1, 2, 3 correspond to the left, central and right boxes, respectively. Left and right boxes do not have a title as they are usually related to the corresponding scale.

6.5.2 Scales, Value Boxes, Bars

Each `Gauge type` has its own set of scales, value boxes and bars. Each of these is then associated with a parameter and an user name. These can be further edited in more detail. Bars are slightly special and are covered in Section 6.5.2.1.

Selecting a scale, value box or bar item opens a window similar to an example shown in Figure 6.34.

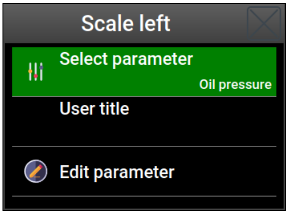


Figure 6.34: Editing a scale. Value box works in the same way.

`Window title` tells which element of the scale is being edited. For example, Figure 6.34 shows that the *left scale* is being configured.

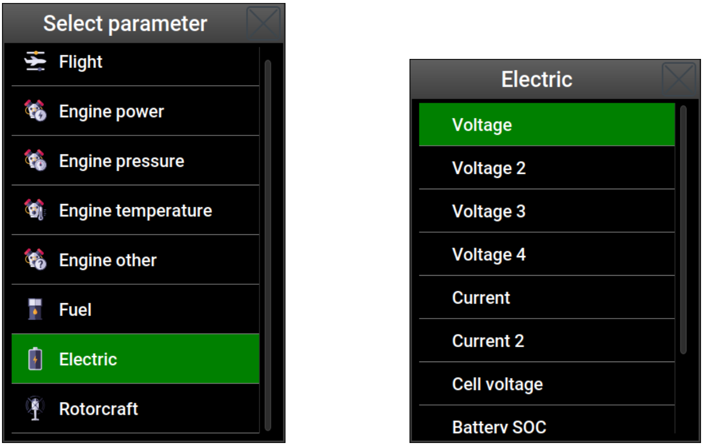
`Select parameter` allows selection of the parameter to be shown for a scale, a value box or a bar. In some special cases such selection is not possible (airspeed, altimeter, vertical speed gauges). As there is a lot of parameters to chose from, the parameter selection is made in two steps – first a logical group is selected and then a final parameter. Figure 6.35 illustrates an example. Please note, that a parameter can appear in more than one group.

`User title` allows user defined parameter name. When this is left empty, the short name of selected parameter will be shown.

`Edit parameter` opens editor window for the selected parameter. This can be used to change parameter color bands, parameter names and some attributes. Please note that these parameter changes are global. They will affect any other visual element in Nesis that depend on this parameter.

6.5.2.1 Bars

Bars behave in a very similar way as `scales` and `value boxes` with one exception – they are handled as a group itself. In most cases there is not a single bar, but a set of bars. Each bar may belong to a different parameter, while certain



(a) Groups. (b) Parameters within a group.

Figure 6.35: A parameter selection example. A group is selected first and a parameter afterwards.

bars belong to the same parameter but with different index (EGTs, CHTs, for example).

As bars act as a group, there is an intermediate window, which handles such group – a parameter can be added, removed to a group or being edited.

Figure 6.33c shows an example of a bar group, which consists of six EGT values. These EGTs belongs to the same parameter, but each has a different index 1,2 . . . 6.

A selection of a bar group opens a window. An example is given in Figure 6.36.

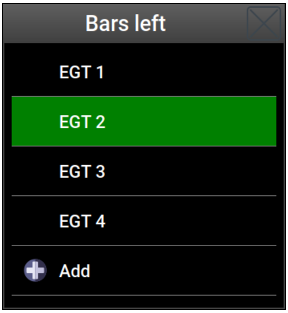


Figure 6.36: Parameter in one bar group. In this case they all belong to the same EGT parameter, but each with a different index.

In order to add a parameter, select the `Add` button. This opens a window for parameter selection. The selected parameter will be then added to the list.

Nesis does not allow you to use more than eight items in a bar group. When more than eight items are used, bars become very small and visual result becomes sluggish.

A selection on any of existing parameters opens a window where parameter details can be edited. In principle this is identical to section 6.5.2 from page 128 with two extra options:

`Index` appears only for CHT and EGT parameter types. Namely there may be several EGTs and CHTs in use for one engine. They all belong to the same parameter (EGT/CHT), but with different index.

`Delete` is used to remove this parameter-index pair from the bar group.

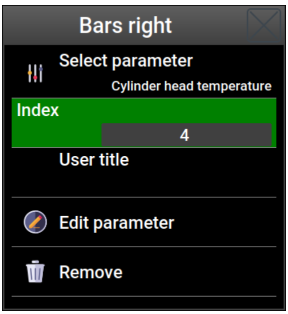


Figure 6.37: EGTs and CHTs get extra options – index selection and delete.

Let's observe a change that appears when different parameter types are mixed in a bar group. Example in Figure 6.33c shows six EGTs in a group. Let's add a `Placeholder` and then edit the placeholder into `Manifold pressure`. After this change the gauge appearance changes as it is illustrated in Figure 6.38. As long as all bar items belong to the same parameter (pure EGT or pure CHT case), they are combined together and individual titles are omited. But after they are mixed each one gets its own title.

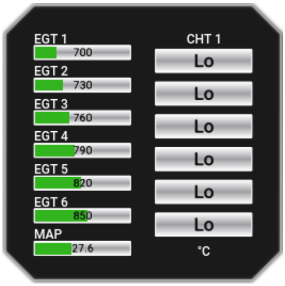


Figure 6.38: A change of appearence after `MAP` was added to the group.

6.5.2.2 EGT And CHT Scales

The scales were already covered in Section 6.5.2. However, there is an exception for parameters that support indices (EGT, CHT). In this case one scale can show several needles where each needle corresponds to different index.

All handling is very similar to bars with a limitation to one parameter only, but with several needles. When scale parameter is selected and when parameter type is EGT or CHT a window appears allowing to add additional needle using the `Add index` command, Figure 6.39.

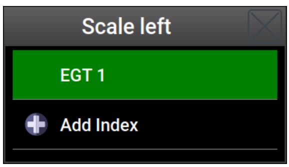


Figure 6.39: Adding a second needle for the same parameter. EGT and CHT only.

An example with two scales both having two needles per scale is shown in Figure 6.40.

Figure 6.40: Two scales, both with two needles.

Please note that you can't define arbitrary index. Index is bound to number of max indices that can be used with EGT or CHT. This value is defined as `Count` in the parameter editor, see Section 5.6. Let's take Rotax 912 ULS engine for example. It has two CHTs (or CTs) one is located on cylinder 1 and the other on cylinder 3. In this case, you set `Count` to 2 and then you can only use indices 1 and 2. You can not use indices 1 and 3. The same is true for EGTs.

Please do not use a trick where one would set `Count` to 3 and then add indices 1 and 3 only on the scale and connect CHT 1 and CHT 3 sensors only. Such trick will leave index 2 (CHT 2) undefined. The Nesis alarm system will expect all three temperatures properly defined but CHT 2 is missing and you may get false alarms or no alarms at all. In addition, three bars will be shown on the modern page, which is not what you probably want.

Chapter 7

Maintenance

Nesis does not require special maintenance. Every two months or in a case of any requested service, you shall check our service bulletins, which are accessible from our web site `www.kanardia.eu`; search for the `SERVICE BULLETINS` in the menu. They are listed in chronological order, more recent first.

7.1 Annual Checks

It is advisable that some checks are performed during annual aircraft inspection. In particular, you may want to check various pressure sensors.

7.1.1 Pito-static

Static and dynamic pressure test shall be performed with standard pitostatic testing equipment. Nesis has integrated solid state sensors, which are known to develop slight offset in time. This offset shall be adjusted.

7.1.1.1 Static Pressure

Select the `Static(altitude)` and adjust the correction so that indicated static pressure will show the same value as the reference static pressure.

7.1.1.2 Dynamic Pressure

Select the `Dynamic (airspeed)` item from the offset list. Adjust the correction, so that dynamic pressure will show zero. We recommend doing this test in a closed hangar.

7.1.2 Engine Pressures

We recommend checking/adjusting engine pressure sensors once per year. Make sure that there is no pressure in the fuel or oil system. Remove the sensor from the engine, if unsure. All engine sensors are checked with the engine turned off!

7.1.2.1 Oil Pressure

Select the `Oil Pressure` item from the offset list. Adjust the correction, so that pressure will show zero.

7.1.2.2 Fuel Pressure

Select the `Fuel Pressure` item from the offset list. Adjust the correction, so that pressure will show zero.

Some engines may be equipped with absolute sensors (Rotax iS family for example). If this is the case, the unloaded sensor must show the static pressure. Adjust the correction, so that the indicated pressure matches the static pressure.

7.1.2.3 Manifold Pressure

Select the `Manifold Pressure` item from the offset list. Adjust the correction, so that manifold pressure will match the static pressure. Both values are indicated on the screen.

7.2 Service

Nesis and corresponding equipment does not have any serviceable parts. In the case of a device failure, the device shall be sent to the factory for a repair. Please refer to the Warranty conditions (published as a part of User's Manual), for more details.

Appendix A

Third-Party Interface Integration Guidelines

Next sub-sections illustrate connection details for some specific devices. These are merely our recommendations as in some cases a different settings/approaches are also possible.

Some devices can be connected in different ways. Any device manual always supersedes instructions given here.

A.1 SkyDemon

SkyDemon can connect wirelessly to the Nesis to synchronize its current navigation point with Nesis navigation system.

A.1.1 Sven Dongle for Nesis

The Nesis can connect to the SkyDemon app via a Sven dongle. This dongle acts as a bridge, with an RS-232 serial interface on one side and a Bluetooth Low Energy (BLE) serial link on the other.

There are two versions of the Sven dongle:

- Nesis version – plugs directly into the Nesis serial port. This is the one you need.

- Amigo version – plugs directly into the Amigo device's serial port.

Both versions serve the same function of enabling RS-232 to BLE serial communication, but the physical connectors and pinouts are tailored to their respective host devices.

Figure A.1: Sven dongle for direct connection to Nesis. Note the RJ12 connector at the end of the cable.

A.1.1.1 Connection - Nesis Side

Plug the RJ12 connector of the Sven dongle into one of the Nesis RS232 ports. You can use any free port. Here we assume port 2 will be used. The port also provides power for the dongle.

Once connected, configure Nesis port according to `NMEA in`, as it is shown in Figure A.2. Note you may use different port.

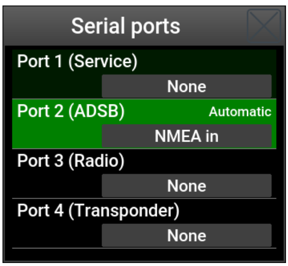


Figure A.2: Nesis serial port selection.

A.1.1.2 Connection - SkyDemon Side

Please refer to the latest SkyDemon manual for full connection details. Below is only a brief step-by-step summary:

- Ensure Nesis is powered on and that Sven is physically connected to it.
- Tap the settings icon in SkyDemon app.
- Choose `Connectivity` and select `Add Bluetooth Device`.
- `SVENXXX` appears in the device list, where `XXX` is replaced by Sven's serial number. Select it.
- Modify the device settings as follows:

  `Connected Devcie Type:` Autopilot

  `Autopilot Messages:` All
- Tap `Save` to confirm and close.

A.1.1.3 Activating Connection

The connection is active only when SkyDemon is in `Flying` mode:

- Select a route or some waypoint in SkyDemon.
- Tap the `Fly` command to enter into the flying mode.
- Nesis may need about 30 seconds to detect the connection and baudrate. Once connection is established, you see the `E` symbol in the status area – top right corner of the Nesis screen, Figure A.3a.

(a) Connection established.

(b) Follow active waypoint is in use.

Figure A.3: Connection status indication.

- Execute `Main menu | Navigation | Follow external direct to`. This puts Nesis into the following mode – the `E` symbol gets two bars beneath, Figure A.3b. Any change of active waypoint on SkyDemon is sinchronized with Nesis. If autopilot is in the `LNAV` mode, then the autopilot will follow the active navigation, too.

A.2 Funke

A.2.1 Radio ATR833

Please read the *ATR 833 Installation Manual* before any connection is made to Nesis. The manual can be obtained from `https://www.funkeavionics.de/`.

A.2.1.1 Audio

Nesis audio output may be connected to the external audio input on Funke ATR833 radio station. Figure A.4 shows the schematics.

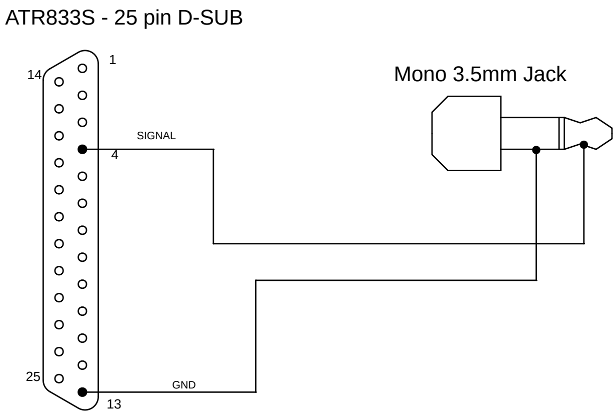


Figure A.4: Schematic for connecting Nesis audio output to Funke ATR833 radio station.

The Funke ATR833 radio station must be configured to accept audio from Nesis. Please follow next steps to configure external audio input on Funke ATR833 radio:

- press the `SET` button for at least 5 seconds to enter setup,
- press the `SET` button four times (4x) to reach the `External Audio` menu,
- with the `VOL/SEL` button select entry `auto off`,
- press the `DW` button or wait for 10 seconds to exit setup menu.

If some messages are cut you should select the `no RXTX` mode. However this makes audio input permanently active, which may lead to some small noise always present in a headset.

A.2.1.2 Frequency Manipulation

Nesis enables radio frequency manipulation via an RS-232 connection by employing a clever workaround: the device emulates a Funke remote control unit. As a result, the connection can only be established when the actual Funke remote unit is not connected to the ATR 833 radio.

ATR 833 utilizes 25 pin D-SUB connector. Figure A.5 illustrates the connection of ATR 833 and Nesis. Illustration shows only leads required by Nesis. Much more leads are connected to the 25 D-SUB connector. Use an adapter board, if possible. Please refer to the ATR 833 documentation for more details on connections.

If ATR 833 and Nesis are both connected to the same airplane ground, then GND line may be omitted (dashed line).

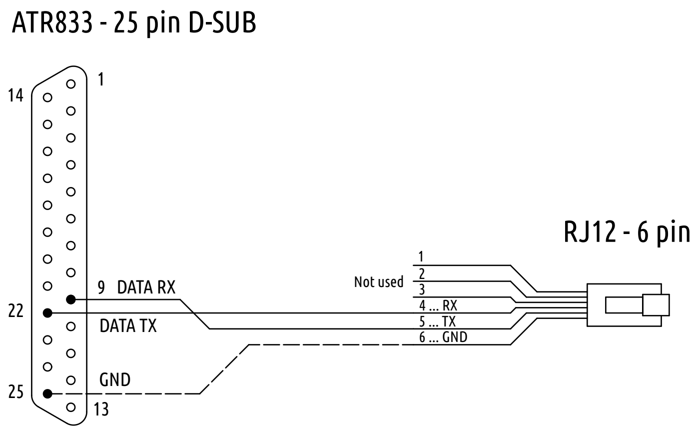


Figure A.5: Schematic connection for ATR-833 and Nesis RS-232 port.

After the connection was established execute `Main menu | Options | Service | Settings | Serial ports` and set appropriate port to `Funke ATR833` as shown in Figure A.6.

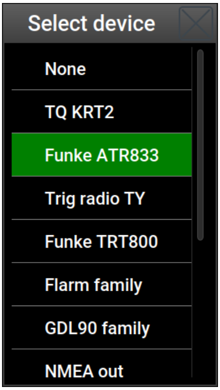


Figure A.6: Nesis port details.

A.2.2 TRT800 Transponder

Please read the *TRT800 Installation Manual* before any connection is made to Nesis. The manual can be obtained from `https://www.funkeavionics.de/`. Open the *Service* menu and search for the manual.

A.2.2.1 Squawk Manipulation

Funke transponder TRT800 may be optionally configured to receive squawk settings directly from Nesis. This option requires to connect to the remote *female Binder connector* of the Funke Cable plan TRT800EMRS. In addition, the transponder settings have to be changed. For the connection we recommend using *male Binder connector* with the part number `99 0413 00 05`, Figure A.10. Connect it according to the schematic given in Figure A.7.

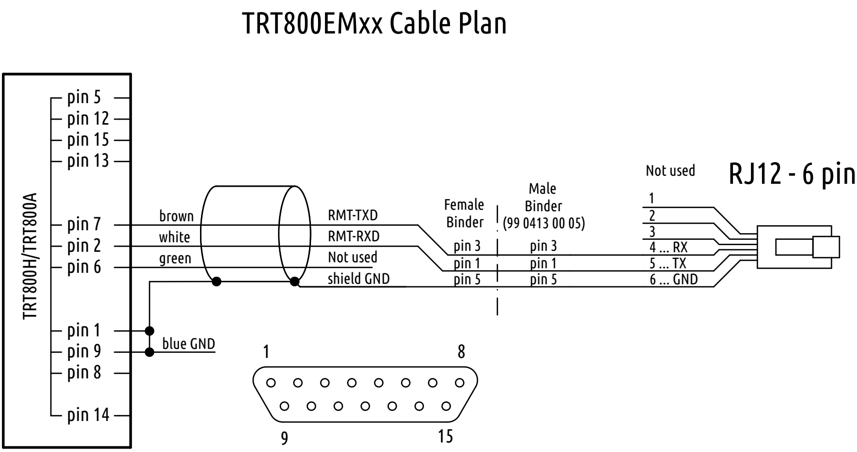


Figure A.7: Schematic connection for the TRT800 transponder squawk manipulation.

Select `Main menu | Options | Service | Settings | Serial ports` and set the appropriate RS-232 port to `Funke TRT800`.

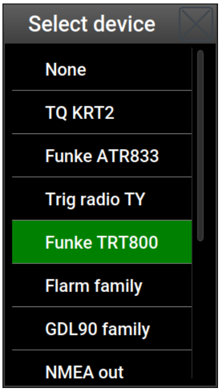


Figure A.8: Nesis port details.

In addition to the connection, you have to perform the following configuration on the transponder:

- Press and hold the `ID` button for about 26 seconds until you see the `ENTER SETUP` on the LCD.

- Press the `MODE` button 4 times until you see `DATA-PORT 2:` page.
- Rotate the knob and select the `REMOTE TEST` option.
- Press the `MODE` twice more to exit the setup.

Figure A.9: Data-port 2 must be set to `REMOTE TEST` option.

Figure A.10: Binder male connector, part number 99 0413 00 05.

A.2.2.2 GNSS-In

Funke transponder TRT800 may optionally connect to some GNSS data source, which then includes some of these data in ADS-B transponder responses.

Important: Always verify with your local aviation authorities whether this type of connection is permitted. Nesis GNSS source is not certified, and its connection to transponder may be restricted or prohibited in certain jurisdictions. Do not connect to your transponder if the aircraft is operated in U.S. airspace, as this configuration is not compliant with FAA regulations.

This connection is made to the open cable ends, which are part of the external memory address adapter (TRT800EMxx). Do not attempt to open the connector/adapter!

Connect according to Figure A.11, brown lead (RXD) from pin 12 on transponder with TX lead from RJ12 connector. Connect also GND from RJ12 with one of the grounds on transponder (shield of the cable or blue lead from pin 9). The communication is unidirectional only – Nesis transmits GPS data on TX and transponder receives the data on RX.

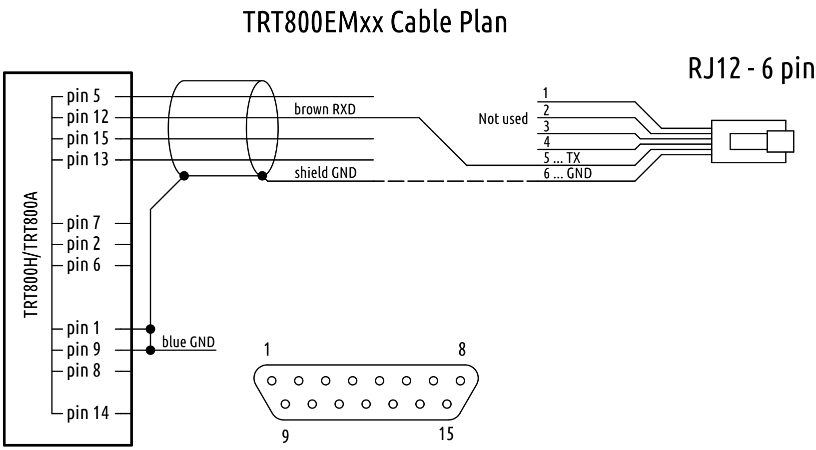
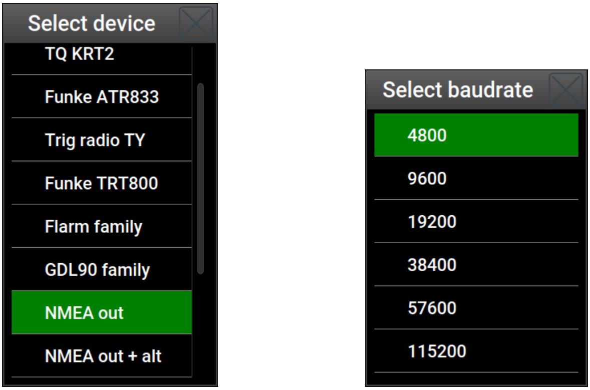


Figure A.11: Schematic connection for the TRT800 transponder for GNSS-In NMEA reception.

According to Funke manual, configure TRT800 to receive `NMEA` and set data rate to 4800. Finaly, execute `Main menu | Options | Service | Settings | Serial ports` on Nesis, select appropriate port and set it to `NMEA out` and set baudrate to 4800.

A.2.3 Air Surveillance – TM350

Please read the *TM350 Installation Manual* before any connection is made to Nesis. The manual can be obtained from `https://www.funkeavionics.de/`. The conneciton can be established in two ways, via cable using RS-232 port or via WiFi.



(a) Devcie selection. (b) Baudrate selection.

Figure A.12: Nesis port settings for the TRT800 GNSS-In option.

A.2.3.1 RS-232 Port

This is the recommended way to connect to the TM350. TM350 gets power trough the DSub-15 connector. See Funke documentation. Nesis shall not be the power source.

The TM350 DSub-9 (9 pin) connector shall be used to communicate with a Nesis serial port. The schematics is shown in Figure A.13. Here we connect to TM350 port D1. TX and RX must be connected. GND may be optional if both devices are connected to the same ground, which is the usual case. However, depending on the circumstances, you may need to connect GND lines as well.

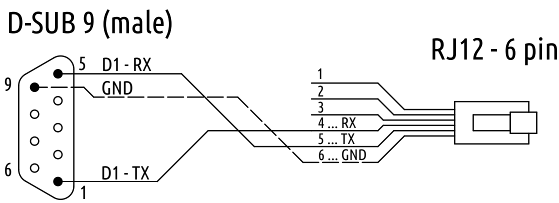
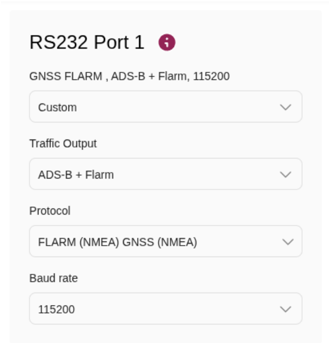


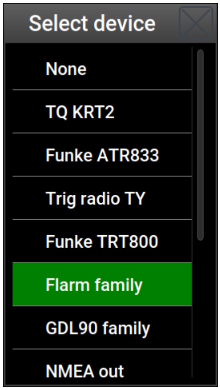
Figure A.13: Schematic connection for TM350 port D1 using RS-232.

Once the harware connection is made use a tablet or PC to connect to TM350 and configure RS232 Port 1 as shown in Figure A.14a. You have to configure other parameters as well – follow Funke manual.

Next execute `Main menu | Options | Service | Settings | Serial ports`, select proper port and set the port to `Flarm family`.



(a) TM350 Port 1 settings.



(b) Nesis port settings.

Figure A.14: TM350 and Nesis port settings.

When you are using WiFi dongle as well, it may happen, that Nesis receives data traffic from two sources simultaniously. This creates problems. If this is the case, execute `Main menu | Options | ADS-B/Flarm | WiFi traffic settings` and set the `Not used for traffic` option. This prevents traffic information from being received over Wi-Fi.

A.2.3.2 WiFi

If Nesis is equipped with a WiFi dongle plugged into USB port, you can also connect TM350 over WiFi. In this case, do not use RS-232 connection at the same time.

See Section 3.1.3 about WiFi. TM350 acts as an access point where SSID is `TM350-XXX` and the password is `SNXXX` where `XXX` shall be replaced by the product serial number. See TM350 manual for details.

Once Nesis is connected to the access point, you should receive traffic information automatically over the `UDP:4000` port. If this is not the case, please make sure that `Main menu | Options | ADS-B/Flarm | WiFi traffic settings` is set to `UDP:4000 - GDL90 (default)` as in Figure A.15.

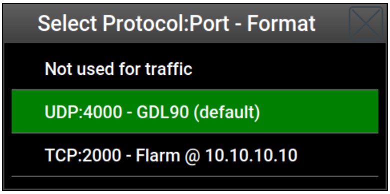


Figure A.15: Protocol, port and format selection for TM350 over WiFi.

Please note that Nesis does not support TCP:2000 - Flarm protocol yet.

A.3 Foxtral Anti-collision System Traffic Awareness

Details of the Foxtral device are available from `http://foxtral.eu`. This device can connect to Nesis in one of two ways. Use one way or another, just do not use both at the same time. We recommend to use the RS-232 cable variant, if possible.

A.3.1 Connection Using WiFi Dongle

Configure Foxtral as an access point and then connect Nesis WiFi dongle to this access point. In most cases this is all you have to do. Perhaps you can check `Options | ADSB/Flarm | WiFi traffic settings` and make sure that the `UDP:4000 - GDL90` is selected. On WiFi, Foxtral is using GDL90 format. See Figure A.15.

A.3.2 RS-232 Connection

Foxtral comes equipped with a cable, which has a D-Sub 9 connector on one end and two cables on the other end. One of these two cables connects to GNSS antenna via the USB connector and the other cable has open ends. These open ends are used to power the Foxtral device and connect it to the RS-232 port.

Manufature the cable according to the schematic on Figure A.16. The cable has RJ12 6 pin connector on one side (Nesis) and connects to the open ends of the Foxtral cable.

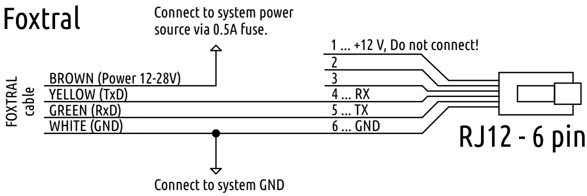


Figure A.16: Schematic connection for the Foxtral device.

Do not use Nesis as the power source for Foxtral! Foxtral is using significant amount of power, which may exceed the power capacity of Nesis and can make your whole system unusable.

When communicating via RS-232 port, Foxtral is using the Flarm format. Once connected, configure corresponding port on Nesis as `Flarm family`. Nesis shall automaticaly detect proper baud rate. See also Figure A.14b.

A.4 Trig

A.4.1 Radio TY91/TY92

Please read the *TY91/TY92 Installation Manual* before any connection is made to Nesis. The manual can be obtained from `https://trig-avionics.com/`. Open the *Support* menu and search for the manual.

A.4.1.1 Audio

Audio output of the Nesis must be connected to the auxilary input on Trig TY91/TY92 radio station. Please connect Nesis audio output as on Figure A.17.

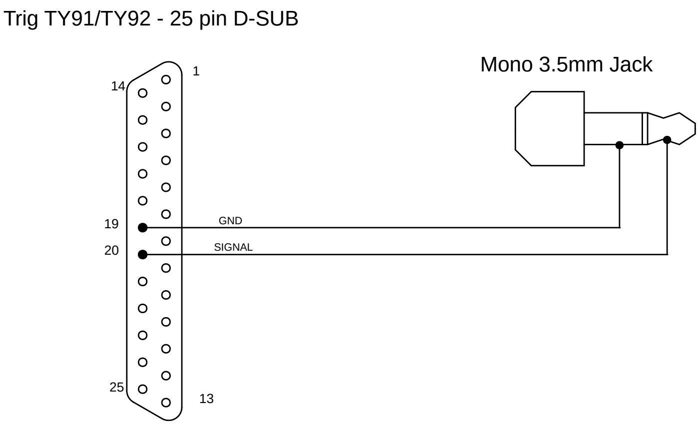


Figure A.17: Schematic for connecting Nesis audio to Trig TY91/TY92 radio station.

The Trig TY91/92 radio station must be configured to accept audio from Nesis. Please follow next steps to configure auxilary audio input on Trig radio:

- press the `MON` button for at least 2 seconds to enter setup,
- press the `MON` button twice to reach the `Auxilary input volume` menu,
- use small turning knob to select relative audio volume,
- press the `MON` button to reach the `Auxilary input muting` menu,
- use small turning knob to select bewteen `off` and `on`.

When `Auxilary input muting` is set to `on` the auxiliary audio input will be muted while the radio station is receiving or transmitting.

A.4.1.2 Frequency Manipulation

Trig TY91/TY92 radios consist of main unit and of a controller unit (TC90). The connection must be made to the controller unit. Figure A.18 illustrates the connection between Nesis and the TC90 controller unit.

If TC90 and Nesis are both connected to the same airplane ground, then GND line may be omitted (dashed line).

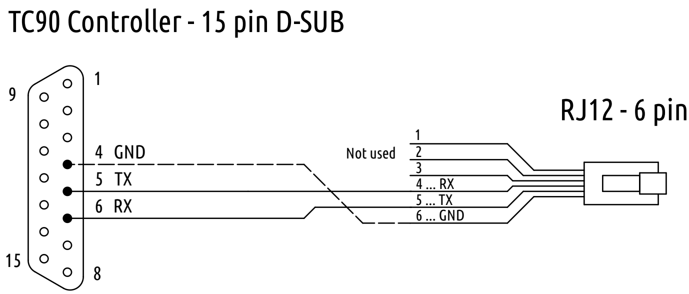


Figure A.18: Schematic connection for Trig.

Next execute `Main menu | Options | Service | Settings | Serial ports`, select proper port and configure the port to `Trig radio TY`, as shown in Figure A.19.

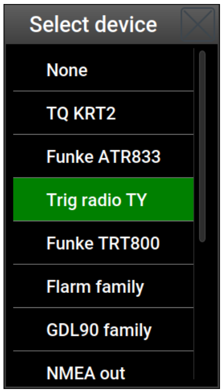


Figure A.19: Nesis device selection.

A.4.1.3 Transponder TT21/TT22 – GNSS In

Trig transponder may optionally connect to some GNSS data source, which then includes some of these data in ADS-B transponder responses.

Important: Always verify with your local aviation authorities whether this type of connection is permitted. Nesis GNSS source is not certified, and its connection to transponder may be restricted or prohibited in certain jurisdictions. Do not connect to your transponder if the aircraft is operated in U.S. airspace, as this configuration is not compliant with FAA regulations.

Please read the *TT21/TT22 Installation Manual* before any connection is made to Nesis. The manual can be obtained from `https://trig-avionics.com/`. Open the *Support* menu and search for the manual.

When a GNSS data source is connected to the transponder it will enable ADS-B out function automatically. Select `NMEA 0183` protocol on the transponder some interface speed (baudrate). You have to match this also on Nesis– execute `Main menu | Options | Service | Settings | Serial ports` and configure apropriate port accordingly. Figures A.12 on page 144 show one possible example. In your case baudrates may be different.

Figure A.20 shows connection schematics. The D-Sub 25 connector on the transponder side is multipurpose connector. Only connection related to the Nesis are shown. The communication is unidirectional only – Nesis transmits GNSS data on TX and transponder receives the data on RX.

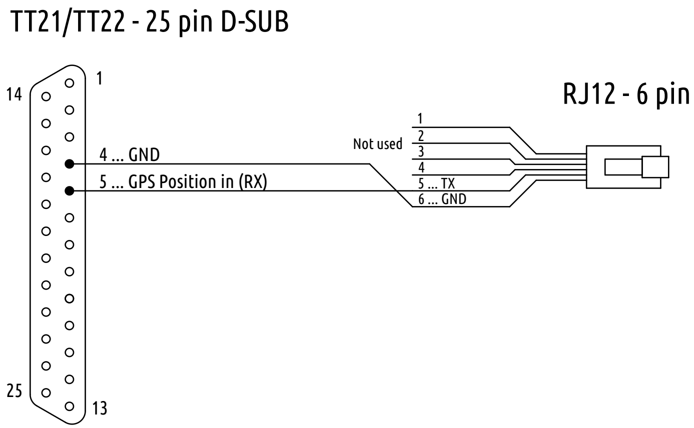


Figure A.20: Schematic connection for the Trig TT21/TT22 transponder.

Some Trig transponders do not have their own pressure sensor and require some external input. In this case you may try the `NMEA out + alt` option. This option mixes the static pressure (altitude) information into the NMEA out stream. Note however that Nesis static pressure (altitude) information is not certified. *Check with your local authorities if such connection is permited.*

A.5 TQ

A.5.1 Radio KRT2

Please read the *KRT2 Manual* before any connection is made to Nesis. The manual can be obtained from `https://www.tq-general-aviation.com`.

A.5.1.1 Audio

Audio output of the Nesis must be connected to the External-NF input on KRT2 radio station. Please connect Nesis audio output as on Figure A.21.

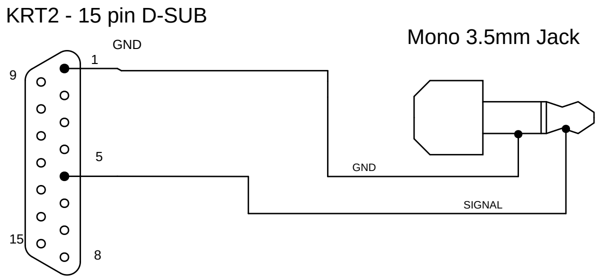


Figure A.21: Schematic for connecting Nesis audio to KRT2 radio station.

KRT2 must be configured to accept audio signal from Nesis. Please follow next steps to enable external audio on KRT2:

- Press the `AUX` button six times (6x) to reach the `EXT` menu.
- Use rotation knob to select different audio levels.

The correct selection is usually `EXT01` or `EXT02`. Different selections in the `EXT` menu means:

- `EXT00` - external input always off,
- `EXT01` - external input always on,
- `EXT02` - use threshold for enabling external audio - minimum volume,
- ...
- `EXT09` - use threshold for enabling external audio - maximum volume.

A.5.1.2 Frequency Manipulation

Connection to a KRT2 radio is made using a trick. Nesis pretends to be a KRT2RC remote control unit. This means that connection is only possible when the remote unit is not connected to KRT2.

KRT2 utilizes 15 pin D-SUB connector, where the housing is used as 16-th pin for GND. Figure A.22 illustrates the connection of KRT2 and Nesis. Illustration shows only leads required by Nesis. Much more leads are connected to the 15 D-SUB connector. Use an adapter board, if possible. Please refer to the KRT2 documentation for more details on connections and adapter board.

If KRT2 and Nesis are both connected to the same airplane ground, then GND line can be omitted (dashed line).

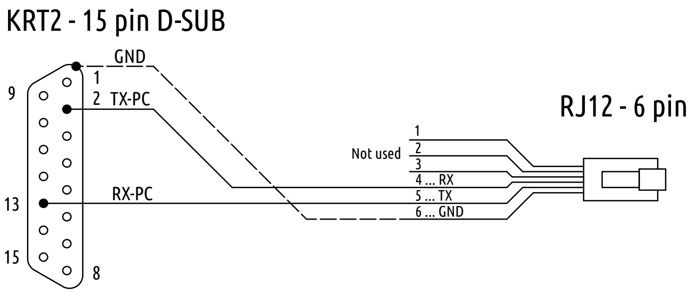


Figure A.22: Schematic connection for KRT2 and Nesis RS-232 port.

Once connection is made, execute `Main menu | Options | Service | Settings | Serial ports`, select proper port and configure the port to `TQ KRT2`, as shown in Figure A.23.

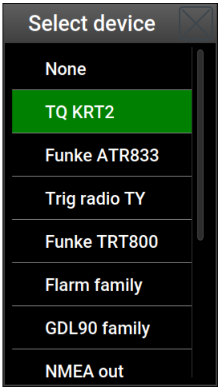


Figure A.23: Nesis device selection.

A.5.2 KTX2 Transponder – GNSS In

Please read the *KTX2 Manual* before any connection is made to Nesis. The manual can be obtained from `https://www.tq-general-aviation.com`. Please note that KTX2 requires software version 101 or higher for the ADS-B out to operate.

Important: Always verify with your local aviation authorities whether this type of connection is permitted. Nesis GNSS source is not certified, and its connection to transponder may be restricted or prohibited in certain jurisdictions. Do not connect to your transponder if the aircraft is operated in U.S. airspace, as this configuration is not compliant with FAA regulations.

Figure A.24 shows connection schematics. The D-SUB 15 connector on the transponder side is multipurpose connector. Only connection related to the Nesis are shown. Although the communication is unidirectional only – Nesis transmits GNSS data on TX and transponder receives the data on RX, KTX2 manual requires to connect the RX line as well. It does not say anything about GND lines however.

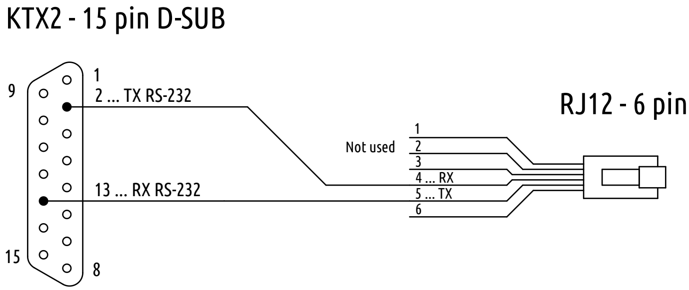


Figure A.24: Schematic connection for KTX2.

You have to match KTX2 settings on Nesis too – execute `Main menu | Options | Service | Settings | Serial ports` and configure apropriate port accordingly. Figures A.12 on page 144 show one possible example. In your case baudrates may be different.

A.6 AIR Avionics

A.6.1 AIR Traffic – AT-1

Please read the *AIR Traffic Installation Manual* before any connection is made to Nesis. The manual can be obtained from the `https://www.air-avionics.com/` web site. Open the *Support* menu and search for the manual.

Connection

AT1 has a D-Sub 26 HD connector on its back side. This is a multi purpose connector and several devices may use it. Schematics shown on Figure A.25 shows only connections required to connect data port 3 on AT1 with Nesis. It is also assumed that Nesis will provide power for AT1.

In order to turn AT1 on, a switch between pins 22 and 23 is required. When switch is closed, AT1 is turned on and vice versa. Alternatively, pins 22 and 23 can be permanently connected. In this case, AT1 is powered on as soon Nesis is powered on.

A separate power line can be provided for AT1. In this case, do not connect pin 1 on AT1 with pin 1 on RJ12. However, pin 6 on RJ12 and one of GND pins on AT1 shall be connected.

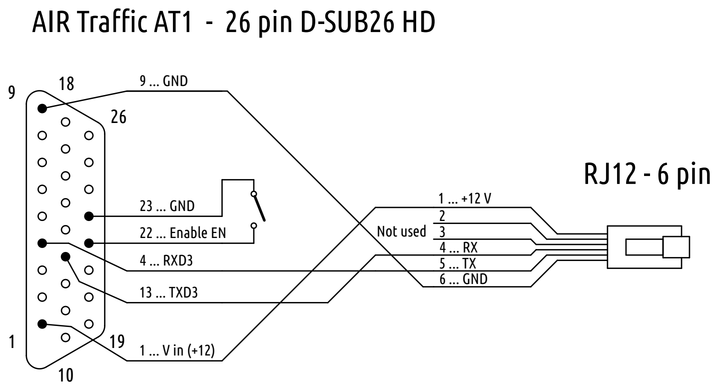


Figure A.25: Schematic connection for AIR Traffic AT1 device.

Configuration

The AT1 devices can't be configured with Nesis and one of the procedures from device's manual shall be used. The WiFi solution is shown next.

Turn the AT1 on. AT1 will act as an WiFi access point. Connect a computer, a telephone or a tablet to the *AIR-Traffic* SSID and establish connection per device's manual. Once connection is established, open the browser with correct URL address. Figure A.26 shows the situation after the connection was made and device data was synchronised.

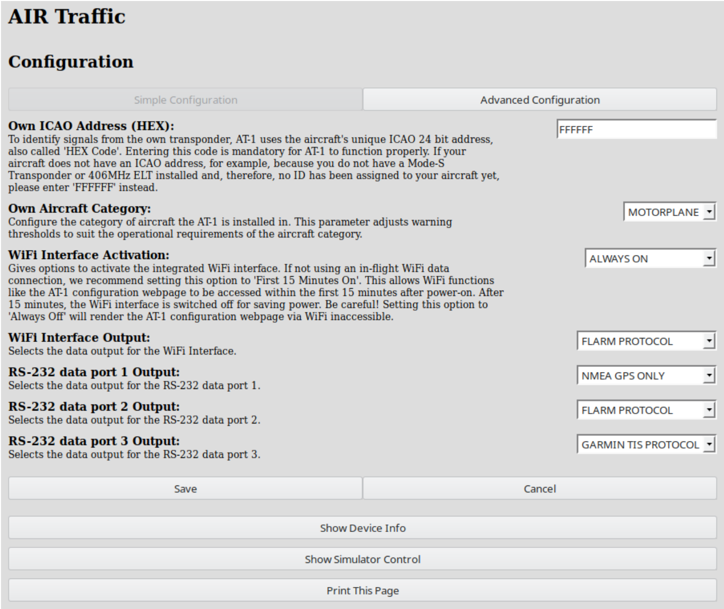


Figure A.26: Home page of the AT1 device. RS-232 data port 3 was not set yet.

Set the HEX code – *Own ICAO Address* of your transponder.

Nesis will connect to data port 3. Default protocol for port 3 is Garmin TIS protocol. This must be changed. At the same time we also recommend using higher baud rate. In order to change this, select the *Advance Configuration* button and scroll down until the RS-232 data port section. Figure A.27 shows settings we used.

1. Change the *RS-232 data port 3 Output* to FLARM PROTOCOL and
2. change the *RS-232 data port 3 RS-232 Data Rate* to 57600.
3. You can also experiment with *Range* and *Vertical Range* settings, but default values are OK.
4. Press the *Save* button to activate the changes.

Nesis requires a few seconds to detect new data rate and detect the format. This procedure is automatic.

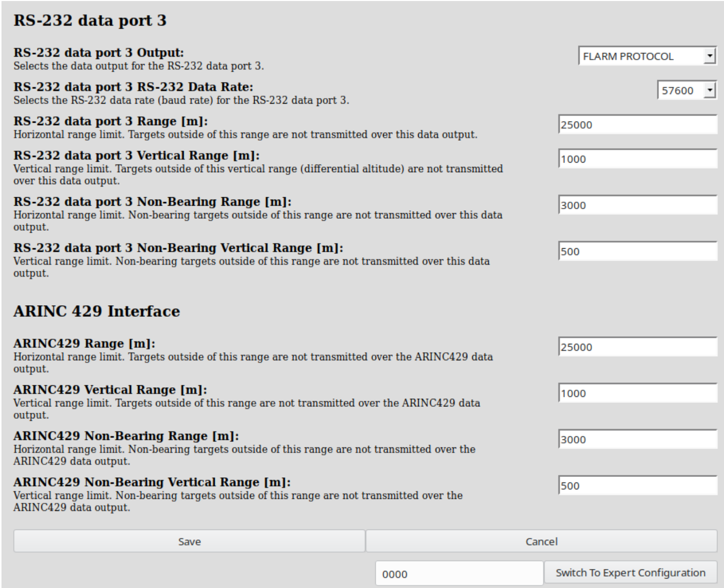


Figure A.27: Data port 3 settings required for the communication with Nesis.

A.6.2 AIR Control Display – ACD-57

Please read the *AIR Control Display 57 Installation Manual* before any connection is made to Nesis. The manual can be obtained from the `https://www.air-avionics.com/` web site. Open the *Support* menu and search for the manual.

ACD-57 may be used to connect radio and transponder at the same time. Currently we support the radio option only. In the future, we plan to add support for transponder as well.

A.6.2.1 Radio

Connect radio to ACD-57 according to the ACD-57 manual. Hereinafter we assume:

- ACD-57 Connector 1 is used for connection between ACD-57 and Nesis.
- ACD-57 Connector 2 is used for connection between ACD-57 and radio.

ACD-57 has a D-Sub 15 HD connector on its back side. This is a multi purpose connector. Schematics shown on Figure A.28 shows only connections required to connect data port 1 on ACD-57 connector 1 with Nesis.

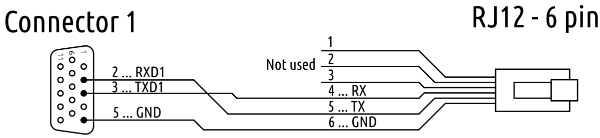


Figure A.28: Schematic connection between ACD-57 and Nesis.

Do not use Nesis to power ACD-57. ACD-57 together with radio/transponder exceed the power capabilities of Nesis serial port.

After connection was made, ACD-57 and Nesis must be configured properly.

1. Consult ACD-57 manual to activate the installation options – see the Pin Code Protection section. Once installtion is accessible, select the `DEVICE | INSTALLATION | DATA PORTS | CONTROL INTERFACE` menu. This opens a window where you set:
   - `PROTOCOL` to `AAV COM` – we are comunicating with radio only.
   - `DATA PORT` to `RS-232 1` – we are using data port 1.
   - `BAUDRATE` to `38400` – select some baudrate. See Figure A.29. You have to match this baudrate also in Nesis settings. Do not use *automatic* as this will not work with Nesis
2. Close all menus/windows. ACD-57 will restart in normal mode.
3. On Nesis select `Main menu | Options | Service | Settings | Serial ports` and select the port where ACD-57 was connected. Then select `ACD Radio` and use the same baudrate as in the previous step. This manual assumes a baud rate of 38400; however, alternative rates are supported, provided that both devices are configured to use the same value to ensure proper serial communication.
4. Close all windows. Nesis will restart. After the restart, connection should be established automatically.

Figure A.29: ACD-57 port configuration for radio communication (COM).

A.7 Flarm

A.7.1 Power Flarm

Please read the approprite Power Flarm Manual before any connection is made to Nesis. The manual can be obtained from the Flarm Technology Ltd web site. Nesis User Manual has one complete section devoted to Flarm based products. Please read this section as well.

A.7.1.1 Software Update

When you purchase your Flarm device, it is very likely that the pre-installed software has already expired. Please ensure that you update the software before use. To update the software:

- Download the latest version from the official Flarm website.
- Copy the update file to a USB stick.
- Restart the Flarm device with the USB stick inserted.

Detailed instructions are available on the Flarm website.

A.7.1.2 Configuration

In order to use Port 1 on the Flarm device, you have to activate it and set it properly. We suggest you to use the *Flarm configuration tool*, which is available from the `Support|Tools & Software` section of the Flarm web site.

From connection point of view, it is important to set:

- Data sentence on the RJ 45 connector – `GPS and Flarm`.
- Protocol version for the RJ45 connector – `Version 7` or later.
- Baud rate of the RJ45 connector – `115200` (or at least 57600).

Note however that this is not the complete configuration.

A.7.1.3 Connection

Power Flarm has two communication ports at the back side. Port 1 has RJ45 connector and port 2 has D-Sub 9 pin connector. This section describes connection to port 1.

The port 1 on Flarm has 8 pin RJ45 connector, while Nesis is using 6 pin RJ12 connector. The schematics in Figure A.30 shows meaning of individual pins and proper connection. 6 or 8 pin flat cable can be used. Pins 1 and 8 on the Flarm side can be left open, as well as pins 3 and 4.

Here we assumed that Power Flarm gets power from Nesis. Hence pin 2 on Flarm side and pin 1 on Nesis side must be connected as well. For the same reason GND pins must be connected too.

Note: The Flarm device can also be powered through the D-Sub 9 connector. You may use either the D-Sub 9 connector or RJ45 as the power source – but not both simultaneously.

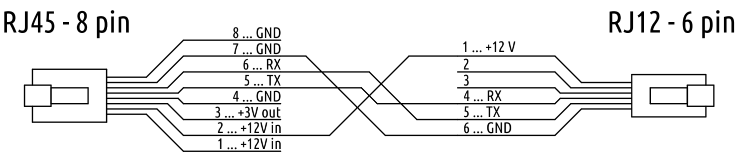


Figure A.30: Schematic connection for Power Flarm devices.

Once connected, execute `Main menu | Options | Service | Settings | Serial ports`, select proper port and set it to `Flarm family`. See Figure A.14b on page 145.

A.8 uAvionix

A.8.1 echoUAT

Please read the *echoUAT Manual* before any connection is made to Nesis. The manual can be obtained from the `https://uavionix.com/` web site.

echoUAT is a dual link receiver (1090 and 978 MHz) and UAT transmitter (978 MHz). echoUAT needs some external GNSS (GPS) source to function properly – the position data from the GNSS source will be used in ADS-B out transmitions over UAT channel.

A.8.1.1 Use in the US

FAA in the US requires that GNSS source is certified. Because Nesis GNSS is not certified, you are not allowed to use it as GNSS source.

When some certified GNSS source is used, echoUAT can provide ADS-B in data for Nesis (traffic information) via RS-232 cable.

Figure A.31 gives the connection details. When both devices are connected to the same power source, which is usually the case, then there is no need to connect GND (dotted line). Note that you have to supply some certified third party GNSS as well on pin 6 (COM 2).

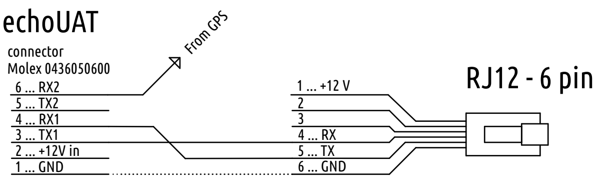


Figure A.31: echoUAT device connection schematc - US region.

echoUAT supports GDL90 protocol. Please configure the device to transmit data on COM 1, as it is shown on Figure A.32. From the Nesis point of view only settings in the orange rectangle are important. Rectangle on the left makes sure that both TIS-B (traffic on 1090 MHz) and FIS-B (uplink on 978 MHz) are received. The rectangle on the right configures COM 1 port as it is expected by Nesis.

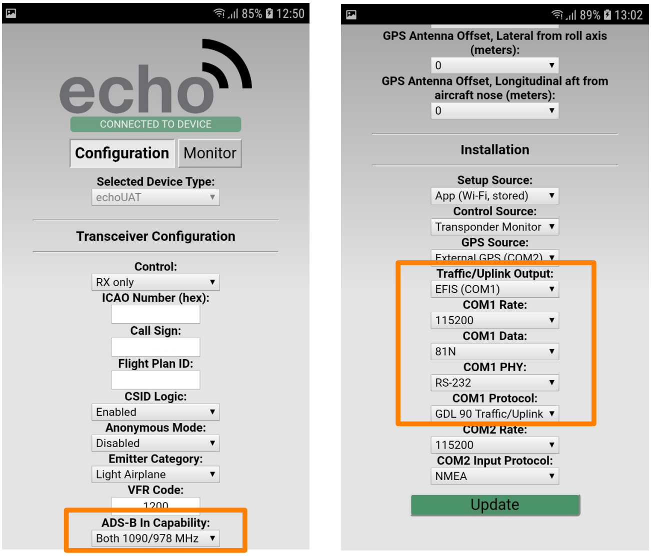


Figure A.32: echoUAT COM1 port configuration.

Port 2 in Figure A.36 shows how the port shall be configured to receive GDL90 data stream from echoUAT. Here connection to port 2 was used, but you can use any other port as well.

A.8.1.2 Use Outside the US

You can use echoUAT outside the US, however its potential is not fully utilized. Most non US countries do not have UAT ground stations to send/receive traffic on 978 MHz. This means that echoUAT only receives traffic info on 1090 MHz, where it monitors interogation responses from other aircraft equipped with suitable transponders.

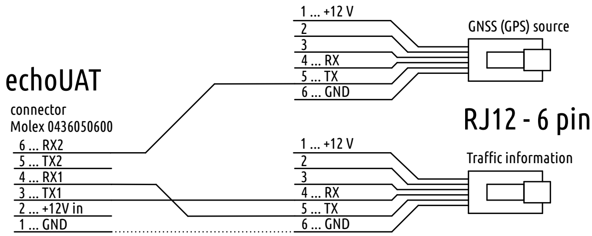


Figure A.33: echoUAT device connection schematic – outside US.

Figure A.33 shows connection with the Nesis. Here we connect two ports. echoUAT COM1 sends traffic information into Nesis, while echoUAT COM2 receives GNSS position from Nesis.

The COM1 port is configured as before, see Figure A.32. The COM2 port configuration is shown in Figure A.34.

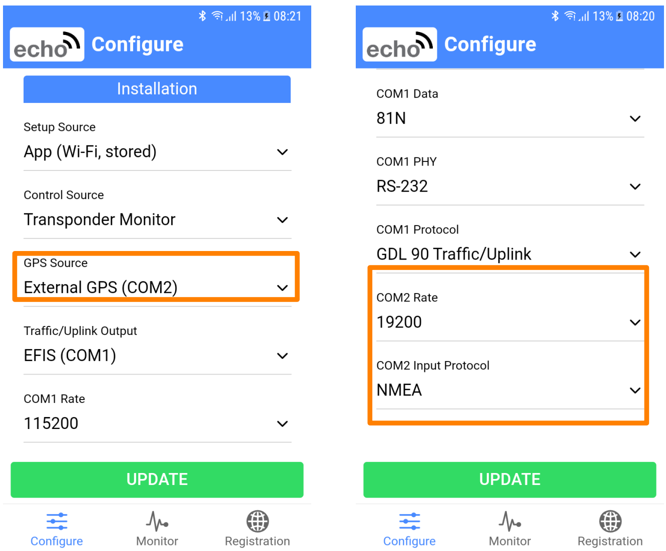


Figure A.34: echoUAT COM2 port configuration for NMEA in (outside the US).

Once connection is established, a check can be made. Open the `Monitor` page on the app and you should see something like shown in Figure A.35. Your coordinates and elevation will be different, of course.

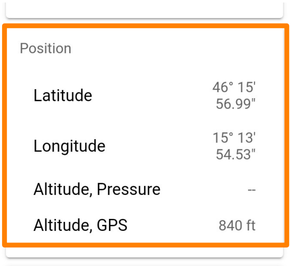


Figure A.35: echoUAT is receiving GNSS coordinates from Nesis. Note that pressure altitude is not being received, as it is not provided by Nesis in the NMEA stream.

Please note that we used 19200 bauds for COM2 in Figure A.34. Different rates can be also used. It is important that both Nesis and echoUAT are configured to the same rate.

As you see in schematic A.33, you shall use two ports in Nesis. One to communicate with echoUAT port COM1 and the other to communicate with COM2. Figure A.36 illustrates preferred port selection, though you can use any port you like. Here we used Nesis port 2 to connect to echo UAT COM1 and Nesis port 4 to connect to echoUAT COM2.

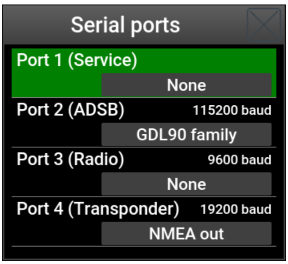


Figure A.36: Ports used in Nesis.

A.9 Garmin

A.9.1 AERA Family

Nesis allows you to connect with AERA family devices over the RS232 connection. For this you may need to purchase the AERA Aviation Bare Wire

Connector accessory. The bare wires are used to provide power for the AERA and also for comunication. The example in next subsections will be given for AERA 660. Other AERAs work on similar principles.

Please read the approprite AERA Manual before any connection is made to Nesis. The manual can be obtained from the `https://support.garmin.com/` web site.

A.9.1.1 Connection

In this example we are connecting to Serial Port 2 on AERA. Connection is made according to Figure A.37.

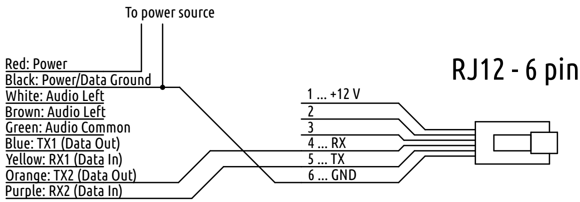


Figure A.37: Schematic connection to Serial Port 2 on AERA.

Do not use Nesis as a power source for AERA. AERA may overload the power capacity of the port.

A.9.1.2 Configuration

Once connected, navigate AERA menu `Main menu | Tools | Setup | Interface` and select:

`Serial Port:` Serial Port 2

`Serial Data Format:` NMEA Out, 9600 Baud

`NMEA Output Mode:` Normal

On the Nesis side, select `Main menu | Options | Service | Settings | Serial Ports` and set the connected port to `NMEA In`. In the example we used port 2, but any other port can be used instead.

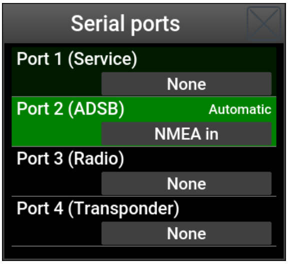


Figure A.38: Nesis serial port selection.

The baud rate on Nesis side will be automatically detected. Nesis listens on the port for the RMB messages (used for active waypoint navigation) and RTE, WPL messages, which are used to import flight plan.

The connection status is indicated by symbols on the top row. Figure A.39a appears when connection was established. Figure A.39b appears when Nesis is active in the *follow* mode – it is actively following current AERA waypoint.

(a) Connection established. (b) Follow active waypoint is in use.

Figure A.39: Connection status indication.

A.9.1.3 Commands

Once connection is alive, execute `Main menu | Navigation` and choose from:

- `Follow external direct to` to put Nesis into the follow mode. Any change of active waypoint on AERA is synchronized with Nesis.
- `Import external route` to import active AERA route into Nesis. Nesis activates the imported route as its own. Note: any subsequent change on AERA is NOT automatically reflected on Nesis.

A.10 Flight Data Systems

A.10.1 Carbon Monoxide – GD 40

This device is produced by Flight Data Systems `http://www.fdatasystems.com/gd-40-co-detector/`. It connects to Nesis via RS-232 port. A typical connection is shown on Figure A.40.

GD 40 consumes about 40 mA at 12V . This is low enough to be powered from Nesis port. Be careful however, as total power capacity of devices powered by Nesis is limited. If you are in doubt, some external power source shall be used instead.

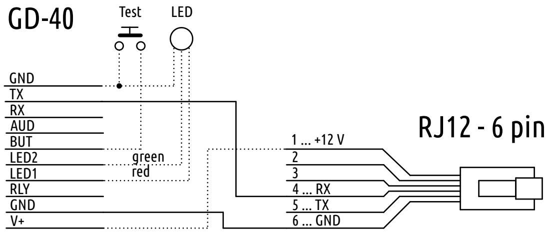


Figure A.40: Typical connection to GD-40 CO device.

GD 40 comes equipped with red/green warning led. This can be optionally connected according to schematics. Optional push button can be connected to GD 40. When pushed GD-40 commences a test procedure. GD 40 also drives a relay switch and outputs audio stream. Please refer to the GD 40 manual for more details `http://www.fdatasystems.com/s/GD_40_Manual.pdf`.

A.11 Obsolete Devices

A.11.1 TRX 1500

Please read the *TRX-1500A User and Installation Manual* before any connection is made to Nesis. The manual can be obtained from the `https://www.air-avionics.com/` web site. Open the *Support* menu and then select *Old & Discontinued Products*.

Connection

TRX 1500 has a 15 pin three row main connector at the back side. The connector provides power supply to the unit and several I/O ports.

As TRX 1500 uses only one connector for several ports, the schematics on Figure A.41 shows two cables comming out of the main connector. The bottom one connects to Nesis serial port, while to top cable is optional and can be connected to one of optional Flarm displays.

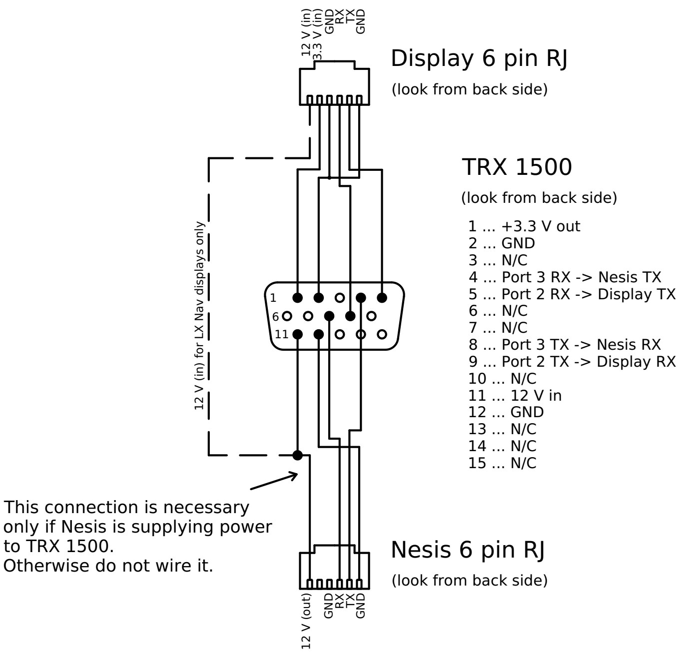


Figure A.41: Schematic connection for TRX 1500.

The schematic assumes that Nesis will be connected on port 3 and optional display on port 2.

Some displays require 12 V for their operation. In this case Pin 11 shall be also connected with the display connector.

Configuration

TRX 1500 can't be configured with the Nesis. A PC computer with TRX-Tool software and USB connection must be used instead. See TRX 1500 documentation for details.

We recommend the configuration as shown on next figures. Figure A.42 shows the *general* page. If you have a transponder on your aircraft, enter the transponder ICAO address into the *ICAO Mode-S address (hex)* field.

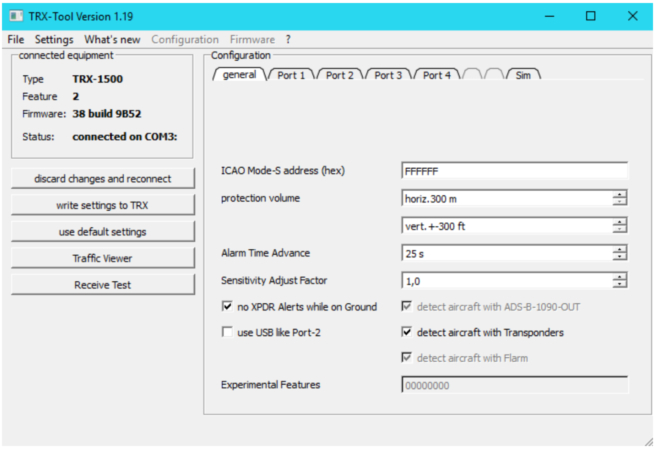


Figure A.42: TRX 1500 general settings page. Enter correct transponder ICAO address here.

Figure A.43 shows typical settings for Port 2, where optional LCD display may be connected.

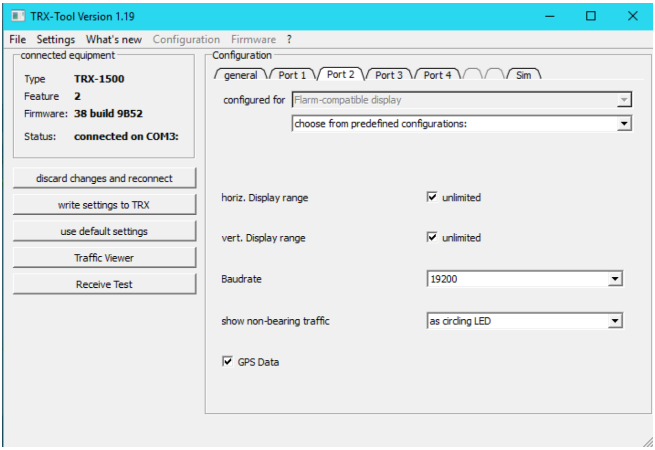


Figure A.43: TRX 1500 port 2 settings page. Port is connected to display.

Figure A.44 shows settings used to connect Nesis on the port 3.

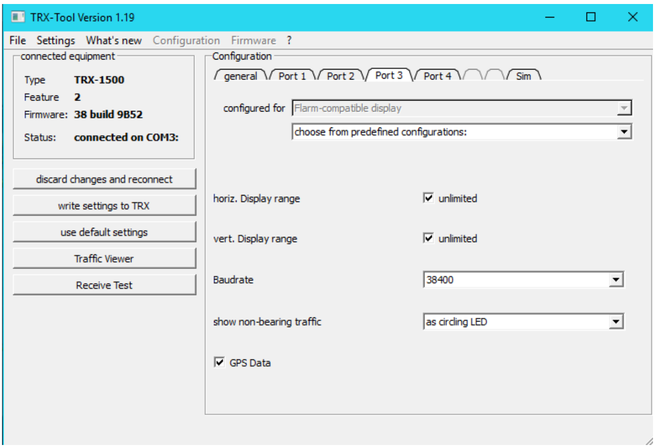


Figure A.44: TRX 1500 port 3 settings page. Port is connected to Nesis.

Different settings may suit your needs better. Feel free to experiment. If something goes wrong, you may return to the settings shown on the Figures A.42 to A.44.