

Amigo — Manual

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Revision 2.0

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

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Revision History

The following table shows the revision history of this document.

Rev.	Date	Description
1.0	June 2018	Initial release
2.0	October 2020	Servo motor settings and tuning capabilities, new screenshots, new definitions, prepared to work with Horis and Emsis as well.

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1 Introduction

First of all, we would like to thank you for purchasing our Amigo. Amigo is an electronic device, which enhances autopilot functionality. Amigo can not act alone and it must be combined with some other Kanardia device. This can be Nesis, Aetos, Horis and Emsis PFD. In addition, it must be connected with autopilot servos.

This manual describes the technical description, operation, installation and tuning.

1.1 Icons Used Trough 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.



This icon denotes background information about the subject.



This icon denotes an installation tip.

1.2 General Description

Amigo is an electronic device which is used as a remote unit for Kanardia autopilot system. It serves for easy changing of the autopilot parameters like desired track and altitude. It is also used for autopilot tuning.

Amigo can not work standalone and it must be connected with other Kanardia devices to exchange information. You can not use third party devices. The connection is made with a CAN bus. Typically, Amigo is connected with:



- Nesis, Aetos, Horis or Emsis PFD device. They all host an AD-AHRS-GPS device internally, which is essential for proper AP operation. The AD-AHRS-GPS device provides attitude, altitude, airspeed, heading and GPS data required by an autopilot.
- Two servomotors, which are connected to the command system in order to steer an aircraft.

Amigo has a high-brightness IPS LCD display. The panel has two rotary-push knobs and two simple buttons, which are used to operate Amigo.

On the back side, Amigo has two primary CAN bus connectors, which allow simple autopilot integration. A RS232 connector is also provided for possible future extension of Amigo functions. It also host two secondary CAN connectors, which are reserved for future use, too.

1.3 Technical Specification

Table 1 shows some basic technical specification of Amigo autopilot controller.

Description	Value
Weight	170 g
Size	100 × 48 × 30 mm
Operational voltage	7 to 32 V
Power consumption	2.4 W
Current	200 mA at 12 V 100 mA at 24 V
Operating temperature	-30 ~ +85 °C
Humidity	30 ~ 90 %, non condensing
Communication	CAN bus, 29 bit header, 500 kbit, Kanardia protocol

Table 1: Basic technical specifications for Amigo.

Figure 1 shows vertical version of Amigo. Amigo exists also in horizontal version. From technical point of view are both versions are identical.

2 Operation

2.1 General Precautions



The approved Pilot's Operating Handbook (POH) always supersedes the information in this manual.

Refer to the approved Pilot's Operating Handbook (POH) for emergency procedures.



Figure 1: Front and side view of the Amigo with its principal dimensions. Dimensions are given in mm. Figure is not in scale!

2.2 User Interface

Amigo user interface was carefully designed with an ease of operation in mind. The result is a device with only two rotary knobs and two push-buttons which provide an easy access to most commonly used autopilot functions.

LCD display is divided in two parts. The top part (or the left part) refers to the lateral modes (directional modes) and the bottom part (or the right part) refers to vertical modes (altitude modes).

Figure 2 illustrates knobs, push buttons and LCD screen division.

- ① Lateral knob – TRK: Rotating the knob changes the reference track.
- ② Navigation mode – HNAV: Short press on the button activates the horizontal navigation mode. The navigation data for this mode must come from some other device, Nesis for example. If such data is not available the command is ignored.
- ③ Vertical knob ALT: Rotating the knob changes the target altitude. The knob is also used for selections.
- ④ Option knob – OPT: Short press on the key selects the optional parameter for vertical mode – vertical speed. This is the target vertical speed to be used during climb or descent towards the target altitude.

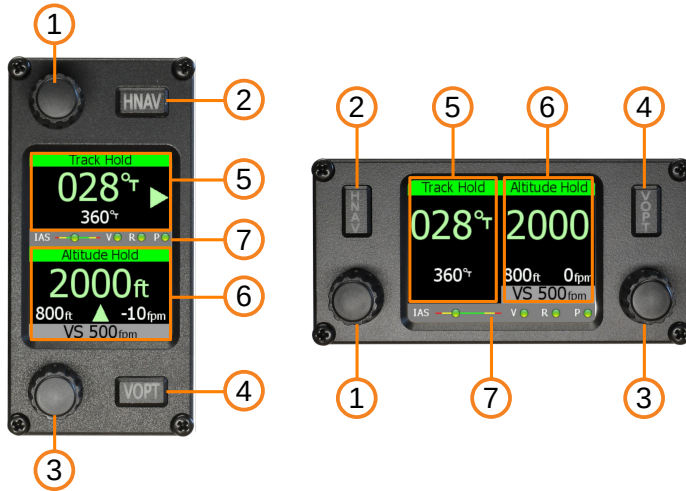


Figure 2: Amigo controls and screen layout.

- (5) Lateral info: This part of LCD display shows lateral mode information.
- (6) Vertical info: This part of LCD display shows vertical mode information.
- (7) Status line: Displays status of the autopilot limiting conditions.

2.3 Status Line

Amigo LCD screen always displays status line in the middle for vertical orientation or in the bottom right for horizontal orientation. The status line tells if conditions for the AP operations are met. Figure 3 shows an example.



Figure 3: The status line.

- IAS ... shows a small slider. If indicated airspeed is within limits for the AP operation, the slider will be green. When the airspeed is close to the either limit, but still inside the valid range, the slider will become yellow and when it is outside limits, it will be red.

- **V** ... stands for vertical speed. Same logic as for IAS applies also here. If current vertical speed is within limits, the light is green, close to limits the light becomes yellow (amber) and outside limits the light is red.
- **R** ... stands for roll angle. Again, green, yellow and red lights are shown.
- **P** ... stands for pitch angle. It can be green, yellow or red.

When any of the above mentioned parameters is red and autopilot is engaged, the autopilot refuses to take control. Also, when AP is active and any of the status parameters becomes red, the autopilot will automatically disengage both servo motors. An error window is shown, which explains why the autopilot is not accessible.



Please refer to the Autopilot manual for more details on how to set the parameter limits.

2.4 Autopilot Lateral Modes

Amigo consists of two lateral modes: track hold (TRK) and horizontal navigation (HNAV). Default lateral mode is the track hold mode, which is displayed every time Amigo powers up.

- To activate TRK mode, rotate the TRK knob – this will change the reference track and immediately active the track hold mode.
- To activate horizontal navigation mode, short press the HNAV button. The AP will now follow horizontal navigation from some other device (Nesis or Aetos are required).

2.4.1 Track Hold Mode – TRK

In short, TRK engages roll servo motor to maintain selected reference track. When a TRK mode is inactive the first increment/decrement of the TRK knob sets the current track value for the reference and automatically engages roll servo motor. Any following rotation of the TRK knob changes the reference heading value:

- Reference track value can take values from 1 to 360° with 1° resolution.
- Rotating the TRK knob clockwise increments the reference track.

- Rotating the TRK knob counterclockwise decrements the reference track.
- Moderate rotation of the TRK knob gives 1° /step change.
- Rapid rotation of the TRK knob gives 10° /step change.
- A navigation rose is shown during HDG knob rotation, Figure 4.



Figure 4: Navigation rose is shown for more intuitive track selection. Current track points upwards and orange needle points to a new track selection.

Short press on the TRK knob disengages roll servo motor (when servo was active) and another short press on the TRK knob engages the servo with previous reference heading value.

Figure 5 illustrates heading hold situation on the upper part of the LCD display.

- ① Target track. This value changes with TRK knob rotation.
- ② Current aircraft tracking.
- ③ Steering arrow points into direction where AP shall turn. Right arrow appears on the right side and left arrow on the left side. Size of the arrow depends on the course deviation. When deviation is small, the arrow disappears.

2.4.2 Horizontal Navigation (HNAV)

Short press on a HNAV key engages the Horizontal Navigation (HNAV) mode. This mode selects Nesis or Aetos (or some other device, which can act as

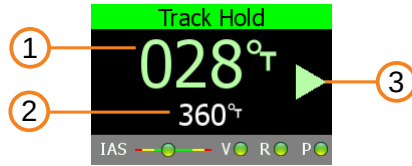


Figure 5: Upper part of the LCD display in the Track Hold mode.

a source) as a primary navigation source. The autopilot follows some pre-planned route or fly to a direct-to waypoint. It also engages roll servomotor if it is inactive. The HNAV mode takes care the direction only – it does not set or commands the altitude. In order to change an altitude use ALT control.

HNAV mode can be disengaged by pressing the HNAV button or by pushing HDG button.

The HNAV button is illuminted in one of three colors:

White color means that HNAV information is not available. Pressing the HNAV button will have no effect.

Orange color means the HNAV information is available. Pressing the HNAV button will activate HNAV mode.

Green color means that HNAV information is available and active. Pressing HNAV button will switch to the Track Hold mode.

When HNAV mode is active it will remain active as long as some source device provides required track. If the source stops transmitting this information, autopilot switches into the Track Hold mode. The reference track is the GPS track at the time when this switch happens.

2.5 Autopilot Vertical Modes

For the time being, the only vertical mode is the Altitude hold (ALT) mode.

2.5.1 Altitude Hold (ALT)

Altitude Hold mode (ALT) engages pitch servo motor to maintain selected reference altitude.

When ALT mode is inactive the first increment/decrement of the ALT knob sets current altitude (it rounds it to nearest 10 ft or meters) as a reference



altitude hold. It also engages the pitch servo motor. Any following rotation of the knob changes the reference altitude:

- Reference altitude can take values from 0 to 20000 ft (6000 m) with 10 ft (or 10 m) resolution.
- Rotating the ALT knob clockwise increments reference altitude.
- Rotating the ALT knob counterclockwise decrements reference altitude.
- Moderate rotation of the ALT knob gives 10 ft/step (10 m/step) change.
- Rapid rotation of the ALT knob gives 100 ft/step (100 m/step) change.

Short press on ALT knob pauses altitude hold mode (if altitude hold mode is engaged) and disengages the pitch servo motor. Another short press on ALT knob reengages the pitch servo motor with previous reference altitude.

ALT mode has an additional parameter vertical speed (VS) which defines the maximum vertical speed which Amigo will use to maintain or climb/descent to reference altitude level. Default VS value is 500 ft/min. Short press on OPT key displays VS parameter dialog. Rotate the ALT knob to change the vertical speed value:

- Vertical speed parameter for altitude hold mode can take values from 100 ft/min to 1000 ft/min with 100 ft/min resolution.
- Rotating the ALT knob clockwise increments vertical speed parameter value.
- Rotating the ALT knob counterclockwise decrements the vertical speed parameter value.
- Rotation of the ALT knob gives 100 ft/min per step change.

Dialog will close automatically about 7 seconds after the last change of the parameter.

During the altitude transition Amigo will try to maintain the vertical speed as close as possible to the defined vertical speed. Due to aircraft performance limitations (engine power, trim position, flight configuration, altitude, weight, etc.) it might happen that the actual vertical speed will be significantly lower than the maximal defined vertical speed.

Figure 6 illustrates the information of the Altitude Hold mode.



- ① Target altitude hold.
- ② Current altitude.
- ③ Climb, descent marker. The marker size depends on the difference between current altitude and target altitude.
- ④ Current climb/descent rate.
- ⑤ Target climb/descent rate.

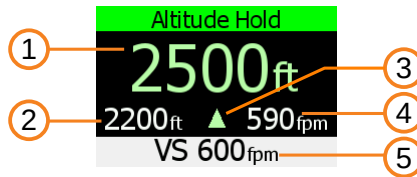


Figure 6: Lower part of the LCD display in the Altitude Hold mode.

2.6 External Button Operation

An external push button can be connected to the AUX port. See section 5.3.1 for details about connection.

- A short press on the external button disconnects autopilot.
- A long press on the external button activates autopilot Track Hold mode and Altitude hold mode. Current track and altitude are used for reference.

2.7 Disengaging The Autopilot

Autopilot servo motors can be disengaged in several ways. For more exhaustive list, please refer to the Autopilot Installation manual.

- A short press on TRK knob while the lateral hold mode is active disengages roll servo motor.
- A short press on ALT knob while the altitude hold mode is active disengages pitch servo motor.

- A press on AP button on Joyu control stick disengages both servo motors. Note: Joyu must be properly configured first.
- An external button can be connected to the AUX port. It is usually mounted on command stick or on steering wheel. A press on this button will disengage both servo motors.
- Power line for both servo motors must be routed via a circuit breaker switch. Turning off the circuit breaker will disengage both servo motors.

2.8 Options

Pressing the ALT knob for about two seconds opens the **Options** window as shown on Figure 7. This window allows:

- Quick change of LCD brightness. Note that the change of brightness affects all Kanardia displays connected to the same CAN bus. A change on Amigo will also change brightness on Nesis/Aetos/Horis/Emsis, etc.
- The **Settings** option opens a new window, where user settings can be accessed. These settings affects Amigo only. See section 3.
- The **Autopilot** options open access to various autopilot settings, options and tuning windows. Use this with care. It shall not be used on normal operation. It shall be only used during autopilot tuning. See section 4.

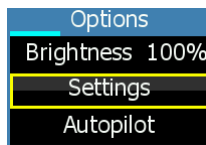


Figure 7: Options window.

3 Settings

The **Settings** window gives access to some Amigo specific settings as it is shown on Figure 8.

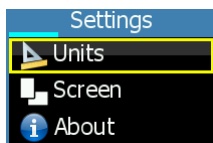


Figure 8: Settings window.

3.1 Units

The following units can be selected. Note that this unit selection affects Amigo only. Other devices connected to the CAN bus are not affected.

- Direction: true or magnetic.
- Altitude: feet or meters.
- Vertical speed: feet/min or m/s.
- Airspeed: kts, km/h or mph.

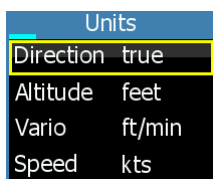


Figure 9: Units window.

3.2 Screen

The screen options defines the screen layout orientation: portrait or landscape. See Figure 10.

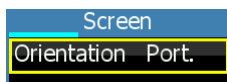


Figure 10: Screen orientation selection.

3.3 About

The About window shows some information about Amigo; its serial number, software version and software creation date. In addition, it shows information about all devices connected to the CAN bus. Left of the colon is the device name and hardware version, right of the colon are software version, development version in parenthesis and serial number.

Turn the ALT knob to see all the units connected to the CAN bus.



Figure 11: About window.

4 Autopilot

The autopilot window is used to set and tune various autopilot parameters. It shall not be used in normal operation. This window shall be accessed only during autopilot setup, setting and tuning. Figure 12 show all five options.



Any accidental change of any of parameters in this section and subsections may result of autopilot being inoperative.

The description of all these autopilot items is given in a separate manual, *Autopilot Installation Manual*. No further details are given here.



Figure 12: Autopilot window options. Two windows are shown as all options do not fit into one.

5 Installation

Amigo requires 48 x 100 mm chamfered slot in the instrument panel, see figure 13. Position of the slot must ensure good access for knob and button operations and must always be visible from the pilot's perspective.

Carefully cut the slot. The slot must be tight. There is only about 1 mm margin between the slot edge and the Amigo panel end – there is almost no room for an error.

5.1 Mounting Procedure

The mounting screw holes are located at all four corners of the Amigo front panel. The device is mounted using four screws type M3. To prevent internal stresses, please make sure that the instrument panel is flat. It is highly recommended that the instrument panel is mounted using rubber shocks, which reduce the vibrations. Figure 13 illustrates the mounting hole.

Remove the mounting screws from the device. Insert the device from the front side of the instrument panel and fix it with all four screws.

Due to better access it is normally more convenient to connect all cables at the back of Amigo before fixing it into the instrument panel.



5.2 Connections

Figure 14 shows Amigo's back side with all connection ports.

POWER connection is seldom used. Amigo has a very modest power consumption and thus it get power from the CAN bus. However, it can be also powered from the power connector.

Secondary CAN Not in the use for the moment. Reserved for the future use.

Primary CAN is our standard CAN connector. Use standard RJ45 Ethernet cable. Two CAN ports are provided so that devices can be daisy-chained. This connector must be used to connect Amigo to main CAN bus Nesis, Aetos and servos.

AUX – This is a multipurpose D-SUB 9 port. Currently only remote autopilot switch can be connected. More functions will be available with future SW versions.

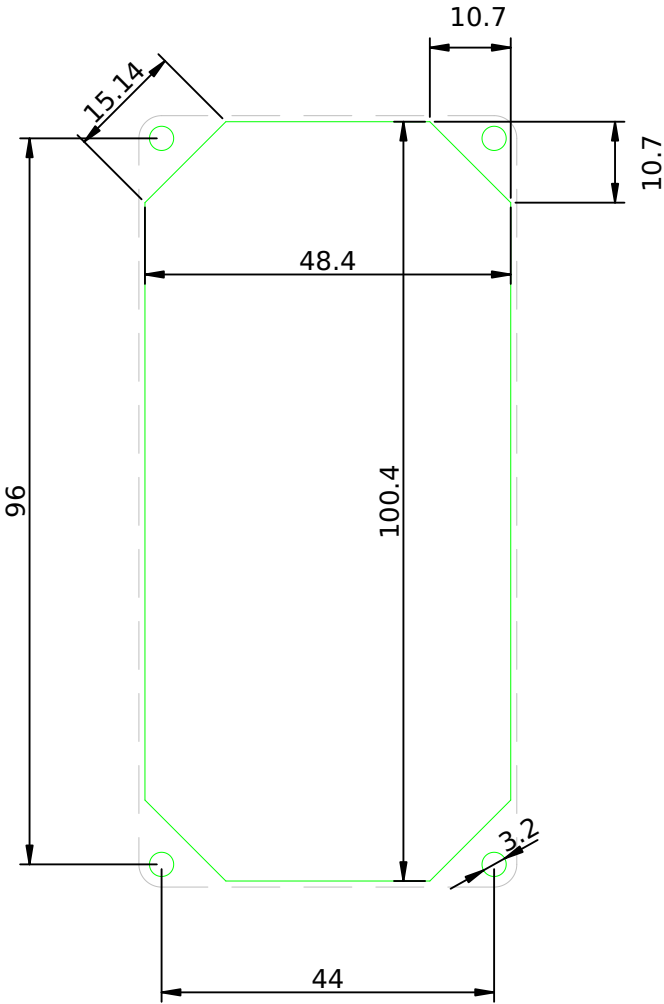


Figure 13: Instrument panel cutout and mounting holes. Dimensions are in millimeters. Some tolerance has been already incorporated. Warning: Figure may not be in scale.

5.3 The AUX Port

This is a multifunction port in a form of standard D-SUB 9 connector. An external push button and RS-232 communication can be connected. Table 2

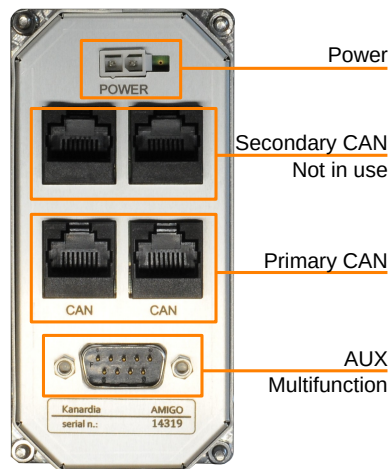


Figure 14: Back side of Amigo with connection ports.

defines port pins and Figure 15 defines the pin numbers.

Table 2: Description of the AUX port pins.

Pin	Description
1	NC
2	RX (RS-232)
3	TX (RS-232)
4	GND
5	GND (RS-232)
6	NC
7	NC
8	External button
9	12 V output, max 100 mA

5.3.1 External Button

An external button push button can be connected to the AUX port. When pin 8 is on contact with ground (GND on pin 4) Amigo detects that external button has been pressed. Figure 16 illustrates the connection.

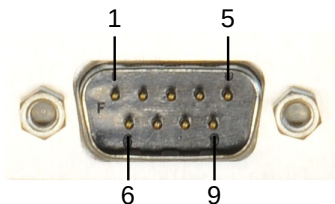


Figure 15: Back side of Amigo with connection ports.

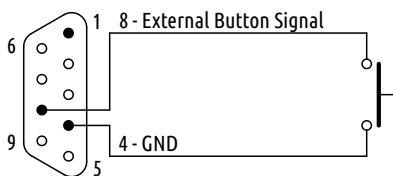


Figure 16: External buttons connection schematics.

6 Maintenance & Repair

No special maintenance is required. Amigo has no serviceable parts inside. In the case of malfunction, it must be sent to factory for a repair.

7 Limited Conditions

Although a great care was taken during the design, production, storage and handling, it may happen that the Product will be defective in some way. Please read the following sections about the warranty and the limited operation to get more information about the subject.

7.1 Two Years Warranty

Kanardia d.o.o. warrants the Product manufactured by it against defects in material and workmanship for a period of twenty-four (24) months from retail purchase.

Warranty Coverage

Kanardia's warranty obligations are limited to the terms set forth below:

Kanardia d.o.o. warrants the Kanardia-branded hardware product will conform to the published specification when under normal use for a period of twenty-four months (24) from the date of retail purchase by the original end-user purchaser ("Warranty Period"). If a hardware defect arises and a valid claim is received within the Warranty Period, at its option and as the sole and exclusive remedy available to Purchaser, Kanardia will either (1) repair the hardware defect at no charge, using new or refurbished replacement parts, or (2) exchange the product with a product that is new or which has been manufactured from new or serviceable used parts and is at least functionally equivalent to the original product, or, at its option, if (1) or (2) is not possible (as determined by Kanardia in its sole discretion), (3) refund the purchase price of the product. When a refund is given, the product for which the refund is provided must be returned to Kanardia and becomes Kanardia's property.

Exclusions and Limitations

This Limited Warranty applies only to hardware products manufactured by or for Kanardia that have the "Kanardia" trademark, trade name, or logo affixed to them at the time of manufacture by Kanardia. The Limited Warranty does not apply to any non-Kanardia hardware products or any software, even if packaged or sold with Kanardia hardware. Manufacturers, suppliers, or publishers, other than Kanardia, may provide their own warranties to the Purchaser, but Kanardia and its distributors provide their products *AS IS*, without warranty of any kind.

Software distributed by Kanardia (with or without the Kanardia's brand name including, but not limited to system software) is not covered under this Limited Warranty. Refer to the licensing agreement accompanying such software for details of your rights with respect to its use.

This warranty does not apply: (a) to damage caused by use with non-Kanardia products; (b) to damage caused by accident, abuse, misuse, flood, fire, earthquake or other external causes; (c) to damage caused by operating the product outside the permitted or intended uses described by Kanardia; (d) to damage caused by service (including upgrades and expansions) performed by anyone who is not a representative of Kanardia or an Kanardia Authorized Reseller; (e) to a product or part that has been modified to significantly alter functionality or capability without the written permission of Kanardia; (f) to consumable parts, such as batteries, unless damage has occurred due to a defect in materials or workmanship; or (g) if any Kanardia serial number has been removed, altered or defaced.

To the extent permitted by applicable law, this warranty and remedies set forth above are exclusive and in lieu of all other warranties, remedies and conditions, whether oral or written, statutory, express or implied, including, without limitation, warranties of merchantability, fitness for a particular purpose, non-infringement, and any warranties against hidden or latent defects. If Kanardia cannot lawfully disclaim statutory or implied warranties then to the extent permitted by law, all such warranties shall be limited in duration to the duration of this express warranty and to repair or replacement service as determined by Kanardia in its sole discretion. Kanardia does not warrant that the operation of the product will be uninterrupted or error-free. Kanardia is not responsible for damage arising from failure to follow instructions relating to the product's use. No Kanardia reseller, agent, or employee is authorized to make any modification, extension, or addition to this warranty, and if any of the foregoing are made, they are void with respect to Kanardia.

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7.2 TSO Information — Limited Operation

This product is not TSO approved as a flight instrument. Therefore, the manufacturer will not be held responsible for any damage caused by its use.

The Kanardia is not responsible for any possible damage or destruction of any part on the airplane caused by default operation of instrument.