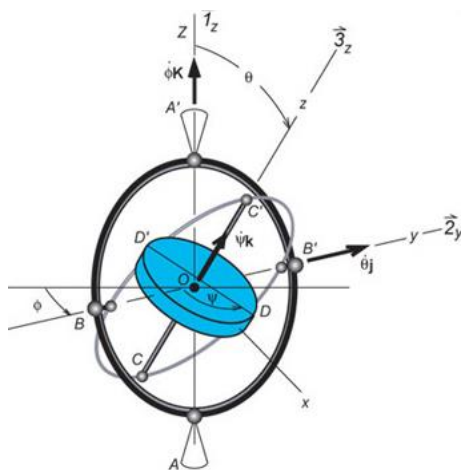


ALPHAMINICOURSE ***Gyro Compass***

Installation and Operation MANUAL



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Document : Manual ALPHAMINICOURSE
Issue : 3.0
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CAUTIONARY NOTICES

Please note the following cautionary notices that apply throughout this Manual.

WARNING

The ALPHAMINICOURSE weighs 12,5 kg. To avoid personal injury, take proper precautions if the equipment is lifted or moved.

CAUTION!

The ALPHAMINICOURSE includes precision components and bearings. To avoid damage of any part of the gyro compass/ handle all items with care.

During gyro compass transportation follow the requirements specified in chapter 7.

Retain the original transit cases so they can be used to transport the gyro compass when necessary. One will void the warranty if improper packing during transportation is used.

CAUTION!

It is forbidden to move the switched off gyro compass while rotor is still spinning! Always allow a period of 5 minutes after you power-off the gyro compass for the gyro rotor to stop spinning. Non-observance of this requirement may be the reason of gyro compass damage.

CAUTION!

During operation gyro compass must remain level within $\pm 45^\circ$. If its tilt is more than 45° in any direction, it will 'topple'. Built-in test system will then power-off the gyro rotor and show alarm conditions on the Control Unit. To restore normal operation, level the gyro compass and then restart it.

Do not tilt gyro compass for more than 45° with the gyro rotor spinning or during the gyro compass run-up. Note that the gyro rotor continues to spin for five minutes after you power-off the system.

CAUTION!

If the gyro compass is placed in an enclosed space, make certain there is sufficient ventilation and circulation of free air to allow effective cooling.

CAUTION!

Do not make any connections to the gyro compass with power on the supply cable.

CAUTION!

DO NOT modify this equipment in any way without obtaining a written permission from ALPHATRON MARINE otherwise you will void the warranty.

CAUTION!

One will void warranty for operating the gyro compass in conditions different from those specified in the chapter 5 and in IEC 60945-2002.

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1 WARRANTY



Following the installation of the Alphaminicourse either a copy of the Installation / Commissioning report or the Warranty Registration Form is to be sent to Alpatron Marine in Rotterdam (Alphaline@alpatronmarine.com) within two weeks. Carefully note that the Installation / Commissioning report should cover at minimum the information as requested on the Warranty Registration Form. The Warranty Registration Form can be found in chapter 11. One should obey this procedure to validate the warranty.



Following the installation of the Alphaminicourse a Gyro Settings Registration Form is to be sent to Alpatron Marine in Rotterdam (Alphaline@alpatronmarine.com) together with the Warrant Registration Form. This information is requested for presetting a reconditioned Alphaminicourse before it is replaced. The Gyro Settings Registration Form can be found in chapter 12.

2 INTRODUCTION

The Gyro compass (GC) Alphaminicourse is designed for determination of the ship heading relative to geographic meridian in the gyro compass (GC) mode and the trajectory deviation angle in the directional gyro (DG) mode.

Specification of the Alphaminicourse makes it ideal for installation and operation on the vessels of almost any size and various applications.

Among the features of the Alphaminicourse are:

- ❑ Short settling time
- ❑ Operation from 24V DC electrical supply

This Manual is an important part of the Alphaminicourse. It describes the gyro compass and contains full installation and operating instructions. You should retain the Manual with the gyro compass for use by personnel who will install and operate it.

Installation and operation of the Alphaminicourse are no complex tasks. However, it is necessary to familiarize with the contents of this Manual before you start to install and use the gyro compass. Time spent in identifying the test sequence now will ensure your gyro compass is operational in the minimum time.



WARNINGS

Where appropriate, this Manual includes important safety information highlighted as **WARNING** and **CAUTION** instructions. One should obey these instructions:

WARNING instructions alerts one to a potential risk of death or injury to users of the gyro compass.

CAUTION instructions alerts one to a potential risk of gyro compass damage.

For one's convenience, the section Introduction includes all the cautionary notices of this Manual.

All measurements in this Manual conform to SI standard of units unless otherwise indicated.

Before gyro compass installation read sections 2 and 3:

Chapter 2 contains introductory notes and describes standard features.

Chapter 3 includes full instructions for safe and proper installation of gyro compass and its connection to external equipment.

Before you use the gyro compass read sections 4 and 5:

Chapter 4 describes gyro compass operation.

Chapter 5 contains gyro compass specifications and description of data formats.

If you suspect a fault, read section 6:

Chapter 6 contains information on gyro compass maintenance and diagrams.

Chapter 7 includes requirements for gyro compass transportation.

Chapter 8 includes requirements for gyro compass storage.

For service of the manual read section 9:

Chapter 9 contains information on the servicing of the gyro compass.

2.1 Gyro compass Description

The Alphaminicourse comprises the Main Unit with the Control Unit as an integrated part. The Control Unit may be integral or remotely placed.

Figure 1.1 shows the general view of the gyro compass with the integral Control Unit. Due to the physical principles of north-seeking gyro compass, achievable accuracy depends on the operating latitude and the vessel dynamics. To decrease the heading error the Alphaminicourse uses information supplied by external equipment, for example a GPS receiver and a speed log, to apply latitude and speed corrections.

2.1.1 Main Unit of gyro compass ALPHAMINICOURSE



The Main Unit comprises the following sub-assemblies:

- ❑ High precision dynamically tuned gyroscope and gimbal suspension.
- ❑ Power supply board.
- ❑ Digital and analog control boards.
- ❑ RFI filter.

A Gyro compass installation is a relatively simple operation and you should be able to accomplish this quickly without the need for specialized personnel or equipment. However, don't forget that the gyro compass weighs 12,5kg and you must take due care when you lift or move it.

Figure 2.1 – Main Unit with remote Control Unit

Accuracy of alignment of the gyro compass housing with the surveyed fore-aft axis of the vessel will have a direct impact on the accuracy of the Alphaminicourse heading measurements. Since the Alphaminicourse is the main source of heading information for other systems on board, such as radars, satellite communication antennas, etc., its heading determination error will influence the operation of all ship-borne systems. Therefore you should take care when you install and align gyro compass. Refer to section 2 for full instructions on the Alphaminicourse installation, connection and alignment.

The only component available for user servicing is a 3,15A fuse. In case of failure, refer to chapter 6 for instructions.

2.1.2 Control Unit

The Control Unit (CU) provides all the functions and indicators necessary to control and operate the Alphaminicourse.



The four-character LED can show the following information:

- ❑ Heading in degrees from 0.0 to 359.9
- ❑ Latitude from 89S to 89N
- ❑ Latitude source
- ❑ Speed in knots from 0 to 90
- ❑ Speed source
- ❑ Alarms and status information
- ❑ Separate LED indicators show presence of power and readiness of gyro compass for operation

Refer to section 4 for instructions to operate the Alphaminicourse.

2.1.3 Auxiliary Inputs

Auxiliary inputs may be used for the Alphaminicourse speed and latitude correction.

Ideally, the Alphaminicourse should accept latitude and speed information from external sources such as a GPS receiver or a speed log. However, you may input this information manually if external sources are not available. The advantage of using GPS or a speed log to provide correction signals is that they allow automatic corrections to be applied without operator intervention.

Chapter 3 includes instructions to connect and configure the external sources of latitude and speed information.

Chapter 4 includes instructions to set latitude and speed manually.

2.1.4 Heading Outputs

The Alphaminicourse is a self-contained precision navigation instrument capable of supplying heading reference information simultaneously to a wide range of equipment located on board the vessel. On a typical vessel heading information is used by:

- ☐ Autopilot
- ☐ Radars
- ☐ Radio direction finder
- ☐ Course plotter and course recorder
- ☐ Satellite communication systems
- ☐ Satellite television

To support this wide range of equipment, the Alphaminicourse can supply heading information simultaneously through multiple channels using any of the common transmission formats.

Refer to Chapter 4 for a description of the available outputs and their data formats.

2.2. Principle of Operation

In the absence of external influences, a free-spinning gyroscope rotor will try to maintain a fixed orientation in space. The Alphaminicourse exploits this property and uses earth gravitational attraction and rotation to align the gyroscope spin axis with the meridian, i.e. in the true north direction.



NOTES:

Handwritten notes area consisting of 30 horizontal lines.

3. INSTALLATION

To obtain the best performance from the Alphaminicourse you must take care when you install and connect it. This section includes all the information and instructions you will need to complete these tasks.

You should read this section carefully and understand the important instructions that it contains before you begin to install or connect the equipment.

3.1 Unpacking and Inspection page 14

Explains the inspection checks that you should perform after unpacking of the Alphaminicourse.

3.2. Installation and Connection page 15

Choose the suitable location to install the Alphaminicourse. Connect the system to an electrical supply and to external equipment.

3.3 Alignment page 29

The care that you take as you align the Alphaminicourse with the fore-aft datum on the vessel will have the direct influence upon its accuracy.

3.1 Unpacking and Inspection

WARNING



The ALPHAMINICOURSE weighs 12,5kg. To avoid personal injury, take proper precautions if the equipment is lifted or moved.

CAUTION!



The ALPHAMINICOURSE includes precision components and bearings. To avoid damage of any part of the gyro compass/ handle all items with care.

During gyro compass transportation follow the requirements specified in chapter 7.

Retain the original transit cases so it can then be used to transport the gyro compass when necessary. One will void the warranty if improper packing during transportation is used.

CAUTION!



It is forbidden to move the switched off gyro compass while rotor is still spinning! Always allow a period of 5 minutes after you power-off the gyro compass for the gyro rotor to stop spinning. Non-observance of this requirement may be the reason of gyro compass damage.

After you have received the gyro compass first of all check all items against the shipping documents. Inspect the unit carefully to check for any damage that may have occurred during transportation. If you find any damage, submit a claim to the carrier and immediately notify ALPHATRON MARINE.

To avoid loss or damage of any component, store all sub-assemblies in the transit case until you need to install them. Follow the storage requirements listed in the chapter 8.

If there is any components shortage in the shipment, notify ALPHATRON MARINE immediately.

You can find the contact details of ALPHATRON MARINE on the title page of this Manual.

3.2. Installation and Connection

3.2.1 Selection of Place

For proper installation of the Alphaminicourse carefully note the following requirements:

CAUTION!



During operation the gyro compass must remain level within $\pm 45^\circ$. If its tilt is more than 45° in any direction, it will 'topple'. Safety routines in the gyro software will then power-off the gyro rotor and show alarm conditions on the Control Unit. To restore normal operation, level the gyro compass and then restart it.

Do not tilt the gyro compass for more than 45° with the gyro rotor spinning or during the gyro compass run-up. Note that the gyro rotor continues to spin for five minutes after you power-off the system.

CAUTION!



If you placed the gyro compass in an enclosed space, make certain there is sufficient ventilation and circulation of free air to allow effective cooling.

- ☐ Choose the place where the Alphaminicourse will be protected from damages.
- ☐ Do not install or operate the Alphaminicourse where the ambient temperature could fall below -15°C or rise above $+55^\circ\text{C}$, or where rapid changes of temperature can occur.
- ☐ Do not install the Alphaminicourse close to strong mechanical or electrical noise sources, or in a location susceptible to vibration or shock.
- ☐ Minimum allowed distance between the gyro compass housing and any standard magnetic compass is 1.5 meters.
- ☐ Choose the place so that there is a convenient access to the Alphaminicourse for installation, connection and service. Required spacing is shown in the Figure 3.5.1.

3.2.2 Gyro compass Installation

The Alphaminicourse should be aligned so that its fore-aft axis is parallel to the fore-aft datum of the vessel. Any misalignment between the compass housing and the vessel will decrease the accuracy of heading measurements provided by the gyro compass.

To install the gyro compass you will need the following tools:

- ❑ Hex male screwdriver with flat-to-flat dimension S2.5
- ❑ Hex male screwdriver with flat-to-flat dimension S3.0
- ❑ Screwdriver 5.5mm x 150mm
- ❑ Screwdriver 3mm x 75mm
- ❑ Two adjustable spanners with opening to at least 33mm
- ❑ Suitable cables for the installation as indicated in the Table 3.1.

Table 3.1 – Suitable cable types

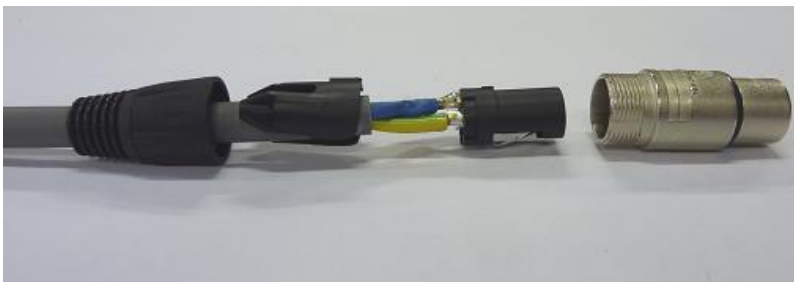
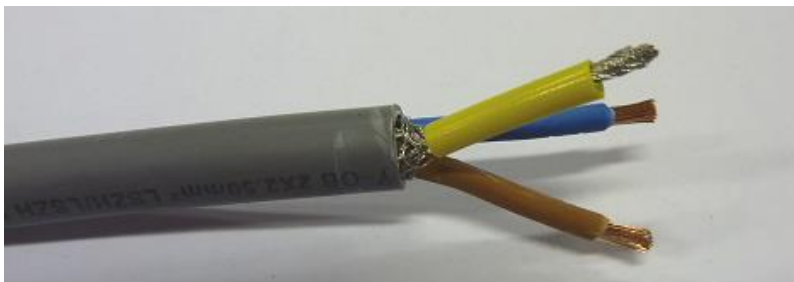
Purpose	Suitable cable
Power supply	3 x 1.5 mm ² screened cable
Step output Resolver heading output Ready & Fail output Rate of Turn output RCU output LOG input	3 x 2 x 0.5 mm ² screened cable
Serial data heading output GPS input	2 x 2 x 0.5 mm ² screened cable

There is no need to remove the gyro compass cover during installation.

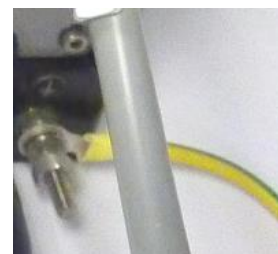
1. : During installation you must align the Alphaminicourse so that its fore-aft axis is parallel with the fore-aft keel line of the vessel. It is not necessary for the gyro compass to be on the vessel centre line. There are alignment marks on the base of the Alphaminicourse that help to achieve correct alignment.
2. : Three elongated securing holes on the gyro compass base allow you to adjust the alignment after installation. With the gyro compass positioned accurately, mark the supporting surface with the center positions for the three securing holes. Dimensions are given in the Figure 3.5.1.
3. : Remove the gyro compass and drill three 8.5 diameter holes, using the marks you have just made on the supporting surface.
4. : Reposition the gyro compass and align it to the fore-aft datum. Use three M8 bolts with washers and nuts to secure the gyro compass in position.
5. : Connect a 24V electrical supply in accordance with the Table 3.2 to the connector "24VDC" (acceptable variation range from 21.6V to 31.2V DC) on the rear side of the gyro compass base using a 3-pin plug from the assembly set. Figure 3.1 shows the rear panel with connectors.



The connection of the Power connector is to be installed according to below images:



6. : Connect the ship's safety ground to the earthing stud adjacent to the power connector.



7. : Make all necessary input and output signal connections via connectors located on the rear panel of the Alphaminicourse in accordance with the Tables 3.3 and 3.4.



The connectors of the Alphaminicourse are to be installed according to below images:



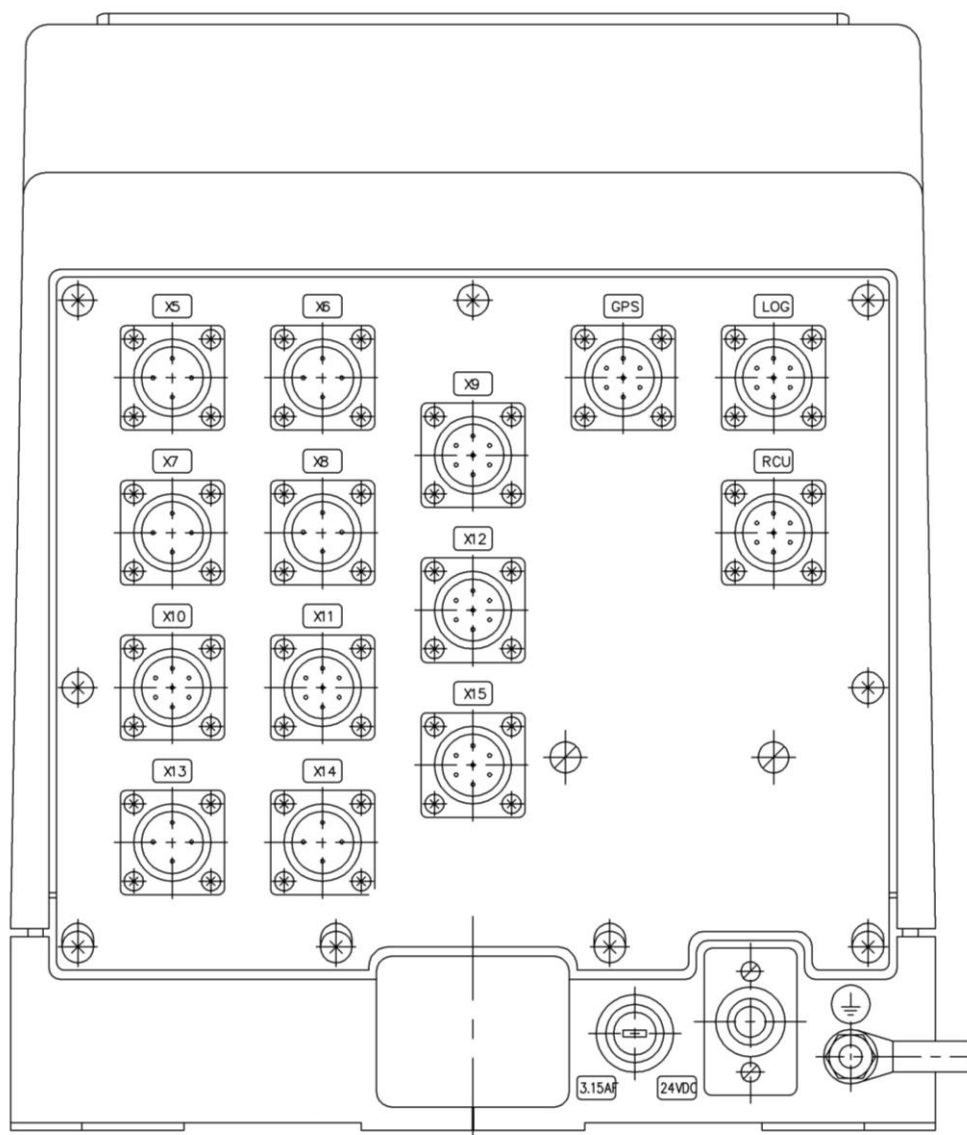


Figure 3.1 – Rear panel with connectors

24 VDC	– 3 Pol. F.male	with 10M cable (Item nr. G-002318)
X5, X6, X7, X8	– 4 Pol. male	with 10M cable (Item nr. G-002319)
X13, X14	– 4 Pol. male	with 10M cable (Item nr. G-002320)
RCU, X9, X10, X11, X15	– 7 Pol. male	with 10M cable (Item nr. G-002322)
GPS	– 7 Pol. F-male	with 10M cable (Item nr. G-002323)
LOG, X12	– 7 Pol. F-male	with 10M cable (Item nr. G-002324)

3.2.3 Connection diagram Alphaminicourse

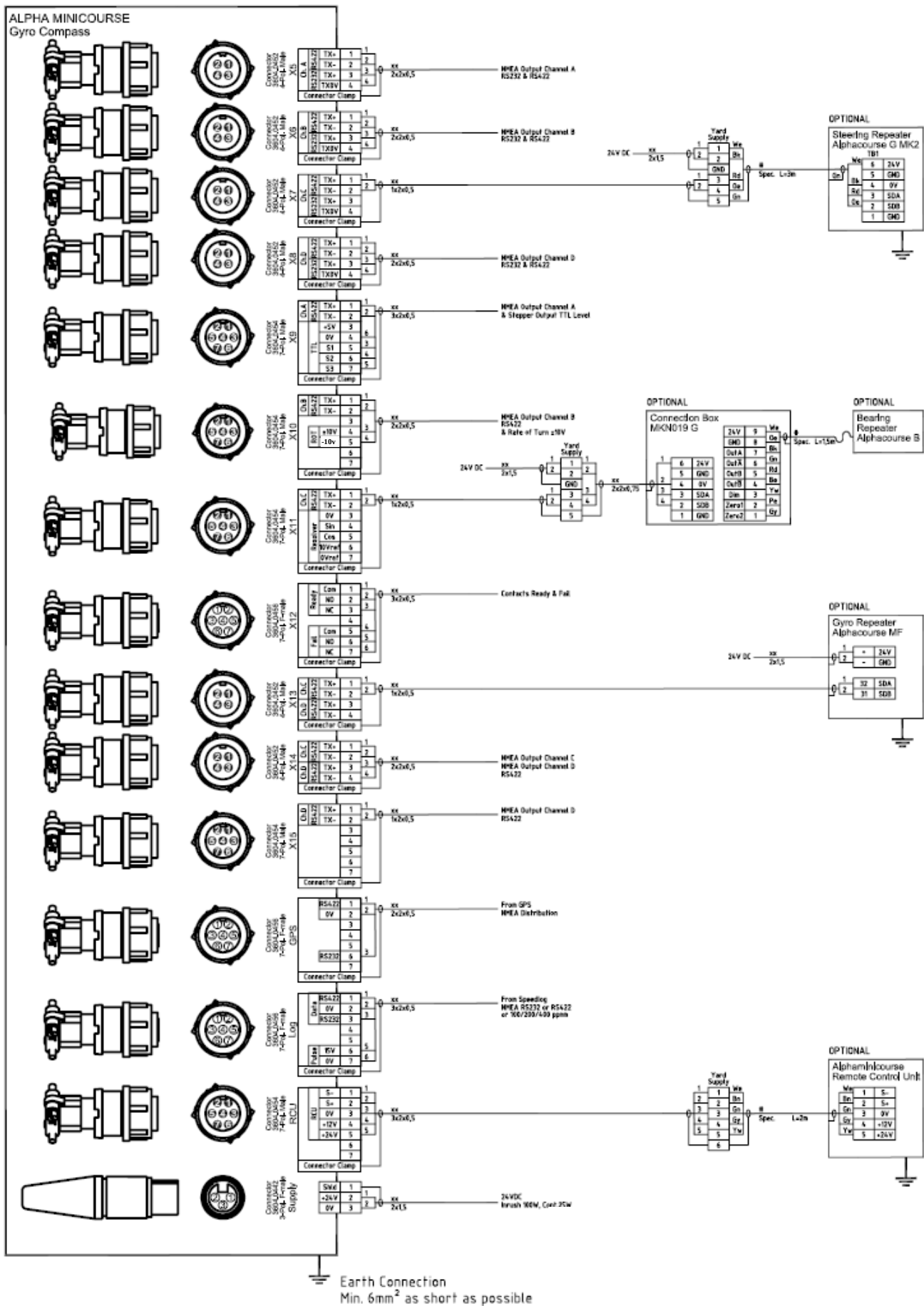


Table 3.2 – Power supply input

Pin	Description
24VDC/1	Cable shield
24VDC/2	+24V DC
24VDC/3	0V

Table 3.3 - Inputs

Signal description	Signal type	Connector on the rear panel
GPS input	IEC 61162 RS232 IEC 61162 RS422	GPS/6(+15 V) GPS/2(0 V) GPS/1(A) GPS/2(V)
Log input	IEC 61162 RS232 IEC 61162 RS422	LOG/3(+15 V) LOG/2 (0 V) LOG/1(A) LOG/2(V)
Log input	Pulses with amplitude from 5V to 10V	LOG/6(+15 V) LOG/7(0 V)

Table 3.4 – Outputs

Signal description	Signal type	Output	Connector on the rear panel
Heading Channel A	IEC 61162-1/2	RS232	X5/3(+15 V), X5/4(0 V)
		RS422	X5/1(A), X5/2(V)
		RS422	X9/1(A), X9/2(V)
Heading Channel B	IEC 61162-1/2	RS232	X6/3(+15 V), X6/4(0 V)
		RS422	X6/1(A), X6/2(V)
		RS422	X10/1(A), X10/2(V)
Heading Channel C	IEC 61162-1/2	RS232	X7/3(+15 V), X7/4(0V)
		RS422	X7/1(A), X7/2(V)
		RS422	X11/1(A), X11/2(V)
		RS422	X13/1(A), X13/2(V)
		RS422	X14/1(A), X14/2(V)
Heading Channel D	IEC 61162-1/2	RS232	X8/3(+15 V), X8/4(0 V)
		RS422	X8/1(A), X8/2(V)
		RS422	X13/3(A), X13/4(V)
		RS422	X14/3(A), X14/4(V)
		RS422	X15/1(A), X15/2(V)
Heading	Step		X9/3(5 V) X9/5(S1) X9/6(S2) X9/7(S3) X9/4(0 V)
Failure		FAIL CC	X12/5
		FAIL NO	X12/6
		FAIL NC	X12/7
Ready		RDY CC	X12/1
		RDY NC	X12/2
		RDY NO	X12/3
Rate of Turn	Analog ± 10 V		X10/4(+10V) X10/5(-10V) X10/3(0V)
Heading	Resolver		X11/6(10V/400Hz) reference voltage X11/7(0V) reference voltage X11/4(2V/400Hz) sin X11/5(2V/400Hz) cos X11/3(0V)

Table 3.5 – Input/output of the CU Control Board

Signal description	Signal type	Terminals of Control board
Power supply input	DC voltage	XT/5 (+24V) XT/3(0V)
On/Off output	DC voltage	XT/4(+12V/0V)
Data input/output	RS422	XT/2(S+) XT/1(S-)

Table 3.6 – Inputs/outputs of the RCU connector for connection of the Remote Control Unit to gyro compass

Signal description	Signal type	Connector on the rear panel
Power supply input	DC voltage	RCU/5 (+24V) RCU/3(0V)
On/Off input	DC voltage	RCU/4 (+12V/0V)
Data input/output	RS422	RCU/2(S+) RCU/1(S-)

3.2.4 Remote Control Unit

There may be applications where you prefer to install the Control Unit at some distance from the gyro compass. For this purpose you may use Remote Control Unit. Housing of RCU into which the CU from the Main Unit is mounted is provided as a mounting kit.

The mounting kit includes the following items:

- ❑ RCU housing
- ❑ Blanking plate for the Main Unit housing
- ❑ Fastening parts for mounting
- ❑ 2m 3x2x0,5mm² cable (see drawing)



There is no need to remove the gyro compass cover to install RCU externally:

1. Release and remove the four M3 screws at the corners of the CU that secure it to the housing of the Main Unit.
2. Lift the CU away from the Main Unit.
3. Disconnect the CU cable from the Y-cable on the analog PCB. Instead connect the second cable that is located nearby. If there is no Y-cable inside and purchased a brand new gyro please contact Alphatron: (Alphaline@alphatronmarine.com).
4. Disconnect the cable from the CU, release the terminal screws.
5. You may place the RCU on the table.

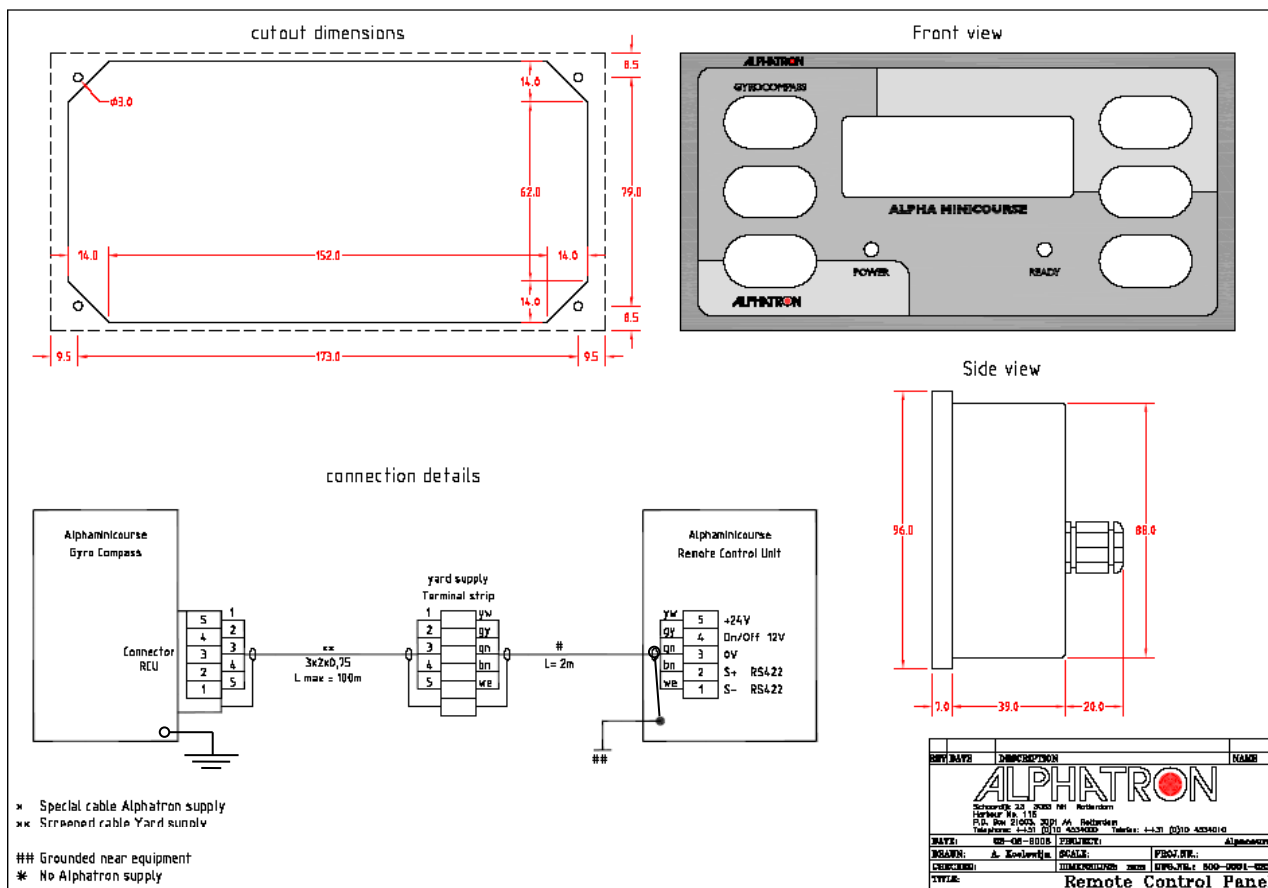
Select a location for the RCU:

- ❑ The mounting surface can be vertical or horizontal according to requirements.
 - ❑ Avoid installing the RCU where it might be exposed to shock or vibration.
 - ❑ Choose a location for the RCU that allows a clear view of the display in all conditions.
6. Take the cable for interconnection of the RCU to the Main Unit. Route the cable through the cable gland on the CU housing.

The cable, run between the gyro compass and the RCU, must not exceed 100 meters.

7. In accordance with Tables 3.5, and 3.6 connect the cable to the terminals of the CU and to the connector RCU on the rear panel of the Main Unit.
8. Fit the CU into the housing and screw four M3 screws at the corners of the CU.
9. Fit the blanking plate to fill the gap left in the cover of the Main Unit after the removal of the CU.

Cut out dimensions and connection details of the Remote Control Unit:



3.2.5 Setting of the Gyro compass Interfaces

The DIP-switch is used for simultaneous setup of all digital channels.

1. DIP-switches are located on the Controller board of the Control Unit. To lift off the CU it's no need to remove the gyro compass cover, simply release and remove the four fixing screws of the CU.
2. Carefully set the DIP SWITCHES in accordance with your particular requirements using the Table 3.7. Don't change the settings of other switches inside the gyro compass.
3. Refit the CU to its place.



Dipswitches

Back side of Remote Control Unit

Table 3.7 – Setting of the DIP-switches

DIP-switch		
Number and Setting		Function
1	2	
Off On Off On	Off Off On On	Baud rate 4800 baud (digital output RS232 and RS422)* 9600 baud (digital output RS232 and RS422) 19200 baud (digital output RS232 and RS422) 38400 baud (digital output RS232 and RS422)
3 Off On		Heading decimal place One decimal place (digital heading output)* Two decimal places (digital heading output)
4 Off On		Checksum No checksum (digital output RS232 and RS422)* Checksum transmitted (digital output RS232 and RS422)
5 Off On Off On	6 Off Off On On	Output sentences THS (digital output RS232 and RS422) * THS and ROT (digital output RS232 and RS422) HDT and VHW (digital output RS232 and RS422) HDT and ROT (digital output RS232 and RS422)
7 Off On Off On	8 Off Off On On	Speed log input type Log NMEA serial * 100 pulses per nautical mile 200 pulses per nautical mile 400 pulses for nautical mile

Factory default settings appear in bold and are marked by asterisk in this table.

3.2.5.1 Setting of the digital interface on the Control Unit

Each digital channel may have individual local settings (that are different from the global settings of DIP-switches on the Control Unit).

To enter the mode of channel tuning press and hold the button «SPEED» and then switch on the gyro compass. The display will indicate:

- O U T x
- where x – number of a channel (beginning from 1st up to 4th: A, B, C, D consequently).

With arrow buttons select the required channel or EXIT:

- if EXIT is selected, press the button "LAT" to return to the operation mode with retaining of all adjustments in non-volatile memory of the unit;
- if you would like to make settings in this or that channel, each time you press the "LAT" button one of the following channel parameters is selected successively:

B x x.x – transmission rate (Bauds)
 x x.H Z – data rate (Hz)
 P x x x – accuracy of heading (Precision)
 C S x – availability of Checksum (CheckSum)
 S.x x x – set of sentences (Sentences)

When the parameters are selected the unit returns to the tuning mode, i.e. the display will indicate OUT x. You may repeat the same procedure for other channels or finish the setting. The Parameter marked by D (excluding data rate parameter) means that it is set in accordance with Table 2.7. To change the value of the parameter select the required value with arrow buttons and then press the button "LAT" to go to the next parameter:

B D	- Global data transmission rate (factory setting)
B 4.8	- 4800 bit/s (factory setting)
B 9.6	- 9600 bit/s
B 19.2	- 19200 bit/s
B 38.4	- 38400 bit/s
1.H Z	- 1 time a second
10.H Z	- 10 times a second (factory setting)
20.H Z	- 20 times a second
50.H Z	- 50 times a second
P D	- Global heading accuracy (factory setting)
P 0.1	- One decimal place
P 0.0 1	- Two decimal places
CS D	- Global checksum (factory setting)
CS 0	- Checksum is not transmitted
CS 1	- Checksum is transmitted
S. D	- Global set of sentences (factory setting)
S.H D T	- HDT
S.H + R	- HDT + ROT
S.H + V	- HDT + VHW
S.V + R	- VHW+ ROT
S.T H S	- THS
S.T + R	- THS + ROT
S.A L L	- «All Data»

In the mode "All Data" HDT, ROT and additional sentences with coordinates and speed of movement are transmitted. Sentence package is transmitted once a second despite of independent of transmission channel settings. Detailed description is given in the subsection 5.2.3.

3.2.5.2 Setting of the analog interface and Backward Running Mode

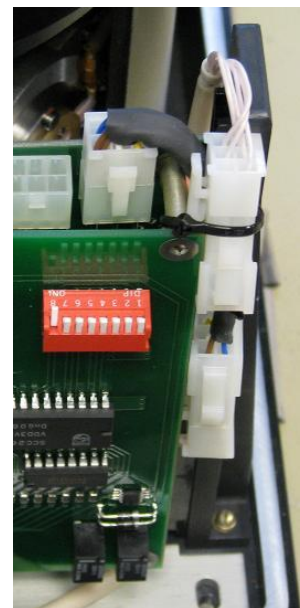
DIP-switches on the Digital board are used to set the scale of the analog rate of turn and the ROT limit for the step signal.

1. DIP-switches are located on the Digital pcb. Without removing the gyro compass cover unscrew and remove 4 securing screws to take the Control Unit out.
2. Set DIP-switches on the Digital pcb carefully for specific requirements of your installation.
3. The Scale of the analog rate of turn is selected by setting of three DIP-switches in accordance with the Table 3.8.
4. The ROT limit for the step signal is selected by setting of two DIP-switches on the Digital pcb in accordance with the Table 3.9.
5. Backward running mode is selected by one of the DIP-switches in accordance with Table 3.10
6. Refit the Control Unit to its place.

Table 3.8

1	2	3	ROT for 10V
OFF	OFF	OFF	Default 20 °/s (*)
ON	OFF	OFF	30 °/min = 0,5 °/s
OFF	ON	OFF	60 °/min = 1 °/s
ON	ON	OFF	90 °/min = 1,5 °/s
OFF	OFF	ON	120 °/min = 2 °/s
ON	OFF	ON	180 °/min = 3 °/s
OFF	ON	ON	300 °/min = 5 °/s
ON	ON	ON	1200 °/min = 20 °/s

(*)Factory settings


Table 3.9

6	7	8	ROT
OFF	OFF	ON	Default 6 °/s (*)
ON	OFF	ON	maximum 6 °/s
OFF	ON	ON	maximum 12 °/s
ON	ON	ON	No limit

(*)Factory settings

Dip-switches on Digital Board

The setting of the DIP-switches and Interfaces described in this Table is used only for gyro compasses with the software version 2.12 (Main Unit) and version 4.0 (Control Unit) and later versions. If necessary, you may look for MU and CU software versions by pressing both buttons ▲ and ▼ simultaneously. The display will show the running line of **XXX-Y-Z** type, where:

XXX – Conventional letters of gyro compass type, e.g. GVK;
 Y – MU version;
 Z – CU version.

The unit will return to the heading indication when you release the buttons.

Table 3.10

4	Backward running mode
OFF	Disabled (*)
ON	Serial data of channel D contains the heading rotated by 180°. If GPS receiver is used as a source of speed, speeds becomes negative when the vessel is running backward (when the gyro compass heading and the GPS course over ground are directed oppositely)

(*)Factory settings

3.3 Alignment

It is very important to align the gyro compass to the fore-aft datum on the vessel accurately. Any misalignment will appear directly as a fixed error in heading measurements. Because measurements from the Alphaminicourse are used by diverse systems around the vessel, any misalignment between the gyro compass and the fore-aft datum might have a significant impact on these systems operation.

There are several methods of gyro compass alignment to the vessel fore-aft datum:

- ❑ Align the gyro compass to the fore-aft axis using a known reference line, such as surveyed bulkhead or frame member. The marks on the gyro compass base plate are precision indicators of the gyro compass alignment orientation.

To provide perfect speed correction the gyro compass panel with connectors shall be oriented to the vessel bow.

- ❑ Use the direction finder to align the gyro compass precisely with the fore-aft datum on the vessel.

Remove any residual misalignment by making miniscule adjustments to the gyro compass mounting plate. When you have achieved perfect alignment, tighten the securing bolts fully to lock the gyro compass in position.

3.4 Final Tests After Installation

After you have installed the gyro compass and connected power supplies to it, perform the following tests:

1. Power-on the gyro compass by following the instructions in sub-section 4.2. Wait for three hours before you perform the following tests.
2. Check the vessel heading against the known reference mark on a chart. Typically this could be the alongside position of the fitting-out dock. Alternatively, accurately survey an object at least five kilometers ahead of the vessel using the fore-aft line as a datum.
3. Check the displayed gyro compass heading at definite intervals to make certain it is consistent with the surveyed vessel heading.
4. If there is an error larger than $\pm 0.5^\circ$, re-check the vessel fore-aft datum to confirm that it is correct.
5. Check that all repeaters are accurately aligned with the gyro compass heading and make certain they maintain their alignment at all times while the gyro compass is operating.

3.5 Installation Drawings

Figure 3.5.1 – Gyro compass installation

Figure 3.5.2 – Control Unit installation – table mount

Figure 3.5.3 – Installation Alphaminicourse Steering repeater Alphacourse G

Figure 3.5.4 – Installation Alphaminicourse Bearing repeater Alphacourse B

BOW

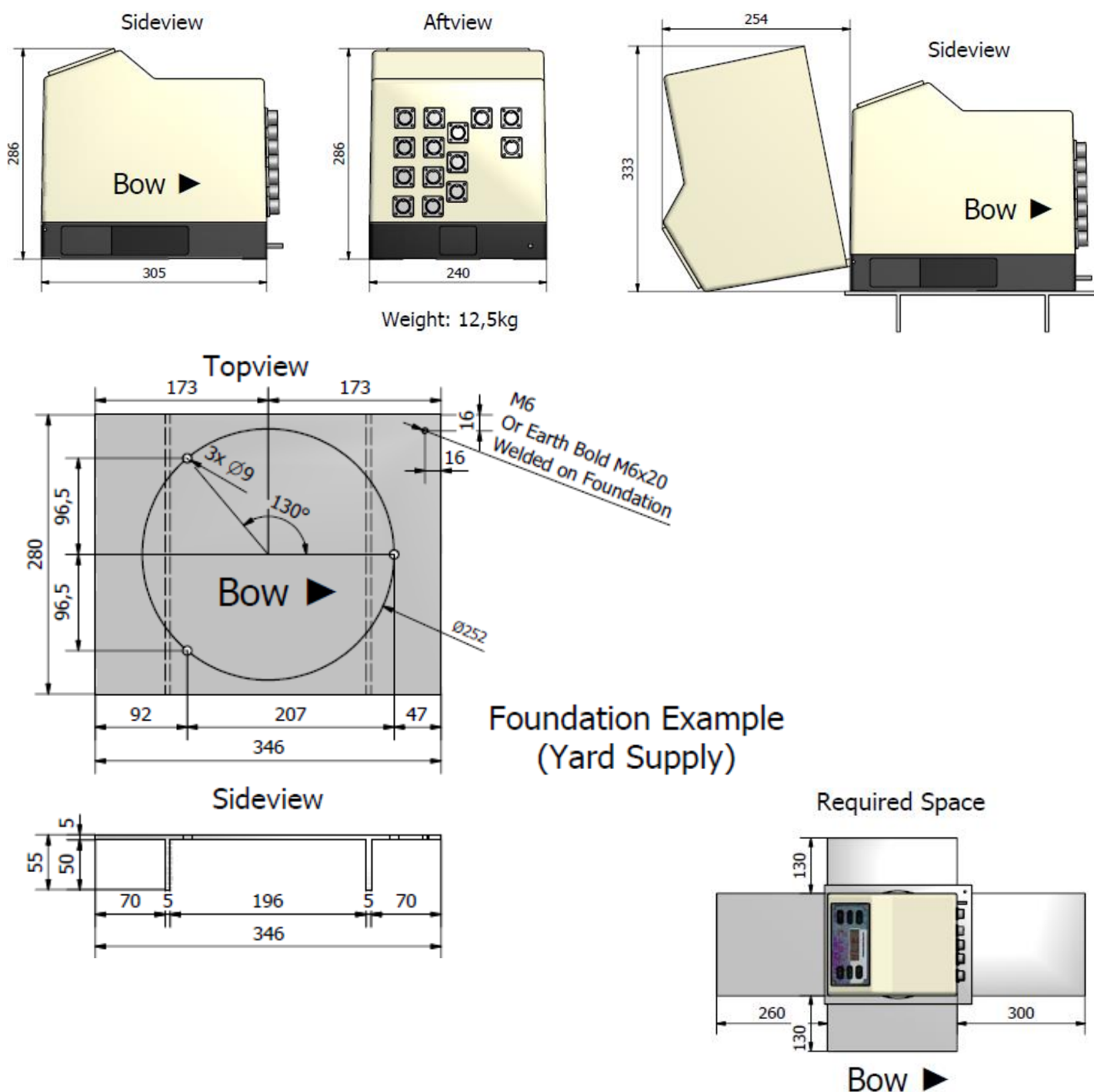


Figure 3.5.1 – Gyro compass installation

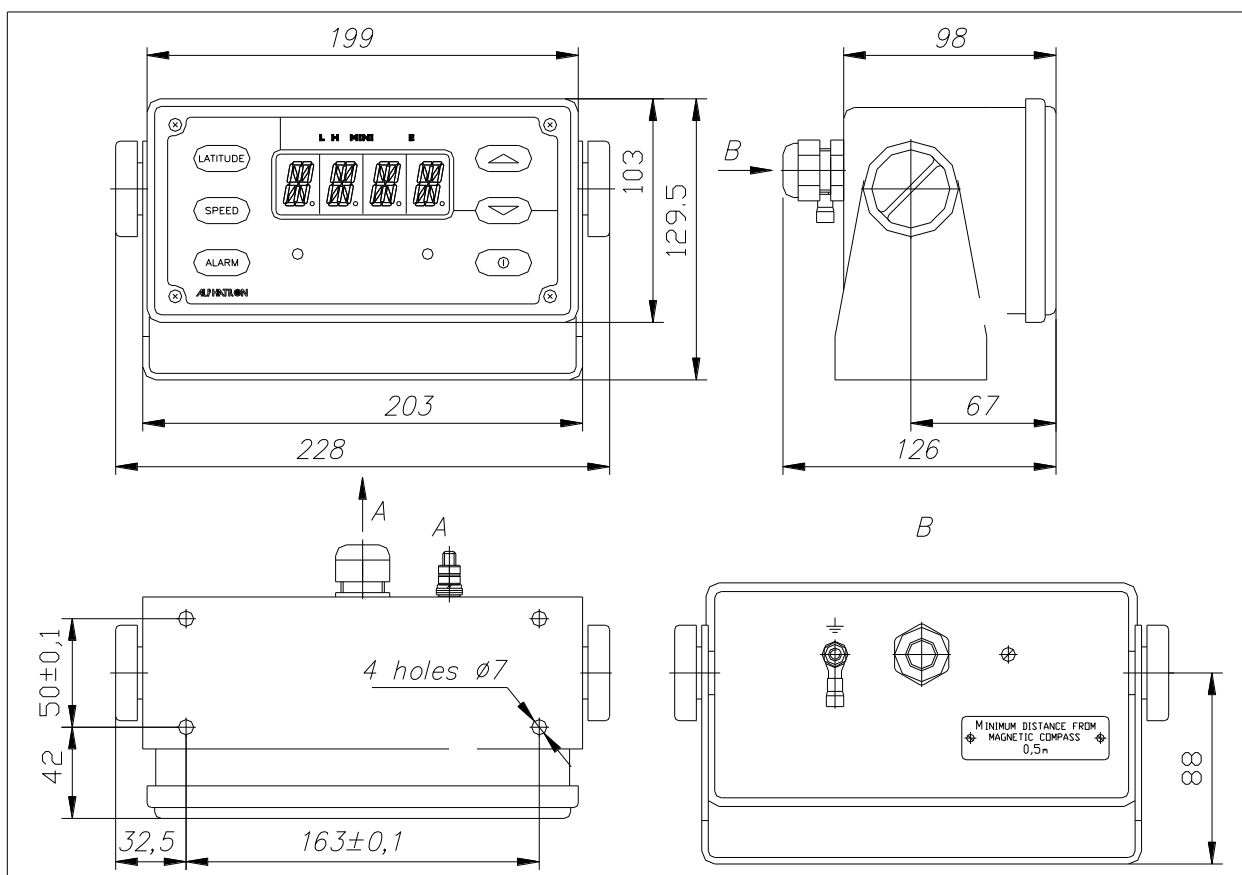


Figure 3.5.2 – Control Unit installation – table mount

Figure 3.5.3 – Installation drawing Alphaminicourse Steering repeater Alphacourse G

The Alphacourse G is the steering repeater in the Alphaminicourse gyro system. The installation drawing is as follows:

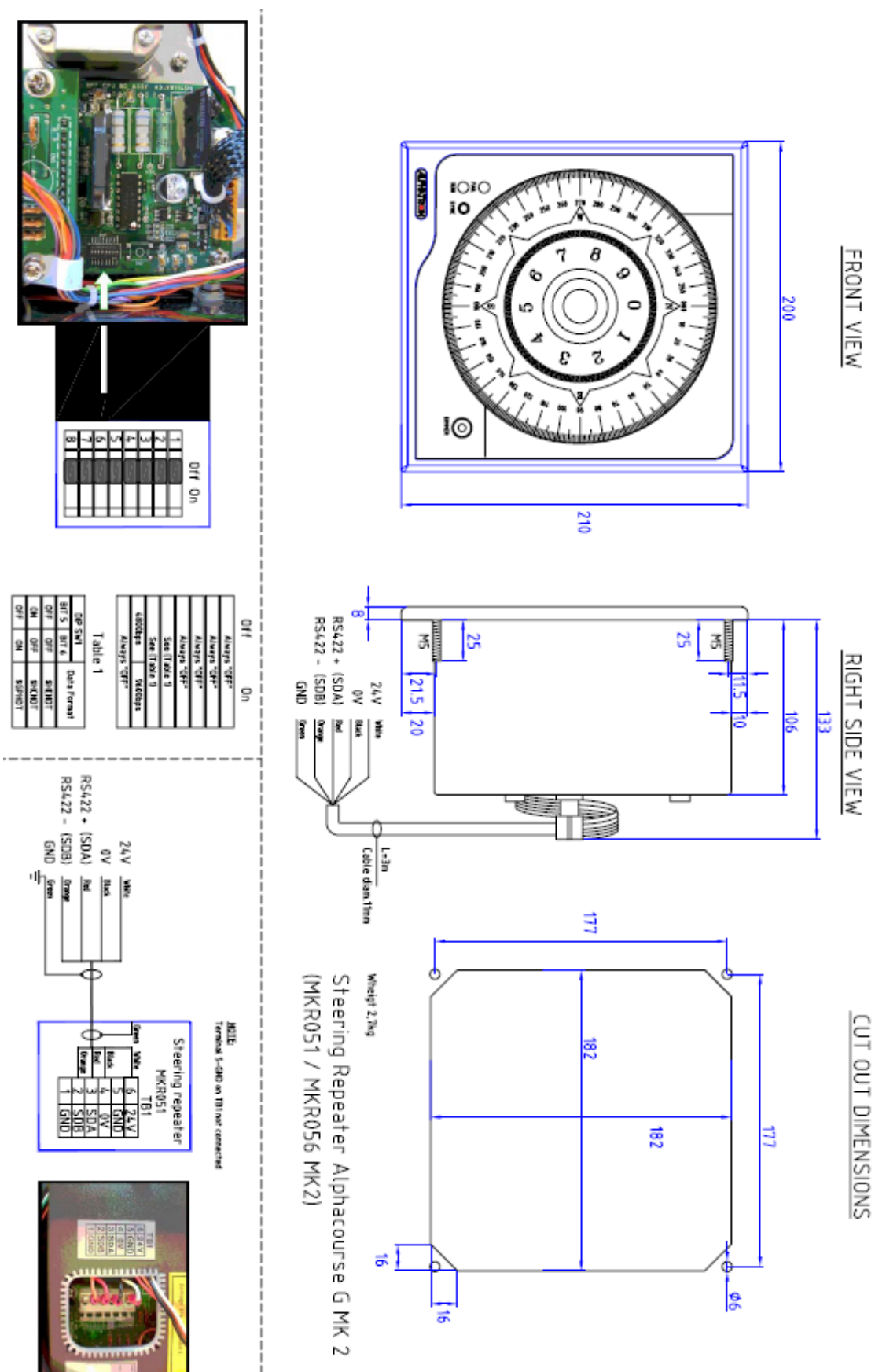


Figure 3.5.4 – Installation drawing Alphaminicourse Bearing repeater Alphacourse B

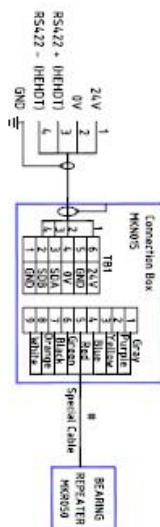
The Alphacourse B is the bearing repeater in the Alphaminicourse gyro system. The installation drawing is as follows:



1	2	3	4	5	6	7	8
Off	On						

DP SW1	Data Format
BIT 5 BIT 6	SHH/OT
ON OFF	SHH/OT
OFF ON	SHH/OT
Always "OFF"	
Always "OFF"	
Always "OFF"	
Always "OFF"	
See (Table 1)	
4800ps	
Always "OFF"	

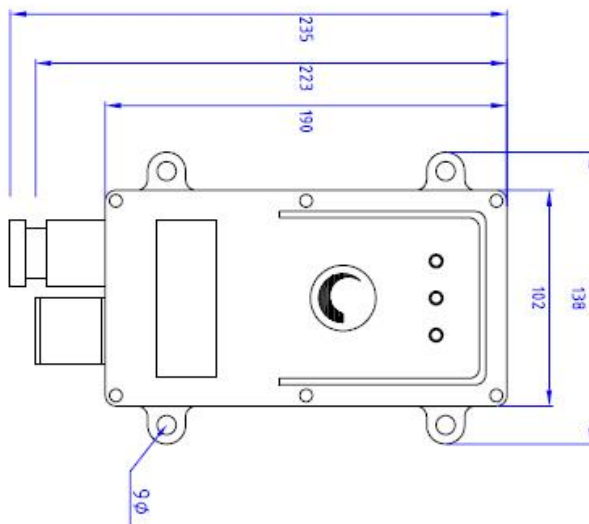
Table 1



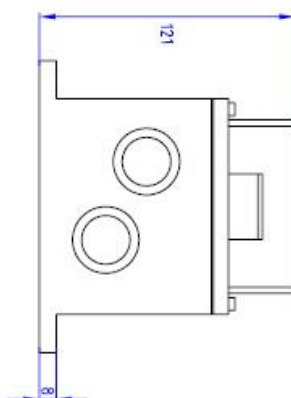
NOTE:
Terminal 5-GND on TB not connected



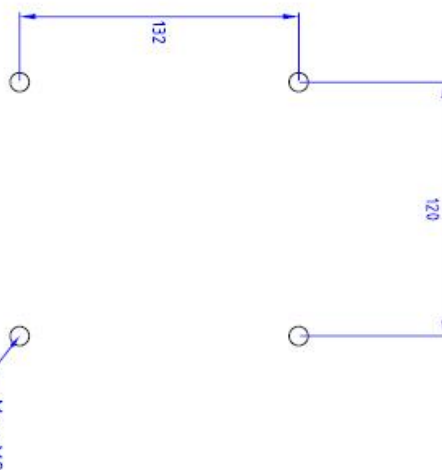
Weight 16kg
Junction Box
Bearing Repeater Alphacourse B



FRONT VIEW



BOTTOM VIEW



DRILLING PLAN

NOTES:

This image shows a full page of blank white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page, typical of notebook or legal stationery. There are no margins, text, or other markings present.

4 PRESTARTING PROCEDURES AND OPERATION

This section explains how to power-on and operate the Alphaminicourse after installation. Data formats relevant to the system are given in section 4.

4.1 Control Features **page 37**

The CU provides all the controls you will need to operate the Alphaminicourse as well as 4-character display panel that shows the heading and any alarm messages and error codes.

4.2 Power-on **page 38**

Explains how to power-on the Alphaminicourse after installation and describes the initialization sequence.

4.3 Operation **page 39**

Explains how to select the latitude and speed correction sources, and how to set the latitude and speed manually if necessary.

4.4 Error Modes **page 41**

Identifies the system error modes. Use these indicators to identify a possible fault condition.

4.5 Operating instructions **page 44**

Includes general advice for operating the Alphaminicourse on a vessel.

4.1 Control Features

On the front panel of the CU all the operator controls for the Alphaminicourse are located.



Figure 4.1 – CU front panel controls

Table 4.1 – CU control and indication functions

Control	Function
	Unit power-on/power off.
▲	Selection Up. Press to increase display brightness.
▼	Selection Down. Press to decrease display brightness.
LAT	Latitude selection button. Press to display current latitude source and correction value. Use together with Up/Down buttons to preset latitude source, correction value and gyro compass operating modes.
SPEED	Speed selection button. Press to display current speed source and correction value. Use together with Up/Down buttons to preset speed source and correction value.
ALARM	Shutdown of audible alarm in case of failure. When the unit is powered-on with the pressed Alarm button, the "emergency mode" is enabled: gyro compass does not operate and the heading received from GPS or from other compass connected to GPS input is translated to the CU display and to outputs RS232, RS422, STEP.
137.8	Four digit alphanumeric display. Note: The display can show additional information as error codes and messages.
POWER lamp (red)	Indicates 24V DC is supplied to the Alphaminicourse, when lighted.
READY lamp (green)	No light – the Alphaminicourse is in automatic settling mode. Steady light – the Alphaminicourse has settled and True Heading is available. Blinking – the Alphaminicourse is in DG mode (heading storage mode).

Note – All CU buttons are recessed to prevent accidental operation.

Table 4.2 – CU display formats

Format	Function
Heading 012.3	Heading Only
Speed 01 G01 L01 L	(by pressing the Speed button) Speed value with manually selected speed source Speed value with GPS selected speed source Speed value with LOG selected speed source with NMEA output Speed value with LOG selected speed source with pulsed output
Latitude 52N 52S G52N	(by pressing Latitude button) Latitude value in the Northern Hemisphere with manually selected latitude source Latitude value in the Southern Hemisphere with manually selected latitude source Latitude value with GPS selected latitude source
GC operating modes GPS LOG GC DG	Operation of the GC with GPS receiver (pp.4.3.1 and 4.3.2) Operation of the GC with log (p.4.3.2) Gyro compass operating mode (p.4.3.3) Heading storage mode (Directional Gyro) (p.4.3.3)

4.2 Power-on

The gyro compass starting cycle is fully automatic. To initialize the gyro compass operation you shall do the following:

1. Check that there is a nominal 24V DC electrical supply available to the gyro compass. The acceptable supply range is 21.6 VDC to 31.2 VDC. To ensure continuous operation, the power supply for this unit should have 100W power rating.
2. To start the Alphaminicourse press the power switch on the CU .
3. The red «POWER» lamp on the CU shall illuminate that indicates that the Main Unit of the gyro compass is receiving power.
4. The CU will enable the audible alarm for about 1 second. The display will show the current gyro compass dial heading and the «READY» lamp will not light until the gyro compass has settled. If there is no heading indication on the display and alarm is enabled, it means that the unit doesn't pass testing or there is no connection with the CU.
5. Set the source of latitude information on the CU by following the instructions of p.4.3.1.
6. Set the source of speed information on CU by following the instructions of p. 4.3.2, if GPS is not selected as data source.
7. Use buttons ▲, ▼ to adjust the CU illumination level to a comfortable setting.
8. Wait for the gyro compass to settle. This will occur automatically and will take from 30 minutes to 2 hours depending on initial heading offset and sea conditions. The Alphaminicourse signifies its settled condition by illuminating the green lamp «READY».
9. If necessary, you can view the software versions of the Main Unit and the Control Unit by simultaneous pressing of buttons ▲ and ▼. The display will show the running line of **XXX-Y-Z** type, where:
 XXX – conventional letters of gyro compass type, e.g. GVK;
 Y – MU version;
 Z – CU version.

The unit will return to the heading indication when you release the buttons.

4.3 Operation

The Alphaminicourse will settle automatically after power-on. To perform the specified accuracy, the system requires latitude and speed correction, applied manually or from external sources.

Ideally, the Alphaminicourse should accept latitude and speed information from external sources such as GPS or a speed log, which allows the system to apply corrections automatically.

4.3.1 Latitude correction

1. Press and hold the Latitude selection button.
2. Use buttons ▲ and ▼ to set the local latitude manually. The display will show the latitude in one degree increments in the range 89°N to 89°S, for example, *70N*.
3. To select automatic latitude and speed compensation from GPS receiver, use the buttons ▲ and ▼ to scroll beyond 89°N or 89°S until the display shows **GPS**.

To select automatic compensation of latitude from GPS receiver and speed from log paragraphs 4.3.1.3, 4.3.2.1 and 4.3.2.3 of this manual shall be followed consequently.

If there is no valid input from GPS receiver, the display will indicate the alarm *NO+GPS* in 10 seconds.

If the input is not recognized or is invalid during 10 seconds, the display will indicate the alarm *????+GPS* (input format is not recognized) or *ERR+GPS* (input checksum is invalid).

4. Release both buttons to set the speed to the displayed value or to set the gyro compass to use GPS as the source of automatic latitude and speed correction. The display will then return to normal heading indication.

Note: The latest set latitude and operating mode are preserved in the gyro compass software and are restored after switching on.

If operating latitude is selected manually, remember to change the setting when necessary.

In medium latitudes, a 10° error in setting the operating latitude will result in compass error of approximately 0.3°.

4.3.2 Speed correction

1. Press and hold Speed selection button.
2. Use buttons ▲ and ▼ to set the speed manually in the range from 0 to 90 knots.
3. To select automatic speed compensation from log, use the buttons ▲ and ▼ to scroll beyond 90 knots until the display shows LOG

If there is no NMEA signal from log, the display will indicate the alarm NO+LOG in 10 seconds.

If input is not recognized or invalid within 10 seconds, the display will indicate the alarm ????+ LOG (input format is not recognized), ERR+LOG (input checksum is invalid).

4. Release both buttons to set the speed to the displayed value or to set the gyro compass to use log as the source of automatic speed correction. The display will then return to the normal heading indication.

Note: The latest set speed and operating mode are preserved in the gyro compass software and are restored after switching on.

If the vessel speed is selected manually, remember to set the average vessel speed and to change the setting when necessary. On completion of the voyage return the setting to zero. For a vessel steaming along the meridian, a 5-knot error in speed setting will generate an error of approximately 0.5°.

4.3.3 Operating mode (gyro compassing GC and directional gyro DG)

5. Press and hold the Latitude selection button.
6. Use the buttons ▲ and ▼ to scroll beyond the range 89N to 89S and GPS until the display shows GC and then DG. In the GC mode the gyro compass will be a north-seeking and in the DG mode the gyro compass is a direction saving instrument. In this mode you may use the Alphaminicourse as the heading indicator up to the Pole. If the gyro compass has settled on north immediately prior to entering into the DG mode, it will continue to provide a proper indication of the northerly direction for some period, but will not continue to seek north. The validity period depends entirely on the gyroscope drift characteristics.
7. Release both buttons to set the gyro compass operating mode. The display will indicate the selected operating mode for several seconds and will then return to the normal heading display. When the DG mode is selected the green «READY» indicator on the CU will start to blink.

Note:

The latest set operating mode is preserved in the gyro compass software and is restored after switching on. Gyro compass will not seek north while operating in the DG mode.

4.4 Error Modes

The Alphaminicourse has three possible error modes:

1. Loss or corruption of GPS signal
2. Loss or corruption of speed log signal
3. Gyro compass system warnings and failures

4.4.1 Loss or corruption of GPS signal

This error mode can occur when you have selected GPS as the source of speed or latitude and the signal corrupts or becomes lost for a period of 10 seconds. You can recognize this condition by the following indications:

- ☐ When GPS data are lost or invalid the display shows NO+GPS or ERR+GPS.
- ☐ The audible alarm will sound.

Press the ALARM button to cancel the audible alarm.

1. The gyro compass will use the last valid speed and latitude values.
2. The CU will continue to show the alarm message until a valid input is re-established or a different input source is selected.

If valid input has not been established within 30 minutes the audible alarm will be enabled.

4.4.2 Loss of speed log

This error mode can occur when you have selected speed log as the source of speed information and the signal corrupts or becomes lost for a period of 10 seconds. You can recognize this condition by the following indications:

- ☐ When the selected source of NMEA information is lost the display shows NO+LOG or ERR+LOG;
- ☐ The audible alarm will sound.

Press the ALARM button to cancel the audible alarm.

1. The gyro compass will use the last valid speed value.
2. The CU will continue to show the alarm message until a valid input is re-established or a different input source is selected.

If valid input has not been established within 30 minutes the audible alarm will be enabled.

4.4.3 Gyro compass System Warnings and Failures

The Alphaminicourse has a built-in system that monitors operation of the gyro compass. This systems checks two categories of functions:

- ☐ Warnings
- ☐ Failures

Warnings

If the gyro compass detects a warning condition, it will inform you about it using the following:

- ☐ The display shows a <message>.
- ☐ The audible alarm will sound.

Press the ALARM button to cancel the audible alarm.

Table 4.3 – Gyro compass warning codes

<Message> on CU screen	Definition of warning code
Dark display or "frozen" heading data ¹	Loss of communication link with the CU
<i>BETA</i>	High pendulum signal

Note 1 – When communication link with the CU is lost the heading display is not renewed and the CU buttons do not function (except ALARM button).

The CU will continue to show the alarm message until the warning condition has been removed. If the warning condition has not been removed within 30 minutes the audible alarm will be enabled. To rectify the fault condition, refer to the Table 6.1 of the chapter 6. If necessary, contact ALPHATRON MARINE or an approved local service agent.

Failures

If the gyro compass detects a failure condition, it will use 7 methods to alert you:

- ☐ The display shows the failure message;
- ☐ The audible alarm will sound;
- ☐ If servo system fails, the «READY» lamp will extinguish;
- ☐ No "Gyro Ready" signal on the connector X12 if the servo system fails;
- ☐ The "Gyro Fail" signal will be activated on the connector X12;
- ☐ Serial output will not transmit sentences;
- ☐ Stepper output will not transmit the heading.

Press the ALARM button to cancel the audible alarm.

Table 4-4 – Gyro compass failure codes

<Message> on the CU screen	Definition of failure code
<i>SS</i>	Failure of the servo system on Analog pcb
<i>RDC</i>	Failure of the resolver-digital converter on digital pcb
<i>DSP</i>	Failure of the processor on analog pcb
<i>PWR</i>	Failure of the Power Supply pcb

These failures are considered unrecoverable, possibly due to a component failure.

In case servo system fails, the gyro motor and the servo system will be de-energized.

The gyro compass will be disabled until the operator resets it. Refer to the section 4.2 before restarting the gyro compass.

Table 4.5 – Detection of failure and warning conditions

«Gyro compass Failure» (X12/7) output	«Gyro compass Ready» (X12/5) output	Output Sentence	Type of Failure Alarm
yes	no	no	SS or the unit is switched off
yes	yes	no	RDC
yes	yes	yes	BETA

4.5 Operating Instructions

4.5.1 General

- ❑ The Alphaminicourse shall be running continuously that provides establishment of the gyroscope normal operating conditions and partial compensation of its errors. The system should be powered-off only during long periods of lay-up, for example during vessel dry-docking. To power-off the Alphaminicourse, press the button . The heading display will go blank and the front panel indicators will switch off.
- ❑ If you intend to disable the gyro compass for a long period of time you should arrange to run the gyro compass for a period of at least thirty minutes at intervals of not more than six months.
- ❑ The Alphaminicourse is fully protected against interruption of its electrical supply. It will re-start and align itself automatically on restoration of electrical power.

The gyro compass will show the accurate heading, when the "Ready" lamp on the CU is on.

- ❑ Monitor the performance of the gyro compass Alphaminicourse regularly. When functioning correctly, and provided the correct Speed and Latitude compensations are applied, the heading error in latitudes up to 60° and for speeds up to 25 knots will normally be less than 0.75° regardless of the vessel maneuvers.
- ❑ Never move the gyro compass when the gyro rotor is spinning and the servo system is switched off during 1 minute after power-on and during 5 minutes after power-off.

4.5.2 Corrections for speed and latitude

- ❑ Gyro compass operational accuracy largely depends on the accuracy of speed and latitude corrections.
- ❑ Most users find it the most convenient to apply speed and latitude corrections automatically, via signal inputs from PGS and/or ships logs.
- ❑ However, the users should be aware that if the input signal contains the wrong information, then the wrong corrections would be applied. For instance, it has been noted that some GPS installations, under certain circumstances, may output a "valid" signal with the speed and latitude fields set to all zeros indicating that the vessel is stationary on the equator.
- ❑ An incorrect input of speed and/or latitude will cause the gyro compass to indicate an incorrect heading and in the case of extreme errors could cause, in certain circumstances, the gyro compass to produce high pendulum signal.

4.5.3 Operation in High Latitudes

- ❑ While the latitude becomes higher (to the North or to the South) the value of the horizontal component of earth rotation is decreasing proportionally to the latitude cosine. Hence, the higher the latitude, the less efficient is the gyro compass operation as a north-seeking device.
- ❑ In latitudes higher than 80° it is recommended to use the gyro compass in the Directional Gyro mode.

4.5.4 Operation on High Speed Crafts

- ❑ The gyro compass gravity control gives the rise to errors whenever the gyro compass accelerates or decelerates along the north-south line that is whenever the northerly speed or course changes. These errors are caused by the inertia of the pendulous element of the gyro compass, which produces a torque about the horizontal axis and therefore a precession in azimuth. This effect, called ballistic deflection, causes an increase in error during acceleration.
- ❑ The precession in tilt that arises from the damping component of gravity control is called ballistic tilt. The combined effects of ballistic tilt and ballistic deflection cause the gyro compass to tilt downwards. Because of the factors that guide the behavior of a damped gyroscope, the gyro spin axis will return to the settled position by the normal anticlockwise spiral after the acceleration has ceased.
- ❑ In the Alphaminicourse the gravity control comes from an accelerometer (pendulum), which generates an electrical signal related to the tilt of the gyro spin axis. This signal is heavily damped and the range of output is restricted to a small angle. The use of accelerometer damping by the Alphaminicourse is of prime importance in the reduction of a particularly serious form of ballistic error called intercardinal rolling error. This type of error occurs most noticeably when the vessel steams on an intercardinal heading while rolling simultaneously through a significant angle.

If the gyro compass is installed at some distance above the vessel center of roll rotation, as is usually the case on commercial vessels, the resulting lateral acceleration components along the east-west and north-south axes of the gyro compass combine to build an error in the northerly settle point.

If the effect persists for long enough, this error might become as large as several degrees. However, by damping the accelerometer using a time constant several times larger than the vessel-rolling period, intercardinal rolling errors are significantly reduced.

- ❑ Another form of ballistic error arises from north-south accelerations generated by vessel maneuvers. Such accelerations can arise from changes in speed and/or course. By limiting the angular output of the accelerometer, the Alphaminicourse reduces the error typically to less than one degree.
- ❑ It is also possible to eliminate acceleration effects by temporarily operating the gyro compass in the DG (Directional Gyro) mode. In this mode gravity control is used for tilt corrections only, so that ballistic effects would cause negligible heading error during short-term acceleration periods. The DG mode can be selected manually from the Control Unit (p. 4.3.3).
- ❑ The Alphaminicourse complies with all requirements of IMO Resolution A.821(19), Performance Standards for Gyro compasses for High-Speed Craft.



NOTES:

Handwritten notes area consisting of 30 horizontal lines.

5 TECHNICAL DATA

5.1 Specifications

5.1.1 Power Requirements

Voltage:	24V DC (acceptable range 21.6 VDC to 31.2 VDC)
Power consumption:	50 W at start-up (duration 70 s) 25 W in the steady-state mode

CAUTION!



To comply with the requirements of IMO Resolution A.821(19), Performance Standards for Gyro compasses for High-Speed Craft, the gyro compass shall be powered by an uninterruptible power supply.

5.1.2 Performance (definitions from ISO 8728)

Settle point error	: 0.2° sec latitude
Static error	: 0.2° sec latitude
Dynamic error	: 0.3° sec latitude (Scorsby and Intercardinal motion tests)
Settle point repeatability	: 0.2° sec latitude
Follow-up speed	: 200°/s
Time to settle within 0.7°	: <45 minutes with a $\pm 30^\circ$ initial heading offset

5.1.3 Compensation

Latitude compensation range	: 89°N to 89°S
Speed compensation range	: 0 to 90 knots

5.1.4 Environment

Operating environment	: IEC60945-2002 designated category "weather protected"
Operating temperature	: -15°C to +55°C
Storage temperature	: -60°C to +70°C

5.1.5 Signal Inputs

Latitude	: IEC 61162 RS232 or RS422 from GPS
Speed	: pulse at 100, 200 or 400 per nautical mile from log IEC 61162 RS232 or RS422 from GPS or log

5.1.6 Signal Outputs

S-type heading	: 1 x step-by-step, 6 steps/degree (TTL level) Update 6°/s, 12°/s, unlimited
Resolver heading	: 1 x 10V 400Hz (max.3V per phase), sector value 360°
Analogue rate of turn	: 1 x ROT $\pm 20^\circ/\text{s}$ ($\pm 10\text{V}$) $\pm 30^\circ/\text{min}$; $\pm 60^\circ/\text{min}$; $\pm 90^\circ/\text{min}$; $\pm 120^\circ/\text{min}$; $\pm 180^\circ/\text{min}$; $\pm 300^\circ/\text{min}$; $\pm 1200^\circ/\text{min}$ (selected by customer)
Serial data outputs	: Channel A : 1 x RS232 ; 2 x RS422 ; Channel B : 1 x RS232 ; 2 x RS422 ; Channel C : 1 x RS232 ; 4 x RS422 ; Channel D : 1 x RS232 ; 4 x RS422 ;
Serial data formats	: IEC 61162-1/2
Serial data transfer rate	: 4800 baud ; 9600 baud ; 19200 baud ; 38400 baud
Serial data transfer frequency	: 1Hz (1sec) ; 10 Hz (100msec) ; 20 Hz (50msec) 50 Hz (20msec)
Status/alarm	: Ready - NO relay/NC relay Failure - NO relay/NC relay

5.1.7 Dimensions and Weight

Dimensions	: 288mm (H) x 240mm (W) x 329mm (D)
Weight	: 12.5 kg
CU size (external mounting)	: 96mm (H) x 192mm (W) x 108mm (D)
CU weight	: 3.0 kg

5.1.8 Input from the GPS-Receiver or Speed Log

The gyro compass input load is 2mA for all serial data inputs.

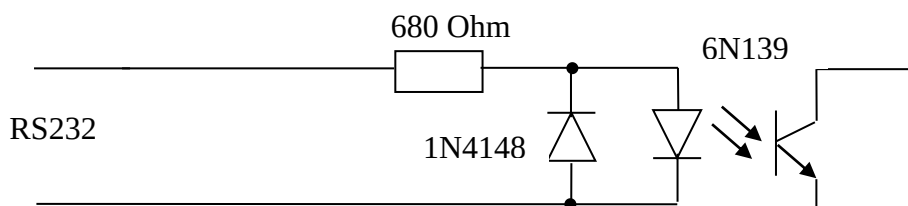


Figure 5.1 – Gyro compass Input RS232

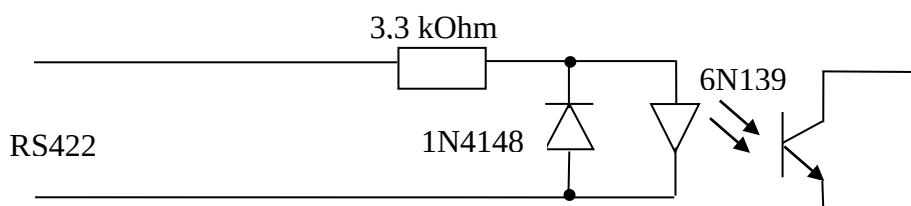


Figure 5.1a – Gyro compass Input RS422

5.1.9 Data Transmitters

The data transmitters of 26C31 type (interface RS422) have the maximum output current 150 mA.

5.1.10 Standards

The Alphaminicourse is designed to meet the requirements of the following:

- ❑ Regulations of the Russian Maritime Register of Shipping
- ❑ IMO Resolution A.424 (XI), Performance Standards for Gyro compasses Standard Craft
- ❑ IMO Resolution A.821 (19), Performance Standards for Gyro compasses for High-Speed Craft
- ❑ IMO Resolution A.694 General requirements for nav. equipment aids forming part of GMDSS
- ❑ MSC.191(79): Standards for navigation-related information on navigation displays
- ❑ IEC 60945: incl. Corr.1, General Requirements – Methods of testing and required test results
- ❑ IEC 62288: General Requirements – Methods of testing and required test results
- ❑ ISO 8728: Ships and marine technology, Gyro compasses for Standard Craft
- ❑ ISO 16328: Ships and marine technology, Gyro compasses for High-Speed Craft
- ❑ CE marking
- ❑ Electromagnetic Compatibility (EMC) Directive
- ❑ The Marine Equipment Directive 96/98/EC
- ❑ IEC 61162-1: (E) Marine navigation and radio communication equipment and systems – Digital interfaces.

5.2 Data Formats

Set the DIP-switch and adjust the channels using the Control Unit in accordance with your specific input and output requirements. Instructions are given in the sub-section 3.2.4.

Inputs – Refer to sub-section 5.2.2.

Acceptable input formats:

- ☐ Latitude information using serial IEC 61162 GNS, RMC, GLL or GGA sentences.
- ☐ Speed information using serial IEC 61162 VBW, RMC, VTG or VHW sentences. The sentences can contain speed information in knots and/or km/h. The Alphaminicourse will use the speed in knots if available, in preference to speed in km/h.
- ☐ If an RMC sentence is used, it must contain both speed and latitude information.
- ☐ Pulsed speed input (5V to 10V).

Outputs – Refer to sub-section 5.2.3

Serial output formats:

The Alphaminicourse transmits information through RS232 and RS422 serial lines using the IEC 61162 format. The serial transmission rate can be either 4800, 9600, 19200 or 38400 baud, with updates occurring at 1,10,20,50 Hz as defined by the setting of the DIP-switch.

Other output formats

- ☐ Resolver Heading Output
- ☐ Stepper S-code Heading Output
- ☐ Rate of Turn output using bipolar analogue voltage in the range +10V / -10V.

The following sub-sections describe each of the formats supported by the Alphaminicourse.

5.2.1 IEC 61162 Serial Data Formats – General Information

The Alphaminicourse accepts and transmits asynchronous serial data through RS232 and RS422 lines using 8 data bits, 1 stop bit and no parity. In each packet the least significant bit goes the first. The most significant bit of the 8-bit character will always be zero.

Start	D0	D1	D2	D3	D4	D5	D6	D7=0	Stop
-------	----	----	----	----	----	----	----	------	------

Baud rate = 4800

Data bits = 8 (bit D7 is always zero)

Parity = none

Stop bits = one

Figure 5.2 – Serial data format

All data is interpreted as ASCII characters that form IEC 61162 sentences split into individual fields. All fields, including null fields, are separated by commas.

The IEC 61162 format supports an optional checksum, if included. The checksum occurs as an additional field immediately before the carriage return line-feed characters. It consists of an asterisk (*) followed by a checksum derived by exclusive OR-ing the eight data bits of each valid character preceding the asterisk, but excluding the \$ symbol, in the sentence. The absolute value of the checksum is transmitted in ASCII characters representing the value in HEX. IEC 61162 sentences are transmitted ten times a second.

5.2.2 Inputs

5.2.2.1 IEC 61162 Input Signals

The Alphaminicourse will accept sentences in both data formats: IEC 61162-1:2000(E) and NMEA 0183 version 2.1

In the following descriptions of input sentences, the Alphaminicourse uses the data fields marked 'XXX' in IEC 61162 sentence. The gyro compass does not use the fields marked '???' and their descriptions are included here for completeness only. The gyro compass will recognize the arriving sentence format and automatically extract the required data from it.

GPS Interface (see Table 3.3 for connection details)

The Alphaminicourse can accept speed, latitude, date and time inputs from GPS in IEC 61162 format using GNS, RMC, GLL, GGA, VTG, VHW sentences.

\$??GNS,?????.??,XXXX.XX,X,?????.??,?,X--X,??,?.?,?.?,?.?,?.?,?.?*,??[CRLF]

Start character
Talker identifier (any characters)
Mnemonic of recommended min GNSS data
UTC of position (hhmmss.ss)
Latitude (ddmm.mm)
Mnemonic for North or South
Longitude (dddmm.mm)
Mnemonic for East of West
Mode indicator
Total number of satellites in use (0-99)
Horizontal dilution of precision
Antenna altitude relative to mean sea level
Geoidal separation
Age of differential data
Differential reference station ID
Checksum field
Carriage return Line-feed characters

Figure 5.3 – IEC 61162 GNS input sentence structure

\$??RMC,??????.??,X,XXXX.XX,X,?????.??,?,X,X,?.,??????.?.,?,X[CRLF]

Start character
Talker identifier (any characters)
Mnemonic for recommended min GPS data
UTC of position (hhmmss.ss)
Status, A=valid, V=Nav.Receiver warning
Latitude (ddmm.mm)
Mnemonic for North and South
Longitude (dddmm.mm)
Mnemonic for East or West
Ground speed in knots
Course over ground in degrees
Date of fix
Magnetic variation in degrees
Magnetic variation indicator East or West
Mode indicator
Carriage return Line feed character

Figure 5.4 - IEC 61162 RMC input sentence structure

\$??GLL,XXXX.XX,X,?????.??,?,??????.??,XX[CRLF]

Start character
Talker identifier (any characters)
Mnemonic for geographical latitude and longitude
Latitude (ddmm.mm)
Mnemonic for North or South
Longitude (dddmm.mm)
Mnemonic for East or West
UTC of position (hhmmss.ss)
Status
Mode indicator
Carriage return Line-feed characters

Figure 5.5 - IEC 61162 GLL input sentence structure

\$??GGA,?????.??,XXXX.XX,X,?????.??,?,X,??,?.?,?.?,?.?,?.?,?.?,????[CRLF]

Start character
Talker identifier (any characters)
Mnemonic for GPS fix data
UTC of position (hhmmss.ss)
Latitude (ddmm.mm)
Mnemonic for North or South
Longitude (dddmm.mm)
Mnemonic for East or West
GPS quality indicator
Number of satellites in use (00-12)
Horizontal delution of precision
Antenna altitude relative to mean sea level
Mnemonic for meters
Geoidal separation
Mnemonic for meters
Age of differential GPS data
Differential reference station (0000-1023)
Carriage return Line feed characters

Figure 5.6 - IEC 61162 GGA input sentence structure

\$?? VTG, ?.?,?.?,?.?,?.?,X.X,X,XX.X,X,X[CRLF]

Start character
Talker identifier (any characters)
Mnemonic for ground course and speed
Course in degrees and tenths
Mnemonic for True heading
Course in degrees and tenths
Mnemonic for Magnetic heading
Speed in knots
Mnemonic for knots
Speed in km/h
Mnemonic for km/h
Mode indicator
Carriage return Line-feed characters

Figure 5.7 - IEC 61162 VTG input sentence structure

\$?? VHW,???.? ,? ,???.? ,? ,XX.X,X,X,XX.X,X[CRLF]

Start character
Talker identifier (any characters)
Mnemonic for vector heading and water speed
Heading in degrees and tenths
Mnemonic for True heading
Heading in degrees and tenths
Mnemonic for Magnetic heading
Speed in knots
Mnemonic for knots
Speed in km/h
Mnemonic for km/h
Carriage return Line-feed characters

Figure 5.8 - IEC 61162 VHW input sentence structure

Log Interface (see Table 3.3 for connection details)

The Alphaminicourse can accept speed inputs at the log interface in IEC 61162 format using VBW, VTG and VHW sentences.

\$?? VBW , ?.? , ?.? , ? , X.X,?.? , X, ?.? , ? , ?.? , ? *hh[CRLF]

Start character
Talker identifier (any characters)
Mnemonic for ground speed/water speed
Longitudinal water speed in knots
Transverse ground speed
Status: water speed, A=valid, V=invalid
Longitudinal ground speed in knots
Transverse ground speed in knots
Status: ground speed, A=valid, V=invalid
Transverse water speed of stern in knots
Status: water speed, A=valid, V=invalid
Transverse ground speed of stern in knots
Status: stern ground speed, A=valid, V=invalid
Checksum field
Carriage return Line-feed character

Figure 5.9 - IEC 61162 VBW input sentence structure

\$?? VTG, ?.?.?.?.?.?.?.?.X.X,X,XX.X,X,X[CRLF]

Start character
Talker identifier (any characters)
Mnemonic for ground course and speed
Course in degrees and tenths
Mnemonic for True heading
Course in degrees and tenths
Mnemonic for Magnetic heading
Speed in knots
Mnemonic for knots
Speed in km/h
Mnemonic for km/h
Mode indicator
Carriage return Line-feed character

Figure 5.10 - IEC 61162 VTG input sentence structure

\$?? VHW, ????.?.?.?.?.?.?.?.X.X,X,XX.X,X,X[CRLF]

Start character
Talker identifier (any characters)
Mnemonic for vector heading and water speed
Heading in degrees and tenths
Mnemonic for True heading
Heading in degrees and tenths
Mnemonic for Magnetic heading
Speed in knots
Mnemonic for knots
Speed in km/h
Mnemonic for km/h
Carriage return Line-feed character

Figure 5.11 - IEC 61162 VHW input sentence structure

5.2.2.2 Pulsed Input

The Alphaminicourse can accept a speed input in the form of pulses occurring at a frequency of 100, 200 or 400 per nautical mile as selected by the DIP-switch.

The gyro compass determines the vessel speed by reference against the microprocessor timing circuits. The speed pulses do not need a particular mark/space ratio, but they should have amplitude from 5 to 10 Volts.

5.2.3 Outputs

5.2.3.1 IEC 61162 Output Signals

The Alphaminicourse can output serial data through RS232 and RS422 serial lines in IEC 61162-1:2000(E) format. Dependent on the settings, the output may contain either:

1. Heading – as described below, OR
 2. Heading and Rate of turn – as described below, OR
 3. Heading and Speed – as described below.
 4. Speed and Rate of Turn
 5. All Data
- ❑ For Heading information the HDT and THS format sentence is used. At the DIP-switch you may set the resolution for the output to one or two decimal places. Refer to Figure 5.13 and 5.17 for a description of this output format sentences.
 - ❑ For Rate of Turn the ROT format sentence is used. Refer to Figure 5.14 for a description of this output format.
 - ❑ Speed information is transmitted in VHW format sentence, if the gyro compass is configured for manual or log input. VHW sentence also contains the heading that is inserted with the resolution as set by the DIP-switch. Refer to Figure 5.15 for a description of this output format.
 - ❑ If the All Data mode is selected sentences HDT, ROT, THS and additional sentences with coordinates and speed are transmitted. The Data package is transmitted with frequency 1 Hz despite of the transmission channel settings.

If the GPS mode is on, sentences received from GPS are transmitted as additional: RMC, RMA, GLL, GGA, GNS, ZDA, VBW, VHW, VTG. Talker identifier (that follows the symbol '\$') is changed for "HE". Presence of checksums in transmitted sentences is determined by their presence in received sentences despite of transmission channel settings.

In GPS mode additional sentences look as follows:

```

$HEGLL, xx00, x,,,, A, M[CRLF]
      |      |
      |      | Mnemonics for North or South
      |      |
      |      | Latitude (dd)

$HEVTG, xxx.x, T,,, x . x, N, x . x, K, M[CRLF]
      |      |      |      |
      |      |      |      | Speed in km/h
      |      |      |      |
      |      |      |      | Speed in knots
      |      |      |
      |      |      | Heading
  
```

Figure 5.12 - IEC 61162 additional sentence structure

Accuracy of heading and presence of checksums is determined by transmission channel settings.

\$HEHDT,XXX.X,X[CRLF]

Start character
Talker identifier (any characters)
Mnemonic for True heading present
Heading in degrees and tenths
Mnemonic for True heading
Carriage return Line-feed character

Figure 5.13 - IEC 61162 HDT output sentence structure

\$HEROT,X.X, X[CRLF]

Start character
Talker identifier
Mnemonic for Rate of Turn
Rate of turn °/m (negative for port turn)
Status: A=valid, V=invalid
Carriage return Line-feed character

Figure 5.14 - IEC 61162 ROT output sentence structure

\$?? VHW,???.??.??.??.XX.X,X,XX.X,X[CRLF]

Start character
Talker identifier (any characters)
Mnemonic for vector heading and water speed
Heading in degrees and tenths
Mnemonic for True heading
Heading in degrees and tenths
Mnemonic for Magnetic heading
Speed in knots
Mnemonic for knots
Speed in km/h
Mnemonic for km/h
Carriage return Line-feed character

Figure 5.15 - IEC 61162 VHW output sentence structure

5.2.4 IEC 61162 Sentence with Checksum

If the optional checksum is to be sent with any of the above IEC 61162 sentences, it is added as an extra field before the carriage return character as shown in Figure 5.16.

\$HEHDT,XXX.X,T*hh[CRLF]

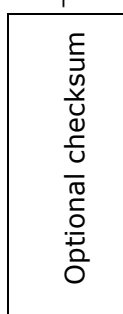


Figure 5.16 - IEC 61162 sentence with optional checksum

The checksum consists of an asterisk followed by the checksum calculated by exclusive OR-ing the eight data bits of each valid character preceding the asterisk in the sentence, but excluding the \$ symbol. The Alphaminicourse transmits the absolute value of the checksum in ASCII characters representing the value in HEX.

In accordance with the standard IEC 61162-1:2010 for the digital heading transmission it is recommended to use the THS sentence instead of HDT.

\$HETHS ,XXX.X, a*hh [CRLF]

 | |

 True Heading in degrees Mode identifier

Note – Mode identifier

A = autonomous

E = computed (accurate trajectory calculation)

M = manual input

S = simulation mode

V = data not valid (including idle mode)

Figure 5.17 - IEC 61162 THS sentence structure

In the mode All Data the gyro compass failures are transmitted as following:

```
$HEALR, ,240, A ,x, sss<CR><LF>
$HEALF, 1, 1, 0, ,B, ,x, ,240, y, 1, 0, sss,<CR><LF>
$HEALC,1 ,1 ,0 ,n , { ,240, y, 1 }...<CR><LF>
```

Where x - acknowledgement indicator (V – No, A – yes);

y – failure code (see Table 5.1);

sss – failure textual description (see Table 5.1);

n – number of failures;

$\{\}$ – identifier of one failure in the list of failures;

... - list of failures (if more than one).

Figure 5.18 - IEC 61162 ALR, ALF, ALC outputs sentence structure

Table 5.1 – Failure codes and textual descriptions

Code	Text	Description
1	Servo System	Servo System failure
2	DSP	Signal processor failure
3	RDC	Angle-to-digit convertor failure
4	Power	Failure of internal power supply
5	GPS	No GPS signal or invalid data
6	LOG	No LOG signal or blockage

5.2.5 Other Output Formats

5.2.5.1 Resolver Output (option)

The resolver heading output is available continuously at X11 connector on the rear panel when the gyro compass is powered-on. The connection details are given in the Table 3.4. This output with the maximum voltage 2V per phase is taken from a 1:1 resolver where it comes directly from the gyro compass azimuth gimbal. The resolver reference voltage is 10V, 400Hz.

Electrical loading specifications:

- ❑ not less than 5 kOhms between X11/4 and X11/3, X11/5 and X11/3;
- ❑ Not less than 1 kOhm between X11/6 and X11/7.

5.2.5.2 Stepper Output

Stepper S-code output is available continuously at X9 connector on the rear panel while the gyro compass is powered-on. See the connection details in the Table 3.4.

The stepper output is a TTL compatible S-code signal with a 10mA sink capacity.

5.2.5.3 Rate of Turn (option)

The ROT output is calculated by the internal processor updated at 20 Hz and made available continuously at X10 connector on the rear panel while the gyro compass is powered-on. Refer to the Table 3.4 for connection details.

The ROT output is an analogue voltage in the range $\pm 10V$ that represents the rate of turn:
 $\pm 30^\circ/\text{min}$; $\pm 60^\circ/\text{min}$; $\pm 90^\circ/\text{min}$; $\pm 120^\circ/\text{min}$; $\pm 180^\circ/\text{min}$; $\pm 300^\circ/\text{min}$; $\pm 1200^\circ/\text{min}$.
Particular value is set on the Control Unit.
Positive rates of turn are to starboard.

6 MAINTENANCE

CAUTION!



Inappropriate tampering with the internal controls and components of the gyro compass can lead to damage or serious performance degradation.

NEVER open the gyro compass cover or make any adjustments inside the gyro compass unless one is a fully Alphasatron Authorized Service Agent.

There is little need for user maintenance on the Alphaminicourse and one should never need to remove the cover.

Gyro compass maintenance includes inspection of the Alphaminicourse external appearance, security of attachment, condition of cables and reliability of their connection.

If the gyro compass is not used for a period of 6 months and more (e.g. the vessel is laid up for repair), the compass should be run for 30 minutes at intervals not less than 6 months.

6.1 Gyro compass Alphaminicourse drift adjustment

Periodic maintenance of the gyro compass including drift adjustment is carried out once a year after its installation on the vessel as well as after repair or a long idle time. Drift compensation is made when the vessel is moored to the berth.

Switch on the gyro compass in accordance with the procedure of the p.4.2 of the Manual. On the control panel set the speed 0 knots and the local latitude manually or use the GPS mode. In 12 hours take the reading of the current heading Hg from the control panel. By taking the bearing determine the gyro compass correction value ΔH :

$$\Delta H = H_b - H_g,$$

where H_b – the vessel heading received as a result of direction finding,
 H_g – the current heading of the vessel in accordance with gyro compass.

Switch off the gyro compass. In 5 minutes set the GC into the adjustment mode by pressing at first the buttons ▲ and ▼ and then the button . In this mode the gyro compass and the servo system are de-energized. The display will show:

D - 0.1

Correction		
Sign of correction		
Value of correction		

With the help of ▲ and ▼ buttons set the value of correction. The input range is from -9.9 to 9.9 degrees. By briefly pressing the buttons «LAT» and «SPEED» simultaneously the gyro compass will be set into GC (normal gyro compassing) mode with the new value of the horizontal drift. Please note that when pressing the buttons «LAT» and «SPEED» for too long, <OUT1> will appear. Scroll with ▲ and ▼ up to <EXIT> and then press «LAT» to accept. The gyro compass will restart, **keep in mind that the drift correction made is stored.**

After the adjustment the gyro compass shall operate in the GC mode not less than 5 hours and then the gyro compass correction value is determined once again. It should not exceed $\pm 0.2^\circ$ otherwise the adjustment is repeated.

6.2 Built-in Test Equipment

The Alphaminicourse performs a self-test routine during the initialization sequence and monitors its status continually during normal operation. Any deviation from normal operation appears as an error message with the indication of cause on the 4-character display.

A list of messages including two warning codes and five failure codes that are delivered by the built-in test equipment in case of the gyro compass fault is given in the sub-section 3.4.3. The 4-character display will show one of the failure messages and the alarm will sound. If the built-in test equipment detects a fault, use the table 6.1 to investigate the cause.

Table 6.1 – List of failure messages

Failure Code	Probable Cause	Remedy
TEST and audible signal	Component failure	The failure is due to the component damage and cannot be corrected in the field; is to be sent to the manufacturer or to the approved service center
SS	Gyroscope or servo system failure	The failure is due to the component damage and cannot be corrected in the field; is to be sent to the manufacturer or to the approved service center
BETA	1) Improper setting and/ or adjustment of the gyro compass 2) Component failure	1) Adjust the gyro compass properly (set the correct latitude and speed) 2) Cannot be corrected in the field. is to be sent to the manufacturer or to the approved service center
RDC	Resolver-digital converter failure	The failure is due to the component damage and cannot be corrected in the field; is to be sent to the manufacturer or to the approved service center
DSP	Failure of a signal processor on the analog board	The failure is due to the component damage and cannot be corrected in the field.
PWR	Failure of the power supply board	The failure is due to the component damage and cannot be corrected in the field
NO+GPS	Loss or distortion of GPS receiver signal	Check the link and polarity of connection. Use manual correction if case the correct operation of GPS cannot be provided.
ERR+GPS	Invalid GPS signal (invalid checksum)	The link may be not standard. Use manual correction if case the correct operation of GPS cannot be provided.
????+GPS	The unit does not recognize the GPS signal	Adjust the GPS receiver for transmission of the sentences acceptable to the gyro compass.
NO+LOG	Loss or distortion of the log signal	Check the link and polarity of connection.
????+LOG	Log signal is not recognized	Adjust the log for transmission of the sentences acceptable to the gyro compass.
ERR+LOG	Invalid log signal (invalid checksum)	The link may be not standard.

6.3 Fuse Replacement (3.15A 250V)

You can easily replace the fuse, this procedure do not require any special skills. The fuse is located on the gyro compass base from the rear side. You should take it out of the receptacle and replace.

6.4 Alphaminicourse Diagrams

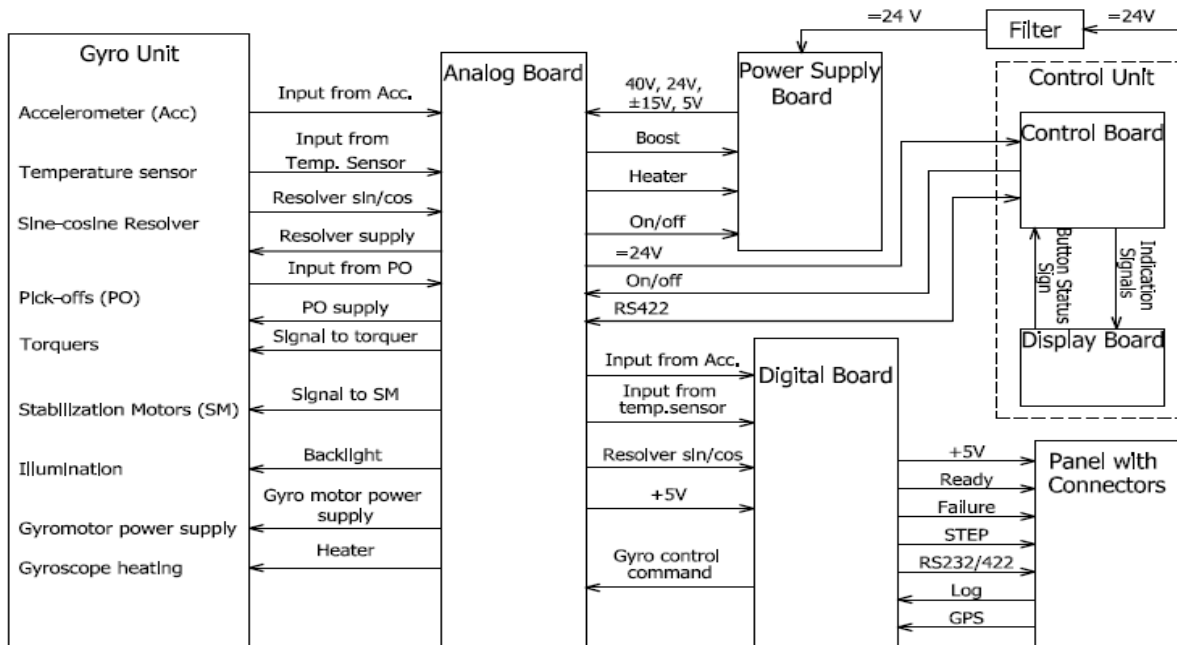


Figure 6.1 – The Gyro compass Block Diagram

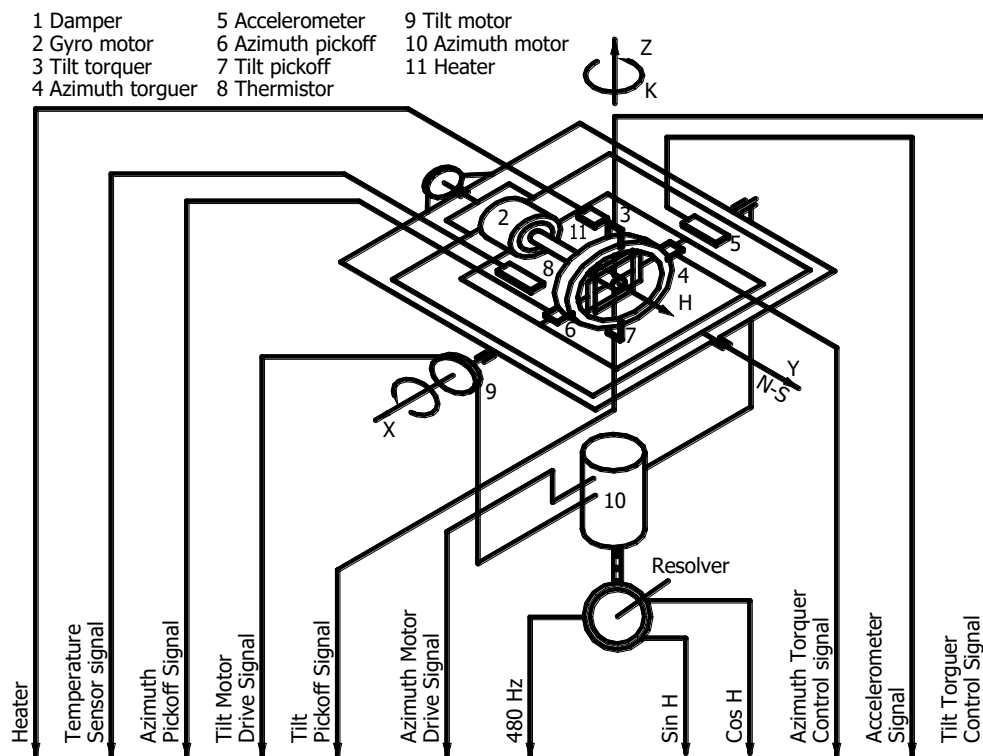


Figure 6.1 – Gimbal assembly functional diagram

7 TRANSPORTATION

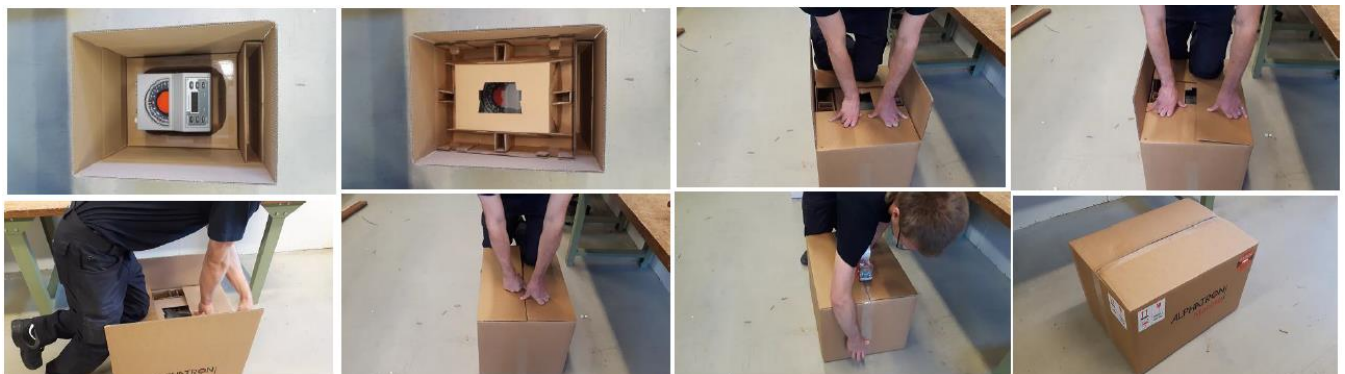
7.1 Dual-use good

The Alphaminicourse Gyrocompass is classified as a dual-use good: They can be used for non-military and military applications. As consequence the products are subjected to dual-use goods export control procedures:

- ❑ Alphatron can be delivered the Alphaminicourse freely to The Netherlands or any country of the European Union.
- ❑ Alphatron can export NEW Alphaminicourse Gyrocompasses under its own Community General Export Authorization EU001 to the following countries: Australia, Canada, Japan, New Zealand, Norway, Switzerland (including Liechtenstein) and United States of America.
- ❑ Alphatron can export repaired Alphaminicourse Gyrocompasses under its own Community General Export Authorization EU003 to the following countries: Albania, Argentina, Bosnia and Herzegovina, Brazil, Chile, China (including Hong Kong and Macao), Croatia, The former Yugoslav Republic of Macedonia, French Overseas Territories, Iceland, India, Kazakhstan, Mexico, Montenegro, Morocco, Russia, Serbia, Singapore, South Africa, South Korea, Tunisia, Turkey, Ukraine, Unites Arab Emirates.
- ❑ The Alphaminicourse can be exported to other countries but only through the preliminary issuance of an individual export license by the Dutch authorities.

7.2 Transport

- ❑ The gyro compass is packed into an special designed Alphatron box and can be transported by any means of transportation to any distance.
- ❑ Transportation boxes with the gyro compass set shall be protected against atmosphere precipitation and shall be fastened to prevent fall, jumps, movements and mutual collision of units. The boxes should be handled during transportation, carriage and loading in accordance with the inscriptions made on the boxes.
- ❑ Ambient temperature during transportation shall be within the range from -60°C to +70°C.
- ❑ All Gyro compasses leaving Alphatron are secured on an pallet and marked with shockwatch indicators. If the shockwatch indicators are red after transportation, please contact Alphatron.
- ❑ Clients who have received a replacement Gyro compass need to use its special designed Alphatron box to transport there defected Gyro compass back to Alphatron. Please see below pictures how to pack.



8 STORAGE

- ❑ The gyro compass shall be stored in a lockable heated space equipped with humidity and temperature indicators. The maximum relative humidity in the storage area is 85%.
- ❑ The indoor temperature shall be within the range +5°C to +30 °C. The distance to the heaters shall prevent their direct influence on the gyro compass.
- ❑ If the gyro compass is stored in the package, it should be positioned in accordance with the inscriptions on the box.
- ❑ In and near the storage area there must be no alkali, acids or other aggressive substances.
- ❑ The gyro compass storage time without the re-preservation is three years.

9 SERVICE

9.1 Self Service

As mentioned on page 62 there is little need for user maintenance on the Alphaminicourse and one should never need to remove the cover. The gyro compass cover may only be opened by fully Alphasatron Authorized agents to make any adjustments or repairs to prevent loss of warranty.

Please keep in mind that drift adjustment as periodic maintenance of the Alphaminicourse gyro compass should be carried out every year after its installation on the vessel as well as after repair or a long idle time.

Drift compensation can be performed when the vessel is moored to the berth, for the operating procedure please use page 62.

10 WARRANTY REGISTRATION FORM
Warranty Registration Form

			
		Telephone: +31(0)10-4534000 P.O. Box 21003 Telefax : +31(0)10-4534030 3001 AA Rotterdam Site: www.alphatronmarine.com The Netherlands Email: alphaline@alphatronmarine.com	
Install. Company*:			
Telephone:			
Email:			
Adress:			
Harbour:			
Vessel Name*:			
Vessel Type:			
Technician:		Installation Date*:	DD / MM / YY
			/ /
System*:		Type*:	
Consisting of / configuration system*		Serial number*	
Connected to:			
Remarks:			
NOTE:	To validate the warranty of this product, please send this document via e-mail, fax or post within two weeks after installation.		
Signature:		Date*:	DD / MM / YY
			/ /

11 GYRO SETTINGS REGISTRATION FORM

DIP-switch on Control Unit (CU)								
Number and Setting								
SA1 DIP-switch	1	2	3	4	5	6	7	8
ON								
OFF								

DIP-switch on Digital Board								
Number and Setting								
SA1 DIP-switch	1	2	3	4	5	6	7	8
ON								√
OFF								

Manual Settings in Control Unit (CU)							
Number and Setting							
OUT 1		OUT 2		OUT 3		OUT 4	
BAUT RATE		BAUT RATE		BAUT RATE		BAUT RATE	
B D		B D		B D		B D	
B 4.8		B 4.8		B 4.8		B 4.8	
B 9.6		B 9.6		B 9.6		B 9.6	
B 19.2		B 19.2		B 19.2		B 19.2	
B 38.4		B 38.4		B 38.4		B 38.4	
DATA RATE (HZ)		DATA RATE (HZ)		DATA RATE (HZ)		DATA RATE (HZ)	
1.H Z		1.H Z		1.H Z		1.H Z	
10. H Z		10. H Z		10. H Z		10. H Z	
20. H Z		20. H Z		20. H Z		20. H Z	
50. H Z		50. H Z		50. H Z		50. H Z	
PRECISION		PRECISION		PRECISION		PRECISION	
P D		P D		P D		P D	
P 0.1		P 0.1		P 0.1		P 0.1	
P 0.01		P 0.01		P 0.01		P 0.01	
CHECKSUM		CHECKSUM		CHECKSUM		CHECKSUM	
C S D		C S D		C S D		C S D	
C S 0		C S 0		C S 0		C S 0	
C S 1		C S 1		C S 1		C S 1	
SENTENCES		SENTENCES		SENTENCES		SENTENCES	
S. D		S. D		S. D		S. D	
S. H D T		S. H D T		S. H D T		S. H D T	
S. H + R		S. H + R		S. H + R		S. H + R	
S. H + V		S. H + V		S. H + V		S. H + V	
S. V + R		S. V + R		S. V + R		S. V + R	
S. T H S		S. T H S		S. T H S		S. T H S	
S. T + R		S. T + R		S. T + R		S. T + R	
S. A L L		S. A L L		S. A L L		S. A L L	