ONWA®
KAP-866

KAP-866
OPERATOR`S MANUAL

Autopilot

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SAFETY INSTRUCTIONS

Safety Instructions for the Operator

WARNING

Do not open the equipment.

Only qualified personnel should work inside the equipment.

Do not disassemble or modify the equipment.

Fire,electrical shock or serious injury can result.

Immediately turn off the power at the switchboard if the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire or electrical shock.Contact a **ONWA** agent for service.

Use the proper fuse.

Use of a wrong fuse can damage the equipment or cause fire.

Be sure the power supply is compatible with the equipment.

Incorrect power supply may cause the equipment to overheat.

The useable temperature range -15℃ to 55℃ for the display unit.

Use of the equipment out of those ranges may damage the equipment.

Safety Instructions for the Installer

WARNING

Do not open the cover unless totally familiar with electrical circuits and service manual.

Improper handling can result in electrical shock.

Turn off the power at the switchboard before beginning the installation.

Fire or electrical shock can result if the power is left on.

Be sure that the power supply is compatible with the voltage rating of the equipment.

Connection of an incorrect power supply can cause fire or equipment damage.

Use the proper fuse.

Use of a wrong fuse can damage the equipment or cause fire.

NOTICE

Observe the following compass safe distances to prevent interference to a magnetic compass:

	Standard Compass	Steering Compass
Display unit KAP–866	0.4 m	0.3 m
Heading sensor KA–GC9A	1.2 m	1.2 m

WARNING!

Automatic pilots are designed to be a navigational aid. As an automatic steering aid, an autopilot can alleviate the boredom of hand steering.

This allows the operator of the vessel time to attend to other duties, keep a more accurate check of navigation duties or just relax and enjoy the trip.

HOWEVER, THE AUTOPILOT SHOULD NOT BE LEFT SOLELY IN CHARGE OF THE VESSEL AND AN ADEQUATE WATCH SHOULD BE MAINTAINED AT ALL TIMES.

IT IS NOT RECOMMENDED THAT THE AUTOPILOT BE USED WHILE NAVIGATING IN RESTRICTED WATERWAYS AS WATER CURRENTS, WIND CHANGES OR RADIO TRANSMITTER INTERFERENCE MAY AFFCT VESSEL COURSE SUFFICIENTLY TO ENDANGER YOUR OWN OR OTHER VESSELS.

FOREWORD

Thanks you for purchasing the ONWA KAP-866 Autopilot.

The KAP-866 Autopilot controls the vessel steering through mechanical drive, reversing pump set, solenoid valves or relays.

The compass must be installed in a place free of magnetic interference, and connected to the autopilot via the cable supplied.

The rudder feedback must be attached to the rudder in such a way that it can accurately measure the position of the ship's rudder. This must also be connected to the autopilot via the cable supplied.

KAP-866 is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly installed and maintained.
Please carefully read and follow the operation, installation and maintenance procedures set forth in this manual.

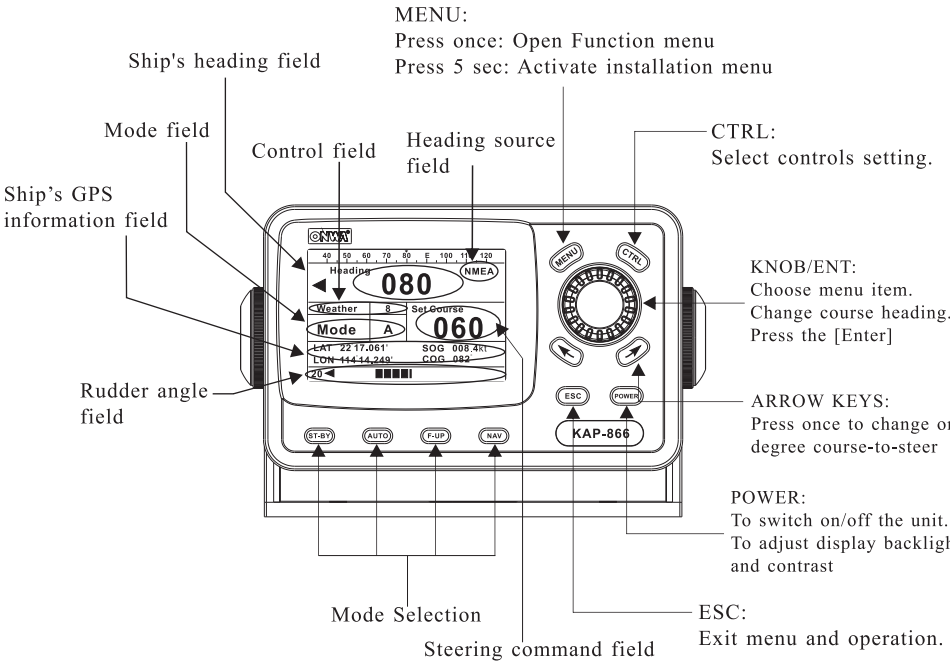
We would appreciate feedback from you.

Thank you for considering and purchasing ONWA.

Verifying the contents

When you first time open the box please confirm you have following items inside the box:
- Control unit KAP-866 with mounting
- Heading sensor KA-GC9A
- Light duty rudder feedback unit KRF-36
- 30 meters cable for KRF-36 to control unit
- 4 ways plastic marine ratchet mount for KA-GC9A
- 2 meters power cable
- Standard accessories
- Manual

1.1 Controls



1.2 Turning the power on/off

- **Power on**

Press [**POWER**] once to switch on the unit with a "beep" sound.

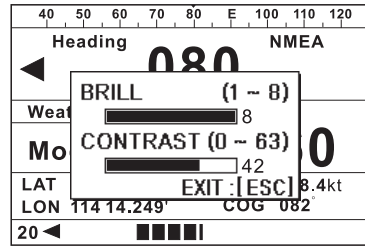
● **Power off**

Press and hold [**POWER**] key until the unit turn off.

NOTE: If the device is a long time when not in use, Better to turn off the main switch of the power supply unit.

1.3 Display backlight and contrast adjustment

1. Press the [**POWER**] key. Dialog box for adjustment of Panel brilliance and display contrast.

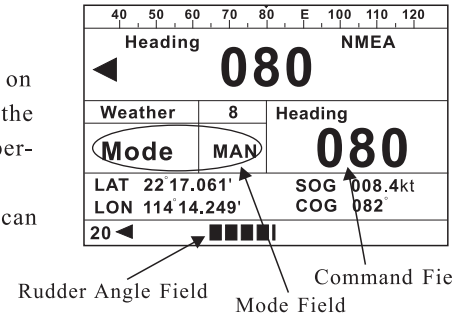


2. Turn the Knob to select BRILL box and press the Knob to confirm, then turning the Knob to change the backlight brilliance and press the Knob again to confirm the setting.
3. Turn the Knob to select CONTRAST box and press the Knob to confirm, then turning the Knob to change the display contrast and press the Knob again to confirm the setting.
4. Press [**ESC**] to exit.

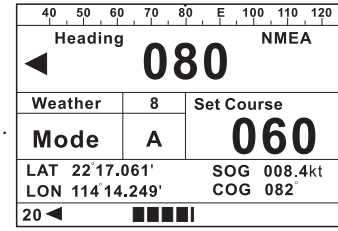
1.4 Standby Mode

When switching on the unit it stays on Standby Mode and "Man" display on the Mode field to indicate the steering operate manually.

In any steering mode, press [**ST-BY**] can return to manual steering mode.



1.5 Auto Mode



Press [**Auto**] change steering mode to Auto and "A" display on the Mode field to indicate the steering operate automatic to the set course.

The autopilot will lock on to the current heading. Change course as follows :

a) Rotating the Knob to change the course-to-steer by one degree for each "click".

b) Pressing the [↖] or [↗] arrow keys will also cause a one degree course change for each press to corresponding direction.

Controls:

press the [**CTRL**] to select Weather adjustment. Turning the Knob to change the setting of the Weather control then press the Knob to confirm the setting or press [**ESC**] to exit.

1.5.1 Weather Control

This setting is used for adjusting the autopilot's reponse on varies sea conditions. The weather value sets the desired accuracy of the vesse l steering. A high weather setting will cause the vessel to steer very accurately but may cause excessive use of the steering.

In good weather, set this control to a high value, but ensure that the drive arrows display on ship's heading field would not flickering continuously. This will give the straightest possible course.

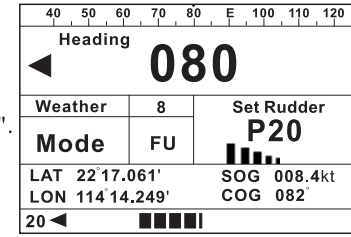
In poor weather, reduce this setting to prevent over-working the steering.

1.6 Follow-Up Mode

Press [**FU**] to change the steering mode to Follow Up and "FU" display on the Mode field to indicate the rudder steer follows the set command angle on the Command field.

Set rudder angle can change the course of the autopilot :

a) Rotating the knob will change the rudder angle command by one degree for each "click".

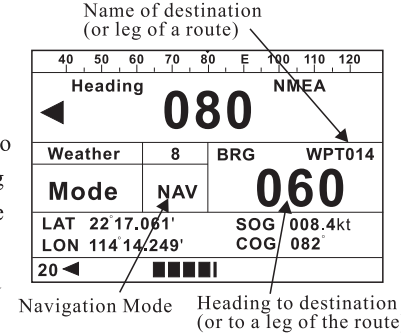


Rudder will steer and stop on the set angle and direction.

Rotate the Knob to clockwise direction to drive the rudder to Starboard side while rotate the Knob to Counter-Clockwise direction to drive the rudder to Port side.

b) Pressing the [↖] or [↗] arrow keys will cause a one rudder angle change in that direction.

1.7 Navigation Mode



For use when KAP-866 is interfaced to a GPS Navigator with NMEA0183 data output.

In Navigation mode this allows the autopilot to be directed by the GPS Navigator, enabling automatic heading changes and eliminating the effects of wind and tide.

The number displays on the Command field indicates the course-to-steer,which will be the bearing between the origin ad destination Waypoints,plus a factor to correct for the **Current crosstrack-error(XTE).**

Engaging Navigation Mode

Press [**NAV**] change the steering mode to Navigation mode and "NAV" display on the Mode field to indicate the steering is directed by the connected GPS Navigator.

The vessel will begin turnin from its current course to the course requested by the GPS Navigation.

If no GPS data is being received by the KAP-866, the autopilot will lock onto the course of the vessel at the time that Navigation Mode was engaged, and the “No GPS Data alarm” shall sound.

Setting up your GPS Navigator

Because there are a great variety of GPS Navigator that will work with this autopilot, the following is a guide only. For more information, Please study your GPS Navigator manual.

The GPS Navigator must be set up to output NMEA0183 data on a pair of wires which are connected to the "GPS IN" terminal connections on KAP-866.

The data generated must include at least one of the followings:

- The APA sentence.
- The APB sentence.
- The BOD and XTE Sentences.

If only the XTE data sentence is available, the pilot can steer in a Restricted manner. See later in this section.

The GPS unit must then be commanded to go to a waypoint, or to follow a line joining two or more waypoints (called a route).

This unit will then send information to the autopilot from which can be calculated the course-to-steer. IF several waypoints are linked together into a single route, and the GPS unit is set to "auto-sequenence" between them, and an "arrival zone" of more than 0.1 NM(Nautical Miles)is set so that the GPS can detect when the vessel has reached a waypoint, then the KAP-866 will be able to steer from each waypoint to the next without intervention.

If only the XTE information is available from your GPS unit then your vessel must be on track, and heading in the correct direction before engaging the GPS mode, and the auto-sequencing feature is not available.

Remember:

Prior to engaging Navigator mode, a route must be programmed into the GPS for the Autopilot to follow.

No GPS Data Alarm

If the autopilot is not receiving valid information while in GPS Mode, the No GPS Data alarm will sound, and "NO GPS" will blink on the display. This counld be caused by:

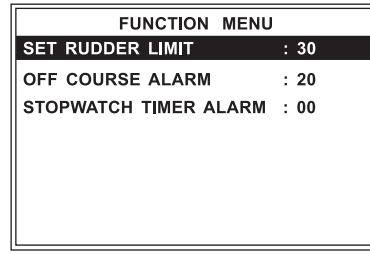
- Incorrect wiring of the GPS to the KAP-866.
- Incorrect data output from the GPS unit.
- No route set up or selected in the GPS unit.
- No location fix at the GPS unit.

The bearings generated by the GPS unit must correspond to the bearings the KAP-866 is receiving from its magnetic compass. The greater the difference between these Bearings, the less accurate will be the Navigator mode steering.

- Ensure that the GPS unit has the correct magnetic correction factor.
- Ensure that the KAP-866 compass is correctly aligned and installed.

2.1 Function Menu

Press [**MENU**] to display the Function menu.
Turning the Knob to move cursor between the Function menu items. Press the Knob to confirm the selection. Turn the Knob to change the setting in the setting in the selected item. Press the Knob to confirm the setting or press [**ESC**] to exit.



2.1.1 Set Rudder Limit

There are physical limitations to the angle that the rudder can move through. If the autopilot attempts to drive the rudder past these limits, damage to the steering gear may occur.

Setting Rudder Limit is to prevent the rudder from over-steer beyond the set limit. The Rudder Limit will function before the steering system reach the mechanic limit.

There are 2 symbols "P_L" (Port Limit) and "S_L" (Starboard limit) will appear on the display. When you see either of these 2 symbols:

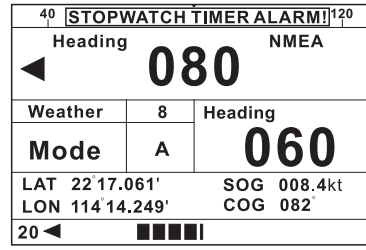
a) When rudder moves excess the set Port Limit (or Starboard Limit) a "P_L" (or S_L) will appear on the display. No port (or Starboard) rudder movement command will be sent out from the autopilot.
b) The functioning of Starboard Limit (S_L) us same as Port Limit (P_L)

Note: The factory default setting of Rudder limit is 30 degrees. That means if rudder feedback unit is properly installed then when the rudder is moved over Port or Starboard 30 degrees, the display will show P_L or S_L.

2.1.2 Stopwatch Timer Alarm

In any mode press [**MENU**] to display Function menu. Rotate the Knob to move cursor to "STOPWATCH TIMER ALARM" and press the Knob to confirm. Rotate the Knob to change the setting between 0~120 minutes and press Knob to confirm and save setting.

After setting "STOPWATCH TIMER ALARM" the countdown will start once "AUTO" or "NAV" mode is set. when countdown to "0" from preset time the "STOPWATCH TIMER ALARM" will be triggered, a continuously short "beep" sound and flashing "STOPWATCH TIMER ALARM!" will appear on the display.



The user can press [**ESC**] to cancel the alarm and the timer will start another countdown again. Once countdown to "0" from the preset time the "STOPWATCH TIMER ALARM" will be triggered again. The "STOPWATCH TIMER ALARM" will be carried out repeatedly until either the user select other modes (ST-BY or F-UP) than "AUTO" or "NAV" modes or change the timer to "000".

If the "STOPWATCH TIMER ALARM" is triggered and the user without press [**ESC**] to cancel the alarm within one minute, the alarm sound will change form short "beep" to continuous long "beep" and the external alarm (if installed) will be triggered.

Note: Stopwatch Timer alarm only active on [AUTO] or [NAV] mode.

2.1.3 Off Course Alarm

An alarm will sound if the vessel has deviated from its desired course by more than a set number of degrees. This can be caused by a number of steering faults, any of which require attention by the crew.
The angle at which this alarm sounds may be set to any value between 1 and 90 degrees.

To set the off-course alarm angle

In any mode press [**MENU**] to display Function menu. Rotate the Knob to move cursor to "Off Course Alarm" and press the Knob to confirm. Rotate the Konb to change setting from 0~90 degrees and press the Knob to save setting or press [**ESC**] to exit without save the setting.

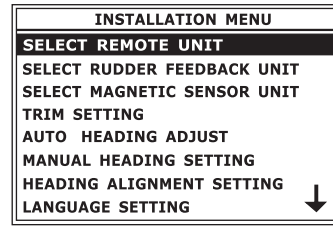
When the allowable angle is exceeded, the off-course alarm will sound and a flashing "OFF COURSE" will show on display. When the vessel is brought on to its correct course again, the alarm will cease.

Note that the alarm will sound if a large course change is entered. This alarm will cease as soon as the vessel completes its course change. The alarm may also sound when changing from one section of a GPS route to another, and will cancel itself when the course change is completed.

The default value for the off-course angle (ie the one set when the KAP-866 is turned on) is 20 degrees.

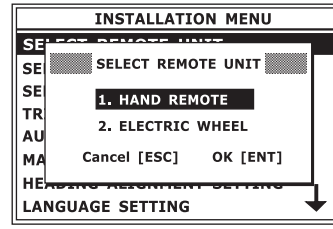
2.2 Installation Menu

Press and hold [**MENU**] button to enter the Installation menu. Rotate the Knob to the desire item and press the knob to enter the that item to make the related change.



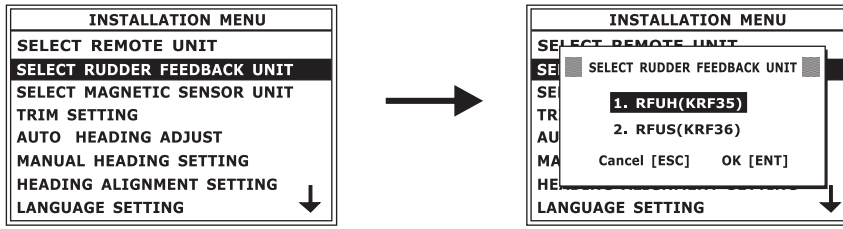
2.2.1 Select Remote Unit

There are 2 kinds of option remote units are available from Onwa, Hand Remote (RT580) and Electric Wheel (RW250).Choose either remote unit which is installed.
Note: No remote set up is needed if no remote unit is installed.



2.2.2 Select Rudder Feedback unit

There are 2 kinds of Rudder Feedback units are available from Onwa. heavy duty (KRF35) and light duty (KRF36) rudder feedback unit. Choose the correct rudder feedback unit which is installed. Usually light duty rudder feedback unit is for vessel below length of 50 meters (165 feet)
Note: Choice of Rudder Feedback Unit:
1) Heavy Duty Rudder Feedback Unit KRF35-RFUH
2) Light Duty Rudder Feedback Unit KRF36-RFUS



2.2.3 Select Magnetic Sensor Unit

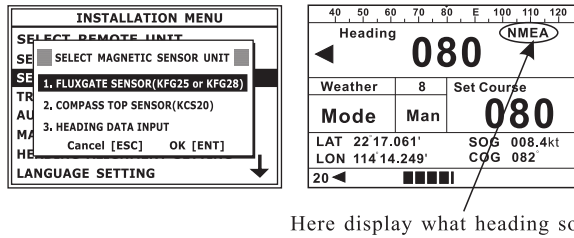
There are 3 kinds of Magnetic Heading Sensor units and heading sources are available from Onwa.

Note: Choice of Magnetic Sensor Unit and heading source

1) Fluxgate Sensor KFG25 and KFG28-FLUXGATE SENSOR

2) Compass Top Sensor KCS20-COMPASS TOP SENSOR

3) Heading data input(from KA-GC9A or gyrocompass)



Here display what heading source you selected

Display related to the heading source you selected:

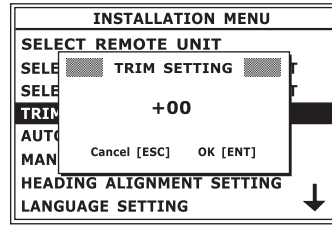
- COMPASS : 1. FLUXGATE SENSOR (KFG25 or KFG28)
- FLUXGATE : 2. COMPASS TOP SENSOR (KCS20)
- NMEA : 3. HEADING DATA INPUT

Note : If you selected "3. HEADING DATA INPUT" but KAP866 could not detect any heading data input, an alarm "HEADING DATA LOST" appears.

2.2.4 Trim Setting

Sometimes for some reasons the installation of Rudder Feedback Unit is not 100% aligned with the position of the Rudder. We could use the Trim Setting to compensate the installation error.

Note: It is not advised to use this function to compensate the error if the angle different is excess 10 degrees between actual rudder angle and display angle from rudder feedback unit. Re-installation should be carried out if the said angle error is excessed 10 degrees.

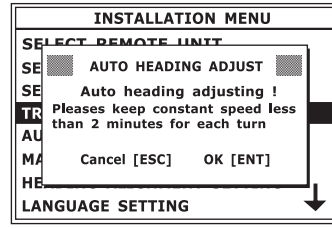


2.2.5 Auto Heading Adjust

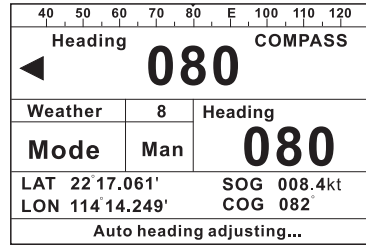
The compass has been calibrated during manufacture. This calibration will be satisfactory for almost all installations. If you have a steel vessel, or some other factor which causes the compass to perform poorly, the calibration procedure will adjust compass characteristics to compensate.

The calibration should only be done if the compass is known to be inaccurate. If the KAP-866 display as constant offset (e.g. The compass reads 3 degrees high on all bearings), simply rotate the Fluxgate Sensor case to align bearings with the ships compass. It is not necessary to re-calibrate the compass as desc-ribed below.

If the KAP-866 has inconsistent variation on different headings, the following calibration procedure can be carried out. This procedure should only be done in calm waters with adequate sea room.
In the menu select"AUTO HEADING ADJUST"and press knob The following window appears:

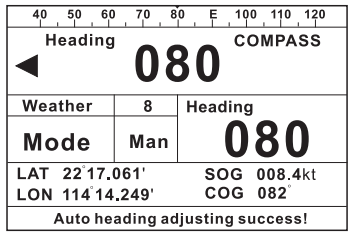


Press the knob to start auto heading adjustment "Auto heading adjusting" message will appear on the lower part of the display and heading update per second to show the status of adjustment.

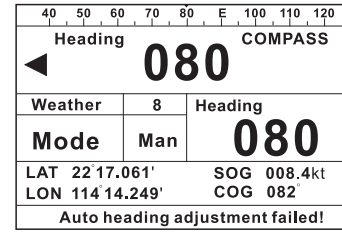


Note : This function is applied to KFG25 (or KFG28) or KCS20 installation. In case your heading source is NMEA0183 or KA-GC9A this item is disabled.

Steer the vessel in clockwise direction with constant speed less than 2 minutes per each circle until the following correction success message appear.



Success



Fail

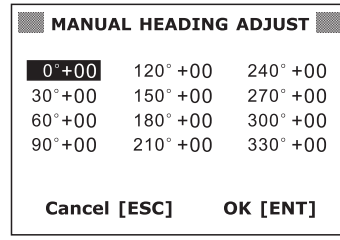
The message goes away after 6 seconds.

In case of correction fails repeat the above steps until the correction is successful.

2.2.6 Manual Heading Setting

Manual Compensation is a supplement to the type of single orientation parabola to adjacent 10 degrees. This method could be done by qualified personnel.

1) In the Installation menu select "MANUAL HEADING SETTING" and press the Knob, the following window appears:



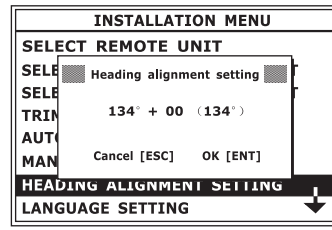
2) Rotate the Knob to choose which bearing you want to correct and press the Knob to confirm. Rotate the Knob to apply compensation and press the Knob to save the change or press [**ESC**] to exit without save.

Note: Anyway ship's magnetic compass and heading on KAP-866 shows each azimuth are unlikely to maintain consistent.

2.2.7 Heading Alignment Setting

Adjustment of heading might be needed during installation. Usually a fixed error in all direction would exist. It is due to the mechanical error when fixing.

1) Rotate the Knob to select "HEADING ALIGNMENT SETTING" in the installation menu. Press the Knob to show the following window:

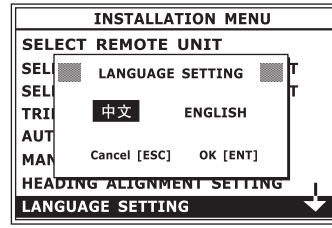


2) Rotate the Knob to change the heading alignment setting and press the Knob to save the change or press [**ESC**] to exist the window with out save the change.

2.2.8 Language Setting

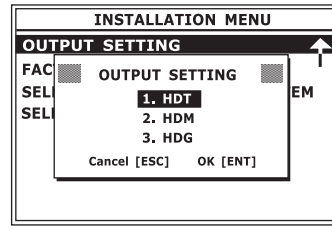
Choose different languages for different users.

1) Rotate the Knob to select "LANGUAGE SETTING" in the installation menu. Press the Knob to show the following window:



2) Rotate the Knob to select desire language and press the Knob to save change or press [**ESC**] to exit without save the change.

2.2.9 Output Setting



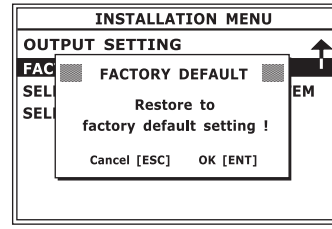
Output data available from KAP-866 includes the following three types:
HDT: True heading
HDM: Magnetic heading
HDG: Magnetic heading & magnetic variation value*
Note*: the default magnetic value is 0 since there are no enough data to calculate the magnetic variation. In calculation of magnetic value it requires position data (LON/LAT) and date, those data are not available in KAP-866.

Note:
Since there are no available data in KAP-866 for calculation of magnetic variation therefore:
- "HDT" outputs magnetic bearing instead of ture heading data.
- The magnetic variation data in "HDM" would be "0"

2.2.10 Factory Default Setting

For any reason need to reset all settings to factory default setting you can do as following instruction.

1. Rotate the knob to select "FACTORY DEFAULT SETTING" in installation menu. Press the Knob to show there following window:



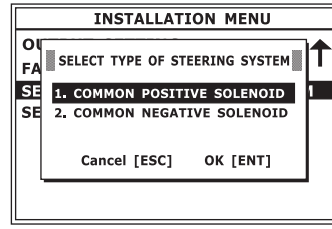
2. Press the Knob to clear all saved settings or press [**ESC**] to exist without clear the saved setting.

Note: When you select to load factory default setting all saved settings would be cleared. This action can not reversible.

2.2.11 Select Type of Steering System

Some vessel the steering system is either common positive solenoid or common negative solenoid or reversing motor. KAP-866 can be set to work with above systems.

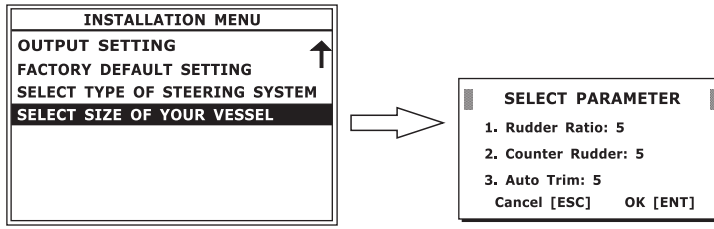
1. Rotate the Knob to select "SELECT TYPE OF STEERING SYSTEM" in the installation menu. Press the Knob to show the following selection:



2. Rotate the Knob to select the correct system and press the Knob to save setting or press [**ESC**] to exit without save the change.

2.2.12 Select size of your vessel

Different vessel size with different steering rudder design should require different settings of Rudder, Counter Rudder and Auto Trim settings. The options just provide a reference of vessel size of 25 meters (around 83 feet) to 40 meters (132 feet), the actual settings should be tested and set during sea trial after Installation.



3. AUTOPILOT INSTALLATION

3.1 Installation of Main Unit

3.1.1 Position

The KAP-866 main panel should be mounted in an accessible position, Protected from rain or salt water.

3.1.2 Wiring

Cablings have to be run from KAP-866 to the rudder feedback unit, compass unit, compass unit and steering drive system. Wiring should be kept as far away as possible from radio aerials and aerial cables to prevent interference to the radio, and to prevent transmitted signals from the radio influencing to the autopilot. The power source for the autopilot should be fused separately from other equipment. Maintain conventional colour coding and, if necessary, mark the cables for ease of identification.

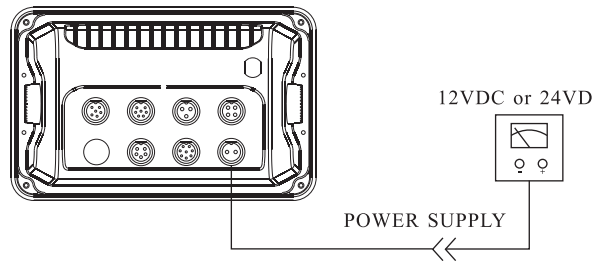
Connection - As per diagram labelled Connection Diagram for KAP-866.

3.1.3 Magnetic Effect

As a minimum amount of steel is used in the control unit. there is negligible effect on a steering compass. Some radio interference may be caused and the routing of cables should be considered when wiring the vessel.

3.1.4 Power supply consideration

KAP-866 can be operated with 12VDC or 24VDC. To consider to use 12VDC or 24VDC you have to find out the operating voltage of steering drive system onboard first. Usually the steering drive system is solenoid drive or reversing motor drive. If the steering drive system onboard is operated on 12VDC the you have to connect 12VDC power suppl to KAP-866. If the steering drive system onboard is operated on 24VDC then you have to connect 24VDC power supply to KAP-866.

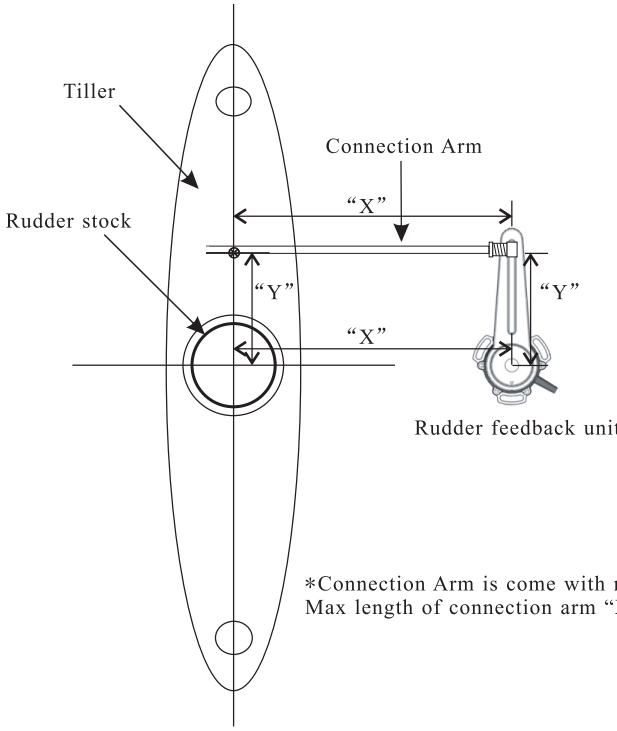


3.2 Installation of Rudder Feedback

3.2.1 Position

Install rudder feedback as shown in the diagram labelled Rudder Feedback Unit Installation The unit should be adjacent to the tiller and must copy the angular movement of the tiller. The markings on the rudder feedback unit indicates the required movement of the tiller for course correction. It should be installed with the shaft uppermost, mounted and linked in such a way that the four pivot points (tiller post, feedback shaft and the adjustable linkage points) form the four corners of a parallelogram.

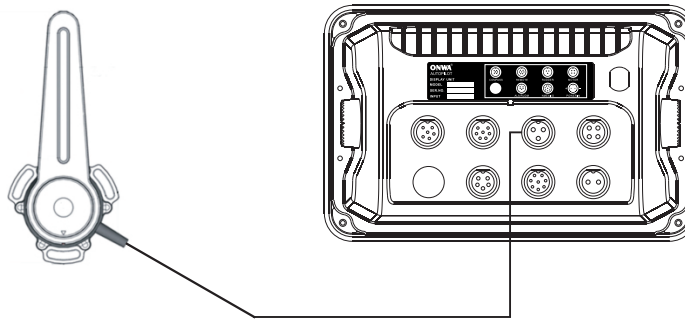
The rudder feedback unit is water resistant. However, if it is to be mounted in a wet position, some effort is necessary to ensure the unit does not become immersed in water. If necessary the rudder feedback unit may be mounted upside down, in which case the black and red connections to the KAP-866 ter-minal should be reversed.



*Connection Arm is come with rudder feedback unit
Max length of connection arm "X" = 345mm (adjustable)

3.2.2 Wiring

Connect the cable of rudder feedback unit to the 3 pins socket on the rear panel of KAP-866. To check the wirng of the rudder feedback unit by steer the rudder to either side (Port or Starboard), see whether the rudder angle indication on KAP-866 goes to corresponding direction. If the rudder angle indication on KAP-866 goes to reverse direction against the applied rudder then you need to reverse the wiring of RED and BLUE.



Pin1	Terminal 5V :	+ 5 volts	Red
Pin2	Terminal Rud :	Signal	Yellow
Pin3	Terminal GND :	GND	Blue

After installation of the feedback unit is complete and the linkage is fitted, have the steering of the vessel turned lock to lock and ensure:

a) The direction (port or starboard) indicated on the top of the RFU is correct.

b) No undue mechanical strain is placed on the rudder feedback or linkage.

NOTE: THE AUTOPILOT WILL NOT FUNCTION CORRECTLY IF A RUDDER FEEDBACK IS NOT FITTED, OR IF THE FEEDBACK IS FAULTY OR INCORRECTLY ADJUSTED.

NOTE: THE RUDDER FEEDBACK UNIT IS FACTORY ALIGNED. THE ARM SHOULD NOT BE REMOVED OR LOOSENED UNNECESSARILY. IF ARM IS LOOSENED OR REMOVED, VOLTAGE ALIGNMENT SHOULD BE CHECKED BEFORE USING THE AUTOPILOT. THIS MUST BE DONE BY A COMPETENT TECHNICIAN.

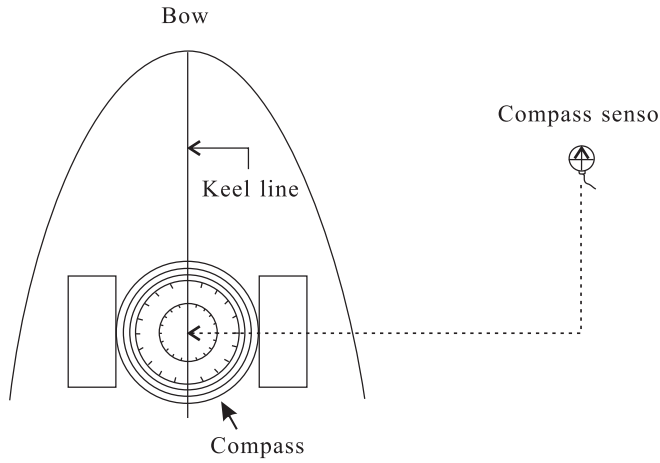
3.3 Installation of Compass

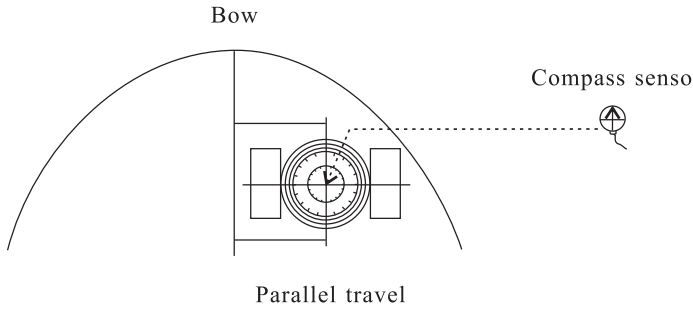
There are two types of compass suitable for this autopilot - **a magnetic sensor unit** (fluxgate), which is a complete compass, and the **compass-top sensor** (CTS), which is used together with a standard magnetic ships compass.

3.3.1 Installing a Compass-Top Sensor (KCS-20)

The sensor unit placed on the glass plate of the ships compass, in the exact centre of the compas card and secured with an adhesive such as double-sided tape or silicon sealant. Before fixing the sensor in place, align it carefully so that the **KAP-866** compass displays the same bearing as the ships compass.

The compass top sensor is preferred for steel hull vessels provided a suitably compensated compass is fitted to the vessel.





3.3.2 Installing an indoor magnetic sensor unit (KFG-25)

The compass unit should be treated carefully as the internal gimbals can be broken if dropped. Remove any internal packing before use.

The position of this compass is the most important item in the installation of the autopilot. Good course holding depends on the compass being free from magnetic interference.

As this compas s has no moving card, it is not necessary for the compass to be mounted low in the vessel. This is usually a place of high magnetic interference and should be avoided. However, a position of severe roll such as the top of a mast should also be avoided.

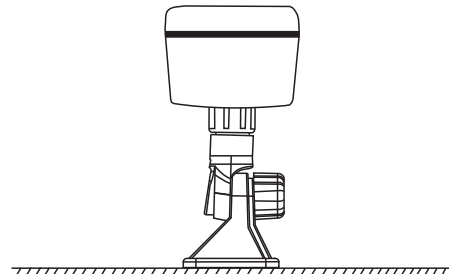
The compass need not be mounted in a weatherproof position. The compass can be mounted on top of a flat surface, on a bulkhead or from the deck head. Check other side of bulkhead for materials, which may cause magnetic interference.

Interference from any iron or steel can cause malfunction of the compass unit. To prevent this occurring a minimum distance of 1 meter(3 feet) should be kept from any steel or other ferromagnetic materials. This includes speakers and radios with internal speakers.

Fasten the compass bracket with non-magnetic screws. The compass must be mounted in a near vertical position.

Desktop mounting

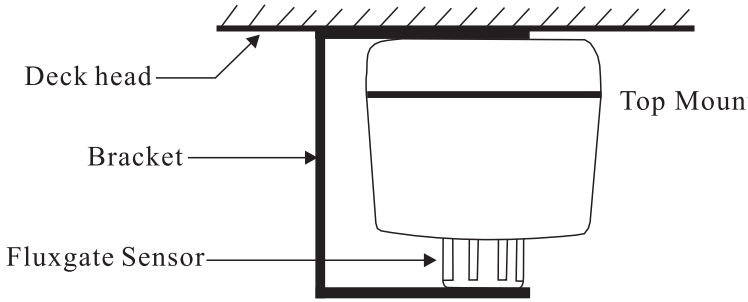
- only suitable for fiberglass or wooden vessel.
- To ensure the signal of sailing directions is accuracy, please choose a location where vibration and shock are minimal.

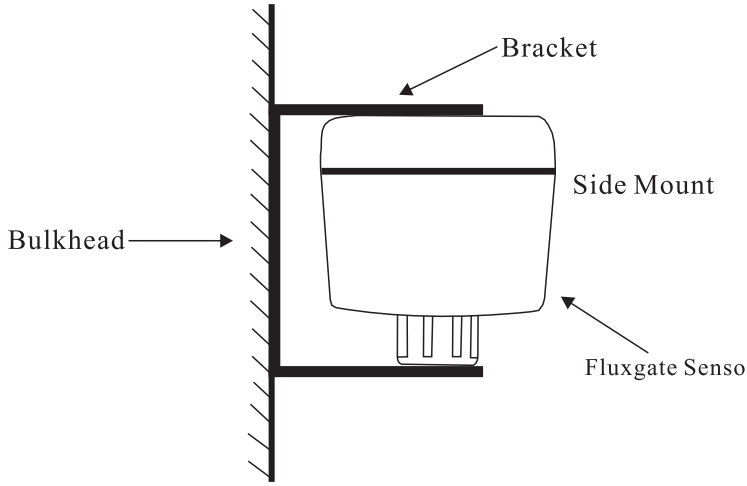


Installed in the surface of platform

Bulkhead mounting

- Only suitable for fiberglass or wooden vessel.
- The bulkhead installation can save the space.
- The bulkhead cannot contain the steel with magnetic interference material.

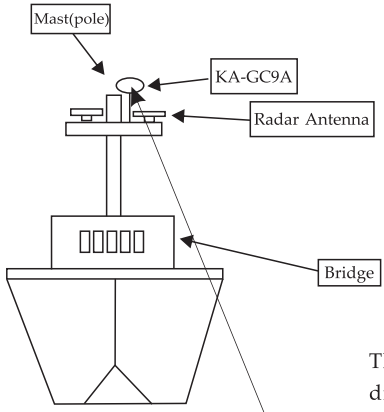




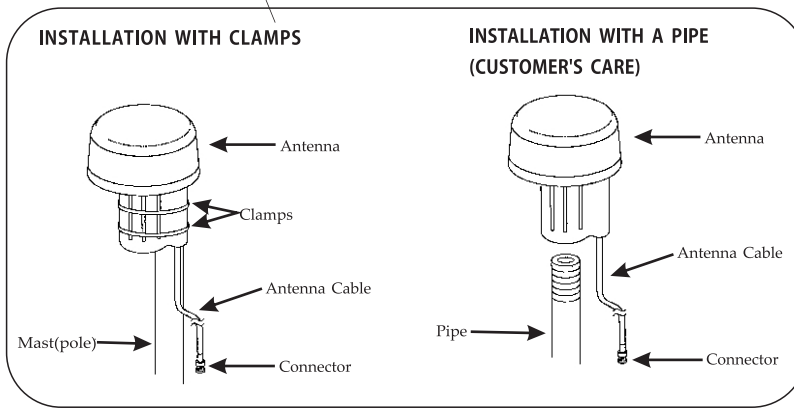
Examples of bulkhead Mount

3.3.3 Installation of Heading and GPS sensor KA-GC9A

When you turn over the KA-GC9A you can see an arrow sign on the antenna base. Please make sure this arrow should point exactly to the BOW direction.



This arrow should point exactly to the BOW direction of your boat

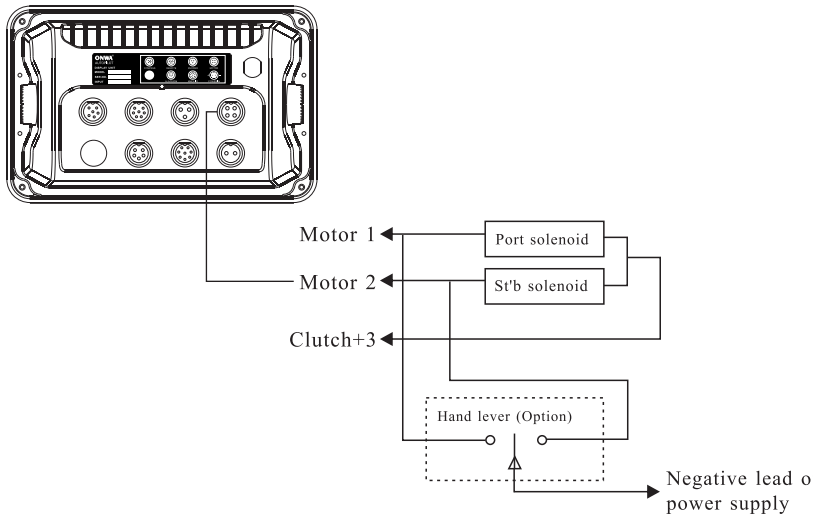


Considerations before installation:

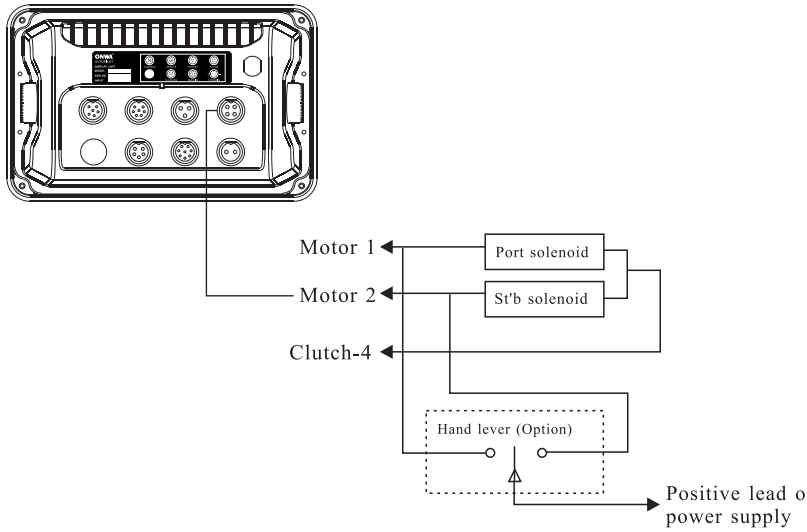
- Please install the KA-GC9A outside, ensure that the GPS is not covered.
- Keep the length of the cable in mind when selecting a mounting location.
- It should be installed with a minimum of 1 meter to revent the influence of iron and steel or other magnetic materials.
- Do not use magnetic screws for fixing KA-GC9A.
- Select the vertical way position for installation.

3.4 Installation of solenoid

3.4.1 Connect common positive solenoids as follow. If the rudder goes to reverse direction against KAP-866 command then you need to reverse the connection of Motor 1 & Motor 2.



3.4.2 Connect common negative solenoids as follow. If the rudder goes to reverse direction against KAP-866 command then you need to reverse the connection of Motor 1 & Motor 2.



3.5 Installation of reversing motor pump

In case to use KAP-866 with reversing motor pump you are advised to purchase option isolated power drive LSD-50P50FID2 from Onwa dealer.

3.6 NMEA Connection

KAP-866 can accept extermal heading information in format of NMEA0183 (4800 8n1) to replace standard fluxgate magnetic sensor. KAP-866 can accept either one of the followings NMEA0183 sentence for heading source:

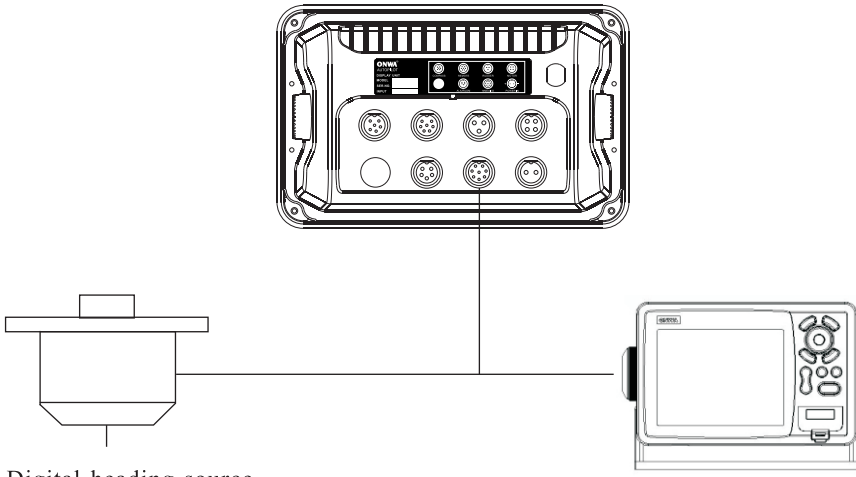
1) HDG
2) HDT
3) HDM

KAP-866 can also accept GPS information in format of NMEA0183 (4800 8n1) as course setting command. When there is a route or waypoint navigation is engaged in the GPS device, KAP-866 will follow the command from the GPS device to drive the vessel to the waypoint or route which is set in the GPS device. KAP-866 can accept either one of the following NMEA0183 sentence for navigation:

1) APA
2) APB
3) BOD & XTE

Data In

For GPS navigation or heading information, Connect the data output and data return wires of external device to the IN+ and IN- of KAP-866 GPS connector. Onwa KGN100 or KGN200 is supplied as an option to convert the analog signal (sychro or stepper) of gyrocompass onboard to NMEA0183 data as heading source to KAP-866.



Digital heading source

GPS device

Note: the baudrate of Input1(pin1&2) is 4800 and Input2(pin5&6) is auto scan baudrate (4800, 9600, 19200 and 38400)

3.7 External Alarm Installation

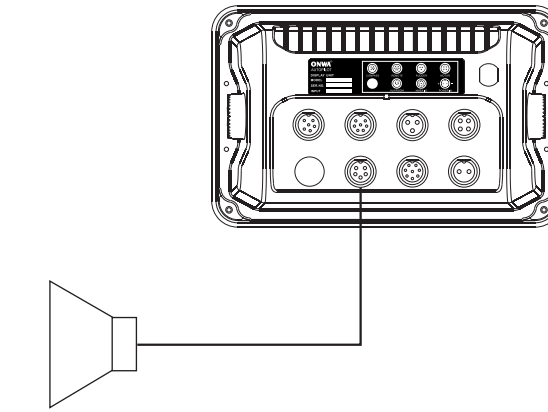
An external buzzer may be connected to the ALA + and ALA - of KAP-866 Alarm connector

The ALA- output will be 10 volts when the alarm is not sounding (with alarm connected), and approximately 0 volts when active. We recommends a 12-volt piezo buzzer with maximum current draw not exceeding 250 milliamps be connected to this output.

If a larger type siren or alarm unit, which draws in excess of 250 milliamps is used, this must be connected via a relay. The KAP-866 external alarm circuit is used to energise the relay coil and power to the siren or alarm unit is connected via the relay contacts.

.

The external alarm output is activated if the stopwatch timer has been sounding for longer than one minute.

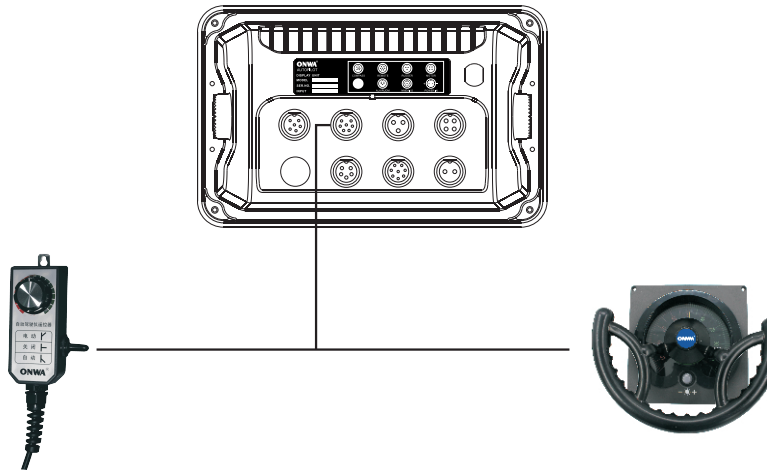


External Alarm

3.8 Installation of Remote Units

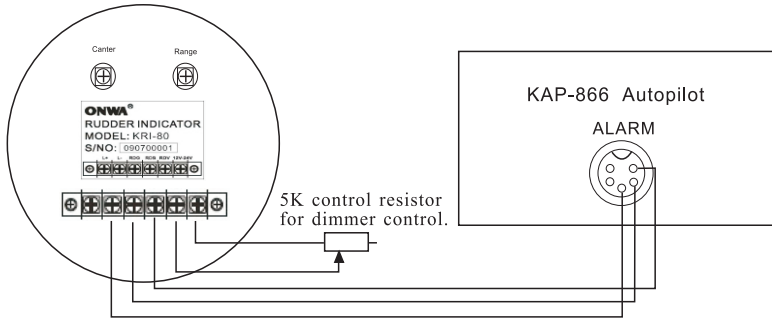
Onw a Hand remote (RT580) and Electric wheel (RW250) is supplied as an option. Sometimes the user require to operate autopilot away from KAP-866 then this time a remote unit is needed.

The installation of remote units are very easy, just plug and play.
Connect the remote units to the KAP-866 remote connector with the supplied cable.



3.9 Installation of external rudder indicator

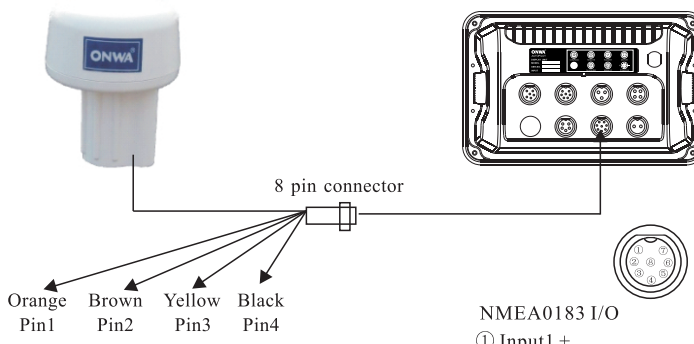
Onwa rudder indicator KRI-80 is supplied an option. Connect KRI-80 to KAP-866 as follow:



Center and Range Calibration is needed on the KRI-80 after installation. Place the rudder on midship position, adjust "Center" VR on KRI-80 to get "0" degree on the meter. Place the rudder to 30 degree on either port or starboard, adjust "Range" VR on KRI-80 to get "30" degree on the meter.

3.10 Connect NMEA0183 data IN/OUT with a KA-GC9A is connected

In case you want to connect a GPS plotter output to KAP-866 or you want to connect the heading data from KAP-866 to external equipment use if the NMEA0183 I/O port is occupied by KA-GC9A heading sensor , you can follow the below connection instruction.



(Note: Please refer to connection diagram of KAP866)

NMEA0183 I/O

① Input1 +
② Input1 −
③ Output +
④ GND
⑤ Input 2+
⑥ Input 2−
⑦ +5V
⑧ GND

baudrate: 4800

auto baudrate

4. Commissioning Checks Connection Tests

Voltage to be connected is the required DC voltage (12 or 24V).
Important note: The supply voltage must match the operating voltage of solenoid or reversing motor.

- Ensure polarity of the voltage supply is correct.
- All electrical connections are correct.
- Tie up or cut the unused wires.
- Turn steering wheel fully clockwise and visually check that moving and mechanical parts do not foul; visually check that RFU has moved in the correct direction as indicated on the RFU label.
  Note: RFU = Rudder Feedback Unit

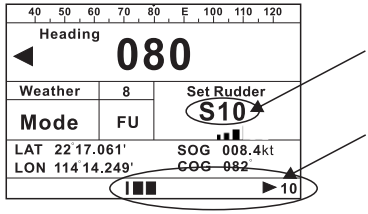
Note : All installations , commissioning checks and sea trial of autopilot must be carried out by an experienced autopilot technician. Improper installations, commission checks and sea trial might result of a danger.

4.1 Dockside Tests

1. Turn steering (by hand) to center (midships) position
2. Power on the KAP-866
3. Determine vessel heading by a sighting on known heading or compass
4. Align Autopilot heading sensor until display reads correct heading
5. Engage Follow up mode by press [F-UP] key
6. Turn course knob to starboard 10 degrees

CAUTION : IF AUTOPILOT DRIVES HARD OVER, IMMEDIATELY TURN OFF THE CONTROL UNIT, REVERSE THE CONNECTION OF SOLENOID OR REVERSING MOTOR...REPEAT FROM STEP1

7. Confirm that the rudder moves to starboard



Set Rudder to Starboard 10 degrees

Confirm rudder moves to starboard 10 degrees

8. Turn course knob back to center, then 10 degrees to port
9. Confirm that the rudder moves to port
10. Press [ST-BY] to leave Follow up mode

Note : AT NO TIME SHOULD THE AUTOPILOT DRIVE THE RUDDER INTO THE MECHANICAL STOPS.

The autopilot is now ready for full operational testing(sea trials). Testing should Only be carried out in clear waterways until you are familiar with the operation.

4.2 Sea Trial Tests

The default KAP-866 settings for Rudder Ratio, Counter Rudder and Auto Trim are optimized. However in some reasons such slow vessel, small rudder etc. might need further adjustment during sea trial.

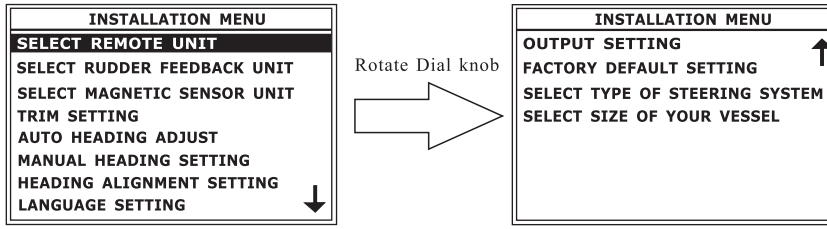
Note : It is advised only can be adjusted by experience autopilot technician.

The below adjustment instruction is available for firmware V1.73 or above.

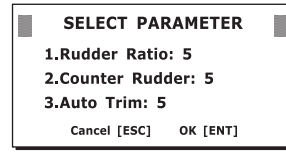
To confirm the firmware version, you can find it on the right low corner of the welcome screen during switching on the unit :

Adjustment instruction

1) On standby mode press and hold [Menu] key for few seconds to enter installation menu as shown :



2) Rotate the dial knob and scroll down to second page to locate “SELECT SIZE OF YOUR VESSEL” and press the dial knob to enter the sub-menu as shown below:



3) Rotate the dial knob to select the item to be adjusted and press the dial knob once to start adjust.

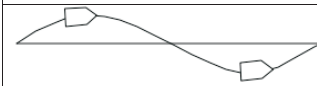
4) After adjusted you have to press the dial knob to save the setting.
5) After finish adjust press [ESC] key to quit the sub-menu and then press [ESC] key again to quit the Installation menu

Note for adjustment

It is advised to adjust on a calm sea during sea trial.
1) Stabilize the vessel on a heading and then activate [AUTO] mode
2) Set the speed as close to cruising speed as possible
3) Watch the behaviour of Auto steering and adjust as below if necessary.

Rudder Ratio

This parameter determines the ratio between commanded rudder and the heading error. The higher rudder ratio value the more rudder is applied.
Increase or Decrease rudder ratio to optimise the straight line steering performance in terms of Understeer and Oversteer as described below :

Understeer	Oversteer
	
Large deviations or protracted periods off the Heading Set due to insufficient rudder application	Autopilot applying too much rudder causing vessel 'weave' which may increase to a tight 'S' pattern
Action : Increase Rudder Ratio setting	Action : Reduce Rudder Ratio setting

Counter Rudder

Counter rudder is the amount of counteracting (opposite) rudder applied to stop the turn at the end of a major course change.
The settings depend on vessel's characteristics, loaded/ballast conditions.
Increasing counter rudder settings may result in some higher rudder activity also when steering a straight course.

The best way of checking the value of the Counter rudder setting is when making turns.
The figures illustrate the effect of various Counter Rudder settings :
A. Counter rudder too low; overshoot response
B. Counter rudder too high; sluggish and creeping response
C. Correct setting of Counter rudder; ideal response

Perform various course changes and observe how the boat settles on the new heading. Start with small changes, 10-20 degrees and proceed with bigger changes, 60-90 degrees. Adjust Counter rudder value to obtain best response as illustration C.

Note : As many boats turn differently to port verus starboard (due to propeller rotation direction), do the course changes in both directions. You may end up with a compromise setting of Counter rudder that gives a little overshoot to one side and bit sluggish response to the other.

To adjust overshoot (vessel goes past new heading) or undershoot (vessel stops short of new heading) when altering course using the Autopilot :
If vessel overshoots – Increase Counter Rudder value
If vessel undershoots – reduce Counter Rudder value

Auto Trim

Auto Trim function continuously monitors any long-term differences between the heading set and the mean course actually steered, such as sea current and strong wind. Any long-term difference is automatically adjusted by the Auto Trim function.
Since the long-term difference is calculated by accumlation of heading steering and rudder applying so change of Auto Trim value will change the accumlation timing.
Proper adjustment of Auto Trim can greatly reduce the action of Rudder movement.

5. MAINTENANCE, TROUBLESHOOTING

5.1 Preventive maintenance

WARNING

ELECTRICAL SHOCK HAZARD
Do not open the equipment.

Only qualified personnel should work inside the equipment.

Regular maintenance is important for good performance . A maintenance program should be established and should include the following points.

- Check connectors between the control unit, heading sensor and rudder feedback unit for tightness.
- Check for water leakage in the interconnection cable between the control unit, heading sensor and rudder feedback unit.
- Remove dust and dirt from the display unit and fluxgate sensor unit with a dry, soft cloth. For the LCD, wipe it carefully to prevent scratching, using tissue paper and an LCD cleaner. To remove stubborn dirt, use an LCD cleaner, wiping slowly with tissue paper so as to dissolve the dirt. Change paper frequently so the dirt will not scratch the LCD. Do not use chemical cleaners for cleaning they can remove paint and markings.

Note: do not use contain chemical cleaners clean, it might help to eliminate paint and equipment will be marked.

5.2 Troubleshooting

This section provides basic troubleshooting procedures which the user may follow to restore normal operation.

Troubleshooting

Symptom	Cause	Remedy
Cannot turn on the power	Power cable on the display unit	Firmly connect the power cable
	Power supply failure	Check the power supply.
	Blown fuse	Replace fuse with correct rating. Have a qualified technician to check if fuse blown again after replacement.
Heading indication changes randomly when ship is at anchor or does not change when ship moves.	Sensor trouble or Cable contact is bad.	Run the diagnostic test to determine cause.
Rudder not functioning	Low voltage output from KAP-866 or steering system problem	1. Check voltage supply to KAP-866 2. Check the steering system
No rudder angle indication	RFU problem or RFU cable contact is bad	1. Check RFU 2. Check RFU cable 3. Check RFU and rudder connection

If large heading error occurs or heading indication is frequently interrupted, contact your dealer for advice.

6. TECHNICAL PARAMETERS

6.1 General

6.1.1 Heading Reference: Fluxgate, Magnetic Compass, NMEA

6.1.2 Heading Sensor: KA-GC9A (standard), KFG-25 and KCS-20 (option)

6.1.3 Heading Resolution: 1°

6.1.4 Course Detection: 0.1°

6.2 Output/Input (IEC61162)

6.2.1 Input: Dual NMEA 0183 inputs

Support: APA, APB, BOD & XTE, HDG, HDT, HGM, RMC

Baud Rate: 4800 X1, auto baudrate X1(scan among 4800, 9600, 19200 and 38400)

6.2.2 Output: One NMEA0183 output

Support: HDG, HGT, HGM (selectable from menu)

Baud Rate: 4800, n, 8, 1

6.3 Environmental Conditions

6.3.1 Ambient Temperature: -15℃~70℃

6.3.2 Waterproofing

Display Unit: IPX5

Heading and GPS sensor: IPX67 for KA-GC9A

Fluxgate Sensor Unit: IPX5 for KFG-25

Rudder Feedback: IPX7

6.4 Display

6.4.1 Sunlight viewable high contrast LCD

6.4.2 LCD size: 95(W) × 63(H)mm, 240×160 dots

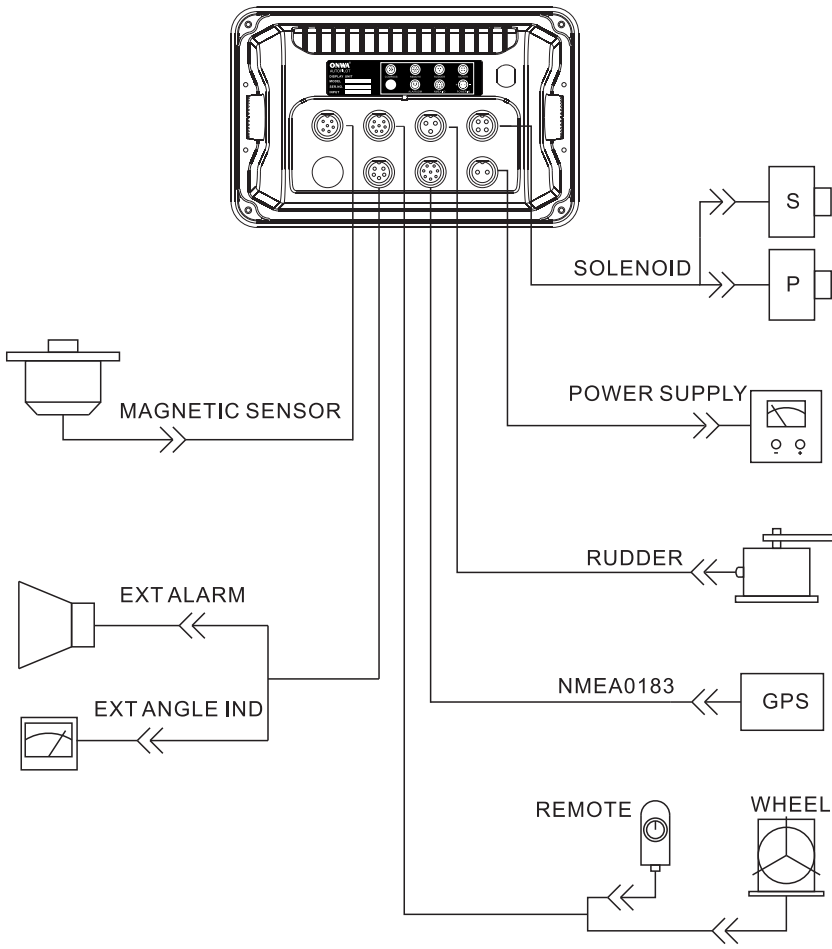
6.5 Electrical parameters:

6.5.1 Operating Voltage: 10 to 30VDC

6.5.2 Power Consumption: Standby mode 0.4 Amps, Auto mode 1.0 Amps Peak for control unit only.

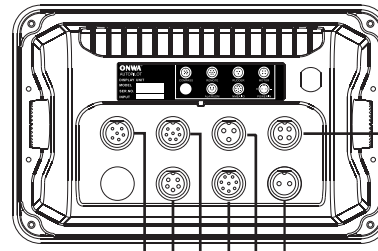
6.5.3 Drive Output: 10 Amps max

7. INTERCONNECTION DIAGRAM



SOLENOID OR REVERSING MOTOR

1. MOT+
2. MOT-
3. CLU+
4. CLU-



MAGNETIC SENSOR

1. Green
2. Red
3. Yellow
4. White
5. Blue
6. Shield

POWER

1. DC input-
2. DC input+

EXT ALARM&ANGLE IND

1. Alarm+
2. Alarm-
3. +5V
4. Rudder Indicator
5. GND

RUDDER

1. +5V
2. Signal
3. GND

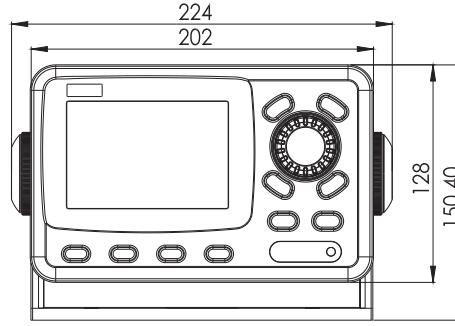
REMOTE

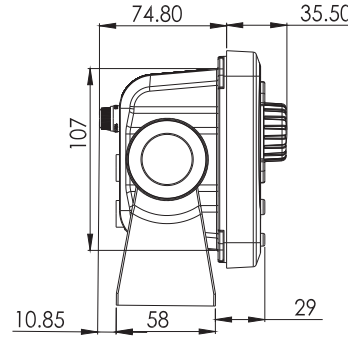
1. Adjust
2. Control1
3. Adjust
4. Control2
5. +5V
6. GND
7. +10V

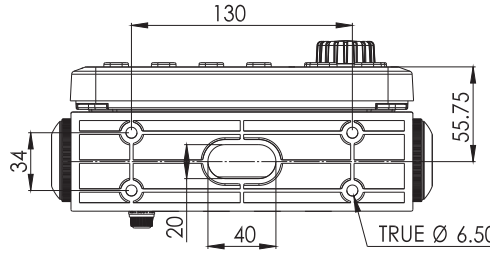
NMEA0183 I/O

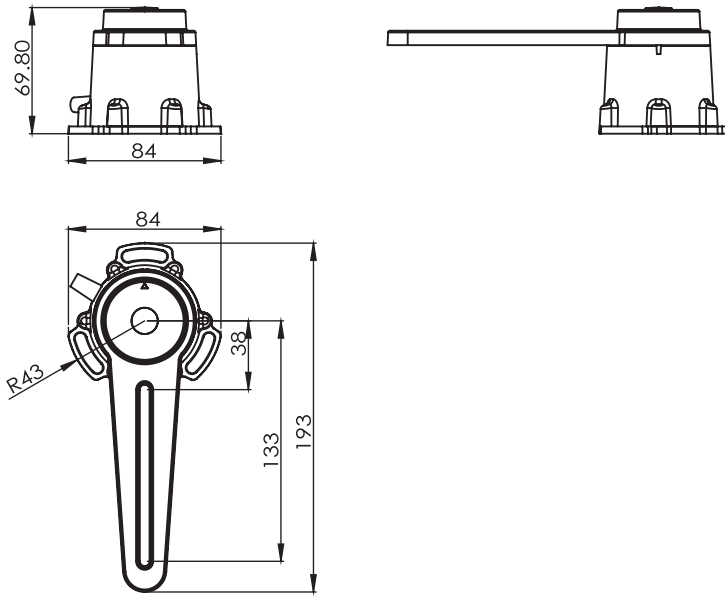
1. Input 1+ {baudrate : 4800}
2. Input 1-
3. Output + {baudrate : 4800}
4. GND
5. Input 2+ {Auto baudrate (4800, 9600,19200,38400)}
6. Input 2-
7. +5V
8. GND

8. DISPLAY UNIT SIZE

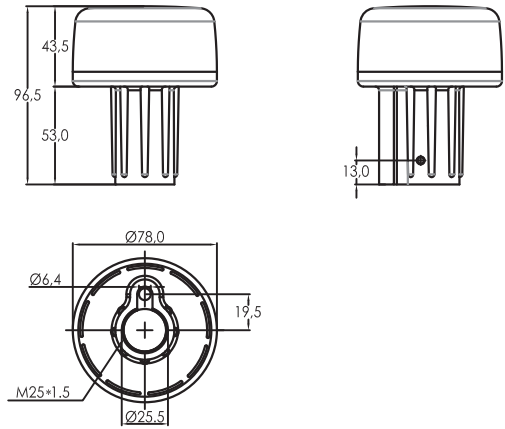








KRF-36 Size



KA-GC9A Size