

**ONWA**  
**KAP-833**

**KAP833**

**OPERATOR'S MANUAL**

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**Autopilot**



## **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 AFFECT VESSEL COURSE SUFFICIENTLY TO ENDANGER YOUR OWN OR OTHER VESSELS.**

## Introduction

The **KAP-833** autopilot is a hybrid of digital and analogue technology to give the best of both worlds - excellent steering characteristics with digital compass display, keypad course input, GPS and gyro interfaces, and much more, in solid metal case.

The KAP-833 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 ships rudder. This must also be connected to the autopilot via the cable supplied.

Provision has been made for two **hand remote, panel remote, steering lever** or **steering wheel** stations. These are very robust units, which will not be adversely affected by water. The abilities they provide are somewhat different from the main control panel. See the Operation section of this manual for details.

**For more in formation on installation of your KAP-833 autopilot, see the Autopilot Installation section of this manual.**

**For more information on using your KAP-833 autopilot, see the Autopilot Operation section of this manual.**

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# 1 Autopilot Operation

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## 1-1 Overview of Operation

The following is a brief list of the capabilities of the KAP-833 autopilot. Each described in more detail in a separate chapter.

Note: Power to the **KAP-833** is supplied via **Weather** control. Turn the knob control in a clockwise direction to apply power to the KAP-833; this will initially put the KAP-833 into **Standby** mode.

### ● Standby Mode

The digital display shows the current magnetic heading.  
The autopilot will not apply any steering control.

### ● Auto Mode

The autopilot will maintain your vessel on any desired magnetic course. This course can be set from the control panel by dialling up a course change with the course knob, entering a course from the keypad, or recalling a stored course with the PRESET button.

### ● Power Steer

The rudder angle may be controlled by the course knob on the main panel or from one of the remote steering stations.

### ● GPS Mode

When receiving information from a GPS unit, the autopilot can steer a vessel to a precise latitude and longitude.

### ● Stopwatch Timer Mode

A timer can be set for 1 to 60 minutes. When the time expires, an alarm will sound. Uses include timing of trawling runs, or a reminder to check for anchor drag at set periods during a storm.

### ● Remote steering stations

Two of these may normally be fitted (eg on each side of the bridge), allowing adjustment of the autopilot course, or direct control of the rudder (**power steering**). An optional third steering lever may be connected to the control unit, subject to a special order at time of delivery.

### ● Rudder Ratio, Weather and Counter Rudder

These controls customise the **KAP-833** for your vessel. They may also be used to adjust steering for varying sea conditions.

## **1-2 Standby Mode**

Turn **Weather** control knob clockwise to switch KAP-833 on to **Standby** mode.

In this mode

- The Main and Standby lights are on
- The motor clutch is disengaged
- No steering control output is generated
- The commercial watch alarm is turned off (if enabled)
- The digital display shows the vessels current magnetic course

Possible alarms

- Stopwatch timer alarm

If the option of Electric steering is enabled, this mode may not be available and the unit will go direct to power steer on turn on.

### **1-3 Auto Mode**

Engaging Auto steering mode

When in Standby Mode and the “AUTO” key is pressed, a beep will sound and the adjacent yellow light will be turned on.

The autopilot will lock on to the heading indicated.

### **Disengaging the Autopilot**

Press the **Standby** button. A beep will sound and the vessel will return to manual steering (**Standby Mode**). The AUTO light will be turned off and STANDBY light turned on.

### **Course Adjustment**

Pressing the port (red) or stbd (green) arrow keys will cause a one degree course change in that direction. The display will change to indicate the new **course-to-steer**.

Rotating the course-change knob will change the course-to-steer by one degree for each “click” .

Entering a course from the keypad, and pressing GOTO will change the course-to-steer to the bearing entered.

## **1-4 Power Steering Mode**

### Engaging Power Steering Mode

Press the Power button. A beep will sound and the adjacent light will come on. The rudder will move to the centre position.

### Setting the rudder angle

Rotating the course control knob clockwise will move the rudder to starboard. Rotating the course control knob anticlockwise will move the rudder to port.

The angle of rudder applied depends on the amount of rotation of the course knob.

The maximum angle of rudder is controlled by the internal and external rudder limit settings.

For information on power-steering with a remote unit (eg: **Electric Wheel** or **Steering Levers**), see the section on remote units.

If your vessel requires counter-rudder while steering in auto mode, you may wish to set the counter rudder control “1” (ie: disabled) while using power-steer.

## **1-5 GPS Mode**

For use when interfaced to a GPS generating NMEA 0183 data output. While in auto mode this allows the autopilot to be directed by the GPS, enabling automatic heading changes and eliminating the effects of wind and tide.

The digital display indicates the **course-to-steer**, which will be the bearing between the origin and destination waypoints, plus a factor to correct for the current **cross-track-error (XTE)**.

### **Engaging GPS Mode**

When in any mode, press the “GPS” key. A beep will sound and the adjacent yellow light will be turned on.

The vessel will begin turning from its current course to the course requested by the **GPS unit**, at a maximum rate of 10 degrees per second.

If no GPS data is being received by the KAP-833, the autopilot will lock onto the course of the vessel at the time that **GPS Mode** was engaged, and the **No GPS Data** alarm shall sound.

### **Disengaging GPS Mode**

- Pressing the “Auto” key will set the KAP-833 to **Auto Mode**.
- Pressing the “Standby” key will return the pilot to **Standby**.

### **Setting up your GPS unit**

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

The GPS unit must be set up to output “NMEA0183” data on a pair of wires which are connected to the **GPS In** terminal connections inside the KAP-833. The data generated must include **at least on** of the following.

- The **APA** sentence.
- The **APB** sentence.
- The **BOD** and **XTE** sentences.

If only the **XTE** data sentence 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-sequence” 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-833 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 GPS 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 the GPS light will blink. This could be caused by:

- Incorrect wiring of the GPS to the KAP-833.
- Incorrect data output from the GPS unit.
- No route set up or selected in the GPS unit.
- No location fix at the GPS unit.

See also Alarms in the Operation section of this manual.

The bearings generated by the GPS unit must correspond to the bearings the KAP-833 is receiving from its magnetic compass. The greater the difference between these bearings, the less accurate will the be **GPS Mode** steering.

- Ensure that the GPS unit has the correct magnetic correction factor.
- Ensure that the KAP-833 compass is correctly aligned and installed.

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## **2** Alarms

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A number of conditions will cause alarms to sound. In some cases, lights on the control panel will also blink. Each alarm has a different “beep pattern” (except stopwatch and commercial watch alarm). The external alarm output may also be turned on by some of these alarms; this does not have a “beep pattern” .

### **2-1** Stopwatch Timer Alarm

This alarm indicates that the time set by the user has expired.

Alarm pattern is 0.2 second on, 0.2 second off until reset.

The external alarm output is turned on 1 minute after the internal alarm commences. Note that a suitable piezo buzzer must be attached to this output. This is not supplied with the KAP-833 but is available as an option.

### **2-2** Angle Off Course Alarm

The alarm pattern is 0.2 seconds on, 0.2 seconds off when vessel is more than the set number of degrees from **course-to-steer**. The “off-course” light blinks on and off at the same rate as the audible alarm. The angle at which this alarm sounds can be set to any desired limit (including completely disabled).

#### ● Angle Off Course

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 180 degrees.

#### **To set the off-course alarm angle**

Enter the desired angle in degrees from the keypad, and then press the **off-course** button.

#### **To examine the current off-course alarm angle**

When no digits entered from the keypad, press the **off-course** button. The currently set alarm angle (in degrees) will be displayed for two seconds.

When the allowable angle is exceeded, the off-course alarm will sound and the off-course light will flash. When the vessel is brought on to its correct course again, the alarm will cease.

Changing to **power-steer** or **standby** modes will cancel the alarm.

The default value for the off-course angle (ie the one set when the KAP-833 is turned on) is 30 degrees.

Note that the alarm will sound if a large course change is entered (eg from keypad, preset course or course change knob). 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.

**2-3 No GPS Data Alarm**

The alarm sounds 0.2 seconds on, 0.2 seconds off if the autopilot is not receiving valid information from the GPS. The “GPS” light blinks on and off at the same rate as the audible alarm.

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## **3 Remote Unit Operation**

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The Panel and Hand Remotes come with a 3-way switch for selecting **POWER**, **Off** or **AUTO** features.

The Steering Lever can be supplied with or without a 3 way switch. When the switch is fitted, the Steering Lever is used in the same way as a Panel or Hand Remote. When supplied without a switch, the Lever is used as an Electric Wheel.

The Electric Helm or Steering Lever (without switch) are dash mounted units and control rudder angle by manually turning the wheel or moving the lever.

**To engage AUTO Mode - Panel or Hand Remote and Steering Lever.**

Ensure the Remote Switch is **Off** and knob (or lever) is set to centre. Move the remote switch from **Off** to **AUTO**.

### **Course Adjustment**

When **AUTO** mode is engaged, turning the Remote knob (or lever) will alter the **course to steer**. This change will be reflected on the digital heading display. If the remote **AUTO** mode was engaged with remote knob at centre, the course can be changed to **port** or **stbd** by 90 degrees.

### **To disengage AUTO Mode**

Either move the remote switch to **Off** (which also disengages the autopilot) or press the desired mode key on the KAP-833 main panel (Auto, GPS, Power or Standby).

### **To engage Power Steer Mode**

Ensure the remote unit switch is set to **Off**, and the remote dial (or steering lever) is set to centre. Change the remote switch to the **Power** position.

The remote dial (or steering lever) now acts as the helm, giving control over the movement of the rudder. The maximum rudder angle is controlled by the rudder limit adjustment on the KAP-833 main panel.

### **To disengage Power Steer Mode**

Return The rudder to centre before switching to **Off**.

### **Electric Helm or Steering Lever**

The KAP-833 can be customised to accept input from an electric helm (steering wheel) or Steering Lever to provide electric steering in place of, or in addition to, manual steering. The KAP-833 is programmed to suit a customer's needs. For full electric steering, Power Steer mode will automatically be selected at turn-on. For manual steering plus electric steering, Power Steering must be selected manually on the KAP-833 unit. In both of these options, the course-change knob on the KAP-833 has no effect in Power mode.

**The Remote Operation can be modified by the Installing Technician as listed in special modes section of this manual.**

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## **4** Control function setting

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### **4-1** Weather

The main power switch is incorporated in this variable control. When in the OFF position no power is applied to KAP-833. By turning this in a clockwise direction from the OFF position, the switch applies to the KAP-833.

This setting is used for adjusting the autopilot response to varying sea conditions and varying vessel capabilities. The weather value sets the desired accuracy of the vessel 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 lights do not flicker continuously. This will give the straightest possible course.

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

Rotating this control fully anti-clockwise will turn off power to the KAP-833 autopilot.

#### **4-2 Counter-Rudder**

In some vessels, changing course requires a large amount of rudder to be applied initially, and then a smaller amount of rudder in the REVERSE direction to stop the vessel from swinging beyond its desired course. This is called **counter-rudder**.

The KAP-833 autopilot has this feature built-in. A **counter-rudder** setting of “1” gives no counter-rudder steering, suitable for light and manouverable vessels. If you find your ship over-steering when under autopilot control, increase the counter-rudder setting by a couple of steps, and see if the next course change behaves better.

Once the correct setting is found for your vessel, it should not need to be changed.

Note that when in POWER STEER mode, you may prefer to set the **counter-rudder** control to “1” .

### **4-3 Rudder(Rudder Ratio)Control**

This setting is used to determine the amount of rudder the vessel requires for steering (actually, the amount of rudder angle applied for a given angle off course).

The centre position is usually suitable for most vessels, but should the vessel's steering be sensitive or slow, adjustment maybe required.

In general, an agile vessel with a relatively large rudder or very small keel will require a small rudder setting. A large, slow vessel may require a high value for the rudder ratio.

This may also be adjusted according to speed - low speeds may require more rudder angle for steering than high speeds.

- A value of “1” signifies the minimum amount of applied rudder (for sensitive steering, large rudders or low gearing ratio.)

- A value of “10” signifies the maximum amount of applied rudder (for vessels with slow steering, small rudders or high gear ratio.)

When the **rudder** setting is too low, turns will take an excessive amount of time and the vessel may “wander” .

When the **rudder** setting is too high, turn will be rapid and the vessel will oversteer.

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## **5** Compass Calibration

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The compass supplied with your KAP-833 autopilot 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-833 compass display as **constant offset** (eg the autopilot compass reads 3 degrees high **on all bearings**), simply rotate the KAP-833 compass case to align bearings with the ships compass.. **it is not necessary** to re-calibrate the compass as described below.

If the KAP-833 compass 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.

1. Enter “901” by using keypad, then hold down **GOTO**, Press **AUTO**, then release both buttons together.
2. Turn vessel slowly through two complete circles in same direction. Each complete turn should take at least 60 seconds.
3. When the circles are complete, enter “902” by using the keypad, then hold down **GOTO**, press **AUTO** then release both buttons together.

This completes the compass calibration. Check alignment of the KAP-833 compass by steering vessel due North (000 on ships compass) and, if necessary, rotate outer case of the KAP-833 compass in its bracket until the heading display reads 000.

Note: The effectiveness of the calibration is dependent upon all 3 steps being completed. Should you wish to abort the calibration procedure at any time during the circle turning, do not carry out step 3.

It is important to realise that on any vessel the ships compass can have heading errors as a result of the vessels magnetic signature. These errors can be minimised by having the ships compass swung and compensated by a licensed compass adjuster. In any case it is highly unlikely that the ships compass and autopilot compass will be congruent for every heading.

If you are unsure of the success of the calibration, you may return to the factory calibration setting by entering “903” , hold down **GOTO**, press **AUTO**, then release both buttons together.

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## **6** Autopilot Installation

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### **6-1** Installation of Main Unit

#### **Position**

The **KAP-833** main panel should be mounted in an accessible position, protected from rain or salt water.

#### **Wiring**

Access for wiring must be provided. Cabling will have to be run to the **rudder feed back 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 the pilot.

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-833**.

#### **Magnetic Effect**

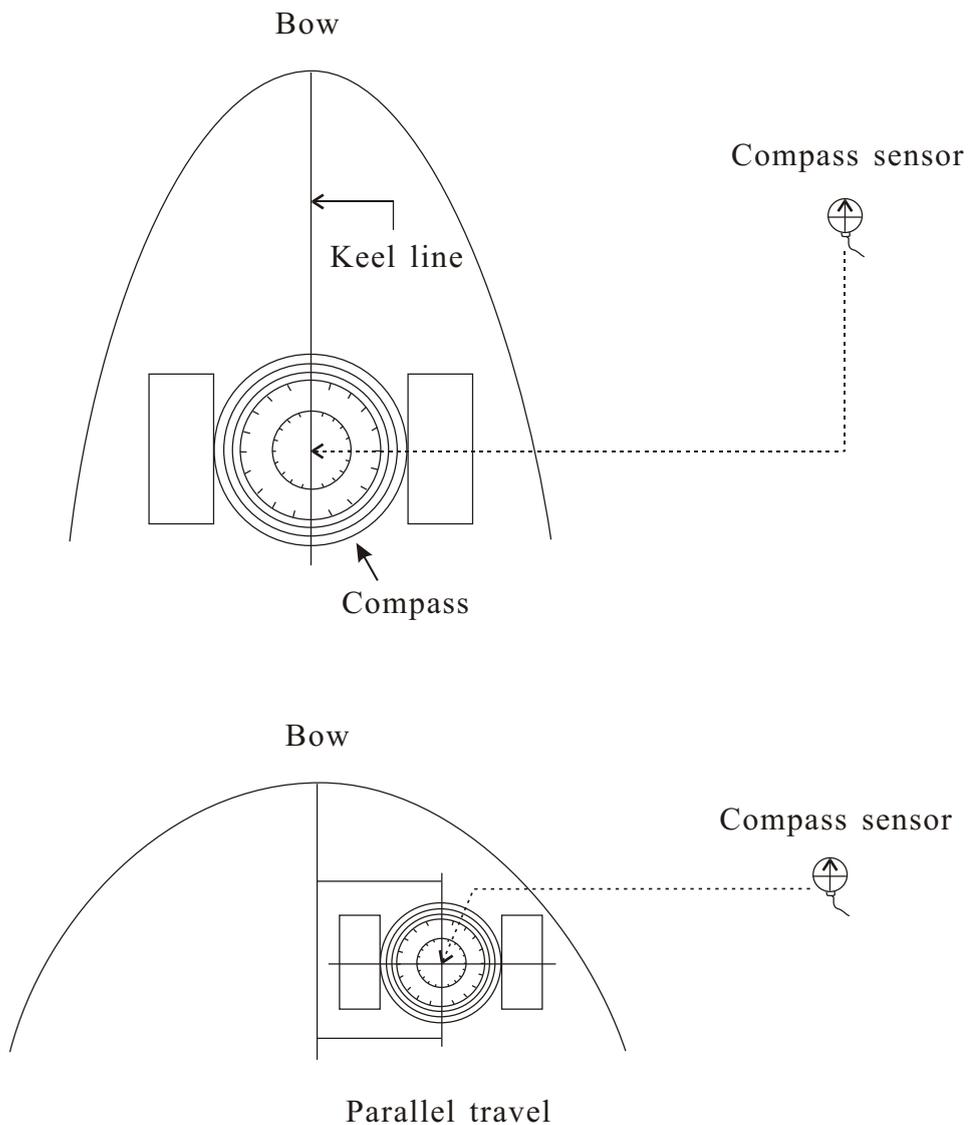
As a minimum amount of steel is used in the control unit. there is negligible effect on a steering compass. Some radio interference may be caused and the routing of cables should be considered when wiring the vessel.

## 6-2 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.

### Installing a Compass-Top Sensor

The sensor unit placed on the glass plate of the ships compass, in the exact centre of the compass 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-833** 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.



### **Installing a Magnetic Sensor Unit (Fluxgate)**

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 compass 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. See also the diagram labelled “compass installation” .

## Calibration

The compass unit will need to be rotated in its bracket for the correct heading to be displayed. The compass is calibrated before leaving the factory and will be accurate enough for sea trials. After initial sea trials, you **may** wish to recalibrate the KAP-833 compass, although in most cases the factory calibration will be as good as or better than calibration achieved on the vessel. See the Compass Calibration section in **autopilot operation**.

## Interchanging Magnetic Sensor Unit & Compass Top Sensor

The magnetic sensor unit (fluxgate) and compass top sensor can be interchanged. However, the compass detector switches identified as component SW 1 on the PCB must be switched to correct position. (Note: Rear cover must be removed).

For magnetic sensor unit (compass): **switch 1 and 2 to OFF**

For compass top sensor: **switch 1 and 2 to ON**

	<b>OFF</b>	<b>ON</b>
<b>1</b>	<b>COMPASS</b>	<b>CTS</b>
<b>2</b>	<b>COMPASS</b>	<b>CTS</b>
<b>3</b>	Not used	
<b>4</b>	<b>RFUS</b>	<b>RFUH</b>

### **Terminal Strip Side of PCB**

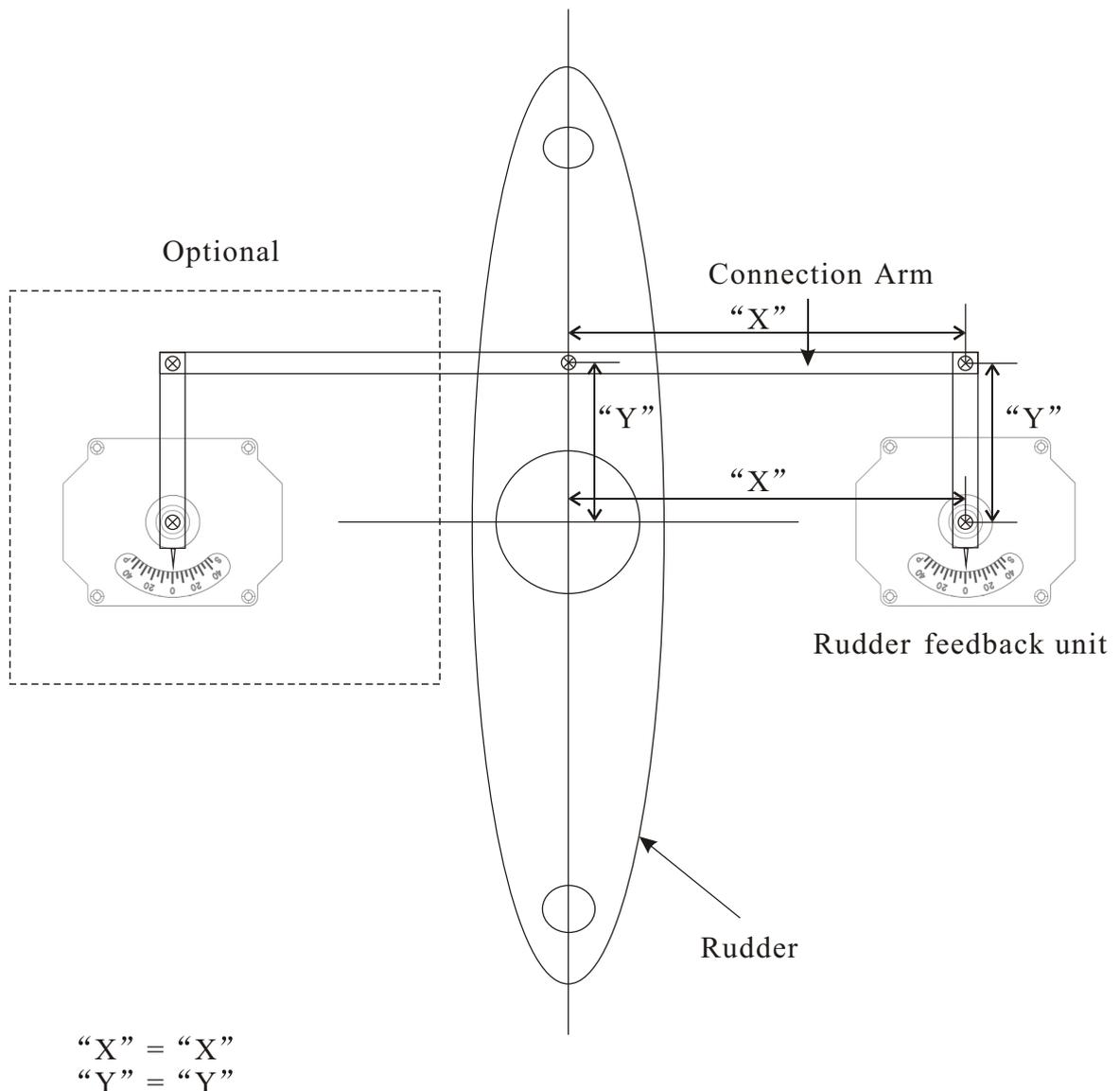
For Magnetic Sensor (COMMAG - Autopilot Compass) switches 1 and 2 must be OFF. For Compass Top Sensor (CTS) switches 1 and 2 must be ON.

### 6-3 Installation of Rudder Feedback (RFUH standard supplied)

#### 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 blue and red (or brown) connections to the KAP-833 terminal strip should be reversed.



### **Electrical connection**

Terminal RUDDER is marked 5V, RUD, Neg and shield, if shielded cable is used. The connections are as below.

Terminal 5V :	+ 5 volts	Red
Terminal Rud :	Signal	Yellow
Terminal GND :	GND	Black

If a small RFUS is used Sw1 (Dip switch) section 4 should be set to OFF.

### **FOR RFUH, IF INTERNAL RESISTORS ARE IN CIRCUIT, IT FUNCTIONS AS RFUS.**

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:

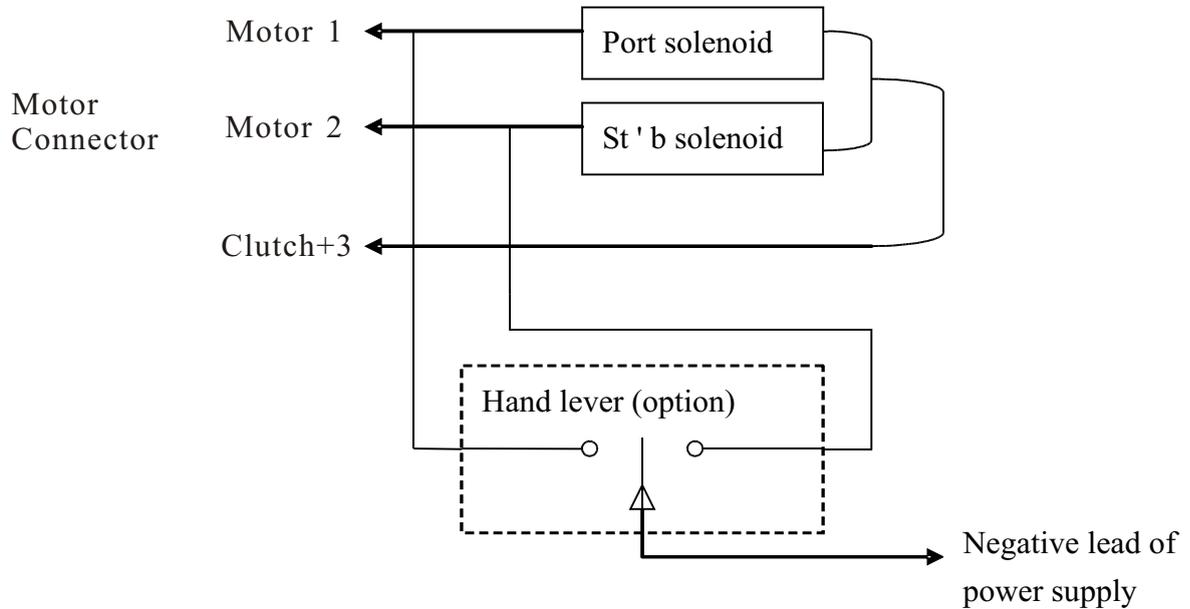
- a)The direction (port or starboard) indicated on the top of the **RFU** is correct.
- b)No undue mechanical strain is placed on the rudder feedback or linkage.

**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.**

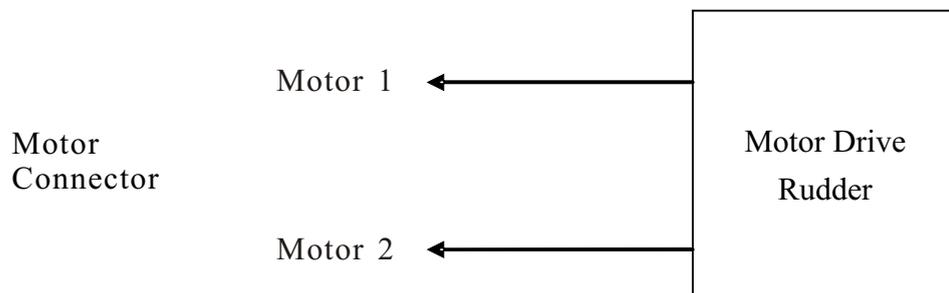
#### 6-4 Installation of solenoid

Please connect the solenoids as follow:



#### 6-5 Installation of Motor

Before connect KAP-833 to Motor drive rudder you have to open the upper cover of KAP-833 and short circuit D68, D69. Then connect the motor as follows :



## **6-6** Installation of Remote Units

**Hand Remote, Panel Remote and Steering Lever** (with switch).

These units are very robust and may be mounted where subject to occasional splashes of water. If mounted in direct sunlight, the Panel Remote decal may fade.

The cable leading from the unit should be connected to the **Remote** connector on the rear panel of your **KAP-833**.

## **6-7 NMEA Connection**

### **Data In**

For GPS navigation, connect the GPS unit **data output** and **data return** wires to terminals marked IN- and IN+ of the NMEA Data terminal GPS IN1+ and In1-. The connections to be used are marked IN- (Negative), IN+ (Signal).

### **Data In Connection - NOTE: Examples only**

- For any GPS unit which has a BNC type output plug (a bayonet plug, taking a coaxial cable with core and shield), connect the core to IN1+ and the shield to In1-.
- For a GPS unit with loose wires connect the positive to the IN + and negative to IN-.

Refer to diagram for terminal location.

## **6-8 External Alarm Installation**

An external buzzer may be connected to the port ALARM, terminals **ALA+** and **ALA-**.

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.

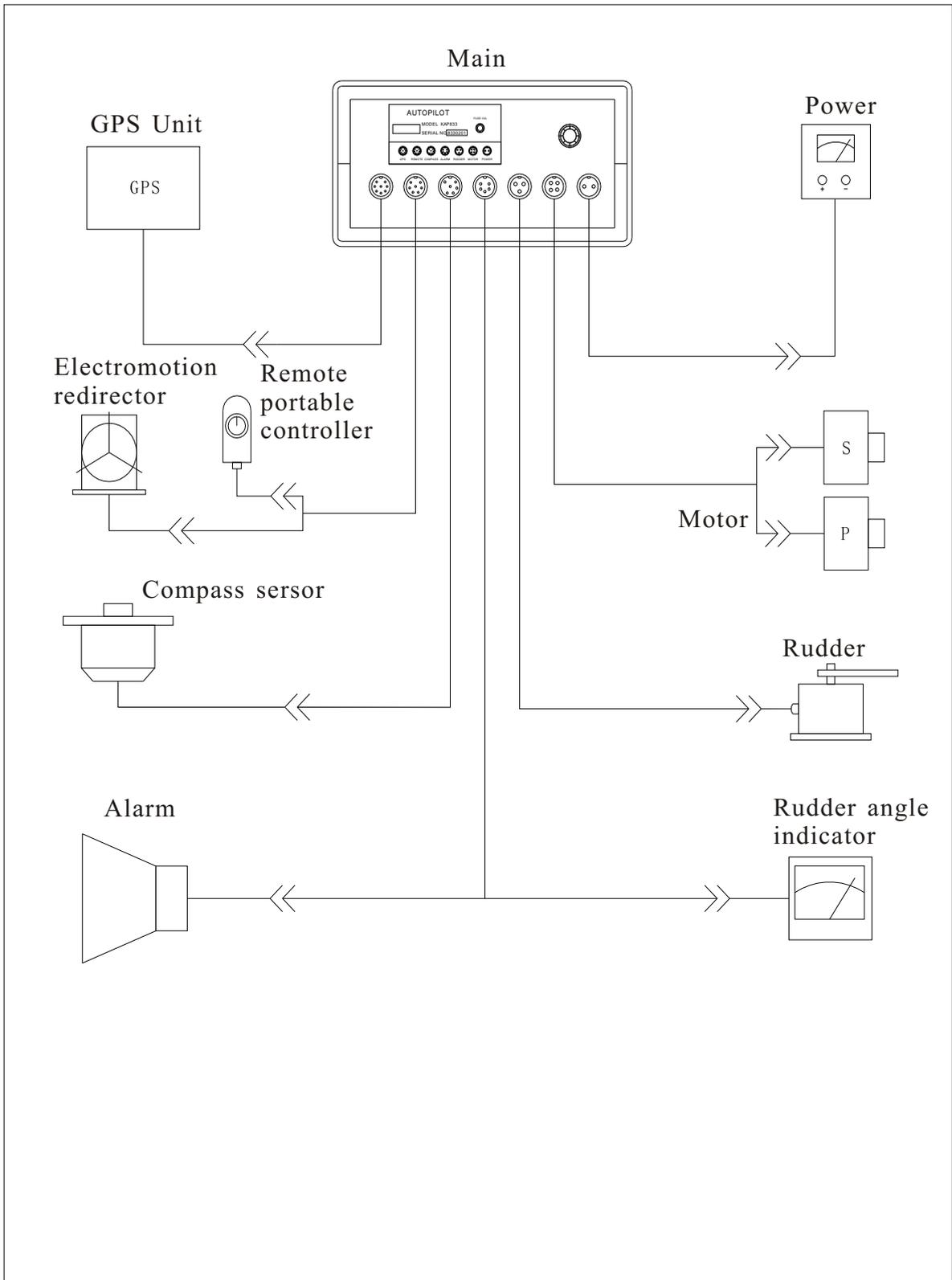
If a larger type siren or alarm unit, which draws in excess of 250 milliamps is used, this must be connected via a relay. The KAP-833 external alarm circuit is used to energise the relay coil and power to the siren or alarm unit is connected via the relay contacts.

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

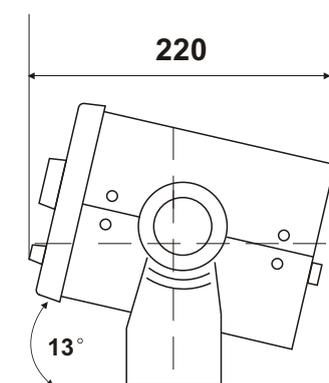
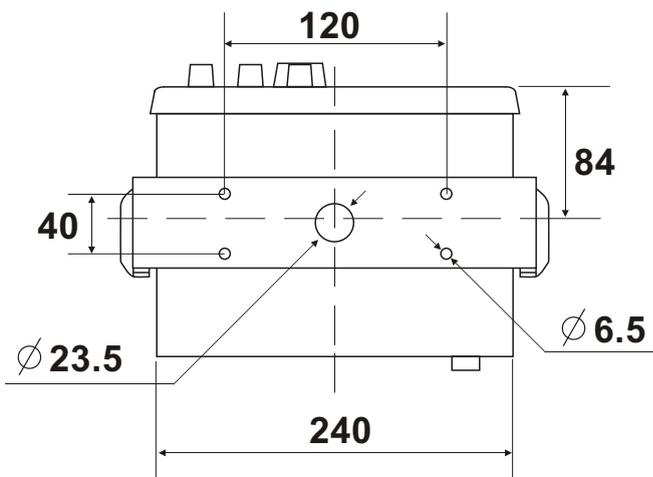
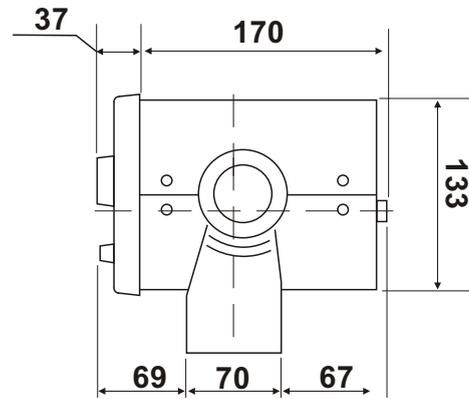
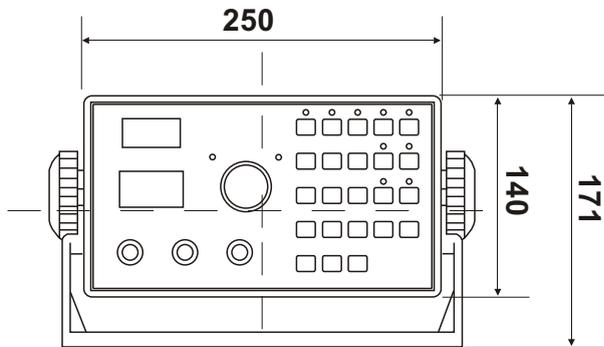
**6-9** PORT Wiring Diagram

<p><b>GPS</b></p>	<p><b>REMOTE</b></p>	<p><b>COMPASS</b></p>	<p><b>ALARM</b></p>	<p><b>RUDDER</b></p>	<p><b>MOTOR</b></p>	<p><b>POWER</b></p>
<p><b>GPS</b>            1. In 1+            2. In 1-            3. Out 1            4. Gnd            5. In 2+            6. In 2-            7. Out 2            8. Gnd</p>	<p><b>REMOTE</b>            1. Adjust            2. Contro 1            3. Adjust            4. Contro 2            5. +5V            6. Gnd            7. +10V</p>	<p><b>COMPASS</b>            1. Green            2. Red            3. Yellow            4. White            5. Blue            6. Shield</p>	<p><b>ALARM</b>            1. ALA-            2. ALA+            3.            4. 2.5V            5. MATT</p>	<p><b>RUDDER</b>            1. +5V(red)            2. Sig(yellow)            3. Gnd(black)</p>	<p><b>MOTOR</b>            1. MOT-            2. MOT-            3. Clutch +            4. Clutch -</p>	<p><b>POWER</b>            1. Power -            2. Power +</p>

## 6-10 System Configuration with optional items



## 6-11 Installation Dimension Diagram



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## **7** Commissioning Checks

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### **7-1** Connection Tests

1. Voltage to be connected is the required DC voltage (12 or 24V).
2. **ENSURE POLARITY OF THE VOLTAGE SUPPLY IS CORRECT.**
3. All electrical connections are correct.
4. Loose cables are correct.
5. 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.
6. Repeat step 5 for anti-clockwise.
7. Turn on power and adjust the rudder limits if necessary. See Adjustments section of this manual.

### Dockside Tests

1. Turn steering (by hand) to centre (midships) position.
2. Determine vessel heading by a sighting on known heading or compass.
3. Turn on power supply
4. Align Autopilot magnetic sensor until display reads correct heading.
5. Select AUTO mode on control unit.
6. AUTO light will come on.

**CAUTION: IF AUTOPILOT DRIVES HARD OVER, IMMEDIATELY TURN CONTROL UNIT OFF, REVERSE MOTOR WIRES MARKED MOT AND MOT AT THE SCREW TERMINALS ON THE KAP-833 AUTOPILOT. REPEAT FROM STEP 1.**

7. Turn course knob 10 degrees to starboard.
8. Green steering light should come on.
9. Confirm that rudder moves to starboard.
10. Turn course knob back to centre, then 10 degrees to port.
11. Red steering light should come on.
12. Confirm that rudder moves to port.

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

13. Press STANDBY key to leave auto mode.

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.

## **7-2** Adjustments

### **Rudder Limit**

The Rudder limit control is hardware preset.

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.

An internal potentiometer VR101(RUDLIM) is set to ensure that the KAP-833 will not drive the rudder past the set limits.

An internal control of the KAP-833 can then be used to limit the amount of rudder travel to an even narrower range. This can be used to limit the rate of turn of the vessel. Under normal operation the internal rudder limit control is set at maximum.

### **Rudder Limit (Software Preset)**

If the autopilot attempts to drive the rudder beyond its physical limits, the steering gear may be damaged. An internal **rudder limit** adjustment has been set to prevent this occurring. The internal **rudder limit** control can then be used to restrict the rudder angle range even further, and is intended to be used to prevent sharp turns, rather than protect the autopilot system.

**NOTE: If the rudder feedback unit has been installed correctly, it should not be necessary to adjust the Rudder Limits Switch Setting.**

The rudder limits prevent the steering motor driving the rudder beyond its physical (mechanical) stops. The **limit switch** is set so that the limit display comes on before the rudder reaches the stops.

These are two display symbols **P\_L** (port limit), **S\_L** (starboard limit) indicating the state of the rudder limit circuits...

- The port limit **P\_L** display will come on when the rudder position is further to port than the limit set by the **rudder limit port setting**. This will cause any port drive command to be ignored and turn off the port drive light on the front panel.
- The starboard limit **S\_L** functions in same way rudder angles to starboard.

**NOTE: THE RUDDER LIMITS ARE FACTORY SET TO APPROXIMATELY 25 DEGREES. IF THE RUDDER FEEDBACK HAS BEEN INSTALLED CORRECTLY, THE P\_L AND S\_L SYMBOLS SHOULD DISPLAY WHEN THE RUDDER IS MOVED PORT OR STARBOARD BY 25 DEGREES.**

### **Setting Rudder Limit**

- Select **Standby** mode
- Enter “**905**” and press and hold **GOTO** the **Auto, Standby or Power**, only the standby light will be on  
The display will indicate between 0 and 256 this is representative of rudder position where 128 is centre, 256 is fully port and 0 is fully starboard.
- Set the rudder to the required port position and press Port Arrow Button
- Set the rudder to the required Starboard position and press Stbd Arrow Button
- To store the Data press “**GOTO**”

### **Rate-of-Turn Control**

The rate-of-turn control on the internal preset.

A Potentiometer VR102(TURN) sets the maximum rate-of-turn for the vessel, to prevent very sharp when changing course.

Fully anticlockwise will turn 1 degree/sec (ie 180 degrees in 3 minutes). Fully clockwise will turn 40 degrees per second (ie as fast as possible for most vessels).

The slower settings may be used for turns while trawling, trolling, etc., and the faster settings used to prevent dangerous or uncomfortably sharp turns.

Note that the turn rate of a vessel will also depend upon the rudder ratio setting, and perhaps the rudder limits.

If a course change is entered, and then it is realised that the rate-of-turn control is set too low (ie the turn is too slow) just alter the rate-of-turn control clockwise until the correct speed is found.

Once a turn is begun, adjusting the rate-of-turn control downward (anti-clockwise) will have no effect. ie., the turn rate can be INCREASED during a turn, but not DECREASED.

**The rate-of-turn control applies only in AUTO and GPS modes.**

Rate of turn is also controlled by the rudder limit and rudder ration controls.

A course-change entered from one of the remote steering stations is not controlled by the rate-of-turn knob.

## **Trim**

The Trim control on the internal preset VR31 (TRIM).

When the KAP-833 first is switched on and in **Standby** mode, the **Trim** knob should initially be set in **mid** position which corresponds to setting of **5**.

There are circumstances in which the autopilot may set the rudder in the centre (according to its feedback unit), but the vessel does not steer straight ahead. Reasons for this are:

1. The rudder feedback unit may not be perfectly aligned.
2. There may be a side-wind, current, net drag, etc., which causes the vessel to steer to one side.

The KAP-833 computer program can compensate for these errors, but may take a few minutes to correct completely. Adjusting the **trim** control can eliminate these errors immediately.

To find the correct **trim** setting:

- With the vessel travelling ahead, switch autopilot the to **power steer** mode.
- Adjust the **trim** control until the ship steers straight.

The trim control is **not** intended to be used for adjusting the vessel course in auto or power steer mode.

### **7-3 Fuse Protection**

The KAP-833 has a **10 Amp fuse** mounted internally. This device will shut off power to the KAP-833 autopilot if a short-circuit occurs inside the autopilot, or between a power output and ground.

If this fuse blows repeatedly, recheck all your installation and wiring carefully. If no error is found, consult your dealer or Technician.

### **KAP 833 Special Modes**

To enter special modes enter number on keypad, press and hold GOTO then press STANDBY.

To store the data press GOTO.

To exit special modes press MAIN

To use preset value press PRESET

### **Selection**

- 901 Start compass calibration (CAL displayed)
- 902 Store compass calibration
- 903 Return to default compass calibration. (RES displayed)
- 904 Factory test for calibration.
- 905 Set limit switches(Analogue Volt Dis)  
PORT ARROW (for port)/STBD ARROW (for Stbd)
- 908 Option remote:
  - r-1 Hand remote provision for 2
  - r-2 Active remote
  - r-3 Hand remote plus power steer on pin 3
  - r-4 Basic remote plus power steer on pin 3 in standby mode.(Electric steering vessel)
  - r-5 When in power steer mode accept input from 3, Power steer mode from other inputs pin 1 and 2 selected by 4 being pulled high for 1 and low for 2 to be active. Input 4 can be pulsed with a momentary push button to select the mode.
  - r-6 When in standby the system goes to power steer mode accepting input from 3, Power steer mode from other inputs pin 1 and 2 selected by 4 being pulled high for 1 and low for 2 tp be active. Input 4 can pulsed with a momentary push button to select the mode.

When setting limit switches in vessel with only power steer, Mode 908 allows movement of the rudder using the encoder or port and starboard buttons .If remote system is r-5 or r-6 select 908 mode prior to selecting 905 limit switch mode. Use encoder to move rudder to desired position. Limits do not operate in this mode.