

TMQ Electronics

AP-RP Autopilot

OPERATION AND INSTALLATION
MANUAL

Contents

Contents	2
Warning!	4
Introduction	5
Autopilot Operation	7
Overview of Operation	7
Definition of Terms	9
AP-RP Modes	10
Standby	10
Auto	10
GPS Mode	11
Power Steer Mode	13
Rudder Control (Rudder Ratio)	14
Sensitivity Control	14
Alarms	15
Autopilot Installation	16
Installation of Main Computer Unit (MCU)	16
Position	16
Wiring	16
Accessibility	16
DIP Switch Setting	16
Installation of AP-R - Remote Control Unit	17
Position	17
Wiring	17
Magnetic Effect	17
Installation of Compass	18
Position	18
Wiring	18
Magnetic Effect	18
Mounting	19
Installation of Rudder Feedback	20
Position	20
Installation of Optional Remote Units	21
Hydraulic Drive Installation	22
Position	22
Precautions	22
Wiring	22
Mechanical Motor Installation	23
Motor Gearing Ratio	23
Position	23
Wiring	23
Warning	23

GPS Connection	24
Data In and Out	24
Data In Connection Examples:	24
Programming the GPS unit	24
Commissioning Checks	25
Connection Checks	25
Dockside Tests	25
Adjustments and Indicator Lights	26
Main Computer Unit (MCU) Indicator Lights	26
Rudder Limits	26
<i>Warranty</i>	27

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 CAN ENDANGER YOUR OWN OR OTHER VESSELS.

Introduction

The **TMQ Electronics AP-RP** autopilot comprises a number of units:

Essential Electronics:

- * Main Computer Unit (MCU)
- * Remote Control Unit (AP-R)
- * Compass (COMMAG)
- * Rudder Feedback (RFUS)

Options:

- * AP-R as vertical or horizontal mount
- * Control Head Display Unit
- * Remote Panel / Hand Remote / Steering Lever

Drive Units:

- * Mechanical
- * Hydraulic

The main computer unit (**MCU**) is a black box, which is generally installed inside a dry locker or other protected position.

The compass must be installed in a place free of magnetic interference, and connected to the **MCU**.

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 **MCU**.

The AP-R remote control unit (either vertical or horizontal) has a mounting bracket which is attached to a dash or similar convenient mounting location. The AP-R control can be removed from its mounting bracket and used as a "roving" unit via a 6 metre cable which is connected to the main computer unit.

The **AP-R Remote Control Unit** provides all the necessary functions to operate as an autopilot. It may also be used in conjunction with the AP50 control head if this option is required.

Provision has been made for other types of **remote panel, hand remote, steering lever** or **steering wheel** station. These are very robust units which will not be adversely affected by water. The abilities they provide differ from the remote unit (and control head). See the Operation section of this manual for details.

For more information on installation of your AP-RP autopilot, see the Autopilot Installation section of this manual.

For more information on using your AP-RP autopilot, see the Autopilot Operation section of this manual.

Autopilot Operation

Overview of Operation

Pressing the relevant button on the remote unit will select one of the possible **Steering Modes** in the **Main Computer Unit (MCU)**. It is the **MCU** which generates signals to the steering motor (whether mechanical, hydraulic, or other type).

The following is a brief list of the capabilities of the **AP-RP** autopilot. Each is described in more detail in a separate chapter.

* **Standby Mode**

The vessel is not under autopilot control. Vessel must be hand steered in this mode.

* **Auto Mode**

The autopilot will maintain your vessel on a magnetic course. The course the vessel is heading when the pilot is turned to **auto** mode will be the course steered.

* **GPS Mode**

When receiving information from a GPS unit, the autopilot can steer a vessel to a precise latitude and longitude, or through a sequence of latitudes and longitudes (route).

* **Power Steer Mode**

The vessel is "manually steered" by pushing the appropriate **port** and **stbd** buttons on the remote.

* **Rudder and Response Settings**

These customise the **AP-RP** autopilot for your vessel's steering. They may also be used to adjust for varying sea conditions.

The following features require the optional AP50 Control Head Display Unit:-

*** Compass Calibration**

The compass can be calibrated on the vessel using a simple procedure.

*** Optional Rudder Angle Bars**

The **AP50** display units can show rudder angle bars on the screen in **manual, auto** and **GPS** modes, or this can be disabled.

*** Rudder Angle Numeric Display**

The rudder angle can also be displayed in degrees. This is useful for installation, and may also be useful when hand-steering or in **remote power steer** mode.

*** Selectable keypad backlighting**

When using the autopilot at night, 3 levels of backlighting are available.

Definition of Terms

Current Course

The magnetic heading of the vessel at the current time.

Course-to-steer

The magnetic heading which the autopilot is attempting to achieve.

Main Computer Unit (MCU)

The "black box" which actually controls the steering and has all remotes and ancillaries connected to it.

AP-R

The remote control unit with keypad which is used to send commands to the **MCU**. This is also referred to as a steering "station".

Remote Unit (Options)

This is a collective term for an "active remote", "panel remote", "hand remote", "steering lever" or "steering wheel" station. Each of these function in similar ways, but differ in appearance.

AP-RP Modes

Standby

In this mode:

- * The **STBY** light is on.
- * The motor clutch is disengaged
- * No steering control is generated by the autopilot
- * The vessel will need to be steered by hand

Auto

Engaging Auto mode

When in **STBY** and the **AUTO** button is pressed, a beep will sound and the auto light turns on. The auto pilot will lock on to the current heading of the vessel and begin to steer the vessel.

Disengaging Auto mode

Press any other mode button (red buttons). A beep will sound and operation is then transferred to the mode selected.

Course Adjustment

Pressing the **< or << PORT or > or >> STBD** buttons will cause a 1 degree or 10 degree course change in that direction (depending which button is pushed). Larger course changes required several pushes on the relevant button.

IMPORTANT!!

Before entering auto mode, ensure that the rudder is in the centre position (ie: vessel steering straight ahead). If you do not do this, the course steered will be inaccurate.

TMQ Autopilots select the position of the rudder when auto is selected as the position of the rudder to allow the vessel to steer straight ahead. This can be an advantage in most vessels when a slight amount of helm from the physical centre position is

required for the vessel to go straight.

GPS Mode

For use when autopilot is interfaced to a GPS generating NMEA 0183 data output in the correct sentence format. 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.

Engaging GPS Mode

Normally engaged from **AUTO mode**. Press the **GPS** button, a beep will sound and the GPS light will turn on.

The vessel is under autopilot control and being directed by the GPS. If the new GPS course differs from the original course, the vessel will begin turning from its current course to that requested by the **GPS unit** at a maximum rate of 10 degrees per second.

If no GPS data is received by the **AP-RP**, 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

Press any of other mode button (red buttons). A beep will sound and operation will be transferred to the mode of control selected.

Setting up your GPS unit

Because there are a great variety of GPS units that will work with this autopilot and varying revisions of NMEA 0183, the following is a guide only. For more information, consult your GPS manual.

The GPS unit must be set up to output "NMEA 0183" data on a pair of wires which are connected to the NMEA socket at the end of the **MCU** (see page 24 - GPS connections). The data generated must include **at least one** of the following:

- * 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 only. 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, the GPS unit is set and capable of "auto-sequence" between them and an "arrival zone" of more than 0.05 NM (Nautical Miles) is set so that the GPS can detect when the vessel has reached a waypoint, then the **AP-RP** 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 unit; the "auto-sequence" feature is not available in this instance.

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 flash. This could be caused by:

- * Incorrect wiring of the GPS to the **MCU**.
- * Incorrect data output (wrong sentence) 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 **AP-RP** is receiving from its magnetic compass. The greater the difference between these bearings, the less accurate will be the **GPS Mode** steering.

- * Ensure that the GPS unit has the correct magnetic correction

factor.

* Ensure that the **AP-RP** compass is correctly aligned and installed, and not subject to magnetic influence.

Power Steer Mode

In this mode the vessel is under autopilot control **but does not respond to the compass.**

Engaging Power Steer mode

When in any mode, press **POWER STEER** button and a beep will sound. The vessel will need to be steered "manually" by pressing the PORT [**< 1**], [**<< 10**] or STBD [**> 1**], [**>> 10**] buttons as required for the desired course changes. (A useful feature when the AP-R is removed from its bracket and the vessel can be steered when at a position away from the helm).

Disengaging Power Steer mode

Press any other mode button (red buttons). A beep will sound and operation is then transferred to the mode selected.

Rudder Control (Rudder Ratio)

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).

To adjust this, press the up or down **RUDDER** buttons while in **STBY, AUTO, GPS, or POWER STEER** mode.

The **rudder** setting may be altered by subsequent pressing of rudder buttons.

- * When the **rudder** setting is too low, vessel track will be slow "S" ie: understeer through too little rudder applied.
- * When the **rudder** setting is too high, vessel track will be rapid "S" ie: oversteer through too much rudder applied.

Sensitivity Control

This setting is used for adjusting the autopilot's response to varying sea conditions, and varying vessel capabilities. The response value sets the desired accuracy of the vessel steering. A low value of response will cause the vessel to steer very accurately but may cause excessive use of the steering motor (hunting).

To adjust this, press the up or down **SENSITIVITY** buttons while in **STBY, AUTO, GPS, or POWER STEER** mode. Pressing the down button successively will narrow the sensitivity dead-band.

The **sensitivity** setting may be altered by subsequent pressing of the sensitivity keys.

- * A low **sensitivity** value signifies a smaller acceptable heading deviation (for calm weather)
- * A high **sensitivity** value signifies a larger acceptable heading deviation (for rougher weather - to reduce the work on the drive unit).

NOTE: Too low a setting may cause the steering motor to work continuously. The **sensitivity** setting should be increased until this ceases.

Alarms

A number of conditions will cause alarms to sound.

No MCU Alarm

This indicates that the remote is not receiving data from the **MCU**. Check that all plugs are secure. The STBY light will flash.

No GPS Data Alarm

The alarm sounds if the autopilot is not receiving valid information from the GPS. The GPS light flashes and the beeper sounds.

Angle Off Course Alarm

The alarm sounds when vessel is more than 45 degrees from **course-to-steer**. The AUTO light flashes and the beeper sounds.

Autopilot Installation

Installation of Main Computer Unit (MCU)

Position

The **MCU** should be mounted in an accessible position, protected from rain or salt water. Inside a locker or on a bulkhead below decks are suitable. It should be mounted close to the steering motor where convenient to minimise voltage drop between the **MCU** and motor.

Wiring

Access for wiring must be provided. Cabling from the various ancillaries (remote, compass, rfus and autopilot drive motor) will have to be run to the MCU. Wiring should be kept as far 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 **MCU** must have a direct connection to power supply via an isolating switch. A power cable rated at 15 amps should be connected between power input switch and terminals on the **MCU**.

Accessibility

The MCU location should be easily accessible so that it is possible for a technician to make adjustments to the unit. To access the internal of the unit two screws either end allow the top lid to be removed.

DIP Switch Setting

The DIP switch is located on the PCB near the internal piezo alarm.

- 1 Marked F-CF=Commag C=CTS
- 2 Marked F-CF=Commag C=CTS
- 3 Remote Selection
- 4 Marked S-HS=Standard RFU H=Large RFU

Installation of AP-R - Remote Control Unit

Position

The remote control should be mounted in a position accessible to the steering position, protected from direct rain or salt water if possible.

Wiring

Access for wiring must be provided. Cabling will have to be run to the **main computer unit (MCU)**. Wiring should be kept as far as possible from radio aerials and aerial cables to prevent interference to the radio and transmitted signals from the radio influencing the pilot. Cable should also be run separately (if practical) from other current carrying cables. Cable length is 6 metres.

Magnetic Effect

As no steel is used in the remote control, there is negligible effect on a steering compass. Some radio interference may be caused by the internal electronics.

Installation of Compass

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

Position

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

As the 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.

In a steel vessel, the compass should be mounted 1 metre above the cabin-top or superstructure.

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.

Wiring

The cable leading from the compass must be connected to the correct socket on the main computer unit (MCU). There is no restriction on cable length.

Magnetic Effect

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.

NOTE: The stated minimum distance is 1 metre. This requirement will vary from vessel to vessel and may be more or less than 1 metre. It is often necessary to try the compass in several areas to obtain the optimum

position.

Mounting

Fasten the compass with non-magnetic screws. The compass must be mounted in an approximately vertical position. See also the diagram labelled "Compass Installation".

Calibration

The compass is calibrated in the factory. The only alignment necessary on the vessel is to **fit the compass into its mounting bracket with the cable facing aft.**

Installation of Rudder Feedback

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 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 wires in the cable must be reversed (Note: yellow wire in cable is not used).

When 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 indicated on the top of the **RFU** is correct.
- b) no undue mechanical strain is placed on the rudder feedback or linkage.

NOTE 1: THE AUTOPILOT WILL NOT FUNCTION CORRECTLY IF A RUDDER FEEDBACK IS NOT FITTED, OR IF THE FEEDBACK IS FAULTY OR INCORRECTLY ADJUSTED.

NOTE 2: 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.

NOTE 3: THE FEEDBACK ARM HOLDS AN O-RING AGAINST THE FEEDBACK BODY TO FORM A WATER RESISTANT SEAL. DO NOT MOVE THE ARM UP THE SHAFT.

Installation of Optional Remote Units

This section only applies when other remote units are purchased as options to the AP-RP.

Hand Remotes, Panel Remotes, Steering Levers and Steering Wheels:

Provision is included for 3 different remote input selections:

- R-1 Provision for 2 hand remotes
- R-2 Provision for 1 TMQ Active remote.
- R-3 Not available this model
- R-4 Basic remote plus power steer on pin 5 in standby Mode. (Electric steering vessel)

To select the mode: (Not an operator function)

Select "MANUAL"
Push switch 3 to on and monitor the status led.

Push the switch off to select the mode after the required number of LED illuminations
ie 1 illumination for R1
2 illuminations for R2
4 illuminations for R4

If a non TMQ supplied remote is being used the Pin configuration is:

<u>Pin Number</u>	<u>Function</u>	<u>R1</u>	<u>R2</u>	<u>R4</u>
1	5v Power	Power	Power	Power
2	Remote	Wiper 1	Wiper	Wiper
3	Negative Control	Negative Control 1	Negative Select 1	Negative Control
4		Wiper 2	Select 2	Wheel Input
5		Control 2	Select 3	
6				

In Version R1 and R4 control line pin 4 and 6 (in R1) is set to 5v for power steer and 0v for Remote Auto. Open circuit returns the Autopilot to Manual mode and version R4 effective power steer from a potentiometer input on pin 5.

R2 allows selection of GPS and adjustment of rudder ratio, sensitivity, power steer and auto from the remote socket.

Hydraulic Drive Installation

Follow any instructions of the Hydraulic Steering Supplier.

THE AUTOPILOT SUPPLIER'S ADVICE SHOULD BE SOUGHT IF USING UNBALANCED RAMS WITH THIS AUTOPILOT.

The following Hydraulic Drive Units are recommended:

1. A pump with adjustable flow rate suitable for most installations (12V or 24V DC) with flow rates up to 1000cc per minute.
2. A pump with adjustable flow rate suitable for high volume 12 or 24 volt installation with flow rate up to 2000cc per minute.

Position

All pump units must be mounted horizontally, in a dry position, lower than the highest Helm Pump on the vessel. Hydraulic lines must be used to connect the pump to the steering lines of the vessel.

With most pumps, a balance line must be used to connect the drive pump back to the helm reservoir. Check with your pump supplier.

Precautions

Some brands of Helm Pumps will require lock valves fitted to prevent the helm from turning when the autopilot is operating. Consult your steering supplier for this information.

All air must be purged from the steering system before commencing tests with the autopilot. Consult your hydraulics manual.

Wiring

Connect the pump unit to the **main computer unit (MCU)** with the supplied 2-core cable. This cable may be extended if required but the maximum voltage drop allowed in the motor cable with full load of 10 amps is 0.5 volts. This must be considered when selecting the extension cable.

Mechanical Motor Installation

Motor Gearing Ratio

Mechanical drive motors should have a nominal output speed of 30 RPM. They are typically fitted with a 16 tooth 3/8 pitch sprocket to suit B.S. chain (06B-1R). 1.5 meters of chain, a 38 tooth sprocket and mounting bolts are also required.

Due to wide variation of mechanical steering systems and the turning speed of vessels, this ratio has proved the most effective in regard to helm speed and the required torque. If steering problems are encountered, different sprockets can be fitted on the motor drive shaft; the variations normally available are 10 or 24 tooth.

Position

Mounting of the motor unit requires a flat base and fasteners with sufficient strength to withstand in excess of 150kg pull. The output shaft should always be parallel with the shaft to be driven although the motor can hang down or be mounted on the side.

Wiring

Connect the motor unit to the **main computer unit (MCU)** using the supplied 4-core cable. This cable may be extended if required but the maximum voltage drop allowed in the motor cable on full load of 10 amps is 0.5 volts. This must be considered when selecting the extension cable.

Warning

Time taken for rudder to travel lock to lock should not be less than 12 seconds. This will occur if steering shaft total turns are less than 2. In this type of installation a large sprocket will be required on the steering shaft. Refer to supplier for the correct sprocket size.

GPS Connection

Data In and Out

For GPS navigation, connect the GPS unit via the outside of the two 6 pin socket.

	Pin 1	NMEA Rx +		
	Pin 2	NMEA Rx -		
information)	Pin 3	NMEA Tx +	(heading
	Pin 4	NMEA Tx -	"	
sensor)	Pin 5	TMQ Data Rx +	(TMQ Rate
	Pin 6	TMQ Data Rx -	"	

Data In Connection Examples:

For any GPS unit which has a BNC type output plug (a bayonet plug, with a core and shield), eg for the JRC brand JLU-121, JLR-6000 or NWU-53, connect the core to **NMEA Rx +** and the shield to **NMEA Rx -**.

For any GPS having open wires, connect **TX+** to **NMEA Rx +** and **TX-** to **NMEA Rx -**.

For a GPS with the following marking, connect **Data Out +** to **NMEA Rx +** and **Common** to **NMEA Rx -**.

For a Plotting system, connect **Data Out +** to **NMEA Rx +** and **Data Common** to **NMEA Rx -**.

For information on connecting other types of GPS units, refer to the owners manual.

Programming the GPS unit

This is the part of the GPS-to-autopilot connection that causes the majority of problems. The **AP-RP** autopilot looks for **APA**, **APB**, **XTE** and **BOD** information in the **NMEA 0183** data format. For more information on this, see the Operations section of this manual and consult your **GPS unit** manual.

Commissioning Checks

Connection Checks

1. Power 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 clipped or tied up.
5. Turn steering wheel fully clockwise and visually check that moving and mechanical parts do not foul; visually check that RFU has moved in correct direction as indicated on the RFU label on top.
6. Repeat step 5 for anti-clockwise.

Dockside Tests

1. Turn steering (by hand) to midships position.
2. Determine vessel heading by a sighting on known heading or compass.
3. Turn on power supply
4. Select AUTO mode.

CAUTION: IF AUTOPILOT DRIVES HARD OVER, IMMEDIATELY TURN CONTROL UNIT OFF, REVERSE MOTOR DRIVE WIRES AT THE SCREW TERMINALS ON THE MAIN COMPUTER UNIT AND REPEAT FROM STEP 5.

5. Using the buttons on the Remote Unit, change course 10 degrees to starboard.
6. Confirm that rudder moves to starboard.
7. Change course 10 degrees to port
8. Confirm that rudder moves to port.

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

9. Go back to "Manual" (Standby) mode.

The autopilot is now ready for full operational testing.

Adjustments and Indicator Lights

Main Computer Unit (MCU) Indicator Lights

There are three indicator lights inside the **MCU**.

***CPU** light flashes once per second to indicate that the autopilot computer is functioning.

***Limits** light comes on when the rudder position reaches the limit set by the **rudder limit potentiometer** inside the MCU.

* **Status** light for selection of Analogue Remote type.

NOTE: THE RUDDER LIMITS ARE FACTORY SET AT 25 DEGREES. IF THE RUDDER FEEDBACK HAS BEEN INSTALLED CORRECTLY, IT SHOULD NOT BE NECESSARY TO ADJUST THE LIMIT SETTING.

Adjustment may be necessary when a Rudder Angle Indicator is fitted.

Rudder Limits

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

Turning the rudder limit potentiometer clockwise will increase the amount of rudder which can be applied before reaching the stops.

The one adjustment affects both port and starboard limits. The setting should be such that the rudder cannot be driven into either port or starboard stops by the autopilot.

If at any time during testing the motor runs under load and the rudder does not move checks should be carried out to confirm the limit switch are operating prior to the rudder running into the stops.

Warranty

TMQ Electronics products are thoroughly inspected and tested before shipment from the factory and are conditionally warranted to be free of defects in workmanship and materials for a period of three years from the date of shipment from the factory.

This warranty is extended to and is solely for the benefit of the original consumer purchaser.

Units in need of repair will be repaired without charge to the purchaser during the above mentioned period in accordance with the following terms and conditions:

1. The defective unit is returned "freight prepaid" to TMQ Electronics, 264 Tingal Rd, Wynnum, Qld. 4178.
2. Proof of purchase is supplied and original Serial Numbers on equipment have not been changed.
3. Information is provided regarding the nature of the failure or problem occurring.
4. A return address is supplied to enable the equipment to be returned by road freight. Any other means of transport will be charged to the customers account and must be paid in advance.

This warranty does not cover defects or damages caused by unauthorised service or damage through accident, misuse or abuse. The owner is also responsible for providing reasonable maintenance and weather protection of the equipment.

TMQ Electronics shall not be liable for damage or loss incurred resulting from the use and operation of this product. TMQ Electronics reserves the right to make changes or improvements to later models without incurring the obligation to install similar changes to equipment already supplied. Some states do not allow the exclusion or limitation of incidental or consequential damages; therefore the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

AUTOPILOT — COMPASS INSTALLATION

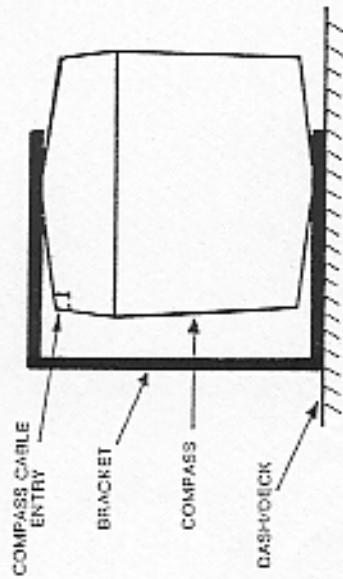


Figure A — Bottom Mount

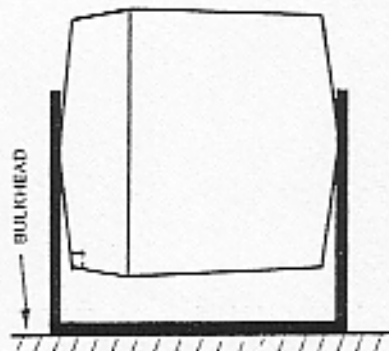


Figure B — Side Mount

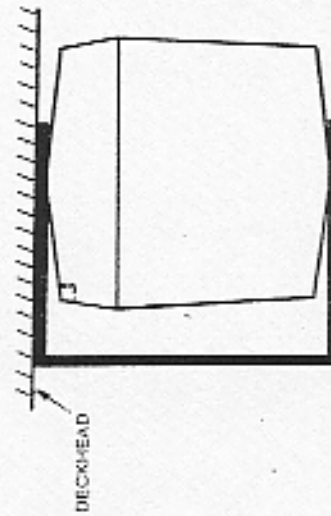


Figure C — Top Mount

NOTE:

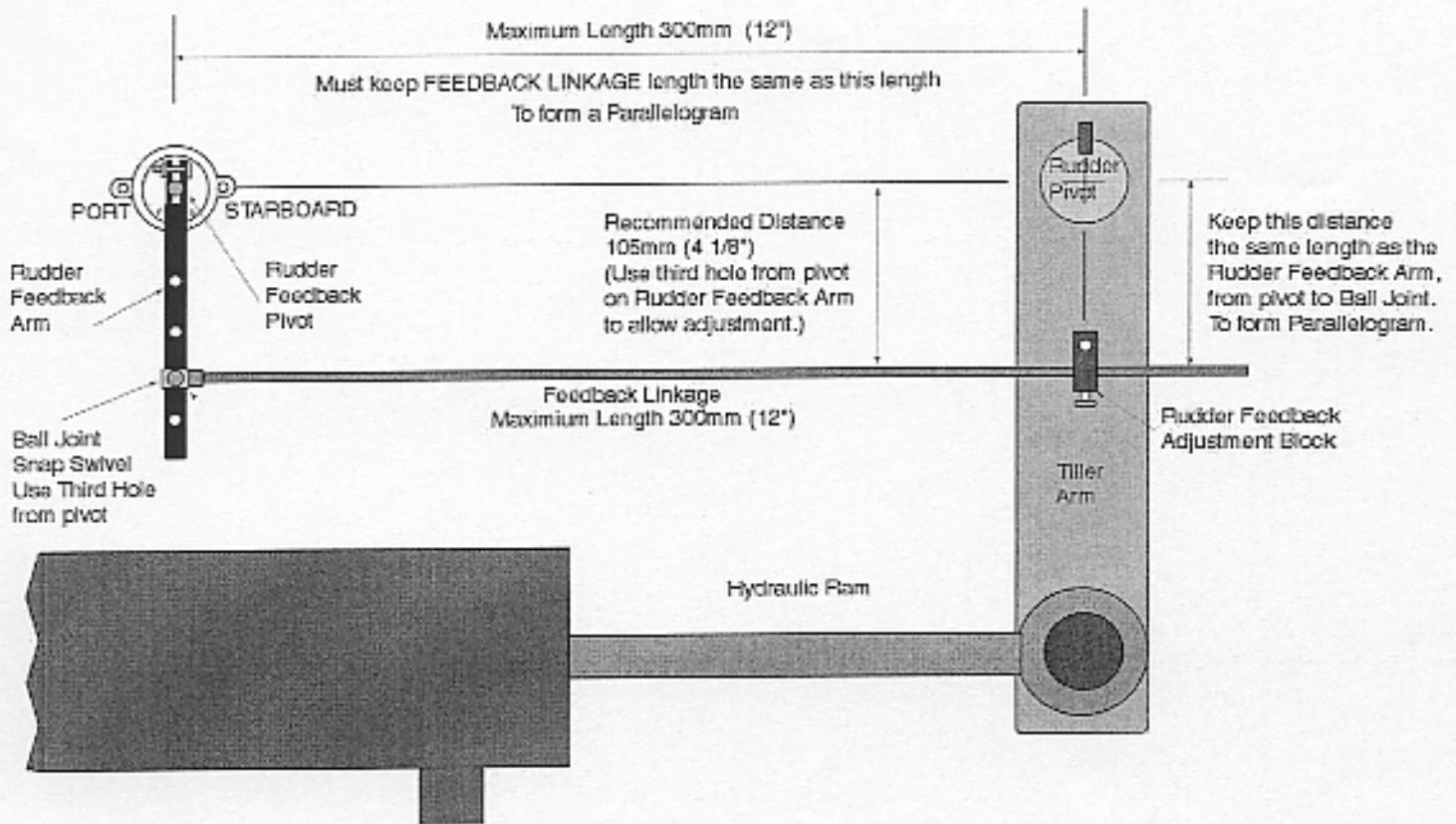
MAGNETIC INTERFERENCE WILL EFFECT THE EFFICIENCY OF THE MAGNETIC SENSOR UNIT. IT IS ESSENTIAL TO POSITION THE MSU FOR MINIMUM INTERFERENCE.

DO NOT RUN MSU CABLE WITH OTHER CABLES ON THE VESSEL AND MOUNT THE MSU WELL AWAY FROM FERROUS METALS, ELECTRICS AND OTHER COMPASSES.

CAUTION WHERE EVER YOU MOUNT THE MSU, BE AWARE OF WHAT IS ON THE OTHER SIDE OF THAT SURFACE.

APPROVED BY	DATE
<i>[Signature]</i>	15.10.93
TITLE INSTALLATION - MAGNETIC SENSOR UNIT	
SIZE A4	REVISION /
Date: 15.10.93	Sheet 1 of 1
File: 04BLANK/1	Drawn By: JC

Rudder Feedback Installation Diagram



Rudder Feedback Installation Notes

- When the rudder is central and the rudder feedback is central all angles should be 90 degrees.
- Use the snap swivel and ball joint on the rudder feedback arm
- Use the rudder feedback adjustment block on the tiller arm
- Hydraulic ram may be mounted on the other side of the tiller arm
- Ensure that when rudder turns to Port, Rudder Feedback turns to Port as indicated on the rudder feedback unit.
- Rudder feedback unit may be mounted upside down. This would require an electrical change. (Polarity of rudder feedback requires reversing)

Wiring:

The cable from the RFU must be connected to the **Rudder** socket on the autopilot. The RFU is supplied with a standard 14 metre cable but can be extended if required during installation.

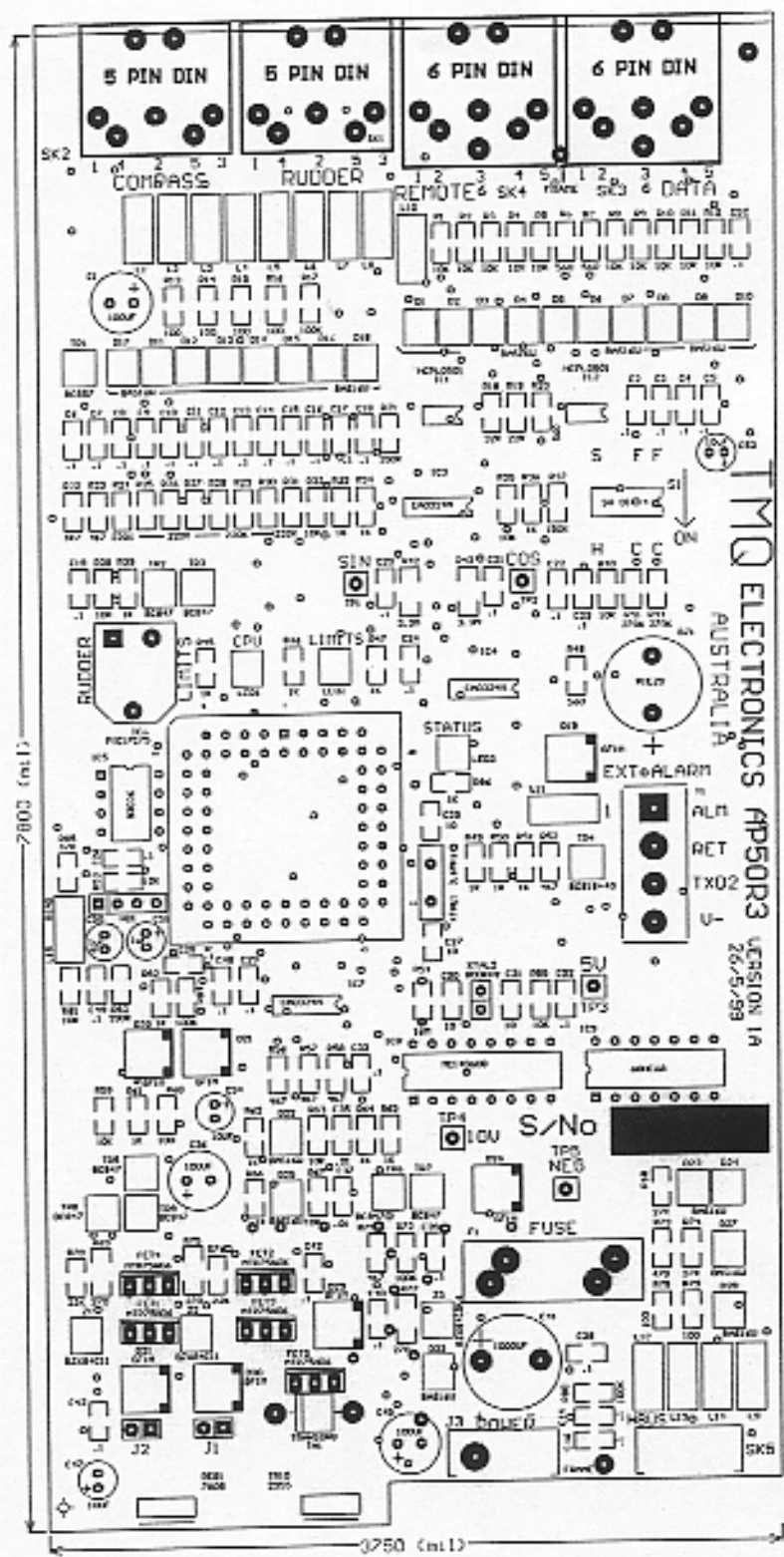
**NOTE 1: THE RUDDER FEEDBACK UNIT IS FACTORY ALIGNED.
THE ARM SHOULD NOT BE REMOVED OR LOOSENED AS THE FEEDBACK ARM HOLDS AN O-RING AGAINST THE FEEDBACK BODY TO FORM PART OF THE WATER RESISTANT SEAL.**

**NOTE 2: IF USING RFUH CONNECT TO THE TERMINAL STRIP RFUH 2 AND SIGNAL POSITIONS. SET THE AUTOPILOT INTERNAL DIP SWITCHES TO RFUH, IF REQUIRED.
(SEE AUTOPILOT INSTRUCTION MANUAL)**

RFUH Internal Terminal Strip.

RFUS 1	RFUH 2	SIGNAL	RFUH 2	RFUS 1
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NOTE 3: ENSURE RUBBER GASKET IN RFUH IS PROPERLY FITTED TO PREVENT MOISTURE OR WATER INGRESS.



TM ELECTRONICS AP50R3 VERSION 1A
 AUSTRALIA 26/5/99

Drill Drawing

29.10.99		PLACE LOGO HERE	
ENGINEER: PHONE:	TITLE: Eurocard VME bus format		
ENGINEER: PHONE:	PART NO.:	REV: 01	DATE: 11-Oct-1999
FILE NAME: Ap50smdr5.pcb	LAYER: Mechanical Layer 1		CHECKED: GEB

