

TMQ ELECTRONICS

BOSUM

OPERATION AND INSTALLATION MANUAL

Contents

Navigation Warning	2
Introduction	3
Autopilot Operation	4
Autopilot Installation	25
Warranty	37
Drawings & Diagrams (9 Pages)	38

TMQ Electronics, 264 Tingal Rd, Wynnum, QLD. 4178.

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 **Bosun** 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 a solid metal case.

A Bosun system contains:

- * Autopilot Unit
- * Compass
- * Rudder Feedback
- * Up to two Hand Remote/Panel Remote/Steering Lever/Wheel units, with a special option of an additional steering lever or wheel unit.

The Bosun has outputs to control the vessel steering through solenoid valves or relays.

The autopilot unit should be installed out of direct sunlight and protected from water and spray.

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

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.

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 information on installation of your Bosun autopilot, see the Autopilot Installation section of this manual.

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

Autopilot Operation

Contents

Overview of Operations	5
Standby Mode (autopilot inactive)	6
Auto Mode (steering a compass course)	7
Power Steering Mode	8
GPS Mode (steering with a GPS unit)	9
Stopwatch Timer	11
Angle-off-course	12
Remote Units	13
Customising for your vessel	16
Rate-of-turn	16
Weather	17
Counter Rudder	18
Trim	19
Rudder limit	20
Rudder (rudder ratio)	21
Commercial Watch Timer	22
Compass Calibration	23
Alarms	
StopWatch Timer	24
Watch Alarm	24
Angle Off Course	24
No GPS Data	24
Autopilot Installation	25
Warranty	37
Drawings	38

Overview of Operation

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

Note: Power to the **Bosun** is supplied via the **Weather** control. Turn the knob control in a clockwise direction to apply power to the Bosun; this will initially put the Bosun 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 **Bosun** for your vessel. They may also be used to adjust steering for varying sea conditions.

* **Commercial Watch Timer**

For vessels under survey requirements, the timer can be "locked" on to provide a warning alarm at any fixed interval and an output for a loud external alarm if alarm not reset within 1 minute of beginning to sound.

Standby Mode

Turn **Weather** control knob clockwise to switch **Bosun** 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

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 auto pilot 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.

Preset Course

Enter a course from the keypad, and press the PRESET button. That course is now stored away for future use (see above). To see what the preset course is, press the PRESET button. The stored bearing will be displayed on the screen for 2 seconds.

By pressing the PRESET key, then the GOTO key will change the course-to-steer to the preset course.

Rate of Turn Control

The rate-of-turn control on the front panel sets the maximum number of degrees per second that the vessel will turn through. This rate-of-turn control applies in AUTO and GPS modes ONLY. See the separate section on **Rate-of-Turn** for more information.

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 AND the setting of the rudder control on the front panel.

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

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 to "1" (ie: disabled) while using power-steer.

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. Rate of turn can be altered by setting **Rate of Turn** knob to required position (refer page 14 Rate of Turn).

If no GPS data is being received by the **Bosun**, 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 **Bosun** 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 "NMEA 0183" data on a pair of wires which are connected to the **GPS In** terminal connections inside the **Bosun**. 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. 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 NIM (Nautical Miles) is set so that the GPS can detect when the vessel has reached a waypoint, then the **Bosun** 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 **Bosun**.
- * 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 **Bosun** 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 **Bosun** compass is correctly aligned and installed.

Stopwatch Timer Mode

The **Bosun** has two independent timers. One operates in **standby** mode, and is disabled when the autopilot is set to any other mode. The second timer operates in all modes EXCEPT **standby**, and is disabled when the autopilot is set to **standby**.

To set the timer, enter a value between 1 and 60 at the keypad, and press the timer key. That value will be stored into the timer, and it will begin counting down to zero. The timer light will be on, to indicate that the timer is running. When the timer expires, an internal alarm will sound and the timer light will flash. If the timer is not reset within one minute, the external alarm (if fitted) will sound.

If the timer button is pressed with no number entered on the keypad, and no timer alarm sounding, the timer delay will be displayed, and the timer will commence counting down.

While the alarm is sounding, pressing the timer button will cause the timer alarm to cancel, and the timer to begin counting down again. The time delay set will NOT be displayed.

Selecting a stopwatch time of zero will disable this feature.

If the **commercial watch alarm** feature is enabled, the timer alarm delay in all modes **except** standby is fixed. Attempting to change the timer value will display the error code "999".

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, or disabled completely.

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

With 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 **Bosun** is turned on) is 30 degrees.

Entering a value of zero degrees will disable the off-course alarm.

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.

Remote Unit Operation

There are four kinds of remote unit:

- 1 A Panel Remote which mounts into the vessel dash - has a control knob for setting rudder angle or compass course.
- 2 A Hand Remote is a hand-held unit with an 8M flexible cable and a control knob for setting rudder angle or compass course.
- 3 A Steering Lever which mounts into or on the vessel dash and has a lever arm for rudder angle or course control.
- 4 An Electric Helm which has a ships wheel as its control.

The Panel and Hand Remotes come with a 3-way switch for selecting **Power, Off** or **Trim** 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. Connections to the AP9 differ in each case - refer to the section in this manual on "Installation of Remote Units".

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 Trim 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 **Trim**.

Course Adjustment

When trim 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 trim mode was engaged with remote knob at centre, the course can be changed to **port** or **stbd** by 90 degrees.

To disengage Trim Mode

Either move the remote switch to **Off** (which also disengages the autopilot), or press the desired mode key on the Bosun 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 Bosun main panel.

To disengage Power Steer Mode

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

Electric Helm or Steering Lever

The Bosun 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 AP9 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 Bosun unit. In both of these options, the course-change knob on the Bosun has no effect in Power mode.

To engage Electric Steering - if fitted in addition to manual steering

Note: The following programming procedures must be done quickly as the display will revert to reading compass heading after 2 or 3 seconds. If the display does revert to heading during procedure or shows a reading of 999, simply begin again by entering 955.

Switch Bosun AP9 on to **STANDBY** mode. Using the keypad enter **955**. Hold **GOTO** button depressed and press **AUTO** button then release **both** buttons together. This action removes control from the large knob on the Bosun and allows the electric wheel (or lever) to be used in the **POWER** mode.

The AP9 will hold this programme until such time as it is removed by following the same procedure as above.

To engage **Electric Steering** - if fitted in place of manual steering

Note: This programme allows the Bosun AP9 to enter the **POWER** mode immediately it is switched on. This provides the vessel operator with electric steering via the electric helm or steering lever.

Switch Bosun AP9 on to **STANDBY** mode. Using the keypad enter **956**. Hold **GOTO** button depressed and press **AUTO** and release **both** buttons together. This action will immediately set the Bosun AP9 into **POWER** mode and make steering available via the Electric Helm.

The AP9 will hold this programme until such time as it is removed by following the same procedure as above

Rate-of-Turn Control

This knob sets the maximum rate-of-turn for the vessel, to prevent very sharp turns 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 ratio controls.

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

Weather

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

This setting is used for adjusting the autopilot's 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 Bosun autopilot.

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 **Bosun** autopilot has this feature built-in. A **counter-rudder** setting of "1" gives no counter-rudder steering, suitable for light and maneuverable 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".

Trim

When the Bosun is first switched on and in **Standby** mode, the **Trim** knob should initially be set in **mid** position which corresponds to a 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 **Bosun** 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 the autopilot 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.

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.

An internal potentiometer is set to ensure that the **Bosun** will not drive the rudder past the set limits.

An external control on the front panel of the **Bosun** 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 external **rudder limit** control is set at maximum.

See the Adjustments chapter of the Installation section of this manual.

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, turns will be rapid and the vessel will oversteer.

Commercial Watch Alarm

The stopwatch alarm described earlier in this manual can be "locked on" so that while the autopilot is in control of the vessel, the timer button **must** be pressed frequently to prevent first a quiet and then a loud alarm from sounding.

This may be a requirement for a commercial vessel under survey which is fitted with an autopilot, depending on local regulations. In most cases, when this feature is used, an external alarm will also be fitted. See the autopilot installation section of this manual for details.

IMPORTANT!! READ THIS!!

The **Bosun** autopilot must be returned to the manufacturer to cancel or change the commercial watch alarm once it is enabled.

When sent from the factory, the Bosun commercial watch alarm is not enabled. The user can use the inbuilt timer as an anchor watch alarm, a timer for trawling runs, or any other purpose. The timer can be enabled or disabled by the user at any time, as described elsewhere in this manual.

To turn on the **commercial watch alarm**:

- * Select **standby mode**.
- * Enter "905", press and hold "goto" then press "auto" on the keypad then release both buttons together. All indicator lights except timer and off-course will turn on, and the display will show zeros.
- * Enter "333", press & hold "goto" then press "auto" on the keypad and release both buttons together. The display will return to all zeros.
- * Now enter the desired number of minutes for the watch timer duration (eg 5 for Queenstand). Press the **goto** button to confirm. The autopilot will now return to its usual display.

Press the **standby** key at any time before the last **goto** keypress to change your mind about enabling the commercial watch timer.

To verify that all has been set up correctly, change to **auto** mode. The timer light will come on automatically. Pressing the timer button will display the number of minutes set for the commercial alarm. Attempting to change this time will display the error code "999".

Now, as soon as the Bosun changes to auto mode, gps mode, remote trim mode, etc., the timer will be set to the commercial watch alarm time. If the timer expires, an alarm will sound and the timer light will blink. Pressing the timer button at any time will restart the timer. If the timer button is not pressed within one minute of the alarm beginning,

the external alarm will sound (if connected). Changing to power steer or standby mode will turn off the timer.

Compass Calibration

The compass supplied with your **Bosun** autopilot has been calibrated after manufacture, and 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 following procedure will adjust compass characteristics to compensate. The calibration should only be done if the compass is **known** to be inaccurate.

If the **Bosun** compass displays a constant offset (eg the autopilot compass reads 3 degrees high **at all bearings**), rotate the compass case to align bearings with the ships compass .. **do not** recalibrate the compass as described here.

Note that this recalibration procedure should only be done in calm waters with adequate sea room.

1. Enter "901" at the keypad, then hold down **Goto** and press **Auto** and release both buttons together.
2. Turn the vessel slowly through two complete circles, so that each compass bearing is covered. Each complete turn should take at least 60 seconds.
3. Enter "902" at the keypad, then hold down **Goto** and press **Auto** then release both buttons together.
4. Rotate the compass case so that North is correctly aligned.

The compass calibration does not take effect unless step 3 is completed, so you may abandon the recalibration by simply **NOT** performing step 3.

You may return to the factory calibration level at any time by entering "903" , hold down **Goto** and press **Auto** and release both buttons together.

Alarms

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".

Stopwatch Timer Alarm

This alarm indicates that the time set by the user has expired. Alarm pattern is 1 second on, 1 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 AP9 Bosun but is available as an option.

Commercial Watch Alarm

This alarm indicates that the time "locked in" by the commercial watch alarm feature has expired (disabled in **Standby mode**). Alarm pattern is 1 second on, 1 second off until reset.

The external alarm output is turned on 1 minute after the alarm commences. Note that a suitable buzzer must be attached to this output. This is not supplied.

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).

No GPS Data Alarm

The alarm sounds 0.5 seconds on, 0.5 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.

Autopilot Installation

Contents

Installation of Bosun	
Main Unit	26
Compass	27
Rudder Feedback	29
Remote Units	30
Hydraulic Drive Installation	
Position	31
Precautions	31
Wiring	31
GPS Connection	32
External Alarm	33
Commissioning Checks	
Connection Tests	34
Dockside Tests	34
Adjustment	
Internal Rudder Limits	35
Fuse Protection	36

Installation of Main Unit

Position

The **Bosun** 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 feedback 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 equipments. Maintain conventional colour coding and, if necessary, mark the cables for ease of identification.

Connection - As per diagram labelled **Bosun Block Diagram**.

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.

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 is 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 **Bosun** 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 with care 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 is dependant 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".

Wiring

The 5-wires & shield of the compass cable must be connected to the correct terminal strip inside the Bosun labelled TERM3. The colour code is marked next to the terminal strip. Ensure good contact is made between cable conductors and terminal strip connectors. There is no restriction on cable length if extension is required. See also the diagram labelled "Wiring Detail".

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 **Bosun** 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 DIP1 on the PCB must be switched to correct position. (Note: Rear cover must be removed).

For magnetic sensor unit:

switch 1 and 4 to ON

switch 2 and 3 to OFF

For compass top sensor:

switch 2 and 3 to ON

switch 1 and 4 to OFF

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 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 **Bosun** terminal strip should be reversed.

Electrical connection

Terminals 5, 7 and 8 of the large 12-way terminal strip (labelled TERM1) should be used for the heavy duty rudder feedback unit (RFUH) supplied. In unusual circumstances a standard rudder feedback (RFUS) can be used if connected to terminals 6,7 & 8.

Terminal 5 :	Signal	green wire
Terminal 7 :	+5 volt power	red or brown wire
Terminal 8 :	0 volt ground	blue wire

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.

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 1 or Remote 2** connections of terminal strip 2 (Term 2) in the **Bosun**, as shown in the drawing labelled "Bosun Wiring Detail".

To install a remote unit as Remote No.1 use terminals 3 to 6 of the 12-way internal connector labelled TERM2.

Term 3:	No 1 Trim Signal (0 - 5v)	- green wire
Term 4:	No 1 Logic (switched)	- yellow wire
Term 5:	+5 Volts	- red wire
Term 6:	0 Volts	- blue wire

To install a remote unit as Remote No.2 use terminals 7 to 10 of the terminal strip.

Term 7:	No 2 Trim Signal (0 - 5v)	- green wire
Term 8:	No 2 Logic (switched)	- yellow wire
Term 9:	+5 Volts	- red wire
Term 10:	0 Volts	- blue wire

Electric Wheel and Steering Lever (without switch)

The cable leading from the unit should be connected to the Main Terminal Strip (Term 1) in the Bosun AP9

Term 10:	+ 5 V Lever (or wheel)	- red wire
Term 11:	Signal Lever (or wheel)	- green wire
Term 12:	0 V Lever (or wheel)	- blue wire

Note: Yellow wire is not used in the Electric Wheel or Steering Lever cable.

Refer to the section "Remote Unit Operation" for operational details of the remote units.

Hydraulic Drive Installation

Follow any instructions of the Hydraulic Steering Supplier.

THE AUTOPILOT SUPPLIER'S ADVICE SHOULD BE SOUGHT IF USING UNBALANCED RAMS WITH A REVERSING PUMP.

The bosun autopilot is designed primarily for spool valve operation. TMO can supply the following pump sets:

1. A constant running pump set (including spool valves) for 24V DC operation with flow rate up to 4000cc per minute.
2. A constant running pump set (including spool valves) for 240V AC or 415V AC 3-phase operation with flow rate up to 5000cc per minute.

Position

All pump units should be mounted in accordance with pump manufacturer's specifications, **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.

A balance line where required, must be used to connect the drive pump back to the helm reservoir.

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

The pump should be connected to the supply via an isolating switch and suitable protection circuit (fuse or circuit breaker).
Cables must be sufficiently large to carry the required motor current with minimum voltage drop.

GPS Connection

Data In

For GPS navigation, connect the GPS unit **data output** and **data return** wires to terminals 1 and 2 of the 12-way connector strip inside the **Bosun** labelled TERM2. These connections are marked "Gps In" and "Ret". See also the diagram labelled "Wiring Details".

Data In Connection - NOTE: Examples only

- * For any GPS unit which has a BNC type output plug (a bayonet plug, taking a "coax" cable with a core and shield), eg: for the JRC brand JLU-121, JLR-6000 or NWU-53, connect the core to **GPS In** and the shield to **GPS Ret**.
- * For a JLR-4110, connect **TX+** to **GPS In** and **TX-** to **GPS Ret**.
- * For a JLR-4500, connect **Data Out +** to **GPS In** and **Common** to **GPS Ret**.
- * For a Raychart 600/610, connect **Data Out +** to **GPS In** and **Data Common** to **GPS Ret**.
- * For a Trimble NavTrackXL GPS unit, connect **TX-** to **GPS In** and **SigRef** to **GPS Ret**.

Programming the GPS unit

This is the part of the GPS-to-Autopilot connection that causes the majority of problems. If you have difficulty with the **GPS** connection, please read the relevant sections of your **GPS** manual carefully. The **Bosun** autopilot looks for **NMEA 0183** format data containing **APA** or **APB** or both **XTE** and **BOD** information. For more information on this, see the Operations section of this manual and consult your **GPS unit** manual.

External Alarm Installation

An external buzzer may be connected to the internal 12-way terminal strip (TERM2), terminals 11 and 12 (**extalm** and **rel**).

The **Ext Alm** output will be zero volts when the alarm is not sounding, and approximately +10 volts when active. TMQ 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 AP9 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 watch timer alarm has been sounding for longer than one minute.

Commissioning Checks

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 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 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 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 SOLENOID 1 AND SOLENOID 2 WIRES AT THE SCREW TERMINALS ON THE BOSUN AUTOPILOT AND 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 STAGE 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.

Adjustments

Internal Rudder Limits

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 external **rudder limit** control on the front panel 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.

There are two lights inside the back case indicating the state of the rudder limit circuits ...

- * The port (red) limit light will come on when the rudder position is further to port than the limit set by the **rudder limit potentiometers (both internal and external)**. This will cause any port drive command to be ignored, and also turn off the port drive light on the front panel.
- * The starboard (green) limit light functions in the same way for rudder angles to starboard of centre.

NOTE:

The internal rudder limits are factory set to allow 30 degrees of rudder movement with the front panel control fully clockwise. If the rudder feedback unit has been installed correctly, it should not be necessary to adjust the limit setting.

Turning the internal rudder limit potentiometer anti-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.

Fuse Protection

The Bosun has a **5 Amp fuse** mounted internally. This device will shut off power to the Bosun autopilot if a short-circuit occurs inside the autopilot, or between a power output (eg solenoid power output of terminal strip TERM1) and ground.

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

Warranty

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

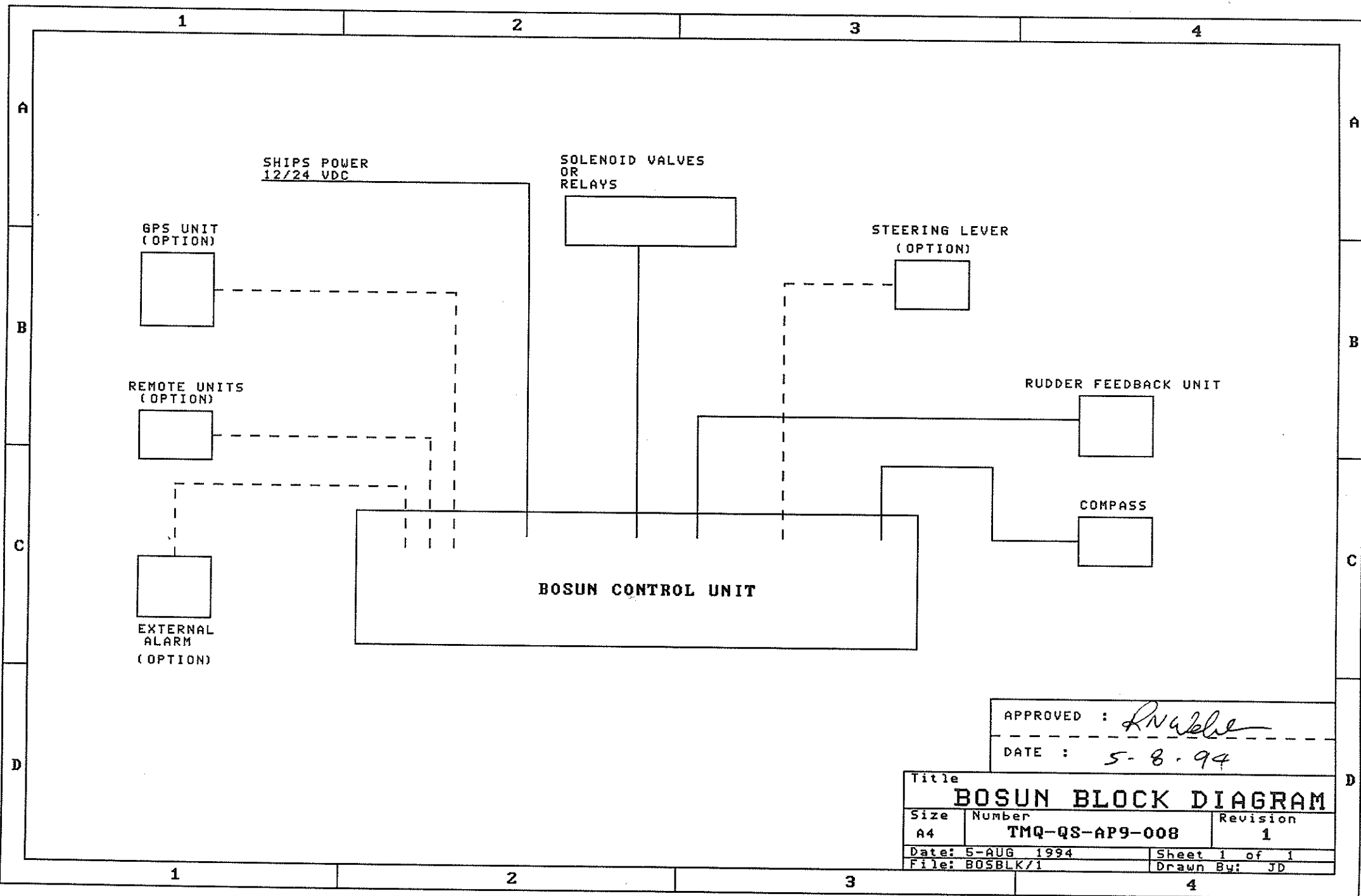
This warranty is extended to and is solely for the benefit of the original consumer purchaser.

All 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.



APPROVED : *R. N. Able*
 DATE : 5-8-94

Title			BOSUN BLOCK DIAGRAM		
Size	Number	Revision			
A4	TMQ-QS-AP9-008	1			
Date:	5-AUG 1994	Sheet	1 of 1		
File:	BOSBLK/1	Drawn By:	JD		

AUTOPILOT — COMPASS INSTALLATION

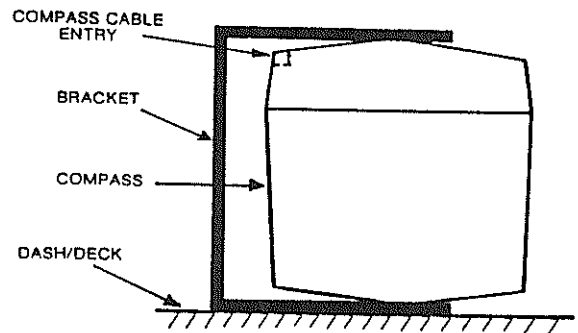


Figure A — Bottom Mount

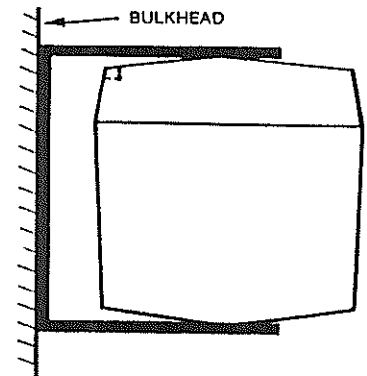


Figure B — Side Mount

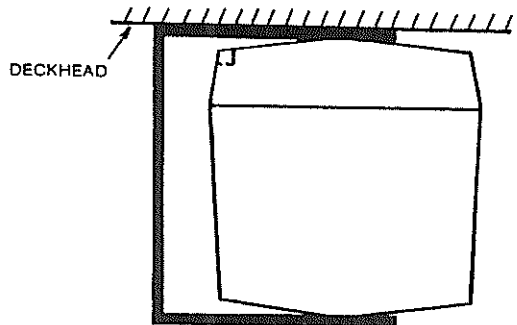


Figure C — Top Mount

NOTE:

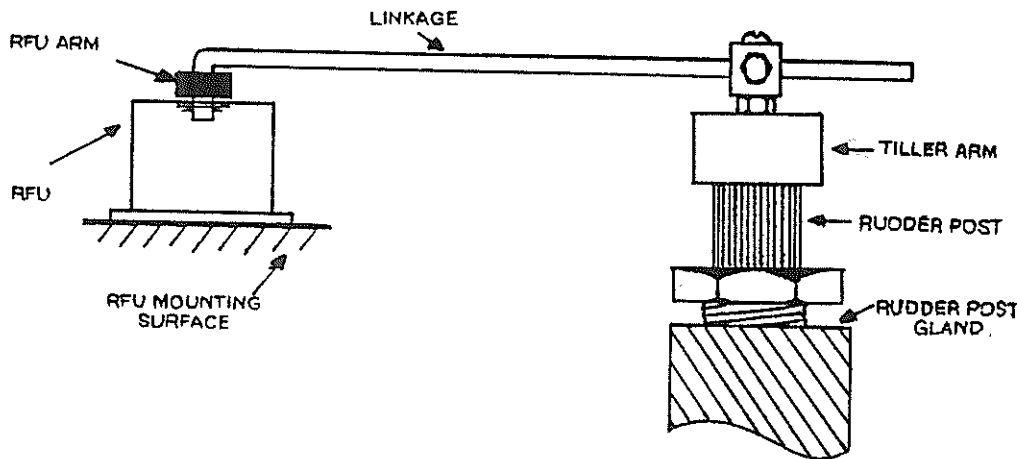
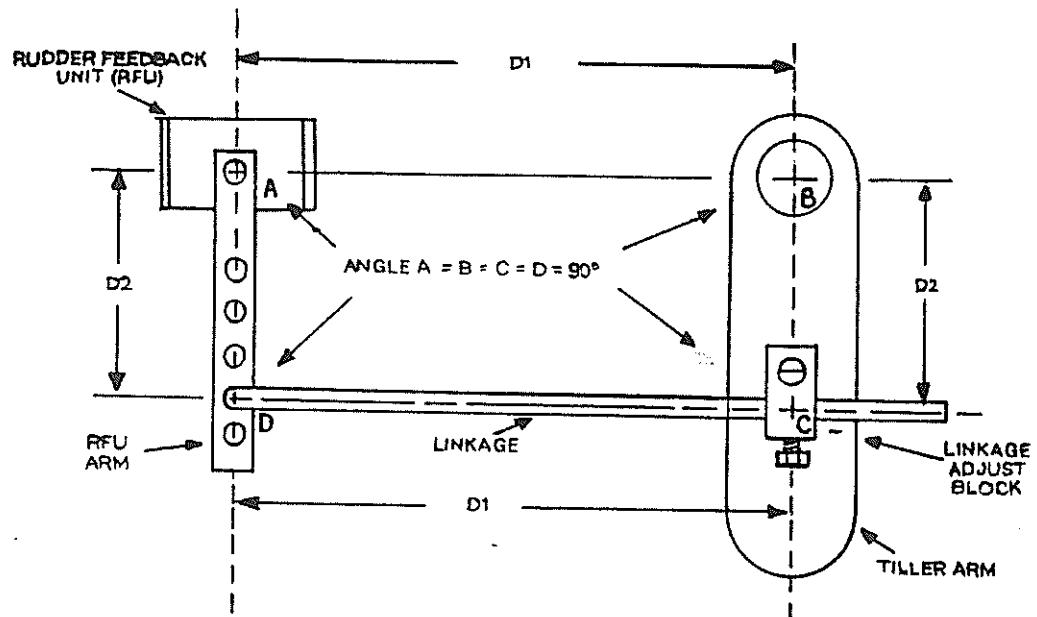
MAGNETIC INTERFERENCE WILL EFFECT THE EFFICIENCY OF THE MAGNETIC SENSOR UNIT. IT IS ESSENTIAL TO POSITION THE MSU FOR MINIMUM INTERFERENCE.

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>		4-8-94
Title INSTALLATION - MAGNETIC SENSOR UNIT		
Size A4	Number	Revision 1
Date: 1-8-93		Sheet 1 of 1
File: A4BLANK/1		Drawn By: <i>gc</i>

RUDDER FEEDBACK UNIT (H-D) — INSTALLATION



NOTE:

1. THIS RUDDER FEEDBACK UNIT HAS BEEN FACTORY ALIGNED. DO NOT LOOSEN RFU ARM SCREWS . IT WILL NOT BE NECESSARY IF THE RFU IS MOUNTED IN ACCORDANCE WITH THE DIAGRAM.
2. LINKAGE ADJUST BLOCK IS MOUNTED ON TILLER ARM. BLOCK SHOULD BE ALLOWED TO SWIVEL WITH THE RUDDER'S MOVEMENT.
3. LENGTH OF LINKAGE ARM IS ADJUSTED BY LOOSENING THE HEX NUT ON THE LINKAGE BLOCK.
4. THE RFU CAN BE MOUNTED ON A BRACKET IF NO SUITABLE MOUNTING SURFACE IS AVAILABLE.

INCORRECT MOUNTING OR MAL-ADJUSTMENT MAY CAUSE DAMAGE TO AUTOPILOT SYSTEM

APPROVED BY		DATE
<i>[Signature]</i>		4-8-94
Title HEAVY DUTY RUDDER FEEDBACK - INSTALL		
Size A4	Number	Revision 1
Date:	Sheet 1 of 1	Drawn By: HL
File: A4BLANK/1		

1

2

3

4

A

A

B

B

C

C

D

D

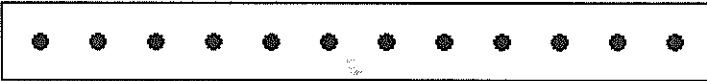
TERM 2

- GPS DATA IN
- GPS DATA RETURN
- REMOTE No.1 TRIM (GREEN)
- REMOTE No.1 LOGIC (YELLOW)
- +5V (RED)
- 0V (BLUE)
- REMOTE No.2 TRIM
- REMOTE No.2 LOGIC
- +5V
- 0V
- EXTERNAL ALARM
- ALARM RETURN

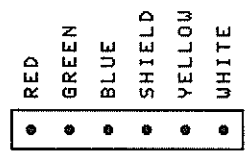
TERM 1

- POWER + 12/24 VDC
- POWER -
- OUTPUT DRIVE 1
- OUTPUT DRIVE 2
- HEAVY DUTY RUDDER FEEDBACK SIGNAL
- STANDARD RUDDER FEEDBACK SIGNAL
- +5V TO RUDDER F/BACK
- 0V TO RUDDER F/BACK
- FUSED POWER OUT FOR SOLENOIDS OR RELAYS
- +5V FOR STEERING LEVER
- MAIN STEERING LEVER SIGNAL
- 0V FOR STEERING LEVER

PROVIDES GROUND FOR
SOLENOID VALVES OR RELAYS



MAIN TERMINAL STRIP



COMPASS

TERM 3

APPROVED : *[Signature]*
 DATE : 25.10.96

Title		
BOSUN WIRING DETAIL		
Size	Number	Revision
A4	TMQ-QS-AP9-005	3
Date: 24-OCT 1996	Sheet 1 of 1	
File: BOSWIR/1	Drawn By: JD	

1

2

3

4

1 2 3 4

A

A

B

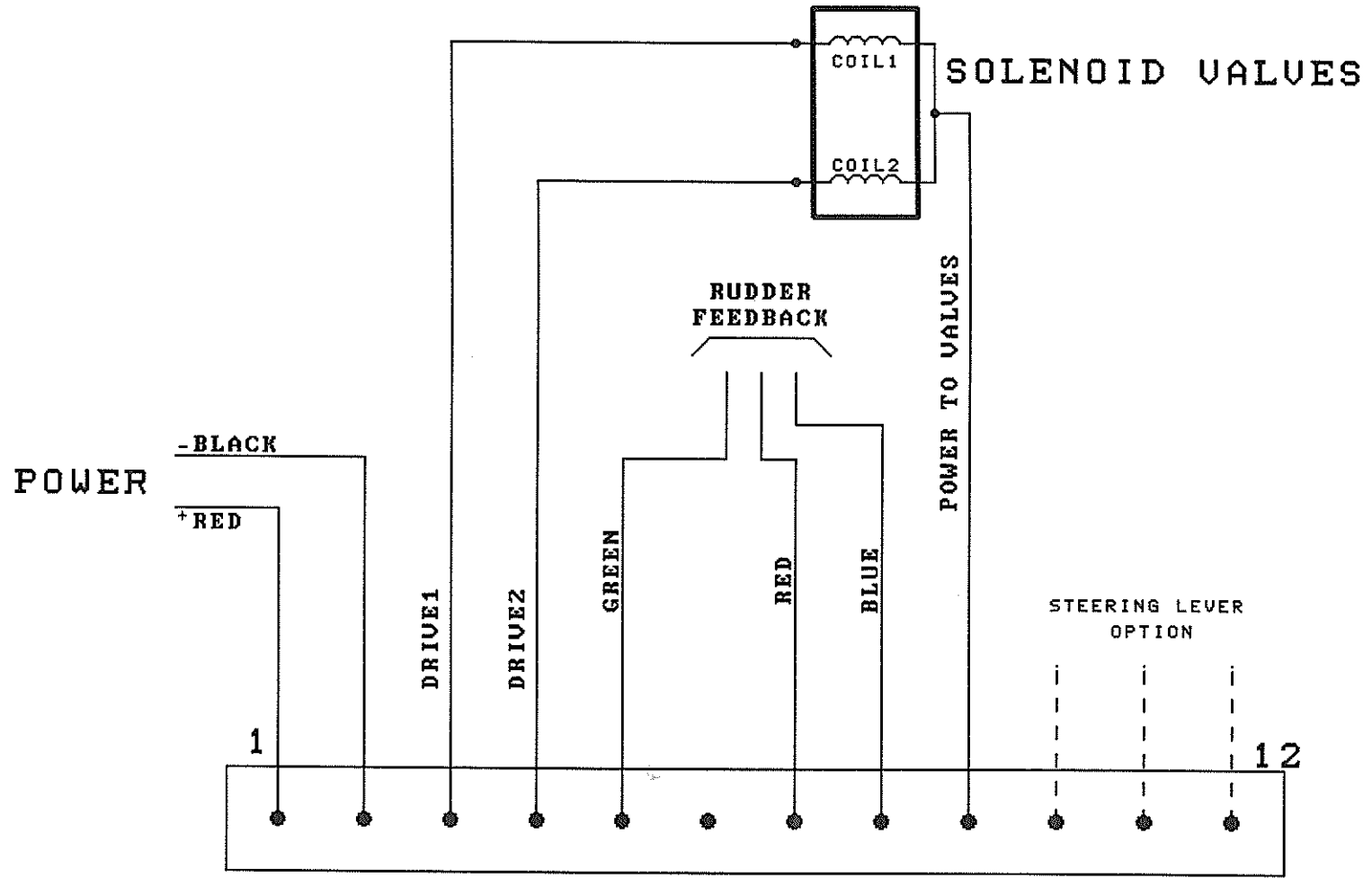
B

C

C

D

D

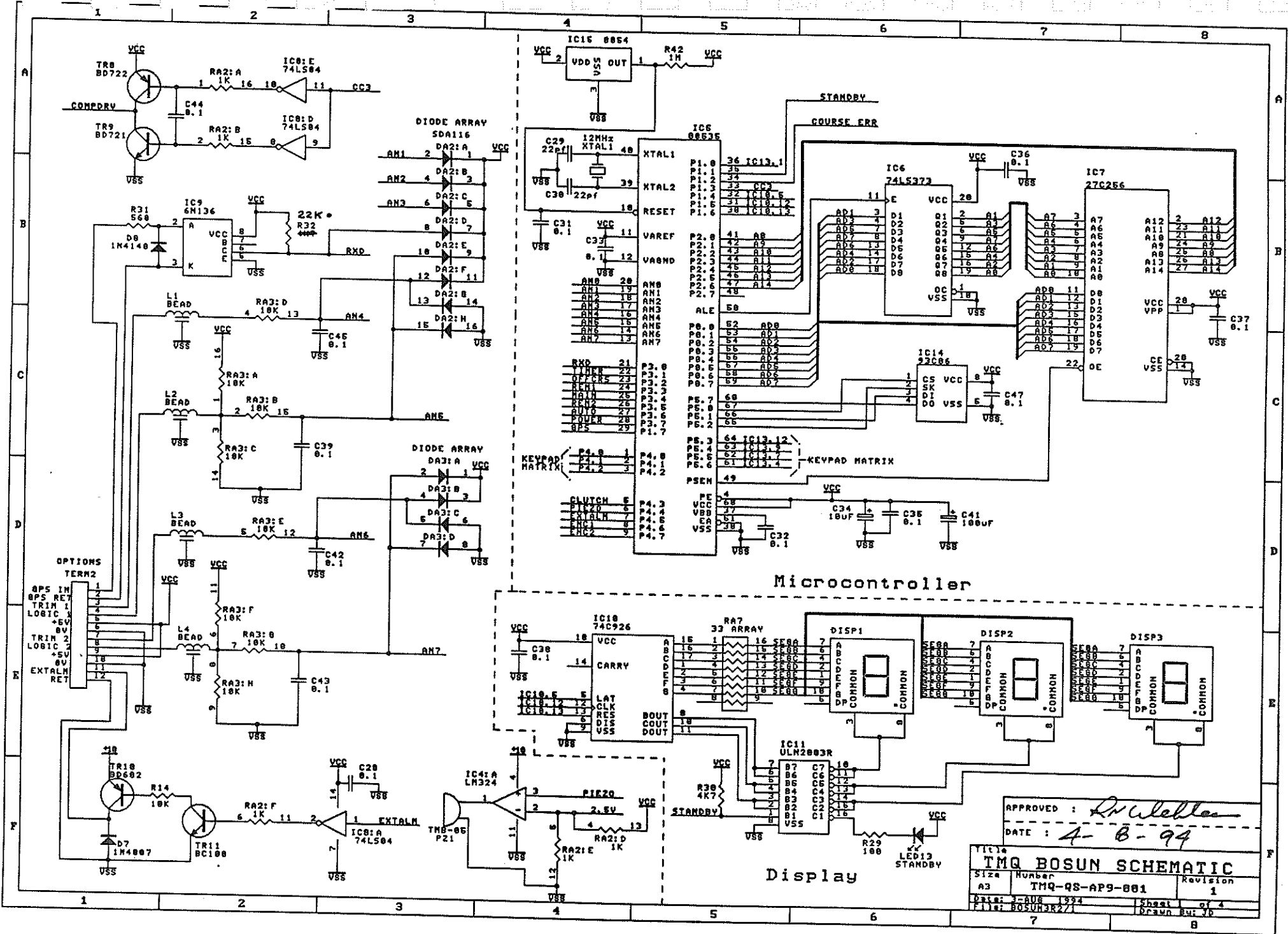


MAIN TERMINAL STRIP

APPROVED : *R. Valeri*
 DATE : 5-8-94

Title		
BOSUN HOOKUP		
Size	Number	Revision
A4	TMQ-QS-AP9-007	1
Date:	5-AUG 1994	Sheet 1 of 1
File:	BOSH00K/1	Drawn By: JD

1 2 3 4

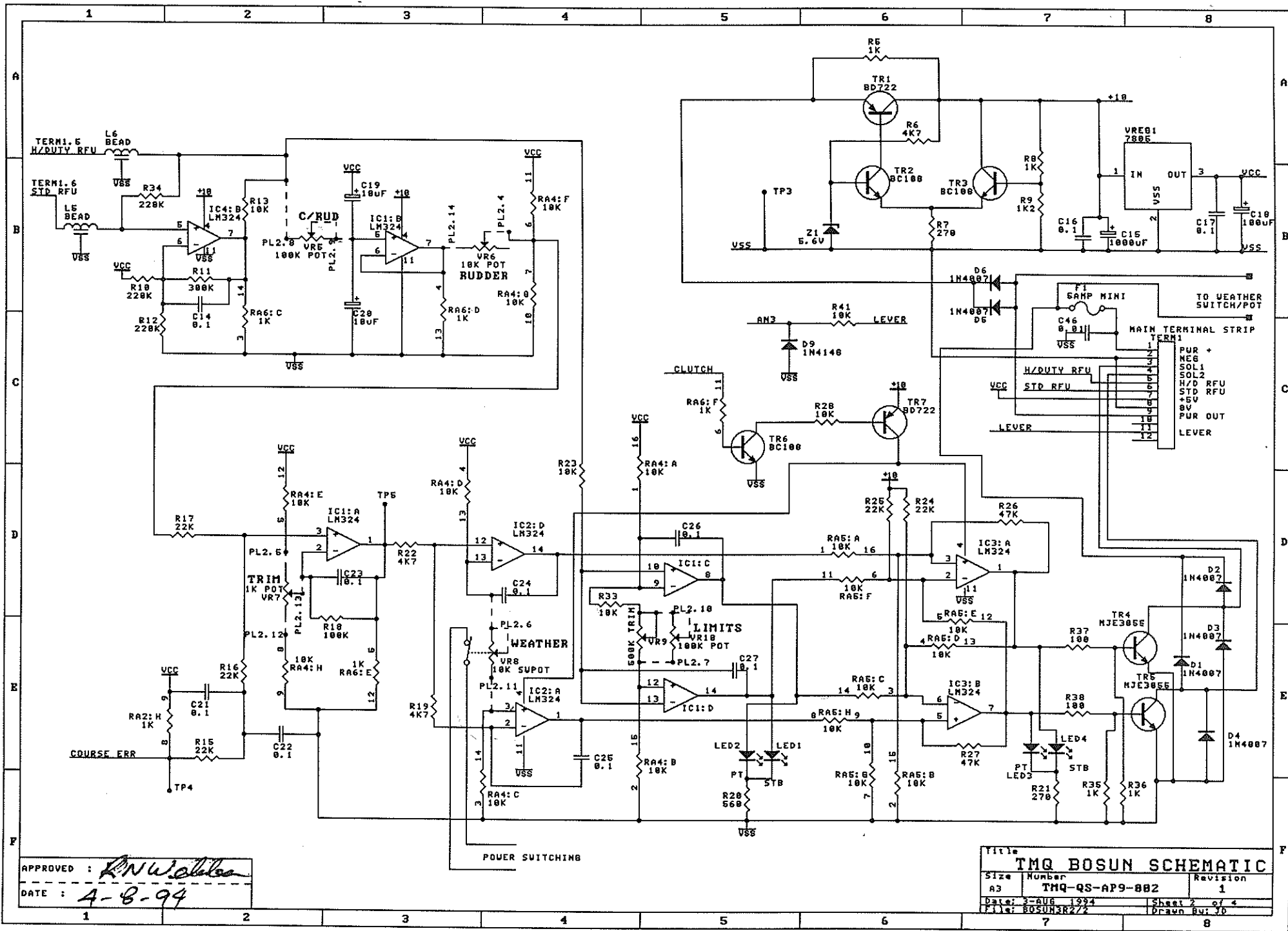


APPROVED : *[Signature]*
 DATE : 4-8-94

Title		
TMQ BOSUN SCHEMATIC		
Size	Number	Revision
A3	TMQ-QS-AP9-001	1
Date:	3-AUG 1994	Sheet of 4
File:	BOSUNJR27	Drawn By: v

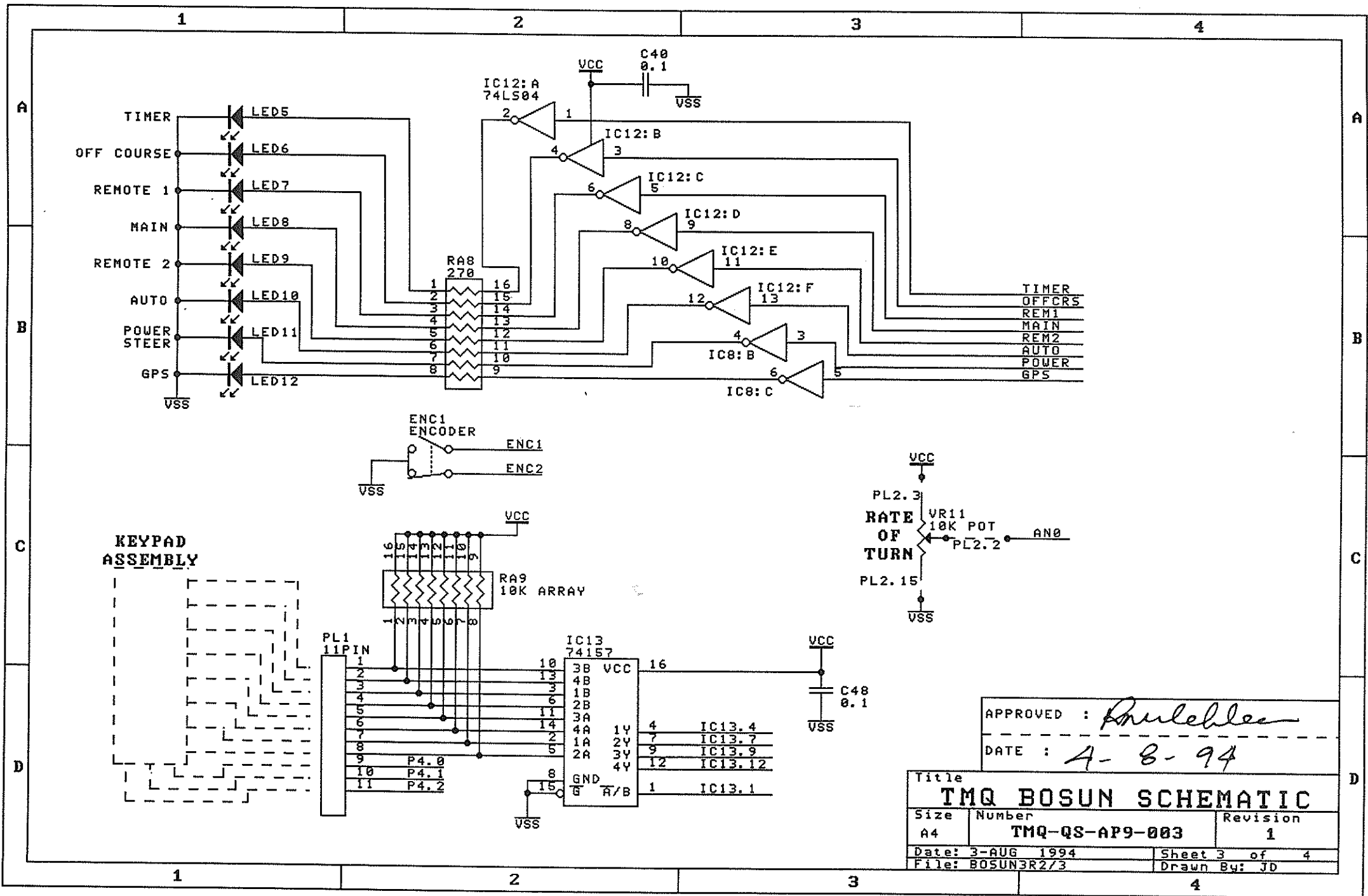
Microcontroller

Display



APPROVED : *[Signature]*
 DATE : 4-8-99

Title			
TMQ BOSUN SCHEMATIC			
Size	Number	Revision	
A3	TMQ-QS-AP9-882	1	
Date:	3-AUG 1994	Sheet	2 of 4
File:	BOSUN3R22	Drawn By:	JD

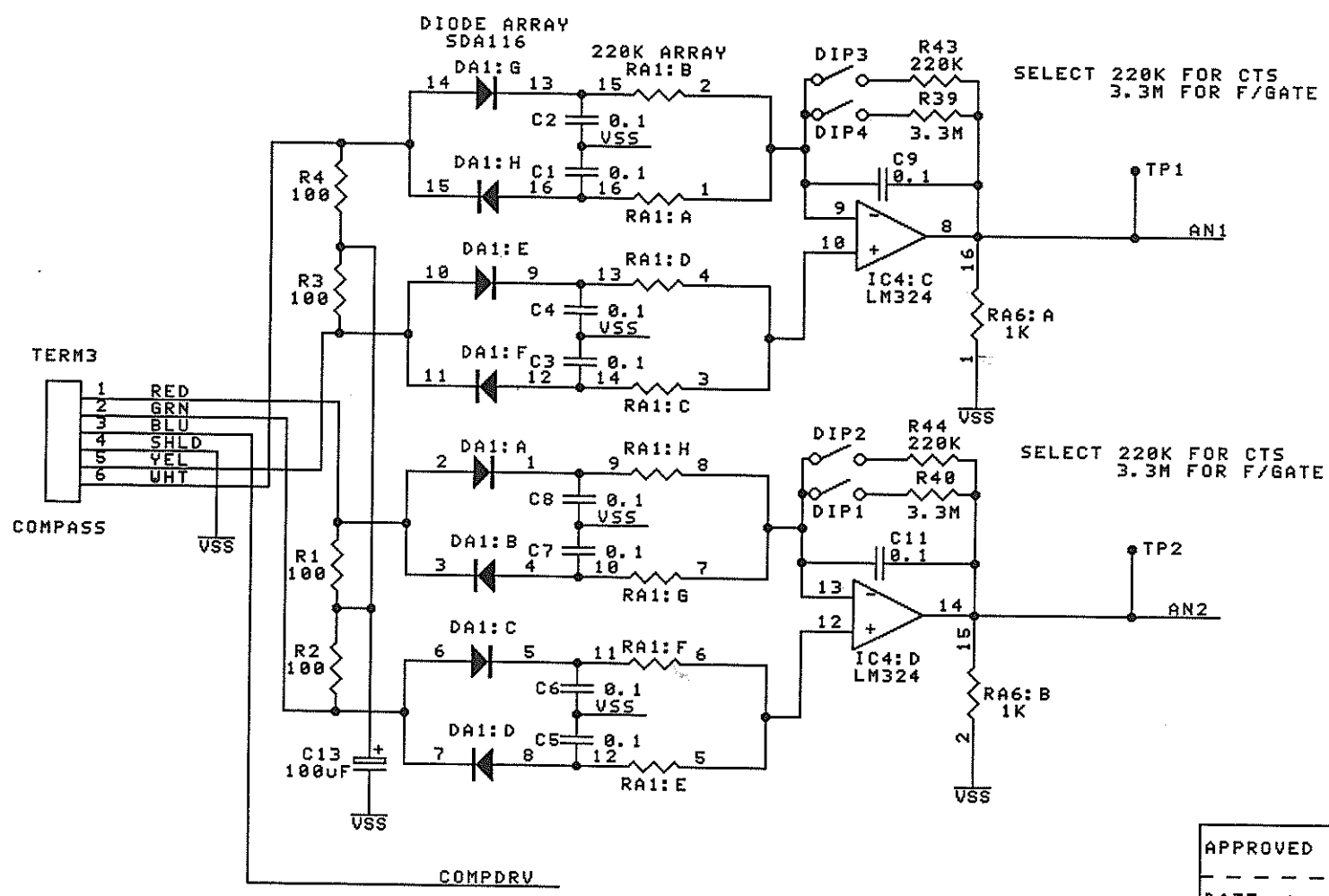


APPROVED : *Amulchlee*
 DATE : *A-8-94*

Title		
TMQ BOSUN SCHEMATIC		
Size	Number	Revision
A4	TMQ-QS-AP9-003	1
Date:	3-AUG 1994	Sheet 3 of 4
File:	BOSUN3R2/3	Drawn By: JD

1 2 3 4

A
B
C
D



APPROVED : *RNweller*
DATE : *4. 8 94*

Title TMQ BOSUN SCHEMATIC		
Size A4	Number TMQ-QS-AP9-004	Revision 1
Date: 3-AUG 1994	Sheet 4 of 4	
File: BOSUN3R2/4	Drawn By: JD	

1 2 3 4