INSTRUCTION MANUAL

SIMRAD RGC50

Gyro compass

20220356 / D

English

Instruction Manual
RGC50 Gyro Compass

This manual is intended as a reference guide for operating and correctly installing the RGC50 Gyro compass.

Please take time to read this manual to get a thorough understanding of the operation and system components and their relationship to a complete RGC50 system.

Document revisions

Rev	Date	Written by	Checked by	Approved by
-	11.90	-	-	-
A	04.06.02			
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C	05.10.06	NG		
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Document history

Rev. –	First edition
Rev. A	New layout. Modified text.
Rev. B	Schematic for Static Inverter updated (page 92).
Rev. C	New version of Switch Panel (page 84 and 93). Minor corrections in text.
Rev. D	New Inverter PCB. New potentiometer in dimmer circuit.

To assist us in making improvements to the product and to this manual, we would welcome comments and constructive criticism. Please send all such - in writing to:

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Contents

1 GENERAL INFORMATION

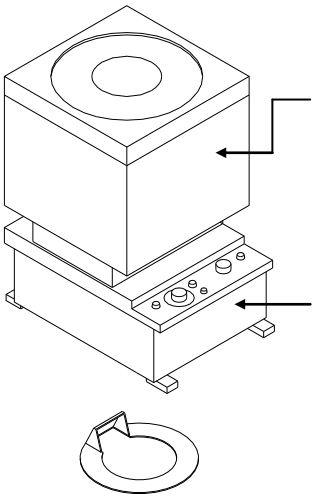
1.1 How to use this manual

This manual is intended as a reference guide for operating and correctly installing the RGC50 gyrocompass. The RGC50 is a compact gyrocompass, designed to enhance the navigation capabilities on small commercial, fishing vessels, and large pleasure yachts. A gyrocompass eliminates the inconvenience and limitations of magnetic compasses, and provides a variety of electrical outputs to supply accurate and consistent heading information to other navigation equipment. The capabilities and precision of the RGC50 will provide exceptional heading information to the navigation equipment installed on your vessel.

Even if you are a previous owner of a gyrocompass, it is highly recommended that you review the instruction manual thoroughly before using the RGC50.

1.2 Equipment supplied

The basic RGC50 gyrocompass consists of:



– RGC50 Master compass unit

– Inverter unit, including power converter and control panel

– Viewing screen (plastic piece that fits on top of master compass)

Optional Equipment

Several Simrad repeaters are available as options to the basic RGC50 gyrocompass:

2 OPERATION

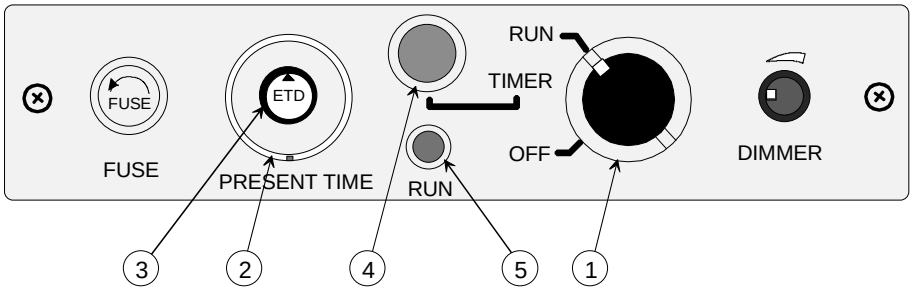


Figure 2-1 Gyrocompass control panel

2.1 Operating method with timer

The RGC50 has the capability of being turned on automatically at a specified time by a TIMER function within a 24-hour time frame period.

1. Set the master switch (1) to the TIMER position.
2. Set the “PRESENT TIME” setting scale plate (2) to the present time.
3. Set the “ETD” setting knob (3) to the scheduled ETD (estimated time of departure) on the “PRESENT TIME” setting scale plate (2).
   – The red Timer running lamp (4) lights.

By the above operations, the gyrocompass will be operative at the scheduled ETD. About four hours before scheduled ETD, the gyrocompass will be started. The green running lamp (5) lights.

4. When ETD comes, set master switch (1) to RUN position.
   – The red Timer running lamp (4) goes out.

Note! *Within about four hours after the scheduled ETD, be sure to perform operation 4 above. If this operation is not performed, the gyrocompass operation will stop automatically. Therefore, when the departure schedule is changed or cancelled, it is not necessary to operate master switch (1).*

2.2 Operating method without timer

1. Set master switch (1) to RUN position.
   - The green running lamp (5) lights.

By the above operation, the gyrocompass will be operative after about four hours.

2.3 Turn Off

1. Set master switch (1) to OFF position.
   - The green running lamp (5) goes out.

The RGC50 will take a period of time to come to a complete stop after the switch is set to “OFF”. This is normal, as the high speed rotor takes time to stop the rotation after power is turned off.

2.4 Connecting an NMEA repeater

To connect an NMEA repeater, a signal interface unit should be used to connect the synchro signal to NMEA signal. To operate several repeaters (radar etc.) an NMEA buffer is recommended.

2.5 NMEA repeater syncronization

No syncronization is needed when using MNEA repeater connected to the signal interface unit.

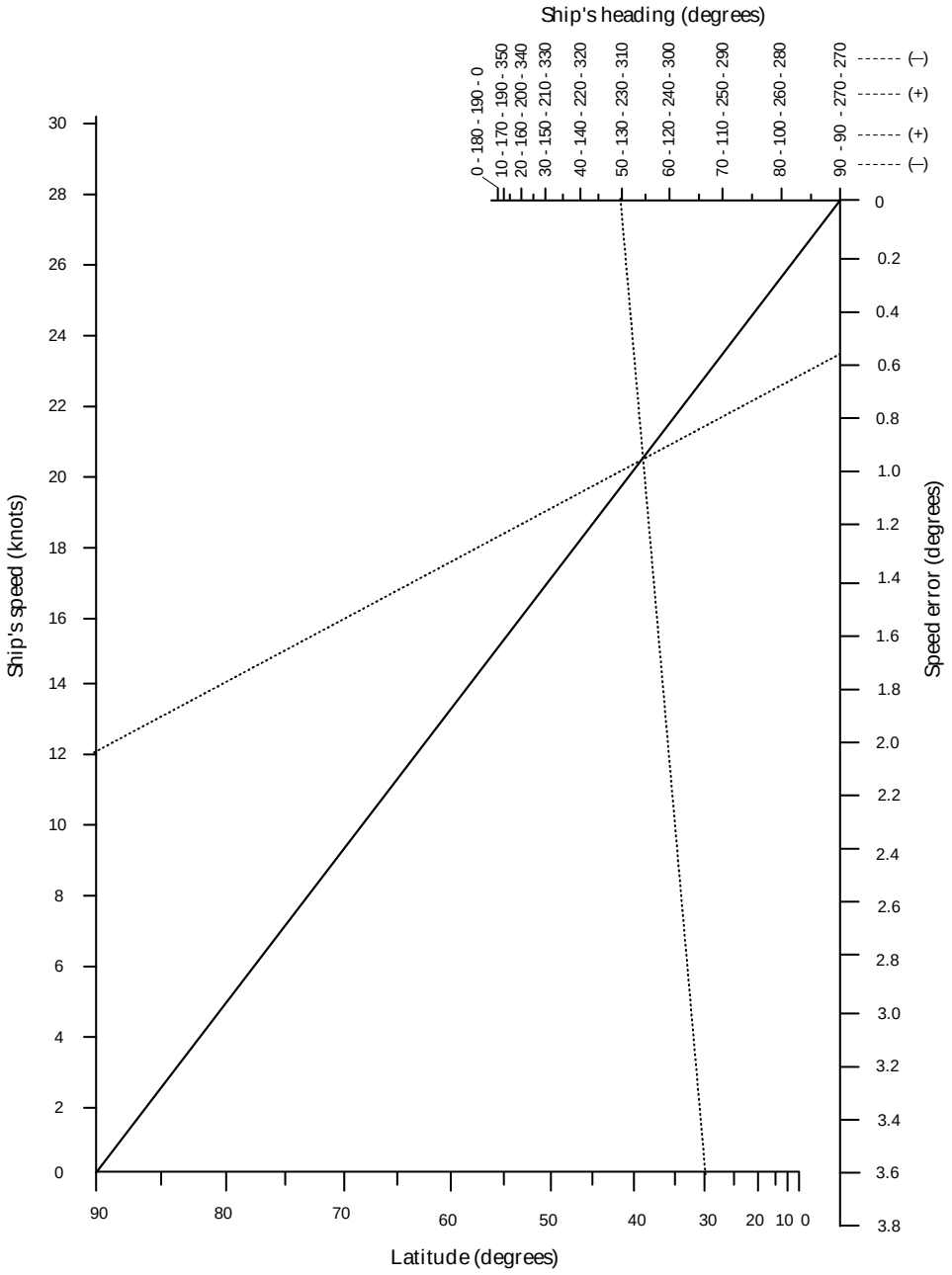
2.6 Speed error correction

The gyrocompass generates a speed error. This is a precession force that is causing a heading change either in westerly or easterly direction depending on the course you are sailing.

To calculate this error, see the figure below.

Speed error (example 0.6°) can be obtained at the point where the speed error graduation line intersects with the line which is extended from the ship’s speed (example 12 knots) across the intersection of the line between the course (example 50°) and latitude (example 30°) with the slanted solid line.

Accordingly, the true bearing is 50°-0.6°=49.4°. (See note)



Note!

When the course is 270°~0°~90°, the true heading is the value of the compass heading from which the speed error is subtracted.
When the course is 90°~180°~270°, the true heading is the value of the compass heading to which the speed error is added.

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3 TECHNICAL SPECIFICATIONS

Master compass
Height: ..... 253 mm
Width: ..... 228 mm
Depth: ..... 228 mm
Weight: 11,0kg

Inverter unit
Height: ..... 142 mm
Width: ..... 228 mm
Depth: ..... 321 mm (with junction box)
Weight: ..... 8,0 kg
Output: ..... 110V AC ±5V
..... 400 Hz +0/–4 (8-10)

Power source
Input: ..... 24V DC ±20%
At starting: 5.0A
In normal operation: 2.0A

Damping
Frequency: ..... 72.4±7' (at latitude 35°)
Damping factor: ..... 30 ±7% (at latit. 35°)

Gimbals freedom
±45°

Temperature range
–20°C to +50°C

Settling point error: ..... 1.8° sec. lat.
Variation error (1o): ..... 1.2° sec. lat.
Settling time: ..... 4 hours
Follow-up rate: ..... Max. 36°/sec.
Speed error: ..... refer figure on page 5
Latitude error: ..... refer figure on page 30

Dynamic/Environmental Performance
Horizontal acceleration (0.1G) ..... 1.8° sec. lat.
Angular motion:
1.8° sec. lat.
- Rolling angle: ..... ±25°, period 7 to 12 sec.
- Pitch angle: ..... ±15°, period 6 to 10 sec.
- Yaw angle: ..... ±5°, period 9 to 13 sec.

Vibration (4 to 40Hz, 2 hours later) .....2.0°
Humidity (50°C, 95% RH, 20 hours later) .....1°
Power fluctuation (Voltage +30%/-20%) .....1°
Power interruption (3 to 30 sec.).....1°
Allowable latitude limit .....70°

Timer
Set time range ..... 4 to 24 hours

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4 ASSEMBLY AND INSTALLATION

4.1 Preparation for installation

Warnings

Electrical warnings

The RGC50 is designed to be connected to 24 VDC power sources only.

If 24V DC is not available on the vessel, it will be necessary to obtain an external voltage converter/inverter unit. Refer to the RGC50 specifications for details on the external voltage converter/inverter requirements.

Transportation warnings

The RGC50 must not be moved or transported without being properly protected. The sensitive element is packed in a carton box, and the final assembly must be done onboard the vessel. Never transport the RGC50 with the sensitive element assembled.

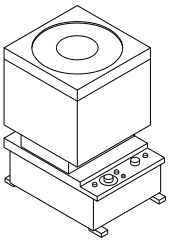
For shipment in connection with service or overhaul, use the original packing.

Unpacking a new unit

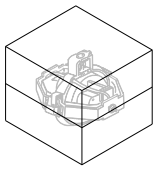
The RGC50 is shipped with the sensitive element packed in a box separate from the master compass unit to protect the internal sensitive element from damage during shipment. It is required that the installing dealer perform the final assembly in accordance with procedure described in ***RGC50 Assembly instructions*** page ***10***, to install the internal sensitive element prior to operating the RGC50.

Standard equipment supplied

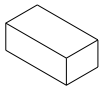
A basic RGC50 is shipped with the following items:



– RGC50 Master Compass unit (includes Master compass and Inverter unit)

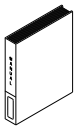


– Sensitive element (packed in a carton box)



– Spares kit (contains optional mounting bracket, spare fuses, spare bulbs)

– Shade plate



– RGC50 Instruction manual

RGC50 Assembly instructions

After unpacking the RGC50, the following procedure must be performed to complete the assembly of the RGC50 gyro.

Note!

The assembly of the RGC50 is a delicate procedure, but it is not difficult if you follow the detailed instructions on the following pages.

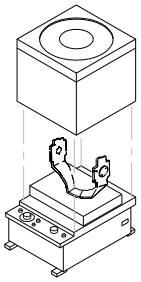
Perform this procedure in a location that is clean and dry. It is recommended that you have a small container tray available to place some of the small hardware that will be temporarily removed during this procedure.

The following tools will be required for this assembly procedure:

- small Phillips head screw driver
- a pair of small pliers
- a large straight blade screw driver

Assembling

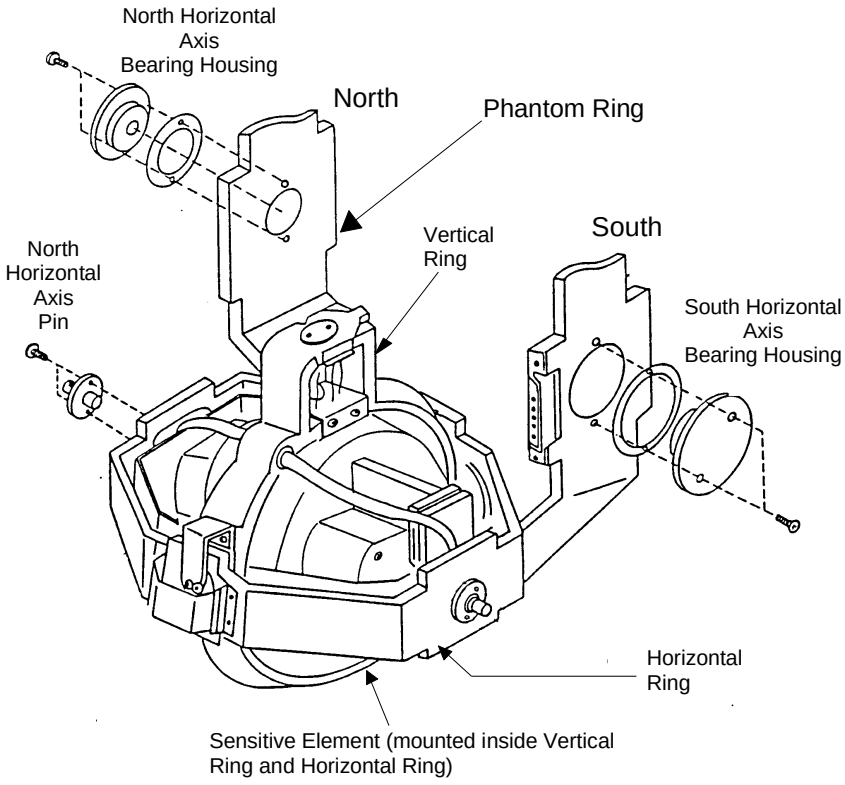
1. Prepare a clean, dry and brightly lit area.
2. Remove RGC50 master compass from the cardboard packing box.
3. Place the Master compass on the bench in front of you so that control panel faces toward you.
4. Set the Sensitive element in it's styrol packing container in a safe location on the bench. **Do not remove the sensitive element from the carton box yet!**



5. Remove the 4 screws that attach the RGC50 Master compass top cover to the support rods, and save screws for reassembly.
6. Carefully lift the cover and set aside for later re-assembly.

Note! *The cover is made up of two pieces, which are easily dropped if not handled carefully.*

7. Study the following diagram to identify the items that will be referenced in the next steps:



8. Orient the Phantom ring so that the North part of the ring is to your left side. North is identified as follows:
   - North indicated on compass card ring
   - Larger diameter Horizontal axis bearing housing
   - No wires or PCB attached to the phantom ring on the North side
9. Remove the retaining screws that secure the bearing housing for the North side horizontal axis bearing housing on the phantom ring. Set the screws aside for re-assembly.
10. Carefully press out the North horizontal axis bearing housing using only your fingers to remove the housing. DO NOT USE any tools and be careful not to scratch the outer surfaces of the bearing housing after it is removed, otherwise you may have difficulty re-installing the housing later in the assembly process. If there are any shim washers used between the bearing and the phantom ring, retain the shim washers for re-assembly.
11. Remove the retaining screws that secure the bearing housings for the South side horizontal axis bearing housing on the phantom ring. Set the screws aside for re-assembly.
12. Carefully press out the South horizontal axis bearing housing using only your fingers to remove the housing. DO NOT USE any tools and be careful not to scratch the outer surfaces of the bearing housing after it is removed, otherwise you may have difficulty reinstalling the housing later in the assembly process.
13. Rotate the phantom ring until 270° on the compass card is pointing towards the control panel.

WARNING! ***Use extreme caution when handling the Sensitive element! Only lift by holding on each side on top of the vertical ring.***

14. Remove the Sensitive element from the carton box. Note that the bottom of the sensitive element is the only one of the six edges that has a flat surface.

Note! *Store the carton box for later shipment of element for future overhaul.*

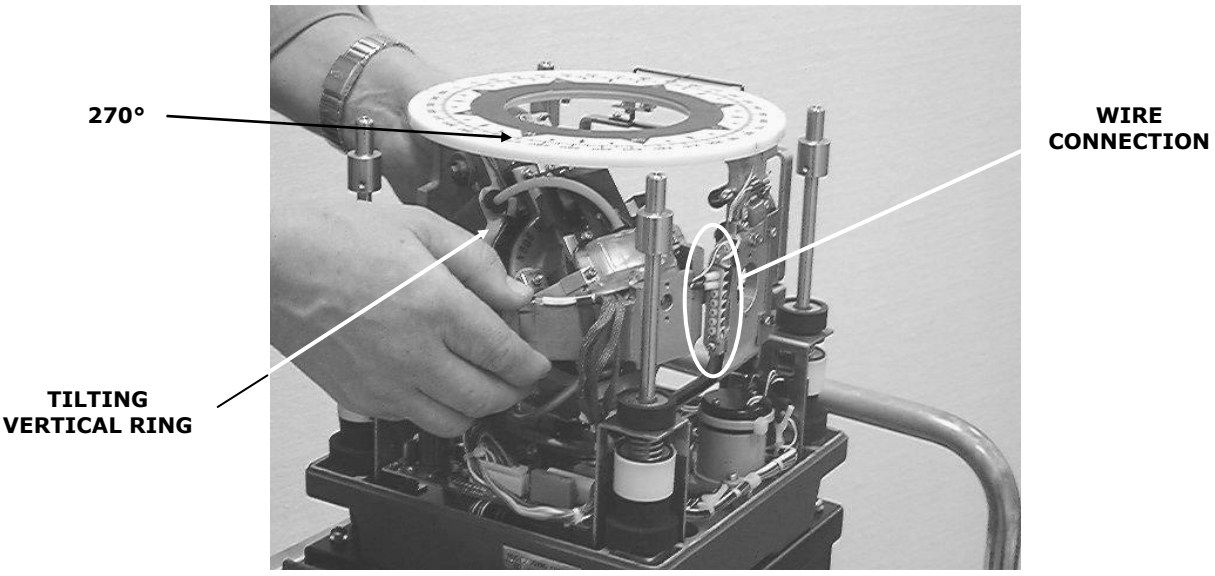
15. Remove the two tie wraps securing the Horizontal ring. Be sure that the correct tie wraps are removed.
    - Do not turn the sensitive element upside down.

– Do not touch the shims that are marked with tape at this time. These shims will be removed only after the RGC50 is installed on the vessel and must be available any time the RGC is transported!

16. Remove the two mounting screws from the South horizontal axis, and set aside for later re-assembly.

17. Carefully remove the South horizontal axis from the sensitive element, and place the axis on a clean surface. The South horizontal axis has a light coating of lubricant on it. This is normal. Do not wipe the lubricant off this axis. It is required for easy re-assembly.

18. Rotate the sensitive element so that the North side (marked by a large N on the lower face of the sensitive element) is facing in the same direction as the compass card. This should put the five green flexible wires to your right and facing towards you.



19. Lift the sensitive element by holding on the east and west side of the horizontal ring.

20. Tilt the vertical ring as long as possible to one of the sides, and insert the north horizontal axis pin into the opening of the north side of the phantom ring. Then insert the south part of the horizontal ring into the phantom ring, and allow the element to rest on the base of the phantom ring.

21. Verify that the five green flexible wires are located directly next to the vertical terminal strip that is attached to the South side of the phantom ring. (If it is not, then you have installed the sensitive element backwards! Refer to

steps 18, 19 and 20 to correctly orient the sensitive element.)

22. Reinstall the South side horizontal axis pin carefully into the horizontal ring.
23. Locate the North Horizontal axis bearing (removed in step 10). The North horizontal bearing is the larger of the two bearings. It will be inserted in step 26. Place the bearing on the table surface near the North side of the gyro, within easy reach during the next assembly steps.
24. Locate the South horizontal axis bearing. (The smaller of the two bearings.) Place in on the table surface near the South side of the gyro, within easy reach during the next assembly steps.
25. With your left hand, carefully grasp the sensitive element at the east side of the Horizontal ring, and lift it slightly (approximately 5mm).
26. With your right hand, carefully insert the North Horizontal axis bearing into the opening in the phantom ring with the screw holes in the axis bearing oriented vertically. (This will also insure that the slot will clear the Allen screw that is installed into the horizontal axis pin). Slide the bearing into the opening while simultaneously inserting the horizontal axis pin into the axis bearing. When the bearing is seated fully into the phantom ring, the axis pin should also be inserted fully into the bearing. Carefully transfer hands so that your left hand is supporting the sensitive element.
27. Using your right hand, insert the South horizontal axis bearing into the phantom ring opening. Carefully position the sensitive element so the south horizontal pin is inserted into the axis bearing, as you press the axis bearing into the phantom ring opening. It may be necessary to slide the sensitive element assembly over towards the South axis in order to seat the axis into the axis bearing. Be careful to align the screw holes for the axis bearing with the screw holes in the phantom ring.
28. At this point, the sensitive element should pivot freely in both axis directions. If your feel any binding, it means that one of the bearings is not installed correctly, or the axis pins are not seated into the axis bearings. If necessary, repeat step 26 and 27 until the sensitive element pivots in both axis directions without any binding.
29. Rotate the North horizontal axis bearing until the screw holes are aligned with the screw holes in the phantom ring.

30. Reinsert the retaining screws in North axis bearing and tighten screws securely. It may be necessary to rotate the bearing slightly to get both screws to tighten without sticking.

31. Reinsert the retaining screws in the South axis bearing, and tighten the screws securely. It may be necessary to rotate the bearing slightly to get both screws to tighten without sticking.

32. Verify that the sensitive element is free to pivot in both axis directions.

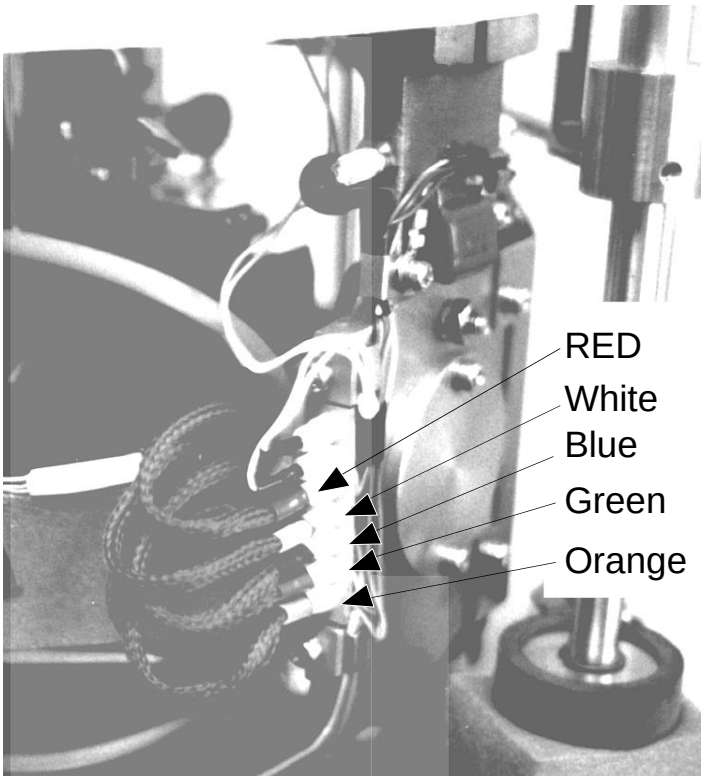


Figure 4-1 Flexible wire placement

33. Carefully insert the correct wires into the appropriate color terminals as shown in Figure 4-1. Note that it may be necessary to use a small pliers to grab the white plastic part of the flexible wire connector for inserting the pin into the receptacle. (Be careful not to mix up the white and the orange color bands!)

34. At this point, all the screws should be back in place except for the 4 large flat head screws used to secure the cover on the RGC50 compass.

35. Carefully rotate the compass card slowly by hand through at least one complete rotation, and verify that the entire phantom ring will rotate without making any contact with

any of the mechanical or electrical components of the RG50 binnacle assembly. Be especially aware of the PCB that is supported on the South side of the phantom ring. Also, verify that the 2 white wires that is connected to the white compass card ring are routed in a way that they will not get caught on any part of the binnacle, especially the pointer support bracket.

Install the RGC50 in accordance with section 4.2.

4.2 Mechanical mounting

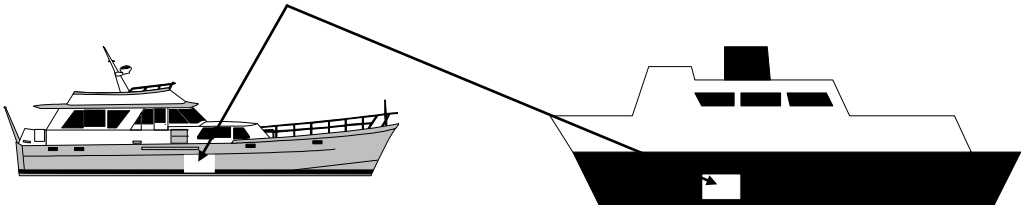
Recommended mounting locations

The following criteria should be taken into account when mounting an RGC50 gyro:

- The best location for a gyrocompass is at the center of the ship's roll and pitch axis.
- Given two locations, the one closer to the water line is the better location.

Mounting a gyrocompass up on a fly bridge is not the best location, and may cause the gyro to "tumble" during operation (requiring the gyro to re-settle). It may even result in damage to the sensitive element in extremely rough sea conditions.

Refer recommended mounting locations shown in the figures below.



Different types of heading repeaters (Simrad Digital repeaters and Analog repeaters, all running from NMEA signal) are available to display heading information in remote locations. Since the RGC50 is used as both a heading sensor and a heading display, it is recommended that a location is selected that will provide the most accurate heading information, and provide the least amount of movement, vibration, or shock to the RGC50.

Note! *The RGC50 may be placed near magnetic objects without concern, since the RGC50 is not affected by magnetic forces like traditional magnetic or fluxgate compasses.*

Precautions

The following precautions must be observed when selecting a mounting location for the RGC50 Master compass unit:

- Ambient operating temperature where the Master compass is located must be between –20°C and +50°C. This means that the RGC50 master compass must not be installed in an engine room!
- The Master compass unit must be mounted on a flat horizontal surface
- The Master compass unit must not be mounted on an angle.
- The housing of the gyrocompass is not weather proof. The Master compass must not be mounted in a location that is exposed to the weather.

RGC50 Mounting Orientation and placement

The RGC50 must be mounted on a flat surface.

Provide ample space around the RGC50 for servicing.

Note that the wiring panel is accessed from the back of the RGC50, so leave sufficient space behind the RGC50 to access the wiring panel.

Note! *The Reference line on the binnacle of the master compass must be aligned with the fore - aft centerline of the vessel. If the RGC50 is mounted off the centerline, the heading readout will be inaccurate, and you will need to re-position the RGC50 master compass during the test phase of the RGC50 checkout.*

4.3 Running test

Connect 24 VDC input power lines on the terminal board attached to the Inverter unit. This board will be found after removing the protective cover. Refer to page 94: Main terminal connection. Connect +24V DC to D+ and D–. Note that this terminal board has two sides and D+ and D– are normally located on the underside when the cover is closed.

Apply power and check for power lamp operation. Check the voltage and frequency between terminals R1 and R2 of the terminal board attached to the Inverter unit. Adjust them with R75 (voltage) and R8 (frequency) of the Inverter board, if necessary. (110V AC ±3V 400Hz ±2Hz).

Check the follow-up motion and the settling condition of the Master compass (including the location of the level).

4.4 Checking and correction of errors

When the compass has settled (normally 4 hours), check the settled heading by a sun azimuth or the known bearing of an object, or the dock heading.

Correct the error by turning the binnacle of the master compass (if mounted separately) or by turning the Inverter base if mounted together.

Large errors will require service adjustment by qualified service technicians. The suspension twist wire on the sensitive element needs to be adjusted. Refer Figure 6-2 Azimuth adjustment.

Reinstall the Master compass cover.

4.5 Checking the timer

1. Turn outer knob to match the present time with the reference line.
2. Turn inner knob to match its reference line with the ETD (estimated time of departure).
3. Set the Master Switch to "TIMER". The timer setting indicator lamp (red) lights.
4. Three hours before departure time the gyro starts running automatically. The running indicator lamp (green) lights.
5. Within three hours, set the Master Switch to "RUN", the gyro continues to run under the settled condition and the timer setting indicator lamp (red) goes out. If the Master Switch is not set to “RUN” position the RGC50 will be shut down 3 hours after the set ETD.

4.6 General information about RGC50 signal output and connected equipment

The RGC50 master compass provides a single 1:1 synchro electrical output signal intended to provide heading information to external equipment. The optional signal interface unit converts the 1:1 synchro heading information into signal formats recognized by a variety of other equipment. A typical installation of an RGC50 may include connection of the RGC50 and signal interface unit to an autopilot, Radar, a digital repeater, and an analog steering repeater. The "intelligent" capabilities of the signal interface unit also provide a capability to use an alternate heading sensor to supply heading information to all of the connected equipment, in the event of a gyro failure.

Note! *For connection to external equipment, refer to the relevant instruction manual for the signal interface unit.*

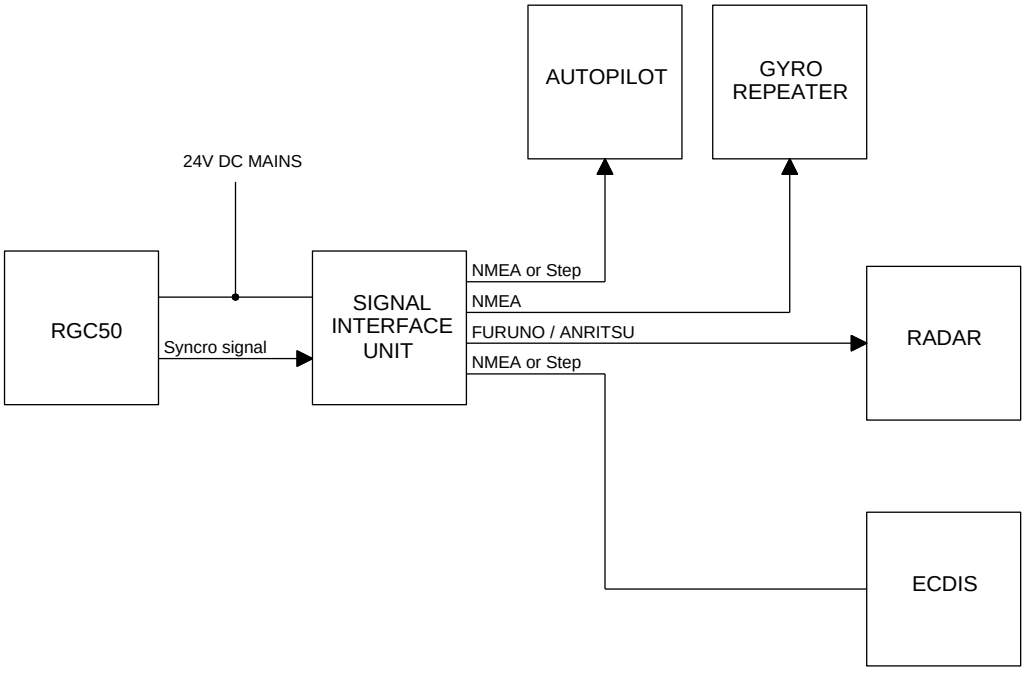


Figure 4-2 Typical installation

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5 PRINCIPLE OF OPERATION

5.1 Master Compass

The Master compass is made up of a gyro rotor located at the center, vertical axes, a suspension wire and a vertical ring which holds the gyro rotor vertically by means of ball bearings. On the outside of these, there are horizontal axes and horizontal ring which supports the gyro rotor horizontally with ball bearings. The outermost component is a phantom ring, which is attached to the binnacle of the Master compass. The Compass card is attached to the upper part of the phantom ring and can be seen through the glass from above the case.

The other components are:

- a liquid ballistic, which gives a north seeking action to the gyro
- a damping weight as a damping device
- a follow-up transformer which detects azimuthal changes
- a servo amplifier which amplifies electrical signals from the follow-up transformer and a servo motor which rotates the card in response to the output from the servo amplifier.

As stated above, the Master compass consists of the gyro section with freedom of three axes, the north-seeking and damping section and the follow-up section.

These sections are arranged on the binnacle via springs to damper vibrations and shocks.

Sensitive element

The Sensitive element consists of the gyro rotor, damping weight, vertical ring, suspension wire, level, follow up transformer, liquid ballistic and horizontal ring.

Gyro rotor and Damping weight

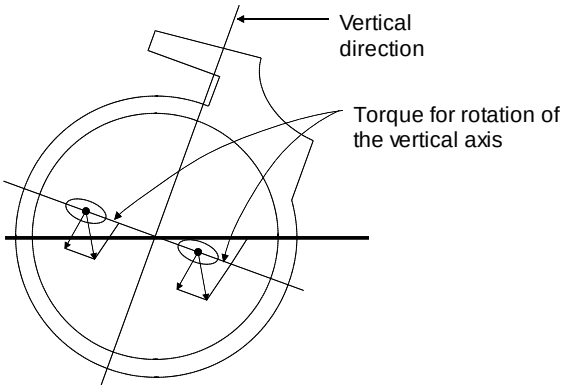
The gyro rotor is the cardinal component of the gyrocompass in which the 81 mm dia. 41 mm thick rotor rotates at a synchronous speed of 12,000 rpm. The gyro rotor is driven about 120° out of phase with the output (110V AC, 400 Hz, 3-phase, square wave) from the Inverter unit. It rotates clockwise as seen from the north side (stamped N.) The rotating gyro rotor should be checked for vibrations or sound that occur at the initial stage of starting. The rotating direction can be checked by looking into the glass window on the north side.

A damping weight is mounted on the west side (in the direction, the case is taken out) of the gyro rotor. The damping weight applies a torque to rotate the vertical axis in proportion to the inclination of the gyro spin axis. This torque causes the gyro to make a damping motion and to stay pointing to the north.

Vertical Ring, Suspension wire and Level

The gyro rotor is suspended by a suspension wire from the top of the vertical ring and is supported horizontally with ultra high precision bearings at the top and bottom of the vertical ring. These bearings serve only as guide bearings. Special care must be taken in handling the bearings. If even a small amount of dust enters, friction between the bearings and axes will increase and result in errors. Although the gyro rotor is structured for dust not to enter, it should be handled carefully. Definitely avoid touching it or blowing smoke on it.

The suspension wire consists of 6 stainless steel wires that are completely free of torsion. If torsion remains, the torsional torque of the wire acts on the vertical axis to cause errors. In order to completely eliminate torsional torque, the suspension wire can be adjusted minutely with the tangent screw at the top of the vertical ring. Regarding the relation between the rotation of the screw and the azimuth, see the relevant figure in chapter 6, ADJUSTMENT.

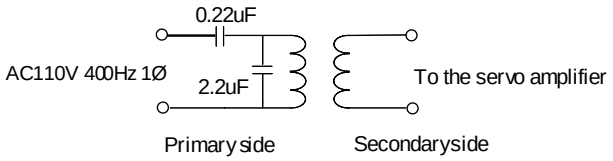


A precise level is provided on the east side of the vertical ring and it indicates the inclination of the gyro spin axis. It is graduated in units of minutes (angle) and is used for balance adjustment described in detail in Chapter 6 Adjustment.

Follow up transformer

Primary and secondary follow up transformers are provided on the south side of the frame attached to the gyro rotor and vertical ring. The gyro rotor points to one point in the space by the characteristics of the gyro. The vertical ring performs the same motion with the hull via the horizontal and phantom rings. If the positional relation of the gyro rotor and vertical ring changes due to the change in the ship's course or the rotation of the earth, this causes a change in the follow up transformer, thereby inducing a voltage in the secondary coil. This voltage operates the servo amplifier and the servo motor to rotate the phantom ring, thus bringing the two follow up transformers back to the correct positional relation as before zero electric output. This causes the correct azimuth to be followed and is indicated through the compass card.

By dividing with a capacitor, an exciting voltage of 110V AC 400Hz single phases is supplied to the primary follow up transformer.



Liquid ballistic

The liquid ballistic consists of a plastic container attached from the north to south of the frame of the vertical ring, a connecting pipe and a special liquid (Galden HS) with a large specific gravity.
The liquid ballistic applies a torque proportional to the inclination of the gyro spin axis to the horizontal axis. This is done by utilizing the amount of liquid not balanced in the liquid ballistic, which is caused by the inclination of the gyro spin axis (rotor driving axis). This torque gives rise to the north seeking action which causes precession to make the gyro point to the north.

Horizontal ring

With the help of ultra high precision bearings, the horizontal ring holds the vertical ring and gives the east west freedom to rotate.

Special care must also be taken in handling these bearings. Play, if there is any, in the bearings produces a change in the center of gravity of the gyro, causing an error in the azimuth. Even minute dust particles will increase friction in the bearings, causing an irregular torque of the horizontal axis rotation, which finally causes an error in the azimuth.

Follow-Up mechanism

The follow-up mechanism consists of the phantom ring, servo amplifier, servo motor and gear mechanism.

Phantom ring, Servo motor and Gear mechanism

The phantom ring, which holds the horizontal ring with bearings, gives the north south axis freedom of rotation. The bearing on the south side is provided with a damping function for oscillation, such as rolling. A 100,000CS (viscosity) silicon oil of 0.7 cc is contained for the damping function. The 202 mm diameter compass card and an illumination plate are on top of the phantom ring to light up the whole card with four electric bulbs.

An illumination controller is mounted to the right of the switch panel of the power unit. The azimuth gear at the bottom of the phantom ring engages with the gear mechanism of the servo motor, driven by the output of the servo amplifier, thus forming the follow up servo mechanism, which is unified with the support by means of the bearings at the bottom of the phantom ring.

5.2 Inverter unit

The inverter unit consists of a switch panel and an Inverter board. The start switch, time setter, indicator lamps, a fuse, and illumination controller of the master compass are arranged on the switch panel.

Operations are performed entirely on the surface. PCB is incorporated and can be replaced by disconnecting the connector. Its consist of timer, inverter and 1 ~ 3 phase converter circuit. A filter to eliminate noise is built in the Inverter unit.

6 ADJUSTMENT

6.1 Master compass

Adjusting the torsion of the suspension wire

1. Remove the square damping weights on the west side of the rotor case. Attach the round weights and put back the nuts and washers.
2. Mount a level on the level mounting base of the horizontal ring.
3. Apply a wood block between the bottom of the sensitive element and the phantom ring and adjust it so that air bubbles in the levels of the horizontal and vertical rings come to the middle.
4. Turn the rotor case to the left and right until it reaches the stoppers and leave it as it is. If there is no torsion in the suspension wire, the marked-off lines of the rotor case and vertical ring agree with each other. If there is a large torsion, loosen the two flat head screws on the suspension wire and turn the support fitting on the suspension wire to make the marked-off line coincident. Then, tighten the flat head screws and minutely adjust the marked-off lines with the tangent screw. After tightening, check again.

Balance adjustment

Vertical balance (east-west direction)

1. Manually hold the bottom of the sensitive element and bring the air bubbles to the middle of the horizontal ring level and rotor case.
2. Bring the marked-off line of the rotor case to be roughly coincident with that of the vertical ring
3. Tilt the vertical ring toward the south side. At this time, the marked-off lines of the rotor case and the vertical ring must remain coincident.
    a. If the west side is heavy (the marked-off line of the rotor case gets displaced to the right), reduce the adjusting weights (round) on the west side of the rotor case by equal amounts. Or add two equal weights to the adjusting weights (round) on the east side.

b. If the east side is heavy (the marked off line of the rotor case gets displaced to the left), perform the reverse of a).

General balance

1. Mount the damping weight.
2. Bring the air bubble of the level mounted on the horizontal ring to the middle.
   If it is not in the middle, add or remove weights to or from the horizontal ring to bring the air bubble to the middle. Push down the west side of the horizontal ring, then push down the east side and the air bubble must be at 30 minutes or less. Adjust it by applying liners to the horizontal ring and ball bearing housing.
3. Two to three hours after the operation, repeat step 2.
4. Remove the level.

Checking position of the pick-up transformer

1. Put the master compass on the meridian after operating for 30 minutes; match the gyro compass azimuth with the meridian. (The damping weight must be mounted.).
2. Check if the rotor case and vertical ring are aligned by looking at the on-line marks. If they are not, adjust by moving the pickup on the secondary side.
3. Set the center of the air bubble of the level to 50'; let it stand and watch changes in the azimuth and the position of the air bubble. Five minutes later the azimuth should be within ±0.3° and the level within ±2'.
   a. To adjust the heading indication, add an equal amount of weights to the left and right on the south or north side on the liquid ballistic frame. When weights are added to the south side, the heading indication increases (westerly error). When weights are added to the north side, the heading indication decreases (easterly error). For the corrective amounts, see Figure 6-1.
   b. To adjust the level, use the tangent screw of the suspension wire. For the direction and corrective amount, see Figure 6-2.

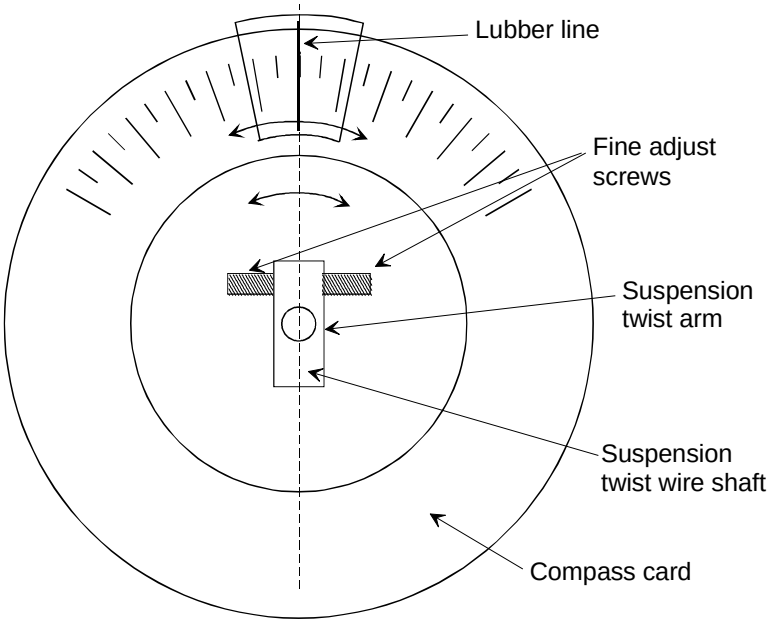
Heading adjustment procedure

Heading error less than ±2 degrees

When the gyro is settled (after approx. 4 hours) and the heading error is less than ±2 degrees, loosen the master compass fixing bolts and turn the gyro to correct the error.

Heading error greater than ±2 degrees

Provided that the gyro is settled and functioning correctly, the heading error should not be more than appr. ±5 degrees. Correction is made as follows: Observe the compass card from above and orient your mind such that the lubber line, fine adj. screws and suspension twist wire shaft is lined up as shown. When the heading is too high, imagine that the lubber line has to be moved CCW to show the correct lower heading. Hence the adjustment is made by turning the fine adjustment screws such that the suspension twist arm moves in the same direction (CCW). Turn the left fine adjustment screw CCW (out) and tighten (CW) the right adjustment screw.



Be aware of that one turn of the fine adjustment screw may give as much as 10 degrees course change.

When doing the adjustment, the element will be displaced and has to align again. This takes some time, depending on the displacement (1-3 hours).

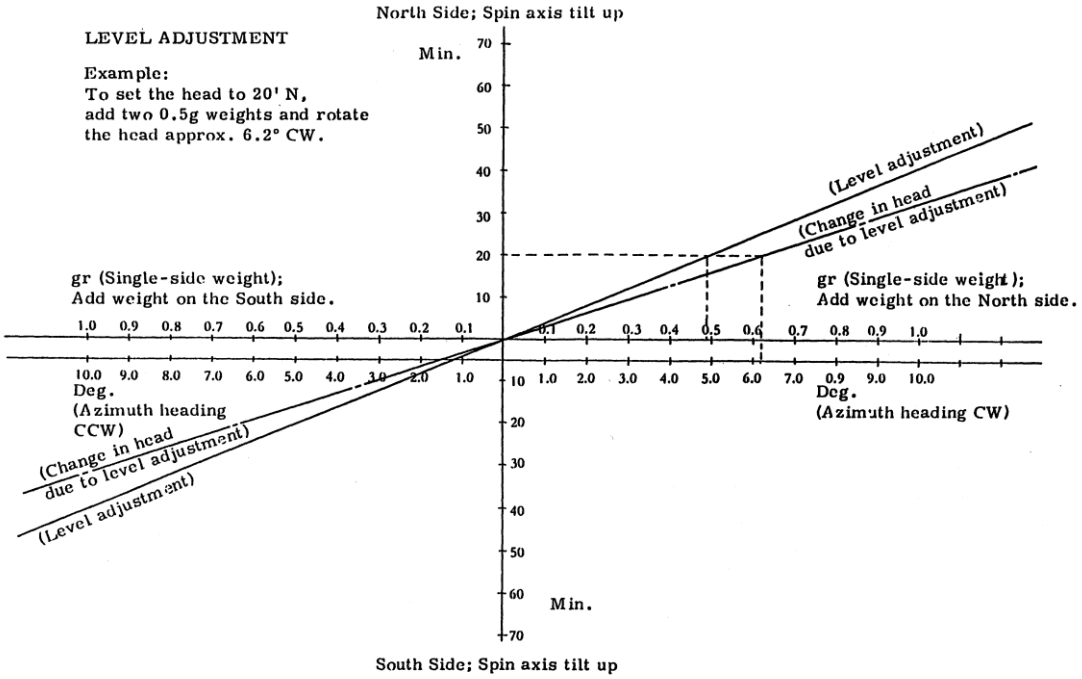


Figure 6-1 Level adjustment

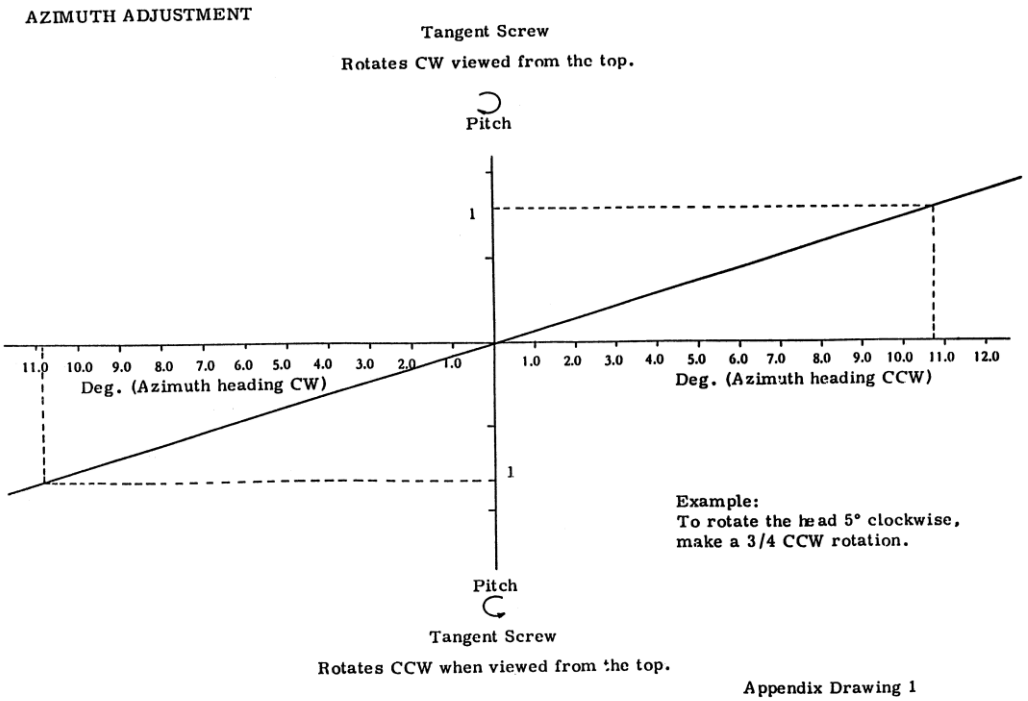


Figure 6-2 Azimuth adjustment

Damping adjustment

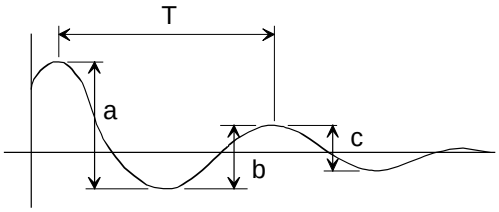
1. Make sure that the master compass becomes still.
2. Let the heading indication be 30° (westerly error) from the settling point. After raising the level air bubble about 10', leave it standing and measure changes in the heading indication as time goes by.
3. Obtain the damping factor and cycle by the following formula.

Damping factor:

$F1 = b/a \times 100$

$F2 = c/b \times 100$

$Fa = \frac{F1 + F2}{2}$



Reference value:

Fa= 25 to 35%

T = 65 to 80 min. (for high latitude)

80 to 95 min. (for low latitudes)

4. The damping adjustment is done by increasing or decreasing the damping weights. For the damping weights, see Figure 6-3.

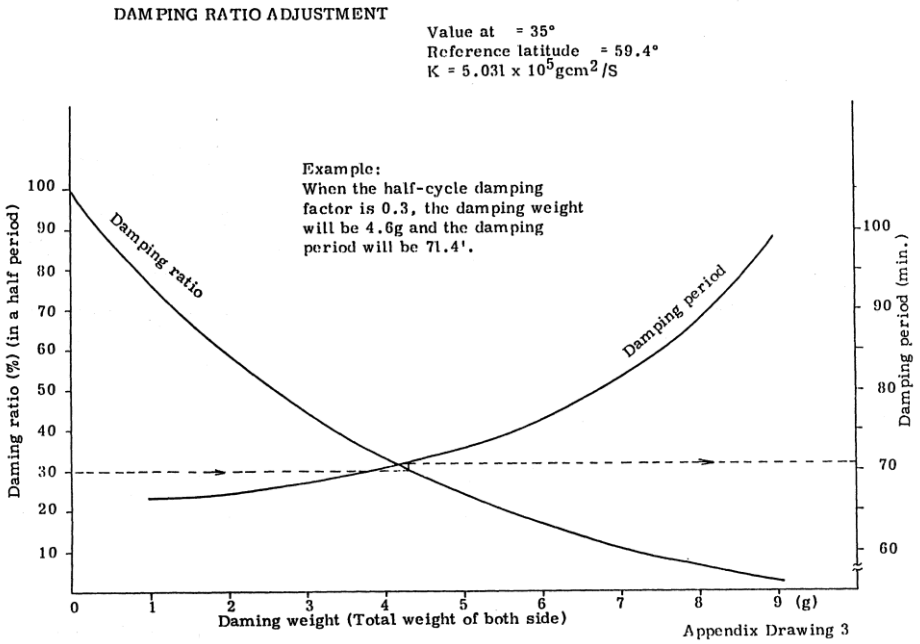


Figure 6-3 Damping ratio adjustment

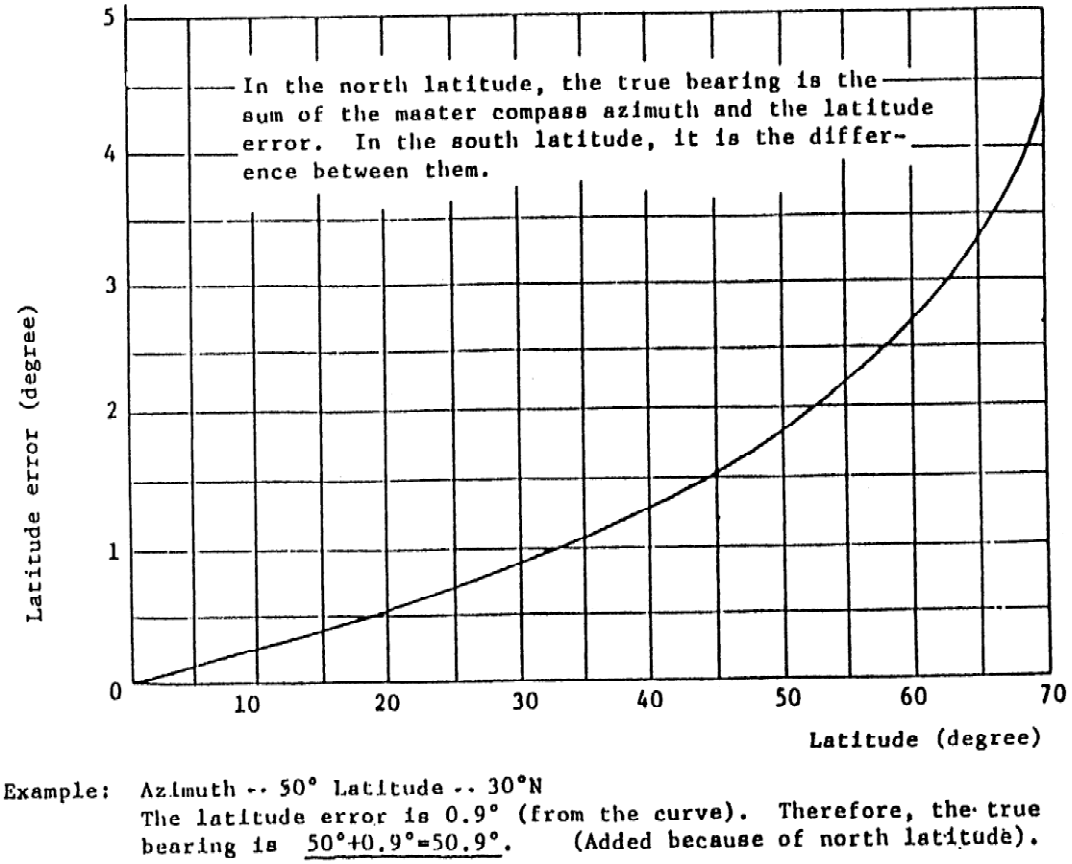


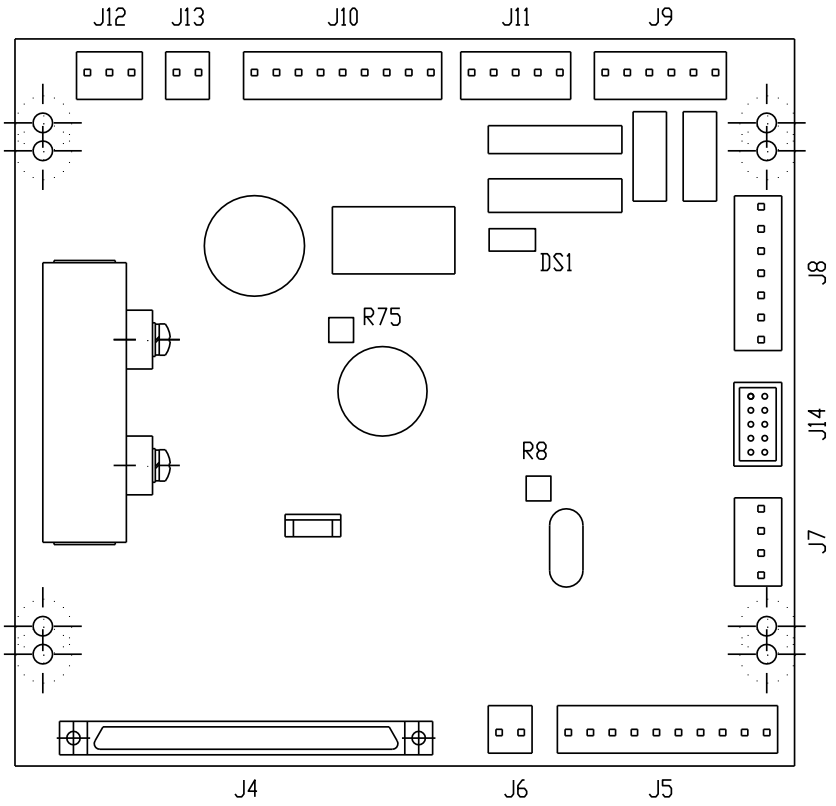
Figure 6-4 Latitude Error Curve

Servo amplifier

1. Ascertain that the Master Compass almost settles at the specified voltage and current.
2. Fully turn resistor VR1 in the servo amplifier clockwise.
3. Forcibly rotate by hand a little the gears of the servo motor gear train which is engaged with the azimuth gear.
4. The Master Compass is likely to hunt. If it hunts, stop it by turning VR1 counter clockwise. Set VR1 to a value smaller than the resistance value at which hunting is stopped.

Make sure that hunting does not occur.

6.2 Inverter board



Voltage adjustment

1. Set the main switch on the control panel to **RUN** position.
2. Wait at least 3 minutes after the light in DS1 is turned off. Measure the voltage level at the output taps (0-110V) of the transformer. The value shall be 110V±3V rms. Use a true RMS multimeter.
3. Adjust the value with R75 if required.

Frequency adjustment

1. Set the main switch on the control panel to **RUN** position.
2. Wait at least 3 minutes after the light in DS1 is turned off. Measure the frequency at the output taps (0-110V) of the transformer. The value shall be 400±2Hz.
3. Adjust the frequency with R8 if required.

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7 MAINTENANCE

Gyrocompass seldom requires checks and maintenance. Inform the crew of the following items:

1. Do not touch any part of the Case unnecessarily.
2. If there is any trouble, stop the Gyrocompass and notify the service station of the noise, abnormal rotation of the compass card, compass error, etc.

Main Bearing List

Place of use	Part No.	Brand	Lubrication oil
Rotor	44177418 (102216991) ø6 x ø19 x 6	Special design bearing	Oil: DTE oil light. Filling amount: 4cc/pc
Ver. & Hor. axes	44137495 (10210326) ø6 x ø19 x 6 Same as ES-11A	NSK Special design bearing	Oil: DTE oil light mixed with TCP liquid
Follow-up axis (north side)	(102201370) ø28 x ø38 x 5	Origin CR28-38 (open type)	Silicon oil KF96 (100,000cs)
Follow-up axis (west side)	(007206061) ø6 x ø17 x 6	JIS medium class (both shield type)	

Main Parts List

Part name	Part No.	Quantity	Remarks
Flexible wire (vertical)	44137545 (102295800)	3 pcs	Ø0.03/5 pcs. (straight) l = 25mm
Flexible wire (horizontal)	44137552 (102295970)	5 pcs	Ø0.03/5 pcs. (straight)
Liquid for ballistic	44138360	4.6cc	GALDEN HS
Liquid for damper	44138378 Silicon Oil KF96	0.7cc	Viscosity: 100,000cs

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8 OVERHAULING

8.1 Precautions

The Master Compass should be overhauled in a clean room or on a clean bench. If not available, disassemble, clean, lubricate and assemble the compass in a clean place with no ventilation taking care not to expose it to dust.

Do not use grease and oil stocked for more than a year.

Use white gasoline for cleaning. (Alcohol or benzine is not desirable because of the powdering.)

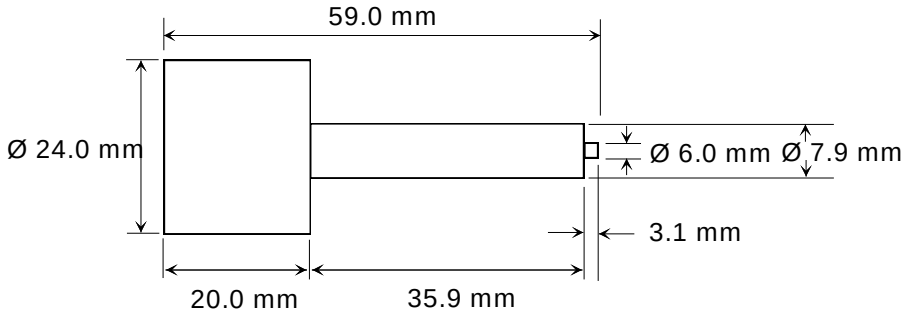
Use filtered dry air for cleaning. When the bearing is air blasted, do not turn the bearing. Never touch the cleaned bearing with hand directly.

A service kit is available (part no. 13108196). This kit includes special tools/oil and adjustment weights.

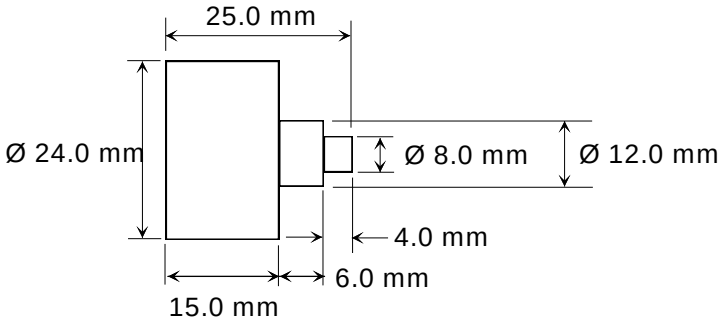
8.2 Special tools/units for adjustment

Special tools

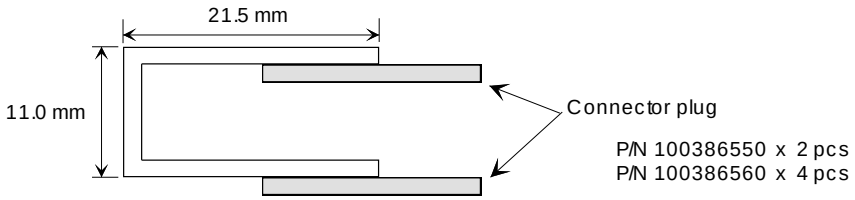
1. Assembling jig for upper portion of the vertical axis (Jig A). Part no. 27103142.



2. Assembling jig for lower portion of the vertical axis (Jig B). Part no. 27103159.



3. Jig for removing the vertical flexible ass'y (suspension wire section) (Jig C).



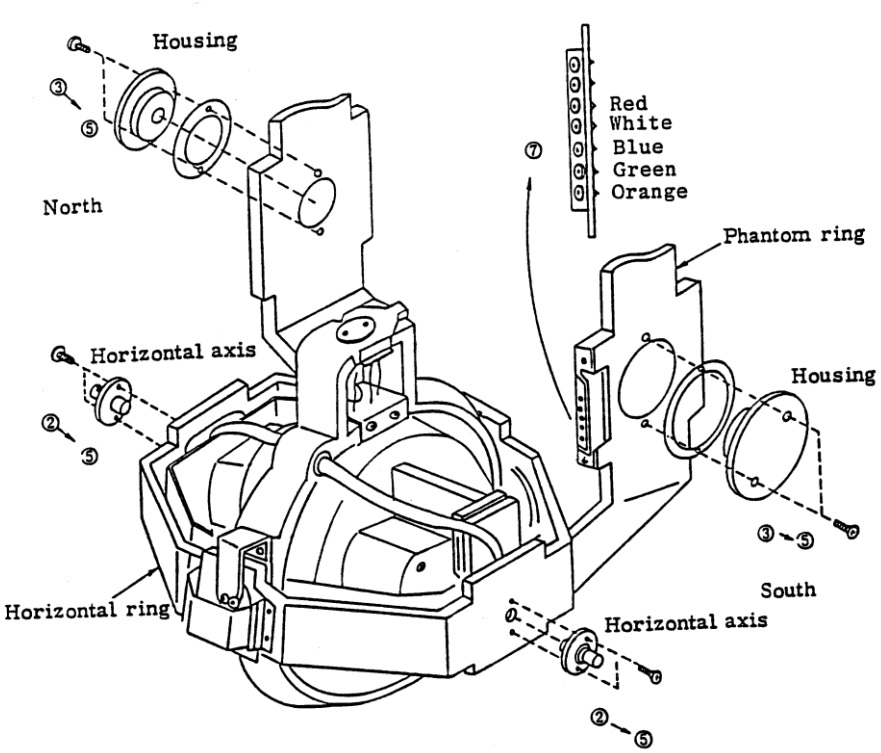
4. Retainer remover (two kinds for expanding and narrowing).
5. Gap gauge made of bakelite or acrylic plate (for measurement of 2 mm thick).
6. Metal fitting for rotor suspension (for measurement of rotor swinging).
7. Connector assembly for rotor.
   - Connector housing P/N 100386550 = 1 pc
   - Receptacle P/N 100386560 = 5 pcs

8.3 Disassembly

Sensitive Element

Removing sensitive element

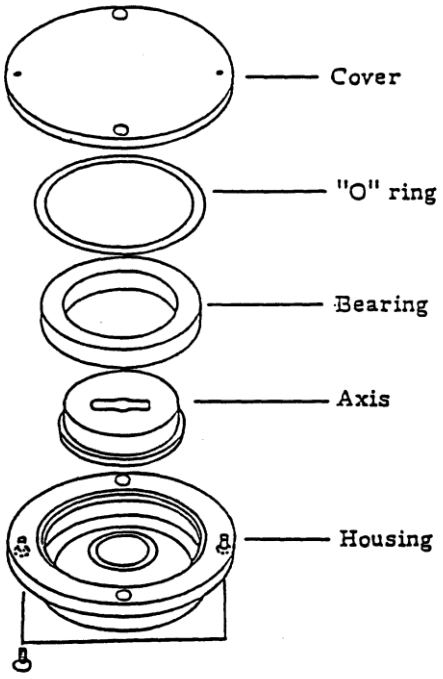
8. Insert the wood or rubber block (5.5mm thick) between the vertical ring lower portion and phantom ring to fix the sensitive element.
9. Pull out five flexible wire pins on the south side of the phantom ring from the connector.
10. Remove the mounting screws of the housing case on the north and south side of the phantom ring and pull the housing case out. At this time, pay attention on the number of clearance adjusting shim.
11. Remove the mounting screws of the horizontal ring north and south gimbal axes, and pull the axes out.
12. Take out the sensitive element from the master compass while keeping the element horizontal.



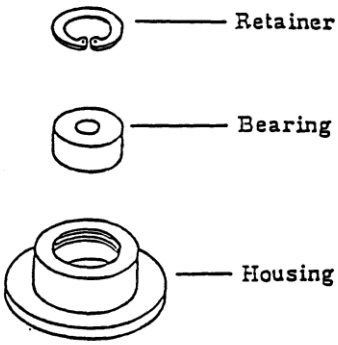
Cleaning and lubricating method for the gimbal ring bearing

1. North-side bearing
   This bearing is united with the damper housing. After cleaning, fill the bearing with 0.7cc of the damper oil (KF-96, 100,000CS).
   The damper is effective if the sensitive element stops after five times swinging or so when it is assembled and swung.

2. South-side bearing
   Remove the retainer and pull the bearing out. This bearing is of shield type and replace with new one when wrong friction condition.



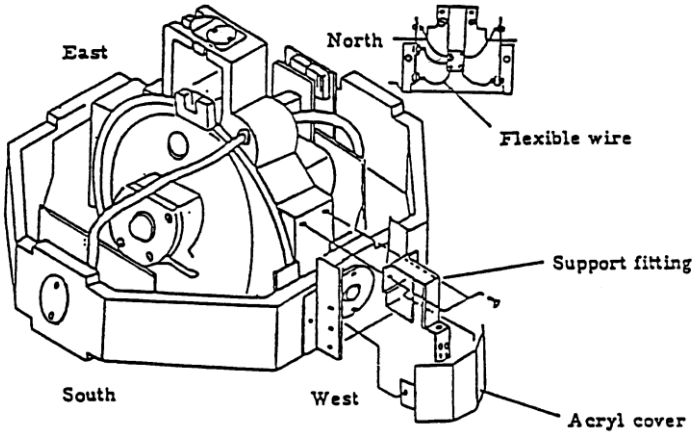
North-side
bearing assembly



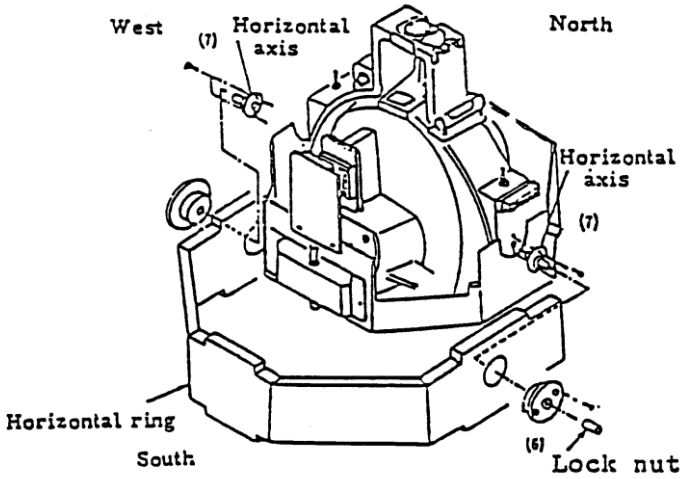
South-side
bearing assembly

Disassembling horizontal ring

3. Remove the acryl cover of the west side flexible wire.
4. Carefully pull out five flexible wire pin on the horizontal ring from the connector.
5. Remove one of the mounting screws of the flexible wire support fitting and fix it aslant with another screw. Then remove two lead wires (orange/green) connected to the liquid ballistic, from the back side.



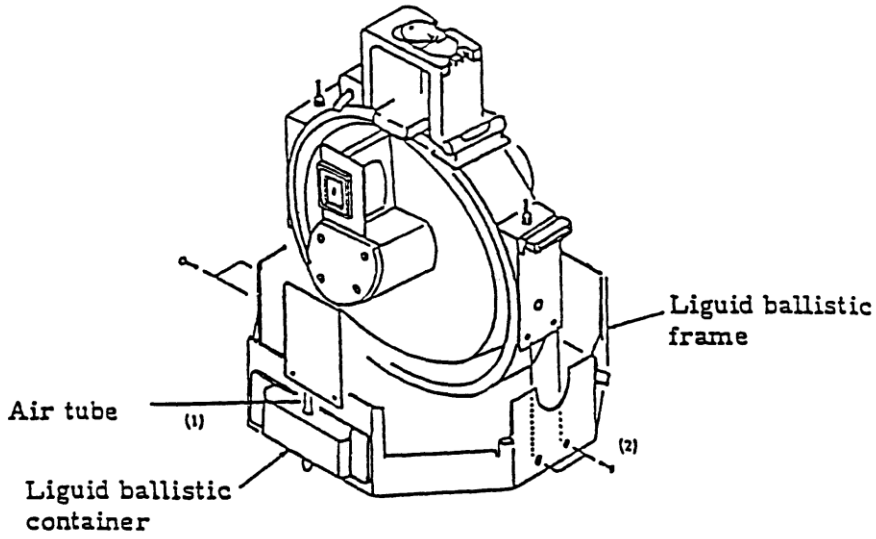
6. Remove the round lock nut of the east-side horizontal axis.
7. Remove the mounting screws of the east and west side bearing housings and pull them out.
8. Remove the mounting screws of the east side horizontal axis and pull it out. (Remain the west side axis.)
9. Pull the horizontal ring out while keeping the vertical ring aslant.



Disassembling liquid ballistic

1. Take out the air tube of the liquid ballistic from the liquid ballistic container.
2. Loosen the screws of the liquid ballistic frame on the east and west sides and take the liquid ballistic out downward together with the mounting block. Care should be taken not to damage the follow up coil in such a way as covering it with a vinyl pouch.
3. Do not remove the liquid ballistic container, the pipe and the follow up coil from the mounting block.
   When these positions are moved, the time has to be wasted for the cross alignment adjustment.
4. The liquid of the ballistic is Galden HS, and 4.6cc is used.
5. Clean the inside of the liquid ballistic pipe with air below and not to wash with benzine, etc.

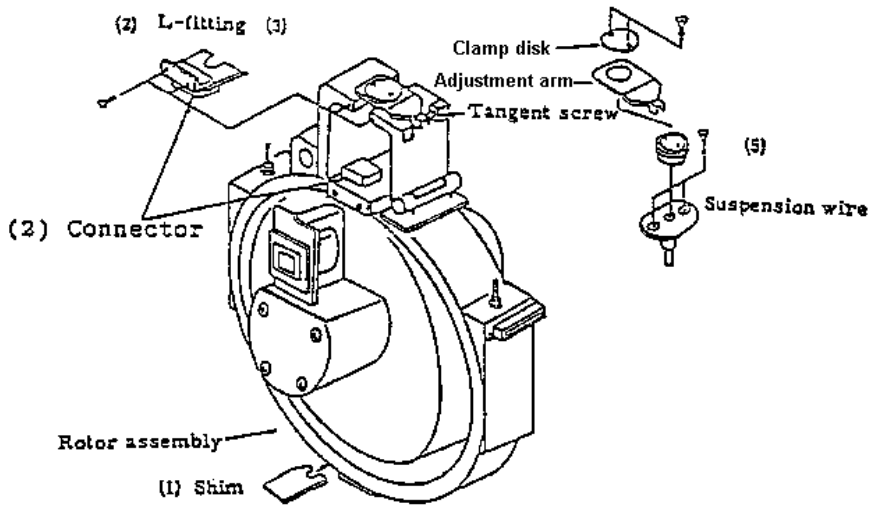
(The liquid does not need to be exchanged when the flow condition, the volume and the color are normal.)



Disassembling vertical ring

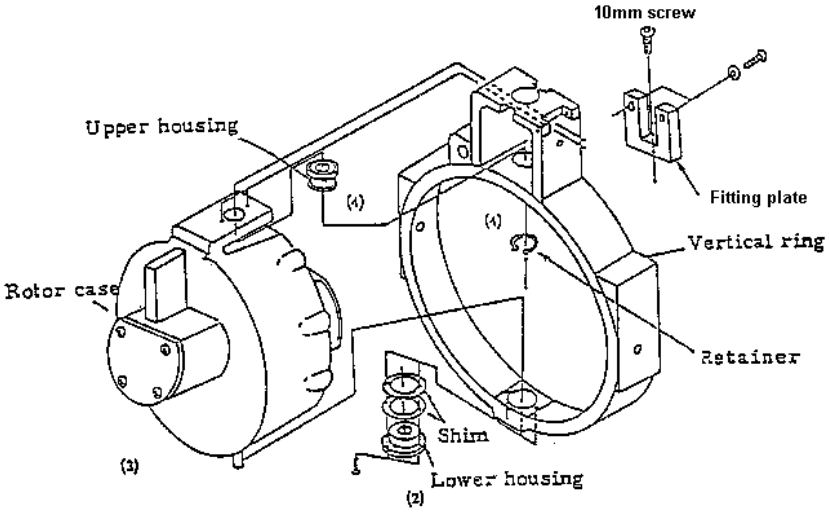
1. Measure the clearance between the inner ring of the vertical ring lower axis and the rotor. (0.35 mm ~ 0.4mm)
2. Pull out both the upper and lower connectors on top of the vertical ring.
3. Remove the vertical flexible ass'y, and mount JIG C (refer page 36) on the connector place.

4. Remove the lower mounting screws of the flexible wire mounting plate and then remove the L shape fitting. Pay attention not to cut the flexible wire.
5. Insert the shim about 0.6 mm thick to the clearance between the rotor case lower side and the vertical rotor case lower side and the vertical ring to give bending to the suspension wire. This should protect the suspension wire when removing it.



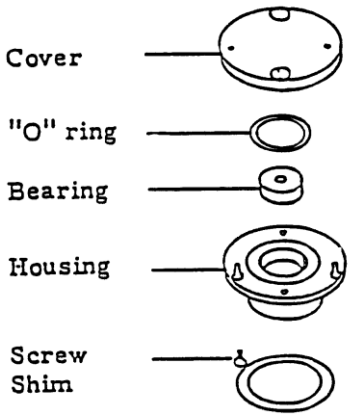
6. Remove the mounting screws of the clamp disk plate on the top of the suspension wire, and loosen the tangent screw to remove the clamp disk and the adjustment arm.
7. Remove the mounting screws at the bottom of the suspension wire. Hold the rotor with one hand to avoid twisting the suspension wire.
8. Pull the top of the suspension wire with hand (pull it up with fingers) to take out the suspension wire axis. Then take out the suspension wire through the slot in the vertical ring north side.
9. Insert Jig A (refer page 35) for upper vertical axis.
10. Remove the fitting plate. Length of the fitting plate mounting screw is 10mm. Be sure to use the same screw when reassembling.
11. Bring the vertical ring down with its north side below, and loosen the housing case mounting screws of the lower bearing to take out the housing case. Pay attention at this time on the numbers of the adjusting shim.

12. Loosen the mounting screws of the vertical lower axis to pull the axis out. Pay attention not to give damage on the bearing fitting surface of the axis.
13. Remove Jig A that was inserted in point 9.
14. Take the rotor case out of the vertical ring from south side.
15. Remove the fixing retainer of the upper bearing housing on the vertical ring to remove the housing case.



Cleaning and lubricating bearing of horizontal and vertical axes

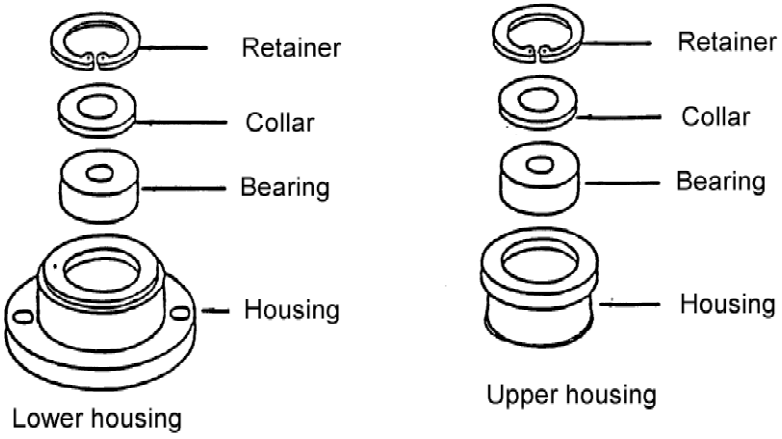
Horizontal bearing



1. Remove the housing cover mounting screws to take the bearing out. Pay attention on the numbers of the shim.
2. Clean the bearing according to the precautions described in page 35.

Vertical bearing

1. Remove each retainer of the upper and lower housings to take out the collar and bearing.
2. Clean the bearings according to the precautions described in page 35.



Lubrication for bearing

The bearing should be housed in the housing case with the side of better rotation upward when the bearing is inserted to the erected pincette upside down and turned slightly by hand.

Replace the bearing of poor rotation with a new one.

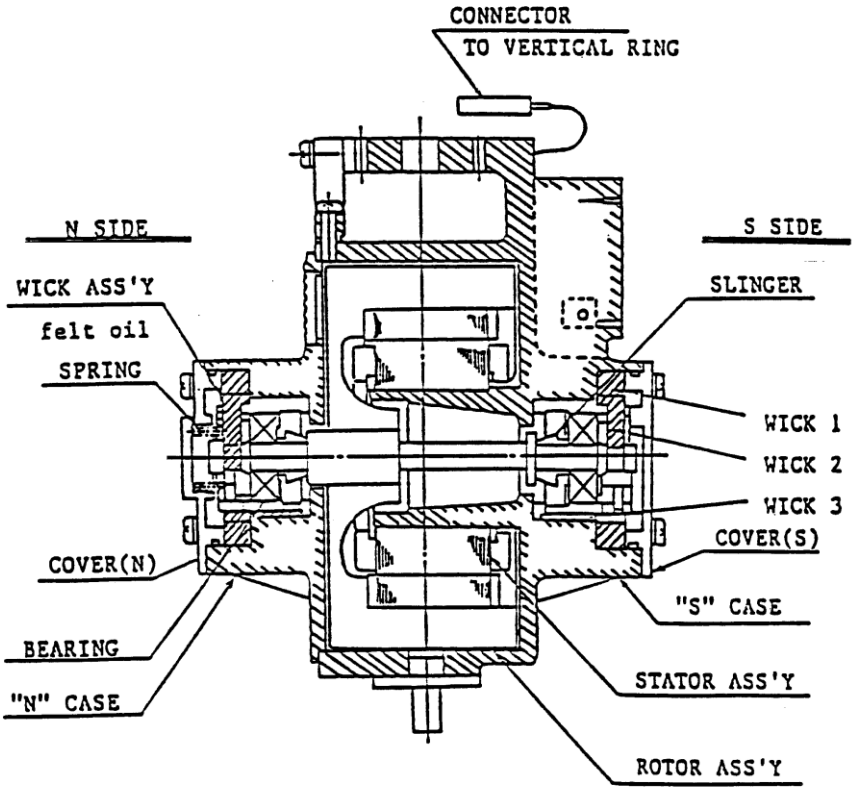
It is desirable to use the bearing of the best rotation for the vertical axis.

The best lubrication for the horizontal and vertical bearings is as follows:

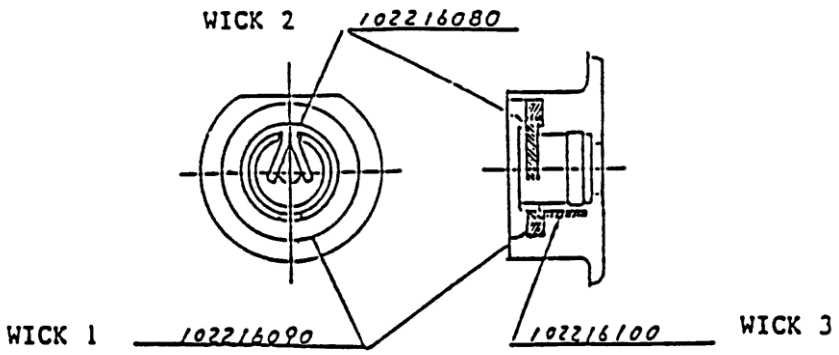
– Put 3-4 drops of DTE oil into the bearing and gently turn the bearing.

Disassembling rotor

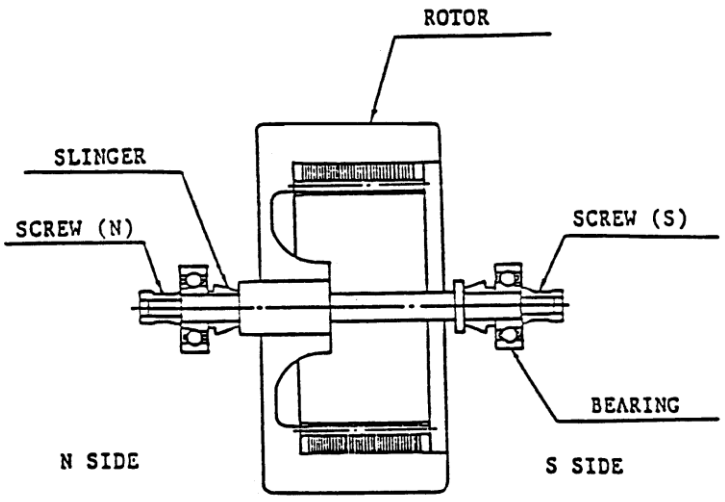
1. It is desirable to confirm the vibration state of the rotor running before disassembling.



2. With the north side up, loosen the cover mounting screws to take the cover off. As there is a spring inside the cover, do that while pushing the cover by hand.
3. There are three kinds of the oil wick. Confirm their condition and color changing. Reuse them after cleaning with white gasoline and drying if the color changing and wear conditions are normal.



4. Take out the oil wicks taking care not to damage them and pull the guide ring out.
5. Remove the fixing screws of the north side bearing.
6. With the south side up, loosen the cover mounting screws to take off the cover.
7. There are three kinds of oil wick. Confirm their condition and color changing. Reuse them after cleaning with white gasoline and drying if the color changing and wear condition are normal.
8. Take out the coil wicks taking care not to damage them, and pull out the guide ring.
9. Remove the bearing fixing screw. (Be careful this is a right-hand screw.
10. With the north side up, loosen the six fixing screws of the north side case to remove the case. Be careful not to damage the follow-up coil on the south side.
11. Take the rotor out of the south side case.
12. Remain the inner race of the rotor axis on the axis and clean it with gauze, etc. Do not take it out, and apply a drop of DTE oil if visual inspection finds no defect and blur.
    Be careful that when the inner race is removed, machining the rotor for balance may become necessary.
    Clean the outer ring and ball. Put 2 drops of oil after reassembled the outer bearing into the bearing. Then assemble them in the rotor after placing them on the tissue paper for about three minutes.



13. Take the bush and bearing out of the south and north side cases.
14. When replacing the rotor bearing with a new one, be careful that the machining rotor for balance may become necessary.
15. Always replace the complete bearing consisting of both the outer and inner ring.

Master Compass

1. Remove the slip ring brushes to clean the slip ring surface and the brush end surface. Use technical spirit to clean and aply CRC-5-56 on the slip ring surface afterwards.
2. Confirm the wear condition of the plate springs of the shock absorber and their effectiveness. (When necessary, replace them.)
3. As for disassembling the follow up servomotor and its assembly, and the syncro transmitter motor and its assembly, refer to the exchanging interval in table 3.

Confirmation of the condition of the items within the exchanging interval should be surely made too.

8.4 Assembling

Sensitive element

Assembling Rotor

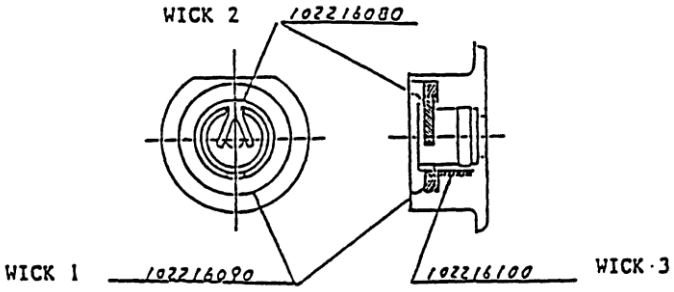
1. Install the bearings into the south and north side case with the surface having a stamp on the outer race outward. Tighten the fixing screws of the south and north side of the inner bearing.
2. Install the rotor into the south side case.
3. Install the north side case and tighten the six mounting screws. Ensure that you mount the case in the correct direction.

   The followings are common to the north and south without the special notice.

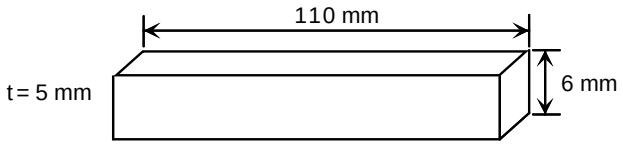
4. Install the bearing fixing bush (with the notch downward).
5. Install the guide ring into the housing case (with the notch outward and upward).
6. Install the oil wicks (three kinds).

– Remove the powder on the new oil wicks by air blow.

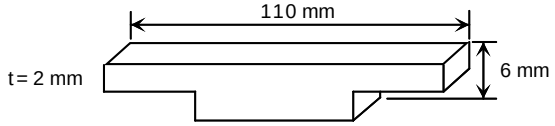
– Install the oil wicks carefully because the life of the rotor bearing is affected by their installed condition.



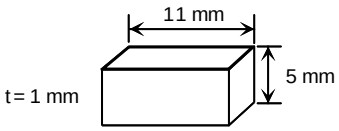
a) Place the oil wick - 1 (P/N 102216090) with its tip at the top.



b) Install the oil wick - 2 (P/N 102216090) so that its tip is inserted to the notch of the guide ring and lie along the axis. (Remember the condition when disassembling.)



c) Insert the oil wick - 3 (P/N 102216100) to the gap at the bottom of the busk case.



d) Pour 4 cc of DTE oil light at the one side of the wick. Pour the oil over the wick uniformly using an injector, etc.

7. Install the south side cover.

8. Place the spring in the north side and install the cover. Be careful not to damage the follow-up coil on the south side.

Notes !

a) After assembling, make sure the rotor has a spring action with swinging the rotor rather strongly in the direction of north and south while keeping the rotor horizontal by hand.

b) Make sure the vibration of the rotor when the power is supplied to the rotor only. (It is acceptable to have the same order vibration as before disassembling.)

   The vibration less than 0.5 micron is desirable at the top of the N/S side rotor axis when measuring with the vibration meter.

c) Stop the rotor with the opposite phase connection of the power supply.

Assembling the vertical ring

1. Install the housing case at the top of the vertical ring and fix with the retainer.
2. Place the rotor with the north side upward.
3. Insert the vertical ring and fix the upper portion (Jig-A) and the lower portion (Jig-B) using the vertical ring assembling jigs.
4. Mount the fixing plate for the rotor and the vertical ring. (The mounting screws are two of ø3 mm - 12mm length, and one of ø3 mm - 10 mm length.)
5. Mount the balance weight on the north side of the rotor.
6. Pull out the lower jig and mount the lower axis. Then mount the housing case of the lower bearing. (Be careful of the clearance adjusting shim.)
7. Erect the vertical ring assembly.
8. Pull out the upper jig and mount the suspension wire assembly. Tighten the mounting screws of the suspension wire while pushing the rotor slightly with hand. Tightening the screws with pushing the vertical ring strongly may cause damage of the suspension wire.
9. Mount the clamp disk and the arm at the top of the suspension and tighten the tangent screw slightly.
10. Measure the clearance of the lower axis to be 0.35mm (hardly) and 0.40 mm (softly). Be sure the rotor moves slightly up and down with this clearance.
11. Mount the flexible wire assembly of the suspension wire section with (Jig C). Be careful not to damage the flexible wire.

12. Arrange the flexible wire in a good shape. Arrange in roundness as far as possible.
13. Mount the upper and lower connector on top of the vertical ring supporting the three 100V three phase. Be careful not to damage the wire.
14. Adjust the twist of the suspension wire. Align to the mark line.
15. Make sure the suspension wire swings about seven times to and from.
16. Adjust the north-south/east-west balance.

Assembling the liquid ballistic assembly

1. Cover the pick up coil with a vinyl pouch. Bring the lead wire outside through the gap between the balance weight supporting pole and the projection of the liquid ballistic.
2. Mount the liquid ballistic frame on the vertical ring so that the frame center is set at the center of the vertical ring. Be careful to not damage the coils.
3. Insert a 2 mm thick gap gauge (made of bakelite or acrylic plate) between the secondary and the primary coil. This to ensure correct distance between the coils when tightening the mounting screws on the liquid ballistic frame.
4. Mount the upper air pipe of the liquid ballistic on the liquid ballistic container. Pay attention to the O ring.

Assembling the horizontal ring

1. Insert the vertical ring into the horizontal ring while keeping the vertical ring aslant and mount the east side horizontal axis.
2. Mount the east/west bearing housing cases.
3. Tighten the locknut of the east side horizontal axis (round). Make sure the clearance in the east-west direction of the horizontal ring.
4. Put the two lead wires from the liquid ballistic (orange/green) on from back side of the connector.
5. Mount the support plate of the flexible wire. The clearance between the pin connector and the horizontal ring is about 1 mm.)
6. Put the five flexible wire pins in the connector.
7. Mount the west side acrylic cover.

Mounting sensitive element

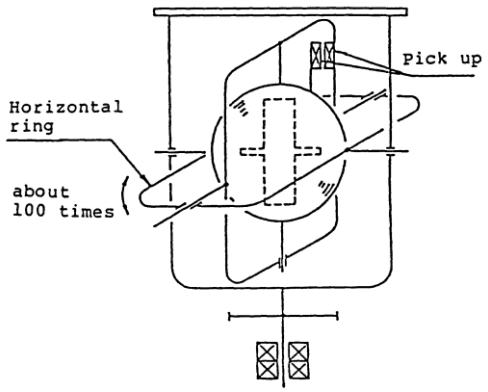
1. Place the rubber or wood block (6 mm thick) on the phantom ring.
2. Mount the sensitive element on the phantom ring while keeping the sensitive element horizontal.
3. Mount the south/north axes of the horizontal ring.
4. Mount the south/north housing cases of the phantom ring and make sure the clearance in the north-south direction. (Pay attention to the clearance adjusting shim.)
5. Put the flexible wires (five) in the south side connector of the phantom ring.
6. Remove the rubber or wood block.

8.5 Adjustment

1. Make adjustment after 2 ~ 3 hours running.
2. Adjust level of the horizontal ring within 2 minutes arc.
3. Refer to:
   - Figure 6-1 page 28 for Level adjustment
   - Figure 6-2 page 28 for Azimuth adjustment
   - Figure 6-3 page 29 for Damping ratio adjustment

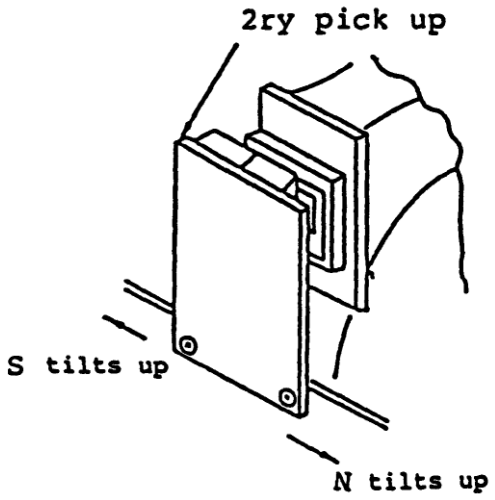
Adjustment of the pick up coil position for perpendicularity of the gyro spinning axis/horizontal axis.

1. Make sure the master compass is stopped.
2. Give a large swing to the horizontal ring about 100 times (to and from) by hand. Make sure not to touch the stopper.



When the movement is more than five minutes observed on the boble level, do as followes:

3. When the N side of the spinning axis tilts up, loosen the mounting screws of the 2ry pick up coil to move it in the east direction by beating slightly with a screwdriver, and tighten the screw.
4. When the S side tilts up, move the 2ry coil in the west direction.
5. Perform the test again (2) to check the level movement.



Note! *Large aberration of the pick up coil to the above each axis may cause error of the gyro when the ship is rolling.*

8.6 Final confirmation

Necessary items should be recorded referring to the check sheet in the separated table.

8.7 CHECK SHEET FOR RGC50

Ship name	Owner	Service Engineer
Ser. No.	Rotor no.	Date of Service

Mechanical Inspection

Sensitive element

1. Tightening all screws.
2. Gap between phantom ring and horizontal ring (10/100)
3. Gap between horizontal ring and horizontal ring axis (10' ~ 20')
4. Gap of vertical ring lower axis (0.35 ~ 0.40 mm)
5. Gap between follow up coils (2.0 ±0.2 mm)
6. Free swinging of suspension wire (7 swings)
7. Oil leakage from liquid ballistic
8. Arrangement of harness/flexible lead wires.
9. Soldering points.

Master compass

1. Tightening all screws.
2. Check shock absorber.
3. Fixing of slip rings and brush.
4. Engagement of transmitter gear and azimuth gear.
5. Engagement of servomotor gear and azimuth gear.
6. Fixing of connector, arrangement of harness.
7. Soldering at transformer and phantom element.
8. Damper oil leakage from phantom element.

9. Non contact between turning phantom ring and others (clearance should be more than 2 mm.)

Phantom ring harness:	Rubber line mounting plate
Buffer amplifier:	Shock absorber/Power supply line harness/Servomotor harness
	Horizontal ring weight mounting/Vertical ring upper portion.
Horizontal ring flexible lead:	Outside cover/Inside bearing portion.
Horizontal ring inside:	Liquid ballistic pipe/Frame weight mounting/Phantom ring lower portion.
Vertical ring upper portion:	Card lamp.

General inspection

Inverter Output (400 Hz)

8-10 AC 110V ±5V _____ V

1. Zero adjustment of 1X, 90X synchro.
2. Lighting of card illumination.
3. GAIN adjustment
4. Perpendicularly test of pick up coil.
5. Damping test

   Fa = ±0.30 ±0.07 Fa =

   T = 72.4' ±7' T =
6. Settling test

   The meridian ±2° 50' ±5

   Swinging amplitude

   P-P = 3° or less

* Perform the following when necessary.

7. Repeatability

   3° or less
8. Swinging test

   ±1°
9. Inclination

   P-P = 3° or less

10. Turning

    ±15°

11. Vibration

    ±1.5°

12. Others

    Damping weight (one side) _____gr

    Swinging weight (one side) _____gr

    Mounting of liquid ballistic weight

13. Package

    Protection of suspension wire (Insertion of shim at upper and lower portion)

    Fixing of rotor case (with sponges two positions)

    Fixing of horizontal ring (with insular rocks two positions)

    Fixing of vertical ring (rubber washer)

    Fixing of phantom ring/vertical ring

    Fixing of shock absorber (with packing four positions)

9 TROUBLESHOOTING

It is essential that the operator fully understand the operations of the gyrocompass so that he can find out such problems as excessive noise, heat and vibration, as early as possible.

Troubleshooting charts:

Chart 1	Green POWER light does not light.
Chart 2	Red TIMER indicator of power supply does not light.
Chart 3	Defective master compass - Gyro rotor does not rotate.
Chart 4	Defective master compass - Compass card rotates in one direction only.
Chart 5	Defective master compass - Compass card hunts.
Chart 6	Defective master compass - Rotor case does not stand up (or no synchronization).
Chart 7	Defective master compass - Excessive noise or vibration from rotor case.
Chart 8	Improper voltage from the power supply.
Chart 9	Defective timer circuit.
Chart 10	Compass error.

Chart 1

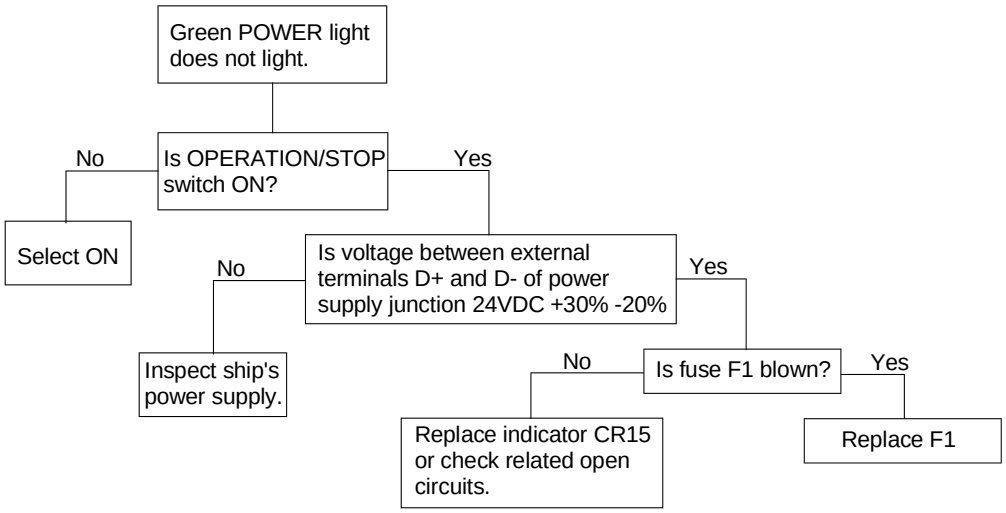


Chart 2

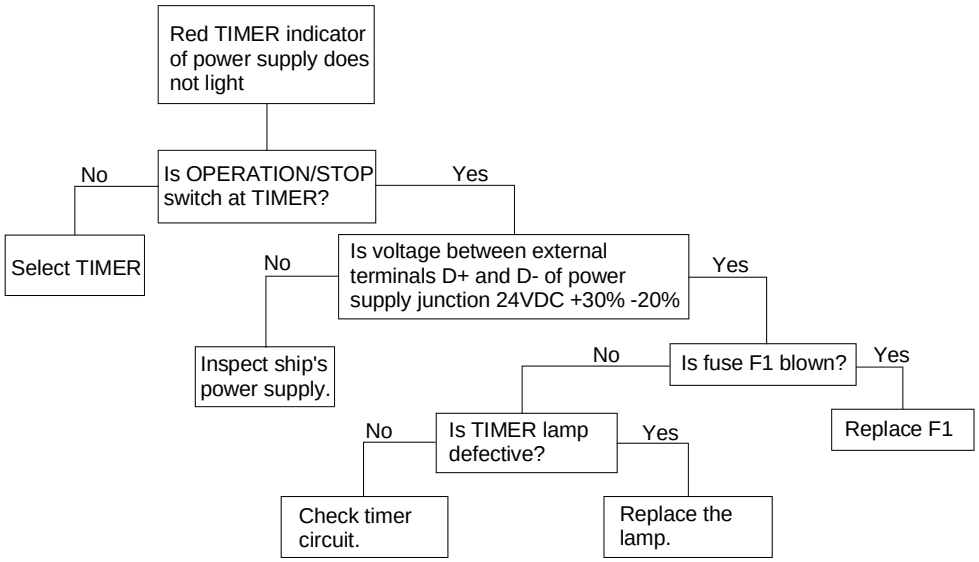


Chart 3

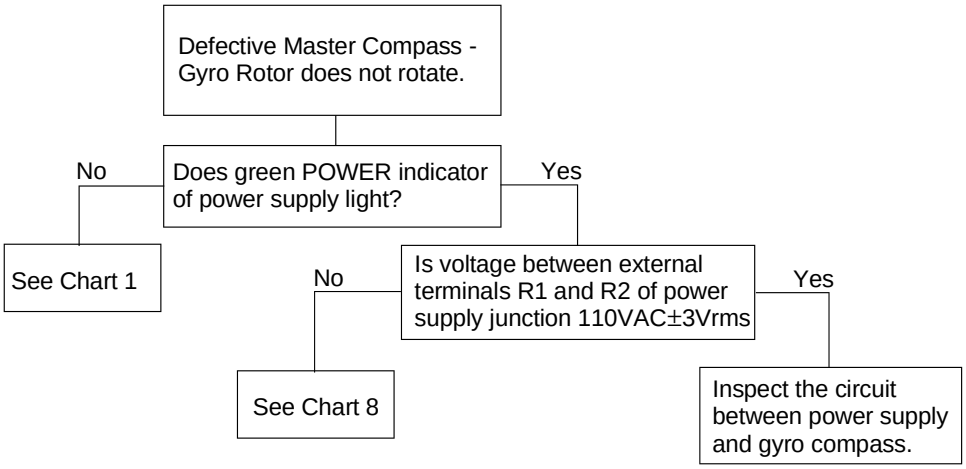


Chart 4

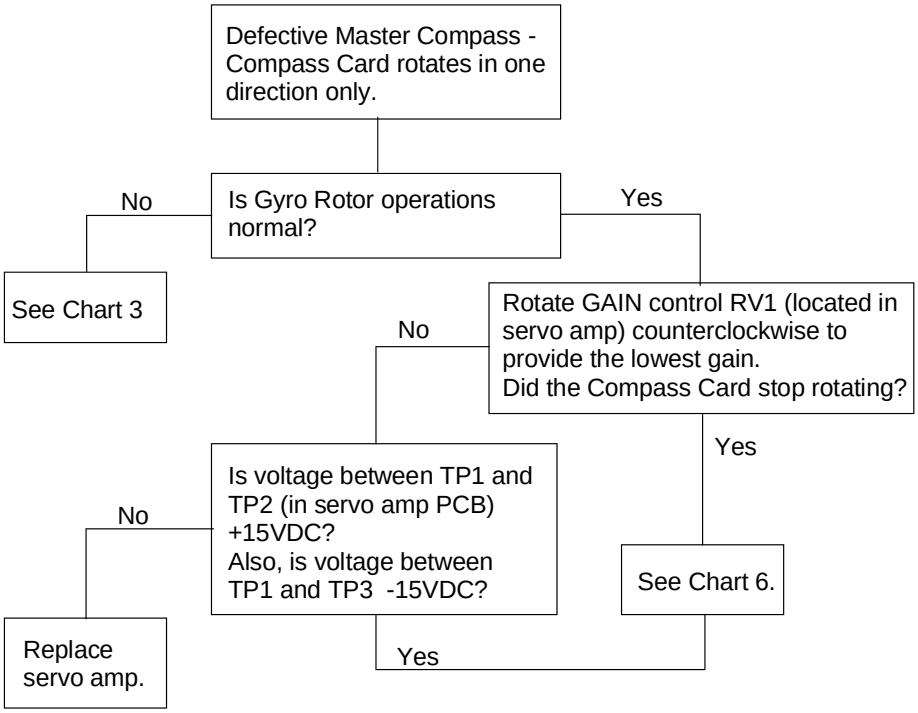
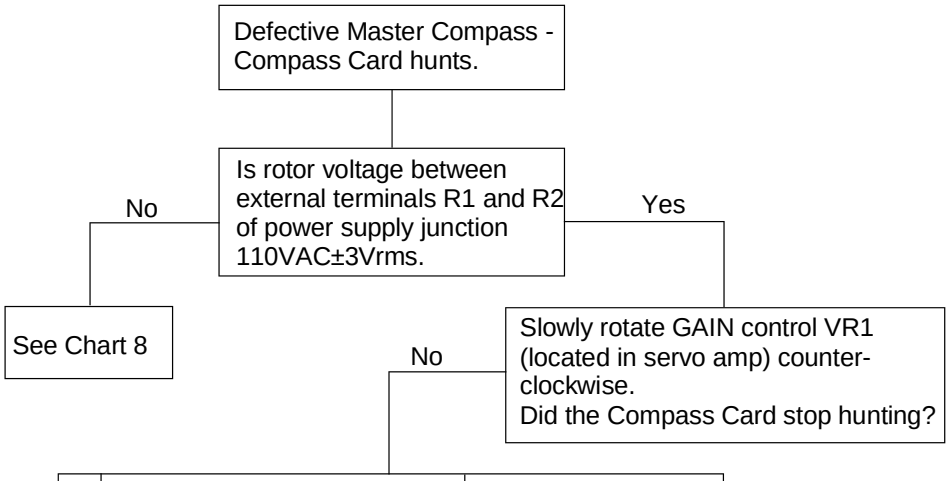
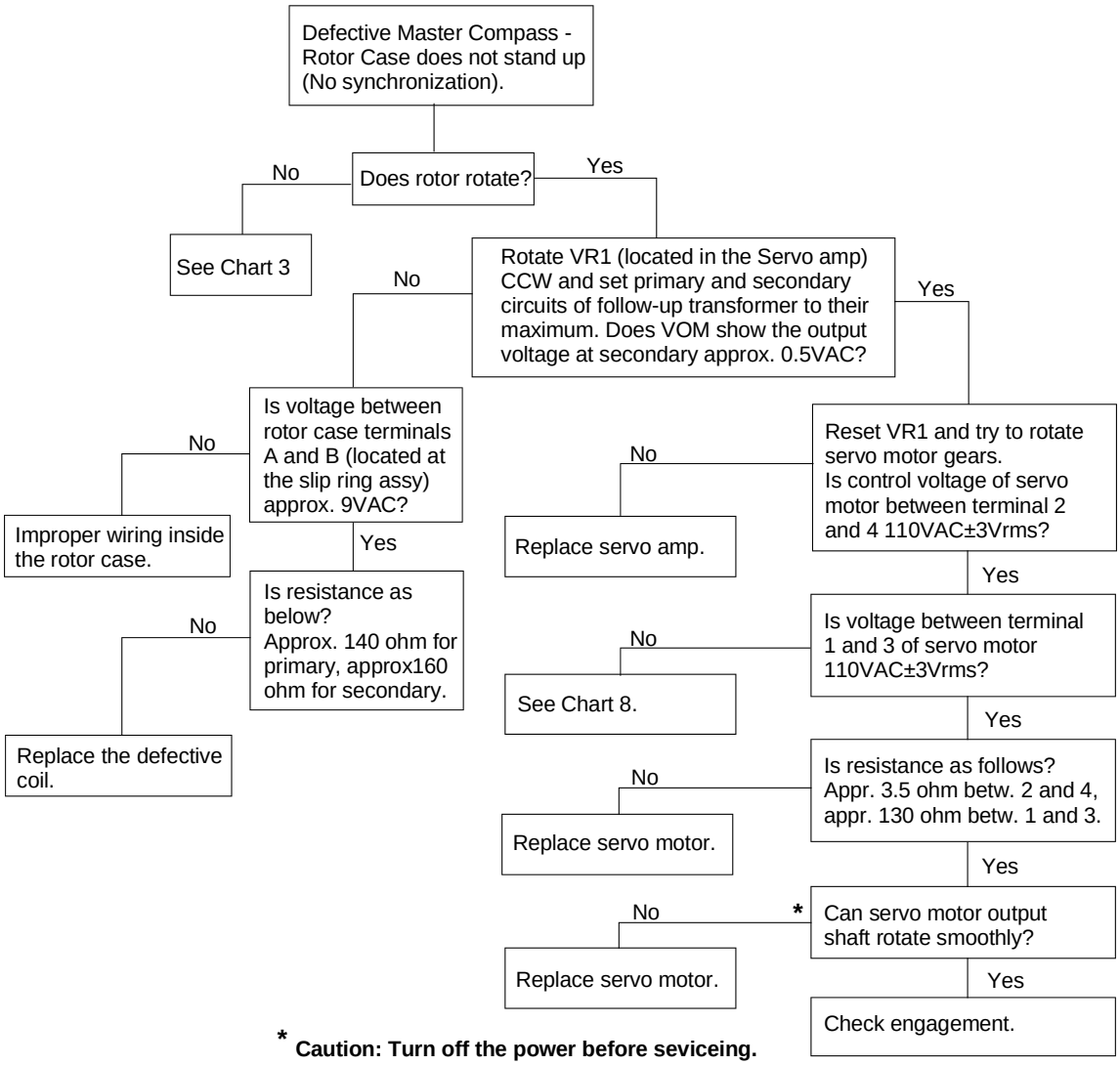


Chart 5



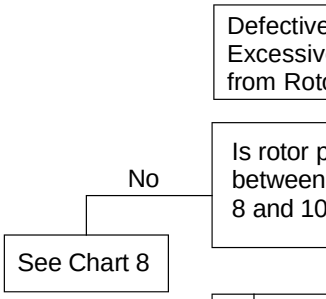
	Problem	Remedy
1	Excessive hunting may occur due to the short-circuited follow-up transformer.	Call for service
2	When the ship turns, hunting may occur due to improper contact of slip ring of master compass.	Polish the slip ring.

Chart 6



*** Caution: Turn off the power before seviceing.**

Chart 7



	Problem	Remedy
1	Only an abnormal noise.	No service is required. The vibration should be closely monitored.
2	Abnormal noise and vibration are generated during start and stop.	No service is required now. The vibration should be closely monitored.
3	Abnormal noise and vibration.	Call for service, although operations can be continued for a while.
4	Bubble in the rotor case leveler cannot be read due to the vibration. (Also, an excessive noise).	Stop the system and call for service.

Chart 8

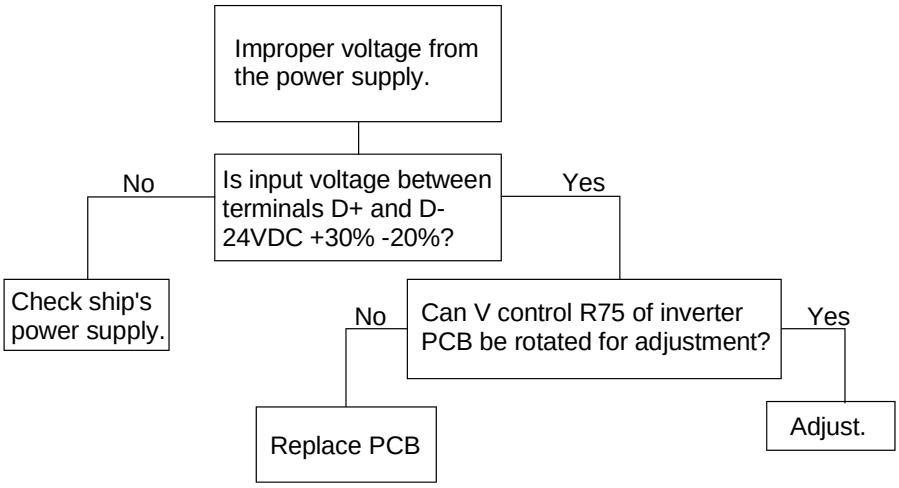
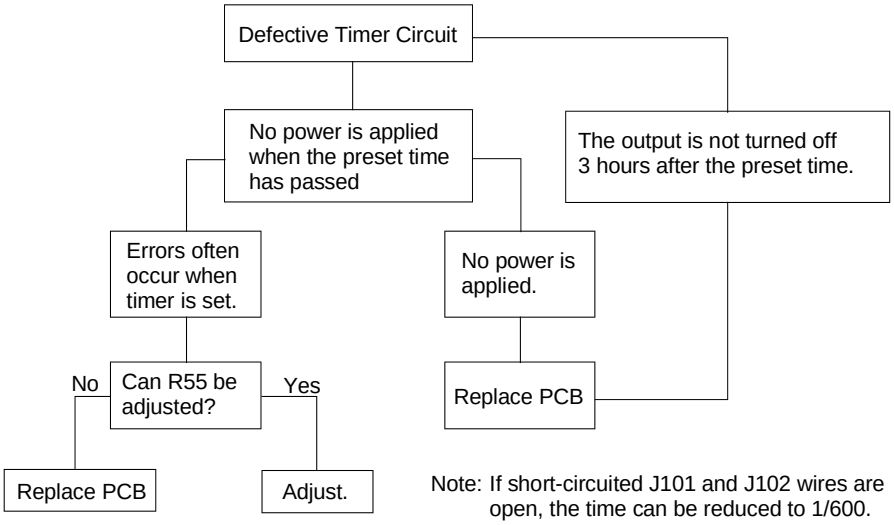
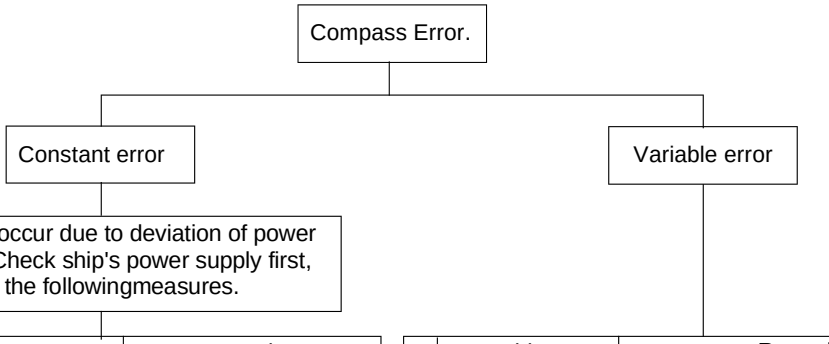


Chart 9



Note: If short-circuited J101 and J102 wires are open, the time can be reduced to 1/600. They must be reset after servicing.

Chart 10



	Problem	Remedy
1	Errors within 5 degrees occur.	Inspect the sensitive element and repair if necessary. Adjustment should be made by the service personnel.
2	Excessively large error may occur due to flexible leads contacting adjacent components, or due to twisted suspension wires (due to loose upper screws).	Adjust carefully in either case.

	Problem	Remedy
1	Errors within 5 degrees occur.	Check for loose connections, contact of flexible wires of vertical and horizontal axes, poor contact of slip ring, excessively thight engagement between servomotor and gears, and malfunction in follow-up circuit. Note: Adjustment should be made by service personnel.
2	Large errors occur.	Check for open contacts, poor contact of slip ring, damaget servomotor bearings, oil leakage from Liquid Ballistics, and failed follow-up circuit. Note: Adjustment should be made by service personnel at the field or in the factory.

10 PARTS LIST

10.1 General

This section contains the parts list and assembly drawings for the RGC50. The assembly drawings consist of a list for all mechanical parts that go into manufacturing the assembly, with physical identification and location of each part by part callout (PC) numbers. In addition, the quantity of each part required per assembly is given, and the part number that each part is composed of.

Note! *Part numbers shown in brackets are Tokimec part numbers.*

10.2 Spare parts

The following items are the only replacement parts that are recommended to be kept as spares for the RGC50 and the accessory equipment. If any parts other than the ones listed here require replacement, refer the service to a qualified RGC50 service dealer.

P/N 44137610 LAMP 24V 2W BA-9S/13 Timer ON:

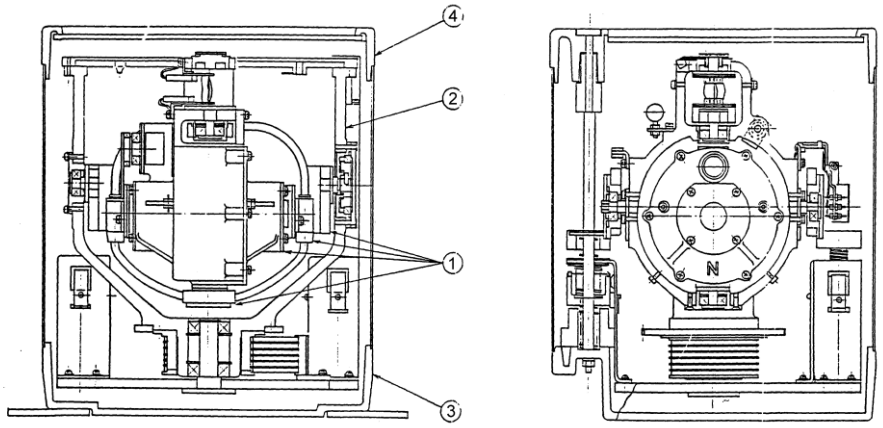
P/N 44137743 LAMP 12V/60mA Compass card

P/N 44138436 FUSE: 5A, 6x30

10.3 Parts List

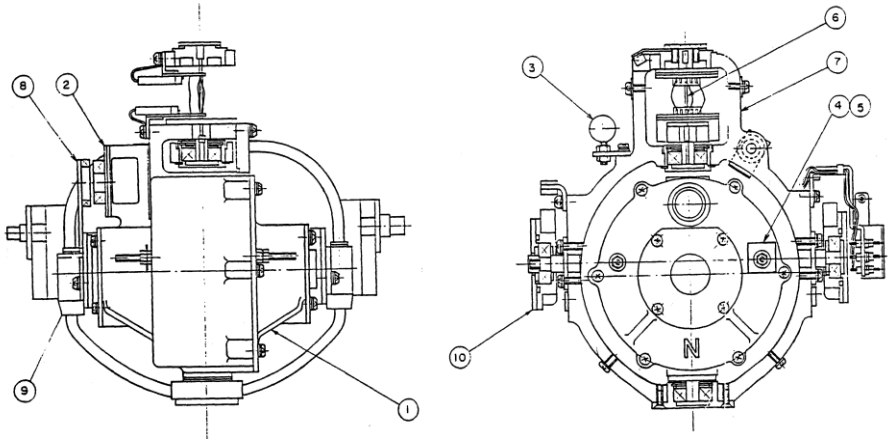
Syb. mark	PC No.	Nomenclature	Description	Part no.
	1	Master Compass		(102296340)
	2	Static Inverter		27101427 (102296090)

10.4 RGC50 Master Compass



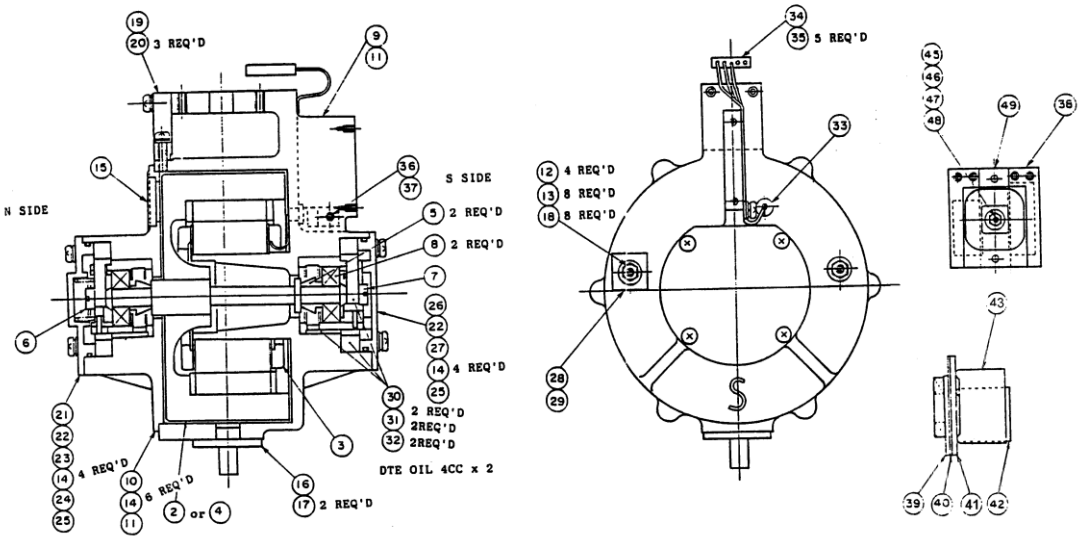
Symb. No.	PC No.	Nomenclature	Description	Part no.
		Master Compass		**(102296340)**
	1	Sensitive element		44137313 (102296350)
	2	Phantom Ring Ass'y		(102295980)
	3	Binnacle ass'y		(102296030)
	4	Cover ass'y		(102296520)
B2		Servo motor	15SM	44176964 (102290861)
B3		Synchro Transmitter	15C x 4	(102290850)
B4		Synchro Transmitter	15C x 6	(100380100)
L1-L4		Lamp	12V T-1, 32	(100370130)
A3		IC	SI-1020G	(102129040)
T1		Transformer		(100377151)
		Servo Amp. PCB		(102296380)
		Coil Ass'y Primary	Pick-up	(102295840)
		Coil Ass'y Secondary	Pick-up	(102295850)
R90		Buffer Amp. PCB		(102296400)
R90		Resistor	1.5K, 10W	(100310900)

Sensitive Element



Syb. mark	PC No.	Nomenclature	Description	Part no.
		Sensitive element ass'y		**44137313 (102296350)**
	1	Gyro ass'y		(102296220)
	2	Follow-up transformer	Primary side	44137354 (102295841)
	3	Level ass'y		(102290690)
	4	Damping weight		44137958 (102200921)
	5	Damping weight		44137966 (102200931)
	6	Suspension wire ass'y	Six wire type	44137396 (102297140)
	7	Vertical ring ass'y		(102295760)
	8	Follow-up transformer	Secondary side	(102295851)
	9	Liquid ballistic		44137412 (102295880)
	10	Horizontal ring ass'y		(102295890)

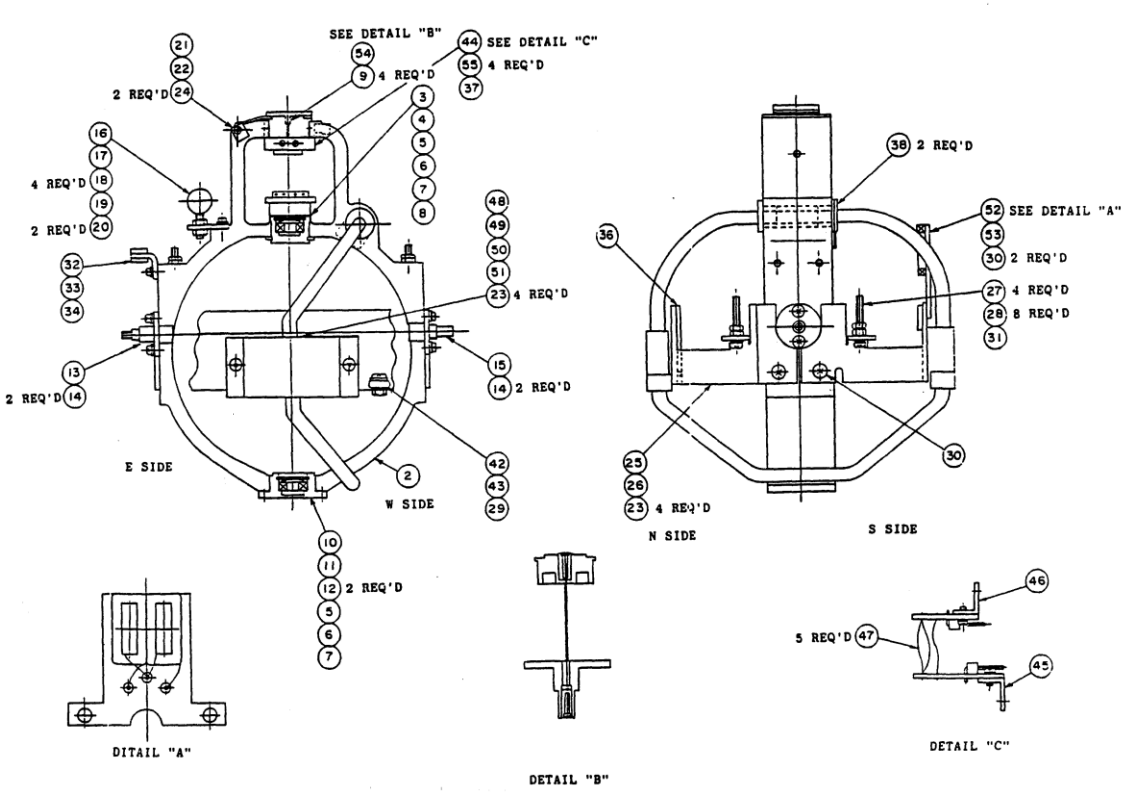
Gyro Assembly



Syb. mark	PC No.	Nomenclature	Description	Part no.
		Gyro ass'y		**(102296220)**
	2	Rotor ass'y	#4,5,6,7 and 8	(102296230)
	3	Stator ass'y		(102296241)
	4	Rotor ass'y		(102296251)
	5	Slinger		(102215690)
	6	Screw (N)		(102215700)
	7	Screw (S)		(102215710)
	8	Bearing	Ø6 x ø19 x 6	44177418 (102216991)
	9	Case		(102216120)
	10	Case		(102216130)
	11	Screw set		(000840082)
	12	Screw, flat		(000630202)
	13	Nut		(002630002)
	14	Screw, pan		(000503082)
	15	Glass		(102102090)
	16	Shaft		(102216021)
	17	Screw flat		(000630062)
	18	Washer spring		(003830002)
	19	Plate		(102216031)
	20	Screw, pan		(000503102)
	21	Color (N)		(102215630)
	22	Spring pin		(004916062)

Syb. mark	PC No.	Nomenclature	Description	Part no.
	23	Cover (N)		(102216040)
	24	Spring	SUS304-WPB	(102216050)
	25	“O” ring		74137800 (007902817)
	26	Color (S)		(102216060)
	27	Cover (S)		(102216070)
	28	Damping weight		74137958 (102200921)
	29	Damping weight		44137966 (102200931)
	30	Wick	FELT 110 x 6/4 x 2	74137974 (102216080)
	31	Wick	FELT 110 x 6 x 5	44137982) (102216090)
	32	Wick	FELT 11 x 5 x 1	44137990 (102216100)
	33	Packing		(102216110)
	34	Connector housing		(100386550)
	35	Receptacle		(100386560)
	36	Holder, wire		(102216140)
	37	Screw, pan		(000503062)
	38	Follow-up transformer	Primary side	44137354 (102295841)
	39	Primary coil		(102215180)
	40	Plate		(102215200)
	41	Printed circuit board		(102215211)
	42	Capacitor	2.2µF 100V	(100326650)
	43	Capacitor	0.22µF 400V	(100326660)
	44	Screw, pan		(000502082)
	45	Screw, flat		(000620084)
	46	Washer		(003720004)
	47	Washer spring		(003820002)
	48	Nut		(002520004)
	49	Shim		(102215230)

Vertical Ring Assembly

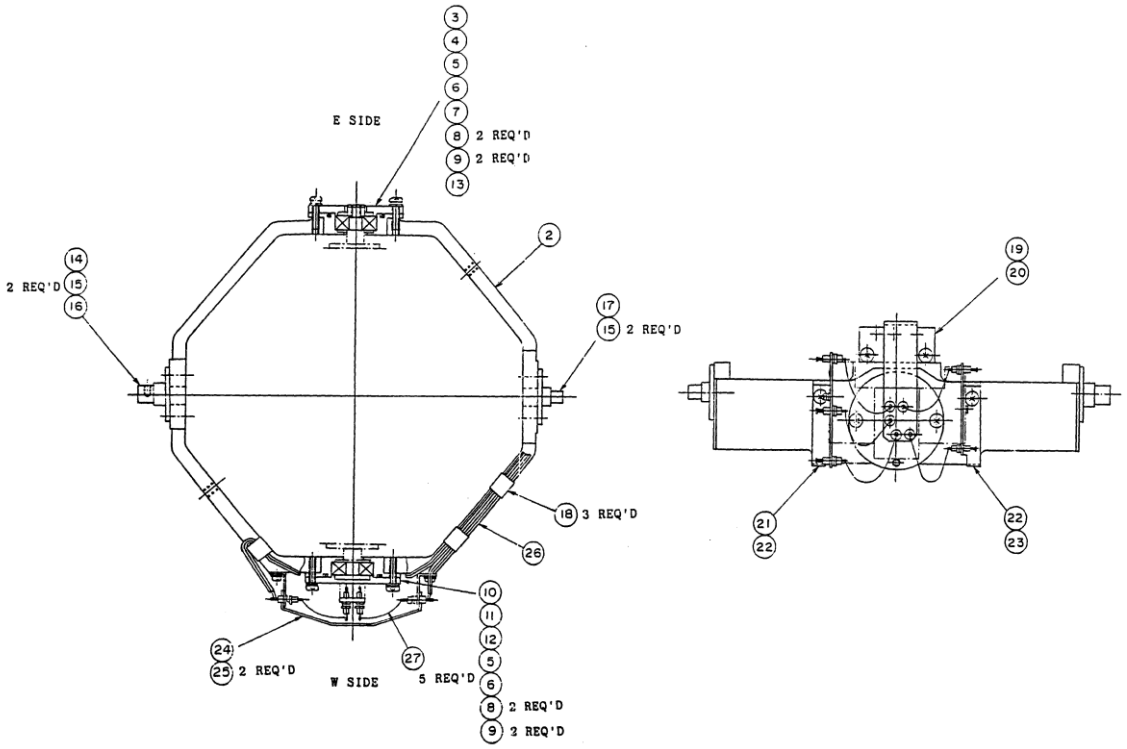


Syb. mark	PC No.	Nomenclature	Description	Part no.
		Vertical ring ass'y		(102295760)
	2	Vertical ring		(102216151)
	3	Housing A ass'y	Up side	(102295770)
	4	Housing A		(102216791)
	5	Bearing ball	ø6 x ø19 x 6	44137495 (102103260)
	6	Spacer		(102215080)
	7	Retainer		(006901372)
	8	Retainer		(006902452)
	9	Screw, plain M3x8		(000630082)
	10	Housing B ass'y	Down side	(102295780)
	11	Housing B		(102216800)
	12	Screw, plain M3 x 8		(000603082)
	13	Shaft	E side	(102215100)
	14	Screw, pan M3 x 8		(000503082)
	15	Shaft	W side	(102215110)
	16	Level ass'y		(102290690)
	17	Level		(102191210)

Syb. mark	PC No.	Nomenclature	Description	Part no.
	18	Nut, hexagon M3		(002630002)
	19	Plate		(102201141)
	20	Screw, pan M3 x 8		(000503082)
	21	Arm		(102215120)
	22	Plate		(102202921)
	23	Screw M3 x 8		(000630082)
	24	Screw		(102103221)
	25	Flame ass'y		(102295790)
	26	Flame		(102215133)
	27	Screw M3 x 20		(000503202)
	28	Nut M3		(002630002)
	29	Nutsert		(010401360)
	30	Screw plain M3 x 8		(000503082)
	31	Washer spring		(003830002)
	32	Stopper		(102103120)
	33	Screw pan M4 x 20		(000504142)
	34	Washer		(003540002)
	35	Screw plain M3 x 8		(000630082)
	36	Weight t2		(102216341)
	37	Holder (1) wire		(102203001)
	38	Bush		(102203010)
	39	Holder (2) wire		(102203020)
	40	Holder (3) wire		(102203030)
	41	Holder (4) wire		(102203040)
	42	Stopper		(102202991)
	43	Ring rubber		(102205720)
	44	Flexible wire ass'y		44137545 (102295800)
	45	PCB A ass'y		(102295810)
	46	PCB B ass'y		(102295820)
	47	Flexible wire	Ø0.03/5 Cu l25	
	48	Liquid ballistic ass'y		74137412 (102295880)
	49	Pipe air		(102201220)

Syb. mark	PC No.	Nomenclature	Description	Part no.
	50	“O” ring		44137818 (007900817)
	51	Galden MS	For ballistic liquid 4.6cc	44138360
	52	Follow-up transformer	Secondary side	(102295851)
	53	Shim	For gap adj. 0.1	44137925
	53’	Shim	For gap adj. 0.05	44137933
	54	Suspension wire ass’y	Six wire type	44137396 (102297140)
	55	Screw pan M3 x 6		(000503062)
	56	Shim	For down shaft	(102215640)
	57	Shim	For down housing t0.1	(102215670)
	58	Shim	For down housing t0.05	(102216510)

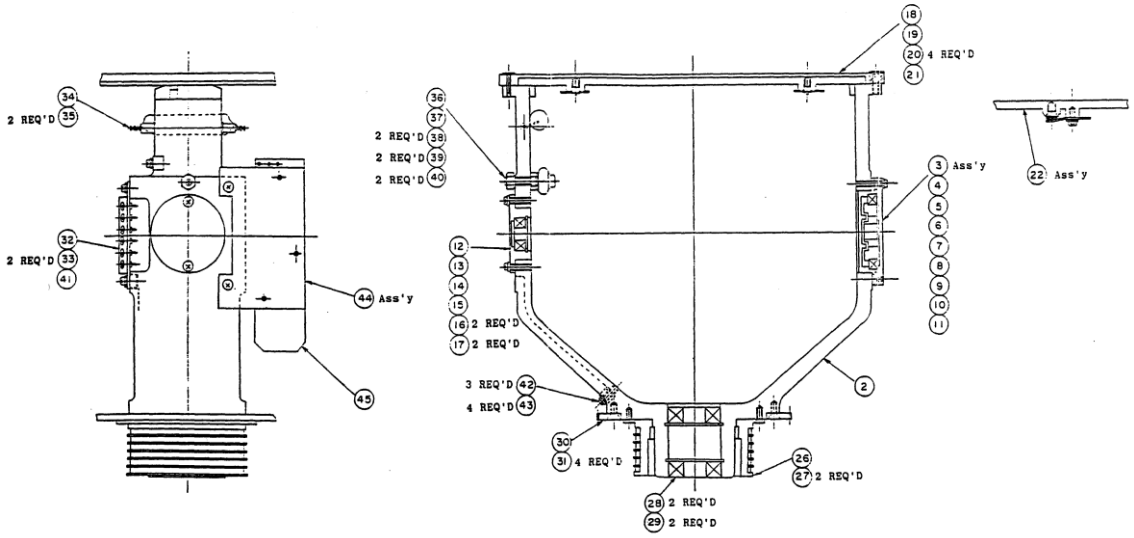
Horizontal Ring Axis



Syb. mark	PC No.	Nomenclature	Description	Part no.
		Horizontal ring ass'y		**(102295890)**
	2	Horizontal ring		(102215292)
	3	Housing A ass'y	E side	(102295900)
	4	Housing		(102215300)
	5	Bearing ball	ø6 x ø19 x 6	44137495 (102103260)
	6	"O" ring		44137826 (007902017)
	7	Cover	E side	(102215321)
	8	Screw, plain M3 x 5		(000630052)
	9	Screw, pan M3 x 10		(000503102)
	10	Housing ass'y	W side	(102295910)
	11	Housing		(102215300)
	12	Cover	W side	(102215330)
	13	Screw		(102215310)
	14	Shaft	N side	44177012 (102201331)

Syb. mark	PC No.	Nomenclature	Description	Part no.
	15	Screw, plain M3 x 8		(000630082)
	16	Screw		(000830052)
	17	Shaft	S side	44177020 (102201341)
	18	Holder, wire		(102214081)
	19	Plate ass'y		(102295940)
	20	Screw		(000503082)
	21	Plate ass'y		(102295950)
	22	Screw		(000503082)
	23	Plate ass'y		(102295960)
	24	Cover		44137727 (102215371)
	25	Screw, pan M2 x 5		(000502052)
	26	Harness		(102295922)
	27	Wire, flexible		44137552 (102295970)
	28	Shim (t:0.1)	For horizontal axis	44137909 (102215680)
	29	Shim (t:0.05)	For horizontal axis	44137919 (102216530)

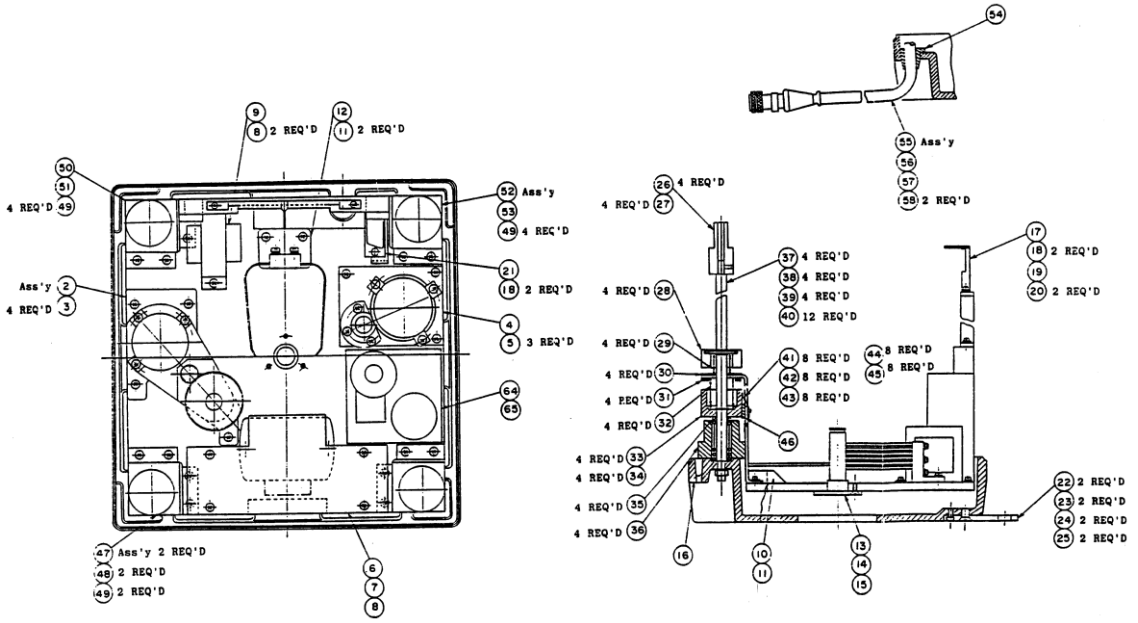
Phantom Ring Assembly



Syb. mark	PC No.	Nomenclature	Description	Part no.
	1	Phantom ring ass'y		(102295980)
	2	Phantom ring		(102203430
	3	Housing A ass'y	N side	(102295990
	4	Housing	N	(102215380
	5	Bearing		44137511 (102201370)
	6	Collar		(102215390)
	7	Cover		(102201391)
	8	"O" ring		(007902917)
	9	Screw, pan M3 x 12		(000503122)
	10	Screw, plain M3 x 6		(000630062)
	11	Damper, oil	Silicone oil, 100000cs 0.7cc	44138378 (102215300)
	12	Housing ass'y	S side	(102291081)
	13	Housing	S	(102201403)
	14	Bearing		(007206061)
	15	Retainer		(006901352)
	16	Screw, pan M3 x 10		(000503102)
	17	Shim		(102202150)
	18	Card ass'y		(102292141)
	19	Card		(102203453)

Syb. mark	PC No.	Nomenclature	Description	Part no.
	20	Screw, pan M3 x 8		(000503082)
	21	Pin, straight		(004720052)
	22	Illumination panel ass'y		(102292150)
	23	Terminal		(102205651)
	24	Lamp		(100370130)
	25	Screw, pan M3 x 6		(000503062)
	26	Slip ring ass'y		(102296012)
	27	Screw, plain M3 x 8		(000630082)
	28	Bearing, ball	ø12 x ø28 x 8	(007260011)
	29	Retainer		(006901442)
	30	Gear, spur		(102201424)
	31	Screw, plain M3 x 8		(000630082)
	32	Plate ass'y		(102296000)
	33	Screw, pan M3 x 8		(000503082)
	34	Resistor	1.5kΩ, 10W	(100310900)
	35	Pin		(083314111)
	36	Stopper		(102103120)
	37	Screw, pan M4 x 25		(000540252)
	38	Washer, plain M4		(003740002)
	39	Washer, spring M4		(003840002)
	40	Nut, hexagon M4		(002540004)
	41	Harness		(102292101)
	42	Holder, wire		(102203052)
	43	Screw, pan M3 x 6		(000503062)
	44	Buffer Amp. Ass'y		(102296460)
	45	Buffer Amp.		44141463 (102296400)

Binnacle

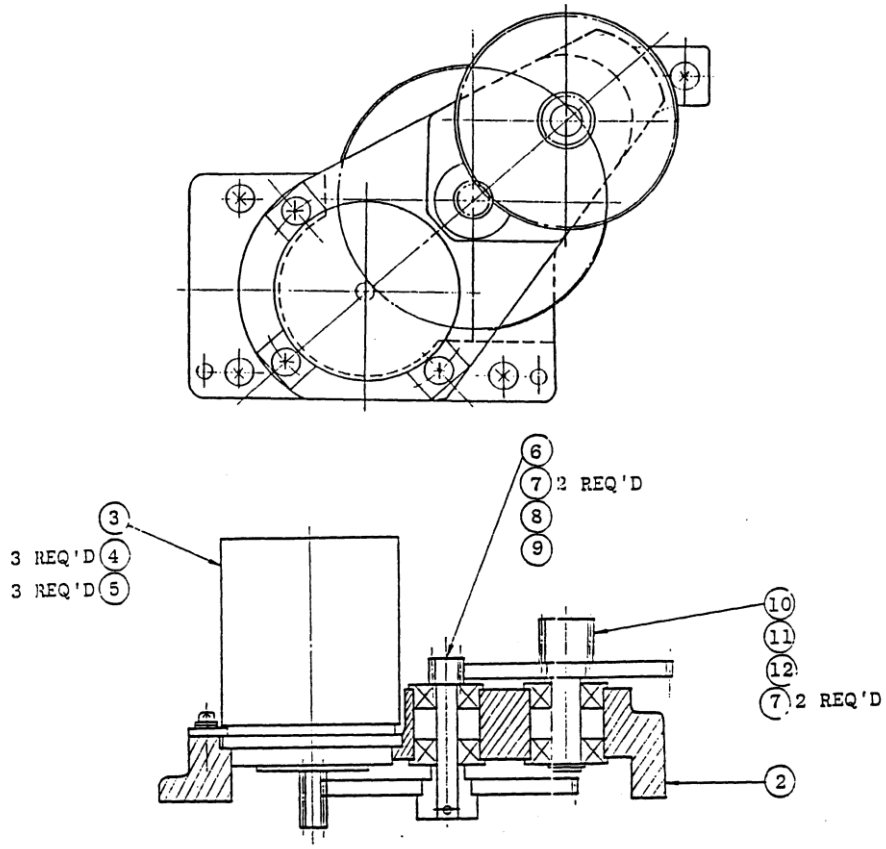


Syb. mark	PC No.	Nomenclature	Description	Part no.
	1	Binnacle		(102296030)
	2	Azimuth motor ass’y		(102290802)
		Servo motor		44176964
	3	Screw, pan M3 x 12		(000503122)
	4	Transmitter PCB		44176774 (102290831)
	5	Screw, pan M3 x 14		(000503142)
	6	Follow-up amplifier ass’y		(102291760)
	7	Support		(084222211)
	8	Screw, pan M3 x 8		(000503082)
	9	Transformer		(100377151)
	10	IC		(102129040)
	11	Screw, pan M3 x 10		(000503102)
	12	Brush ass’y		44137578 (102296510)
	13	Shaft		(102201671)
	14	Screw, plain M3 x 8		(000630082)
	15	Retainer		(006902352)
	16	Base		(102203514)

Syb. mark	PC No.	Nomenclature	Description	Part no.
	17	Pointer ass'y		(102291652)
	18	Screw, pan M3 x 6		(000503062)
	19	Bridge		(102203462)
	20	Screw, pan M4 x 10		(000504102)
	21	Stand	For connector	(102202902)
	22	Plate		(102203521)
	23	Screw, pan M3 x 6		(000530062)
	24	Washer, spring M3		(003830002)
	25	Screw, plain M5 x 8		(000650082)
	26	Shaft		(102203541)
	27	Screw, set M3 x		(000830052)
	28	Stopper ass'y		(102290931)
	29	Spring, coil		(102201812)
	30	Plate		(102201820)
	31	Cushion		(102213210)
	32	Spring, coil		(102201803)
	33	Cup		(102208034)
	34	"O" ring		(007902117)
	35	Spring, coil		(102208051)
	36	Shock absorber		(102208170)
	37	Shaft		(102201775)
	38	Washer, spring M6		(003860002)
	39	Nut, hexagon M6		(002560004)
	40	Retainer		(102202060)
	41	Spring, plate		(102201751)
	42	Screw, pan M2x 3		(000520032)
	43	Washer, plain M2		(003720002)
	44	Washer, spring		(003820002)
	45	Plate		(102213200)
	46	Stopper		(102208181)
	47	Shock absorber ass'y		(102290945)
	48	Stand		(102201863)
	49	Screw, pan M3 x 10		(000503102)

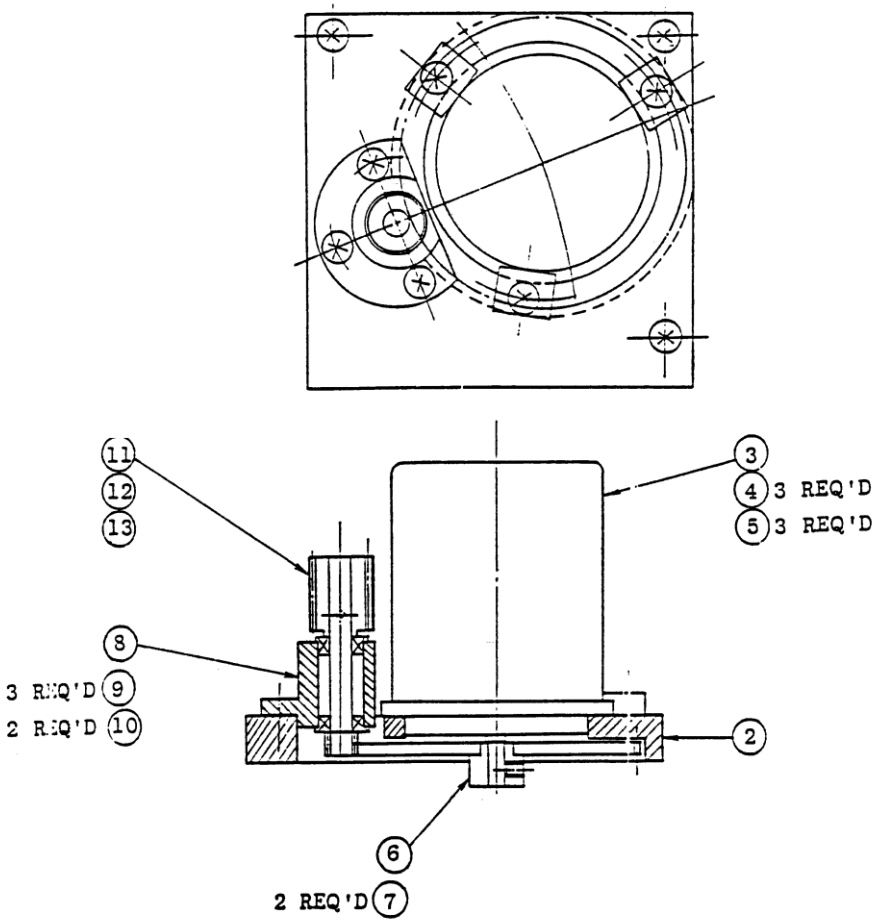
Syb. mark	PC No.	Nomenclature	Description	Part no.
	50	Shock absorber ass'y		(102290895)
	51	Stand		(102202942)
	52	Shock absorber ass'y		(102290926)
	53	Stand		(102201854)
	54	Seal		(102203532)
	55	Cable ass'y		(102296080)
	56	Connector		(084121014)
	57	Clamp		(100305710)
	58	Screw		(100305690)
	59	Harbess		(102296360)
	60	Clamp		(009907120)
	61	Clamp		(009907110)
	62	Retainer		(102207050)
	63	Screw, pan M3 x 10		(000503102)
	64	Transmitter ass'y	90x option	44141695 (102295441)
	65	Screw, pan M3 x 12	90x option	(000503122)

Azimuth Motor Ass'y



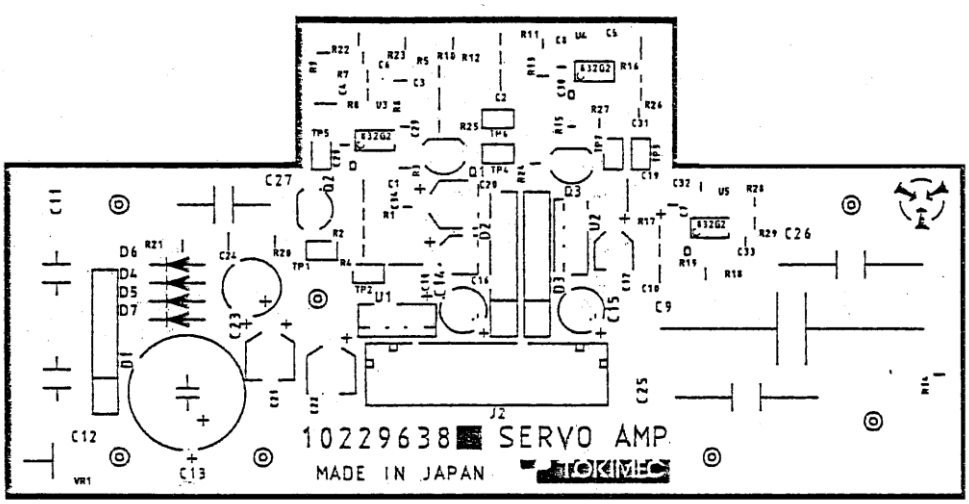
Syb. mark	PC No.	Nomenclature	Description	Part no.
	1	Azimuth motor ass'y		(102290802)
	2	Housing		(102201452)
	3	Servo motor		44176964 (102290861)
	4	Plate, retainer		(102201470)
	5	Screw, PAN M3 x 8	ø4 x ø13 x 5	(000503082)
	6	Gear		(102212010)
	7	Bearing		(102201490)
	8	Gear		(102290811)
	9	Pin, roll		(004916127)
	10	Gear		(102290822)
	11	Collar		(102201550)
	12	Retainer		(006902292)

Transmitter assy



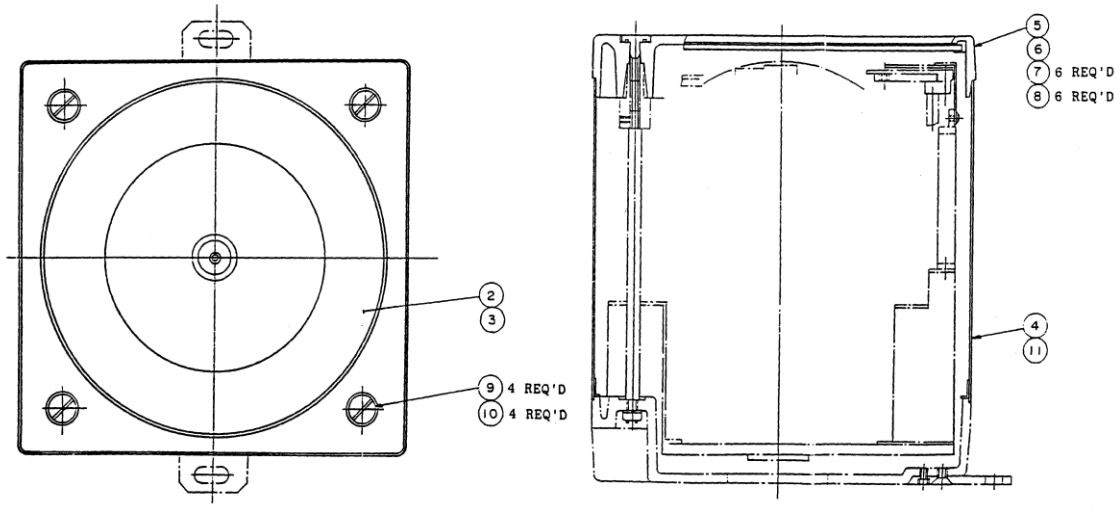
Syb. mark	PC No.	Nomenclature	Description	Part no.
	1	Transmitter ass'y		(102290831)
	2	Housing		(102201572)
	3	Transmitter	15c x 4	(102290850)
	4	Plate, retainer		(102201611)
	5	Screw, PAN M3 x 10		(000503102)
	6	Gear		(102290840)
	7	Screw, SET M3 x 4		(000830041)
	8	Housing		(102201621)
	9	Screw, PAN M3 x 8		(000503082)
	10	Bearing, ball		(102213190)
	11	Gear		(102201642)
	12	Gear		(102201651)
	13	Pin, roll		(004912122)

Follow-up amplifier PCB



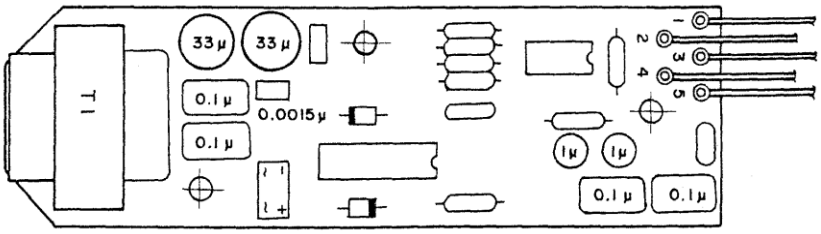
Syb. mark	PC No.	Nomenclature	Description	Part no.
		Follow-up amplifier ass'y		44176733

Cover Ass'y



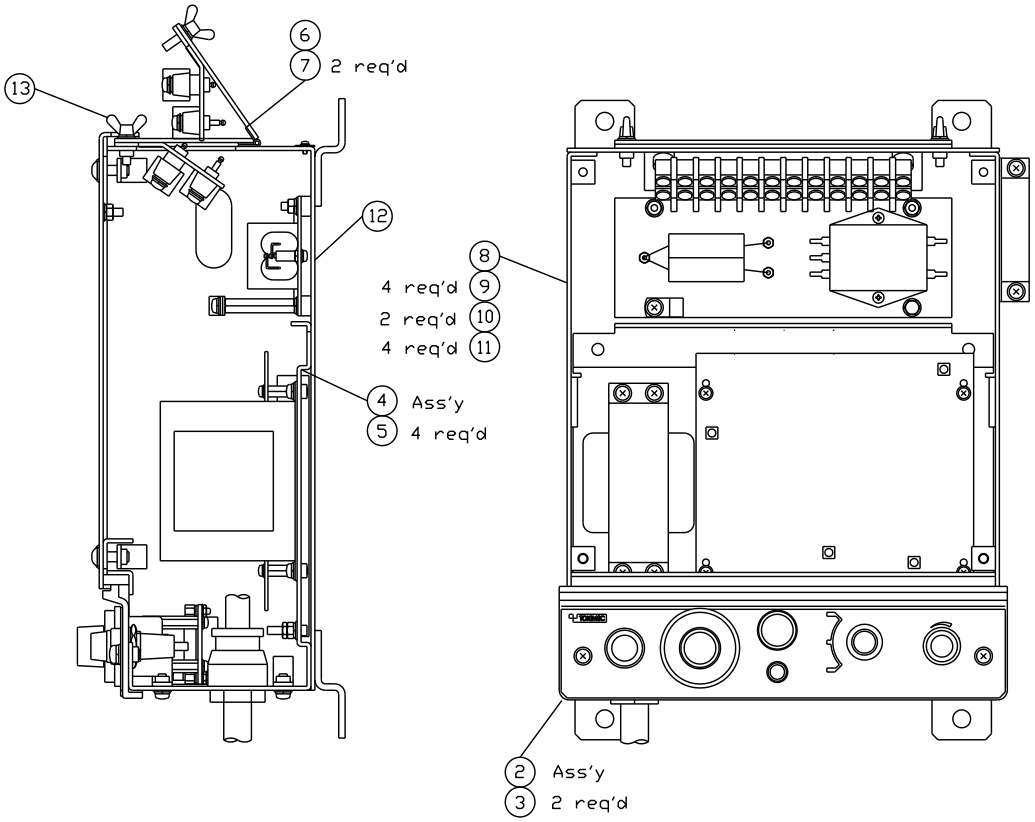
Syb. mark	PC No.	Nomenclature	Description	Part no.
	1	Cover ass'y		(102296520
	2	Glass		44137776 (102295211)
	3	Name plate		
	4	Cover		(102203558)
	5	Panel		(102203563)
	6	Seal		(102203583)
	7	Plate		(102203592)
	8	Screw, PAN M3 x 6		(000503062)
	9	"O" ring		(007901217)
	10	Screw		(102203600)
	11	Name plate		

Buffer Amplifier PCB

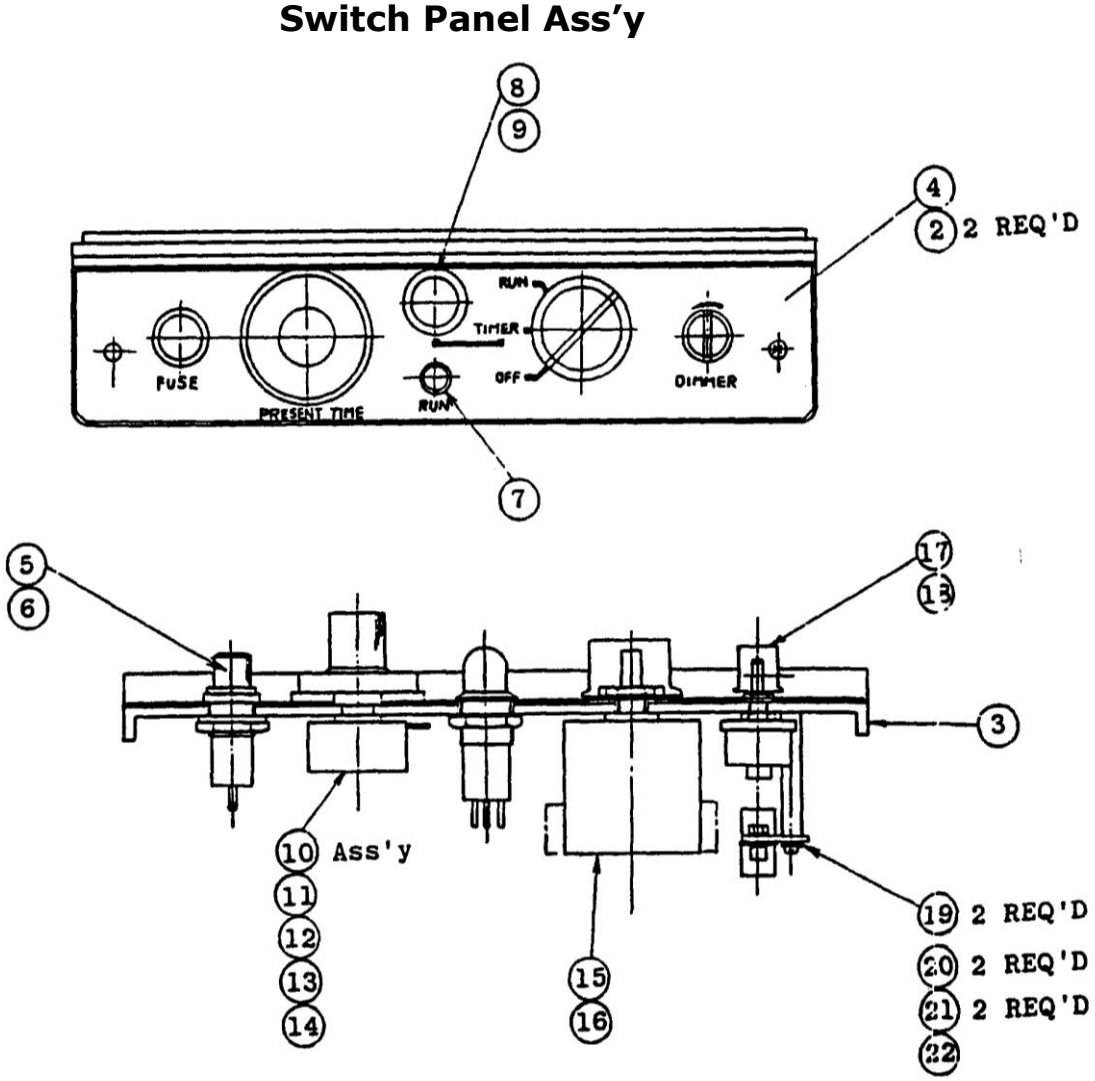


Syb. mark	PC No.	Nomenclature	Description	Part no.
		Buffer amplifier a'ssy		44141463

10.5 Static Inverter



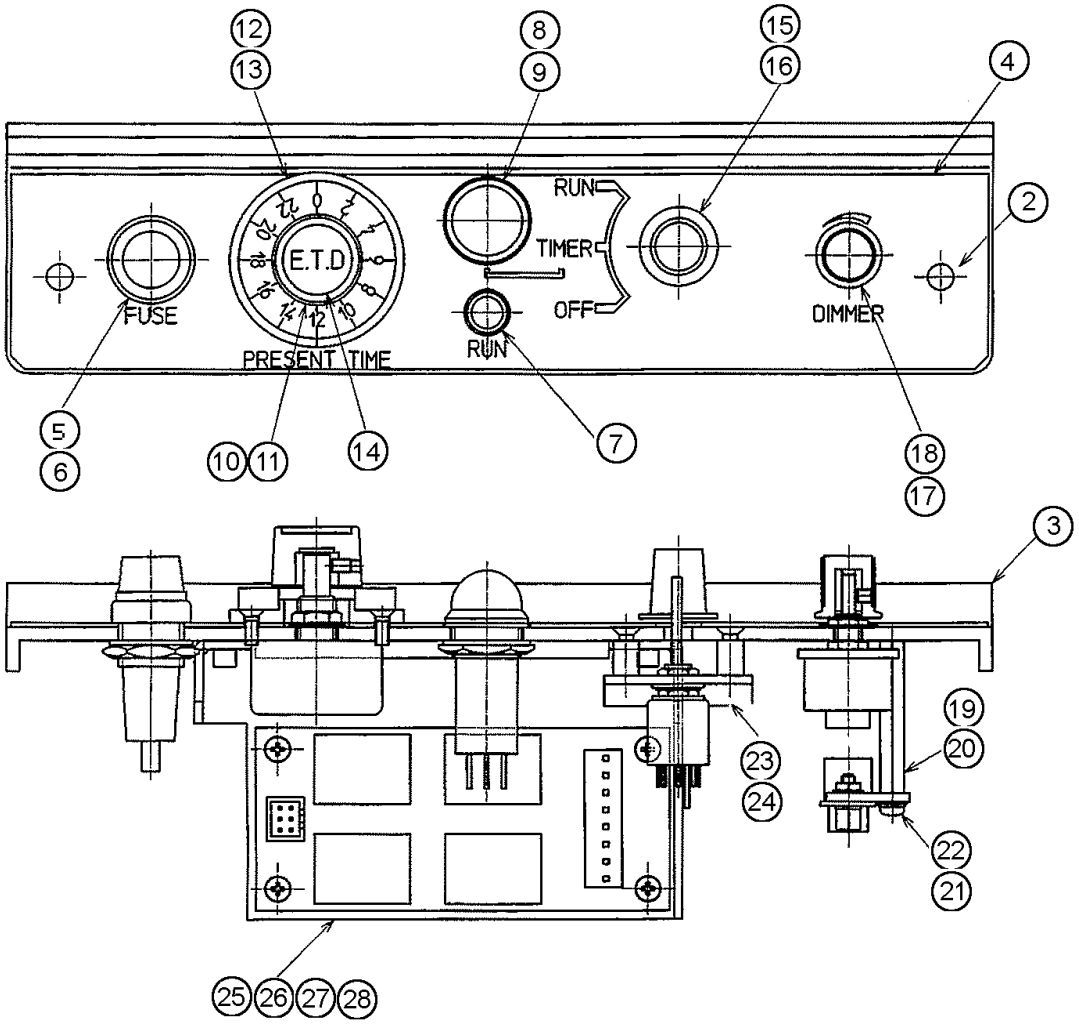
Syb. mark	PC No.	Nomenclature	Description	Part no.
	1	Static Inverter		27101427 (102296090)
	2	Switch panel ass'y		(102292340)
	3	Screw, PAN M5 x 12		(000504102)
	4	Chassis ass'y		(102296100)
	5	Screw, PAN M4 x 10		(000504102)
	6	Cover	Rear	(102214250)
	7	Hinge		(102214261)
	8	Cover		(102203645)
	9	Screw, M5 x 15		(102203661)
	10	Blind plug		(102203651)
	11	Gasket		(102203670)
	12	Case		(102214640)
	13	Screw	Wing	(200212030)
T1		Transformer		(100377680)
NS1		Filter		(100377031)



Switch Panel Ass'y, previous version.
Valid for Master Compass with ser. no. M7173 and below

Symb. No.	PC No.	Nomenclature	Description	Part no.
	1	Switch panel ass'y		(102292348)
	2	Screw, PAN M5 x 12		(000505122)
	3	Panel		(102203866)
	4	Name Plate		(102208542)
XF1	5	Holder, fuse		(082315111)
F1	6	Fuse element	5A	(082315018)
CR15	7	LED	SDB205B	(100370050)
XPL1	8	Holder, Lamp		(114500640)
PL1	9	Lamp	24V, 2W	(081000010)
	10	Setting dial		(102292350)
	11	Knob		(102205600)
	12	Dial plate		(102205580)
	13	Base		(102205590)
R42	14	Resistor, variable	500Kohm	(042145504)
S1	15	Switch	Parts no longer available. Complete Switch Panel Ass'y to be replaced with new version.	
	16	Knob		
R41	17	Resistor, variable	1Kohm, 10W	RVF10SE15R1K-KK
	18	Knob		(100307240)
	19	Support		(200220120)
	20	Screw, plain M3 x 8		(000630084)
	21	Screw, PAN M3 x 8		(000503082)
	22	Plate		(102203882)

Switch Panel Parts, previous version

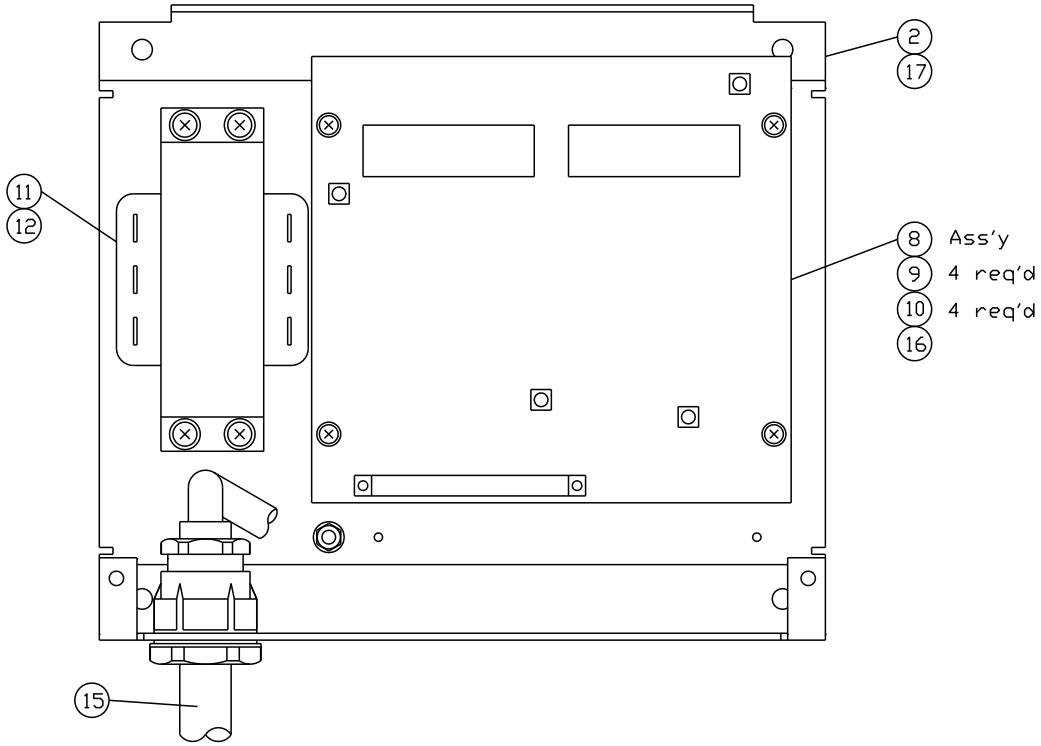


Switch Panel Ass'y, new version.
Valid for Master Compass ser. no. M7174 onwards

Symb. No.	PC No.	Nomenclature	Description	Part no.
	1	Switch panel ass'y		(102292348)
	2	Screw, PAN M5 x 12		(000505122)
	3	Panel		(102203866)
	4	Name Plate		(102208542)
XF1	5	Holder, fuse		(082315111)
F1	6	Fuse element	5A	(082315018)
CR15	7	LED	SDB205B	(100370050)
XPL1	8	Holder, Lamp		(114500640)
PL1	9	Lamp	24V, 2W	(081000010)
	10	Setting dial		(102292350)
	11	Knob		(102205600)
	12	Dial plate		(102205580)
	13	Base		(102205590)
R42	14	Resistor, variable	500Kohm	(042145504)
S1	15	Switch		MRX-204
	16	Knob		AT-4104
R41	17	Resistor, variable	100Kohm	(042114104)
	18	Knob		(100307240)
	19	Support		(200220120)
	20	Screw, plain M3 x 8		(000630084)
	21	Screw, PAN M3 x 8		(000503082)
	22	Plate		(102203882)
	23	Plate		(10222106-)
	24	Screw, Flat M3X6		(2-000630062)
	25	Support Plate		(10222105-)
	26	Screw, Flat M3X6		(2-000630062)
	27	SWRY pwb		(10229911-)
	28	Screw, Pan M3X8		(4-000503082)

Switch Panel Parts, new version

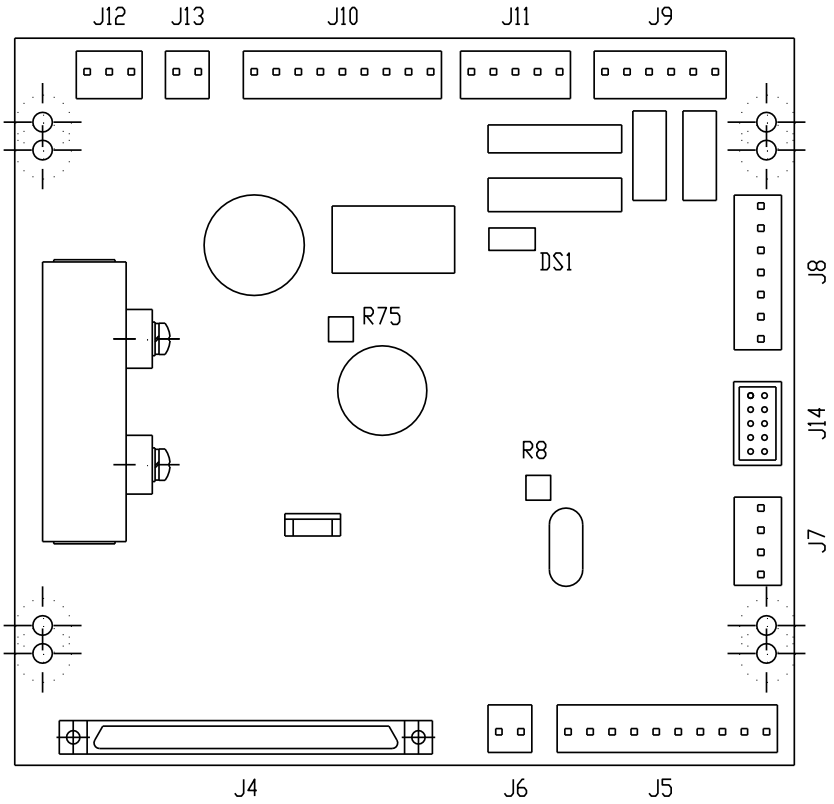
Chassis Assembly



Syb. mark	PC No.	Nomenclature	Description	Part no.
	1	Chassis ass'y		(102296100)
	2	Chassis		(102215481)
	8	Inverter ass'y		27101559 (102295745)
	9	Screw, PAN M3 x 10		(000503102)
	10	Support		(102220190)
	11	Transformer		(100377680)
	12	Screw, PAN M4 x 8		(000504082)
	15	Cable ass'y		(102296110)
	16	Harness	Main	(102296210)
	17	Harness		(102295430)

Chassis Assembly

Inverter board PCB



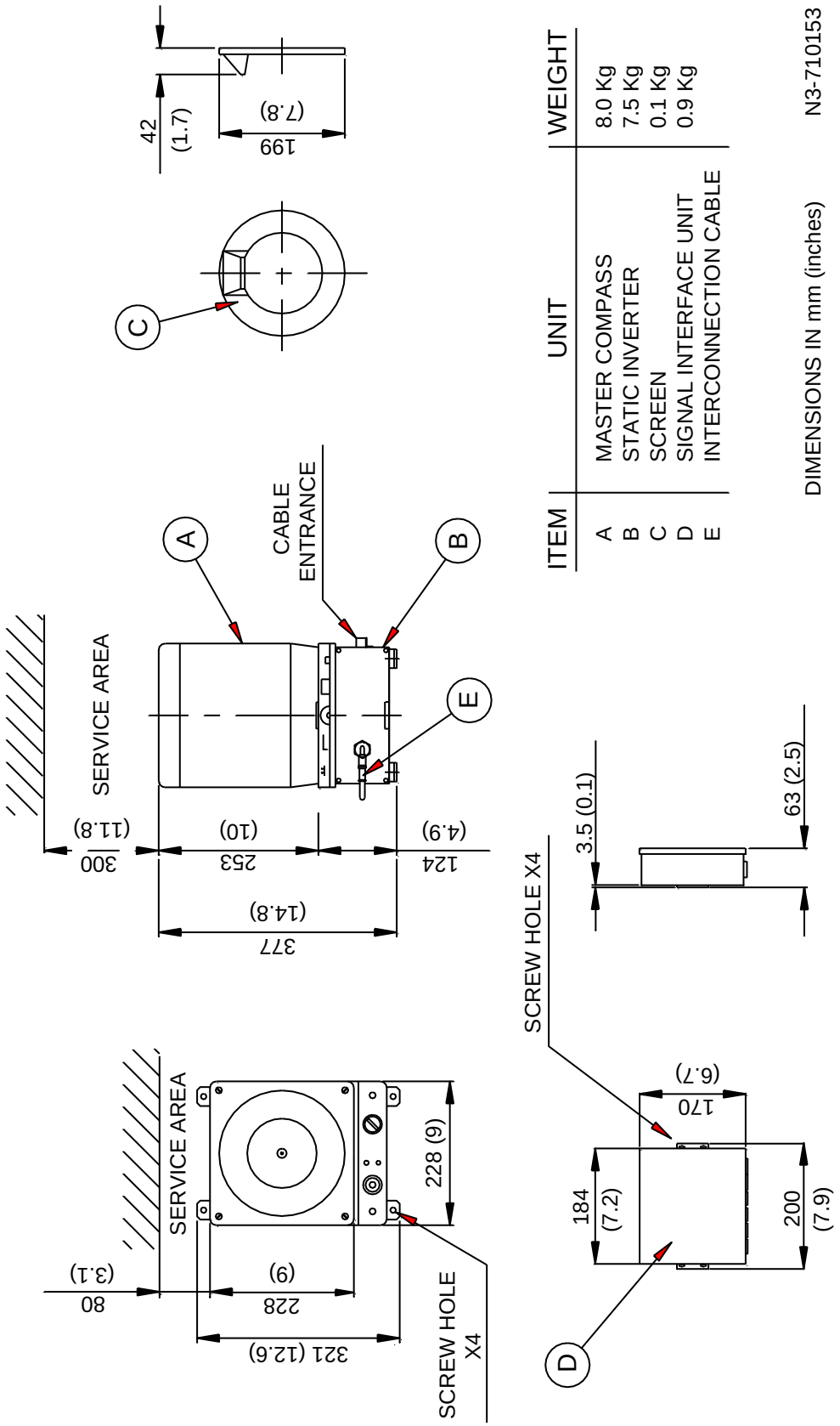
Syb. mark	PC No.	Nomenclature	Description	Part no.
	1	Inverter board		44178184 (1022957407)

11 DRAWINGS

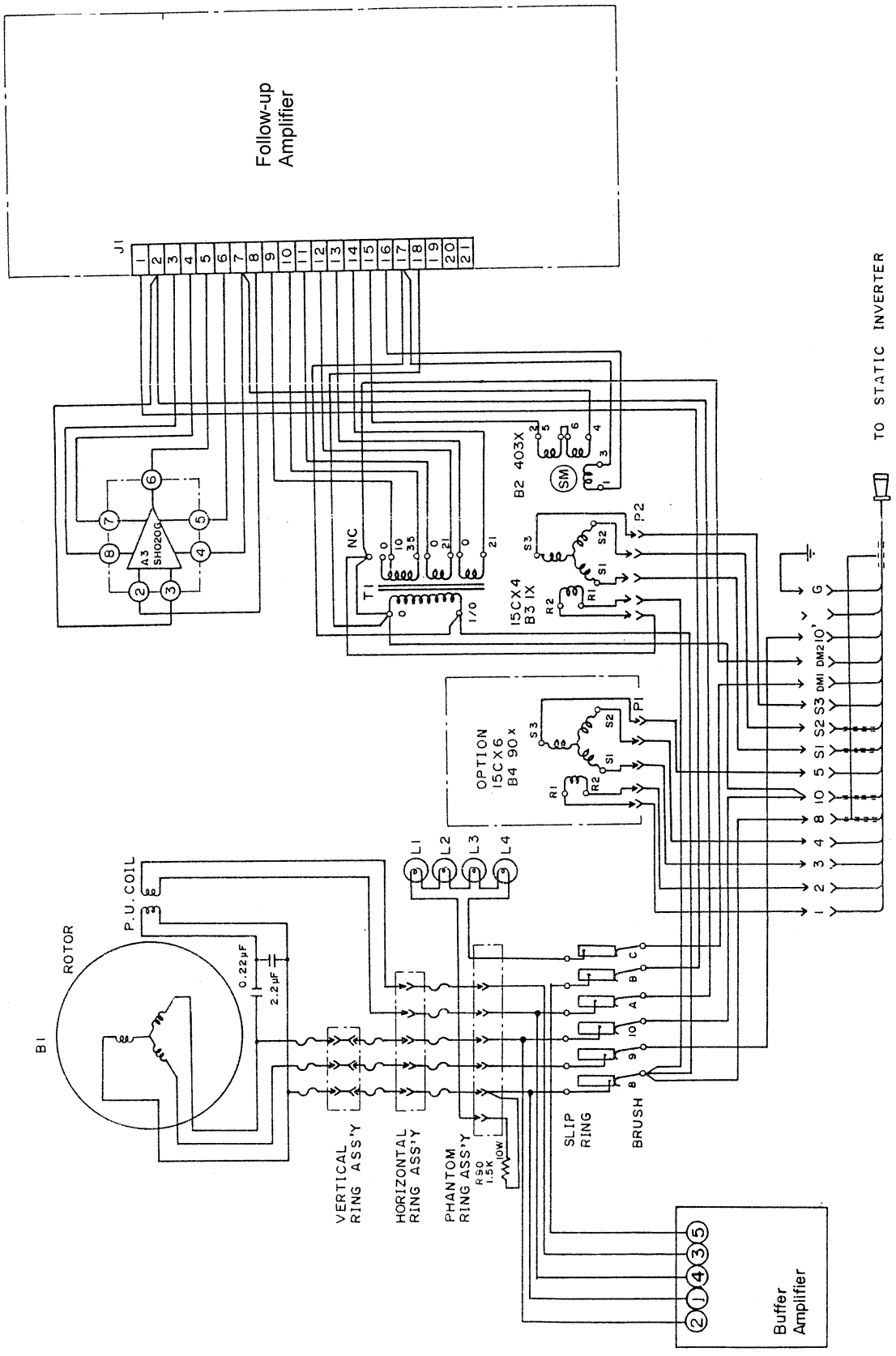
11.1 General

This section contains dimensional drawing and schematic diagrams for the RGC50 gyrocompass.

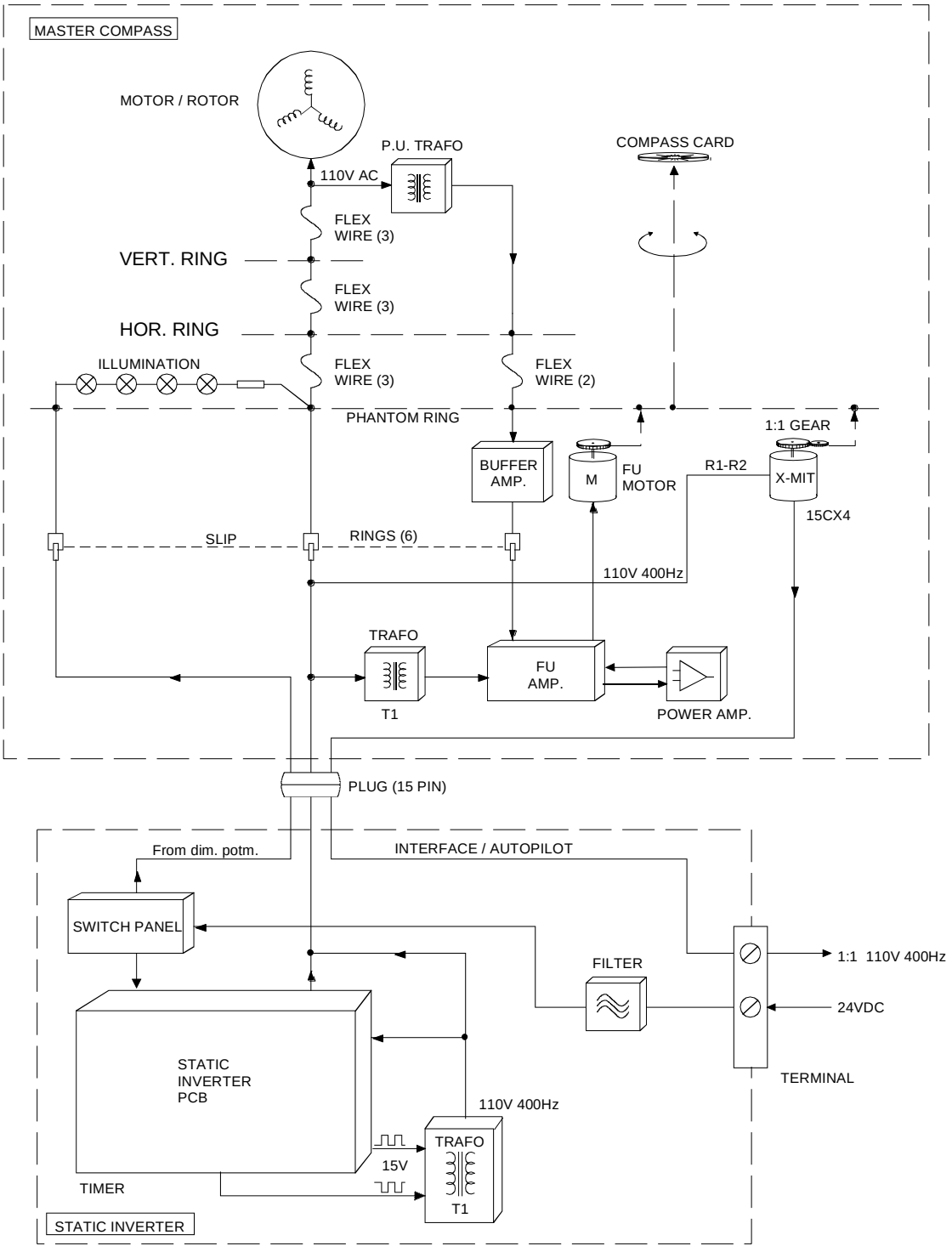
11.2 RGC50 dimensions



11.3 Master compass – schematic diagram

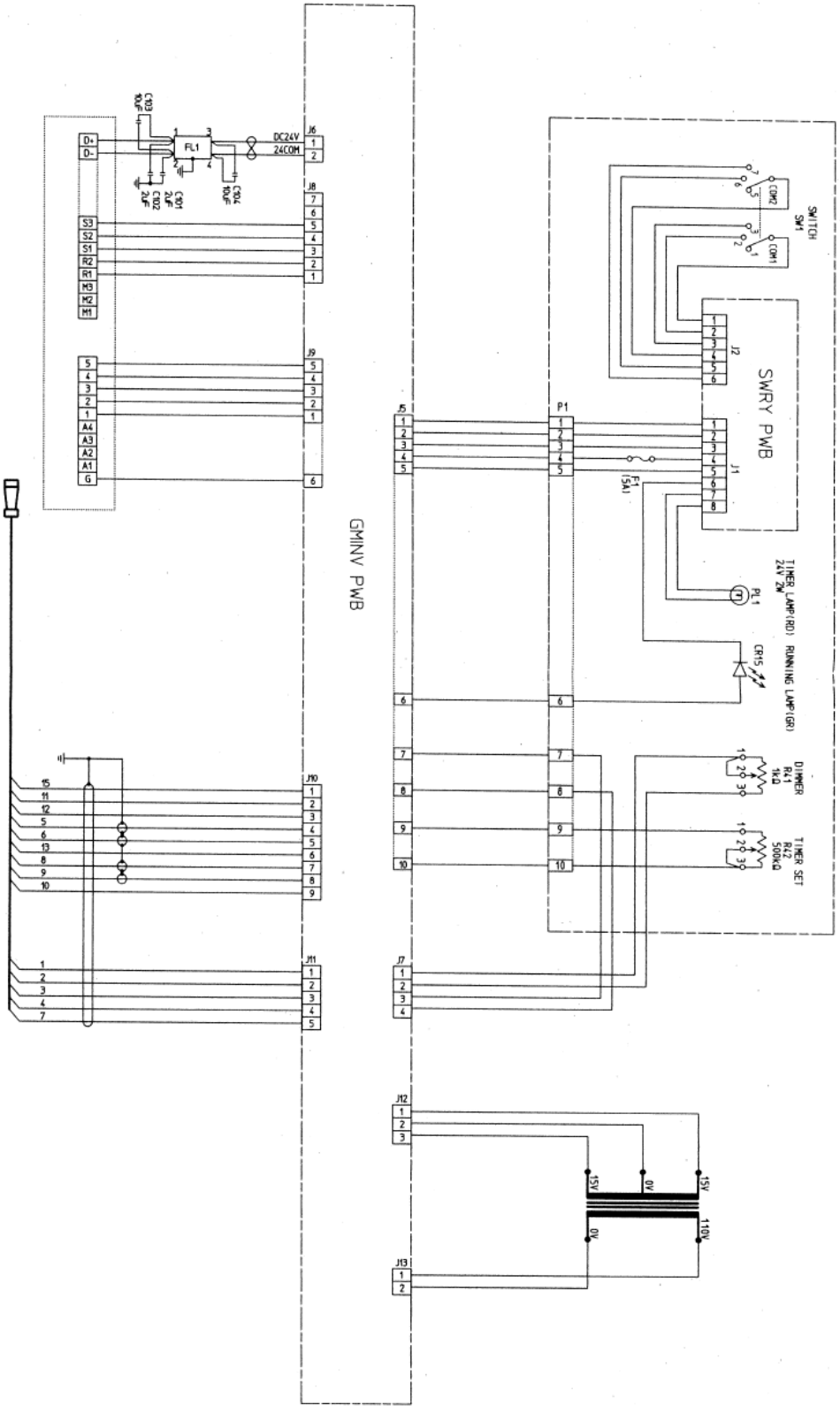


11.4 RGC50 – Block diagram

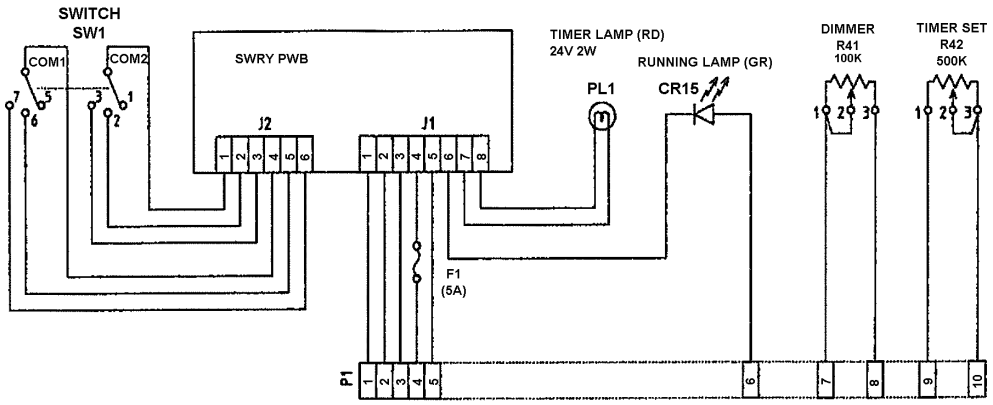


RGC50 GYROCOMPASS

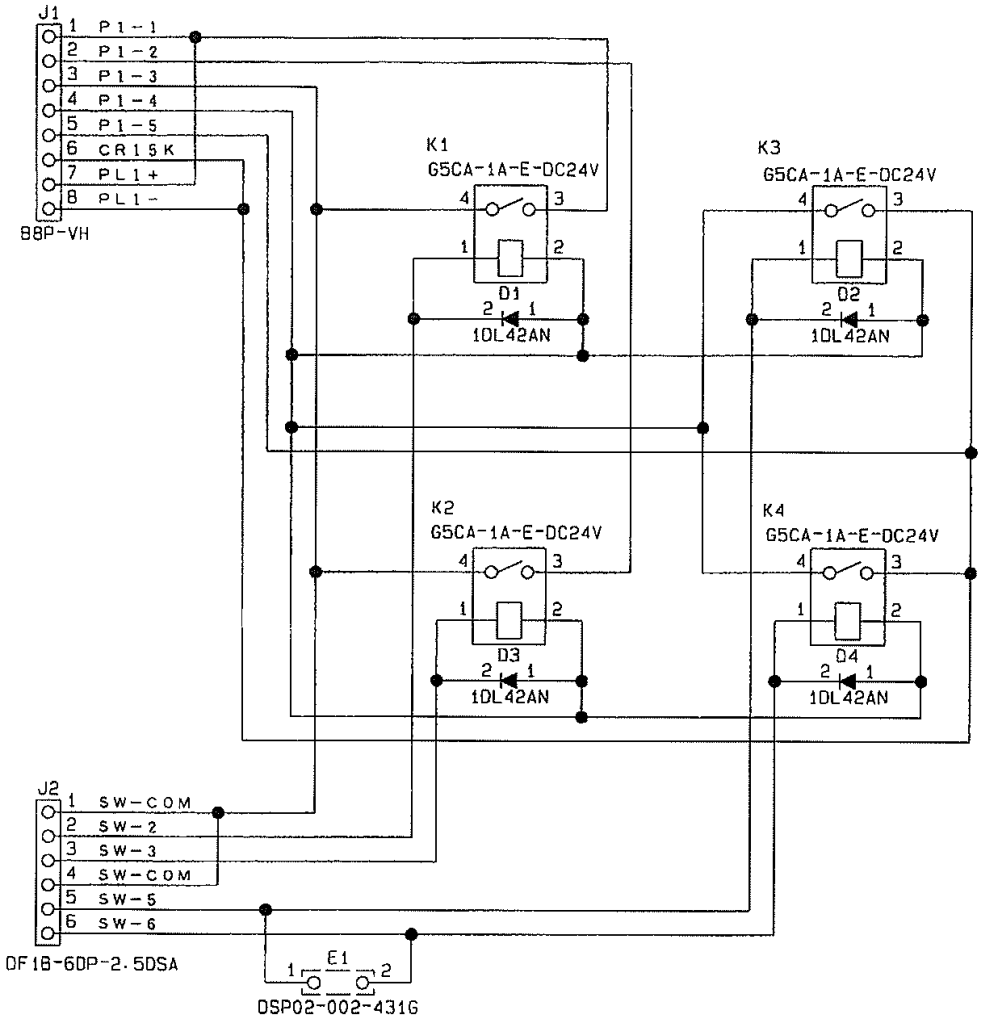
11.5 Static Inverter



Static Inverter Wiring Diagram



Switch Panel Wiring Diagram.
Valid for Master Compass ser. no. M7385 onwards.



SWRY PWB Circuit Diagram.

Valid for Master Compass ser. no. M7174 onwards

Main terminal connections