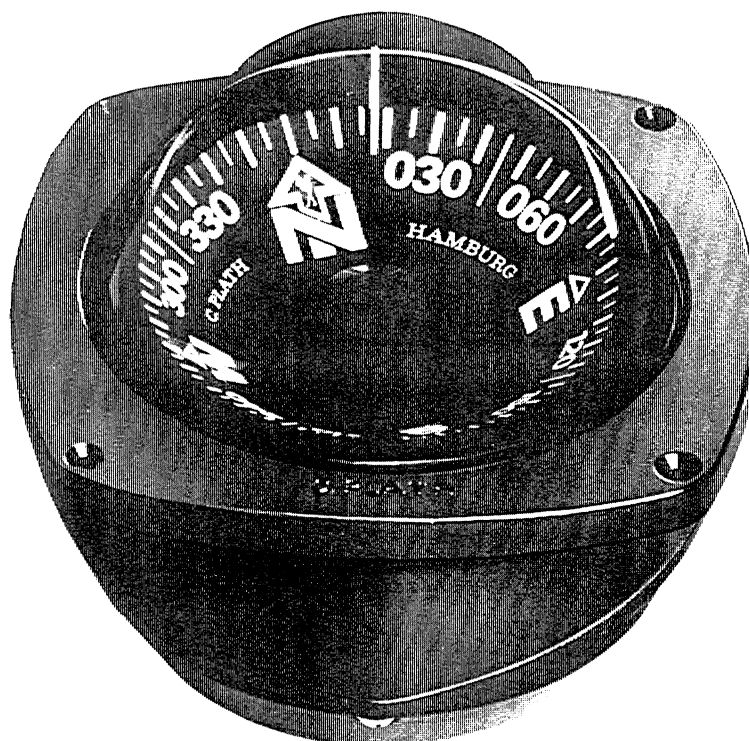




**C. PLATH**  
NAVIGATION · AUTOMATION

**056165**  
1-96

## OWNER'S MANUAL



# MERKUR

**Magnetic Compass**

**13 JUNE 95 REV B**

Head Office and Freight: Stueckenstrasse 1-3, D-22081 Hamburg, Germany  
Correspondence Address: P.O.Box 760 860, D-22058 Hamburg, Germany  
Tel. ++49 - 40 - 2 99 00-0; Fax. ++49 - 40 - 29 90 02 98; Telex 215 202 a plat d



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## 1. INTRODUCTION

The magnetic compass "MERKUR" is a liquid-filled spherical compass designed for application on smaller vessels, such as yachts and motor boats.

The fully gimballed compass card suspension and the location of the lubber line on the gimballed compass card suspension result in extremely high accuracy during extreme ship movement.

The compass housing is manufactured from sea-water resistant aluminium alloy. The glass dome is of an impact resistant mineral glass.

The magnification effect of the liquid-filled spherical dome results in an apparent compass card diameter of 120 mm. Volume fluctuations of the compass liquid caused by changes in the ambient temperature are compensated by a membrane located in the base of the compass.

A 12 V Dazzle-free illumination is an integral feature of the compass.

### 1.1 Technical Data

Lubber line error	$\leq 1^\circ$
Directional error	$\leq 1^\circ$
Lag error	$\leq 2^\circ$
Half period	$\geq 4,7$ sec.
Operational temperature range	- 30° C bis + 60° C

The mentioned data are in accordance with ISO standards for merchant shipping.

Vibration resistance	exceeds German Hydro-graphic Institute requirements
----------------------	---

Freedom of roll and pitch	
MERKUR S, R	unlimited
MERKUR VZ	freedom of pitch limited at $\pm 60^\circ$

Illumination	12 V and 24 V
--------------	---------------

Compass card	
MERKUR S	marked every 5°
MERKUR VZ	marked every 5°
MERKUR Lifeboat compass R	marked every 2°

Dimensions	see figures 1,2,3
------------	-------------------

Weight	1,6 kg
--------	--------



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## 2. THE BASIC FUNCTIONAL FACTS OF THE MAGNETIC COMPASS

### 2.1 General

The needle of a magnetic compass will point to the magnetic north pole when the earth's magnetic field around the compass remains uninfluenced by local causes. If the earth's magnetic field around the compass is disturbed by magnetic interference, the compass needle will no longer point to magnetic north. The difference between magnetic north and the setting of a compass needle due to such magnetic disturbance is called deviation.

On board a ship the earth's magnetic field is always slightly disturbed, particularly so on steel vessels, because the influences from other sources, such as electrical devices on board, cause the ship to generate its own magnetic field, which overlaps the earth's field and produces deviation of the setting of the compass needle.

### 2.2 Deviation

Deviation comprises several components:

A is a constant, which is applicable to all course settings. This constant exists when a line linking the lubber line and the center point of the compass card is not exactly parallel to the keel line of the ship.

B is deviation caused by longitudinal magnetism. The greatest effect caused by this deviation is on east and west courses; on north and south courses the effect is totally absent.

C is deviation caused by athwartships magnetism. The greatest effect is experienced on north and south courses; it has no effect on east and west courses.



D and E are deviations caused by the induction of the earth's magnetism in horizontal iron parts of the ship. They reach their highest values on NE, SE, NW and SW courses. K is deviation caused by vertical magnetism of the ship. This deviation force increases with the amount of heel of the ship and disappears when the ship is on an even keel. The greatest effect is experienced on north and south courses.

### 2.3 Ship's Magnetism

Ship's magnetism has two causes:

- a) The affect of the earth's magnetic field on the iron parts of the ship.
- b) Electrical devices on board which produce magnetic fields.

Induction of the earth's magnetic field turns iron parts into magnets, the magnetic fields of which bring about deviation of the compass.

The effect of magnetism from these iron parts becomes greater as their distance from the compass is reduced.

For example:

- Steel hull and superstructure
- Steering chains and control linkages
- Motors
- Anchors
- Steel canisters
- Steel fittings \*

The use of electrical devices on yachts is on the increase.

\* Stainless steel is normally antimagnetic.





Many such devices produce powerful magnetic fields.

For example:

Radio receivers and transmitters

Generators

Windscreen wipers

Depth sounders

Radar installations

Switching units

Indicator instruments of all descriptions.

Particular attention is drawn to three-phase generators, which produce extremely strong interference fields.

Current-carrying cables also produce magnetic fields, particularly when a steel hull is used as a return line (minus pole to ground). All electric cables should therefore be double-poled. Outgoing and return lines should be laid parallel to each other so that the magnetic fields of the individual lines are more or less neutralized.

#### 2.4 Compass Location

The place of location of the compass should protect the compass against the most powerful effects caused by the magnetism of the vessel. On steel ships the compass is to be installed in the center of the ship, preferably in a steering stand, which lifts the compass out of the interference field of the ship. The location of the compass is to be at least 0,9 meters away from all steel parts. The rudder chain or linkage should be manufactured from an antimagnetic material.

On board ships manufactured from an antimagnetic material, the main object is to ensure that the compass is installed at a safe distance from the engine. A safe distance is considered as being at least one meter from the engine. The installation of a compass amongst monitoring devices or in the vicinity thereof on board a motor-yacht is to be avoided when possible.



A compass must not be installed in a steel superstructure; here the compass cannot be corrected.

The greater part of compass deviation can be corrected by compensating the ship's magnetic field. For this purpose small magnets are fixed in the vicinity of the compass. The field of these magnets is equally strong as the ship's field, and the direction of flow opposite to that of the ship's field.

How to use the compensation capsule is described in the booklet "correction of magnetic compass deviation". It is part of the correction kit.



### 3. INSTALLATION OF THE MAGNETIC COMPASS "MERKUR"

#### 3.1 General

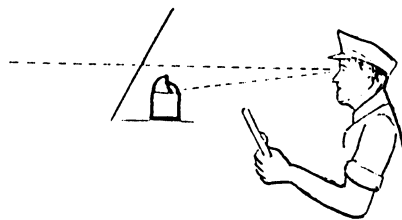
The magnetic compass "MERKUR" is supplied in a shock resistant transport box. When possible, store the compass in this box until it is to be installed.

NOTE: THE COMPASS MUST NOT BE MOUNTED WITH MAGNETIC COMPONENTS.

After the mounting the compass the lubberline is to point to the bows of the vessel.

##### 3.1.1 Choosing the Best Place of Location

If you intend to use your compass for point to point navigation, there is only one proper place for it to be installed - in a direct line forward of the helm station. It should also be close enough to the helmsman to be easily read and in a position slightly lower than the helmsman's line of sight to the horizon. With the compass in this location, it is most convenient to shift your eyes from the water to the compass and back again. If you had to look to either



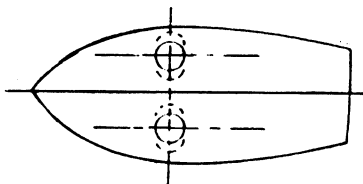
side to view the compass and then look forward to check for water hazards, you would find it quite inconvenient. The exact placement of the compass must, by necessity, vary from boat to boat because of differences in design and in magnetic influences nearby. Sometimes it may be necessary to shift the compass from the most ideal location to a point of compromise because of visual interferences or adjustment problems.

If your need for a compass is for occasional use only, and not for very much long-range cruising, you might select a spot on the boat's dashboard or on the gunwale.



We suggest temporarily putting the compass in position for a Deviation check. This could also apply in selecting the most convenient location for viewing. It goes without saying that the place selected for permanent mounting of the compass should be a spot where it can be easily read by the helmsman. Also regardless of its location on your boat, your compass must be aligned exactly parallel to the fore and aft center line of your boat. (To repeat because this is essential to understand: parallel to the center line, or on the center line if that happens to be where you want to mount your compass.)

Establishing this line parallel to your boat's center line is quite simple, but it almost always takes a little more patience and time than the skipper anticipates. Find the center of the transom using a metal measuring tape, and accurately mark



that center on a piece of masking tape (so as not to permanently mark the boat). This is usually easy. Next you need a second center point at some convenient location forward of the compass position.

With help from some additional pairs of hands, stretch a string tightly between the two center points. Accurately measure out (athwartship) to the location you selected for your compass, and after marking off this distance at your transom and forward line, move the string to this new pair of points. If the string is higher than the area where the compass base will be, use a plumb bob to transfer the line. Off course the boat must be on an even keel if a plumb bob is used. Once you have checked to make sure that you accurately established your compass mounting line parallel to the boat's center line you might just want to permanently scratch or mark a short line for future reference.



This alignment is extremely important, because an improperly aligned compass can never be properly adjusted for deviation, and will have a constant error (in addition to Deviation) no matter what direction your boat is pointed.

If you suspect that there may be magnetic influences near the compass position selected, such as radio speakers, steel cored steering wheels, wiring, etc., it would be well to place the compass temporarily in the position selected and check for Deviation as you swing the boat. With the internal compass compensators neutralized, you should not have a Deviation of more than 15 degrees in any one heading in the compass location selected. Deviation greater than this will be almost impossible to correct, making it necessary to either change the compass location or move the equipment, wiring, etc., causing the problem.

### 3.2 Installation of the magnetic compass MERKUR with square flange (see fig. 1)

The compass will be fitted in a cut-out or cavity. The cut-out diameter is 139 mm with a minimum depth of 72 mm.

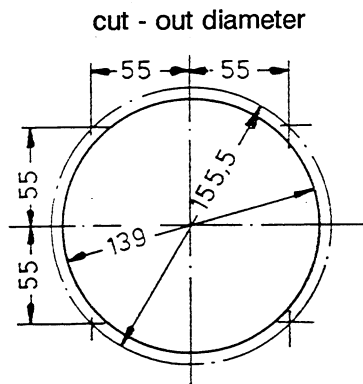
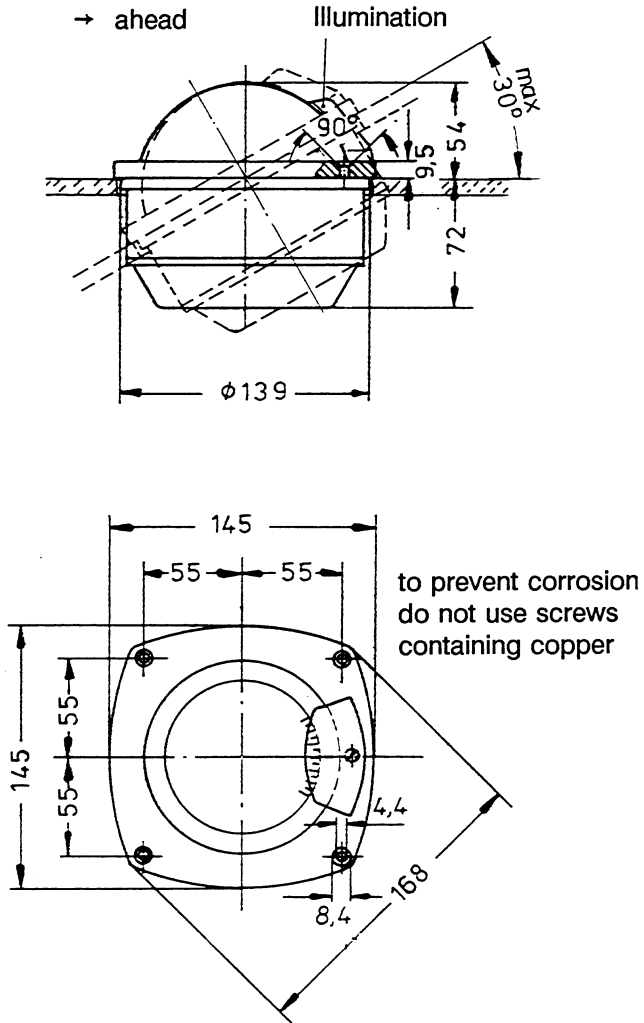
Read carefully section (3.1.1) "Choosing the best Place of Location" of this manual before proceeding with installation work.

NOTE: Before proceeding with installation work, make certain that below the mounting surface sufficient space is available for mounting the compass, see figure 1.

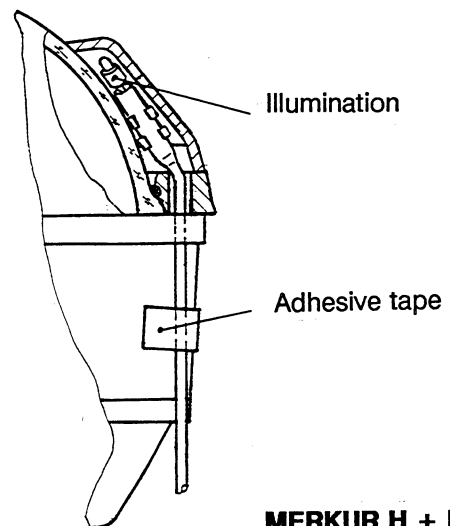
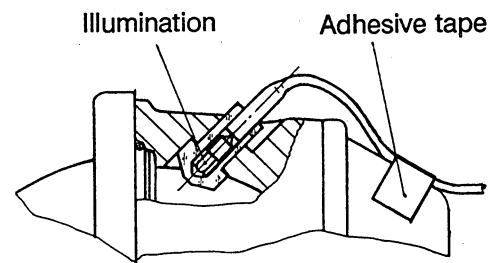
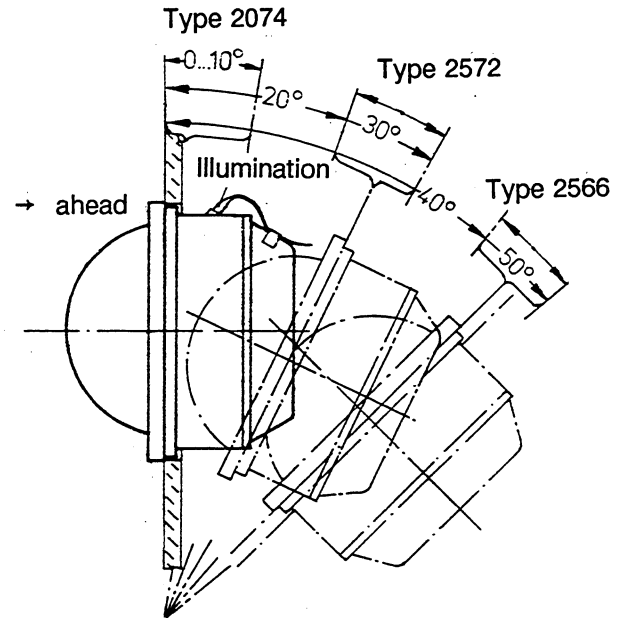
1. Cut a hole 139 mm in diameter in the mounting surface and remove the lampholder with cable from the compass (MERKUR S-F).
2. Place the compass in the hole cut for installation of the compass.
3. Align the compass exactly parallel to the fore and aft center line of the boat. For bulkhead mounted compass MERKUR VZ make sure that it is mounted exactly



### MERKUR S



### MERKUR VZ



### MERKUR H + M

Figure 1 Installation of MERKUR S and VZ, flush and bulkhead mounting



vertical. This can be done with the help of a plum bob.

4. Mark through onto the mounting surface the four attachment holes and the hole for the illumination cable and remove the compass.
5. In a metal mounting surface, drill and tap 4 M4 attachment holes. In mounting surfaces of other material, drill four plain 4,3 mm diameter attachment holes. Further drill a 5 mm diameter hole for the illumination cable.
6. Only for MERKUR S-F: fit the lamp holder to the compass and attach it with the retaining screw.
7. Fit the compass into its mounting location and pull through the illumination cable. Attach the compass with non magnetic, non-copper-bearing screws.
8. Ensure that the correct voltage is available and connect the illumination cable to the power supply. Illumination for 12 V and 24 V are available.

### 3.3 Installation of the Magnetic compass MERKUR with round bezel and the binnacle (see fig. 2)

NOTE: This compass is intended for pedestal or desk mounting by using a binnacle.

1. Set the MERKUR into the binnacle and fix it to the binnacle.
2. Align the compass with the binnacle exactly parallel to the fore and aft center line of the boat (see 3.1.1).
3. Mark the binnacle and the mounting surface at two places to facilitate re-alignment.
4. Remove the compass from the binnacle.
5. Attach the binnacle to the mounting surface (in alignment) by drilling attachment holes into the inner flange of the binnacle. Mount the binnacle with anti-magnetic screws.
6. Ensure that the correct voltage is available and connect the illumination cable to the power supply. In general the supplied illumination is 12 V. As an option 24 V is available.



7. Set the compass into the binnacle and fix it with the two M4 screws supplied with the binnacle.

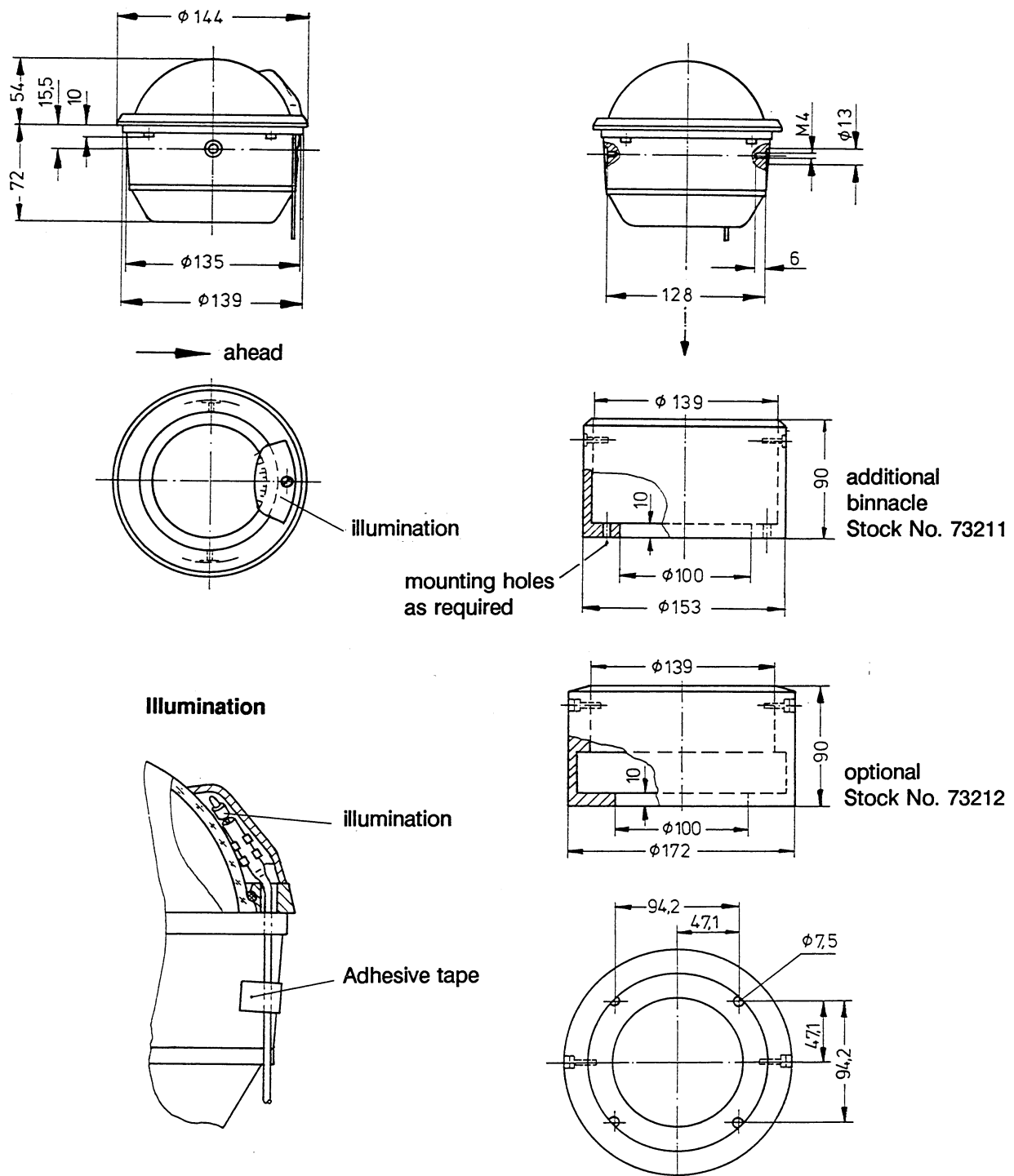


Figure 2 Installation of MERKUR S with round bezel





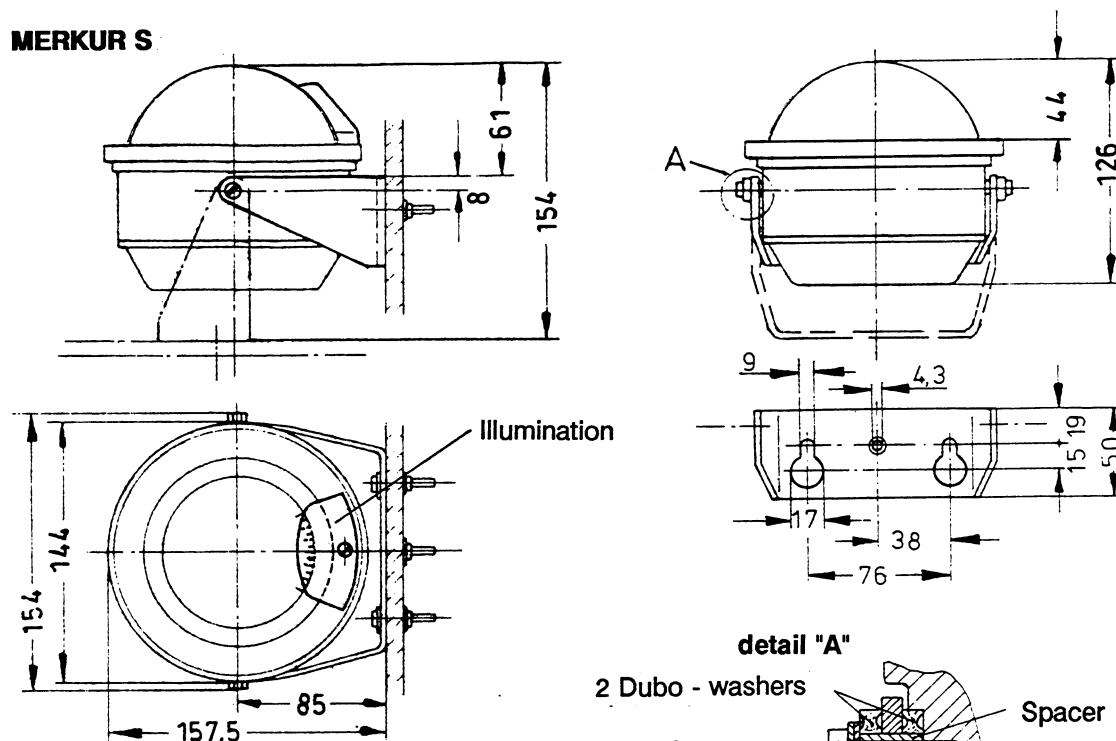
### 3.4 Installation of the magnetic compass MERKUR with bracket (see fig. 3)

NOTE: The bracket is intended for deckhead, bulkhead and deck attachment. It is adjustable through an angle of 180°. The mounting surface must be exactly in an angle of 90° to the fore and aft center line of the boat. When attaching the bracket on a horizontal or slanting surface, the bracket has to be mounted exactly at right angles to the fore and aft center line of the boat.

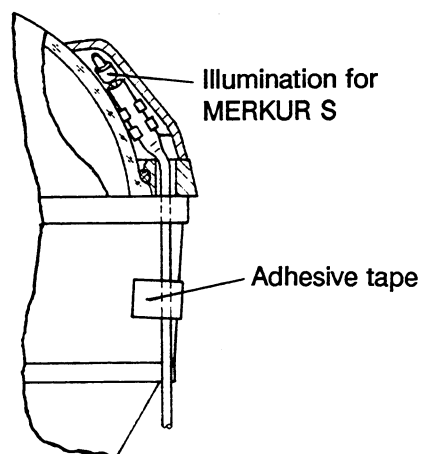
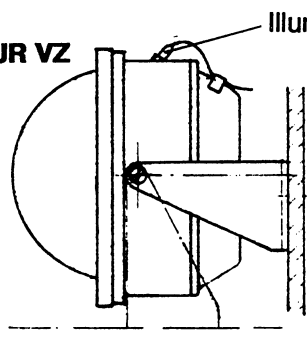
1. Drill two 3 mm attachment holes in the mounting surface.
2. Fit the bracket together with the screws, washers and nuts (see fig. 4 and 5, page 5-02 and 5-04). The bracket is now removable.
3. It is possible to attach the bracket to the mounting surface by fitting a screw M4 to the hole in the middle of the bracket.
4. Attach the MERKUR compass to the bracket. See figure 4 and 5 or Detail A at fig. 3.
5. Ensure that the correct voltage is available and connect the illumination cable to the power supply. In general the supplied illumination is 12 V. As an option 24 V is available.



**MERKUR S**



**MERKUR VZ**



**Bracket mounting**

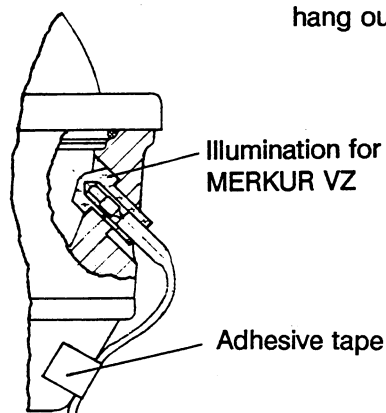
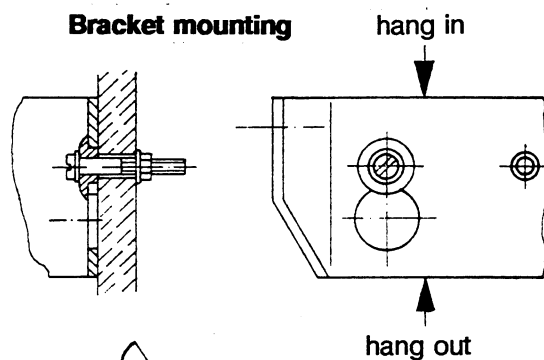


Figure 3 Installation of MERKUR with bracket

#### 4. Compass Correction and Compiling a Deviation Table

##### Deviation Table for the magnetic compass MERKUR

Ship / Yacht

Date

by

compass course	deviation	magnetic course
0°		
10°		
20°		
30°		
40°		
50°		
60°		
70°		
80°		
90°		
100°		
110°		
120°		
130°		
140°		
150°		
160°		
170°		

compass course	deviation	magnetic course
180°		
190°		
200°		
210°		
220°		
230°		
240°		
250°		
260°		
270°		
280°		
290°		
300°		
310°		
320°		
330°		
340°		
350°		

##### 4.1 Compass Correction with the C. PLATH Compass Corrector

If a C. PLATH compass corrector is fitted to the magnetic compass, refer to the instruction book supplied with compass corrector for correction instructions.

After correction of the compass, a deviation table is to compiled; this procedure is also explained in the instruction book supplied with the compass corrector.



If the magnetic compass is not fitted with a compass corrector, it is, however, also recommended that a deviation table be compiled, see 4.2.

#### 4.2 Compiling a Deviation Table

Use of the so-called deviation post, around which the boat may be swung, is an excellent way of determining deviation. A deviation post may be found in most harbours. For determination of deviation the boat must be seaworthy. All moveable iron parts which have an affect upon the compass are to be located in the position they normally occupy when at sea.

On motor-yachts the engine is to be running. On sailing boats it is to be determined whether the amount of deviation remains approximately the same with the engine running and with the engine not running. When a running engine greatly affects deviation, the deviation table is to be compiled with the engine switched off.

A second deviation table is to be compiled with the engine running.

##### Procedure

A suitable bearing object is required, the magnetic bearing of which is known. The boat is then to be swung through  $360^\circ$  at intervals of  $10^\circ$ .

At each step the compass heading and the bearing taken on the bearing object are to be recorded in the table. Deviation is the difference between the magnetic heading of the bearing object and the bearing read from the compass.

EXAMPLE: A ship is swung around a deviation post to determine compass deviation. A bearing is taken on a chimney, the magnetic heading of which is  $68^\circ$ . The following table results:



compass course	compass bearing	magnetic bearing	deviation *
0.0°	66.5°	68.0°	+ 1.5°
10.5°	66.0°	68.0°	+ 2.0°
20.0°	64.5°	68.0°	+ 3.5°
31.0°	64.5°	68.0°	+ 3.5°

\* Sign is so that by addition the correct course may be obtained from the incorrect course.

A graph should now be made where the deviation values are plotted against the associated compass courses. The resulting curve should run smoothly and be without abrupt variations. Bearing errors may be detected easily and corrected. The corrected deviation table.

Deviation Table

compass course	deviation	magnetic course
358.5°	+ 1.5°	0°
8.0°	+ 2.0°	10°
16.5°	+ 3.5°	20°

#### Heeling Error

As long as a ship is lying on an even keel the vertical component K of the ship's magnetism does not cause compass deviation. This affect occurs when the ship heels. On sea-going yachts heeling error very seldom becomes an important factor. For regatta and steel yachts a heeling error table for all courses and heeling angles may be easily made. Heeling error may be calculated on the basis of the following formula:



$$\text{Error} = - K \times \text{heel} \times \cos \text{course}$$

$$\text{where } K = \frac{\text{error}}{\text{heel} \times \cos \text{course}}$$

Starboard heel receives a positive sign and port heel a plus sign.

EXAMPLE: At  $10^\circ$  starboard heel a deviation of  $-5^\circ$  is registered (magnetic course  $180^\circ$ , compass heading  $185^\circ$ ). What is the deviation value at  $20^\circ$  port heel on a magnetic course of  $30^\circ$ .

$$\text{a) } K = - \frac{\text{error}}{\text{heel} \times \cos \text{course}}$$

$$= - \frac{-5^\circ}{+ 10^\circ \times \cos 180^\circ}$$

$$= - \frac{-5^\circ}{+ 10 \times (-1)}$$

$$K = - 0.5$$

$$\begin{aligned} \text{b) Error} &= - K \times \text{heel} \times \cos \text{course} \\ &= - (-0.5) \times (-20^\circ) \times \cos 30^\circ \\ &= (+ 0.5) \times (-20^\circ) \times 0.866 \end{aligned}$$

$$\text{Error} = - 8.7^\circ$$

In this example the compass indicates a heading of  $38.7^\circ$  at  $20^\circ$  port heel. The magnetic course is then  $38.7^\circ + (- 8.7^\circ) = 30^\circ$ . In this way, heeling errors for all courses may be calculated and entered into a table.



Example:

HEELING ERROR

Port heel [°]	Course [°]		Starboard heel [°]
	0		
	10	350	
	20	340	
	30	330	
	40	320	
	50	310	
	60	300	
	70	290	
	80	280	
	90	270	
	100	260	
	110	250	
	120	240	
	130	230	
	140	220	
	150	210	
	160	200	
	170	190	
	180		



#### 4.3 Permanence of Deviation

The ship's magnetism is not so permanent that it be only necessary to make one single compass correction. Even a well-corrected compass will not guarantee that a determined deviation value entered in the deviation table will apply over extended periods.

The ship's magnetism varies

- a) with the geographic latitude
- b) when vibration occurs, for example, when touching the ground
- c) when stationary in the same position for long periods, in winter quarters for example
- d) when the vessel's heading remains constant for long periods
- e) when the ship is struck by lightning.

It is therefore extremely important that the deviation of the magnetic compass be checked at regular intervals and the deviation chart amended. It is however not necessary to correct the compass when a change in deviation is detected because these variations very often disappear after a short time.





## 5. ILLUSTRATED PARTS CATALOGUE

Repair of the magnetic compass MERKUR is only to be carried out by the manufacturer, C. PLATH in Hamburg, West Germany, or C. PLATH, North American Division in Annapolis, Maryland, U.S.A. or an authorized service station. On no account is the compass to be opened by any other than the aforementioned because correct filling of the compass with original C. PLATH compass liquid is necessary to guarantee the correct and safe function of the compass.

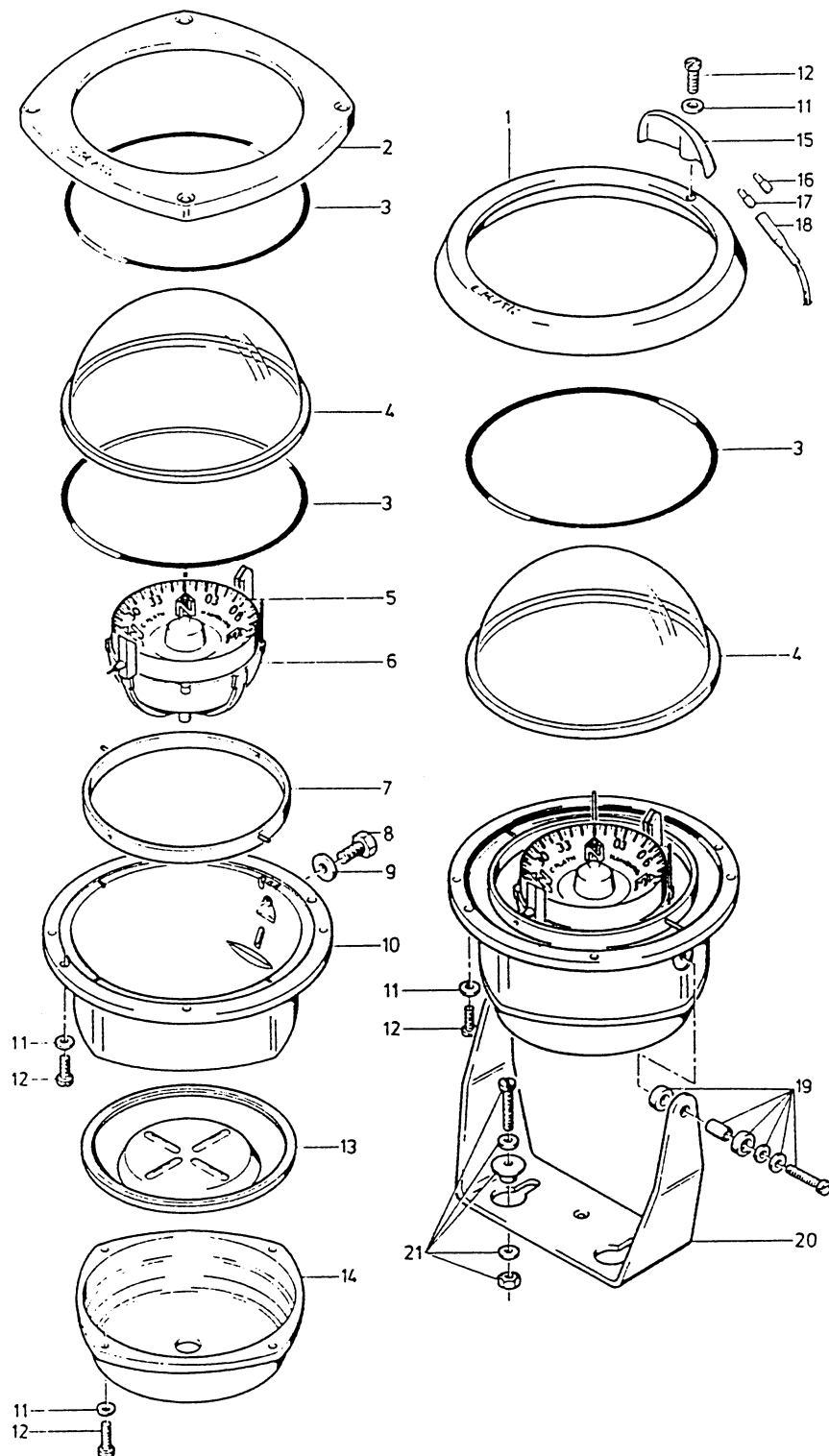
### Ordering Instructions

All parts available as replacement parts carry a stock number. When ordering replacement parts, please quote all data contained on the identification label (fig. 4-01, item 23) attached to the compass.

Address all orders for replacement parts to

C. PLATH  
Stueckenstrasse 1-3  
D-22081 Hamburg  
Germany

C. PLATH  
North American Division  
222, Severn Ave.  
Annapolis, MD 21403  
USA



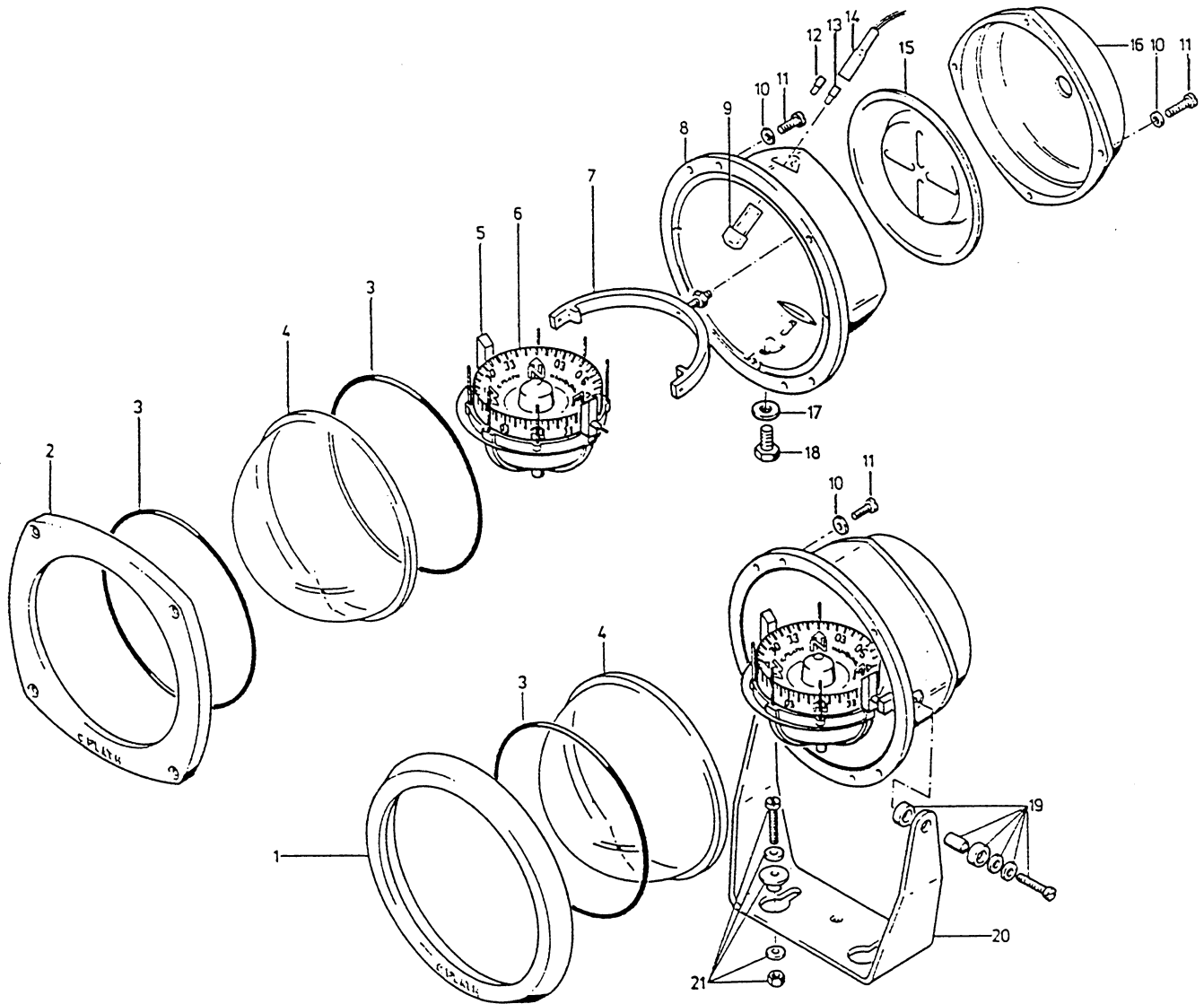
M E R K U R S

Figure 4



SPARE PART LIST  
Magnetic compass MERKUR S  
Type 4220 Square flange  
Type 4221 Round bezel

Fig./Item	Description	Stock No.	Units per assembly
4-	MERKUR S Type 4220 complete	73318	1
	MERKUR S Type 4221 complete	73319	1
1	Verge ring for Type 4221	33764	1
2	Verge ring for Type 4220	33766	1
3	O-Ring 117x2,5	40473	2
4	Glas dome	40401	1
5	Compass card system	30771	1
6	Gimbal system, complete	37948	1
7	Gimbal ring with pins	30772	1
8,9	Filling screw, complete	37226	1
10	Bowl	30784	1
11	Washer 4,3	21098	9
12	Screw M4x12	22866	9
13	Membrane	40331	1
14	Base	33767	1
15	Lampholder	33769	1
16	Lamp 12 V	33779	1
17	Lamp 24 V	33728	1
18	Lampholder	33623	1
19	Mounting kit 1	33494	1
20	Bracket	30785	1
21	Mounting kit 2	33495	1



M E R K U R    VZ  
Figure 5



SPARE PART LIST

Magnetic compass MERKUR VZ 1

Type 2069 Round bezel with bracket

Type 2074 Square flange

Fig./Item	Description	Stock No.	Units per assembly
5-	MERKUR VZ Type 2069 complete	73170	1
	MERKUR VZ Type 2074 complete	73319	1
1	Verge ring for Typ 2069	31524	1
2	Verge ring for Typ 2074	30209	1
3	O-Ring 117x2,5	40473	2
4	Glas dome	40401	1
5	Gimbal system, complete	30774	1
6	Compass card, complete	30775	1
7	Bracket, complete	30806	1
8	Bowl	33753	1
9	Lampholder	33618	1
10	Washer 4,3	22563	8
11	Screw M4x12	22866	8
12	Lamp 12 V	33779	1
13	Lamp 24 V	33782	1
14	Lampholder	33623	1
15	Membrane	40331	1
16	Base	40330	1
17,18	Filling screw, complete	37226	1
19	Mounting kit 1	33494	1
20	Bracket	30785	1
21	Mounting kit 2	33495	1



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