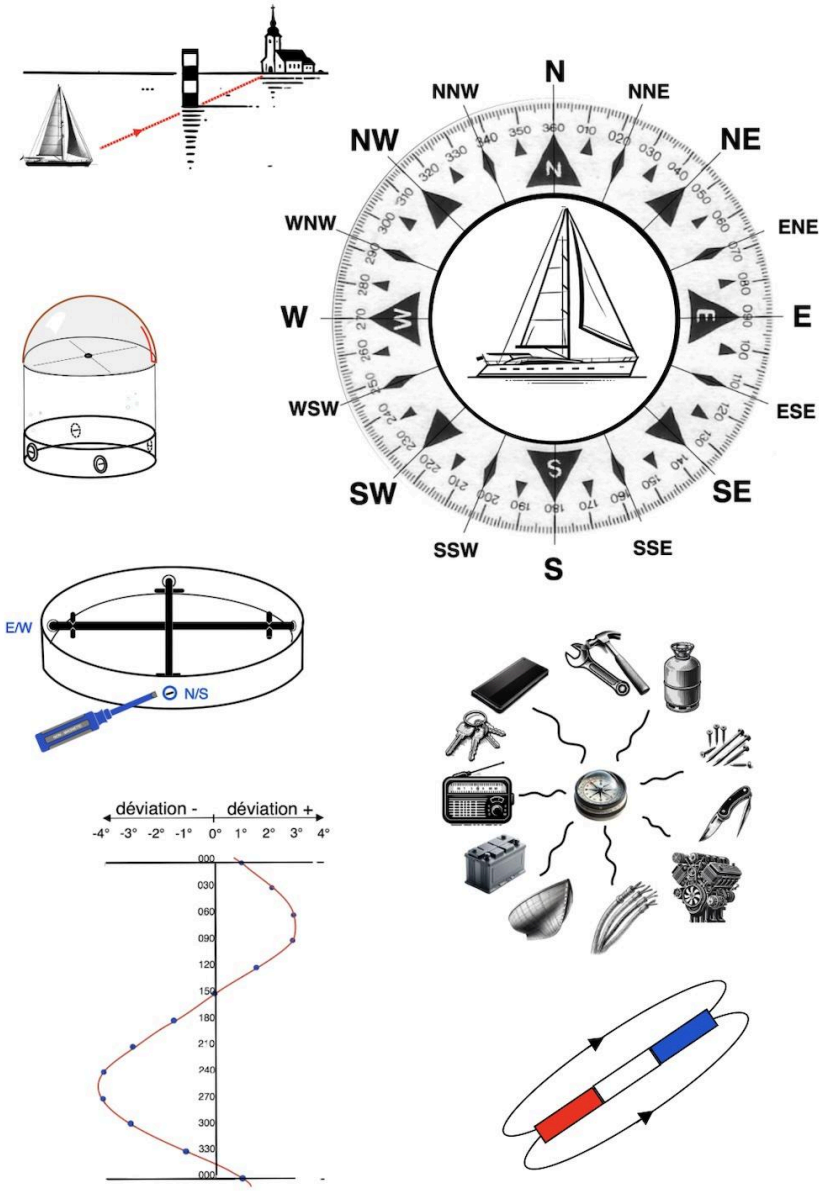
Adjustment of a Magnetic Steering Compass with Integrated or External Correctors.

Illustrated Methods for Cruising Yachts from 9 to 18 Meters.(30 to 60 feet)



C. Adjustment of a Magnetic Steering Compass with External Compensators.

C.1 Introduction to Adjustment Using Magnets Placed and/or Moved Outside the Compass.

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C.2 Illustrated Example of Adjustment Using Magnets Placed and/or Moved Outside the Compass.

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There is a second guide available on my website, www.easysextant.com, titled *Measurements to Create a Deviation Card for Magnetic Steering Compasses*, intended for use after the compass has been adjusted.

A

A. Introduction to Magnetic Compass Adjustment.

Note on Terminology:

The terms *compensation* and *calibration* are often used in English in the context of magnetic compass work. Sometimes, they refer to both techniques: compass adjustment and the measurements used to establish a deviation card. Other times, they may refer only to one of these two techniques. The word *calibration* is also frequently used in relation to the correction of electronic compasses.

The definitions of the terms adjustment and compensation as provided by the Defense Mapping Agency Hydrographic/Topographic Center (Washington, D.C., 1980), which states:

> **"In this handbook, the term *compass adjustment* refers to any changes made to permanent magnets or soft iron correctors whereby normal compass errors are reduced. The term *compass compensation* refers to any change in the current supplied to compass compensating coils, whereby errors due to degaussing are reduced.**

Of course, the latter techniques, mainly used on large steel vessels, are very complicated and will not be described in this guide.

This guide addresses only corrections for permanent magnetic errors, which induce compass errors. These are the main types of errors typically encountered on ocean-going vessels between 9 and 18 meters (30 to 60 feet) in length. Sailing vessels with steel hulls may also experience soft iron errors; however, these are not covered in this guide.

Once again, the words *adjustment* and *compensation* are often mixed up, but the intended meaning is usually easy to understand from the context.

If you're planning to sail offshore — beyond sheltered coastal waters — you should carry a properly adjusted magnetic compass. This is a fundamental safety item and is required under many national and international regulations.

While enforcement and certification standards may vary by country, it's good seamanship to ensure your compass is adjusted and that a current deviation card is kept onboard.

The magnetic compass remains a fundamental instrument in both traditional and celestial navigation — a natural companion to the sextant, as explored on my website, easysextant.com.

Simple to use, reliable, and independent of electronic systems, it provides an added layer of safety — especially in the event of an electrical failure.

Despite competition from modern GPS systems, the compass remains irreplaceable for traditional navigation.

OBJECTIVE OF THIS GUIDE

To correct the deviation of the magnetic steering compass on board and to measure residual deviation errors.

This guide presents four different adjustment (compensation) methods, each illustrated and adapted for 9- to 18-meter (30- to 60-foot) cruising sailboats.

On my website easysextant.com, you'll find a more general explanation of the concepts of variation (magnetic declination) and deviation.

Here, however, we focus exclusively on the phenomenon of deviation, caused by the permanent magnetic influences on board vessels.

Note: in maritime tradition, the term "magnetic variation" is often used instead of "magnetic declination."

The compass should be placed at least 50 cm away from any metallic sources of interference. If a significant magnetic influence is detected, either move the interfering object or relocate the compass.

Magnetic influence follows the inverse square law: when the distance between a magnetic source and the

compass is doubled, the effect on the compass is reduced to one quarter.

Electrical influences, caused by currents flowing through nearby wires, can also disturb the compass. To minimize magnetic fields, twist the wires of each circuit into pairs — including those running beneath the compass and the instrument panel.

Before setting off on a passage, it is very important to check your compass to ensure that its errors remain within acceptable limits.

A visual inspection is also necessary to check that the compass card turns smoothly and freely.

Have there been any changes in nearby metallic objects?

Is the compass properly aligned with the ship's fore-and-aft axis?

The diameter of the compass card should be appropriate for the size of the vessel: 2.75 to 3.5 inches for boats between 16 and 30 feet, at least 4 inches for those between 30 and 40 feet, and a minimum of 5 inches for vessels over 40 feet..

<u>On small boats</u>, provided there are no significant metallic masses on board, compass adjustment can be replaced by simply comparing the accuracy of the main compass with that of a secondary hand-bearing compass on different headings to ensure they are more or less in agreement.

This simplified method, although less rigorous than standard procedures, is often sufficient to ensure accurate navigation without requiring complex adjustments. It is advisable to record in the logbook the date, location, sea state, and the individuals involved in the verification.

Ideally, a gyrocompass should be used as the reference for checking the magnetic compass, given its near-zero error margin. That said, this guide does not address such advanced methods.

Prerequisite conditions: a calm sea without swell, and preferably a low tidal current on that day. Slack tide periods are ideal."

Such ideal conditions are rare—just a few days a year—but they offer the perfect opportunity to enjoy a peaceful day at sea. Allow a full morning for compass adjustment.

All electrical equipment should be switched on to replicate the magnetic fields present under normal navigation conditions. However, it may also be useful to perform a second check with all systems turned off, in order to compare and assess the influence of onboard electronics on the compass.·

Make sure that anyone standing near the compass has emptied their pockets of any items that could create magnetic interference, such as mobile phones, watches, keychains, or knives. Also, only use non-magnetic screwdrivers for compass adjustments.

Accuracy depends on the quality of the compass and the care taken during adjustment. Make sure the compass's lubber line is properly aligned with the vessel's centerline! There should be no air bubbles in the bowl.

Even compasses that come with built-in correctors may still require an optional adjustment unit for accurate adjustment.

Because compass compensation is never flawless, a residual deviation always remains. This deviation is measured relative to the vessel's heading during the process of establishing the deviation card.

This deviation card will then be used by the helmsmen to correct the known error and steer by the true heading.

When the compass is temporarily deflected during testing with a magnet, it should return to its original alignment within a standard minimum time—neither too quickly nor too slowly."

Reminder: Compass adjustment is never permanent or universally reliable. Changes in onboard equipment, cargo, or structural modifications can affect deviation. It should be checked regularly and adjusted when necessary.

Note: In traditional navigation, the Compass Heading (CH) and True Heading (TH) are the most frequently used. The Magnetic Heading (MH), on the other hand, plays a crucial role during compass adjustment and measurements for creating a Deviation Card

The Steering Compass:

Steering Compass: A magnetic compass positioned to indicate to the helmsman the heading being steered by the vessel, taking into account the local magnetic influences onboard.

Compasses with built-in compensators can be fitted with external modules if necessary, or these modules can be used on compasses without integrated correctors. They work by means of small movable magnets that slightly alter the magnetic field sensed by the needles beneath the compass card. These magnets can be fixed or glued to the sides and/or underneath the compass.

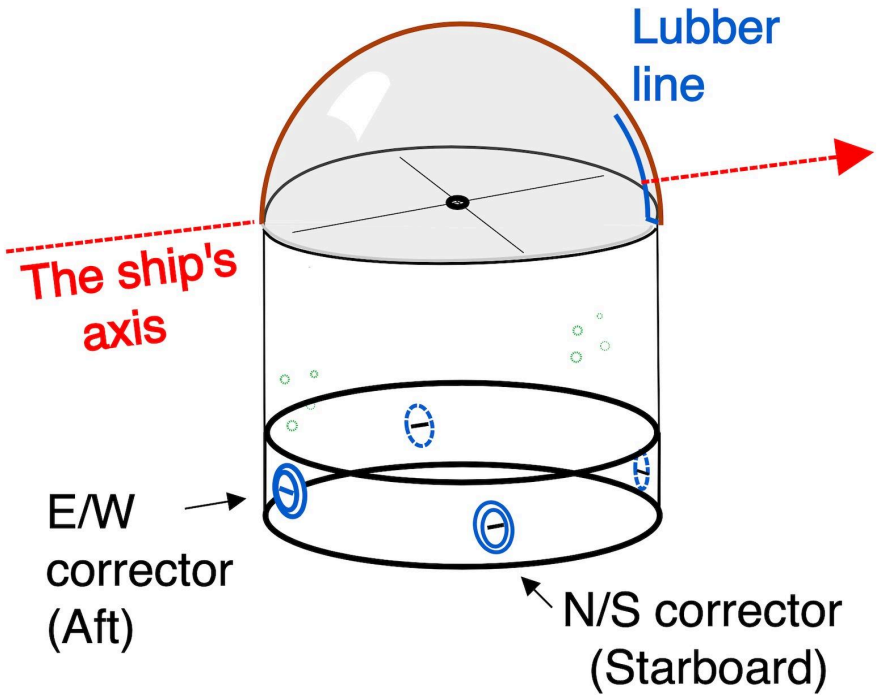
External correction modules:

Autonautic **Plastimo** **Silva** **Ritchi**

The Bearing Compass

1. Adjustment with integrated correctors:

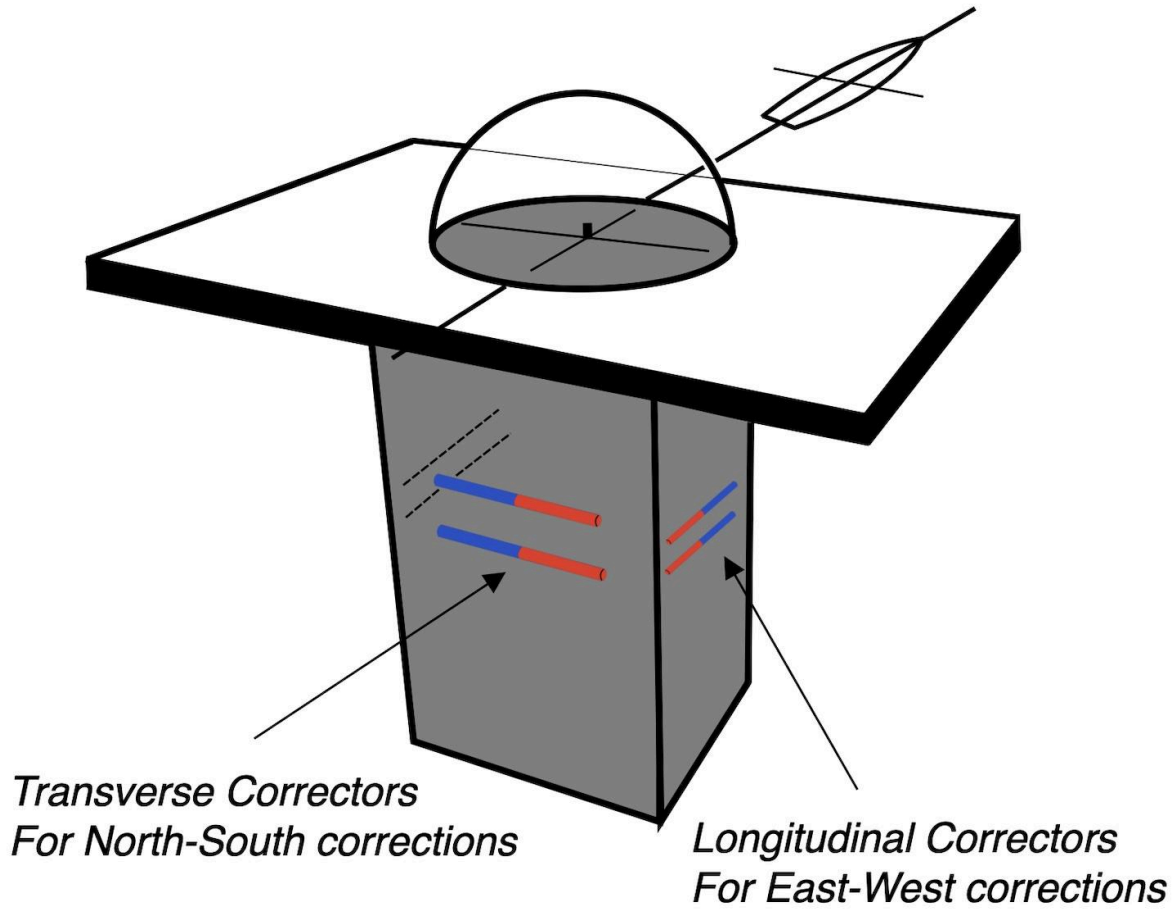
Adjustment aims to minimize the deviation errors of the steering compass caused by local magnetic fields on board the boat. These fields can come from metal components, electrical systems, or other equipment located near the compass.



Method:

Adjust the deviation correctors (screws or rods) to align the readings of the steering compass with those of a reference compass, unaffected by the vessel's magnetic disturbances. Alternatively, it is possible to use known alignments, which can be found on nautical charts.

2. Adjustment with external magnets



Magnetic Compass Adjustment Method:

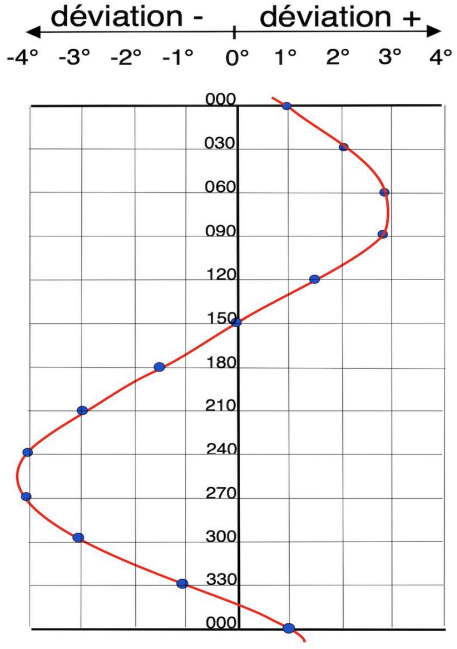
To correct deviation errors, adjustments are made to the magnets placed around the compass. Magnets can be added or removed to adjust the strength of the correcting field, and moved closer to or farther from the compass to modify their influence. These adjustments must be carried out precisely, by observing the effect produced on the measured deviation.

2.Procedures for Establishing a Deviation Card.

This procedure, by contrast, has a broader scope. Its purpose is to maintain and verify the proper functioning of the compass over the long term. This includes:

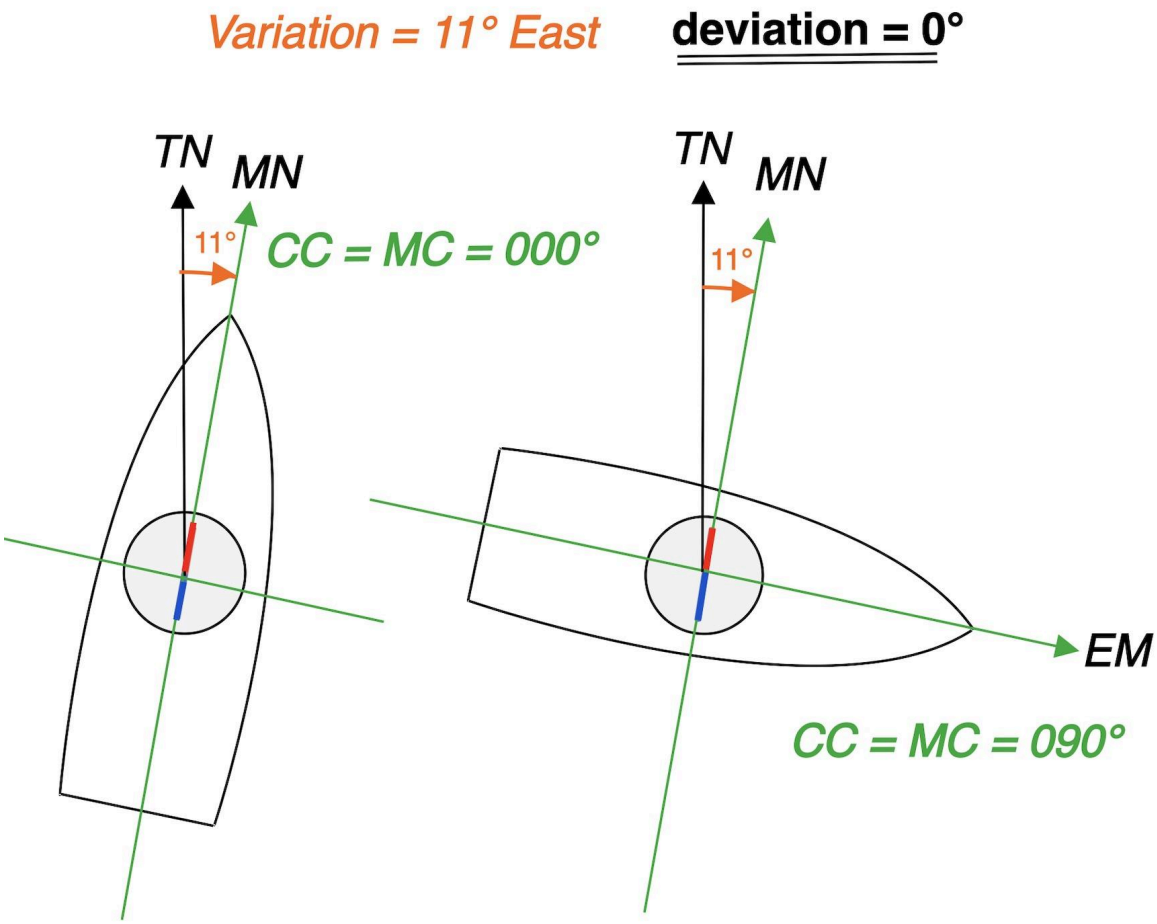
1.Monitoring the environment around the compass, particularly by preventing the introduction of new sources of magnetic disturbance (such as metallic or electrical equipment added after adjustment).

2. Establishing a deviation curve or recording the residual deviations by heading.

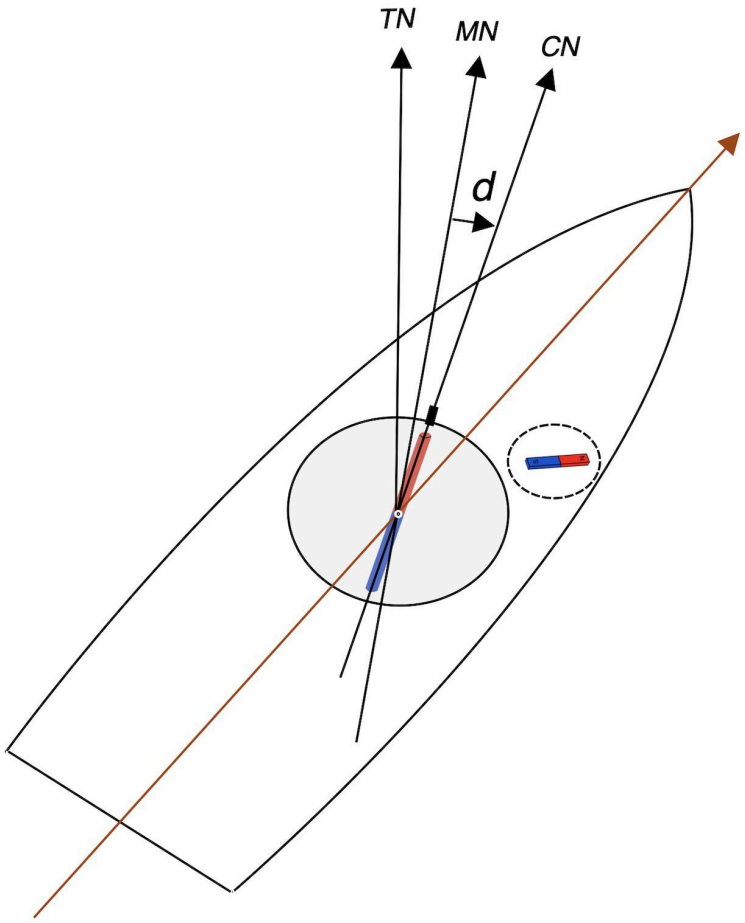


Conclusion: Adjustment corrects errors, while creating a deviation card measures and records them.

When the needle is mounted to the compass card, it holds steady with respect to the vessel. It is, in fact, the ship that swings beneath the card, giving the illusion of movement in the needle.



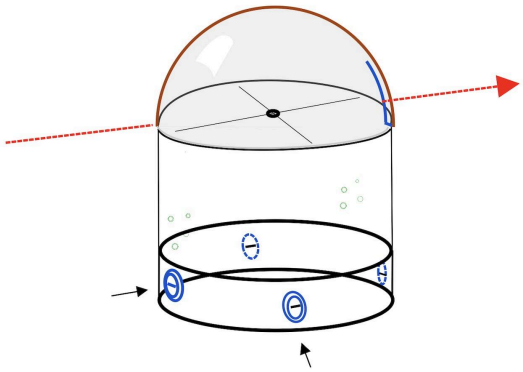
However, a single magnet (see illustration), symbolically representing machinery and electrical equipment, generates permanent magnetic fields that can interfere with the compass and cause deviation. Furthermore, if the hull is made of steel, significant deviations are to be expected



<u>This deviation varies according to the ship's heading</u>, as it results from the vector sum of the Earth's magnetic field and the permanent magnetic fields aboard.

B.1

B Adjustment of a steering compass equipped with built-in correctors.



B.1 Adjustment of a steering compass with built-in correctors, by comparison and alignment between the steering compass and the bearing compass, on four magnetic headings spaced 90° apart, according to the instructions.

The entire procedure depends on the following four key steps.

1. Steer to magnetic north and cancel the deviation using the N-S correctors.

2. Steer to magnetic east and cancel the deviation using the E-W correctors.

3. Steer to magnetic south and reduce the deviation by half using the N-S correctors.

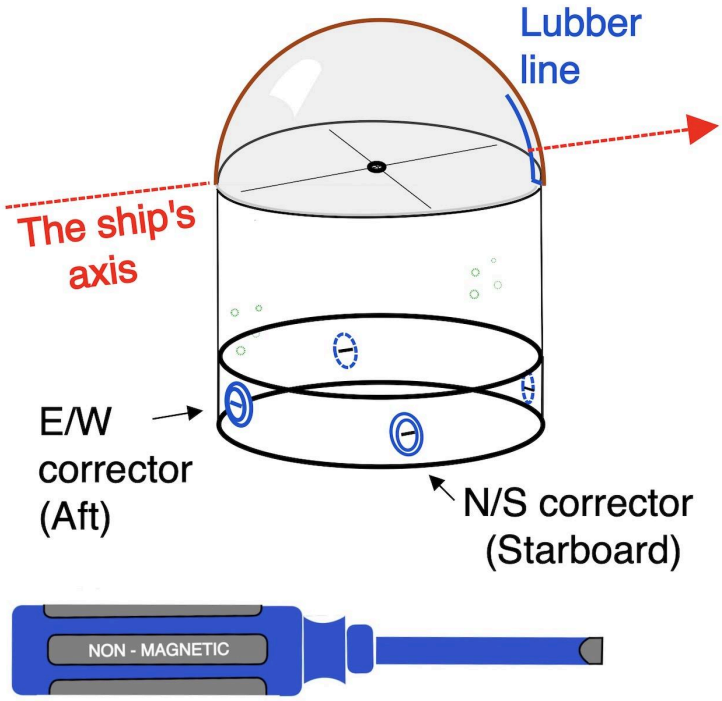
4. Steer to magnetic west and reduce the deviation by half using the E-W correctors.

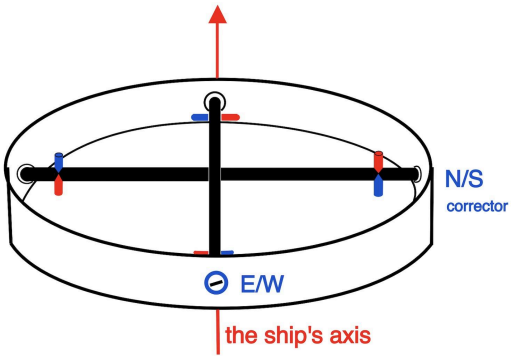
Note: You can start with any of them, but within each pair:

- one heading allows you to cancel the deviation,
- its opposite allows you to reduce it by half.

Following these adjustments, we proceed to establish the deviation curve.

The steering compass with built-in correctors.

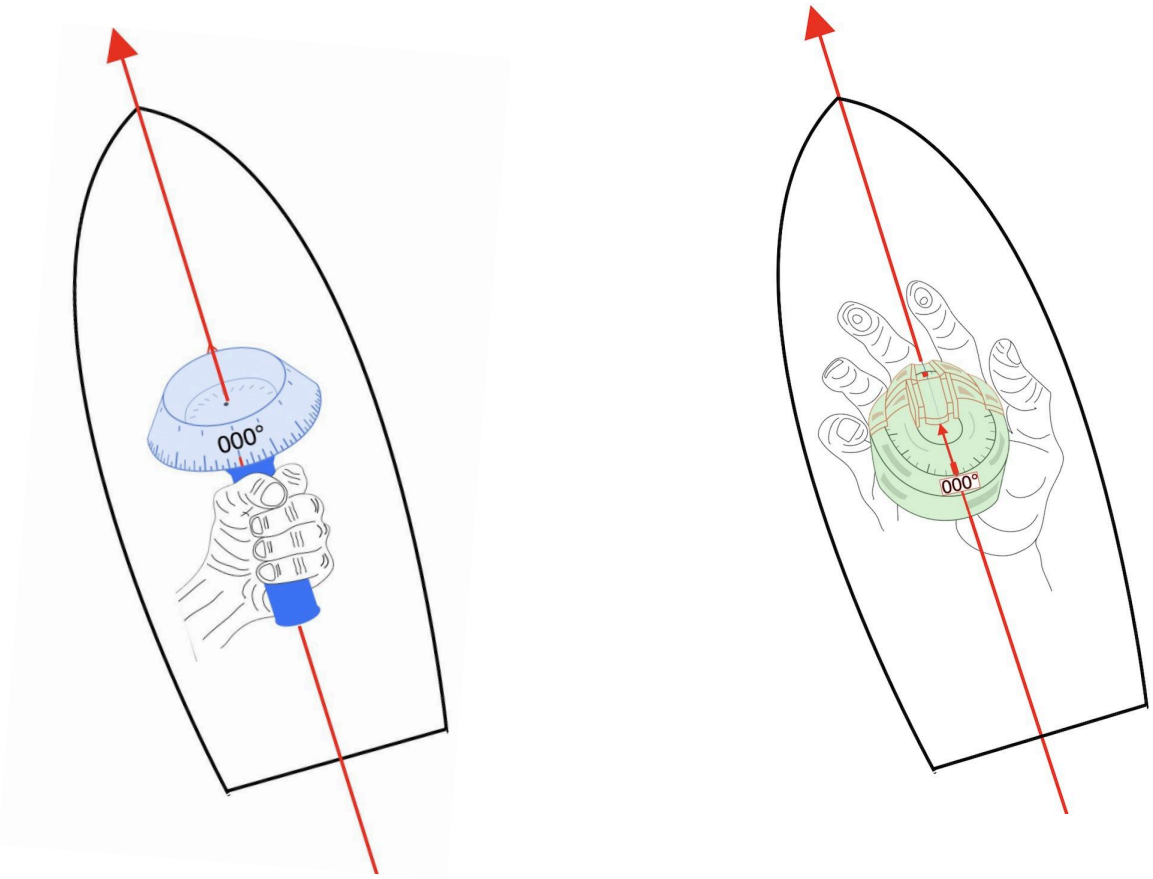




A typical location of adjustment screws on a Ritchie compass.

How to steer to magnetic north?

The vessel is brought to magnetic north using the bearing compass, then the heading shown on the steering compass is compared with the reading from the bearing compass.



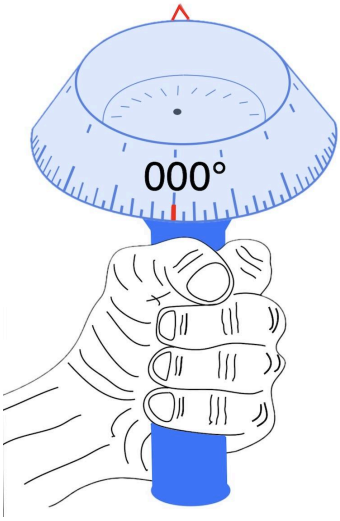
Two types of bearing compasses shown.

There is no need to account for magnetic variation, since both the bearing compass and the steering compass are affected in the same way.

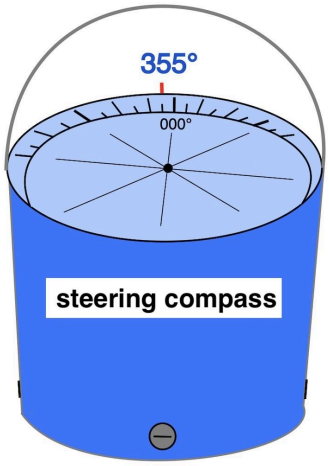
Example of compass adjustment by comparison between the steering compass and the bearing compass.

1. Steer to magnetic north and cancel the deviation using the N/S correctors.

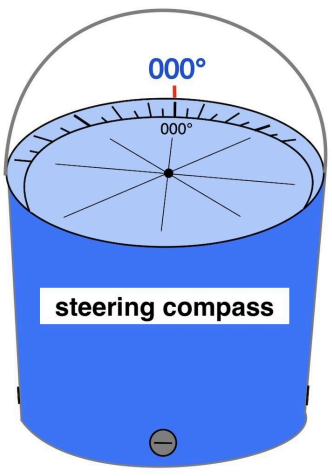
A The vessel is brought to magnetic north using a bearing compass.



B At that moment, the steering compass reads 355°.°

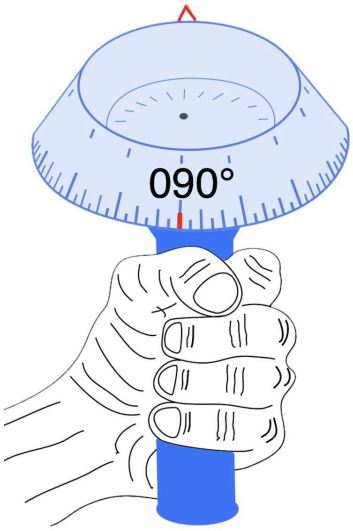


C The deviation is cancelled using the N/S correctors.

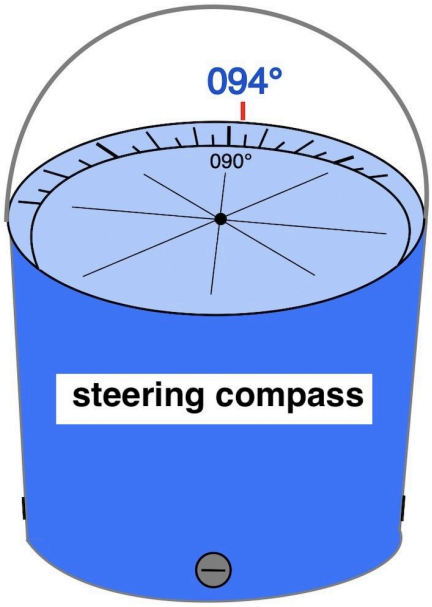


2. Steer to magnetic east and cancel the deviation using the E/W correctors.

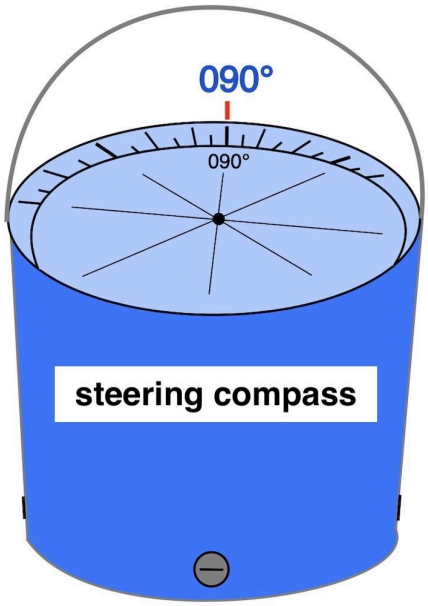
A The vessel is brought to magnetic east using a bearing compass.



B At that moment, the the steering compass reads 094°

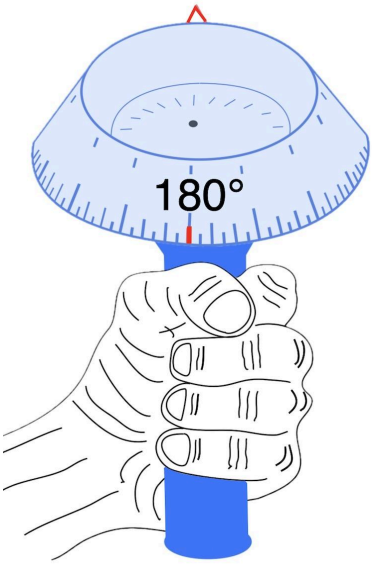


C The deviation is cancelled using the E/W correctors.

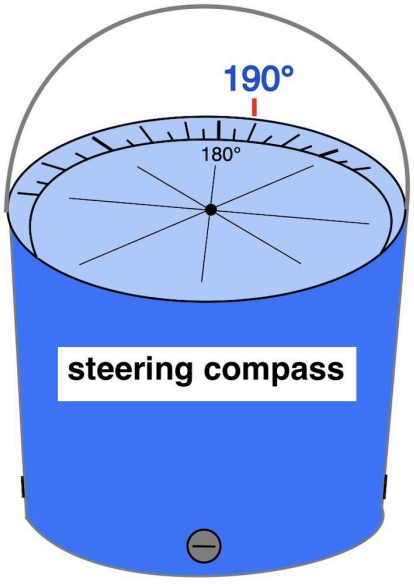


3. Steer to magnetic south and reduce the deviation by half using the N/S correctors.

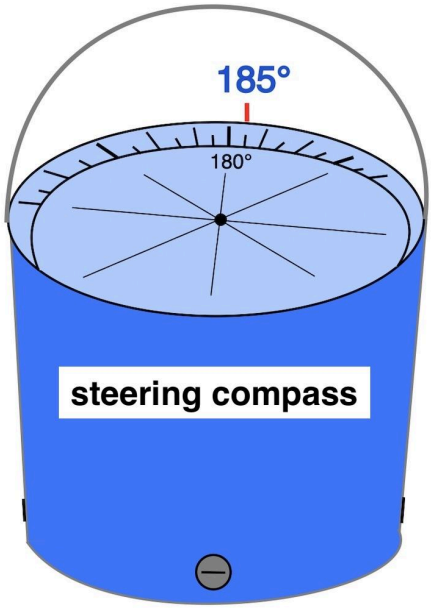
A The vessel is brought to magnetic south using a bearing compass.



B At that moment, the the steering compass reads 190°

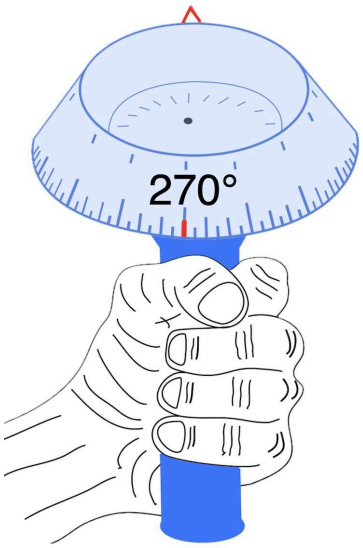


C. The deviation is reduced by half using the N/S correctors.

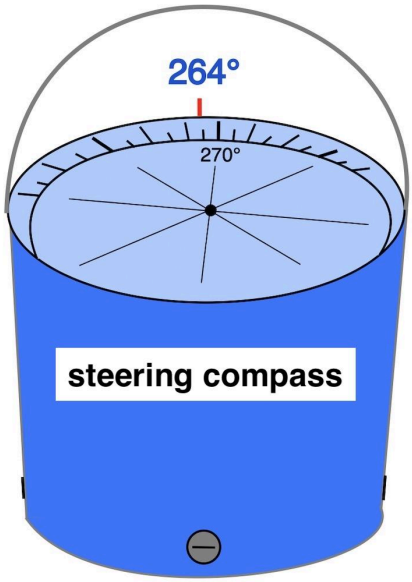


4. Steer to magnetic west and reduce the deviation by half using the E/W correctors.

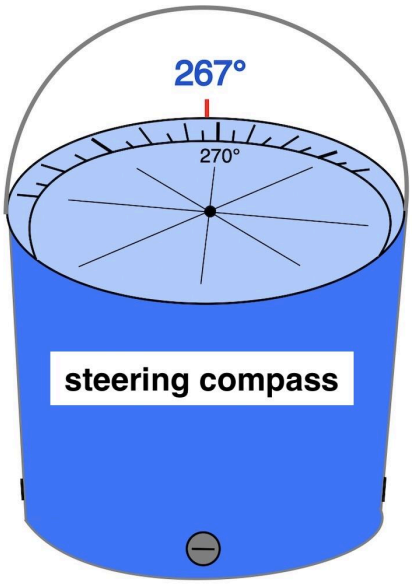
A The vessel is brought to magnetic west using a bearing compass.



B At that moment, the the steering compass reads 264°

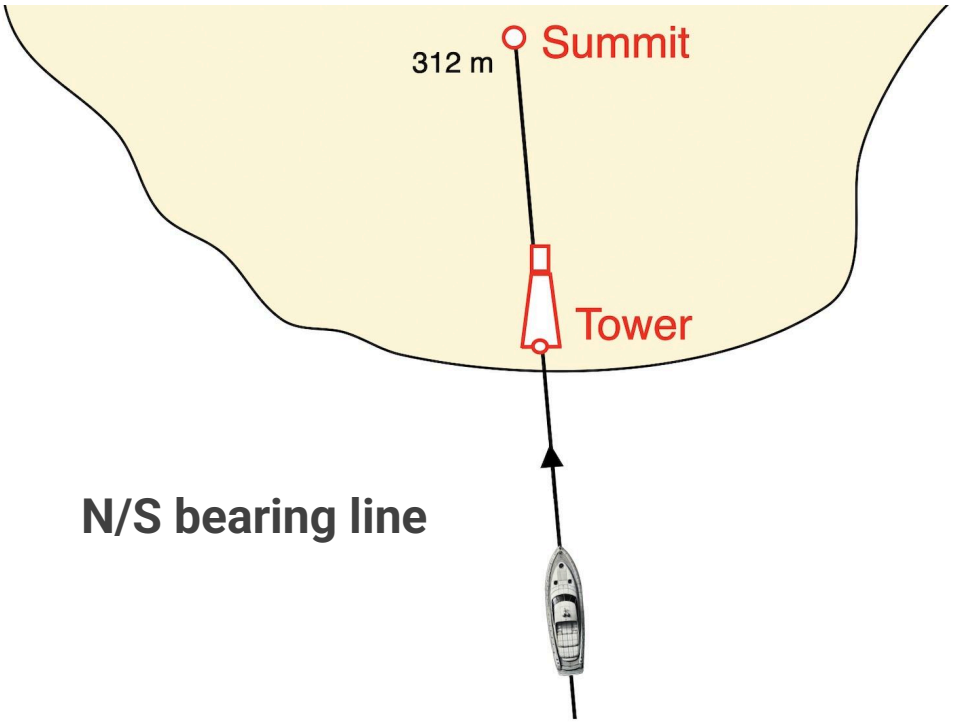


C. The deviation is reduced by half using the E/W correctors.

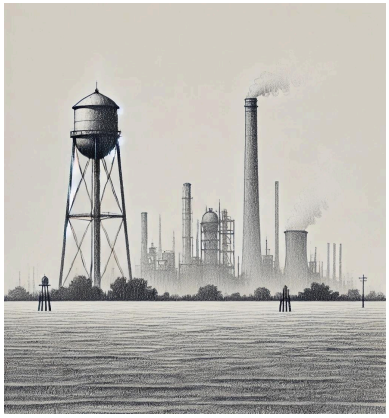


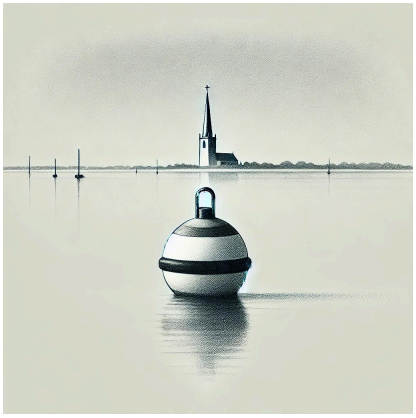
B.2

B.2 Adjustment of a Magnetic Steering Compass with Integrated Correctors Using Two Bearing Lines: North/South and East/West.



B.2 Adjustment on Two Bearing Lines: N/S and E/W, According to the Associated Instructions.



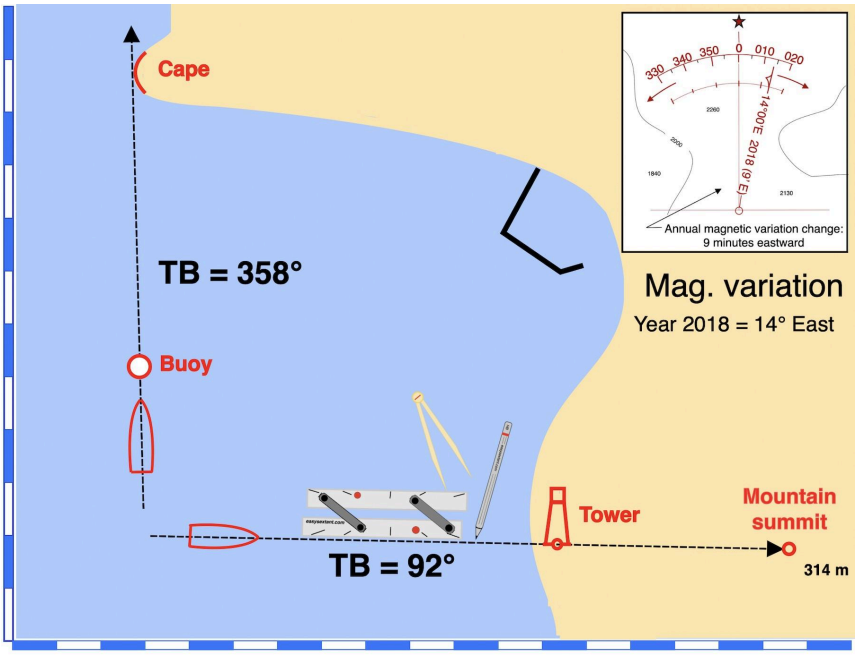


To perform accurate alignments, use clearly identifiable landmarks such as hilltops, towers, church bells, chimneys, or buoys—as long as they are shown on the nautical chart.

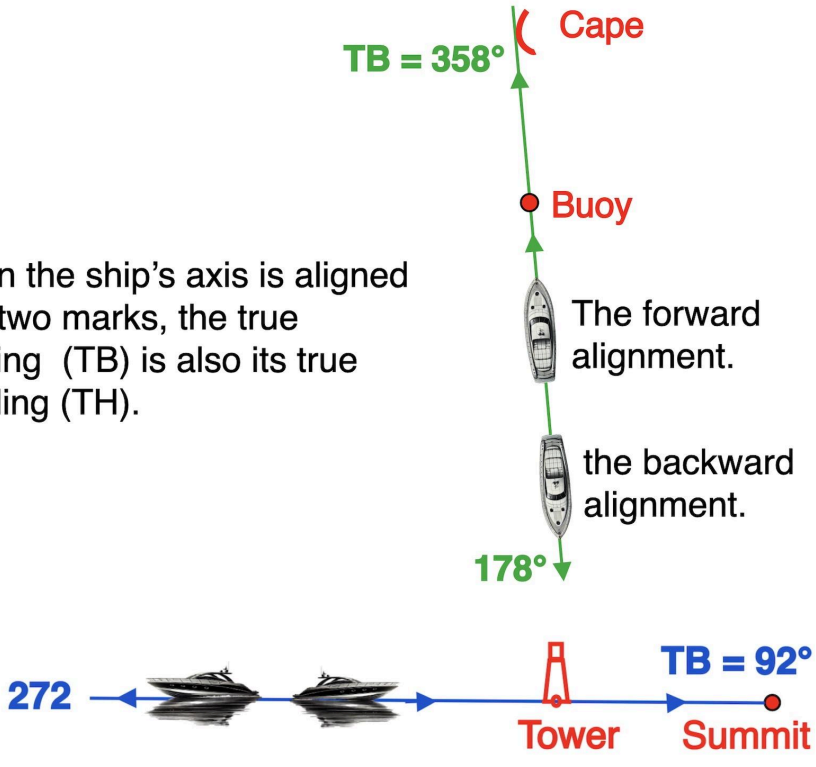
Of course, it is essential to verify the position of buoys using a GPS.

We'll follow a classic pattern.

We're looking on the chart for an alignment close to N/S and E/W.



When the ship's axis is aligned with two marks, the true bearing (TB) is also its true heading (TH).



The alignment doesn’t need to be exactly north/south or east/west — within 10 degrees is fine — but it’s essential that the headings followed in both directions along that line are exactly opposite.

FOLLOWING A BEARING LINE FORWARD

This involves visually aligning two (land)marks while heading toward them, keeping the vessel’s axis perfectly aligned with the bearing line. At this moment, the true heading (TH) is equal to the true bearing (TB).

FOLLOWING A BEARING LINE ASTERN

This involves visually aligning two (land)marks while moving away from them, ensuring that the vessel’s axis remains aligned with the bearing line. At this moment, the true heading (TH) equals the true bearing (TB) of the alignment ±180°.

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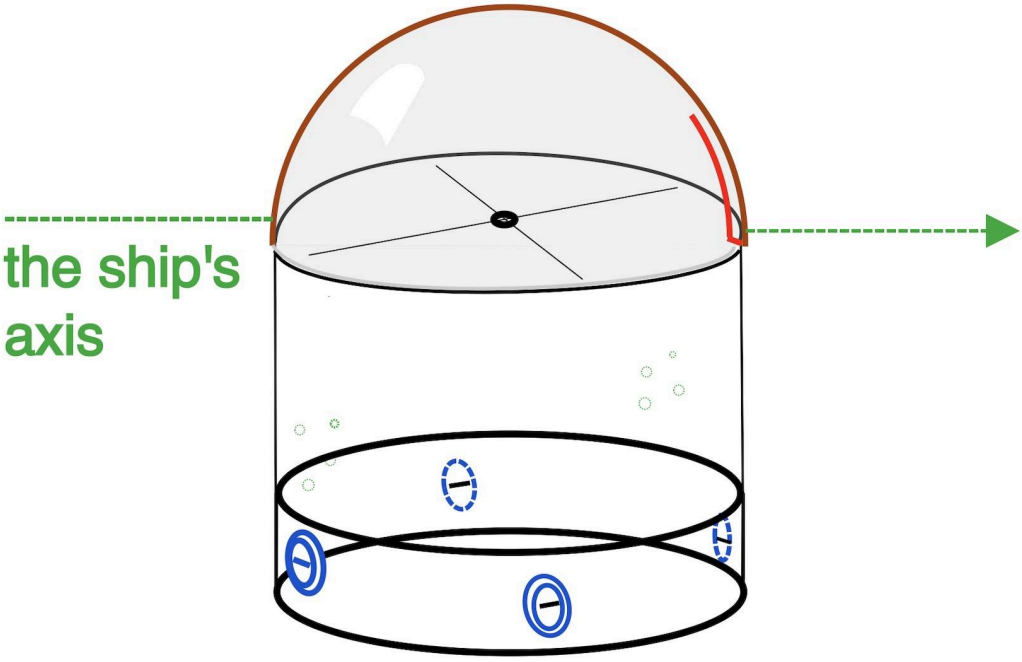
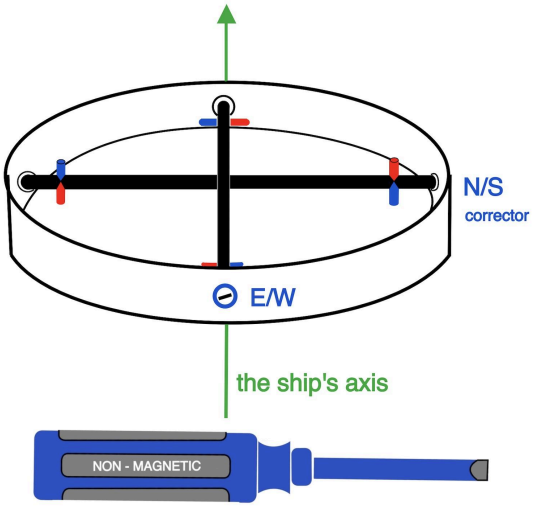
Taking a bearing line astern can be more challenging than following one forward, as it requires good coordination and some practice.

Steering compass with integrated correctors.


the ship's
axis


N/S
corrector
E/W
the ship's axis
NON - MAGNETIC

Example: B.2 Adjustment Using Two Bearing Lines: N/S and E/W

Follow the N/S and E/W bearing lines (see nautical chart above).

- **N/S bearings**: 358° and 178°
- **E/W bearings**: 092° and 272°

Fictional location, date: 2018 — Magnetic variation: 14° E

Instructions

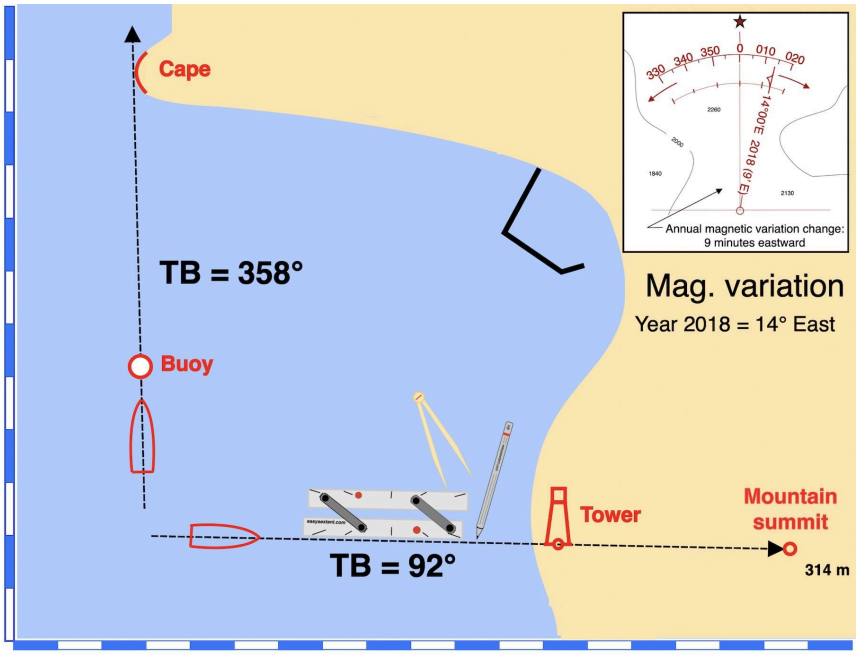
- **Step 1: Follow the N/S bearing line heading North.**
  Instruction: Eliminate the full deviation.
- **Step 2: Follow the E/W bearing line heading East.**
  Instruction: Eliminate the full deviation.
- **Step 3: Follow the N/S bearing line heading South.**
  Instruction: Eliminate half of the deviation.
- **Step 4: Follow the E/W bearing line heading West.**
  Instruction: Eliminate half of the deviation.

The idea is that if you're following a bearing line—for example, 358° true—you can determine the magnetic heading, since the true heading minus the variation equals the magnetic heading (TH – Var = MH)."

Then, the difference between the calculated magnetic heading (MH) and the heading read on the steering compass (CH) corresponds to the deviation. This deviation must be either cancelled or reduced by half, depending on the instructions.

The calculated magnetic heading (MH) serves as the absolute reference in the alignment-based adjustment technique, as it is from this value that any deviation is measured. Without this reference, accurate compass adjustment is not possible.

The example below shows one case where the deviation is cancelled, and another where it is reduced by half.

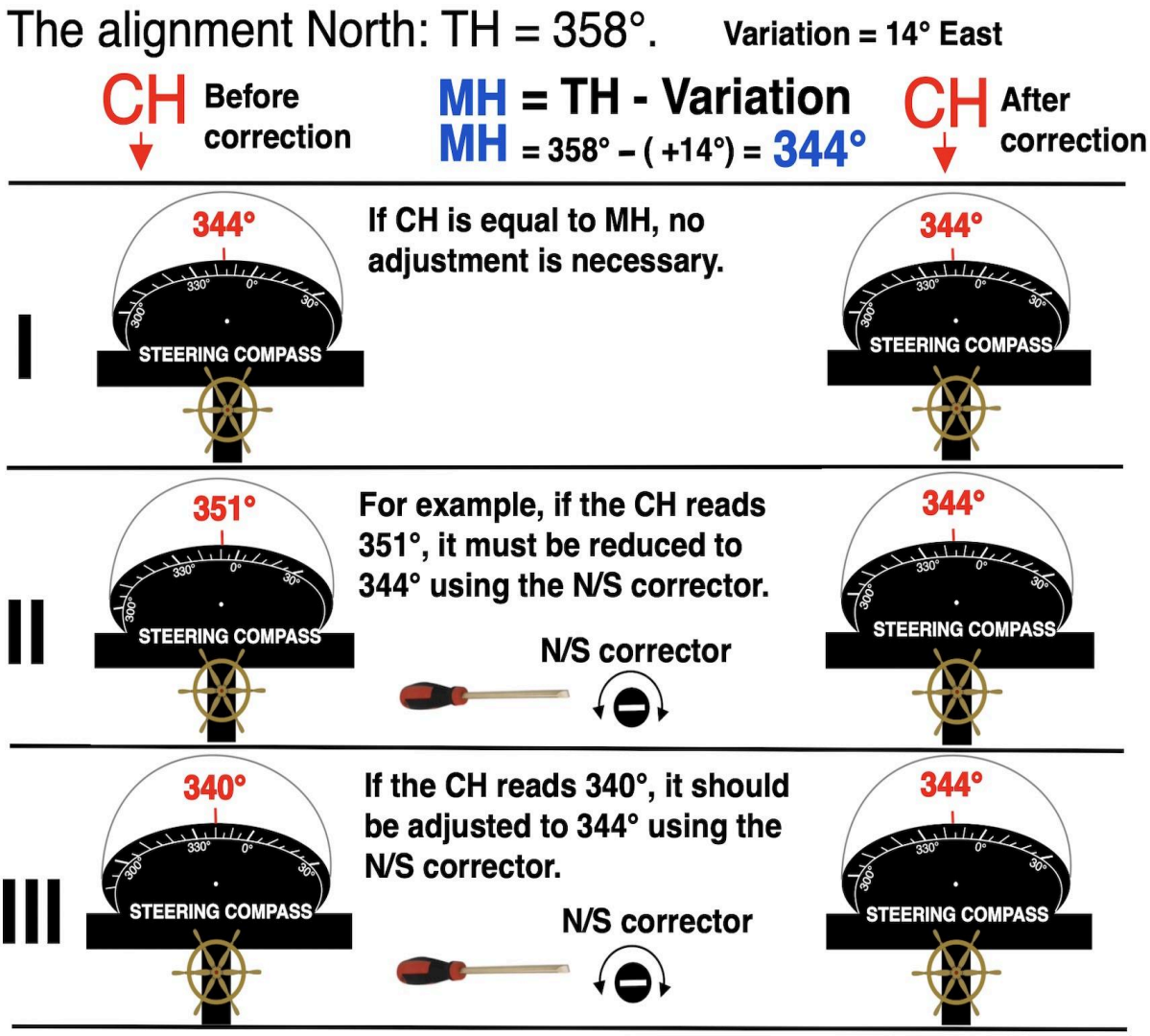


Follow the N/S and E/W bearing lines (see nautical chart above).

- **N/S bearings**: 358° and 178°
- **E/W bearings**: 092° and 272°
- *Magnetic variation: 14° E*

Step 1: Follow the north–south bearing line while heading north.

While aligning, ensure that the vessel's axis is properly aligned with the bearing line. In our example, the true heading (TH) is 358°.



Step 2: Follow the east–west bearing line while heading east.

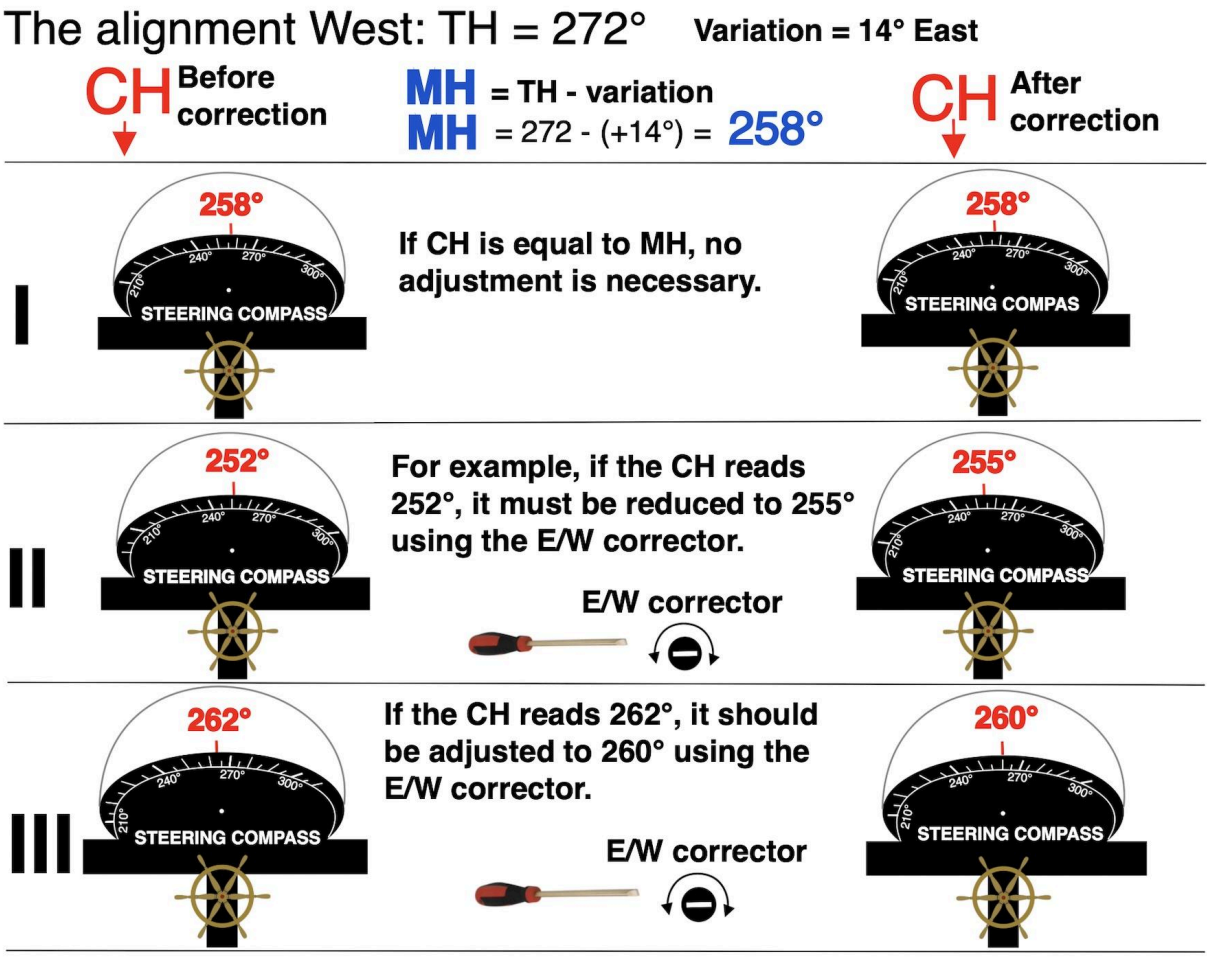
TH = 92°; MH = 78° (Use the same method as in Step 1, but apply the E/W corrector instead.)

Step 3: Follow the north–south bearing line while heading south.

TH = 178°; MH = 164° (Use the same method as in Step 4, but apply the N/S corrector instead.)

Step 4: Follow the east–west bearing line while heading west.

TH = 272°; MH = 258° (See illustration below.)

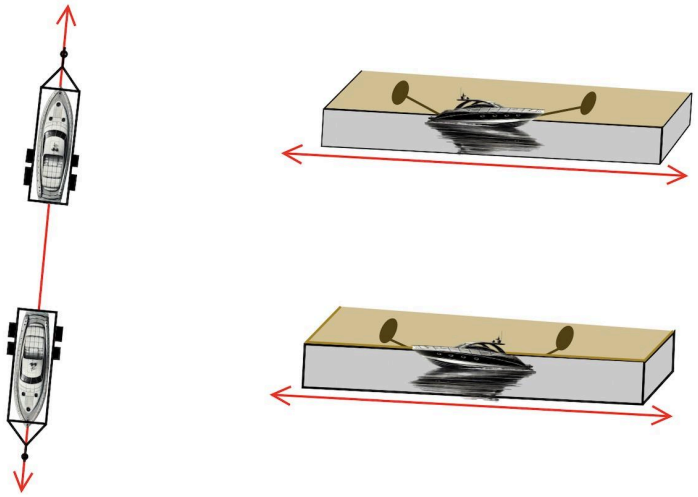


Remember: MH (magnetic heading) is the key reference!

Similar methods can be used for boats on trailers or moored along a dock roughly aligned north–south or east–west.

The author of this guide has never tested these methods, but if a trailer is used, it must be made of aluminum. Don’t forget to move the car away.

Moreover, docks are often heavily reinforced with steel, which must be taken into account when adjusting the vessel’s magnetic steering compass. In both cases, it is essential that the boat completes an exact 180° rotation.



The heading being exactly N/S or E/W is not important, but what matters is that they are exactly 180° apart for the adjustment

B.3

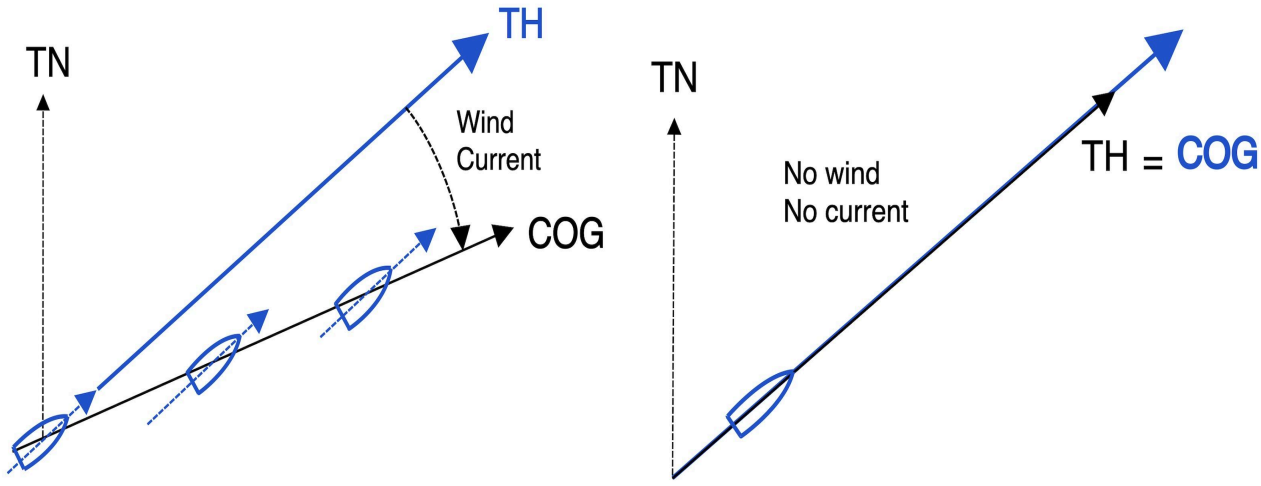
B.3 Adjustment of a Magnetic Steering Compass with Integrated Correctors by Comparing the Steering Compass to the GPS Course on Four Headings, Roughly North/South and East/West, Spaced 90° Apart.

Ritchie compass

B.3 Method of Adjustment:

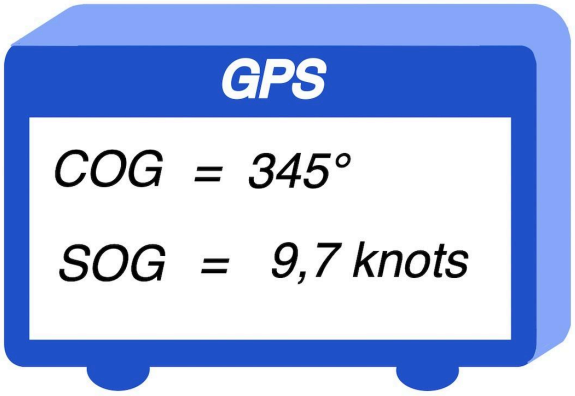
Using GPS to adjust the steering compass.

A GPS is used to obtain the magnetic heading instead of using a hand-bearing compass.



In the absence of wind and current, the true heading (TH) is equal to the course over ground (COG) shown by the GPS.

Choose a calm day, with no wind or current, and sail at about 10 knots. A higher speed improves the accuracy of the course over ground.



COG = course over ground

SOG = speed over ground

The absence of wind is easy to observe. To check for current, you can drop a cork near a buoy and watch for any drift.

In fact, GPS can detect a vessel's drift while it is stationary. By logging its position over time, and in the absence of wind, it is possible to determine the speed and direction of movement caused solely by the current.

If wind or current is present, GPS readings may be inaccurate for compass adjustment and should be avoided.

Example: maintaining a magnetic heading of 090° (East) using GPS, in ideal conditions with no wind or current.

(No wind or current) → True heading = Course over ground : Variation: 12° East = +12°
Formula:

True Heading = Magnetic Heading + Variation

→ **TH = 090° + (+12°) = 102°**

Conclusion:

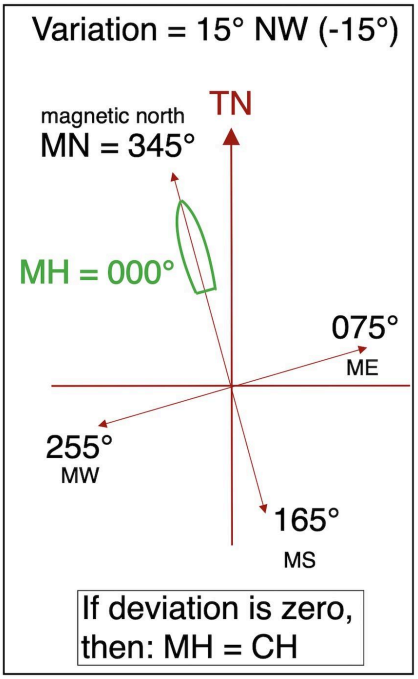
To maintain a magnetic heading of 090°, the GPS should indicate a course over ground (COG) of 102°.

In other words, if the GPS shows a COG of 102°, you are effectively steering a magnetic heading (MH) of 090°.

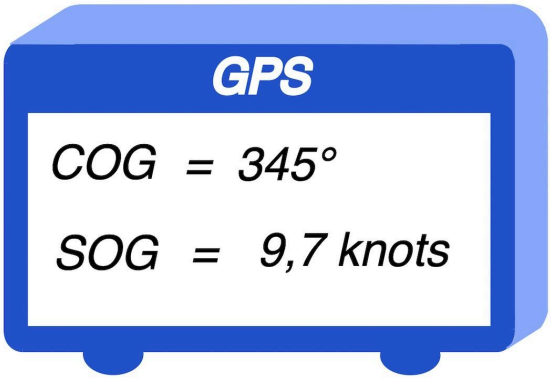
The difference between this magnetic heading and the compass heading (CH) observed on the steering compass is the deviation.

Note: Instead of using the COG, many GPS devices can display the magnetic heading directly, which is even better (see user manual). Same conditions: no wind, no current.

1. Steer the vessel to magnetic north and cancel the deviation using the N/S correctors.

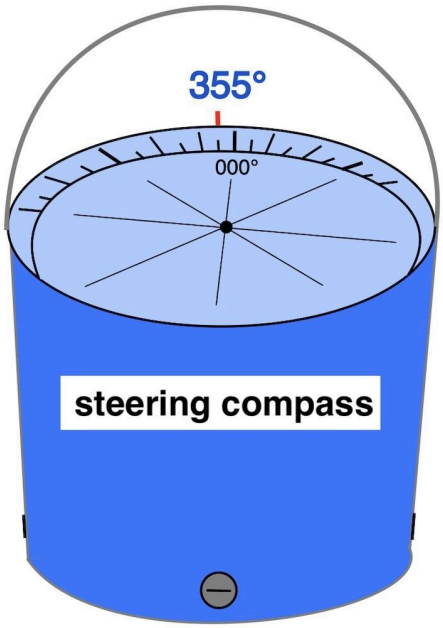


A **The vessel was brought to magnetic north using the GPS.**

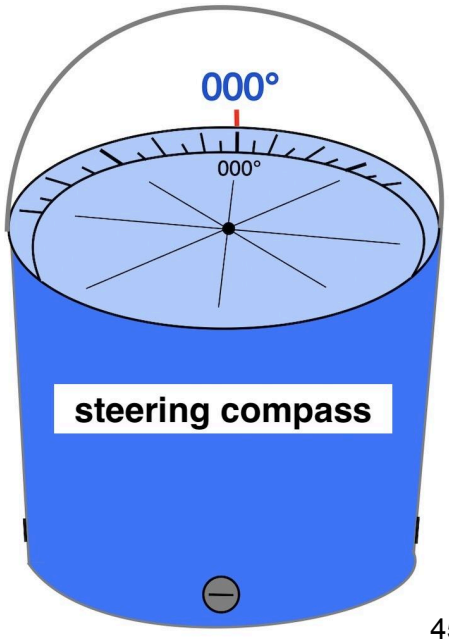


No wind, no current.
TH = COG,
TH = MH + Variation ➤
360° + (–15°) = 345°

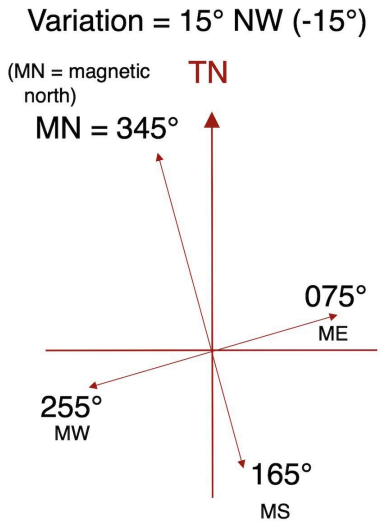
B **At that moment, the steering compass indicated 355°.**



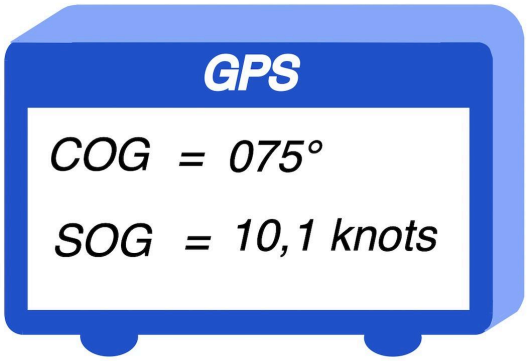
C **The deviation is corrected using the N/S correctors.**



2. Steer the vessel to magnetic east and cancel the deviation using the E/W correctors.

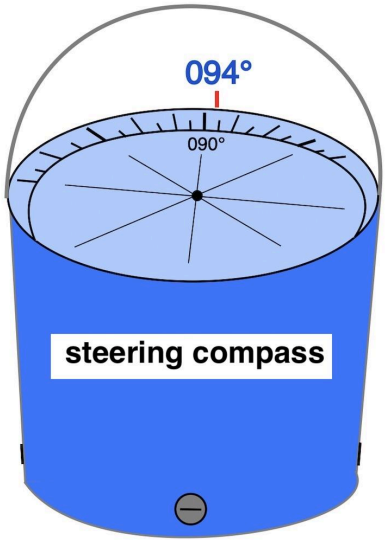


A The vessel was brought to magnetic east using the GPS.

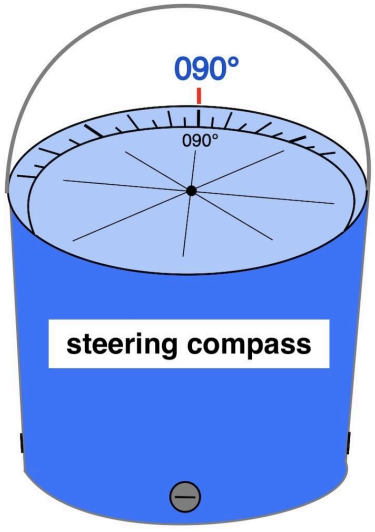


No wind, no current.
TH = COG,
TH = MH + Variation ➤
090° + (–15°) = 075°

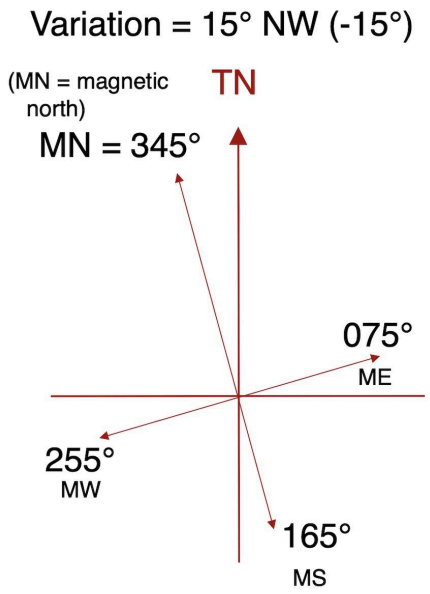
B At that moment, the steering compass indicated 094°.



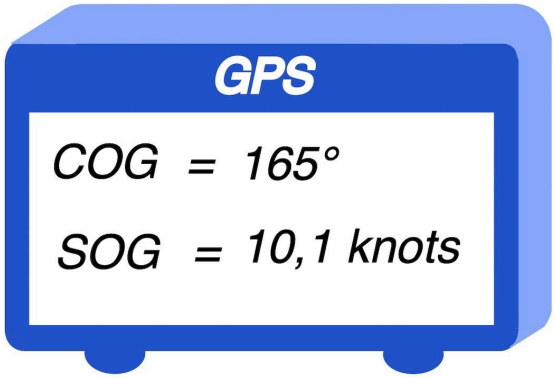
C The deviation is corrected using the E/W correctors.



3. Steer the vessel to magnetic south and reduce the deviation by half using the N/S correctors.

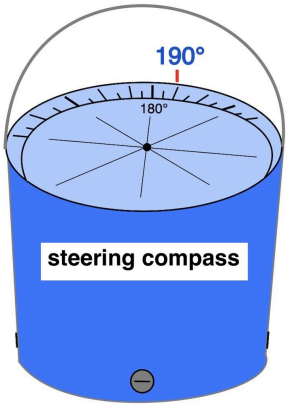


A **The vessel was brought to magnetic south using the GPS.**

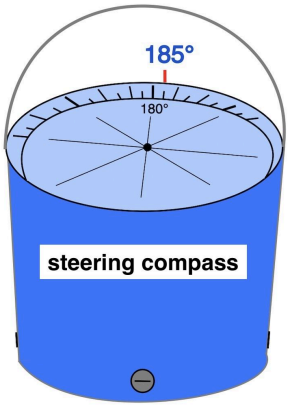


No wind, no current.
TH = COG,
TH = MH + Variation ➤
180° + (–15°) = 165°

B **At that moment, the steering compass indicated 190°.**

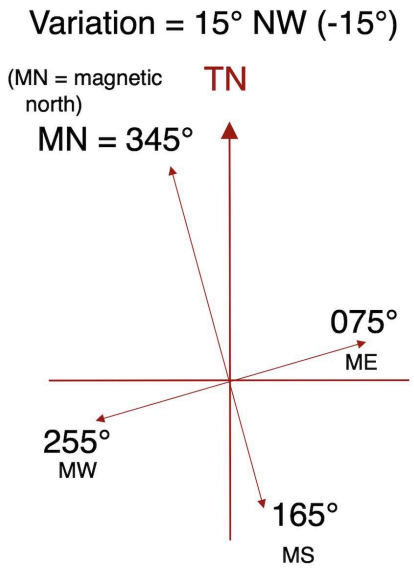


C **The deviation is reduced by half using the N/S correctors.**

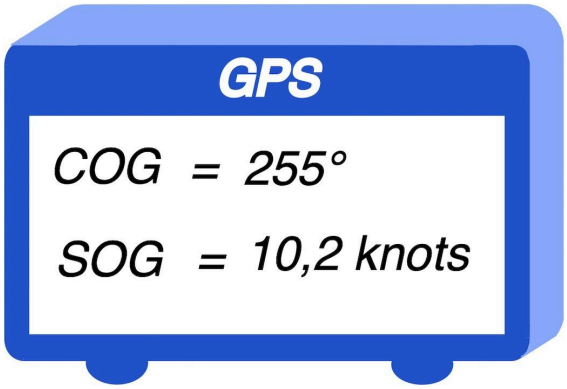


Note: If the steering compass had indicated 180°, no correction would have been necessary at that moment.

4. Steer the vessel to magnetic west and reduce the deviation by half using the E/W correctors.

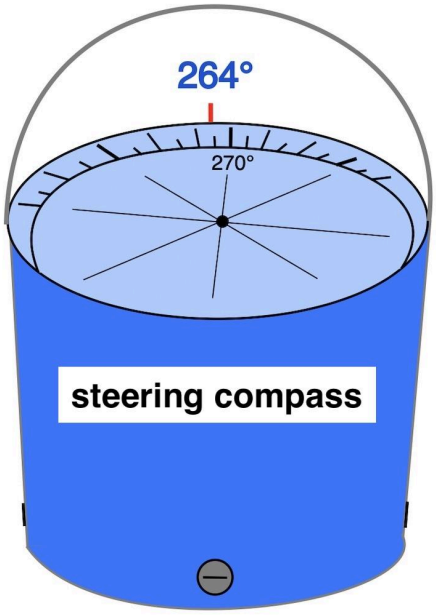


A **The vessel was brought to magnetic west using the GPS.**

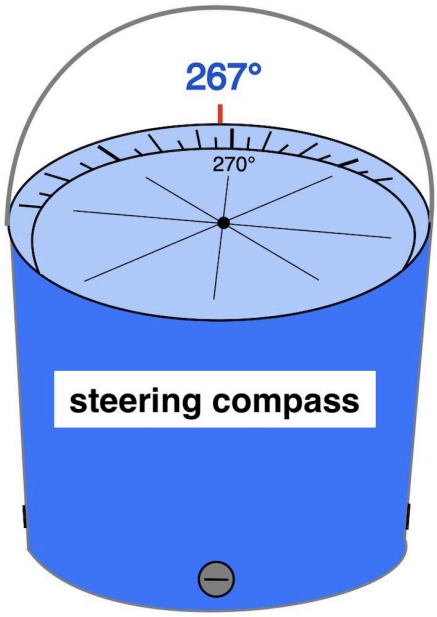


No wind, no current.
TH = COG,
TH = MH + Variation ➤
270° + (–15°) = 255°

B **At that moment, the steering compass indicated 264°.**



C **The deviation is reduced by half using the E/W correctors.**



EXERCISE B.3 : Adjustment of the steering compass using a GPS

(Answers below.)

Variation: 8° E

Conditions: no wind, no current

Minimum speed during compensation: 10 knots

---

1. Come to magnetic north and cancel the deviation using the N/S correctors.

What COG (Course Over Ground) will be shown on the GPS to come to magnetic north?

At this time, the compass heading shows 003°.

What is the amount of error to correct using the N/S correctors?

2. Come to magnetic east and cancel the deviation using the E/W correctors.

What COG (Course Over Ground) will be shown on the GPS to come to magnetic east?

At this time, the compass heading shows 095°.

What is the amount of error to correct using the E/W correctors?

3. Come to magnetic south and reduce the deviation by half using the N/S correctors.

What COG (Course Over Ground) will be shown on the GPS to come to magnetic south?

At this time, the compass heading shows 186°.

What is the amount of error to correct using the N/S correctors?

4. Come to magnetic west and reduce the deviation by half using the E/W correctors.

What COG (Course Over Ground) will be shown on the GPS to come to magnetic west?

At this time, the compass heading shows 280°.

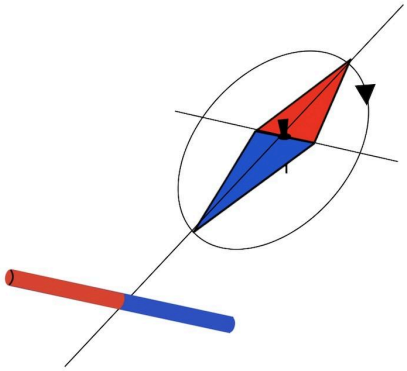
What is the amount of error to correct using the E/W correctors?

Answer exercise B.3

situation	GPS reading TH = COG (no wind/current)	Adjustment needed
magnetic North (MH = 000°)	008°	3° N/S corrector
magnetic East (MH = 090°)	098°	5° E/W corrector
magnetic South (MH = 180°)	188°	6° / 2 = 3° N/S
magnetic West (MH = 270°)	278°	10° / 2 = 5° E/W

C.1

C. Adjustment of a Magnetic Steering Compass with External Compensators.

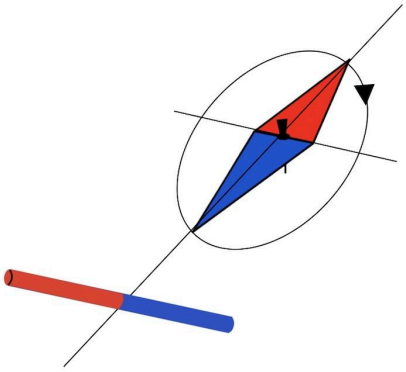


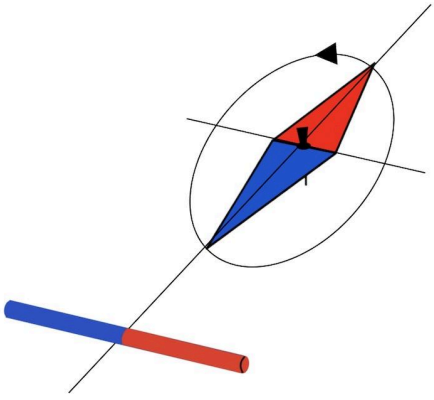
C.1 Adjustment using magnets placed and/or moved outside the compass.

C.1 Adjustment using magnets placed and/or moved outside the compass.

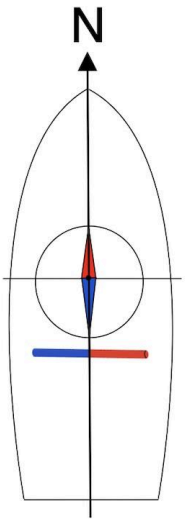
Remember: the blue (–) side of the magnet attracts the red (+) tip of the compass needle. The closer the magnet is, the stronger the attraction. Conversely, moving it farther away reduces the effect.

The advantage of using two parallel magnets rather than a single one, magnetized in the same direction, is that it enables finer and more precise adjustments.

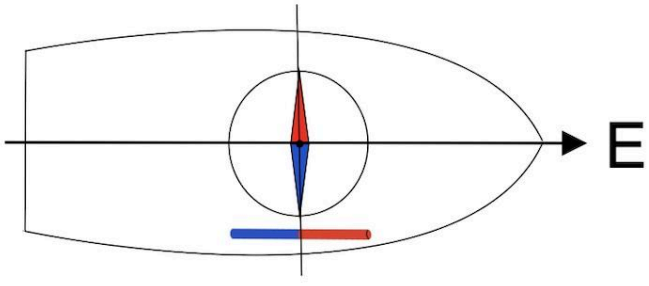




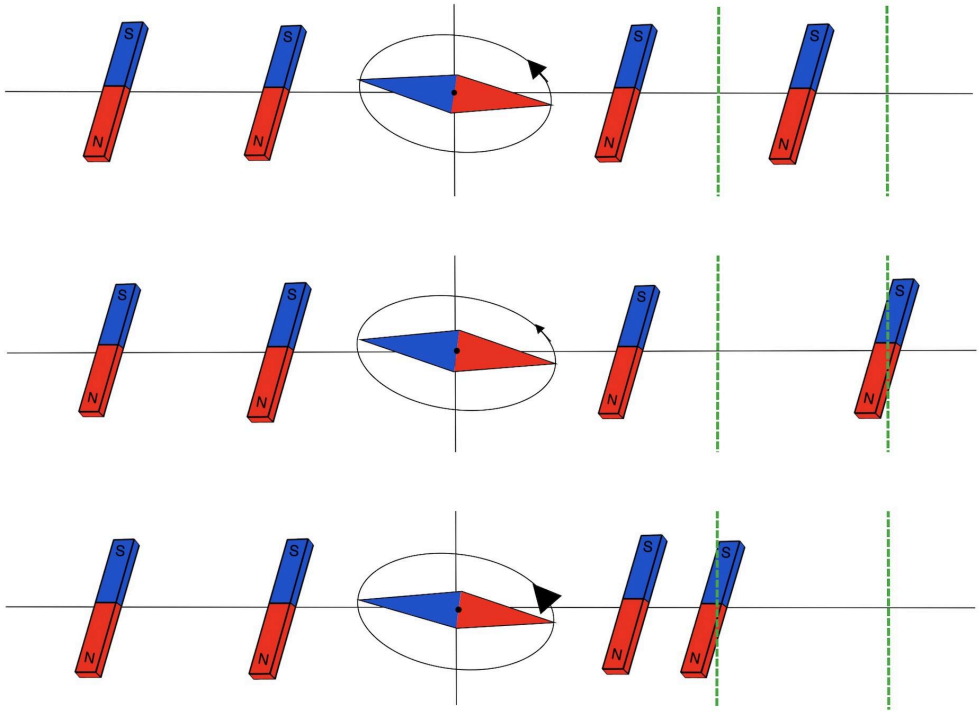
Transverse correctors (also called C-correctors) are used to correct deviations on North and South magnetic headings. They are often arranged in pairs (in the drawing below, only one is visible).



Longitudinal correctors (also called B-correctors) are used to make corrections on East and West magnetic headings.



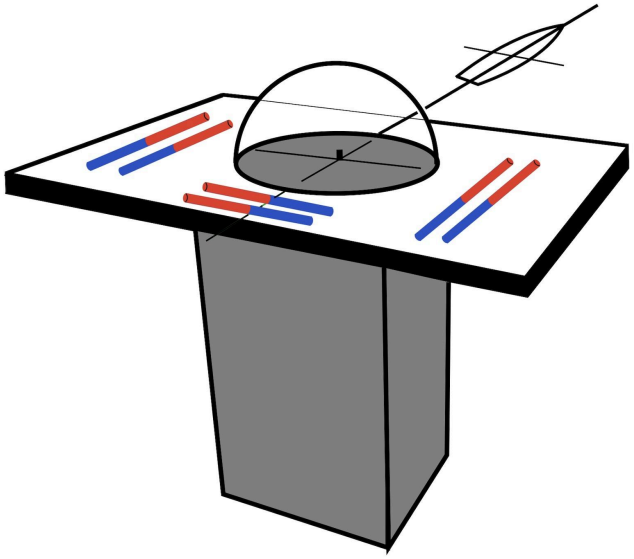
Instead of using a single magnet, multiple magnets can be used to create a more uniform magnetic field and make it easier to apply small corrections.



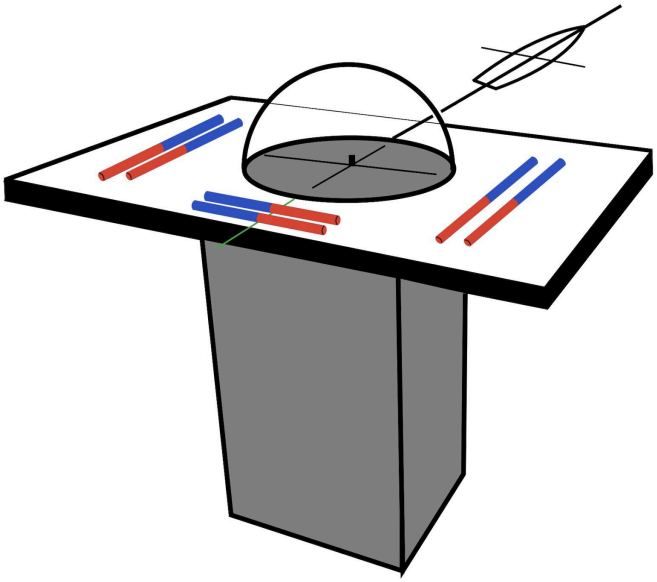
The closer the magnet is, the stronger the attraction. Conversely, the farther it is, the weaker the effect.

On larger compasses, longitudinal correctors can be placed on both sides of the compass, while transverse correctors are generally installed on only one side — either at the front or the rear.

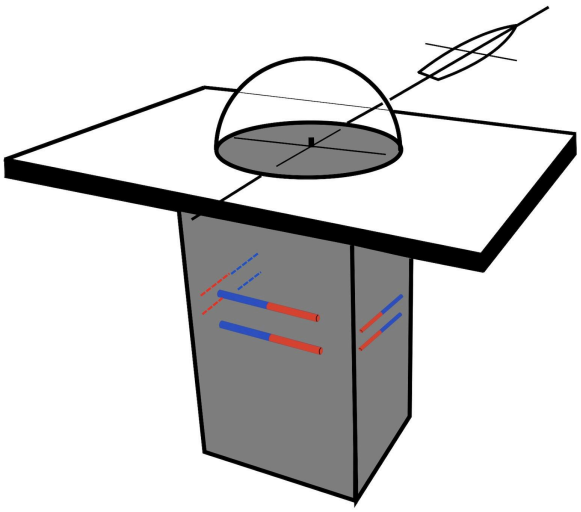
Horizontal Mounting 1



Horizontal Mounting 2



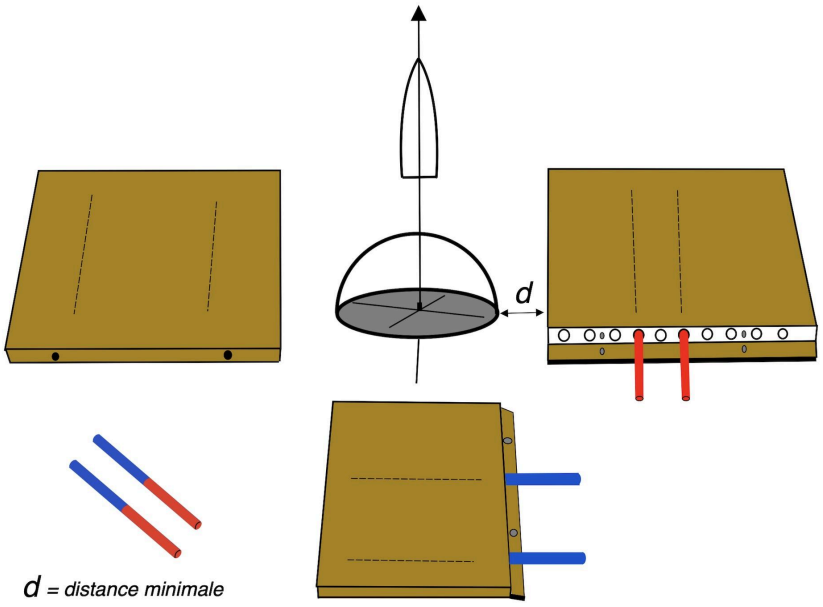
Vertical Mounting



This traditional drawing (vertical mounting) shows how the magnetic compass is adjusted on large merchant ships to compensate for permanent magnetic influences.

The magnets can be moved up or down to weaken or strengthen the magnetic fields in vertical mountings, or brought closer together or farther apart in horizontal mountings, allowing for the desired deviation adjustment.

In general, if the blue poles of the magnets point forward, all the others point forward as well. Similarly, if the blue poles point to starboard, all the others do too. These magnets can be moved together or individually. In some cases, more than 20 vertical positions are provided.



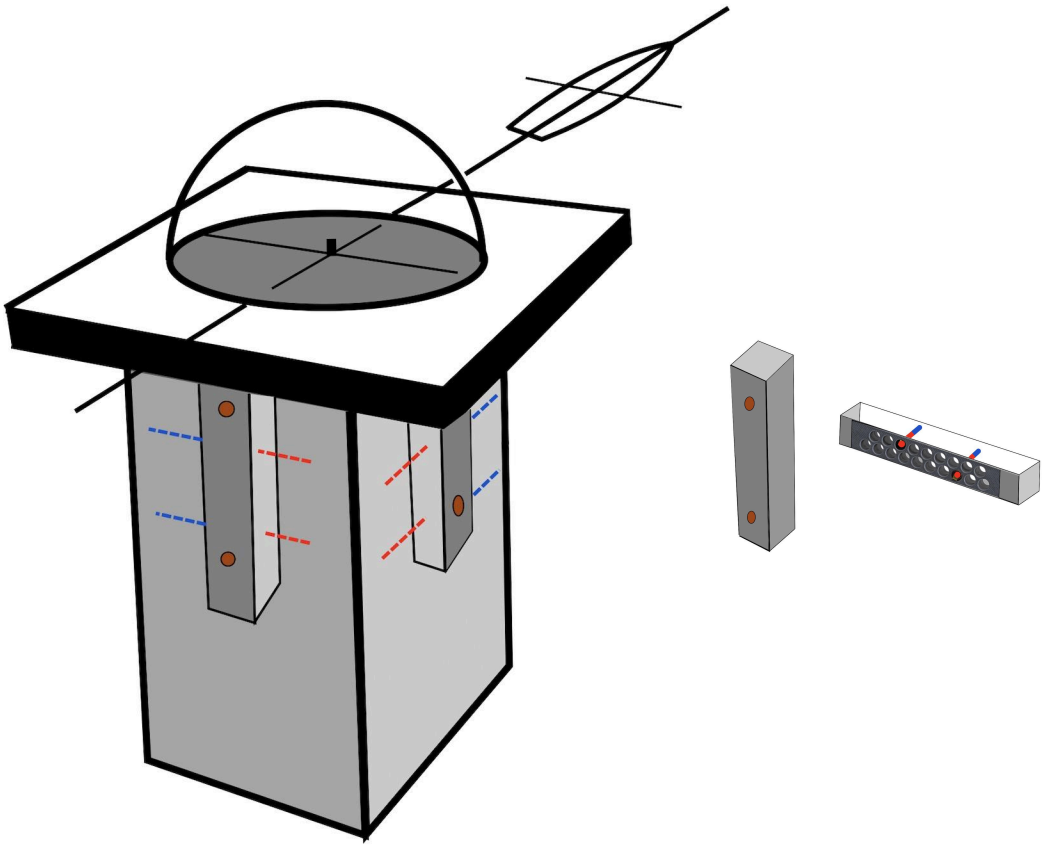
For example, Cassens & Plath sells adjustment cartridges designed for some of their compasses, but they are also compatible with other compass models.

For its compasses, the minimum distance *d* is 20 cm.

In principle, only two are needed: one to starboard or port, and the other aft or forward of the compass.

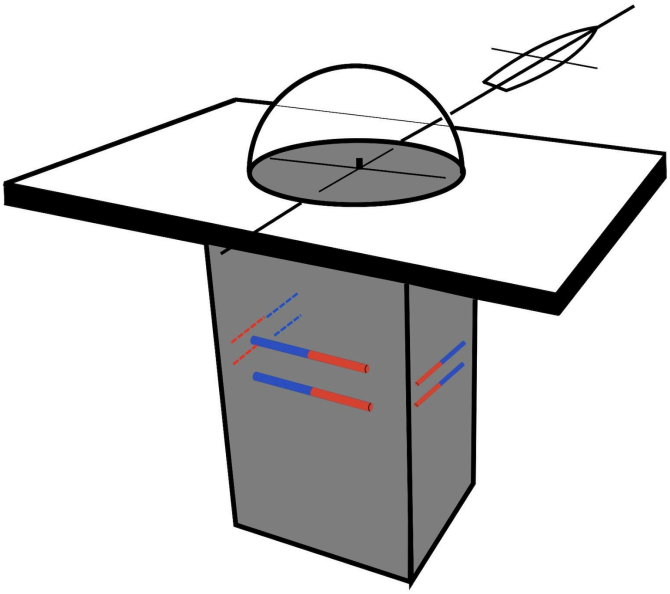
They can be mounted either horizontally or vertically. <u>What matters is that the longitudinal correctors are perfectly parallel to the ship's axis, and the transverse correctors are perpendicular to it.</u>

Other manufacturers offer adjustment cartridges in pairs, often much smaller and easier to handle, especially for smaller compass cards.



C.2

C.2 Illustrated Example of Adjustment Using Magnets Placed and/or Moved Outside the Compass.

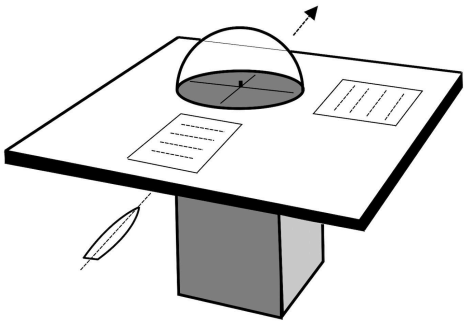


The example below illustrates the positions of the horizontal magnets, but the same principle applies to the vertical magnets (see Chapter C.1).

Steering the boat to the indicated magnetic heading is done here using the hand bearing compass.

You may also use the GPS for this purpose (see Chapter B.3).

We start with no magnets at all:



1. Steer to magnetic north and install the transversal correctors to cancel the deviation.

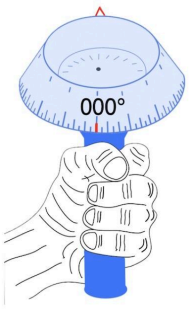
2. Steer to magnetic east and install the longitudinal correctors to cancel the deviation.

3. Steer to magnetic south and reduce the deviation by half using the installed transversal correctors.

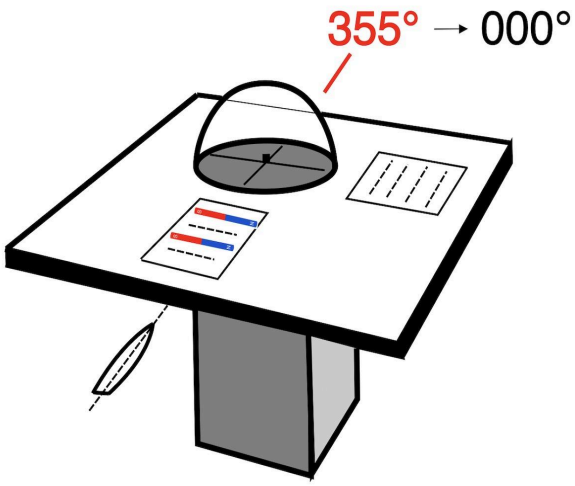
4. Steer to magnetic west and reduce the deviation by half using the installed longitudinal correctors.

Remember: **Opposite poles attract**, so the **blue (–)** end of the corrector **attracts the red (+) tip** of the compass needle.

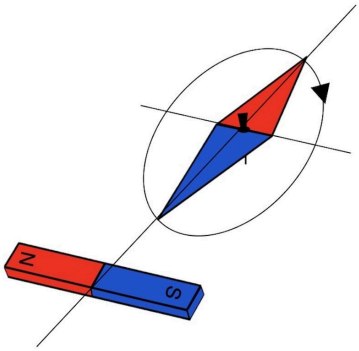
1



We steer the boat to a magnetic heading of 000°



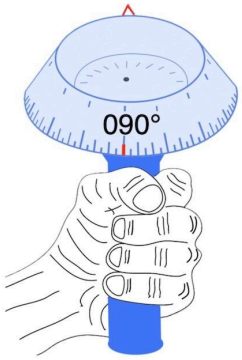
Our steering compass reads 355°, and we need to cancel the deviation.



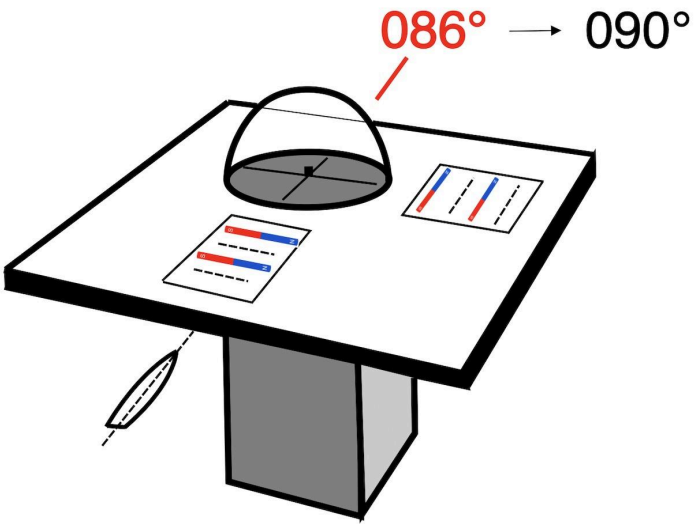
The transverse correctors are not yet installed.

We place the transverse correctors behind the compass, with the red side of the magnet to port, and then move them closer or farther away until the deviation is cancelled.

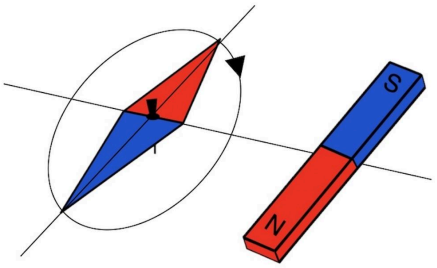
2



We steer the boat to a magnetic heading of 090°



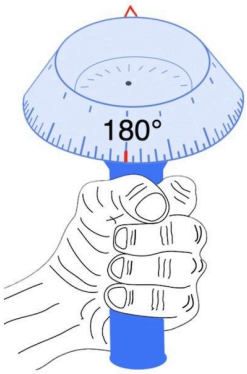
Our steering compass reads 086°, and we need to cancel the deviation.



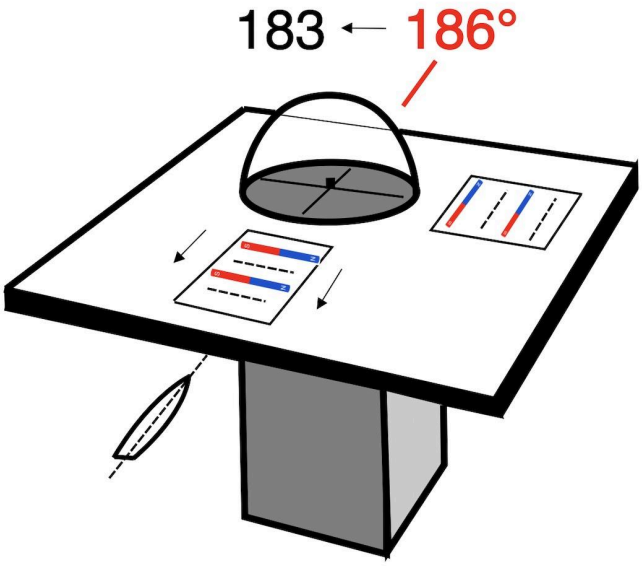
The longitudinal correctors are not yet installed.

We place the longitudinal correctors to starboard of the compass, with the red side of the magnet facing aft, and then move them closer or farther away until the deviation is cancelled.

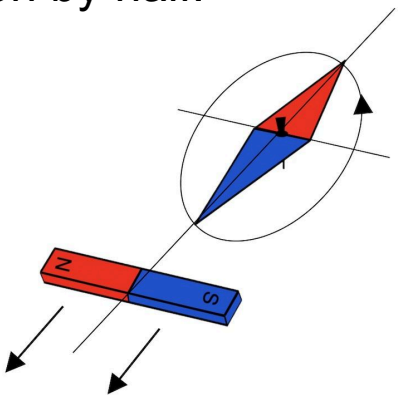
3



We steer the boat to a magnetic heading of 180°



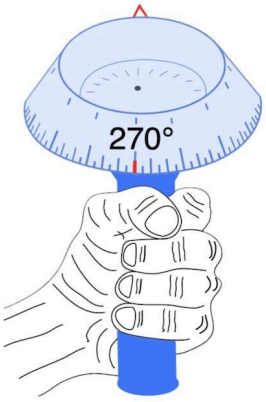
Our steering compass indicates **186°**, and we need to reduce the deviation by half.



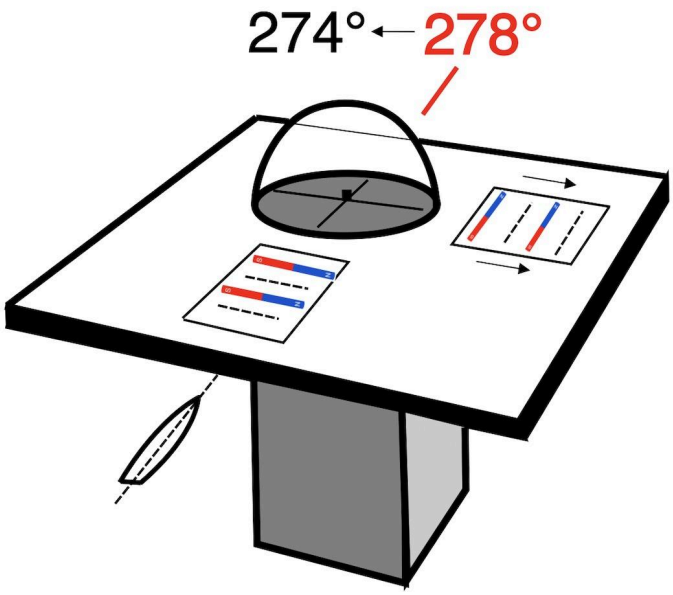
Our transverse correctors are already in place.

Simply move them <u>away</u> gradually until the deviation is reduced by half.

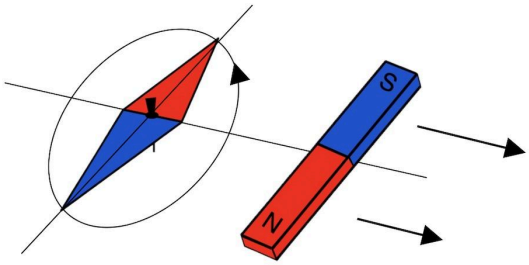
4



We steer the boat to a magnetic heading of 270°



Our steering compass indicates **278°**, and we need to reduce the deviation by half.



Our longitudinal correctors are already in place.

Simply move them <u>away</u> gradually until the deviation is reduced by half.