MANUAL

SIMRAD AUTOPILOT

Compass

20220653C English

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Instruction Manual

This manual is intended as a reference guide for choosing the correct type of compass for autopilot installations.

It describes the different Fluxgate/Rate compass versions; how to install, connect and calibrate them.

Please take time to read the manual. It may give some good hints for your next autopilot installation!

About this document

Rev	Date	Written by	Checked by	Approved by
Rev. C	16.11.05	NG	IK	ThH
	Complete update with RC25, RC36, RC37 and AP25 Series autopilots			

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1 INTRODUCTION

The compass or heading sensor is the most vital component in an autopilot system.

Therefore, great care should be taken when choosing compass type and finding a good mounting location.

Not only should the compass be of good quality, it is even more important that a good mounting location is found.

Last, but not least, the compass must have calibration / compensation facilities.

The best autopilot steering is obtained with a compensated compass!

Of all complaints or problems about autopilots, 70-80% of the trouble can one way or the other be attributed to poor performance of the magnetic heading sensor.

Typical complaints are;

- “My boat doesn’t steer going North.”
- “I can steer on all headings but one or two.
- “In a following sea my vessel is wild, the autopilot will not steer it.”
- “It steers fine when the sea is calm, but not when it’s rough.”

The autopilot compass senses the earth’s magnetic field to determine whether or not the vessel is actually turning, thereby producing a heading error signal. If the field is distorted by local magnetic influence, then the compass cannot accurately measure the degree of turn.

If the compass does not present a stable reference, no amount of subsequent electronic processing can compensate for the signal errors.

The compass will be unable to detect a change in course on some headings, where on other headings a minor turn will cause the compass to show a large course change, thereby putting on excess corrective rudder.

Carefully study chapter 4 of this manual prior to installing a magnetic heading sensor for your autopilot.

2 COMPASS TYPES

2.1 Magnetic compass

The conventional liquid filled magnetic compass with external gimbals is the typical autopilot compass for smaller fishing boats and work boats up to approx. 70ft.

The compass card is supported by the fluid and provided it is compensated by qualified personnel, it is a fairly stable and very reliable heading reference for the autopilot, even in rough seas.

This compass type may also be used on sail- and motor yachts with good result.

It gives most often a better autopilot steering performance on steel boats - providing it can be properly compensated - than a fluxgate compass.

Be aware that so called spherical compasses, most often found in the pedestal of sail boats, can not be used as autopilot compass because of the missing external gimbals.

In order to electrically detect heading change from the compass that the autopilot can use, a course detector (pick-up coil) is needed.

This course detector is normally mounted to the bottom of the compass and as the compass is turning (relative to the compass card) the changing field from the magnet in the compass card will induce a varying signal in the detector.

2.2 Fluxgate compass

Different from the course detector that picks up the magnetic field from the compass card magnet, the fluxgate compass picks up the Earth's magnetic field directly.

The sensor coil is either mechanically gimballed or has a floating ring core (RFC35). This will prevent an uneven distribution of the magnetic field in the sensor coil when the boat is rolling and pitching. Compared to a magnetic compass, however, the fluxgate compass is more sensitive to the motions of a vessel. In rough sea conditions or in sharp turns at high speeds, the sensor may be temporarily displaced from the horizontal plane. A distorted and unstable heading input to the autopilot is the resulting effect. A lot of attention has been paid to reduce this effect when designing the RFC35 Fluxgate compass and it has proven to be successful. The optimum performance is accomplished with the Rate Compass which is a rate sensor stabilized fluxgate compass.

Except from the Rate Compass, fluxgate compasses are not recommended as autopilot compass on steel boats, mainly due to lack of efficient “heeling error” compensation. This compensation is needed when a magnetic heading sensor is mounted on top of the wheelhouse or in the mast.

2.3 Rate compass (RC25, RC36, RC37)

The Simrad Rate Compass is in principle a combination of a solid state rate sensor and a fluxgate sensor, where the rate sensor is slaved to the fluxgate sensor.

The rate sensor will momentarily pick up any angular changes in azimuth, but is almost unaffected by roll and pitch.

As the “rate heading” will drift, the fluxgate sensor is needed to maintain the (magnetic) heading. However, as the rate sensor is the primary “heading” source, the fluxgate signal can be more dampened and thus it will not contribute to the instability caused by heavy rolling and pitching.

The Rate compass gives a more stable and precise autopilot steering on any type of boat. It also eliminates the effect of the distorted horizontal magnetic field at high latitudes and the well known s-ing phenomena when on autopilot steering.

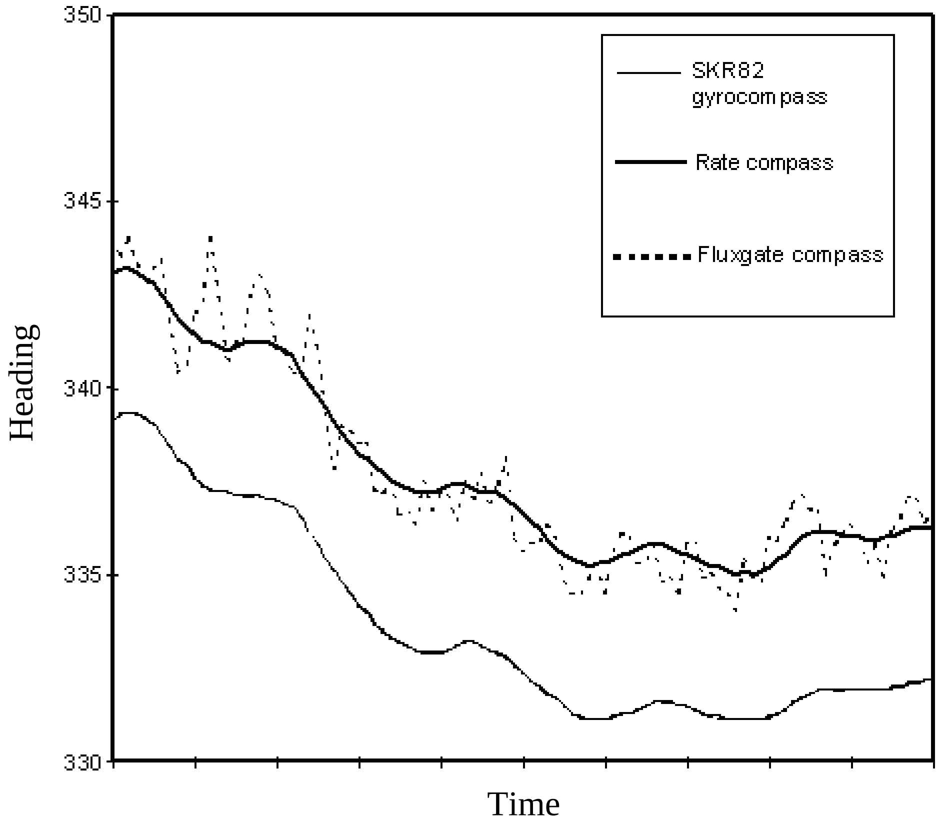
It can also be used as “stand alone” compass to provide a stable heading input to a compass repeater, radar or other equipment.

However, care should be taken when using it on bigger steel boats that can have a strong local disturbing magnetic field that makes a good calibration of the fluxgate impossible.

2.4 Rate Compass performance diagram

Measurements made at open sea in a 33-ft. powerboat.

The ideal reference shown on the graph is performed by the Robertson SKR-82 Gyrocompass.



2.5 Gyro compass

A gyro compass does not use the Earth's magnetic field to seek North, thus being unaffected by the magnetic conditions onboard.

The North seeking mechanism utilizes a spinning wheel (gyro) supported in a 3-axis gimbal or sphere and controlled by damping weights and electronics. By sensing gravity and the Earth's rotation it makes the axis of the spinning wheel always point towards True North. The reading of a gyrocompass is also more stable than that on a magnetic compass.

The gyrocompass is therefore the perfect heading sensor for autopilots on any type of boat. However, because of the high cost it is mainly used on commercial ships, bigger fishing vessels and mega yachts.

2.6 Compass type selection guide

Boat type / Compass type	Leisure, Power	Leisure; Sail	Work/Fishing up to 60 ft	Work/Fishing above 60 ft
Magnetic	3	2	2	2 (1)*
Fluxgate	2	3	3	3
Rate	1	1	1	1 (2)*

Lowest number gives the highest recommendation.

* If steel hull

3 DESCRIPTION OF MODELS

The first RFC35 Fluxgate Compass was made in 1994 for the AP300X series of autopilots. It is today used with all autopilots using ACXX Autopilot Computers and J3XX Junction units. The following Simrad autopilots can use the RFC35 Fluxgate Compass:

AP300CX, AP300PX AP300DLX, AP3000, AP3000X, AP11, AP35, AP20, AP22, AP16, AP21, AP25, AP26, AP27, AP50.

The RFC35 range has been expanded with other models as described in this chapter.

3.1 RFC35 Fluxgate compass

The compass comes with a 15 m cable, open end for connection to the Autopilot Computer or Junction Unit.

RFC35 contains a (main) PCB onto which the fluxgate sensor is mounted.

The fluxgate is a floating ring core type, which means there is no (need for) mechanical gimbals to keep it in horizontal position when the boat pitches and rolls.

The electronics converts the signal from the sin and cosine coils into a pulse width modulated (pwm) signal.

This signal is transmitted on the 2-wire connection to the autopilot, which also is the compass power supply line.

The RFC35 has automatic calibration, initialized in the autopilot sea trial menu.

The compass will calibrate when doing a 1 1/4 turn with the boat.

See respective autopilot manuals for details.

The calibration data and eventual offset adjustment are stored in the Autopilot Computer/Junction Unit.

From RFC35 s.no. 7702E02 onwards and from Main PCB s.no. 10000 Rev. F onwards there are PCB connectors for mounting of extra Rate, NMEA and SIN PCB.

See Wiring diagram, page 20 for connection details.

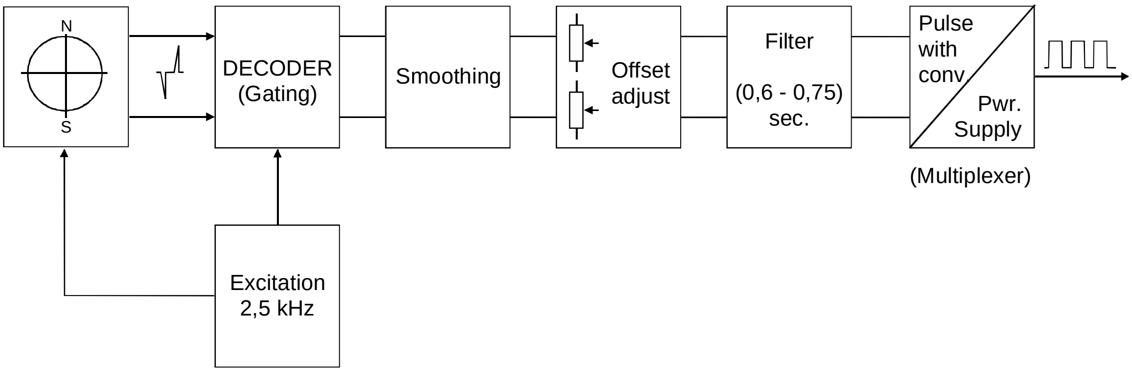


Figure 3-1 RFC35 Block diagram

3.2 RFC35N NMEA Compass

The RFC35N is based on the standard RFC35, with a plug-in NMEA PCB incorporated.

The compass comes with a 15 m cable, open end.

The PCB converts the pwm (pulse width modulated) signal from the main PCB to NMEA0183 HDG format.

The 2-wire pwm signal is still available for autopilot connection.

Different from a standard RFC35, the NMEA compass has it's own microcontroller and memory (EEPROM) where calibration data and offset adjustment are stored.

Compass calibration can be activated from an IS15 instrument or other equipment, such as a PC, if a proprietary NMEA sentence is transmitted to the compass. When the calibration is completed, the compass transmits a sentence to confirm "Calibration completed".

If the RFC35 is connected to equipment that cannot communicate on NMEA, it can be calibrated the same way as the obsolete Robertson RFC250 compass. That is; let the boat turn starboard in a circle until it passes north 3 times.

This procedure must take place within 5 minutes after having applied power to the compass.

As there will be no "Calibration completed" signal, the only way to verify a successful calibration is to check it against known bearings or against the main steering compass providing this is compensated and correct.

RFC35N can be expanded with an optional plug-in SIN PCB to provide an analogue sin/cosine signal to other autopilots; AP200 and AP45 e.t.c. See RFC35NS description below.

3.3 RFC35NS Compass (RFC35N + SIN)

By adding the optional Sin PCB to a RFC35N compass you will get additional analogue Sine/Cosine heading output.

The signal is according to the Simrad standard; ±2V with 2.5V reference which makes the compass compatible with the obsolete RFC250 (NMEA + Sin/Cosine output).

The compass can then be used with the following Robertson autopilots; AP2500, AP200 series, AP40, AP45 and AP9Mk2/3. (See also table at page 36.)

As from 1998 the RFC35NS (part no. 22083596) has been made as a separate model to substitute the RFC250. See section 5.5.

An extra cable gland is supplied for a separate NMEA cable connection if needed.

Note *Optional SIN PCB cannot be used with a standard RFC35 - only with RFC35N.*

3.4 Rate compass (RC25, RC36, RC37)

All three models are based on the same fluxgate sensor and the same rate sensor, hence the performance are the same for all three.

However, they have different output signal and must therefore be used as specified below.

RC25 Rate compass

RC25 is a “Robnet” compass that substitutes the previous RFC35R Rate Compass. It comes with 15m (49’) cable with Robnet connector and is used with thefollowing autopilots: AP50, AP35, AP20/21/22, AP11 and AP300X.

RC36 Rate Compass

RC36 is a “Robnet2” compass and works only with the AP25 series autopilots, including AP16. It comes with a 15 m (49’) cable with Robnet2 connector, fitting into the (male) Robnet2 connector at the back of the control unit (AP16, AP25, AP26).

RC37 Rate Compass

RC37 is outputting heading on NMEA0183 and analog Sine/Cosine formats.

It is a substitution for the previous RFC35RS and is a high performance alternative to RFC35 and RFC35NS.

It comes with a 15 m (49’) open end cable wired for NMEA input and output.

RC37 is an excellent heading source for autopilots, chart plotters, radars and other equipment that will benefit from it’s dynamic characteristics.

RC37 can be used with the following Simrad autopilots: AP45 (Sine/Cosine), AP9Mk3 (Sine/Cosine or NMEA0183).

Explanation to Rate Compass Block diagram

Refer to Figure 3-2.

The rate sensor generates a rate of turn signal that is converted to a heading angle by the integrator circuit. This output is called Rate heading.

The heading output from the fluxgate sensor, is called Flux heading. It is filtered by a low pass filter with a time constant approximately three times higher than in a standard RFC35. The Flux heading is calibrated and calibration data are stored in the EEPROM in the compass.

The high dampening of the Flux heading will suppress unstable heading signals caused by the vessel's roll and pitch.

The reduced response from the Flux heading is compensated for by the Rate sensor. The Rate sensor is very sensitive to any movement (turn) in the horizontal plane, but almost insensitive to roll and pitch.

As the Rate heading is a relative angle it has to be coupled to the Flux heading.

This coupling is made in the Drift Compensation circuit which serves two purposes;

1. It will prevent the Rate heading from drifting away due to internal (temperature) drift in the Rate sensor.

2. When a big course change is made and there is a difference between the integrated Rate heading and the measured Flux heading, the difference will be coupled into the Rate integrator as a bias offset for the Rate heading to make it equal to the Flux heading.

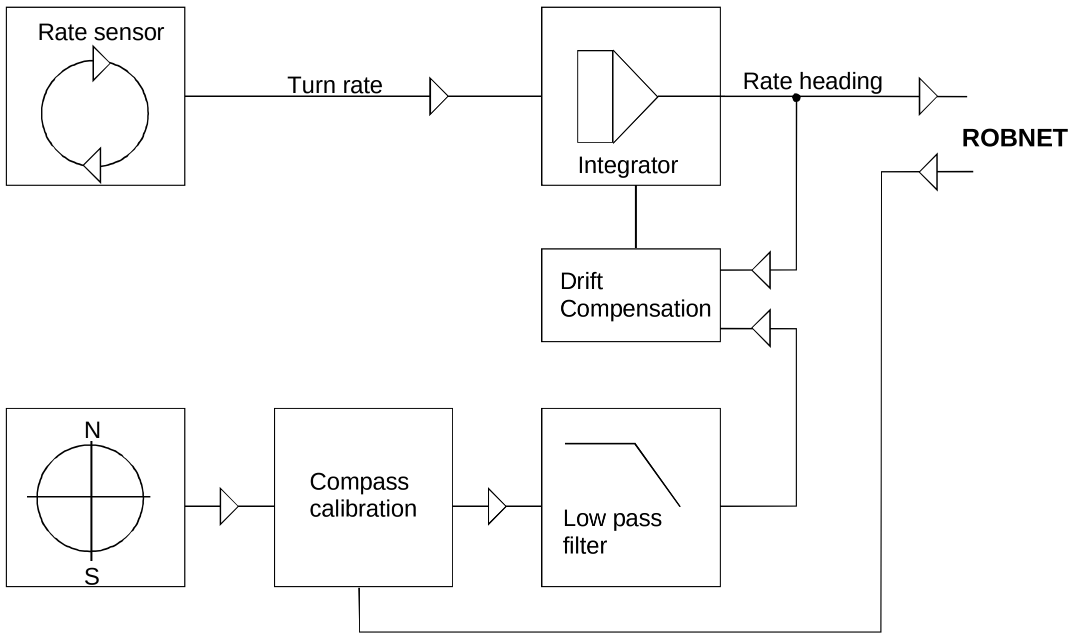


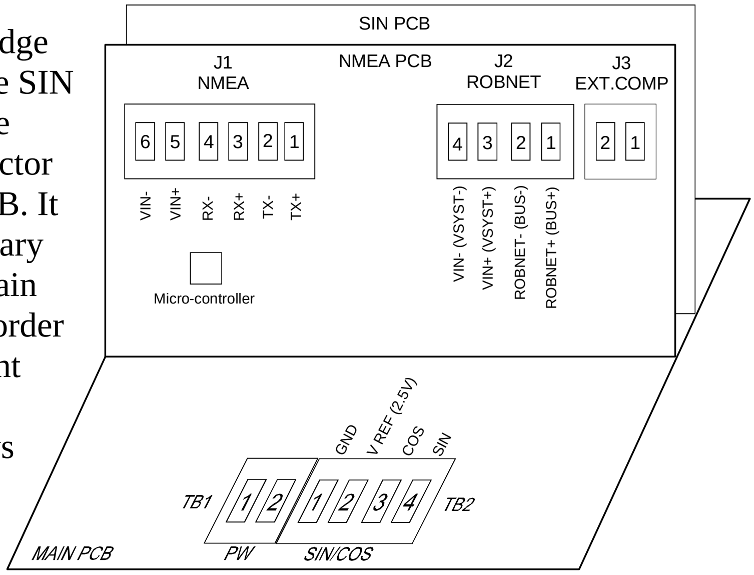
Figure 3-2 Rate Compass Block diagram

3.5 Adding a SIN PCB to RFC35N Compass

Inserting the PCB

Open the compass and insert the SIN PCB into the slots in the housing.

Make sure the edge connector on the SIN PCB fits into the matching connector on the Main PCB. It might be necessary to loosen the Main PCB screws in order to align it in right position. Then fasten the screws after the SIN PCB has been inserted.



Micro-controller chip

The NMEA PCB should have a chip marked <u>V1R3</u> or higher in order to work with the SIN PCB.

Latest software (per February 2005) is V2R4.

4 LOCATION AND INSTALLATION

4.1 Inspection of mounting area

The area around which the compass will be mounted should be inspected for one or more of the following items:

- Vertical or horizontal soft iron rod(s)
- Channel or angle iron.
- Throttle and clutch control push-pull cables.
- DC ampere meters (internal shunt).
- Steel tachometer cables.
- Unpaired, untwisted DC cables.
- All steel, household type, circuit breaker boxes.
- Iron pilothouse hold down bolts.
- Radar magnetrons.
- Other compasses.
- Magnetic flashlights.
- Audio speakers.
- Some microphones.

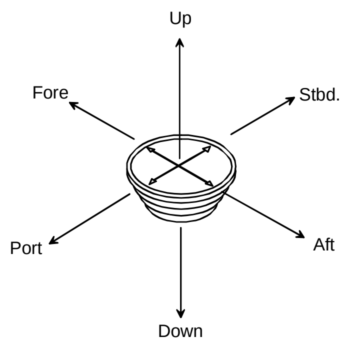
Reasonable care should be taken to mount the compass <u>a minimum of 1 meter from any of these objects,</u> and as much as <u>3 meters from other magnets or radar magnetrons.</u>

4.2 Installation

For initial installation of the compass, the desired mounting location should be checked for <u>unseen items</u> which may cause compass error.

This is done easily by a (small) hand held magnetic compass, provided it has a visible card with markings, to detect magnetic interference.

Place the compass in the desired mounting location. Allow the compass card to come to rest and note what heading it is reading (refer to lubber line or other mark on the compass bowl).



Then slowly proceed to move the compass in a straight line fore and aft (without turning it!) approximately 30 cm out of the mounting location. Repeat the movement, but this time athwart ship.

If at all possible, also move the compass in the vertical plane (up and down).

As a thumb rule, the compass reading should not vary more than 5 degrees from the initial reading during this test. You can then be reasonably sure that the compass location is OK.

If more than 5 degrees deflection is observed, it might still be OK, but if exceeding 10 degrees, chances are that the calibration/ compensation will not be optimal.

If a large deflection is observed, try to find what is causing it or find a new compass location.

Even though the RFC35 Fluxgate compasses can compensate for up to 30 degrees of deviation, these general rules should be followed to ensure the best performance from the compass.

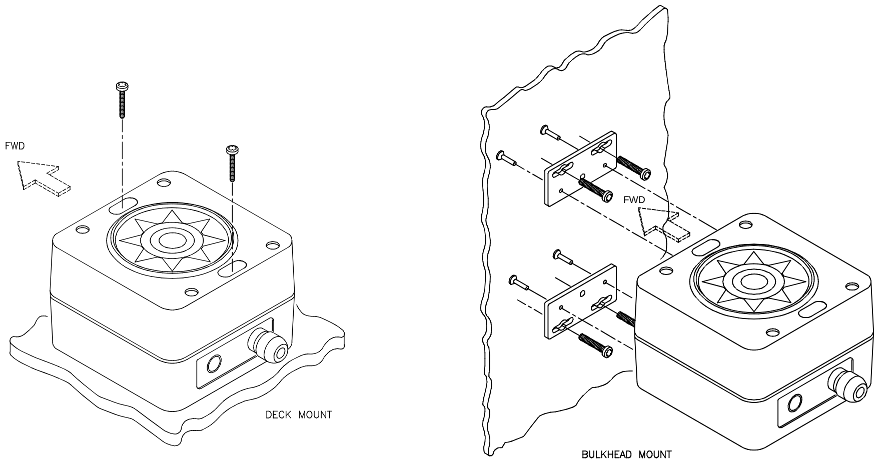


Figure 4-1 RFC35 mounting

4.3 Northerly / Southerly turning error

Autopilot installers operating in higher northerly or southerly latitudes have most probably experienced steering problems when sailing in northerly or southerly direction.

To illustrate this common problem we quote the following from a NMEA publication dated February 1978, written by Mr. M.W. Freeman:

“Another problem that arise as a result of magnetic dip* and increases with latitude, is what is commonly called the Northerly turning error in the Northern Hemisphere and Southerly turning error in the Southern Hemisphere. It is also accentuated by banking of turns in high speed craft. This phenomenon is true in all earth seeking magnetic devices.

The effect of the Northerly turning error becomes extremely critical on higher speed vessels, starting from twelve knots to approximately thirty knots.

Above thirty knots, it is impractical, if not impossible, to rely solely on a magnetic seeking device for control of an automatic pilot.

Because of lateral acceleration in a turn and also because of the necessary banking of the vessel, part of the dip component converts to an azimuth component (unless the compass is gyro stabilized).

The effect of Northerly turning error is generally that the vessel will steer fairly well on east and west at high speed. It will over steer on southerly headings but will make wide swings on northerly headings.

On northerly headings, once the boat has been deflected from course, it will increase its turn in the same direction rather than correcting the course in the opposite direction.

The Northerly turning error can be minimized by:

Selecting a compass and autopilot which has been designed especially with the higher speed boats and Northerly turning error in consideration.

Keeping boat speed under 15 knots.

Simrad’s solution to this problem is to install our RFC35R Rate Compass !

<u>* Magnetic dip</u>

The Earth's magnetic field can be decomposed into a horizontal and a vertical component. The horizontal component gives directional information, but the vertical provides no useful heading information.

Study the simplified presentation of Earth's magnetic field on Figure 4-2. When moving towards the poles, the field lines are no longer parallel to earth's surface, as they are at equator. Hence, the horizontal component is decreasing while the vertical component is increasing.

The angle between the tangent to the field lines and the tangent to earth's surface gives the magnetic dip angle, i.e. the dip angle is 0 degrees at equator and 90 degrees at the poles.

In Egersund, Norway (latitude 58 deg. N) the dip angle is about 67 degrees. In other words, the horizontal component is not more than 1/3 of the vertical component.

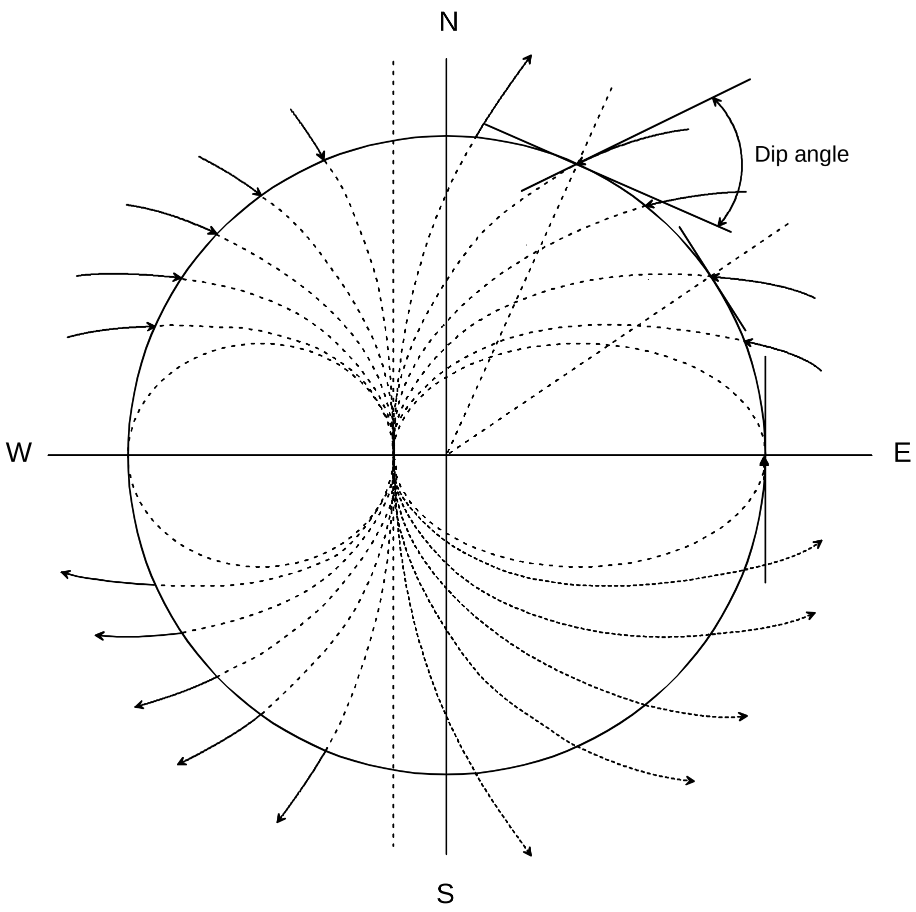


Figure 4-2 Magnetic dip

5 WIRING & CALIBRATION

5.1 RFC35 Fluxgate Compass

Connection to AP25 series, AP20 series and AP35 autopilots

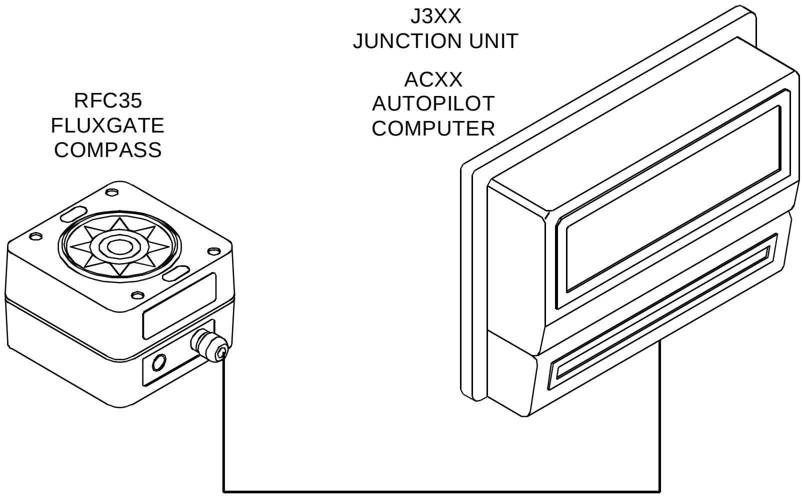


Figure 5-1 RFC35 wiring

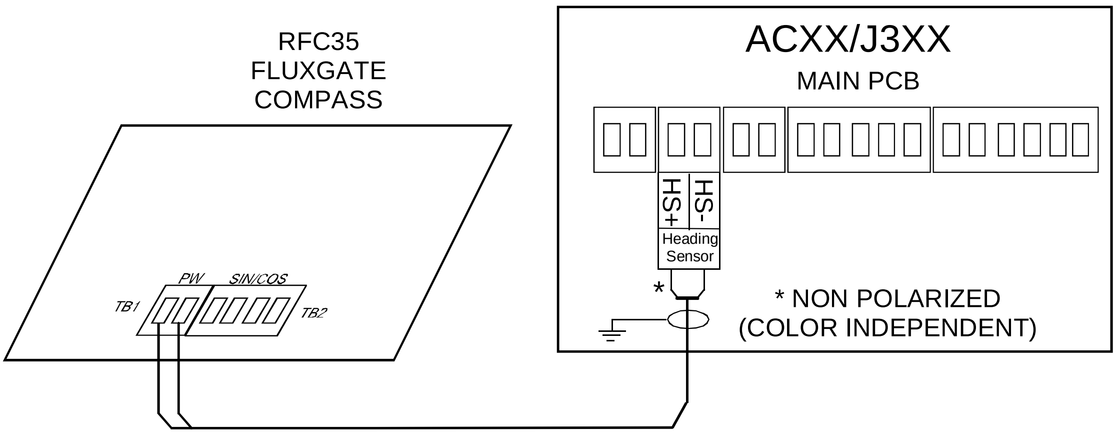


Figure 5-2 RFC35 connection to J3XX and ACXX

The only way to connect a standard RFC35 to the autopilot is via the HS+/HS– terminal in J3xx Junction Unit (AP11, AP300X, AP35, AP20/21/22) and ACXX Autopilot Computer (AP16, AP25/26/27).

Note *RFC35 Fluxgate Compass can also be connected to AP50/J50, but the compass is not recommended for commercial use!*

Calibration

Automatic calibration is activated from the autopilot's "Seatrial" menu. (See autopilot manual for complete calibration procedure).

Calibration data, including any heading offset, is stored in the ACXX/J3XX (EEprom) but will be deleted by a "Master Reset" in the autopilot.

5.2 RC25 Rate Compass (Robnet)

Recommended connection for AP20/21/22, AP300X, AP35 and AP50

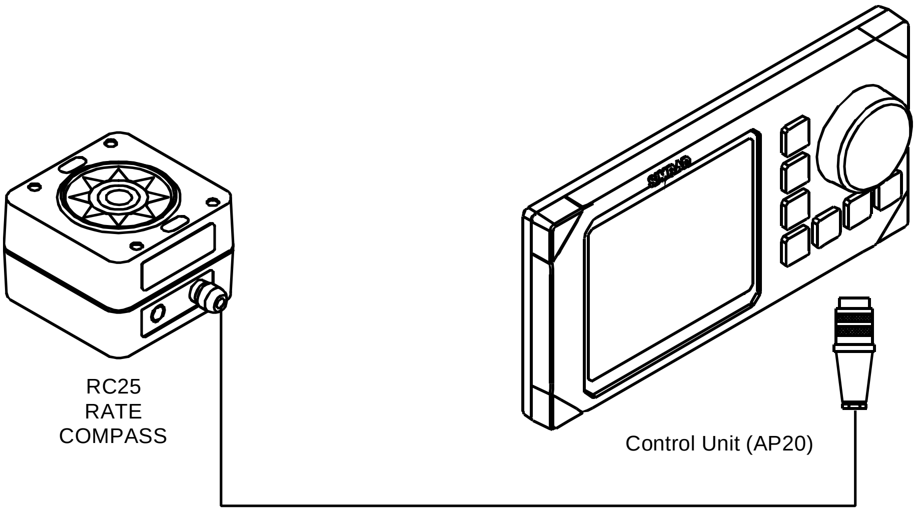


Figure 5-3 RC25 connection to autopilot control unit

Recommended connection of RC25 to the autopilot control unit using the Robnet connector.

Alternative connection to junction unit

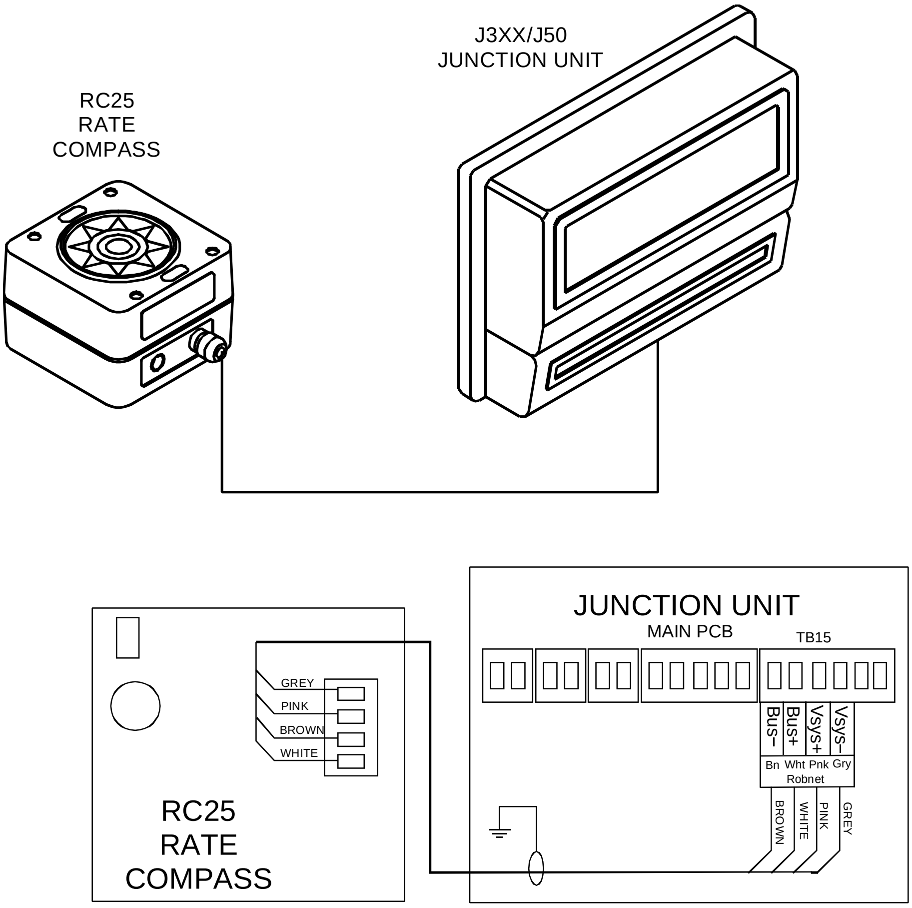


Figure 5-4 Alternative connection to J3XX/J50 Robnet terminal

The Robnet connector on the compass cable is removed and the wires are connected in parallel with the ones going to the control unit.

Connection to AP11

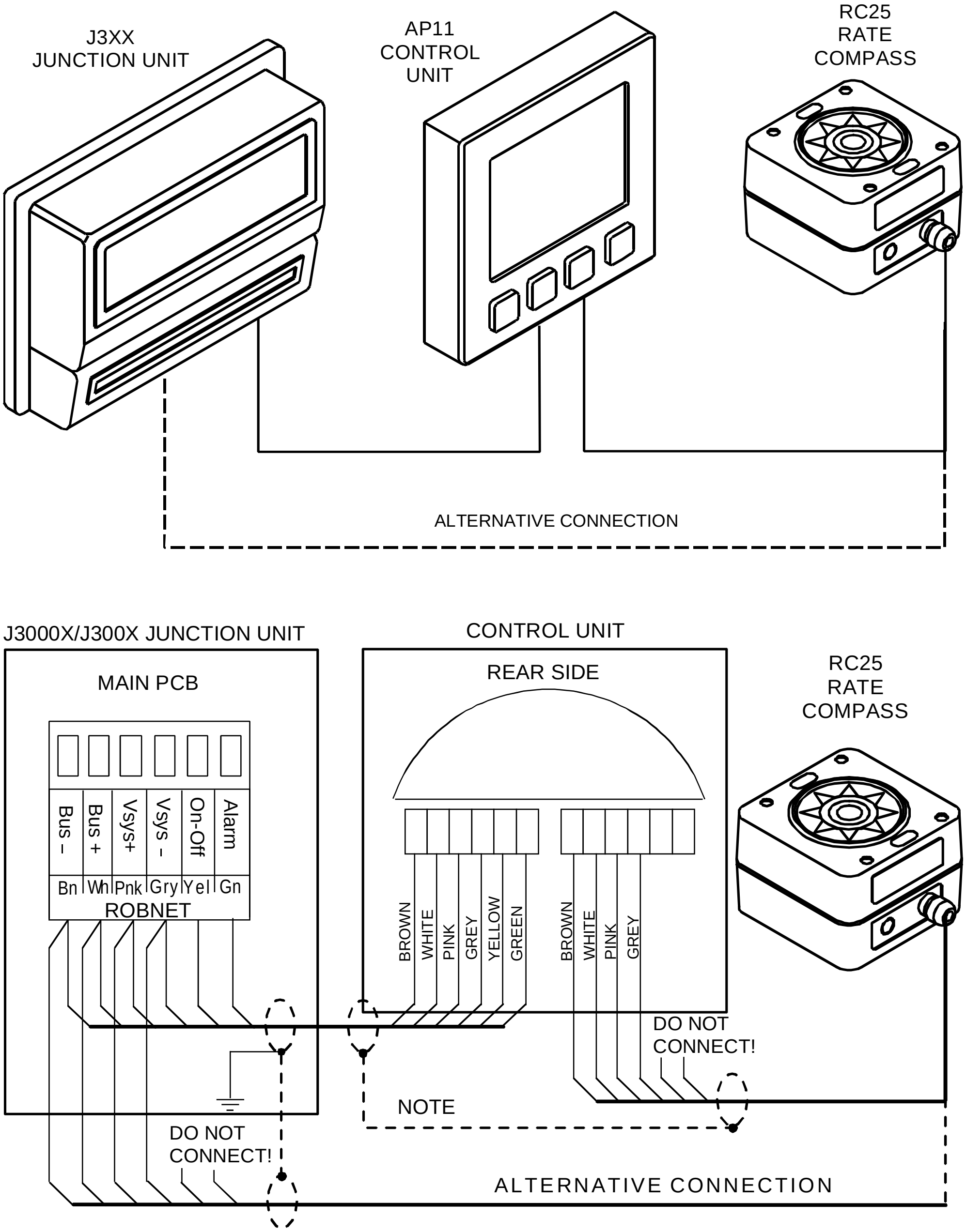


Figure 5-5 RC25 connection to AP11

The Robnet connector on the compass cable is removed and the wires are connected to J3XX Robnet terminal in parallel with the ones going to the control unit or to the spare terminal on the control unit.

Compass set-up and calibration

<u>For AP20, AP21, AP22, AP35:</u>

- Select RFC = Robnet in the Interface setup menu.
- **Select also RFC as compass in the User setup menu to activate RC25 as steering compass.**

<u>For AP300, AP300X:</u>

- Select RFC = RFC300 in the Interface setup menu.
- **Select also RFC as compass in the User setup menu to activate RC25 as steering compass.**

<u>AP11:</u>

- Select “net” as compass in the Dockside setup menu.

<u>For AP50:</u>

- Select FLUX1 or FLUX2 = Robnet
- Select also FLUX1 (or FLUX2) in the User Setup Menu to activate RC25 as Steering compass or Monitor Compass (if more than one compass is connected).

Calibration

Automatic calibration is activated from the autopilot’s Seatrial menu. (See autopilot manual for complete calibration procedure.)

Calibration data, and any heading offset, are stored in the compass (EEprom) and <u>will not be deleted</u> by a “Master Reset” in the autopilot.

5.3 RC36 Rate Compass (Robnet2)

Connection to AP16, AP25, AP26, AP27

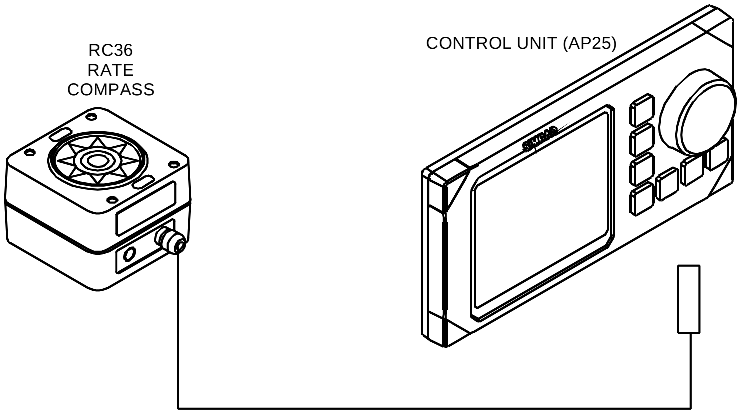


Figure 5-6 RC36 connection to autopilot control unit

Recommended connection of RC36 to the autopilot Control Unit using the Robnet2 connector.

Alternative connection to ACXX Autopilot Computer

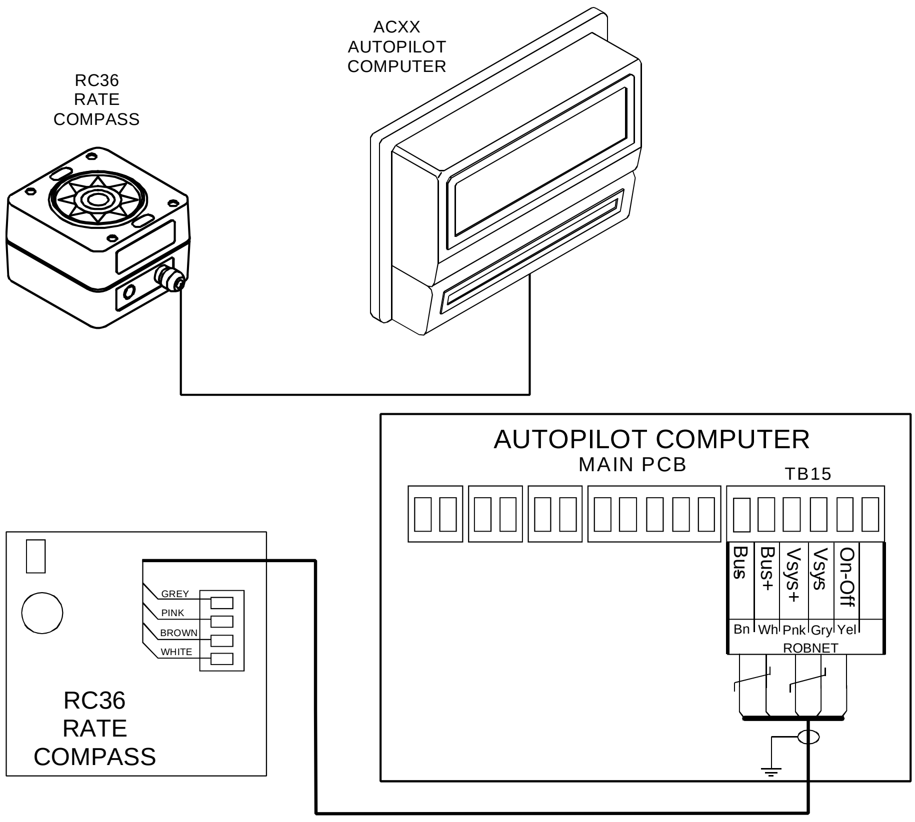


Figure 5-7 Alternative connection to ACXX

The Robnet2 connector on the compass cable is removed and the wires are connected in parallel with the ones going to the Control Unit.

Compass setup and calibration

The AP25 series autopilots (including AP16) has automatic interface (source) setup that detects the connected compass and other connected sources. This setup is taking place first time you switch on a new installed autopilot system, or if later on you perform a “Source update”.

If you have more than one compass connected to the autopilot, you need to enter the “Source select” menu item under “User setup2” and manually select the wanted compass/heading source.

Calibration

Automatic calibration is activated from the autopilot’s Seatrial menu. (See autopilot manual for complete calibration procedure.)

Calibration data, and any heading offset, are stored in the compass (EEprom) and <u>will not be deleted</u> by a “Master Reset” in the autopilot.

5.4 RFC35N NMEA Compass

Connection to IS15 instruments

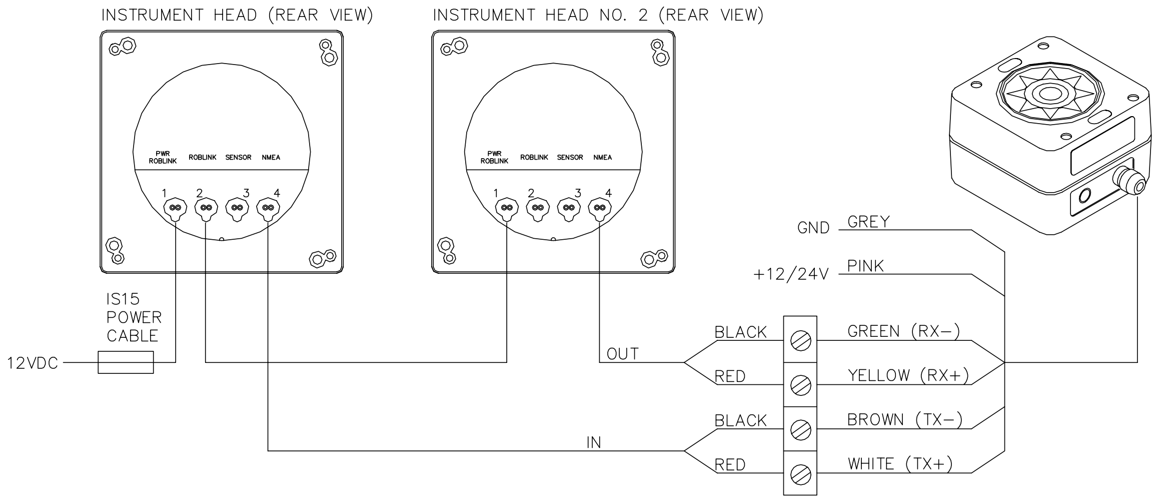


Figure 5-8 RFC35N connection to IS15 instruments

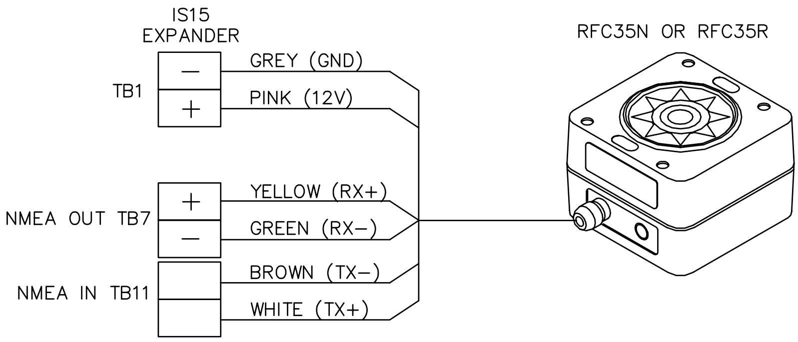


Figure 5-9 RFC35N connection to IS15 Expander

<u>NMEA in:</u> ‘Heading’ and ‘Calibration Completed’ from compass.

<u>NMEA out:</u> ‘Start Calibration’ to compass.

Compass Calibration

Access the screens in the Compass Menu Group. Calibration and data input should be carried out in the same sequence as described below.

This function will activate the automatic compass calibration procedure.

Notes! *1. The procedure will not work with a single instrument head connected to the compass.*

2. Do not use the calibration procedure when the IS15 is connected to a Simrad autopilot.

Before you begin the compass calibration, make sure you have enough open water around you to make a full clockwise turn at low speed. (Complete turn should take about 1 minute).

1. Start turning the boat to starboard and press the  button and hold for 2 seconds. The LCD flashes ‘CAL’.
2. When the calibration is completed, (after having made approximately 1 ¼ turns), the display will read ‘Done’.

Connection to other equipment

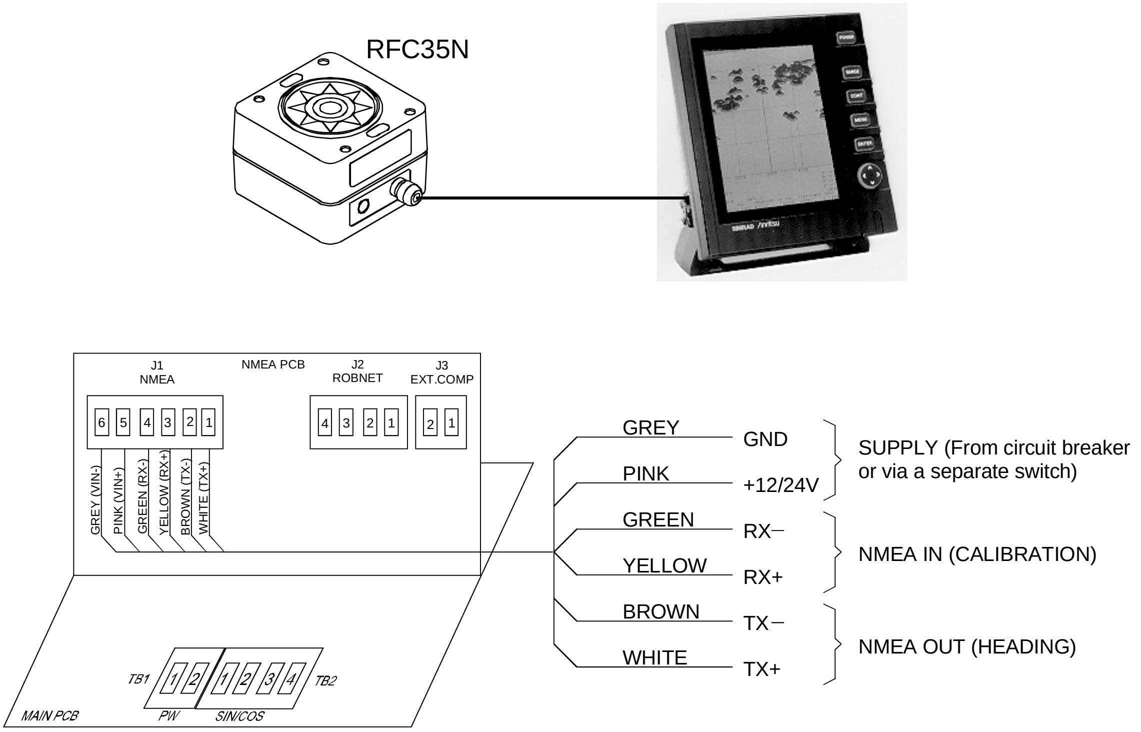
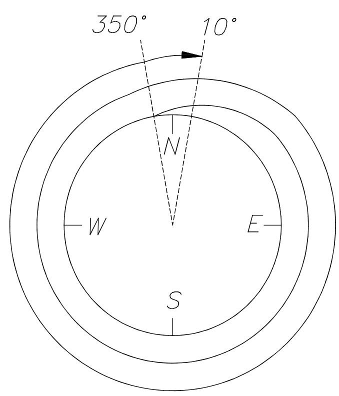


Figure 5-10 RFC35N Connection to other equipment Cable color code

* RX+ (Yellow) and RX– (Green) are only used if the NMEA equipment can send the proprietary sentences for calibration and offset as described in Technical specifications, section 7.5. If so, the calibration procedure will be similar to that of the IS15 instruments. Calibration data and heading offset is stored in the compass and will not be deleted until a new calibration is performed.

Calibration



As most other NMEA users cannot communicate with the compass on NMEA data (calibration start and confirmation) the RFC35N has to be calibrated the following way:

- Switch the compass off/on using the circuit breaker or the separate switch.

- Make two 360 degrees turns to starboard within 5 minutes from turn on. Make sure the boat passes 3 times through North (see figure) in smooth and slow turns. A minimum of roll and acceleration will give the best result.
- The heading sensor is now calibrated. As there is no confirmation of the completed calibration, you will have to verify the compass reading against one or more known headings.

Alignment (Offset)

The calibration procedure must have been carried out. Steer the boat on a known heading. Slightly turn the heading sensor until the correct heading readout is displayed. Tighten the screws.

RFC35N connection for 10Hz NMEA output rate

If the NMEA heading with 10Hz output rate is needed from a RFC35N that is used in an X-series autopilot installation the wiring will have to be as shown below:

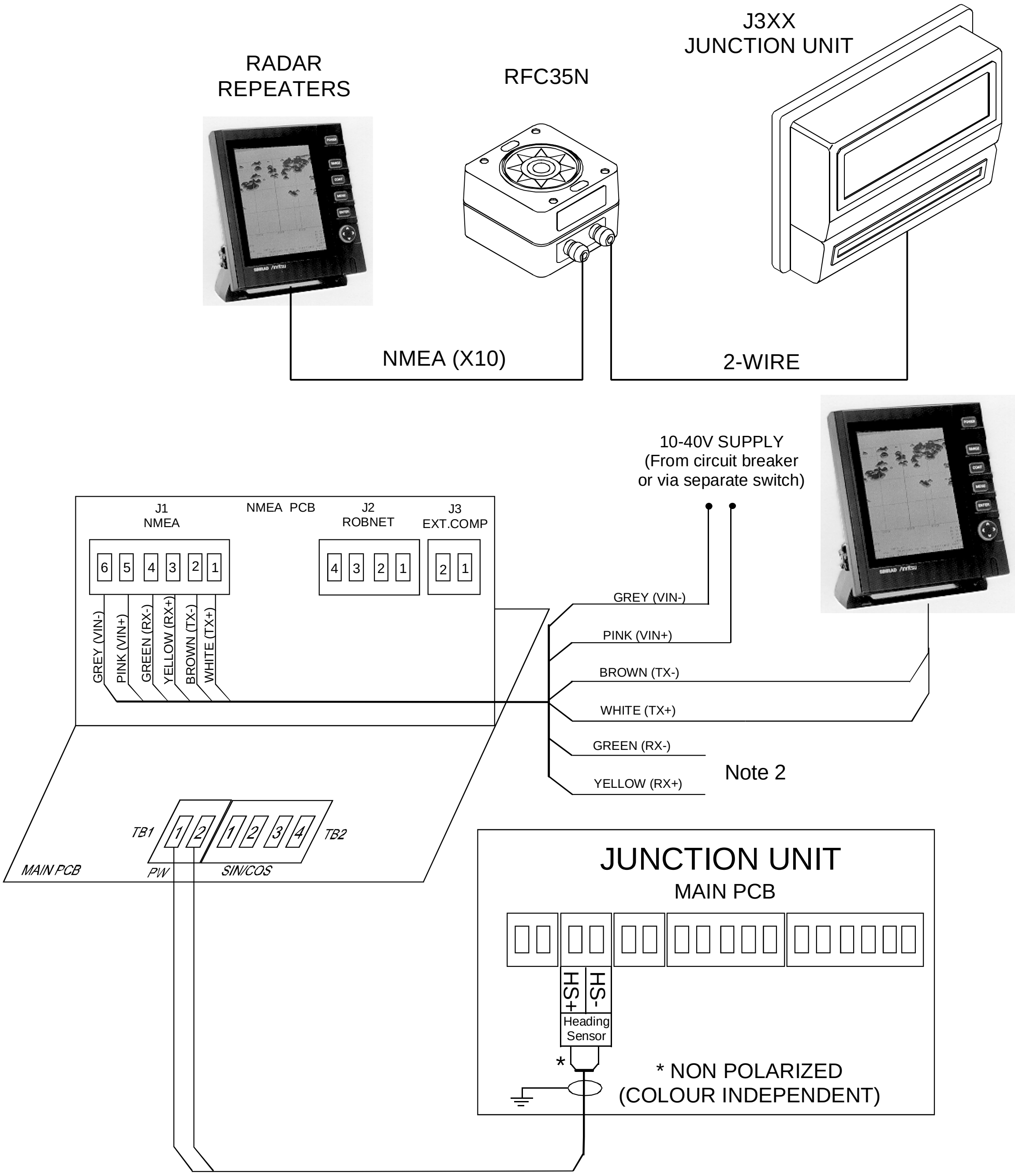


Figure 5-11 RFC35N connection for 10Hz NMEA output rate

Note 1. *As RFC35N can not output Robnet and NMEA at the same time, the connection to the autopilot has to be made by the 2-wire p.w.m. signal (as for standard RFC35).*

Note 2. *RX+ (Yellow) and RX– (Green) are only used if the NMEA equipment can send the proprietary sentences for calibration and offset as described in Technical specifications, section 7.5*

Calibration

Perform calibration as for a RFC35N compass “Connection to other equipment” described in section 5.3, and continue with the normal compass calibration activated from the sea trial menu in the autopilot.

RFC35N as RFC300 substitution

When RFC35N is wired for Robnet instead of NMEA it can substitute an RFC300 Fluxgate compass in an AP300 installation.

1. Open the RFC35N and disconnect the four wires going to J1 NMEA on the NMEA PCB and remove the cable.
2. Cut off the Robnet connector on the existing RFC300 compass cable and pull the cable through the cable gland.
3. Connect four of the six wires to J2 Robnet terminal on the NMEA PCB according to color code in the drawing below. Observe the color codes as there are two versions of Robnet cables/connectors. The standard color code is used on all removable type connectors, while the one shown in brackets is for molded type connectors.
4. The two remaining wires must be isolated to avoid electrical contact with the PCB or other terminals.

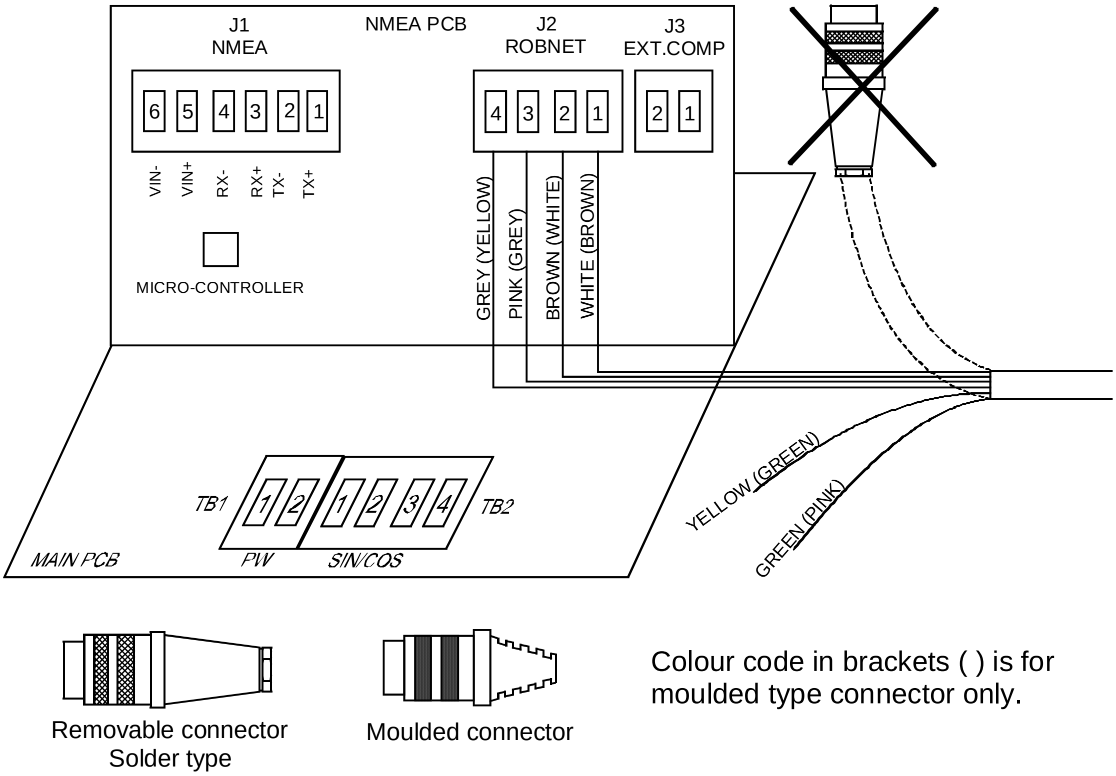


Figure 5-12 RFC35N as RFC300 substitution

Calibration

Automatic calibration is activated from AP300 “Seatrial” menu and RFC35N needs only 1¼ turn to complete the calibration. (RFC300 needs 3 times through North.)

Calibration data and any heading offset is stored in the compass and <u>will not be deleted</u> by a “Master reset” in the AP300.

5.5 RC37 Rate Compass

Connection to AP45 and AP9MK3

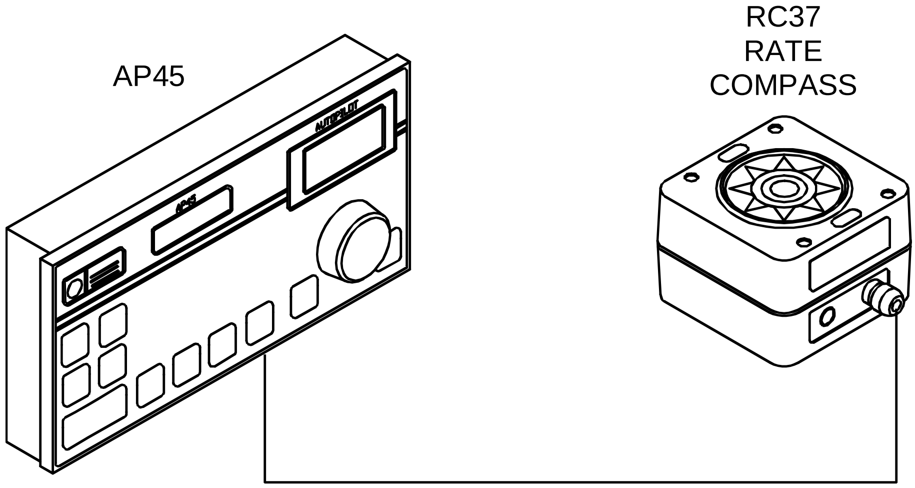


Figure 5-13 RC37 connection to AP45/AP9MK3

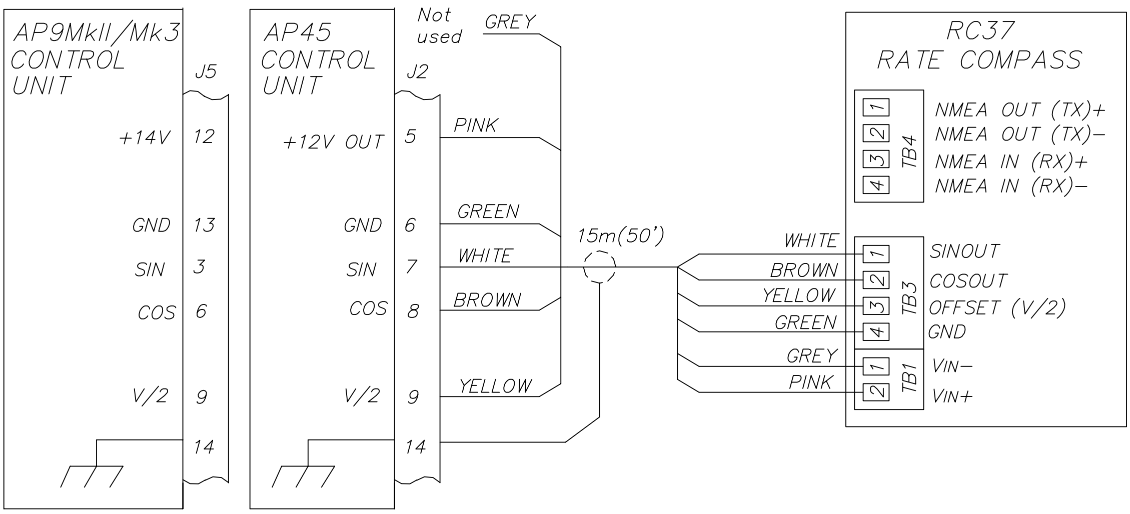


Figure 5-14 RC37 wiring to AP45 and AP9Mk3

5.6 RFC35NS Compass (NMEA+SIN) as RFC250 substitution

As from 1998 the RFC35NS (part no. 22083596) substitutes RFC250. It comes with a “pigtail” cable that matches with the Viking connector on the original RFC250 extension cable (part no. 20183554).

The optional SIN PCB added to the RFC35N compass provides analogue Sine/Cosine heading output.

The signal is according to the Simrad standard; ±2V with 2.5V reference that makes the compass compatible with RFC250 (NMEA+Sine/Cosine output).

The compass can then be used with the following Simrad/ Robertson autopilots: AP100, AP1000, AP2500, AP200 series, AP40, AP45 and AP9MKII/3. See also table page 36.

An extra cable gland is supplied for a separate NMEA cable connection if needed.

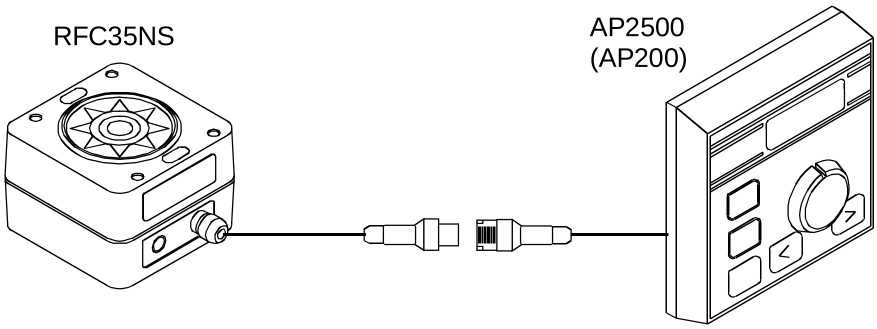


Figure 5-15 RFC35NS connection to autopilot

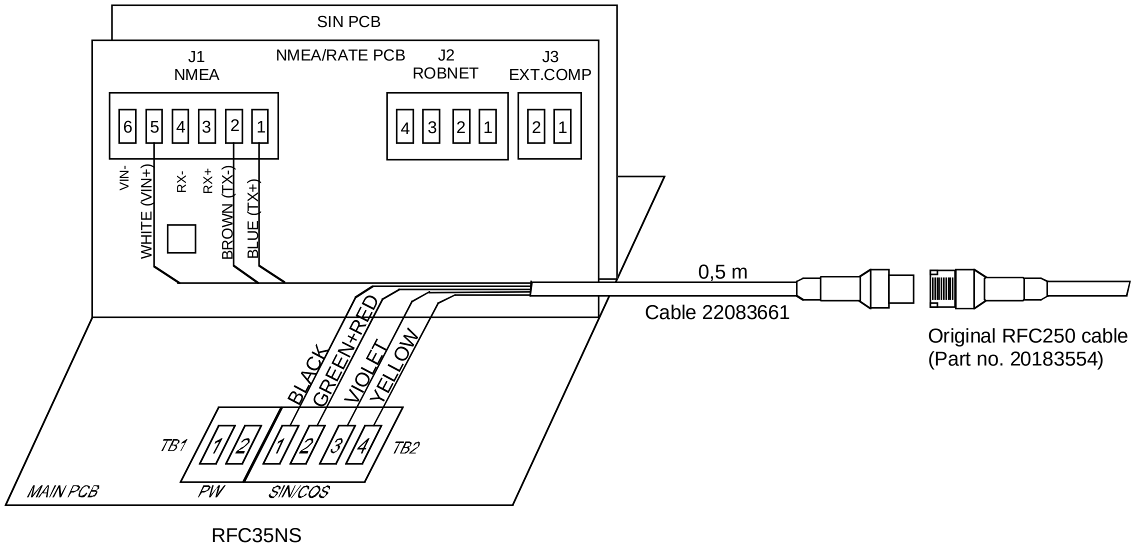


Figure 5-16 RFC35NS as RFC250 substitution; internal connections

Note ! *The optional SIN PCB can not be used with a standard RFC35 - only with RFC35N (or RFC35R).*

Calibration

As for RC37 described in previous section 5.5.

6 COMPASS MODELS, APPLICATION CHART

Autopilot model / Compass	AP50 (J50)	AP25, 26, 27, AP16 (AC20)	AP20, 21, 22, AP11, AP35, (J300X)	AP300X (J300X)	AP300 (J300)	Dataline Pilot (J3000)	AP45	AP9Mk3
RFC35	2-wire pwm	2-wire pwm	2-wire pwm	2-wire pwm	n.a.	n.a.	n.a.	n.a.
RFC35N	2-wire pwm or NMEA	2-wire pwm or NMEA	2-wire pwm or NMEA	2-wire pwm	Robnet	n.a.	n.a.	NMEA
RFC35NS	2-wire pwm / NMEA	2-wire pwm / NMEA	2-wire pwm / NMEA	2-wire pwm	Robnet	Sine/ Cosine	Sine/ Cosine	Sine/ Cosine or NMEA
RC25	Robnet	n.a.	Robnet	Robnet	Robnet	n.a.	n.a.	n.a.
RC36	n.a.	Robnet2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
RC37	n.a.	n.a.	n.a.	n.a.	n.a.	Sine/ Cosine	Sine/ Cosine	Sine/ Cosine or NMEA

n.a. = not applicable

7 TECHNICAL SPECIFICATIONS

7.1 RFC35 Fluxgate Compass

Dimensions: .... See Figure 7-1

Weight: .... 0,9 kg (2,0 lbs)

Supply and output: .... Polarity independent 2-wire supply with superimposed pulse width modulation

Automatic Performance:

Calibration: .... Automatically activated by control head

Gain compensation: .... Automatically adjusted continuously

Repeatability: .... ± 0.5 degrees

Roll/Pitch: .... ± 35 degrees

Accuracy: .... <1° (rms)

Cable supplied: .... 15 m TP shielded cable

Temperature range:

Operation: .... 0 to +55 °C (+32 to + 130 °F)

Storage: .... –30 to +70 °C (–22 to +158 °F)

Environmental Protection: IP56

Mounting: .... Deck or bulkhead

Material: .... Black ABS

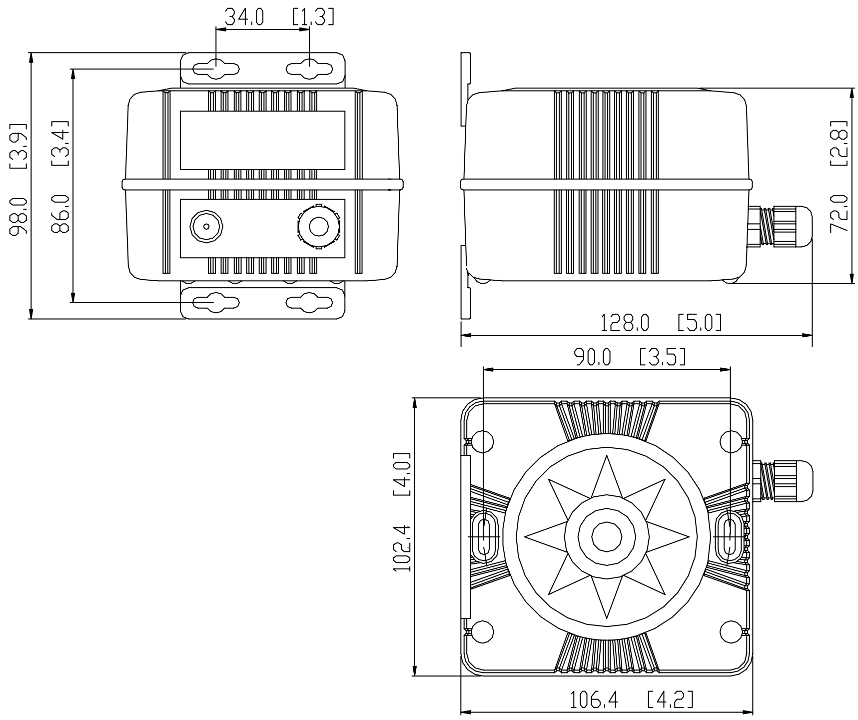


Figure 7-1 RFC35 Fluxgate Compass - Dimensions

7.2 RC25 Rate Compass

Dimensions: .... See Figure 7-1
Weight: .... 0.9 kg (2.0 lbs.)
Power consumption: .... 0.9 watts
Supply and interface: .... Robnet
Environmental Protection: IP56
Material: .... White/black ABS
Temperature range:
  Operation: .... 0 to +55°C (+32 to + 130°F)
  Storage: .... –30 to +70°C (–22 to +158°F)
Mounting: .... Deck-mount or bulkhead-mount
Cable: .... 15 m (49 ft.) Robnet cable with connector
Automatic Performance:
  Calibration: .... Automatically activated by control head
Rate sensor stabilized heading output
  Accuracy: .... <1.25° rms (after calibration)
  Repeatability: .... <0.2° rms
  Roll/Pitch: .... ± 35°

7.3 RC36 Rate Compass

Dimensions: .... See Figure 7-1
Weight: .... 0,9 kg (2,0 lbs)
Supply and interface: Robnet2
Power consumption: .... 0,9 watts
Automatic Performance:
  Calibration: .... Automatically activated by control head
  Gain compensation: .... Automatically adjusted continuously
  Rate sensor stabilized heading output
Accuracy: .... <1.25° (rms)
Repeatability: .... <0.2° (rms)
Roll/Pitch: .... ± 35 degrees
Cable supplied: .... 15 m TP shielded cable
Temperature range:
  Operation: .... 0 to +55 °C (+32 to + 130 °F)
  Storage: .... –30 to +70 °C (–22 to +158 °F)
Environmental Protection: IP56
Mounting: .... Deck or bulkhead
Material: .... White ABS

7.4 RC37 Rate Compass

Dimensions: .... See Figure 7-1

Weight: .... 0,9 kg (2,0 lbs)

Supply: .... 10-29VDC, 1 watt

Heading output: .... Serial and analog

Output format: .... NMEA0183 10x/sec. and sine/cosine

NMEA data: .... $IIHDG,x.x,m*hh<cr><lf>
x.x=heading, hh=checksum

Analog data: .... Sine/cosine ±2V, 2.5VDC reference

Accuracy: .... <1.25 degrees rms (after calibration)

Repeatability: .... <0.2 degrees rms

Calibration: .... Automatic

Roll/Pitch: .... ± 35 degrees

Cable supplied: .... 15 m (49 ft) TP shielded with open end

Temperature range:

Operation: .... 0 to +55 °C (+32 to + 130°F)

Storage: .... –30 to +70 °C (–22 to +158°F)

Environmental Protection: IP56

Mounting: .... Deck or bulkhead

Material: .... Black ABS

7.5 RFC35N NMEA Compass

Dimensions: .... See Figure 7-1

Supply: .... 10-29VDC, 1 watt

Heading output: .... Serial

Output format: .... Serial, RobnetTM bus for Simrad autopilots or NMEA 0183 10x/sec.

NMEA heading: .... $IIHDG,x.x,M*hh<cr><lf>
x.x=heading, hh=checksum

NMEA status: * .... $PSTOK,R<cr><lf>Calibration running
$PSTOK,C<cr><lf>Calibration terminated, or not running (Also presented before calibration is done).

Standard configuration: .... NMEA output

Optional analogue output: .... Sine/cosine by plug-in PCB

* also applies for RFC35R and RFC35NS when connected for NMEA output.

NMEA0183 input data:
Calibration start command: ....$PSTOC<cr><lf>
Heading offset adjust:.. $PSTOK,,,nnn,<cr><lf>
nnn = offset adjust angle 0 – 360 degree.
PSTOK and PSTOC are proprietary NMEA sentences.
Accuracy:..<1.25 degrees rms (after calibration)
Repeatability:.. <0.2 degrees rms
Calibration:..Automatic
Roll/Pitch:..± 35 degrees
Cable supplied: .... 15 m (49 ft) TP shielded
Temperature range:
Operation:...0 to +55 °C (+32 to + 130 °F)
Storage: ....–30 to +70 °C (–22 to +158 °F)
Environmental Protection:..IP56
Mounting: ....Deck or bulkhead
Material: ....Black ABS

7.6 Optional SIN PCB

(For RFC35N)
Supply:...Internal from RFC35 Main PCB
Output:..Analog Sine/Cosine signal
±2V with 2,5V reference.
Accuracy:.. ±1 degree after calibration
Temperature range:
Operation:...0 to +55 °C (+32 to + 130 °F)
Storage: ....–30 to +70 °C (–22 to +158 °F)

7.7 RFC35NS Fluxgate Compass

Dimensions:..See Figure 7-1
Weight: ....0,9 kg (2,0 lbs)
Supply:...10-29VDC, 1 watt
Heading output: ....Serial and analogue
Output format: ....NMEA 0183 10x/sec. (as for RFC35R) and
Sine/cosine ±2V, 2.5VDC ref.
NMEA heading:.. $IIHDG,x.x,M*hh<cr><lf>
x.x=heading, hh=checksum
Standard configuration: ....Robnet output
Optional analogue output: ....Sine/cosine by plug-in PCB

Accuracy: <1.25 degrees rms (after calibration)

Repeatability: <0.2 degrees rms

Calibration: Automatic

Roll/Pitch: ± 35 degrees

Cable supplied: 0.3 m (1 ft) with 7-pin Viking connector

Temperature range:

- Operation: 0 to +55 °C (+32 to + 130 °F)
- Storage: –30 to +70 °C (–22 to +158 °F)

Environmental Protection: IP56

Mounting: Deck or bulkhead

Material: Black ABS