GYRO COMPASS EQUIPMENT
STANDARD 14
BASIC VERSION

Technical Handbook

1. Description
2. Operating Instructions
3. Care and Maintenance
4. Repair
5. Illustrated Spare Parts Catalogue
6. Installation
7. Putting into Operation
Preliminary Remark

The documentation describes the system or the device incl. variations, functional extensions and special types.

An NG... designation behind the type number of a device refers to different variations listed at the beginning of the description.

Possible functional extensions are also stated at the beginning of the description and are designated in the description as a functional extension module (FEM).

If there are customer demands for modifications or complements, you will find them described in the Annex.

The contract for delivery is binding.

The illustrations are numbered in accordance to the chapters, e.g. Fig. 3–1, Fig. 3–2 etc.

With the illustrations named in the text, additional details can be marked.

The used cycles of numerals explain itself by the following example:

Example: (Fig. 4–2.1)

Detail 1 (from Fig. 2 in the Chapter 4
Fig. 2 (in the Chapter 4)
Chapter 4

The first numeral denotes the relevant chapter the illustration belongs to.
The second numeral denotes the number of illustration.
The two numerals are separated from each other by a hyphen.
The third numeral denotes the relevant detail of the resp. illustration and is separated from the previous numerals by a point.

The devices or systems may differ from the illustrations, diagrams and drawings in minor details.
The right of alterations due to further technical development is reserved. The documentation delivered is not subject to the alteration service.

Should an additional expert guidance be required, the ANSCHÜTZ service stations throughout the world are at your disposal.
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**Dimensional drawings:**
- Gyro Compass STANDARD 14
- Inverter STANDARD 14

**Drawing No.**
- 110 D 106 HP005
- 121 C 043 HP005

**Circuit diagrams:**
- **Gyro Compass STANDARD 14**
  - Gyro Compass STANDARD 14
  - Electronics (position of the components)
    - Drawing No.
      - 110 C 106 HP030
      - 110 B 106.03 E01

- **Inverter STANDARD 14**
  - Inverter (subassembling within the inverter STANDARD 14)
  - Step Adapter
  - Compass Electronics
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    - Drawing No.
      - 121 C 043 HP012
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      - 121 C 043.04 E01

**General Diagrams:**
- **Inverter STANDARD 14**
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      - 121 C 043 HP020

**Wiring diagrams:**
- Gyro Compass STANDARD 14
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  - Drawing No.
    - 110 D 106 HP031
    - 121 D 043 HP026
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**Cable Connection Diagram:**
- (dependent on order)

**Annex to Modified Static Inverter, Type 121–043 MOD 015 or MOD 016**

**Drawings:**
- Connection Diagram / Interface
  - Drawing No.
    - AWD–121–025–2–WIR
- Distribution Box / Repeater Compass
  - Drawing No.
    - AWD–138–021–1–OUT

**Additional Descriptions:**
- (dependent on order)
1. Description

**Fig. 1-1:** Example of a Gyro Compass Equipment
STANDARD 14 BASIC VERSION
- Schematic Representation -
  - Basic equipment
  - Optional system components

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1.1 Application
The Gyro Compass Equipment STANDARD 14 BASIC VERSION can be used on board any sea-going ship.

Due to its minimum dimensions, it is best-suited for small ship navigation, e.g. on board fishery craft, tugs, patrol, police, customs, coast guard and cargo boats, motor coasters, off-shore ferries, yachts, dredgers etc.

The Gyro Compass Equipment STANDARD 14 BASIC VERSION provides an analog course indication referred to true north.

Via an electric scanning and transmission system, it permits the compass course reference to be transmitted to analog or digital repeater compasses, autopilot, satellite navigation or communication equipment, radar or DF equipment, course recorder es
well as to an automatic sea chart table ANSCHÜTZ "NAUTOPILOT"**).
Due to its modular construction, twin systems can be realized as well for special applications.

1.1.1 Component Parts of Basic Equipment
The basic equipment consists of:
- Gyro Compass, STANDARD 14 with gyrosphere Type 111–006
  Type 110–106 NG001 (Fig. 1–1.1)
- Gyro Compass, STANDARD 14 with gyrosphere
  Type 110–106 NG002 **
- Inverter, with casing and 5m connecting cable
  Type 111–006
- Inverter, without casing, without main switch, without fuses,
  Type 121–043 NG001 (Fig. 1–1.2)
  Type 121–043 NG003 (built-in version)
  (without illustr.)

Requirement of the "Bundeaanstalt für Seeachifahrt und Hydrographie"
(Federal office for sea navigation and hydrography; BSH, formerly DHI):
If the mastar compass is intended to be used as a steering compass, the
compass card reading must be improved by means of a permanently fixed
magnifying facility.

*) The automatic sea chart table ANSCHÜTZ "NAUTOPILOT" ensures a continu-
ous, visual indication of the ship's current position on sea charts of any scale.
In addition, it permits the electronic storage of waypoints and routes of a ship's
course passed through or planned and - in conjunction with an autopilot, e.g.
"NAUTOPILOT D" - offers the possibility of reproducing the ship's course in ac-
cordance with these stored information, exactly and as often as you want.

**) The version NG002 is additionally equipped with a Transmitter Synchro,
Type 11 CX 4, 1 rev. $\neq 360^\circ$, e.g. for connecting an autopilot.
1.1.1.1  Extension Possibilities of Basic Equipment

The following optional devices can additionally be connected to the basic equipment:

- 3 Steering- or Bearing Repeater Compasses (with ANSCHÜTZ step system) (Fig. 1–1.4, 1–1.10),
or Digital Repeater Compasses (Fig. 1–1.7).

- 1 Signal Unit, e.g. ANSCHÜTZ "NAUTOALARM", Type 135–089 (Fig. 1–1.8).
- 1 Autopilot, e.g. ANSCHÜTZ "PILOTSTAR" or "NAUTOPILOT" (Fig. 1–1.5).
  1 Automatic Sea Chart Table, ANSCHÜTZ "NAUTOPILOT" (Fig. 1–1.11).

- 3 Satellite Navigation and/or Communication Systems (Fig. 1–1.6),
or Radar Equipment or Direction Finder (Fig. 1–1.6).

- 1 Additional Group for Magnetic Sonde Course Scanning, Type 148–332 (see Sect. 6.2.5).
- 2 Rote-of-turn Indicators, (ROT) (without illustr.).
- 1 Power supply unit, e.g. ANSCHÜTZ, Type 119–020, for connecting the gyro compass equipment CYROSTAR to en AC ship's mains:
  - Input voltage  $U_1 = 100$V AC ... $265$V AC (1 phase)
  - Output voltage  $U_0 = 24$V DC (max. 5A electric load).
- 1 DC/DC converter, e.g. Type 121–048 or 121–049 (used with ungrounded ship’s mains), for stabilizing the supply voltage (24V DC ± 0.2%) and for electric isolation of grounded ANSCHÜTZ devices connected. Furthermore – on operating ANSCHÜTZ equipment –, equalizing currents between the different potential levels within the hull are avoided by the device.
- 1 Course Transducer, ANSCHÜTZ, Type 132–603 (Fig. 1–1.3)
- 1 Time Switch, Type NB 03–735 (Fig. 1–1.9).

1.1.1.2  Special Design of Gyro Compass STANDARD 14 with Additional 1/10° Course Indication

On customer request, the gyro compass can additionally be equipped with a 1/10° course indication. This requires a modified compass hood with a cut-out for the 1/10° card.

Note:
The power consumption of the stepping motor for the 1/10° indication approximately corresponds to that of a stepping motor of an ANSCHÜTZ step repeater compass. For reasons of electric load capacity, it is allowed to connect 2 further ANSCHÜTZ step repeaters to the inverter of the gyro compass equipment.
1.2 Construction and Principle of Operation

1.2.1 Construction of the Gyro Compass STANDARD 14

Fig. 1-2: Gyro Compass STANDARD 14
- Schematic Sectional Drawing -
The gyro compass consists of a chassis rigidly connected to the hull. The lower part of the chassis is fitted with a casing. The top side of the chassis is covered by a hood which comprises a window for taking course readings.

The casing and the hood are made of plastics. The supporting plate is mounted on three metal brackets. It accommodates mechanical and electrical components.

The compass base plate carries the fan.

The outer sphere is suspended from a pendulum joint.

The outer sphere includes the hydrostatically suspended gyrosphere.

The 360° card is connected to the outer sphere via the pendulum joint. Course readings are to be made from the 360° card. A heating and ventilation system permits a constant compass operating temperature to be maintained at varying ambient temperatures.

### 1.2.1.1 Supporting Plate

![Diagram of Supporting Plate with Components]

**Fig.1-3:**
Supporting Plate with Components

The supporting plate carries the following components:

a) **on the top side**
- Follow-up gear with 360° card (1-3.1)
- Mounting bracket with control elements (1-3.2)
- Electronics PCB with components and card illumination (1-3.3)
- Stepping motor with toothed belt pulley and toothed belt (1-3.7)
- Synchro (only with version NG002) (1–3.8), or
  sin/cos potentiometer (1–3.8), optional MOD version.

b) on the bottom side:
- Compass connection plug with cable (1–3.4)
- Hinge with connecting flange (1–3.5) and outer sphere (1–3.6) with
  the gyrosphere included.

1.2.1.2 Follow-up Gear

![Diagram showing the 360° Follow-up Gear in the Gyro Compass]

The gas-filled gyrosphere is freely suspended and centered in the supporting liquid in the outer sphere. The gyrosphere contains the north-seeking gyro system. The outer sphere is caused to take the position of the gyrosphere via the follow-up gear by means of a stepping motor.

The toothed belt pulley z1 is attached to the shaft end of the stepping motor. The pinion shaft, which carries toothed belt pulley z2, is driven with a ratio of 5:1 via e toothed belt. The helically toothed pinion z3 is mounted to the upper end of the shaft. It drives the helical 360° card z4 with a ratio of 36:1.

Optional transmitter synchro or optional sin/cos potentiometer in the Gyro Compass, Type 110–106

Via toothed belt pulley z5, which is rigidly connected to the 360° card, a toothed belt drives the toothed belt pulley z6 which is attached to the shaft of a transmitter element (see Fig. 1–4) with a 1:1 ratio (transmitter element additionally built in and corresponding with the system-specific requirements). An ANSCHÜTZ autopilot can be connected to this transmitter element.

(Size of transmitter element used: 11; 1 rev. $\cong 360^\circ$.)
1.2.1.3 Outer Sphere

The outer sphere includes the gyrosphere (1–5.6) suspended in the supporting liquid. It comprises the cup-shaped lower part (1–5.11) and the inner shell (1–5.5) with the outer sphere cover (1–5.2) above it.

The opening in the outer sphere cover is sealed by means of an insert (1–5.1). The insert houses a transparent measuring cone for reading off the supporting liquid level. In the centre of the measuring cone is a sealing screw with o-ring. All further seals are in the form of quad-rings.

The conductive calottes of the outer sphere (1–5.3, 1–5.10) carry current to the poles (calottes) (1–5.4, 1–5.9) of the gyrosphere. The lower part comprises the electric reversing contacts (1–5.6 and 1–5.7) that ensure follow-up. These are positioned at the height of the equator of the gyrosphere.

The lower part comprises the pump unit U3 (1–5.12).
1.2.1.4 Gyrosphere

The gyrosphere is fitted with a conductive calotte at each pole (1-6.1, 1-6.3). At the equator, there is a semicircular conductive band (1-6.2). It is part of the electric pick-off and follow-up system. The gyrosphere comprises the north-indicating two-gyro system (see Fig. 1-6 and 1-9). The gyrosphere is filled with gas and hermetically sealed.

1.2.1.5 Pump Unit and Heating

The pump base plate of pump unit U3 is situated on the bottom side of the outer sphere. It comprises the pump with the pump motor, the heating element and the temperature sensor.
1.2.1.6 **Supporting Liquid**
The supporting liquid is an electrically-conductive mixture composed of distilled water, glycerin and a basic additive. The exact specific gravity of the supporting liquid, in conjunction with a supporting liquid temperature of exactly +52°C, is crucial for the correct functioning of the gyro compass.
The supporting liquid temperature (+52°C) is obtained and kept constant by a:

- **Heating system for heating the supporting liquid**
The heating system consists of an electronically-controlled resistance heating facility connected to the 24V DC circuit and located on the pump base plate.

- **Cooling system for cooling the supporting liquid**
The cooling system consists of an electronically-controlled fan situated laterally on the compass base plate. If the supporting liquid temperature is too high (higher than +52°C), the fan produces a cooling air stream which enters at the top, below the compass hood, and escapes at the bottom of the casing.

1.2.1.7 **Fan**
The fan consists of an electric motor without collector and of a flange-connected fan turbine. The electronic equipment required for the operation is located in the motor casing.
The fan is mounted on the compass base plate. The electric motor requires no maintenance.

1.2.1.8 **Stepping Motor, Type 110-106.09**
The stepping motor drives the follow-up gear in the gyro compass as well as the gears in the step repeater compasses. A 48-pole magnetic rotor turns within a cage which carries the stator windings. The signals from the step adapter SM0, SM1 and the 0V signal zero are led to the connections of the stepping motor.

1.2.1.9 **Synchro, Type NB 23-167-4 (optional)**
The synchro is incorporated in the supporting plate of the gyro compass as a synchro transmitter element, according to customer order. It generates an electric synchro signal proportional to the course angle, e.g. as a reference signal for an ANSCHÜTZ autopilot, e.g. NAUTOPILOT D. One revolution of the synchro corresponds to 360°.
The synchro is driven by the 360° card shaft in the ratio 1:1 by a toothed belt and via toothed-belt pulleys. The synchro is powered by the connected autopilot.

1.2.2 **Operating Principle of the Gyro Compass STANDARD 14**
The gyrosphere, floating freely in the supporting liquid within the outer sphere and comprising the gyro system, constitutes the north-indicating element.
Two gyros installed in the gas-tight gyrosphere and driven by AC produce, in conjunction with the combined effects of the earth's rotation and gravitation, a directive
force which causes the gyrosphere to settle on the geographic north–south line. Two mechanically coupled gyroscopes are used in order to avoid errors caused by the ship's roll and pitch motions.

The outer sphere is suspended as a pendulum and free to turn about its vertical axis. As the ship alters course, an electric follow-up system causes the outer sphere to maintain its azimuth position with regard to the gyrosphere. Therefore, the 360° card—which is mechanically coupled with the outer sphere by means of the pendulum joint—always indicates the course referred to true north.

1.2.2.1

Centring the GyroSphere in the Outer Sphere

During operation, the following means ensure that the gyrosphere remains suspended and centred:

1. The supporting liquid, which is maintained at a constant operating temperature of +52°C.
2. A supporting liquid stream directed at the gyrosphere and produced by the built-in pump.

The weight of the gyrosphere and the specific gravity of the supporting liquid are adjusted exactly so that, at the gyro compass operating temperature (+52°C), the gyrosphere has a slight residual weight. This residual weight is cancelled by the liquid stream produced by the pump and directed from below towards the gyrosphere with the result that the gyrosphere floats freely in the supporting liquid and is simultaneously centred.

1.2.2.2

Power Supply of the GyroSphere

The gyrosphere requires an AC supply of 55V/400Hz for its two gyro motors so that the gyroscopes rotate at a constant speed of approx. 12,000 rev./min.

Fig. 1-8: Principle of Current Transmission and Pick-off between GyroSphere and Outer Sphere
The electric current for supplying the gyro motors passes via the calottes of the outer sphere through the slightly conductive, supporting liquid to the calottes of the gyrosphere. There, it is picked up and fed to the two gyro motors.

1.2.2.3 Electric Pick-off and Follow-up for Course Transmission
The outer sphere is always caused to automatically follow up the position of the gyrosphere until the electric bridge circuit is in equilibrium again. Any displacement of the gyrosphere in relation to the reversing contacts (pick-off contacts) W1 and W2 of the outer sphere results in a modification of the electric resistances in the supporting liquid. Due to the resulting asymmetry of the primary winding currents of the current differential transformer M1 (see Fig. 1–8), an electric voltage is produced in the secondary winding. In the compass electronics and in the step adapter, it is processed into ANSCHÜTZ step signals (192 steps/1°) as well as into SPERRY step signals (6 steps/1°).

1.2.2.4 Gyro System

![Diagram of Gyro System]

**Fig. 1–9:** Gyro System, Arrangement of the Two mechanically Coupled Gyros (Top View of Gyrosphere, Schematic Representation)

When the compass is switched on, the two gyros start spinning and, under the effects of the earth's rotation, the gyrosphere within the outer sphere oscillates about the north-south direction.

A damping system incorporated in the gyrosphere damps these oscillations until the gyrosphere comes to rest (approx. 3 ... 5 h) and the resultant vector axis of its gyro system exactly indicates the north-south direction (see Fig. 1–9).
1.2.2.5

Directive Moment (Adjusting Capability of the Gyro System)

The magnitude of the directive moment of a gyro is dependent upon its mass, mass distribution, its diameter and upon its speed as well as on the earth's peripheral speed and gravitation.

For a gyro (with constant mass and constant speed), the directive moment is dependent upon the peripheral speed of the earth.

The earth's peripheral speed, and therefore the directive moment, shows highest values at the equator. It decreases towards the poles and becomes zero directly at the poles.

1.2.3

Inverter, Type 121–043 NG001, NG003

1.2.3.1

Application

The inverter is used in the Gyro Compass Equipment STANDARD 14 BASIC VERSION. It comprises the main part of the electronics for the Gyro Compass Equipment STANDARD 14 BASIC VERSION.

1.2.3.2

Construction of the Inverter, Type 121–043 NG001/NG003

Dependent on the application, the Inverter, Type 121–043, can be supplied in 2 versions:

- Version A, Type 121–043 NG001 (with casing, type of enclosure IP 23),
- Version B, Type 121–043 NG003 (without casing, type of enclosure IP 00).
Fig. 1-11:
Inverter, Type 121-043 NG001, Casing opened

Version A, Type 121-043 NG001
The inverter has a metal casing and is intended for vertical bulkhead mounting.
The bottom of the casing is provided with a cable entry plate for 13 possible cable entries and with an earthing bolt (M6) accessible from outside with the appertaining washers and nuts.
The wiring PCB, Type 121-043.05, accommodates two plug-in frames including the following PCBs:
- Step Adapter, Type 121-043.04 as well as
- Compass Electronics, Type 121-043.06.
In addition to this, the wiring PCB carries the inverter, Type 121-043.02, as well as the terminal strips ensuring connection
- to the gyro compass STANDARD 14
- to a 24V DC ship’s mains or 24V DC emergency supply or to optional devices such as to an AC power supply with 24V DC output
- up to 3 course reference receivers (with ANSCHÜTZ step system)
- to a signal unit (e.g. ANSCHÜTZ "NAUTOALARM")
- to an autopilot (e.g. ANSCHÜTZ "PILOTSTAR" or "NAUTOPILOT")
– up to 3 SATNAV/SATCOM or RADAR or Direction Finders (with SPERRY input, 6 Steps/1°).
– to max. 2 RoT indicators (ANSCHÜTZ)
– to a course transducer, Type 132–603 NG001 / NG002

A cable, approx. 5 m long, is permanently attached to the inverter and fitted with a 25–pole plug connector for connection with the gyro compass.
The door of the inverter casing carries the main switch B5 as well as the fuses E1 and E2. The door can be locked by means of a special key (included in delivery).

**Version B, Type 121–043 NG003**
The version B is intended to be incorporated into desks, cabinets or steering stands. The inverter is without casing; and also without cable*) and main switch B5*), fuse-holders*) with the fuses E1*) and E2*).
Further design is according to version A (NG001).

### 1.2.3.3 Principle of Operation of the Inverter, Type 121–043 NG001 / NG003

The inverter

- produces the supply voltages for the gyro compass equipment from a 24V DC ship’s mains or from a 24V DC emergency supply as well as from an AC power supply unit with 24V DC output voltage and
- converts the analog course signals – fed from the master compass into the inverter – by means of the compass electronics and of the step adapter into the following step signals:
  - ANSCHÜTZ fine step signals \(\cong 192 \text{ steps/}1^\circ\)
  - SPERRY step signals \(\cong 6 \text{ steps/}1^\circ\)
- amplifies the step signals for connecting step repeaters
- monitors the
  - supply voltage (24V DC) of the equipment
  - follow–up system of the master compass
- provides signalling (via optional signal unit)
  In case of
  - undervoltage or voltage failure of the power supply
  - follow–up switch is at "OFF" or "TEST" position.
- makes available the connections for the power supply, the gyro compass and the repeaters.

*) These parts are individually to be considered for system planning and installation of the device.
- mekas available a sin/cos or a synchro course signal (dependant on optionel modification of the gyro compass) e.g. for connecting an autopilot*).
- produces a rate-of-turn signal (ROT signal) within the compass electronics
  \[ \text{ROT} \triangleq \text{rate of turn}. \]
- amplifies the ROT signal for the connection of rate-of-turn indicators.

Note:
The ROT signal is formed as a DC voltage mean value from the step course signals of the master compass.
This DC voltage mean value is proportional to the rate of turn, as – with increasing course change speed of the vessel – the number of step pulses per unit of time increases.

1.2.3.3.1 Application of the ROT Signal
The rate-of-turn signal (ROT signal) produced by the inverter can be used for measuring the rate of turn of a vessel. A maximum of 2 rate-of-turn indicators can be connected to the inverter. The ROT outputs can be scaled for the intended range of indication by changing an electric bridge on the compass electronics PCB correspondingly.
The scaling can be connected for rates of turn of 30°/min, 100°/min or 300°/min. Special scalings for the ROT indication can be taken into consideration on request and confirmation of order.
For all scalings: \( \pm 10 \text{V DC} \triangleq \text{maximum scale deflection.} \)
The polarity of the ROT outputs is defined as follows:
- Port BB \( \triangleq (+) \)
- Starboard STB \( \triangleq (-) \)

Important note:
The ROT signal supplied by the inverter is no substitute for a signal coming from a rate-of-turn indicator equipment!
The ROT interfaces may be used only on the market not subject to approval!

*) If the inverter is connected to a gyro compass with optional \( \cos \alpha \) synchro or sin/cos potentiometer, the corresponding signal is led via a terminal strip in the inverter to the autopilot.
1.2.3.2 Connecting Possibilities of the Inverter (General Survey)

Via its interfaces (see Section 1.2.3.4) the inverter can be connected with the following devices:

1. gyro compass STANDARD 14 (ANSCHÜTZ)
2. autopilot (ANSCHÜTZ), optional
3. course transducer (ANSCHÜTZ), optional
4. signal unit, e.g. ANSCHÜTZ, optional

3. course reference receivers with ANSCHÜTZ step course transmission system (e.g. ANSCHÜTZ analog or digital repeaters), optional
4. course reference receivers with SPERRY step course transmission system (max. load 90mA) e.g. digital repeaters, SATNAV/SATCOM, radar or DF equipment, optional

2. RoT indicators, ANSCHÜTZ (rate-of-turn indicators), optional

1.2.3.4 Interfaces of the Inverter

The following interfaces are available on the inverter:

- Interface for ANSCHÜTZ step course signals, 192 steps/1° (L20. 1 ... 6)

  To be connected to this interface e.g.:
  1. autopilot, ANSCHÜTZ "NAUTOPILOT" or e.g.
  2. digital navigation data indicator (ANSCHÜTZ)

  Max. load of the interface: ±10mA.

  **Note:**
  A 24V DC voltage supply is led via the interface (L20. 1 ... 6), e.g. for lighting purpose end/or for operating the device.

- Interfaces for ANSCHÜTZ fine step signals, 192 steps/1° (L11., L12., L19. 1 ... 6)

  To be connected to each of these interfaces:
  1. analog step repeater compass (e.g. ANSCHÜTZ Types 133–310, 133–311, 133–312, 133–402 NG002) or
  2. digital navigation data indication (ANSCHÜTZ digital repeater compass, Type 133–809)

  Maximum load per interface (SM0, SM1): ±0.5A.

  **Note:**
  A 24V DC supply is led via each of the interfaces (L11., L12., L19. 1 ... 6), e.g. for lighting purposes and for operating the devices.
• Interfaces for SPERRY step course signals, 6 steps/1° (L14., L15., L16. 1 ... 6)
  To be connected to each of these interfaces e.g.:
  1 SATNAV or 1 SATCOM or 1 RADAR equipment, or
  1 RDF or
  1 digital repeater compass (e.g. ANSCHÜTZ)

  Maximum load of all 3 interfaces: together 180mA or 60mA each
  (+35V DC $\Rightarrow$ Common positive).

  • Interface for 24V DC main supply or emergency supply (L1. 1 ... 3)

  • Interface for 1 signal unit (L3. 1 ... 6)

  • Interface for 1 course transducer (L4. 1 ... 10) (incl. 28V DC main supply)

  • Interface for 1 autopilot (L5. 1 ... 6)

  • Interface for 1 gyro compass (L6. 1 ... 25)

  • Interfaces for 2 RoT indicators (L17., L18. 1 ... 4)

  **Note:**
  One device or equipment only may be connected to each of the interfaces in order that mutual influences might be excluded.
  For reasons of electric loadability, a restricted number of repeaters only can be connected to the inverter!

  If it is intended to operate more nautical repeaters, they can be connected to an optional Course Transducer, Type 132—803.
1.3 Technical Data

1.3.1 Dimensions and Weights of System Components

- **Gyro Compass, Type 110–106**
  - Height: 407 mm
  - Diameter: 345 mm
  - Weight: approx. 12 kg

- **Inverter, Type 121–043**
  - Width: 318 mm
  - Height: 418 mm
  - Depth: 185 mm
  - Weight: approx. 15 kg

1.3.2 Power Supply

1.3.2.1 **Power Supply from 24V DC Ship’s Mains or 24V DC Emergency Supply**

  - for supplying the inverter Type 121–043

  - Input voltage: 24V DC
  - Tolerance range: 19.2V ... 36V DC

1.3.2.2 **Power Supply from the AC Ship’s Mains via an optional Power Unit, e.g. Type 119–020**

  - Input voltage: 100V AC ... 265V AC
  - Frequency of input voltage: 50Hz or 60Hz
  - Output voltage: 24V DC

**Power Supply from AC Ship’s Mains via an optional Course Transducer, Type 132–603**

- Input voltage: 110, 220, 380 or 440V AC
- Frequency of input voltage: 50Hz or 60Hz
- Output voltage: 28V DC (for supplying the inverter)
Power Consumption with 24V DC
Ship’s Mains Power Supply:

a) approx. 90W max.
   (during heating—up)

b) approx. 65W in continuous operation
   with 3 Repeater Compasses, e.g.
   alternatively ANSCHÜTZ Types:
   133–310, 133–311, 133–312,
   133–402 NG002, 133–809.

Power consumption with 110/220/
380/440V AC power supply:

approx. 100VA (via optional course
transducer)
(including supply of gyro compass,
inverter, and 3 Repeater Compasses,
alternatively e.g.
ANSCHÜTZ Types: 133–302,
133–303,
133–310, 133–311, 133–312,
133–402 NG001, 133–402 NG002,
133–809.

1.3.3 Operating Data
Settling times and course accuracies

- After a settling time of \( \leq 3h \),
  the course accuracy is:
  \[ < \pm 2^\circ \]

- After a settling time of \( \leq 5h \),
  the static course accuracy
  (in port, ship at rest) is:
  \[ \pm 0.25^\circ (1 \sigma) \]
  Peak values, referred to the
  linear mean value:
  \[ \pm 0.7^\circ \]

- After a settling time of \( \leq 5h \),
  the dynamic course accuracy
  (at sea, under normal sea conditions
  and optimum alignment
  of the compass) is:
  \[ \pm 1.5^\circ (1 \sigma) \]

Rate of follow—up:
up to 8.3\(^\circ\)/s

Roll and pitch angle freedom:
\[ \pm 30^\circ \]
1.3.4 Ambient Conditions
Permissible ambient temperatures
- Operation: \(0°C \ldots +45°C\)
- Storage
  a) with supporting liquid: \(-10°C \ldots +75°C\)
  b) without supporting liquid: \(-25°C \ldots +75°C\)

Type of enclosure acc. to DIN 40050
Gyro Compass, Type 110–106: IP 23
Inverter, Type 121–043 NG001: IP 23
Inverter, Type 121–043 NG003: IP 00 (without casing) (optionally)
Course Transducer, Type 132–603 NG001: IP 23 (optionally)
Course Transducer, Type 132–603 NG002: IP 00 (without casing) (optionally)
Time Switch, Type NB 03–735: IP 23 (optionally)

Degree of interference
acc. to VDE 0875: Factor "K"

Resistance to vibration of the gyro compass equipment:
According to BSH and GL requirements

1.3.5 Type Test
BSH type test specification: acc. to IMO Performance Standard A 242 (XI)
Degree of interference acc. to VDE 0875:  

Factor "K"

Resistance to vibration of the gyro compass equipment:

According to BSH and GL requirements

1.3.5 Type Test

BSH type test specification

acc. to IMO Performance Standard A 242 (XI)
2. Operating Instructions

2.1 Switching on the Gyro Compass Equipment

The gyro compass equipment can be switched on either without or — if an optional time switch is used — with time delay. For immediate switching-on, proceed as follows (see Section 2.1.1).

![Diagram of control elements and LED on the compass hood](image)

1. Knob for dimming potentiometer
2. LED for signalling
3. Follow-up switch B2
4. RESET range

**Fig. 2-1:** Control Elements and LED on the Compass Hood
(Sectional View of Compass Hood)

2.1.1 Switching-on Procedure

- Set the follow-up switch (2-1.3) to Pos. "0".
- Set the main switch on the inverter (Fig. 1-12) to Pos. "I".
- The red LED (2-1.2) lights up.

The gyroscopes start running up to their rated speed and cause the gyrosphere to settle in the meridian. This settling process is terminated after about 3 ... 5 hours.

After approx. 1 hour from the moment of switching on, the follow-up system can be switched on by means of the follow-up switch (2-1.3). (Set the follow-up switch to Pos. "1", whereupon the red LED (2-1.2) goes out.)

Earlier switching-on (even for a short time) may disturb — and therefore extend — the settling process of the gyrosphere.

The outer sphere now follows up the position of the gyrosphere automatically.
2.2 Adjusting the Repeaters for the Gyro Compass Course
(See also Section 3.2.7, Synchronizing the Course Indications of the Repeaters with the Course Indication of the Gyro Compass.)

After first putting into operation of the gyro compass equipment, all repeater indications must coincide with the gyro compass course indication.
If this is not the case, the repeaters concerned are to be re-adjusted for the course of the gyro compass (synchronization).

Hint:
The course adjustment is to be performed only with the compass in settled condition and with the follow-up system switched on. Thus, adjustment errors of other connected repeaters are eliminated.

2.2.1 Adjusting the Card Illumination on the Gyro Compass and on the Repeater Compasses
By means of the respective illumination potentiometer, the brightness of the card illumination can be adapted to ambient light conditions.

2.3 Signalling during Operation
The LED on the compass hood (2-1.2) indicates the following operating conditions by lighting up red:

- Operating temperature too high (more than +65°C; follow-up system switched on)
- Supply voltage <18.5V for a period of ≥1.5 s
- Follow-up system switched off or in pos. "T"
  e.g. manually via follow-up switch (2-1.3)
  or automatically, e.g. due to undervoltage
- Gyro motors without power supply for longer than 1.5 s.

For cancelling a message, set the follow-up switch briefly to Pos. "0" and then back to Pos. "1" (RESET range, 2-1.4). The red LED goes out. Should the LED continue to light, the cause of the fault must be investigated.

2.4 Checks to be made during Operation
The following checks must be made during operation of the equipment:

- Check the signalling LED (see Fig. 2-1.2)
- Check the course indication of the gyro compass
- Check and compare the indicated values between the gyro compass STANDARD 14 and the analog or digital indications of connected repeaters.
Should the indications deviate from the course indication of the gyro compass, the corresponding repeater must be synchronized (refer to Section 3.2.7). For digital repeater compasses, the enclosed descriptions of device should be observed.

2.5 Voltage Failure of the AC Supply for the optional Course Transducer
(See Section 4.2.4.4).

2.6 Switching off the Gyro Compass Equipment
The following operator actions are required for switching-off:

- Set the follow-up switch (2-1.3) on the compass to Pos. "0".
- Set the main switch on the inverter to Pos. "0".

Hint:
Time switch (if included in the equipment) is not to be actuated!

**Attention:**
When the gyro compass has been switched off, the gyros come to a stand-still only after a run-down time of approx. 15 min. During this period, access to the gyro compass is not allowed!

**Note:**
It is recommended not to switch off the gyro compass equipment, when the ship stays in port for no more than one week.

**Attention!**
On switching off the gyro compass equipment it may happen that the gyrosphere takes a tilted position within the outer sphere. On re-starting the equipment with the follow-up system switched on, the gyrosphere may oscillate for a period longer than 30 hours. In case the gyrosphere shows a tilted position and the indication is variable (the gyro current, height of gyrosphere, supporting liquid temperature are correct!), the follow-up system is to be switched off. Switch off the equipment. Wait until the gyros are at complete standstill (after approx. 15 min.), then switch on the equipment again. After 1 hour, switch on the follow-up system. At the end of the settling process, check the position of gyrosphere once more. If the gyrosphere remains in a tilted position and the indication shows variable errors, the gyrosphere should be exchanged.
2.7 Time Switch, Type NB 03–735 (optional)

2.7.1 Operating instruction

Adjustment of the time when the compass is intended to be available is made by means of the scale of the time switch (see Fig. 1–12).

For this purpose,
- the time till the moment of switching-on
and
- the settling time (4h) of the gyro compass
are to be added together and adjusted on the rotary knob of the time switch.

Note:
The distance of between the short division marks corresponds to 2 hours, the long marks indicating the days (from 0 to 6 days).

Applying the 24V DC operating voltage to the input terminals results in that the output relay D1 immediately becomes activated. The operating voltage is then applied to the output terminals. Simultaneously, the operating voltage is indicated by the green LED N9 "GYRD ON".

Actuating the key "DELAY" causes the relay D1 to drop out and the output to be dead. Simultaneously, the time adjusted by means of the potentiometer R17 runs down. Run-down of the delay time is indicated by the red LED N10 "DELAY".

If during the time run-down the key "DELAY" is actuated once more, the time then adjusted will run down. When the time adjusted has run down, the relay D1 will be re-activated. Voltag is applied to the output again.

The output will be activated always 4 hours before the time adjusted has run down. The key "GYRO ON" permits interruption of the time adjusted end switching on the compass immediately.
3. Cara and Maintenance

3.1 Safety Regulations

**Attention!**
For performing care and maintenance work, due regard to the applicable safety regulations is indispensable (e.g. VDE regulations on the operation of heavy-current installations, VGB4 safety regulations for electric installations and production facilities or equivalent regulations). Before carrying out any servicing measure on the gyro compass in switched-off condition, wait until the gyros have come to a standstill (run-down time approx. 15 min).

3.1.1 General Information
Care and routine preventive maintenance of the gyro compass equipment are restricted to inspections as well as to exchanging the supporting liquid in order to ensure a reliable operation of the gyro compass equipment.

- For new equipment, the first inspection of all system components is recommended to be performed approx. 2 years after first-time commissioning.
- Thereafter, an inspection of all system components incl. overhaul should be made once a year. The supporting liquid has to be exchanged once a year.

Hints:
Due to a certain evaporation, however, the supporting liquid level is to be checked half-yearly, even for new equipment. In case the supporting liquid level is too low, top up with distilled water only! (Cf. Section 3.5.1.)
When exchanging the supporting liquid, use "Original ANSCHÜTZ Supporting Liquid" only!

For exchanging the supporting liquid refer to Sections 3.1.2, 3.1.3, 3.3.1.1, 3.3.3. This maintenance work can be carried out by trained ship's personnel or by any ANSCHÜTZ service station.

For inspections, functional checks and repair work of the equipment, please turn to an ANSCHÜTZ service station.
A List of Service Stations is included in the Compass Book.
In the following sections, you will find described the operations that are required for eliminating disturbances.

3.1.2 Opening the Gyro Compass

3.1.2.1 Removing the Compass Hood

**Fig. 3-1:**
Unscrewing 3 Cross-slotted Screws on the Compass Hood

**Fig. 3-2:**
Removing the Compass Hood to above
3.1.2.2 Removing the Compass Casing

**Fig. 3–3:**
Pushing the Compass Casing over the 3 Cylindrical Pins (some millimetres). The arrow points to one of the cylindrical pins.

**Fig. 3–4:**
Pushing the Compass Casing to above and removing it.

**Note:**
When inserting the compass connection cable laterally below the compass hood, start loosening and removing the 25-pole plug connection of the compass connection cable (see Fig. 3–21) as well as the cable clamp!
3.1.3 Exchanging the Supporting Liquid

In order to ensure reliable functioning of the gyro compass the supporting liquid should be renewed:

- for new equipment after 2 years (from first commissioning), then
- once a year (see Section 3.1.1).

For reasons of expediency, the exchange of the supporting liquid should be made while the ship is in port or in the course of an annual overhaul; it can be carried out by the ship's personnel or by an authorized ANSCHÜTZ service station.

Hints:

- Prior to switching off the gyro compass equipment, record the indicated course. Set the follow-up switch to "T" and make the 360° card run into the "000" position.
- Switch off the equipment on the course transducer and on the inverter.
- On exchanging the gyrosphere and / or supporting liquid in extremely cold weather or in cold regions, the supporting liquid is to be pre-heated to room temperature at least, before it is filled into the outer sphere. Extremely cold supporting liquids might extend the settling process of the gyrosphere by several hours. It may happen that the gyrosphere turns in one direction (>360°) for the first one or two hours and only then will start with its normal settling curve.

Preparing the removal of outer sphere end gyrosphere

Attention:
Before performing further work, wait approx. 15 min until the gyros in the gyrosphere have come to a standstill!

Go on working as described and illustrated under Section 3.3.1:

- Removing the Gyrosphere from the Outer Sphere.
- Draining off the supporting liquid.
- Opening the outer sphere.
- Removing the gyrosphere.
- Cleaning the gyrosphere and outer sphere parts using clear water (if possible, distilled water) only.
- Then dry well the gyrosphere and the outer sphere parts.

Note:
- Reassembly to be made following the dismantling instructions in reverse order.
- Inserting the gyrosphere, for further reassembly proceed as described in Sections 3.3.2 and 3.3.3.
- Checking the cable connections, carrying out functional check.
3.2 Inspecting the Gyro Compass Equipment

3.2.1 Inspecting the Gyro Compass

The work to be carried out on the gyro compass during inspection comprises disassembly and assembly procedures, as described in detail in the following sections:

3.1.3 Exchanging the Supporting Liquid
3.3 Replacing the Gyrosphere
3.4 Removing the Pump.

- Set the follow-up switch to Pos. "T" (360° card turns into "000" position).
- Switch off the compass equipment on the course transducer and on the inverter.
- Remove the compass hood and casing.
- Remove the outer sphere and clean it.
- Clean the compass casing, fan motor end supporting plate from dust and dirt.
- Drain off the supporting liquid and remove the gyrosphere.
- Unscrew the pump unit.
- Clean the pump unit and outer sphere parts with clear water (if possible, distilled water) and dry them well.
- Replace filter ring, teflon washer, seal and gasket.
- Check the cable loom.
- Screw the pump unit onto the outer sphere again.
- Fill the outer sphere with approx. 1/4 l of supporting liquid. (Use only original ANSCHÜTZ supporting liquid!)

Attention:

In extremely cold weather or in cold regions, the supporting liquid is to be pre-heated to room temperature.

- Check the function of the pump by briefly switching the equipment on and off on the course transducer three or four times (with the inverter switched on).
- Then switch off again the inverter and the course transducer.
- Carefully clean the gyrosphere using clear water (if possible, distilled water).
- Re-insert the gyrosphere into the outer sphere.
- Fill supporting liquid into the outer sphere (see Section 3.3.3 and 3.5.1).
- Check the gasket (between outer sphere vessel and cover); renew it, if necessary.
- Close the outer sphere.
- Flange the outer sphere to the pendulum joint again.
- Check the gear wheels, clean and grease them, if necessary.
- Check the toothed belt.
- Check lighting.
3.2.2 Inspecting the Inverter
- Clean the inverter from dust and dirt.
- Open the inverter.
- Measure the supply and operating voltages in the inverter (see Test List for Inverter, compass connection cable removed from the compass, inverter switched on).
- Close the inverter again.

3.2.3 Inspecting the Course Transducer (only if existing)
- Clean the course transducer from dust and dirt.
- Open the course transducer.
- Measure the supply and operating voltages in the course transducer (for this purpose, switch on the course transducer).
- Check the adapter PCBs.
- Close the course transducer again.

3.2.4 Inspecting the Time Switch
- Perform functional check of the time switch (if provided).

3.2.5 Inspecting the Repeater Compass(es)
- Clean the repeater compass from dust and dirt.
- Open the repeater compass.
- Check the repeater compass installed outside for penetration of water.
- Renew defective sealings.
- Check the gear wheels or toothed belts; clean, if required.
- Grease gear wheels, e.g. with MOLYKOTE, oil bearings.
- Renew or regenerate the anti-mist cartridge (only with Type 133–310).
- Check the lighting.
- Check stepping motor or
- Check synchro.
- Close the repeater compass again.
- Synchronize repeater compass.
3.2.6 Checking the Operational Function of the Equipment
- Re-establish cable or plug connections, if applicable.
- Switch on the equipment via the course transducer, inverter and, where applicable, time switch.
- Measure the starting and operating current of the gyro motors and of the pump motor.
- After the operating temperature is reached (+52°C, at the earliest after approx. two hours), check the level of the supporting liquid and the height of the gyro-sphere.
- After the gyrosphere has settled (max. 5 h), switch on the follow-up system.
- Compare the course indications of the repeaters with the gyro compass course indication and, if necessary, synchronize them (see Section 3.2.7).

Hint:
All peripheral equipment belonging to the system should also be checked for correct functioning.

3.2.7 Synchronizing the Course Indication of the Repeaters with the Course Indication of the Gyro Compass

Note:
In order to ensure correct course indication by the repeaters connected, their course indication is to be compared to the NORTH-referred course indication of the gyro compass and, if required, adjusted for the same course value (synchronization). This adjustment must be applied upon commissioning of the gyro compass equipment. Within the scope of the annual inspection of the complete equipment, however, the course indications should also be checked. The same applies when the equipment is again put into operation, e.g. after checks, repairs, current breakdowns or similar.

3.2.7.1 Preparing the Synchronization Procedure
- Switch on the equipment (acc. to Section 2.1). Follow-up switch (2-1.3) remains in "OFF" position for approx. 1 h.
- Set the follow-up switch (2-1.3) to Pos. "T" (Test). The 360° card now turns into its "000" position.
Hint:
Should the case arise that the gyro compass card with follow-up switch position "T" does not turn into its "000" position (may be the case for initial positions in the range between approx. 350° and 360°), operation of push-button B3 results in that the electrical interlock is interrupted. The gyro compass card now turns into its "000" position. (The push-button B3 and the gyro compass card are accessible after removal of the gyro compass hood, see Section 3.1.2).

3.2.7.2

Synchronizing the Repeater Compasses
- Set follow-up switch (2–1.3) to Pos. "1".

The gyro compass card and all repeater compass cards must now run into the same course value. A possibly connected digital repeater compass is to be adjusted for the corresponding course value.

If the indications of the repeater compasses do not coincide with the master compass indication, the repeater compasses concerned are to be synchronized (adjusted) by means of their adjusting devices for the course value of the master compass.

Procedure of synchronizing the repeater compasses:
- Remove protective cap (or locking screw for Type 133–310).
- Insert the screw driver into the opening and adjust the compass card for the value of the gyro compass indication.
- Put on the protective cap (or screw in the locking screw for Type 133–310).

Hint:
With step-type repeater compasses, the step resolution may result in that the 1/10° indication shows a physically-conditioned deviation of max. ±0.08° which cannot be corrected.
3.3 Replacing the Gyrosphere

3.3.1 Removing the Gyrosphere from the Outer Sphere

Required tools:
1. Injector, 1 Suction cup,
2. Screw drivers for cross-slotted screws, sizes 1 and 2.
- Set the follow-up switch to position "T", thus causing the 360° gyro compass card to run into Pos. "000".
- Switch off the gyro compass equipment on the course transducer and on the inverter.
- Remove the compass hood and casing (see Section 3.1.2).
- Wait approx. 15 min until the gyro's in the gyrosphere have come to a complete standstill.

3.3.1.1 Removing the Outer Sphere from the Pendulum Joint

Take hold of the outer sphere at the bottom with one hand applying slight pressure to above. In this position, press down the 4 quick-closing pins on the pendulum joint each one time only (see Fig. 3–5).

Attention!
Now the outer sphere is loosened from the pendulum joint.
- Take hold of the outer sphere and carefully take it out of the gyro compass (see Fig. 3–6).
- Put the outer sphere down beside the gyro compass on a plane surface (see Fig. 3–7).

---

Fig. 3–5: Loosening the Outer Sphere from the Pendulum Joint:
Press down the 4 quick-closing pins one time each.
Attention! Now the outer sphere is loosened from the pendulum joint.
**Fig. 3–6:**
Taking the Outer Sphere carefully out of the Gyro Compass

**Fig. 3–7:**
Putting down the Outer Sphere on a Plane Surface beside the Gyro Compass

**Fig. 3–8:**
Loosening the Plug Connection of the Outer Sphere Connecting Cable from the Bottom Side of the Supporting Plate
Fig. 3-9: Loosening the Individual Wire Plug Connection from the Outer Sphere

Fig. 3-10: Unscrewing the Outer Sphere Insert (6 Screws)

Fig. 3-11: Removing the Outer Sphere Insert
Fig. 3–12: Removing the Supporting Liquid out of the Outer Sphere by means of the Injector (Remove approx. 12 to 15 injector fillings)

Fig. 3–13: Screwing off the Outer Sphere Cover (6 Screws)

Fig. 3–14: Removing the Outer Sphere Cover
Fig. 3-15:
Removing the Inner Shell

Fig. 3-16:
Lifting out the Gyrosphere by means of the Suction Cup.
For this purpose, moisten the suction cup and press it centered on the calotte of the gyrosphere.
Attention! Take out the gyrosphere carefully. Support the gyrosphere with one hand from below.

Fig. 3-17:
Keeping the Gyrosphere in a Safe Place (e.g. on a foam part included in the original packing of the gyrosphere)
Hint:
Before inserting the gyrosphere, check that the outer sphere is not soiled – clean it, if necessary. After long periods of operation, the pump filter should be replaced (at the latest after two years in operation).

3.3.2 Inserting the Gyrosphere into the Outer Sphere
Hint: Compare illustrations showing removal of gyrosphere!
- Fill approx. 1/4 l of original ANSCHÜTZ supporting liquid into the outer sphere.
- Moisten the suction cup and press it onto the centre of the calotte and
- Carefully insert the gyrosphere into the outer sphere (cf. Fig. 3–16).
- Remove suction cup.
- Centrally place the inner shell onto the seat of the lower support bearing of the outer sphere (cf. Fig. 3–15).
- Clean the contact surfaces of the outer sphere, outer sphere cover and insert.
- Check the position of the gasket ring between the outer sphere and outer sphere cover.
- Place the outer sphere cover on the outer sphere (cf. Fig. 3–14) whilst observing the positioning pins!
- Secure the outer sphere cover to the outer sphere (6 screws to be tightened crosswise, cf. Fig. 3–13).
- Check the position of the gasket ring between the outer sphere cover and the insert.
- Carefully place the insert on the outer sphere cover (cf. Fig. 3–11).
- Fasten the insert to the outer sphere cover by means of 6 screws (cf. Fig. 3–10).

3.3.3 Filling the Outer Sphere with Supporting Liquid and Measuring the Level of the Supporting Liquid
- Fill in original ANSCHÜTZ supporting liquid via the opening in the outer sphere cover.
Attention:
In extremely cold weather or in cold regions, the supporting liquid is to be pre-heated to room temperature.
Fill in original ANSCHÜTZ supporting liquid in the outer sphere.

Filling height:
approx. 10mm from the upper edge (see Fig. 3–19).
Tilt of the outer sphere for a short time by approx. 20° (removal of air bubbles). The supporting liquid level can be read off the measuring cone (see Section 3.5.1).

Fig. 3–19: Supporting Liquid Level in the Outer Sphere
(Upper Part of the Outer Sphere, Schematic)

- Replace and tighten the top screw.
- Insert the outer sphere into the gyro compass (refer to Section 3.3.4).
- Mount the compass casing and the compass hood.
- Switch on the gyro compass equipment on the course transducer and on the inverter.
- After 3 ... 4 hours, check again the supporting liquid level at operating temperature (+52°C). For this purpose, the follow-up has to be switched off, the compass opened again and the outer sphere is to be removed from the hinge.
(Proceed as described in Section 3.3.1.1.)

Hint:
Do not remove the plug from the underside of the supporting plate.
- Check the supporting liquid level and correct if necessary.
- Check the supporting liquid temperature (+52°C).
- Subsequently re-assemble the removed parts.
3.3.4 Inserting the Outer Sphere into the Gyro Compass
(Cf. Fig. 3–5 and Fig. 3–6)
Re-establish the cable plug connection (Fig. 3–8) between the outer sphere and the supporting plate (if detached).
- Take hold of the outer sphere with one hand from below and carefully couple the outer sphere to the flange of the pendulum joint. Insert the guide pin on the edge of the outer-sphere cover into the guide slot of the flange of the pendulum joint. Apply slight pressure from below to the outer sphere. In this position, press the 4 quick-closing pins on the pendulum joint one time each (see Fig. 3–5).

Note:
Now the outer sphere is fastened to the pendulum joint.

---

Fig. 3–20:
Mounting the Compass Casing (Pay attention to rear centering, if existing).

Centering:
(pin and groove)

---

Fig. 3–21:
Establishing the 25-pole Plug Connection of the Compass Connection Cable, if loosened.
Secure cable clip.

---

- Replace and secure the compass hood.
Removing the Pump

- Set the follow-up switch (2-1.3) to Pos. "T" and let the 360° compass card run into Pos. "000".
- Switch off the equipment on the course transducer and on the inverter.
- Allow the gyros to run down (approx. 15 min).
- Dismantle the gyro compass (proceed as described in Sections 3.3.1 and 3.3.2).
- Keep the dismantled gyrosphere on an adequate support in a safe place until re-assembly.
- Tilt the outer sphere through 180°.
- Unscrew the 3 fastening screws on the cover of the pump unit (Fig. 3-22) and remove the cover (Fig. 3-23).

Attention, danger of confusion!
To be loosened only the 3 screws for fastening the cover.
- Loosen the electrical plug connections of the cable loom from the pump unit and remove them (Fig. 3-24).
- Loosen the 6 fastening screws from the pump unit (Fig. 3-25).
- Carefully remove/install the parts of the pump (see Fig. 3-26, 3-27, 3-28).

The Pump, Type 110-106.06, comprises the following parts:
- Pump casing
- Filter ring
- Teflon washer
- Stator with base plate
- Rotor
- Pump cover.

Re-install the new or previously removed parts in reverse order. Pay attention to correct position of the positioning pin (Fig. 3-24)!
- Re-establish the electrical plug connections on the pump.
- Tilt the outer sphere to the normal position again.
- Establish cable connection to the supporting plate (if removed).
- Fill some supporting liquid into the outer sphere (with low ambient temperature, pre-heat the supporting liquid).
- Switch on the course transducer briefly on and off 3 or 4 times (check of pump function, bubbling-up of the supporting liquid)
- Switch off the course transducer again.
- For further re-assembly refer to Sections 3.3.2 and 3.3.3.
- Carry out functional check.
Fig. 3-22: Screwing off the 3 Fastening Screws on the Cover of the Pump Unit

Fig. 3-23: Removing the Cover of the Pump Unit
Fig. 3–24:
Loosening and removing the Electric Plug Connections of the Cable Loom on the Pump Unit. Pay attention to the positioning pin responsible for the correct mounting position of the previously removed cover.

Positioning pin

Fig. 3–25:
Unscrewing the 6 Fastening Screws from the Pump Unit

Fig. 3–26:
Removing the Pump Unit with the Rotor included
Attention!
The rotor might fall out. Hold the rotor tight and take it out carefully.
Pay attention to the positioning pin responsible for the correct mounting position of the previously removed pump unit!
**Fig. 3-27:**
Replacing the Pump Filter

**Fig. 3-28:**
Replacing the Gasket Ring on the Pump Casing
3.5 General Checks
For the checks to be made, such as:
- Checking the supporting liquid level
- Checking the pump function
- Checking the height of the gyrosphere,
the outer sphere must be removed and placed beside the compass chassis on
a plane surface (see Fig. 3-7).
However, removal of the cable plug connection to the outer sphere is not required!
The individual checks are to be made only when the follow-up system is switched off
and with an operating temperature of +52°C. This value is reached approx.
1 ... 2 h after switching on, dependent on the ambient temperature.

3.5.1 Checking the Supporting Liquid Level
The supporting liquid level is to be read off the measuring cone (see Fig. 3-19 and
3-29). The part of the measuring cone immersed in the liquid appears dark with re-
gard to the brighter, dry part. If the supporting liquid level is too low (see Fig. 3-29),
the supporting liquid is to be topped up with distilled water only by means of the syr-
inge (Fig. 3-12) via the filling hole (in the centre of the measuring cone).
Proceed as follows:
- Screw out the top screw from the measuring cone by means of a screw
driver (6 mm) and top up with the relevant amount of liquid using the syringe.

Top view of measuring cone:
Supporting liquid level "o.k."

Measuring cone top screw

Top view of measuring cone:
Supporting liquid level "too low"

*Fig. 3-29:*
Reading off the Supporting Liquid Level at the Measuring Cone
3.5.2 Checking the Pump Function and the Height of Gyrosphere

- Switch off follow-up.
- Open the gyro compass.
- Take the outer sphere out of the quick-acting closure.
- Screw out the top screw of the measuring cone, insert the gauge stick into the opening of the measuring cone and measure the height of gyrosphere (see Fig. 3-30).

Push down carefully the gauge stick with your finger.
The pump function and, with this, the height of the gyrosphere, are correct when there is a 1.5 mm to 2 mm height difference between the bottom-contact position \(\Leftrightarrow\) pump "OFF" (Fig. 3-30) and the operating position \(\Leftrightarrow\) pump "ON" (Fig. 3-31).

- Remove the gauge stick.
- Re-insert the locking screw (with sealing ring) into the measuring cone and tighten it.
- Install the outer sphere and close the gyro compass again.
- Switch on follow-up.

---

![Diagram](image_url)

**Fig. 3-30:**
Gyrosphere in Bottom-contact Position:
Pump "OFF" (Schematic)

**Fig. 3-31:**
Gyrosphere in Operating Position:
Pump "ON" (Schematic)
3.6 Ascertaining and Correcting the "A" Error

The "A" error of a gyro compass is brought about by incorrect alignment of the compass casing (rubber line) in relation to the ship's fore-and-aft line or a line parallel to this. The result is a constant gyro compass error which must subsequently be corrected by turning the compass casing.

In order to correct the "A" error of the gyro compass, the gyro compass must be switched on and the gyrosphere in settled position (approx. 5 h after switching on the equipment, the "A" error correction can be performed). In the interest of the desired accuracy, the ship must be at rest (made fast to a pier) in accordance with BSH (ex DHI) regulations!

Procedure:
- Ascertain the ship's position with regard to the geographical north pole (e.g. determine the direction of the pier by means of a sea chart, refer to example in Fig. 3-32: Direction of pier $\equiv 109^\circ$).
- Remove the compass hood and casing.
- Loosen the mounting screws of the gyro compass.
- With the follow-up system switched on, carefully turn the compass chassis until the difference between the actual course (direction of pier $\equiv 109^\circ$) and the course indicated by the compass (e.g. $111^\circ$) is cancelled out.
- Re-tighten the mounting screws.
- Compass casing and hood to be mounted and fastened again.

Example of "A" error correction of the gyro compass:
Before correction, the gyro compass indicates e.g. $111^\circ$.
(Direction of pier is $109^\circ$).
Thus, the "A" error is $2^\circ$. In this case, the "A" error is to be corrected by turning the compass casing anti-clockwise.

Fig. 3-32: Ship lying at the Pier,
True Direction $\equiv 109^\circ$

Indicated compass course: e.g. $111^\circ$
3.7 Repeater Compasses

The repeater compasses require no special maintenance. They should be checked on the occasion of the annual overhaul recommended for the gyro compass equipment (see Section 3.2.5). See also the individual description appertaining to the repeater compass type in question.
4. Repair

4.1 Circuit Description Gyro Compass STANDARD 14

Circuit Diagram 110 C 106 HP 030, Wiring Diagram 110 D 106 HP 031

Lubber line
360° compass card
Electronics PCB
Supporting plate
Pendulum joint with quick fastening
Follow-up motor M3
Synchro M4 (option)
Outer sphere with gyrosphere
Pump group U3
Fan motor M5
Ship's ahead mark

Fig. 4-1: Gyro Compass STANDARD 14
(Hood and Casing removed)

General
The gyro compass comprises the outer sphere U4 with the gyrosphere, the pump unit U3 with the heating resistor R4 and the temperature sensor N1, the supporting plate, the electronics PCB U1 for temperature control, the follow-up motor M3 and the fan motor M5 (on the compass base plate).
A synchro M4 intended for course transmission to an autopilot can be mounted into the supporting plate as an option (for 110–106 NG 002 already existing).

The electric connection between the outer sphere and the electronics PCB is established by means of nine slip rings and nine sliding spring brushes. The slip rings form circular copper laminations arranged side by side on the bottom side of the electronics PCB and are faced with noble metal.

The motors of the two gyros and of the pump are supplied with a trapezoidal AC voltage 55V/400Hz composed of two component voltages of 27.5V each, the electrical centre of which approximately corresponds to the potential of the signal zero (TPA1).

The reversing contacts of the follow-up system are located within the outer sphere of the gyro compass. Together with two bridge resistors, R16 and R17, they are electrically connected to the follow-up amplifier (compass electronics) in the inverter.

The stepping motor signals SM0 and SM1 produced in the compass electronics and in the step adapter from the analog compass signal, and the reference potential 0V are fed into the compass to the stepping motor M3. Via a toothed-belt intermediate drive end via a pinion, the stepping motor M3 drives the externally toothed 360° card which, on its part, turns the outer sphere by means of the pendulum joint.

The follow-up switch B2 permits the following functions to be adjusted:

In Pos. "1", follow-up is switched on, whilst in Pos. "0", follow-up is switched off. With Pos. "T" (TEST), the compass equipment has a synchronization aid which causes the compass follow-up system to automatically run in to course "000" via the contact points in slip ring "9".

**Hint:**

Synchronization between the course indication of the gyro compass and the indication of the repeater compass can be performed with any position of indication!

During a voltage failure or voltage dip, the follow-up process will be interrupted as soon as the supply voltage remains under 18.5V DC. After voltage recovery, the follow-up action will be resumed. A voltage failure or voltage dip of >1.5s is signalized by means of the red LED (Fig. 2–1.2). With that, possibly—resulting course errors are indicated. The red LED can be extinguished by setting the follow-up switch momentarily to Pos. "0" and then again to Pos. "1" (RESET range, see Fig. 2–1.4).
4.1.1 Electronics PCB, Type 110–106.03
Circuit Diagram 110 C 106 HP030
Wiring Diagram 110 D 106 HP031

Fig. 4-2: Top View of the Electronics PCB
(360° Card removed)

An electronics PCB is located above the supporting plate. It carries the components for the electronic temperature control (heating/ventilation), the compass connection, the slip rings, 3 red lamps for card illumination, the follow-up switch, the lighting potentiometer as well as a red LED for signalling.

Power supply for the electronic temperature control of the gyro compass is 24V DC which is fed via B1.18 (0V) and B1.20 (+24V). The 0V connection is connected to the signal zero in the inverter which is applied to B1.25 and TP1. This potential separation has been performed because of current-dependent voltage drops (heating, fan, lighting).
The signal originating from sensor N1 is proportional to the absolute temperature scale, with a slope of 10mV/K. For example, at 323 K = +50°C, a voltage of 3.23V is measured across TP4 and TP1.

The temperature-dependent voltage value is applied to the inputs of three amplifiers (N18/B, N18/1, N18/7) where it is compared with voltage values produced by the precision reference (Zener diode N15) and stepped via the divider resistors R18, R24, R40 and R47.

Via the corresponding amplifiers (quadruple amplifier N18), the three stages actuate the following functions:

At a temperature of > +52.7°C at the sensor, the amplifier N18/7, together with the drive and final transistors N31 and N32, switches off the heating. In this way, the temperature of the supporting liquid is brought to approx. +52°C. If the temperature at the sensor falls to below +51.9°C, the heating is switched on again. R50, R51 and R54 determine the hysteresis of approx. 0.8°C.

At higher ambient temperatures, the heater is only in operation during the heating-up process. After this, the power dissipation of the gyro motors is sufficient for maintaining the temperature. If the temperature at the sensor rises to above +54°C, activation of the fan motor M5 is ensured by amplifier N18/1 together with the input resistors R27/R28 and the subsequent power stage N27/N28.

A temperature-proportional fan voltage is set via feedback R32, R36, R41, nominally being at +54°C and showing such a slope that a difference in temperature of approx. 0.02°C is sufficient for fully activating the fan with 24V DC.

The wiring of diodes N22, N23, resistors R33, R37 and Zener diode N24 limits the fan motor voltage to approx. 27V if the operating voltage exceeds this value with high input tolerances, thus preventing the M5 motor electronics from being damaged.
Switching cycles:
- Heating "ON": <+50°C
- Heating "OFF": <+52°C
- Fan "ON": +54°C
- Overtemperature signal "ON": +65°C

Hint:
An external signal unit can additionally be connected for indicating, both audibly and visually, when the maximum temperature is exceeded.

Fig. 4-3: Operating Temperature (Schematic)

The fourth amplifier N18/8 responds when a temperature > +85°C is reached. Excessive temperatures are indicated by the red LED (Fig. 2-1.2). This LED also indicates signals (alarms) transferred via B1.11, e.g. follow-up OFF ("0"), follow-up at TEST ("T") or "Voltage failure >1.5s" (cf. Section 4.2.2: Fault Signalling).

The wiring with R13, N13, N14 constitutes a simple voltage stabilizing circuit for approx. 18V DC for supplying N18. Lighting is controlled via R12 and transistor N12. The lamps are protected against overvoltages by means of the Zener diode N11.
4.1.2 Test Points on the Electronice PCB 110–106.03

**ATTENTION**! On performing measurements on the electronics PCB, an incorrect connection of the test lines to the corresponding test points may cause a short-circuit or a damage to the device. E.g. unintended bridging over the test points 4 and 5 on the electronics PCB 110–106.03 may result in that the temperature sensor N1 is destroyed! In an analogous way, the same applies to measurements carried out at the test points of the electronics PCBs in the inverter!

---

**Fig. 4-4:** Test Points on the Electronics PCB 110–106.03
### 4.1.3 Test List for Gyro Compass STANDARD 14
(Cf. Circuit Diagram 110 C 106 HP030, Annex)

**Meter:** Multimeter, internal resistance $R_i > 20\,\text{kOhm/V}$

**Condition:** Gyro compass equipment switched on

#### Electronics PCB U1, 110–106.03

<table>
<thead>
<tr>
<th>Test Point: TP</th>
<th>Measurement</th>
<th>Measured Value</th>
<th>Condition/ Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 2 1</td>
<td>Supply voltage &quot;Heating, fan, illumination&quot;</td>
<td>+19.2V...+28.8V DC</td>
<td>Dependent on tolerance of main supply</td>
</tr>
<tr>
<td>- 3 1</td>
<td>Supply voltage &quot;Amplifier&quot;</td>
<td>+15.2V...+18.8V DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensor voltage dependent on temperature</td>
<td>+2.96V...+3V DC</td>
<td>With +25°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+3.21V...+3.25V DC</td>
<td>With +50°C</td>
</tr>
<tr>
<td>+ 5 1</td>
<td>Reference voltage</td>
<td>+6.55V...+7.25V DC</td>
<td></td>
</tr>
<tr>
<td>- 6 1</td>
<td>Fan control signal</td>
<td>+1V...+3.5V DC</td>
<td>Fan OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+3.6V...+4.2V DC</td>
<td>Fan ON</td>
</tr>
<tr>
<td>- 8 1</td>
<td>Heating voltage</td>
<td>0V...+1V DC</td>
<td>Heating OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+18V...+28V DC</td>
<td>Heating ON</td>
</tr>
<tr>
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<td>Measurement</td>
<td>Measured Value</td>
<td>Conditions/Remarks</td>
</tr>
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<td>-----------------------------</td>
<td>-----------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>11 1</td>
<td>Control signal &quot;NORTH 0&quot;</td>
<td>+10V...+13V DC</td>
<td>Follow-up system to &quot;TEST&quot;, compass card indication &quot;0°&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0V...+1V DC</td>
<td>Follow-up system to &quot;TEST&quot;, compass card indication &quot;0°&quot;</td>
</tr>
<tr>
<td>12 1</td>
<td>Control signal &quot;NORTH 1&quot;</td>
<td>+10V...+13V DC</td>
<td>Follow-up system to &quot;TEST&quot;, compass card is turning quickly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0V...+1V DC</td>
<td>Follow-up system to &quot;TEST&quot;, compass card is turning slowly (from approx. 10°)</td>
</tr>
<tr>
<td>14 1</td>
<td>Supply voltage &quot;Gyro sphere&quot;</td>
<td>27V...31V_{eff}</td>
<td>Lower phase</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400Hz</td>
<td></td>
</tr>
<tr>
<td>15 1</td>
<td>Supply voltage &quot;Gyro sphere&quot;</td>
<td>27V...31V_{eff}</td>
<td>Upper phase</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400Hz</td>
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<tr>
<td>14 15</td>
<td></td>
<td>56V...61V_{eff}</td>
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<td></td>
<td></td>
<td>400Hz</td>
<td></td>
</tr>
<tr>
<td>16 1</td>
<td>Reversing contact voltage</td>
<td>14V...27V AC</td>
<td>W2 Follow-up ON and at W1 rest</td>
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<tr>
<td>17 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Point: TP</td>
<td>Measurement</td>
<td>Measured Value</td>
<td>Conditions/Remarks</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>----------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>+ 18 - (L)</td>
<td>Starting current &quot;Gyrosphere + pump&quot;</td>
<td>410mV AC ±50mV AC</td>
<td>Equal pump current with starting and operating (85mV AC ±10mV) ( l_{gyro} = l_{ot} - l_{pump} ) (mV ( \cong ) mA)</td>
</tr>
<tr>
<td>+ 19</td>
<td>Operating current &quot;Gyrosphere + pump&quot;</td>
<td>290mV AC ±50mV AC</td>
<td></td>
</tr>
<tr>
<td>+ L2 - L1</td>
<td>Stepping motor M3 Coil voltage SM1</td>
<td>3V AC ... 7V AC</td>
<td>Follow-up system to &quot;TEST&quot;, compass card is turning quickly</td>
</tr>
<tr>
<td>+ L3 - L1</td>
<td>Stepping motor M3 Coil voltage SM0</td>
<td>52°C</td>
<td>With thermometer NB 25-21</td>
</tr>
<tr>
<td>+ L1</td>
<td>Operating temperature</td>
<td>52°C</td>
<td></td>
</tr>
<tr>
<td>+ L0</td>
<td>Height of gyrosphere</td>
<td>Lifting: 1.5mm 2mm</td>
<td>With 52°C operating temperature</td>
</tr>
</tbody>
</table>
4.2 Circuit Description of Inverter, Type 121–043 NG001 / NG003
General Diagram, Inverter 121 C 043 HP020
Wiring Diagram 121 D 043 HP026

The wiring PCB of the inverter comprises the following electronic sub-assemblies:
- Inverter, Type 121–043.02 (400Hz inverter)
- Compass Electronics, Type 121–043.06 (PCB)
- Step Adapter, Type 121–043.04 (PCB)

4.2.1 Current Supply to the Inverter
The inverter is supplied with 24V DC
(Tolerance range: 19.2 ... 36V DC)
The power supply is performed either:
- from the 24V DC ship’s mains, NAVI or emergency supply or
- from the 110/220V AC ship’s mains via an optional power supply or
- from the 110/220/380/440V AC ship’s mains via an optional course transducer.

The current supply to the inverter is fed simultaneously only by one or by two different electric current supply sources (as a redundancy):
- with supplying the inverter from the 24V DC ship’s mains, NAVI or emergency supply or via an optional power supply
  the feeding is to be performed at terminal L1.1 (+24V)
  and at terminal L1.2 (0V)
- with supplying the inverter
  via an optional course transducer,
  the feeding is to be performed at terminal L4.7 (+28V)
  and at terminal L4.8 (0V).

The inverter operates in the voltage range of 19.2V ... 36V DC without functional restrictions.
The DC voltage fed into the inverter is stepped as +24V₀ and 0V₀ as well as +24V₁ and 0V₁. The DC voltage (+24V₀ and 0V₀) supplies the repeater output 1, 2, 3, the ±10mA course signal output and the signal unit (supply of external devices). The +24V₁ and 0V₁ voltage is picked off behind the anti-interference filter (K1, K2, C1, C2, C3, C4, R3).
The DC voltage (+24V₁ and 0V₁) supplies the 400Hz Inverter, 121–043.02, as well as the gyro compass (supply of internal devices). Monitoring is performed on the Compass Electronics, 121–043.06.
0V₀, 0V₁, 0V₂ and the reference conductor form the central earthing point in the inverter of inverter and compass.
Fig. 4–5: Inverter, Type 121–043, Interior View
Top View of Wiring PCB, PCBs drawn out

1 Relay D1
2 Choke K1, K2, K3, K4, K5
3 Socket strip for inverter, 8 poles
4 Socket strip B2, 32 poles, accommodation for compass electronics
5 Socket strip B1, 32 poles, accommodation for step adapter
6 Terminal strip L6, 25 poles, connection for gyro compass
7 Terminal strip L20, 6 poles, connection for ANSCHÜTZ NAUTOPILOT (±10mA max.)
8 Terminal strip L5, 6 poles, connection for autopilot, NAUTOCOURSE
9 Terminal strip L17, 4 poles, connection for RoT indicator
10 Terminal strip L18, 4 poles, connection for RoT indicator
11 Terminal strip L19, 6 poles, connection for repeater, ANSCHÜTZ step transducer
12 Terminal strip L4, 10 poles, connection for ANSCHÜTZ course transducer
13 Terminal strip L15, 6 poles, SPERRY step output signal, 30mA
14 Terminal strip L16, 6 poles, SPERRY step output signal, 30mA
15 Terminal strip L12, 6 poles, ANSCHÜTZ step output signal
16 Terminal strip L14, 6 poles, ANSCHÜTZ step output signal
17 Terminal strip L11, 6 poles, ANSCHÜTZ step output signal
18 Terminal strip L3, 6 poles, connection for signal unit / signal panel
19 Terminal strip L1, 3 poles, connection for 24V DC emergency supply
20 Terminal strip L2, 12 poles, internal wiring connection
4.2.2 Fault Signalling

The signal relay D1 (with floating contacts) is located on the wiring PCB and is pulled up in faultless operation. It serves for switching e.g. signal buzzers or signal lamps in case of possible fault conditions within the gyro compass equipment.

Note:
Main switch B5 suppresses the fault message on switching off the gyro compass equipment.

By lighting-up of the red LED (Fig. 2-1.2), the following conditions are indicated:
- Excessive operating temperature (higher than +65°C)
- Supply voltage below 18.5V DC for longer than 1.5s
- Follow-up switched off
- Follow-up in position "TEST"
- Gyros without current supply for longer than 1.5 s.

The fault signal "Gyros without current supply for longer than 1.5 s" is stored in the flip-flop N12 of the Compass Electronics PCB 121-043.06.
4.2.3 Inverter Assembly, Type 121-043.02 (400Hz Inverter)
(See Circuit Diagram 121 C 043 HP 012)

Fig. 4-6:
Inverter Assembly
(General View)

The inverter assembly located in the inverter consists of a switching regulator operating with a frequency of 20kHz, and an externally synchronized push–pull transformer with a frequency of 400Hz. Due to rise–time limitation, a trapezoidal voltage with a slope of 20μs is produced in the push–pull transformer. The inverter is supplied with 24V DC via connections B4.1 and B4.2.

The gyrosphere supply, 55V/400Hz, is applied symmetrically with 0V to connections

\[ +27.5V_0 \text{ AC and} \]
\[ -27.5V_1 \text{ AC.} \]

The output voltage is levelled against load variations and variations in the input voltage for ±1%.

The supply voltage ±12V DC for the electronics is generated by means of the push–pull transformer (transformer T1) and rectifier G1.

\[ (+12V \text{ DC } \equiv \text{ B4.3)} \]
\[ (-12V \text{ DC } \equiv \text{ B4.5)} \]

The inverter is externally synchronized with an adjustable frequency of 3.2kHz via connections B4.8 and B2.a12 from the compass electronics PCB.
4.2.4 Compass Electronics, Type 121–043.06
Circuit Diagram 121 C 043 HP019

Fig. 4–7: Compass Electronics, Type 121–043.06
(View of Components Side)

The following components are situated on the compass electronics:
- Follow-up amplifier
- Clock generator
- RoT amplifier
- Jumper for coding the RoT slope
- Decoding of the follow-up switch
- Electronic voltage monitoring of supply voltage 24V DC

4.2.4.1 Follow-up Amplifier

The pick-off signal of the reversing contacts is fed to transformer M1 via compass cable cores B1.22, B1.23, B1.24, terminal strip L6 and plug connectors B1.c16, B1.c16, B1.c12. Transformer M1 produces the current difference which is applied to TPB4 behind the amplifier N10B as a differential voltage of 4V/1° deviation with a frequency of 400Hz. With the aid of the reference, the differential voltage is rectified via comparator N15 by the analog switches N7–B, N7–C.

The differential voltage is applied to TPA8 as a DC voltage of 4V/1° deviation. With the follow-up system switched on, the signal is transferred to the acceleration filter, operational amplifier N11–A, via analog switch N7–D. With a deviation of 1°, a voltage of 8V DC is applied to TPB9.
Together with the clock generator N25, the amplifiers N12–A, N12–B, the AND circuits N26–A, N26–C and the JK flip-flops N27–A, N27–B form a δ modulator.

Depending on the DC voltage at TPB9, positive pulses are generated at TPB8, whilst negative pulses are generated at TPA2. These pulses discharge the integration capacitor C12 via analog switches NB–D or NB–B, with an electric charge determined by the ±12V supply voltage and the clock generator.

A DC charge balance is produced in the capacitor via R45 and a pulse-shaped current balance via R25 or R26. The mean pulse frequency is proportional to the DC voltage at TPB9.

The directional pulses at TPB8 and TPA2 are recoded to direction signal "DIR" and clock signal "STEP" by the gates N19, N26. These signals are directly fed on the step adapter to 2 electronic UP/DOWN counters N1, N2, counting modulo 192 steps/1 degree.

For each 1/192° step, a pulse towards 0V is applied to TPA4.

4.2.4.2 Clock Generator

The clock generator supplies the δ modulator and also the 400Hz inverter with the required frequency of 3.2kHz. The clock generator comprises timer N25 and the timing element consisting of R81, R60, R58 and C11.

The clock frequency can be set to 3.2kHz via potentiometer R58, whereby the maximum follow-up rate of compass transmission is simultaneously set to 8,3°/s and the gyrocompass supply frequency to 400Hz.

4.2.4.3 Decoding the Follow-up Switch

Lines Mode 0 and Mode 1 transmit the positions of the follow-up switch from the gyro compass:
- Zero position "000" of the 360° card "T"
- Follow-up system "OFF" "0"
- Follow-up system "ON" "1".

Mode 0 \(\triangleq\) "LOW" switches on the follow-up system,

Mode 1 \(\triangleq\) "LOW" switches the system to zero run-in. The run-in to zero heading is controlled via two slip ring contacts in the gyro compass with "NORTH 0" and "NORTH 1":

"NORTH 1" \(\triangleq\) "LOW" (slow turning speed)
"NORTH 0" \(\triangleq\) "LOW" ("000" card position).

4.2.4.4 Electronic Equipment for Monitoring the 24V DC Supply

The 24V DC supply is monitored for undervoltage, temporary reduction in the voltage level and for voltage failure. If the ship's mains voltage falls below a value of approx.
18.5V, the demodulator output N10-A is separated from the subsequent filter input and the follow-up system halts at the last value.

R24, R27, R28, Zener diode N6 and comparator N9-B detect supply undervoltages (\(\leq 18.5V\) DC) and apply a "POWER ON" signal to TPB5.

All C-MOS memories, counters, JK flip-flops etc. are isolated from the remaining circuitry via gates at "POWER-ON" \(\equiv\) "LOW" and are further powered by the 12V\(_1\) supply via capacitor C5 in order to retain information during temporary voltage interruptions.

The auxiliary power supply 24V\(_3\) is produced via N14 from the power supply 24V\(_1\) and buffered in capacitor C5.

The "POWER-ON" signal determines the power failure or undervoltage time via R36, C4 and comparator N9-A. If there is a voltage failure or undervoltage of \(\geq 1.5\) s, the signal N-IN1 is generated after voltage recovery and all C-MOS memories are erased (initialized).

As a result of failure or undervoltage of the AC ship’s mains for supplying the course transducer and due to the fact that the 28V DC voltage for the inverter would then not be available (the 24V DC emergency being connected to the inverter as a redundancy), the POWER ON signal is led via the gates N20-B, N18-B and the transistors N23 / N24 to the interface B1.A8 (alarm 1) and B1.A6 (N-alarm 2).

To these two outputs are connected:
- the signal relay D1 as well as a signal unit (optional) and the LED (Fig. 2-1.2) (located above lubber line).

In case of voltage failure of the AC supply for the course transducer*) (the inverter being supplied further with 24V DC from the emergency supply):
- the LED (Fig. 2-1.2) lights up, an optional alarm unit gives alarm
- the follow-up system stops at the last value
- the repeaters stop at their last values
- the gyros in the gyrosphere continue to be supplied with 55V/400Hz
- the course indication is not lost.

After voltage recovery:
- the repeaters connected to the inverter continue operating
- the repeaters connected to the course transducer continue operating
- the LED (Fig. 2-1.2) goes out, an optional alarm unit gives no longer alarm.

Note:
For safety reasons, however, after any voltage failure the course indications of the connected repeaters should be compared with the course indication of the master compass, and synchronized, if necessary.

*) If a Course Transducer is optionally existent in the equipment.
4.2.5 Step Adapter, Type 121-043.04
Circuit Diagram 121 C 043 HP022

![Circuit Diagram]

Fig. 4-8: STEP Adapter, Type 121-043.04
View of Components Side

4.2.5.1 Function of the Step Adapter, Type 121-043.04
From the course signals "DIR" and "STEP", the step adapter produces:

1) ANSCHÜTZ step signals, 192 steps/°
   (for operating the stepping motor in the gyro compass and the stepping
   motors in the connected ANSCHÜTZ step repeaters)
   as well as

2) SPERRY step signals, 6 steps/° (35V DC), 90mA as e maximum
   (for operating SPERRY step repeaters such as SATCOM / SATNAV devices,
   radar equipment, radio direction finder etc.).

4.2.5.2 Principle of Operation of the Step Adapter, Type 121-043.04
The signals "DIR" and "STEP" are counted in the counters N1, N2, modulo 192. At
192 steps, the 1° course information is retained in counters N1, N2. In case of voltage
failure "POWER ON" ≜ "LOW", the-gates N3, N4-C, N10-A, N10-B, N10-C,
decouple the counter outputs.
Together with the resistors R11 ... R20, gates N4, N5, N6, constitute a double D/A converter which, together with the two amplifiers N11-A, N11-B and the two final stages N14, N15, N18, N19, generate the stepping motor drive signals SM0 and SM1. When the 360° card is turned, the signals SM0 and SM1 are of trapezoidal shape, SM0 and SM1 being in phase quadrature. The stepping motor signals are transferred to the repeater compasses via EMC filters, K3 ... K4. The resistors, R55 ... R60, determine the damping behaviour of the repeater compasses.

The code conversion of the 1° course information into the SPERRY-compatible interface (6 steps/1°) is performed by gates N4, N8, N9, N10. The SATNAV signal S1, S2, S3 is fed to the output transistors N20, N21, N22 via gates N10-A, -B, -C and resistors, R41 ... R43. The supply current is limited to approx. 180mA via transistor N28.

The step adapter also comprises the following:
- EMC filters K1, K2
- Filter capacitors C20, C21
- Limiter diodes N23, N24
- Fuses E1, E2, E3
- Jumpers L1 ... L5, L3 ... L6
- Varistors R3, R4
- Decoupling capacitors C2, C3 and C15, C16.
4.2.6  Test List for Inverter, Type 121-043 NG001 / NG003  
(Cf. General Diagram 121 C 043 HP020, Annex)

Meters:  Multimeter, internal resistance $R_i \geq 20 \text{kOhm/V}$  
Oscilloscope, probe 10:1  
($C \approx 10 \text{ pF}$)

Inverter, Type 121-043 / Terminal Strips

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Measurement</th>
<th>Measured Value</th>
<th>Conditions/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1.1</td>
<td>Supply voltage</td>
<td>19.2V...32V DC</td>
<td>Switch B5 &quot;ON&quot;</td>
</tr>
<tr>
<td>L1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L4.7</td>
<td>Supply voltage for gyro motors</td>
<td>56V...61V eff</td>
<td></td>
</tr>
<tr>
<td>L4.8</td>
<td>of gyrosphere</td>
<td>400Hz</td>
<td></td>
</tr>
<tr>
<td>L4.9</td>
<td></td>
<td>27V...31V eff</td>
<td></td>
</tr>
<tr>
<td>L4.8</td>
<td></td>
<td>400Hz</td>
<td></td>
</tr>
<tr>
<td>L6.2</td>
<td>Signal mode 0</td>
<td>0V...+1V DC</td>
<td>Follow-up switch</td>
</tr>
<tr>
<td>L6.14</td>
<td></td>
<td></td>
<td>in Pos. &quot;1&quot;</td>
</tr>
<tr>
<td>L6.2</td>
<td>Signal mode 1</td>
<td>0V...+1V DC</td>
<td>Follow-up switch</td>
</tr>
<tr>
<td>L6.18</td>
<td></td>
<td></td>
<td>in Pos. &quot;T&quot;, &quot;0&quot;</td>
</tr>
<tr>
<td>L6.14</td>
<td>Alarm signal, pilot lamp, compass</td>
<td>0V...+2.5V DC</td>
<td>No error signal</td>
</tr>
<tr>
<td>L6.25</td>
<td></td>
<td>+7.3V...+13V DC</td>
<td>Error signal (Lamp &quot;ON&quot;)</td>
</tr>
<tr>
<td>Terminal</td>
<td>Measurement</td>
<td>Measured Value</td>
<td>Conditions/Remarks</td>
</tr>
<tr>
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<td>-------------------------------------</td>
</tr>
<tr>
<td>L6.12</td>
<td>L6.25 Signal NORTH 0</td>
<td>0V DC...+1V DC</td>
<td>Compass card in Pos. 0°</td>
</tr>
<tr>
<td>L6.19</td>
<td>L6.25 Signal NORTH 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L6.22</td>
<td>L6.14 Signal &quot;Reversing contact&quot;</td>
<td>max. 1V/400Hz</td>
<td>Follow-up system at rest</td>
</tr>
<tr>
<td>L6.23</td>
<td>L6.14</td>
<td>max. 5.5V/400Hz</td>
<td>Follow-up system turning</td>
</tr>
<tr>
<td>L6.24</td>
<td>L6.14 Test return line</td>
<td>0V AC ... +0.5V AC</td>
<td></td>
</tr>
<tr>
<td>L6.7</td>
<td>L6.6 Stepping motor signal SM 1</td>
<td>+6V (+12V*) -6V (-12V*)</td>
<td>Follow-up switch to &quot;TEST&quot;, compass card is turning quickly (*) Applicable to MOD 015 or MOD 018</td>
</tr>
<tr>
<td>L6.8</td>
<td>L6.6 Stepping motor signal SM 0</td>
<td>+6V (+12V*) -6V (-12V*)</td>
<td>3V AC ... 7V AC 8V AC... 14V AC</td>
</tr>
<tr>
<td>L11.1</td>
<td>L11.2 Illumination voltage</td>
<td>18.5V DC ... 32V DC</td>
<td>To NAUTOPILOT or Digital Repeater Compass</td>
</tr>
<tr>
<td>L12.1</td>
<td>L12.2 &quot;Repeater compass&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L19.1</td>
<td>L19.2 Refer. for NAUTOPILOT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L20.1</td>
<td>L20.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L11.3</td>
<td>L11.4 Stepping motor actuation SM 0</td>
<td>+6V -6V</td>
<td>Follow-up switch to &quot;TEST&quot;, compass card is turning quickly, measured value with load by repeater compass. With MOD 015/016, L11 and L12 must not be connected!</td>
</tr>
<tr>
<td>L12.3</td>
<td>L12.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L19.3</td>
<td>L19.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L11.5</td>
<td>L11.4 Stepping motor actuation SM 1</td>
<td>+6V -6V</td>
<td></td>
</tr>
<tr>
<td>L12.5</td>
<td>L12.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L19.5</td>
<td>L19.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal</td>
<td>Measurement</td>
<td>Measured Value</td>
<td>Conditions/ Remarks</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------</td>
<td>------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>L14.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L14.2</td>
<td>L14.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L14.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L15.1</td>
<td>SPERRY output</td>
<td>13V...18V AC</td>
<td>Follow-up switch to &quot;TEST&quot; compass card is turning quickly</td>
</tr>
<tr>
<td>L15.2</td>
<td>L14.5</td>
<td>1/6°/step</td>
<td></td>
</tr>
<tr>
<td>L15.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L18.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L18.2</td>
<td>L18.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L16.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L17.1</td>
<td>Illumination voltage</td>
<td>18.5V...32V DC</td>
<td></td>
</tr>
<tr>
<td>L17.2</td>
<td>RoT indication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L18.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L18.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L17.3</td>
<td>Signal voltage RoT ±10V DC</td>
<td>0V</td>
<td>Follow-up switch to Pos. &quot;0&quot;</td>
</tr>
<tr>
<td>L17.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L18.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L18.4</td>
<td></td>
<td>+10V...+12V DC</td>
<td>Follow-up switch to &quot;TEST&quot;, compass card is turning quickly</td>
</tr>
<tr>
<td>L20.3</td>
<td>Stepping Motor SM 0 actuation</td>
<td>8V...14V AC</td>
<td>Follow-up switch to &quot;TEST&quot;, compass card is turning quickly</td>
</tr>
<tr>
<td>L20.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L20.5</td>
<td>Stepping Motor SM 1 actuation</td>
<td>+12V, -12V</td>
<td></td>
</tr>
<tr>
<td>L3.3</td>
<td>L3.5</td>
<td>Contact D1 closed</td>
<td>No error signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Gyro Compass Equipment STANDARD 14
### BASIC VERSION

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Measurement</th>
<th>Measured Value</th>
<th>Conditions/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>L5.1 L5.2</td>
<td>Supply voltage coarse synchro, 1 rev./360° (Autopilot, NAUTOCOURSE)</td>
<td>See Test list Autopilot &quot;NAUTOCOURSE&quot;</td>
<td>If connected</td>
</tr>
<tr>
<td>L5.3 L5.4</td>
<td>Output signal synchro, 1 rev./360°</td>
<td>ca. +12V DC</td>
<td>Approx. 1 s after voltage failure</td>
</tr>
<tr>
<td>L5.3 L5.5</td>
<td>Auxiliary power supply &quot;Course transducer&quot;</td>
<td>+18.5V...+32V DC</td>
<td>Normal</td>
</tr>
<tr>
<td>L4.1 L4.2</td>
<td>Clock pulses positive N–STEP–P</td>
<td>+12V DC</td>
<td>Compass card not turning</td>
</tr>
<tr>
<td>L4.3 L4.4</td>
<td>Clock pulses negative N–STEP–N</td>
<td>+12V DC</td>
<td>Compass card not turning</td>
</tr>
<tr>
<td>L4.6 L4.4</td>
<td>POWER ON status signal</td>
<td>+12V DC</td>
<td>&quot;Open&quot; collector signal Test: By short-circuiting the terminals L4.6 and L4.4, the total follow-up system (incl. outputs of possible course transducers) is switched off.</td>
</tr>
<tr>
<td>L4.7 L4.8</td>
<td>Power supply DC II</td>
<td>+24V...+32V DC</td>
<td>If connected</td>
</tr>
</tbody>
</table>
### Gyro Compass Equipment STANDARD 14

**BASIC VERSION**

---

#### 4.2.7 Test List for Inverter, Type 121-043 NG001 / NG003
(Cf. Circuit Diagram 121 C 043 HP019, Annex)

**Meters:**
- Multimeter, internal resistance $R_i \geq 20\text{kOhm/V}$
- Oscilloscope, probe 10:1 \(C \leq 10 \text{pF}\)

---

**Compass Electronics PCB, Type 121-043.06**

<table>
<thead>
<tr>
<th>Test Point: TP</th>
<th>Measurement</th>
<th>Measured Value</th>
<th>Conditions/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ TP TPA or TPB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B6 1</td>
<td>Supply voltage</td>
<td>+11.4V...+15V DC</td>
<td></td>
</tr>
<tr>
<td>B3 1</td>
<td></td>
<td>-11.4V...-15V DC</td>
<td></td>
</tr>
<tr>
<td>B5 1</td>
<td>Signal &quot;POWER ON&quot;</td>
<td>+11.4V...+15V DC</td>
<td>Main supply (&gt;18.5\text{V DC})</td>
</tr>
<tr>
<td>B6 1</td>
<td>Signal &quot;N=INIT&quot;</td>
<td>approx. 0V DC</td>
<td>Follow-up system at rest</td>
</tr>
<tr>
<td>B7 1</td>
<td>Offset voltage</td>
<td>approx. 0V DC</td>
<td>For 1° of card deflection</td>
</tr>
<tr>
<td>B9 1</td>
<td>Offsat voltage</td>
<td>approx. 0V DC</td>
<td>1) Follow-up system at rest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2) Follow-up system &quot;OFF&quot; (O)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3) Card in Pos. &quot;000&quot; (T)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-2V...-12V DC</td>
<td>Deflection of card for increasing course angle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+2V...+12V DC</td>
<td>Deflection of card for decreasing course angle</td>
</tr>
<tr>
<td>Test Point: TP + (1) TPA or TPB</td>
<td>Measurement</td>
<td>Measured Value</td>
<td>Conditions/Remarks</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------</td>
<td>----------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>B8 1</td>
<td>Clock pulses for positive direction</td>
<td>5V...8V AC ((\text{LOW}) pulse)</td>
<td>Deflection of card for increasing course angle*)</td>
</tr>
<tr>
<td>A2 1</td>
<td>Clock pulses for negative direction</td>
<td>5V...8V AC ((\text{LOW}) pulse)</td>
<td>Deflection of card for decreasing course angle*)</td>
</tr>
<tr>
<td>A3 1</td>
<td>Direction signal</td>
<td>+11.4V...+15V DC</td>
<td>Compass card turns for decreasing course angle</td>
</tr>
<tr>
<td>A4 1</td>
<td>Step signal</td>
<td>5V...8V AC ((\text{LOW}) pulse)</td>
<td>Compass card deflected</td>
</tr>
<tr>
<td>A5 1</td>
<td>Clock frequency</td>
<td>3.2kHz</td>
<td>Adjustable by potentiometer R58</td>
</tr>
<tr>
<td>A7 1</td>
<td>RoT signal</td>
<td>-10V...+10V DC</td>
<td>Compass card turns for increasing or decreasing value</td>
</tr>
<tr>
<td>A8**) 1</td>
<td>Control voltage, analog switch for follow-up system</td>
<td>0V</td>
<td>Follow-up &quot;ON&quot; (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+8.5V DC</td>
<td>Follow-up &quot;OFF&quot; (0)</td>
</tr>
</tbody>
</table>

*) With test conditions, repeater course values may be out of synchronism. After terminating the measurements, synchronize if required!

**) Dependent on development state of PCB, TP not always connected!
### Test List for Inverter, Type 121-043 NG001 / NG003

(Cf. Circuit Diagram 121 C 043 HP022, Annex)

<table>
<thead>
<tr>
<th>Test Point: TP</th>
<th>Measurement</th>
<th>Measured Value</th>
<th>Conditions/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ TP</td>
<td>Supply voltage +12V&lt;sub&gt;1&lt;/sub&gt;</td>
<td>approx.+12V DC</td>
<td></td>
</tr>
<tr>
<td>TPA or TPB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>Supply voltage +12V&lt;sub&gt;2&lt;/sub&gt;</td>
<td>approx.+12V DC</td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td>Supply voltage -12V&lt;sub&gt;2&lt;/sub&gt;</td>
<td>approx.-12V DC</td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>Step motor excitation</td>
<td>8V AC ... 14V AC</td>
<td>Follow-up switch to &quot;TEST&quot;, compass card is turning quickly</td>
</tr>
<tr>
<td>B2</td>
<td>SM 1</td>
<td>+12V</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>Step motor excitation</td>
<td>-12V</td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>SPERRY output 1/6° step</td>
<td>13V AC ... 18V AC</td>
<td>Follow-up switch to &quot;TEST&quot;, compass card is turning quickly</td>
</tr>
<tr>
<td>B5</td>
<td>SPERRY output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td>Countert signal</td>
<td>approx. 3V AC</td>
<td>Follow-up switch to &quot;TEST&quot;, compass card is turning quickly</td>
</tr>
<tr>
<td>B8</td>
<td></td>
<td>+12V</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>SPERRY supply</td>
<td>approx. +32V DC</td>
<td>max. 90mA &quot;Plus Common&quot;</td>
</tr>
</tbody>
</table>
### 4.3 Tables

#### Shooting, Tables 1-10

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
<th>Column 8</th>
<th>Column 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check operating temperature</td>
<td>Check liquid level</td>
<td>Check operating voltage</td>
<td>55V/400Hz</td>
<td>24V DC</td>
<td>Check height of gyrosphere</td>
<td>1.5 mm</td>
<td>Check position of gyrosphere</td>
<td>White marking point on top of gyrosphere should be visible through hole of insert. Protective screw removed and outer sphere exactly vertical. Gyrosphere must have settled</td>
</tr>
<tr>
<td>o.k.?</td>
<td>o.k.?</td>
<td>o.k.?</td>
<td>o.k.?</td>
<td>o.k.?</td>
<td>o.k.?</td>
<td>o.k.?</td>
<td>o.k.?</td>
<td>o.k.?</td>
</tr>
<tr>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Carry out tests acc. to Table 7</td>
<td>Carry out tests acc. to Table 5 and Test List</td>
<td>Carry out tests acc. to Table 6</td>
<td>Carry out tests acc. to Table 8</td>
<td>Carry out tests acc. to Table 9</td>
<td>Carry out tests acc. to Table 10 and Test List</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: The table continues with similar instructions and checks for the remaining columns.*

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**BASIC VERSION**

**4-6**

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**4-28**

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**AUSBLITZ**

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**Technical Specifications**

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TABLE 2  Check Operating Temperature (52°C)

Operating temperature too high (>54°C)

- Fan not operating
- Continuous fan operation or alarm signal occurs
  - Check electronics for heating and fan

Operating temperature too low (<49°C)

- Room temperature too high? Cooling air supply interrupted?
  - Improve ventilation. Clean cooling air supply ways

- Fan switches off too late
  - Check electronics for heating and fan
  - Check heating resistor and temperature sensor

- Room temperature extremely low
  - Elevate room temperature
TABLE 3  Check Supporting Liquid Level
Operating temperature:  52°C

- Supporting liquid level too low
  - Top up with distilled water!
  - In case of visible leakages, replace gaskets, defective parts and supporting liquid
<table>
<thead>
<tr>
<th>TABLE 4</th>
<th>Check Operating Voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage:</td>
<td>24V DC</td>
</tr>
</tbody>
</table>

Operating voltages not O.K.  
55 V / 400 Hz, 24V DC

Check ship's mains

Check operating voltages in the inverter acc. to test list
**TABLE 5  Check Height of Gyrosphere**

<table>
<thead>
<tr>
<th>Height of gyrosphere:</th>
<th>1.5 mm to 2mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature:</td>
<td>52°C</td>
</tr>
</tbody>
</table>

**Gyrosphere too high**
- Renew supporting liquid

**Gyrosphere too low**
- Check pump function,
  Clean pump,
  Renew filter ring
- Gyrosphere still too low
- Renew supporting liquid
- Gyrosphere still too low
- Replace gyrosphere
TABLE 6
Check Position of Gyrosphere (Tilt)
Condition: The gyro compass must be switched on >4 h

Gyrosphere is tilted, i.e. white marking point on the gyrosphere is not visible
(with protecting screw removed and vertical position of outer sphere).

Perhaps simultaneously: important or variable course error or slowly rotating
indication.

Switch off compass, allow gyros to run down (wait approx. 15 min). Switch
on compass again. (Follow-up system must be switched off.) After approx.
4 h, check whether gyrosphere has settled and tilt has been eliminated.

Yes

Gyrosphere O.K.

No

Replace gyrosphere
TABLE 7  Check Gyro Current

Operating current:  200mA ± 40mA

Gyro current and pump current correct?

Too low
< 150mA

Simultaneously, course error up to 45°, possibly gyroscope tilted?

Replace gyroscope

Too high *)
> 340mA

Renew supporting liquid

Current still too high?

*)  High current consumption may result from increasing conductivity of the supporting liquid!
### TABLE 8  Check Follow-up System

<table>
<thead>
<tr>
<th>Follow-up system too insensitive, rotates too slowly or not at all</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Check follow-up system</strong></td>
</tr>
<tr>
<td>O.K. Sluggish</td>
</tr>
<tr>
<td><strong>Ensure easy action to follow-up gear; adjust gear backlash, if required; oil gearing e.g. with gyro oil</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check stepping motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.K. Defective Sluggish</td>
</tr>
<tr>
<td><strong>Exchange stepping motor</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check step adapter PCB</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.K. Defective</td>
</tr>
<tr>
<td><strong>Exchange step adapter PCB</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check compass electronics PCB</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.K. Defective</td>
</tr>
<tr>
<td><strong>Exchange compass electronics PCB</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check follow-up circuit. Check all electric cable plug connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.K. Defective</td>
</tr>
<tr>
<td><strong>Eliminate interruption. Renew defective cable plug connection</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check repeaters for functioning end for easy action</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.K. Sluggish</td>
</tr>
<tr>
<td><strong>Ensure easy action to gear of the repeater concerned, apply oil</strong></td>
</tr>
</tbody>
</table>
**TABLE 9  Check Course Indication**

**Conditions:** Gyrosphere must have settled

- Course indication not in accordance with ship’s reference
  - Error $< \sim 3^\circ$ (constant)
    - Correct "A" error
  - Error approx. $45^\circ$
    - Continue test according to TABLE 7
- Variable error
  - Continue test according to TABLE 5, 6
TABLE 10 Check the Gyro Compass and Repeater Compass Indications for Coincidence

- No coincidence
  - Repeaters indicate same reading, only gyro compass indicates other value
  - Repeaters indicate different readings compared with the gyro compass
  - Follow-up switch at position "T", make card run into "000" indication. Synchronize repeaters one by one for "000" indication and set follow-up switch to Pos. "1"
  - No coincidence
    - Check stepping motor actuation. Check gear drive
    - Check actuation for each stepping motor separately. Check compass electronics PCB in static inverter
5. Illustrated Spare Parts Catalogue

comprising:

Gyro Compass, Type 110–106
Inverter, Type 121–043
<table>
<thead>
<tr>
<th>Lager-Nr.</th>
<th>Benennung</th>
<th>DESIGNATION</th>
<th>Zeichnungs-Nr.</th>
<th>Stok. QTY.</th>
<th>Bemerkungen</th>
</tr>
</thead>
<tbody>
<tr>
<td>POS.</td>
<td>STOCK-NO.</td>
<td></td>
<td>PART-NQ.</td>
<td></td>
<td>REMARKS</td>
</tr>
<tr>
<td>1*</td>
<td>3.607 850</td>
<td>Haube, kompl.</td>
<td>HOOO, COMPL.</td>
<td>110-106.12 E02</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3.607 128</td>
<td>Mantel, kompl.</td>
<td>CASING, COMPL.</td>
<td>110-106.04</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>3.512 823</td>
<td>360°--CARD</td>
<td>110-106.01--028</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1.620 267</td>
<td>Schraube</td>
<td>SCREW</td>
<td>M 3x6 DIN 7985 A4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>1.620 706</td>
<td>Scheibe</td>
<td>WASHER</td>
<td>3,2 DIN 125 A4</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>3.512 037</td>
<td>Flansch</td>
<td>110-108.27--005</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1.503 084</td>
<td>Zahnscheibe z=72</td>
<td>STUDDEO OISK z=72</td>
<td>NB 08-015.00--069</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>1.601 237</td>
<td>Schraube</td>
<td>SCREW</td>
<td>M 4x14 DIN 912 A4</td>
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<tr>
<td>9*</td>
<td>3.607 830</td>
<td>Elektronik</td>
<td>ELECTRONIC PCB</td>
<td>110-106.03 E01</td>
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<tr>
<td>10</td>
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<td>SCREW</td>
<td>M 3x16 DIN 7985 A4</td>
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</tr>
<tr>
<td>11</td>
<td>1.620 706</td>
<td>Scheibe</td>
<td>WASHER</td>
<td>3,2 DIN 125 A4</td>
<td>7</td>
</tr>
<tr>
<td>12</td>
<td>1.743 149</td>
<td>Hülse</td>
<td>BUSHING</td>
<td>3x7 PA WN 181</td>
<td>7</td>
</tr>
<tr>
<td>13</td>
<td>3.607 146</td>
<td>Potentiometer, kompl.</td>
<td>POTENTIOMETER, COMPL.</td>
<td>110-106.34 (50 kOhm)</td>
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<td>Dichtung</td>
<td>GASKET</td>
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<td>SWITCH, COMPL.</td>
<td>110-106.33</td>
<td>1</td>
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<tr>
<td>16</td>
<td>3.512 039</td>
<td>Steuerstreich</td>
<td>LUBBER LINE</td>
<td>110-106.30--011</td>
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<td>17</td>
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<td>SCREW</td>
<td>M 3x20 DIN 7985 A4</td>
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<tr>
<td>18</td>
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<td>WASHER</td>
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<tr>
<td>19</td>
<td>1.502 227</td>
<td>Glühlampe (rot)</td>
<td>LAMP (RED)</td>
<td>NB 12--048.00--028 (28V/0,04A Bl--Pin)</td>
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<td>20</td>
<td>3.607 133</td>
<td>Schrittmotor, kompl.</td>
<td>STEP MOTOR, COMPL.</td>
<td>110-106.09</td>
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<td>21</td>
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<td>SCREW</td>
<td>M 3x16 DIN 7985 A4</td>
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<td>22</td>
<td>1.743 146</td>
<td>Hülse</td>
<td>BUSHING</td>
<td>3x6,5 Al WN 181</td>
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<tr>
<td>23</td>
<td>1.807 038</td>
<td>Zahnräumen z=150</td>
<td>BELT z=150</td>
<td>NR. 80 150</td>
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<tr>
<td>24</td>
<td>3.607 132</td>
<td>Zwischentrieb</td>
<td>INTERMEDIATE GEAR</td>
<td>110-106.08</td>
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<td>1.607 172</td>
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<td>SCREW</td>
<td>M 4x10 DIN 7985 A4</td>
<td>3</td>
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<tr>
<td>26</td>
<td>3.607 134</td>
<td>Synchro, kompl.</td>
<td>SYNCHRO, COMPL.</td>
<td>110-106.11</td>
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<tr>
<td>27</td>
<td>1.607 173</td>
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<td>SCREW</td>
<td>M 4x12 DIN 7985 A4</td>
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<tr>
<td>28</td>
<td>1.508 381</td>
<td>Synchro</td>
<td>SYNCHRO</td>
<td>NB 23--167.00--004</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>2.013 036</td>
<td>Zahnräumen z=175</td>
<td>BELT z=175</td>
<td>NR. 80 175</td>
<td>1</td>
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<tr>
<td>30</td>
<td>3.607 154</td>
<td>Lüfter, kompl.</td>
<td>FAN, COMPL.</td>
<td>110-108.70</td>
<td>1</td>
</tr>
<tr>
<td>31</td>
<td>1.607 271</td>
<td>Schraube</td>
<td>SCREW</td>
<td>M 3x25 DIN 7985 A4</td>
<td>2</td>
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<tr>
<td>32</td>
<td>1.607 254</td>
<td>Schraube</td>
<td>SCREW</td>
<td>M 3x16 DIN 7985 A4</td>
<td>3</td>
</tr>
<tr>
<td>33</td>
<td>3.511 513</td>
<td>Höhenmaßstab</td>
<td>GAUGING PIN</td>
<td>110--230.31--017</td>
<td>1</td>
</tr>
<tr>
<td>34</td>
<td>3.607 169</td>
<td>Kabel</td>
<td>CABLE</td>
<td>NB 03--732</td>
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</tr>
<tr>
<td>35</td>
<td>3.607 137</td>
<td>Hüllkugel, kompl.</td>
<td>OUTER SPHERE, COMPL.</td>
<td>110-106.14</td>
<td>1</td>
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<tr>
<td>36</td>
<td>3.606 816</td>
<td>Ventil, kompl.</td>
<td>INSERT WITH VALVE</td>
<td>110--230.56</td>
<td>1</td>
</tr>
<tr>
<td>37</td>
<td>1.607 262</td>
<td>Schraube</td>
<td>SCREW</td>
<td>M 3x8 DIN 7985 A4</td>
<td>6</td>
</tr>
<tr>
<td>38</td>
<td>3.908 930</td>
<td>Dichtschraube</td>
<td>PROTECTING SCREW</td>
<td>NB 02--208.00--010</td>
<td>1</td>
</tr>
<tr>
<td>39</td>
<td>1.502 375</td>
<td>O--Ring</td>
<td>RUBBER GASKET</td>
<td>NB 98--006.00--020 (R 10x1)</td>
<td>1</td>
</tr>
<tr>
<td>40</td>
<td>1.792 479</td>
<td>Quadring</td>
<td>RUBBER GASKET</td>
<td>Nr. 4145/366y (64x77x6,62)</td>
<td>2</td>
</tr>
<tr>
<td>41</td>
<td>3.607 150</td>
<td>Obere Hüllkugel</td>
<td>COVER, COMPL.</td>
<td>110-106.54</td>
<td>1</td>
</tr>
<tr>
<td>42</td>
<td>1.607 174</td>
<td>Schraube</td>
<td>SCREW</td>
<td>M 4x16 DIN 7985 A4</td>
<td>6</td>
</tr>
<tr>
<td>POS.</td>
<td>Lager-Nr.</td>
<td>Benennung</td>
<td>DESIGNATION</td>
<td>Zeichnungs-Nr. PART-NO.</td>
<td>Stock COTY</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>--------------</td>
<td>-------------------</td>
<td>-------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>43</td>
<td>1.792 562</td>
<td>Oquadring</td>
<td>RUBBER GASKET</td>
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** Diese Spare Parts are only applicable for Compasses with above mentioned No. of Variant and Development Status. See Type Label and Label of Development Status.
Spare Parts for other Variants and/or Development Status on request.

Since further development may necessitate making modifications to existing equipment, its conformity with the relevant illustrations and drawings is not always ensured. ANSCHÜTZ will be held no liability whatever that may arise from any such differences.
## Umformer
### INVERTER
#### TYPE 121–043 NG 001 E 02

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* Diese Ersatzteile sind nur für Umformer mit o.g. Varianten- und Entwicklungstand-Nr. einsetzbar.

Siehe Typenschild und Entwicklungstand-Schild des Geräts.

Ersatzteile für andere Varianten und/oder Entwicklungstständen auf Anfrage.

---

### Typenschild
**TYPE LABEL**

![Typenschild](image)

### Entwicklungsstand-Schild
**LABEL OF DEVELOPMENT STATUS**

![Entwicklungsstand-Schild](image)

Since further development may necessitate making modifications to existing equipment, its conformity with the relevant illustrations and drawings is not always ensured. ANSCHÜTZ will be under no liability whatever that may arise from any such differences.
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<th>POS</th>
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*Slight further development may necessitate making modifications to eating equipment. In conformity with the relevant illustrations and drawings is not always envisaged.
ANSCHÜTZ will be under no liability whatever that may arise from any such differences.
6. Installation

6.1 Removing the Transportation Supports from the Gyro Compass

6.1.1 General
In order to protect the moving parts of the gyro compass from being damaged during transport, 3 transportation supports are provided in the binnacle (see Fig. 6-1). The transportation supports consist of:
1) two half-cylindrical foam pieces (6-1.1) enclosing the outer sphere. They are inserted between the casing and the outer sphere, and
2) a circular foam piece (6-1.2) inserted between the outer sphere and the bottom of the gyro compass.
3) a plastic retainer (6-1.3) preventing rotation of the 360° card. It is fastened to the 360° card end to a spacer bolt.

These transportation supports must be removed prior to installation. Observe right order (1, 2, 3)!

![Fig. 6-1: Transportation Supports (Schematic Sectional Drawing)]
At first, remove casing and hood of the gyro compass. Then carefully take out the three shaped foam parts. Finally screw off the retainer. (The retainer is screwed on by two screws to be used for fastening the 360° card.) After the retainer has been removed, the screws are to be screwed on again and to be tightened.
**Fig. 6-4:**
Pushing the Compass Casing at first over the 3 Cylindrical Pins each by Some Millimeters

The arrow points at one of the 3 cylindrical pins

**Fig. 6-5:**
Pushing the Compass Casing in the Upward Direction and Removing it

**Fig. 6-6:**
Removing the 3 Foam Pieces
(2 Half-cylindrical and 1 Cylindrical Foam Part)
Fig. 6-7:
Removing the Upper Transportation Support
For this purpose, screw out 2 screws on the 360° card and remove the upper transportation support.

Fig. 6-8:
Removing the Upper Transportation Support and Reinserting and Tightening the Two Screws that had previously been screwed out.

Fig. 6-9:
Loosening the Outer Sphere from the Pendulum Joint:
Press down the 4 quick-closing pins one time each. Attention! Now the outer sphere is detached from the pendulum joint.
6.2 Installing the Gyro Compass Equipment STANDARD 14 BASIC VERSION

The individual components of the gyro compass equipment STANDARD 14 BASIC VERSION are mechanically to be installed in adequate places in accordance with the dimensional drawings and with due regard to the hints given there.

6.2.1 Installing the Gyro Compass STANDARD 14, Type 110–106

(See Dimensional Drawing 110 D 106 HP 005 as well as Drilling Scheme, Fig. 6–12.)

**Note:**
Take into consideration the clearance required for ventilation and for care and maintenance work (see Fig. 6–13).
Fig. 6-12: Marking the 3 Points for Fastening the Gyro Compass STANDARD 14 (Drilling Scheme)

- Punch-mark and drill the 3 fastening holes.
- Tighten the compass chassis by means of the adequate screws and washers.
- Further work to be performed as shown under Part 7.

Fig. 6-13: Dimensional Drawing of Clearance required for the Gyro Compass
6.2.2 Installing the Inverter, Type 121-043 NG001 / NG003

The Inverter, Type 121-043, is available in two versions, A and B.

Version A (NG001) has a casing (IP 23) and a permanently mounted compass connection cable of 5 m in length.

Version B (NG003) is without casing (IP 00), without compass connection cable, without ON/OFF switch and without built-in fuse holders and fuses (E1 and E2).

For version A, the mutual distance of between gyro compass and inverter depends upon the length of the compass connection cable (5 m).

The inverter is always to be mounted in vertical position, e.g. bulkhead mounting.

Take into account the clearance required for installation, for opening the door and for maintenance. (See corresponding Fig. 6-14, Course transducer).

Procedure:
- Punch-mark for drilling the 4 fastening holes
- Drill the 4 fastening holes
- Mount the inverter by means of the adequate screws and washers.

Version B is intended to be incorporated into desks, cabinets or steering stands (IP 00).

For this purpose, an adequate installation site, e.g. in a control desk, is to be chosen. The inverter is to be mounted in vertical position, too (as it is applicable for version A). Adequate ventilation is to be ensured for heat dissipation (power loss). The ON/OFF switch B5, fuses E1/E2 and the compass connection cable are to be supplied by the shipyard.
6.2.3 Installing a Course Transducer, Type 132–603 NG001 / NG002 (optional)
(See also Section 6.2.2 Installing the Inverter, Type 121–043 NG001 / NG003).
Installing a course transducer is to be performed in equivalence to installing the inverter.
For practical reasons, the mounting site of the course transducer should be close to the inverter.
Take into account the clearances that are required for installing and opening the inverter and the course transducer.

The dimensions of the inverter and of the course transducer can be taken from Drawings 121 C 043 HP005 and 132 C 603 HP005 given in the Annex.

**Fig. 6-14:** Marking the Fastening Points of the Inverter and/or of the Course Transducer

- Punch-mark for drilling the 4 fastening holes.
- Drill the 4 fastening holes.
- Mount the course transducer by means of the adequate screws and washers.

Clearance required for inverter and/or course transducer with the door opened.
6.2.4 Installing the Time Switch, Type NB 03–735 (optional)

Fig. 6–15:
Drilling Scheme for Fastening Holes of the Time Switch

The time switch can be installed at any point of the ship you like, provided the ambient conditions are adequate. (The time switch is supplied as a spray-proof design, IP 23.)

For performing fastening and cabling, the time switch must be opened. For this, unscrew the four fastening screws on the cover and remove the cover.

- Punch-mark for drilling the fastening holes.
- Drill the fastening holes.
- Mount the time switch.
- Cable the time switch.

6.2.5 Mounting a Magnetic Sonde for Course Scanning (Optional)

For connecting an autopilot to the gyro compass STANDARD 14, there exists the possibility (if no Transmitter Synchro, Type 11 CX4, is used) of scanning the compass course by means of a suitable magnetic sonde and to convert it into a synchro-signal-like compass course signal (see Assembly Drawing, Fig. 6–16, STANDARD 14 / Magnetic Sonde). For this purpose, a special annular magnet is to be placed - centred and aligned to true north - into the recess of the 360° card.
The magnetic sonde – centred and aligned to true north – is pasted on the acrylic glass disk of the compass hood of STANDARD 14 and permits scanning off the magnetic field of the annular magnet.

In order to reduce the intensity of the magnetic field of the annular magnet, up to 5 matching disks, dependent on the equipment, can be arranged on the annular magnet (see Fig. 6-17.2). In this way, optimum adaptation of the magnetic sonde to the autopilot will be possible by carrying out experiments.

---

**Fig. 6-16:** Assembly Drawing: STANDARD 14 / Magnetic Sonde

- Schematic Representation -

**Table of Magnetic Field Measurement in Plane "A"**

(See Fig. 6-17, Installation Drawing for Additional Group, Type 148–332.)

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<td>0.53 mT</td>
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<tr>
<td>with 4 sheets</td>
<td>0.33 mT</td>
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Fig. 6-17: Installation Drawing for Additional Group, Type 148-332

1 Magnetic sonde suitable to the autopilot used
2 Matching Disk for annular magnet, Type 148-332.00-6
3 Mark (notch) on the annular magnet:
   top side and north–south direction
4 Annular Magnet, Type NB 15–01–9
5 Adhesion surface of annular magnet for double-faceted adhesive tape,
   e.g. DUPLOMONT 04 or a suitable adhesive
6 360° gyro-compass card
7 Cover disk of gyro-compass hood
8 Adhesion surface of magnetic sonde for double-faceted adhesive tape,
   e.g. DUPLOMONT 04 or suitable adhesive
9 Level "A" for magnetic field measurement
6.2.5.1 Mounting Instructions for Additional Group, Type 148–332

1) Set 360° card (Fig. 6–17.6) of the gyro compass exactly to north (to Pos. 000°).

2) Apply double-faced adhesive tape to the bottom side (Fig. 6–17.5) of the annular magnet (Fig. 6–17.4) in 3 points at least.

3) Insert the annular magnet centered into the recess of the 360° compass card and align it to north. The upper notch in the annular magnet should be in alignment with the 000° mark of the compass card. After alignment, the annular magnet is to be pressed on strongly.

4) Pasta the magnetic sonde (Fig. 6–17.1) of the autopilot onto the acrylic glass disk of the gyro-compass hood; take into account the mounting instruction supplied by the manufacturer of the magnetic sonde. (Pay attention to that the magnetic sonde is aligned to true north and fastened in centred position!)

5) Perform trial operation: reduce the intensity of the magnetic field of the annular magnet by arranging of up to 5 matching disks so that optimum adaptation of the magnetic sonde used can be obtained (cf. Table of Magnetic Field Measurement in Plane "A").

6) Parform trial trip. (After successful trial, the matching disks arranged can be fixed by means of a suitable adhesive.)

6.2.6 Installing Further Optional Devices

On installing optional devices, e.g. satellite navigation or communication equipment, autopilot, radar equipment, direction-finder, repeater compasses, digital repeater compasses etc., take into account the descriptions, dimensional drawings, system diagrams or cable and connection diagrams enclosed.
6.3 Cabling, General Hints

(See also relevant Cable Connection Diagram in the Annex.)

Installation of the individual devices or systems on board ship is to be performed only in places where the environmental influences upon the devices and systems are adequate.

- After installation of the individual devices, electrical cabling to the mounting sites is to be performed.

- For cable laying, the requirements of electromagnetic compatibility (EMC) are to be taken into consideration. This means that the devices and cables should have the largest possible distance from EMC sources of trouble (continuous, short-time, clicks).

- All cables must be metal-shielded.

- No spare cores are included in the number of cores found in the cable diagrams.

- All devices are to be connected via the earthing bolts with the protective conductor.

- After laying the cables, they are to be cut to such a length that they fit into the devices at their respective mounting locations. The used cores are to be stripped. Cores that are not used are to be tied up.

- The individual cores are to be checked for continuity and – to each other – for short-circuit.

- Thereafter, the cores are to be connected in accordance with the cable connection diagrams.

Cabling between inverter and gyro compass:
The connecting cable coming from the inverter can be led into the gyro compass in different ways:

1) either laterally, directly below the compass hood, or
2) laterally, directly below the compass casing, level with the base plate. (This type of installation has the advantage that – when work is to be carried out, e.g. on the outer sphere – the connecting cable need not be removed.)

The compass connection cable – after being introduced into the binnacle – is to be fastened by means of clamps.
7.

Putting into Operation

7.1

Mounting the Gyroscope into the Outer Sphere

Installation of the gyroscope is to be performed according to the instructions given in the following sections:
- Opening the Gyro Compass, Section 3.1.2
- Removing the Gyroscope from the Outer Sphere, Section 3.3.1.

Proceed with this section to the Point "Screwing off and Removing the Outer Sphere Cover" (see Fig. 3-14).

Note:
For reasons of protection during transportation, the gyroscope is delivered in a separate transportation box.
For being protected against damage, the inner shell is delivered packed in a plastics bag and placed in the outer sphere. Furthermore, you will find there a mounting instructions sheet, pay attention to it, please!

Procedure:
- Take the inner shell out of the outer sphere and remove plastics bag.
- Rinse out the outer sphere with clear water.
- Take the gyroscope out of the gyroscope packing, rinse with clear water and place it on a foam part of its packing.

Fig. 7-1:
Inserting the Gyroscope into the Outer Sphere
- Fill approx. 1/4 l of supporting liquid into the outer sphere.
- Moisten the suction cap and press it centred onto the calotte of the gyrosphere (cf. Fig. 7-2).
- Place the gyrosphere carefully into the supporting bearing of the outer sphere.

**Fig. 7-2:**
Filling in Further Original ANSCHÜTZ Supporting Liquid (to approx. 1 cm below the outer sphere edge)

- Take the inner shell out of its packing and place it centred onto the seat of the supporting bearing of the outer sphere (see mounting instructions sheet and Fig. 7-3).

**Fig. 7-3:**
Placing the Inner Shell onto the Seat of the Supporting Bearing of the Outer Sphere
- Clean the contact surfaces of the outer sphere and outer-sphere cover.
- Check the position of the sealing ring between the outer sphere and outer-sphere cover.
- Carefully place the outer-sphere cover onto the outer sphere, whilst observing the positioning pins!
- Secure the outer-sphere cover to the outer sphere using the six screws.

**Hint:** Carefully tighten the mounting screws by means of a screw driver (crosswise)!

- Clean the contact surfaces of the outer-sphere cover and insert.
- Fill original ANSCHÜTZ supporting liquid through the opening in the outer-sphere cover. (Supporting liquid level see Section 3.3.3.)
- Check the position of the sealing ring between the outer-sphere cover and insert.
- Carefully set the insert onto the outer-sphere cover.
- Secure the insert to the outer-sphere cover by means of six screws.

**Hint:**
Carefully tighten the mounting screws (crosswise)!

- Re-establish the plug connection for phase connection of the upper calotte (cf. Fig. 3-9).
- Inserting the Outer Sphere into the Gyro Compass (see Section 3.3.4).
7.2 Switching on the Gyro Compass
The gyro compass equipment is to be switched on in accordance with the Operating Instructions given in Section 2.1.

7.3 Checking Signalling
Proceed in accordance with Section 2.3.

7.4 Checks to be made on the Gyro Compass

- Measure the starting and operating currents of the gyro motors (incl. pump motor), see Section 4.1.3 Test List of Gyro Compass.

- General checks, see Section 3.2.1
  Then install outer sphere into the gyro compass, see Section 3.3.4.

- Check and, if required, correct the alignment error ("A" error), see Section 3.6.

7.5 Synchronizing the Course indications of the Repeater Compasses with the Course Indication of the Gyro Compass
(See Section 3.2.7.)

7.6 Checks to be made during Operation
(See Section 2.4.)
7.7 Application of the Speed Error Table (Speed Error Table in the Compass Book)

The speed error is the difference between the course indicated by the gyro compass and the true course. The underlying causes of this error, which is governed by the ship's speed, course and local latitude, are of the physical type. For amount and sign of speed error, see table supplied with every gyro compass installation.

1. Obtain true course by adding speed error to or subtracting it from compass course according to sign taken from table.

   Rule: FROM "WRONG" COURSE TO "RIGHT" COURSE WITH "RIGHT" SIGN

2. Obtain gyro-compass course by adding speed error to or subtracting it from true course with table sign inverted.

   Rule: FROM "RIGHT" COURSE TO "WRONG" COURSE WITH "WRONG" SIGN

WRONG course . . . compass course - steering course
RIGHT course . . . chart course - true course

RIGHT sign . . . table sign
WRONG sign . . . Inverted table sign

Check speed error for correct sign according to rule below:

THE TRUE COURSE IS ALWAYS WEST OF THE COMPASS COURSE

true course → compass course

Example 1 for using speed error table:

Example 1:
compass course ......... 345°
latitude ............... 55°
ship's speed .......... 16 km

speed error from table -1.7°
speed error from table +1.3°

true course 345° - 1.7° = 343.3°
compass course 225° - 1.3° = 223.7°

Example 2 for a bearing:
compass course ......... 255°
latitude ............... 55°
ship's speed .......... 18 km
bearing ............... 135°
speed error from table +0.5°
true bearing 35° + 0.5° = 35.5°

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<th>South</th>
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</table>
Annex
for the Modified Static Inverter, Type 121–043 MOD 015 or MOD 016

Note:
The Modified Static Inverter, Type 121–043 MOD 015 or MOD 016, can be connected with a maximum of 4 repeater compasses
(with ANSCHÜTZ step system, 192 steps/1°).
The connections are made via the Repeater Compass Distribution Box, Type AWD–138–021–1–OUT.
As to the wiring, the following modifications have been performed.

See drawings:
- 121–C 043 HP020
- AWD–121–025–2–WIR
- AWD–138–021–1–OUT

1. The electrical connections of the compass cable for the follow-up motor of the gyro compass (SM 1, SM 0) have been reconnected in the static inverter from L6.7/L6.8 to L19.5/L19.3.

2. The resistors R4 (22 Ω) and R5 (22 Ω) have electrically been bridged over in the static inverter.

3. The Repeater Compass Distribution Box, Type AWD–138–021–1–OUT, has been connected to the terminals L6.7 (SM 1), L6.8 (SM 0), L19.1 (+24V), L19.2 (0Villumination), L19.4 (0Vsteppingmotor) in the static inverter.

The repeater compass distribution box comprises:
- 1 input terminal strip (L8) with 6 terminals
- 8 current-limiting resistors (R1 ... R8, each 33 Ω/4 Watt), for the stepping motors of the repeater compasses.
- 4 fuses (E1 ... E4, each 2A), for the 24V illumination
- 4 output terminal strips (L10, L12, L14, L16) with 6 terminals each for the connection of 4 repeater compasses as a maximum.

Note
See Static Inverter Measuring List, Page 4–20:
By electrical bridging-over of R4 and R5, the voltages of between L6.6/L6.7 and L6.6/L6.8 increase to +12V or −12V!
The AC voltages rise to 8V ... 14V AC as well!

Attention
For load reasons, no further repeater compasses must be connected to L11 and L12 in the static inverter!
Bohrbild
DRILLING SCHEME

Vorschiff
AHEAD

Φ9,5 für FOR M8 oder FOR
für Holzschraube max. Φ9
FOR WOOD SCREW MAX. Φ9
(3x)

Scherpunkt
CENTRE OF GRAVITY

Schutzart:
TYPE OF ENCLOSURE

DISTANCE FROM MAGNETIC COMPASS
STANDARD TYPE: 0.4 m
STEERING TYPE: 0.3 m

Anschluß des Gerätes über Kabel mit Steckverbinder.
CONNECTION OF THE DEVICE VIA CABLE WITH PLUG CONNECTOR
Kabelführung wahlweise innen oder außen (siehe Handbuch)
CABLE RUN SELECTIVE INSIDE OR OUTSIDE (ACCORDING TO MANUAL)