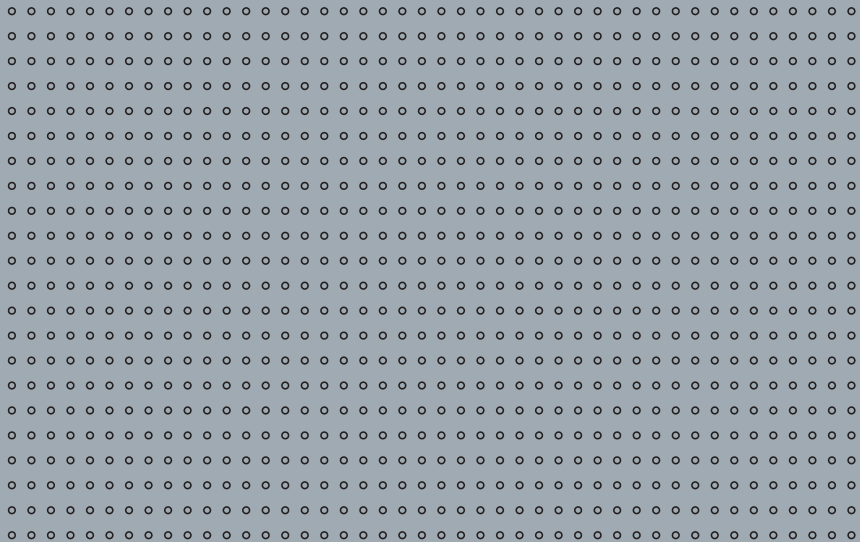


# Installation manual

## Simrad AP24/AP28 Autopilots with AC12/AC42 Autopilot Computers

English



# Installation manual

## Simrad AP24/AP28 Autopilots with AC12/AC42 Autopilot Computers

English

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The original language for this document is English. In the event of any discrepancy between translated versions and the English version of this document, the English document will be the official version.

To the best of our knowledge, the content in this publication was correct at the time of printing.

As we are continuously improving our products we retain the right to make changes to the product and the documentation at any time. Updated manuals are available from our website [www.simrad-yachting.com](http://www.simrad-yachting.com), and are free to download.

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## About this manual

Rev. A	19.10.07	First issue
Rev. B	03.07.08	Corrections on system drawings. Spare parts list updated.
Rev. C	10.11.08	Correction on board terminals page 13.
Rev. D	27.01.09	Correction page 13.

This manual is intended as a reference guide for installing and maintaining the Simrad AC12 and AC42 autopilot computers and other components in an autopilot system.

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

Important text that requires special attention from the reader is emphasized as follows:



*Used to draw the reader's attention to a comment or some important information.*



***Used when it is necessary to warn personnel that a risk of damage to the equipment or hazard exists if care is not exercised.***

# Content

<b>1 System description .....</b>	<b>5</b>
1.1 General .....	5
1.2 How to use this manual.....	5
1.3 Software record .....	6
<b>2 Installation .....</b>	<b>7</b>
2.1 Installation checklist .....	7
2.2 Unpacking and handling .....	7
2.3 Determine system configuration .....	8
2.4 Autopilot system layout.....	9
2.5 Autopilot computer installation.....	11
2.6 Rudder Feedback installation .....	14
2.7 LF3000 Linear Feedback.....	16
2.8 Drive unit installation.....	18
2.9 AP24 and AP28 Control unit installation .....	20
2.10 FC40 and RC42 Compass installation.....	23
2.11 R3000X Remote Control installation .....	24
2.12 JS10 Joystick .....	24
2.13 S35 NFU Lever installation .....	25
2.14 Interfacing .....	25
2.15 SimNet .....	26
2.16 External Alarm .....	30
<b>3 Spare Parts List .....</b>	<b>31</b>

<b>4 Technical specifications .....</b>	<b>35</b>
4.1 AP24 Autopilot System.....	35
4.2 AP24 Control Unit.....	36
4.3 AP28 Control Unit.....	38
4.4 Autopilot Computers.....	39
4.5 FC40 Fluxgate Compass .....	41
4.6 RC42 Rate Compass .....	42
4.7 RF300 Rudder Feedback.....	43
4.8 RF25 Rudder Feedback .....	45
4.9 R3000X Remote Control.....	45
4.10 JS10 Joystick .....	46
4.11 SimNet .....	47
4.12 IP protection.....	47
4.13 AT10 SimNet/NMEA0183 converter .....	48
<b>5 Index .....</b>	<b>51</b>

# 1 System description

## 1.1 General

The autopilot computer is the main unit in the AP24 and AP28 autopilot systems. It contains the steering computer and electronics for the drive unit motor and clutch and provides interface to other system components. Two models, AC12 (8/16 A motor current) and AC42 (30/50 A motor current) are available.

It communicates on the proprietary SimNet data and control network to establish a reliable digital communication and power distribution between the units in the autopilot system as well as other Simrad products.

SimNet provides high speed data transfer and control of Simrad products integrated in a total steering and navigation system.

## 1.2 How to use this manual

This manual is intended as a reference guide for installing and maintaining the Simrad AC12 and AC42 autopilot computers and other components in an autopilot system.

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

Other documentation material that is provided with your system includes an operator manual which includes the setup instructions for the system, a control unit installation guide and a warranty card. The warranty card must be filled out by the authorized dealer that performed the installation.

## 1.3 Software record

### Control units

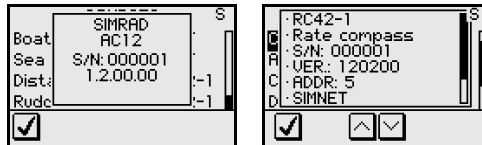
When the system is switched on, a status display shows the serial number and software version for the control unit.



*The shown readout is only an example!*

### Autopilot computers

Serial number and software version for autopilot computers and other SimNet sources can be found under the control unit *User setup* menu. Refer to *Manual source selection* in the autopilot operator manual.



## 1.4 Exchange of software program

For upgrading the software of Simrad products/devices, refer to Manual for Software Upgrade Tool, part no. 20222956.

## 2 Installation

An autopilot system includes several units that need to be mounted in different locations on the boat, and also need to interface with at least three different systems on the boat:

- The boat's steering system
- The boat's electrical system (input power)
- Other equipment on board (SimNet interfacing)

In addition, the advanced capabilities of the system require the installer to perform a series of settings and tests to verify proper operation of the system, refer to the check list below.

### 2.1 Installation checklist

1. Determine the system configuration you are installing (Page 8)
2. Perform the hardware installation (Page 11)
3. Connect SimNet devices to SimNet (page 26)
4. Perform Set-up (refer to Operator manual)
5. Test Autopilot Operation at Sea (refer to Sea Trial instructions in the Operator manual)

### 2.2 Unpacking and handling

Care should be taken when unpacking and handling the equipment. A visual inspection should be made to see that the equipment has not been damaged during shipment and that all components and parts are present according to the packing list.

An autopilot system will include:

- Control unit (AP24 or AP28) with accessories
  - Installation accessories
  - Operator manual



- Autopilot computer (AC12 or AC42) with accessories
  - SimNet cable 5,5 m (18')
  - Installation accessories
  - AC12/AC42 Installation Manual
- Compass (FC40 or RC42) with 5,5 m (18') SimNet cable attached
- Feedback unit (RF300 or RF25) with transmission rod and cable attached.
- Appropriate drive unit for the installation (unless the autopilot is going to operate an existing drive unit or solenoids).
- Optional equipment that may have been ordered for the installation.

## 2.3 Determine system configuration

It is important to become familiar with the configuration of the system prior to beginning the installation. An autopilot basic single station system is shown in Figure 2-1 and a system layout with options is shown in Figure 2-2

Plan your cabling and configure the SimNet network in accordance with chapter 2.15 on page 26. Pay particular attention to the autopilot computer/drive unit combinations.

As most of the units are communicating on a common network (SimNet) with identical connectors, the installation is simple. Try to mount the units within the standard cable length supplied with each unit. SimNet cables are available from your distributor (see page 33) for connection to other SimNet devices and cable extension.



- 1 *On boats powered by outboards or stern drives it may be difficult to install a rudder feedback unit (Refer to RF300, RF25 or LF3000 in this manual). Use of the Virtual Rudder Feedback, VRF™, algorithms in the software may then be preferred as this requires no installation of a rudder feedback*

unit. The VRF can be used on boats up to 40 ft.

- 2 The VRF technology requires a Simrad rate compass (RC42) for heading information to the autopilot system.

## 2.4 Autopilot system layout

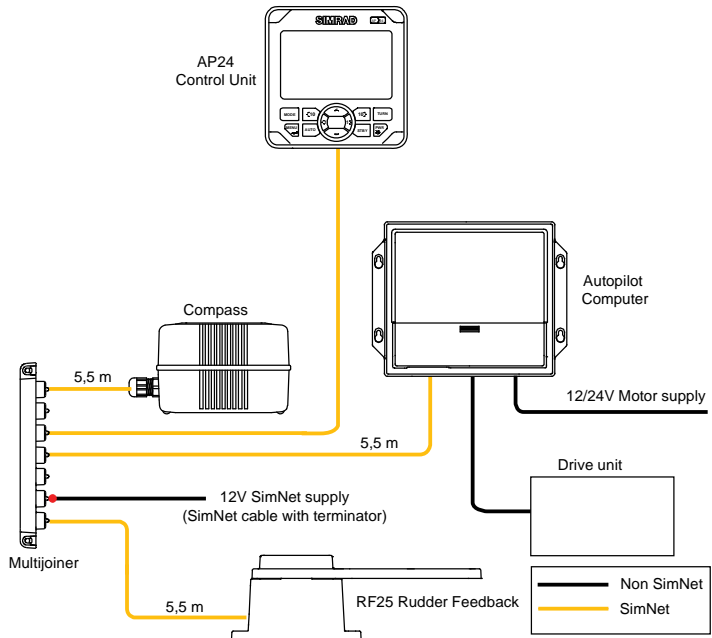


Figure 2-1 AP24 basic system layout

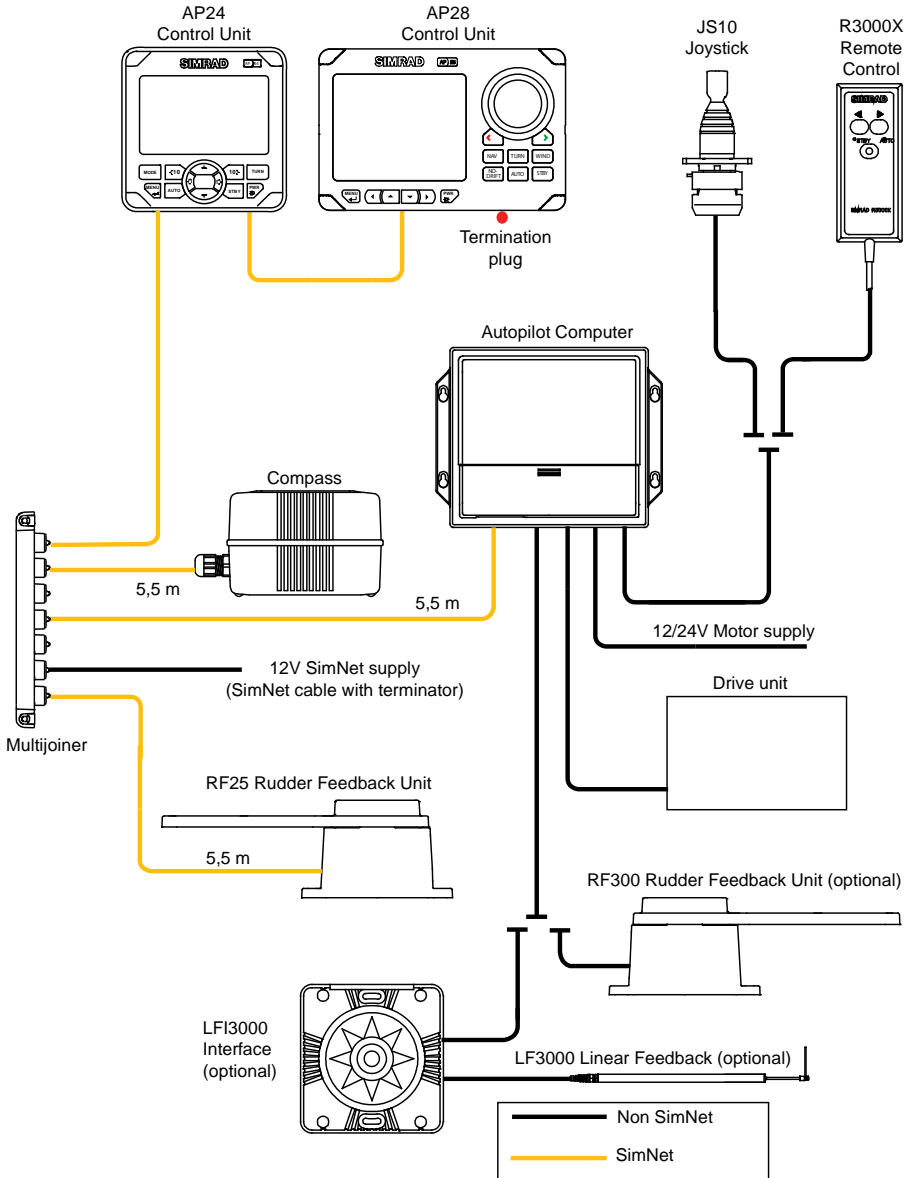


Figure 2-2 AP24 system layout with options

## 2.5 Autopilot computer installation

The autopilot computer is designed to operate in a location with ambient temperatures below +55°C (+130°F).



*The autopilot computer units (AC12 and AC42) should be mounted vertically in a place between the control unit and the drive unit. The unit should not be exposed to dripping or splashing water.*

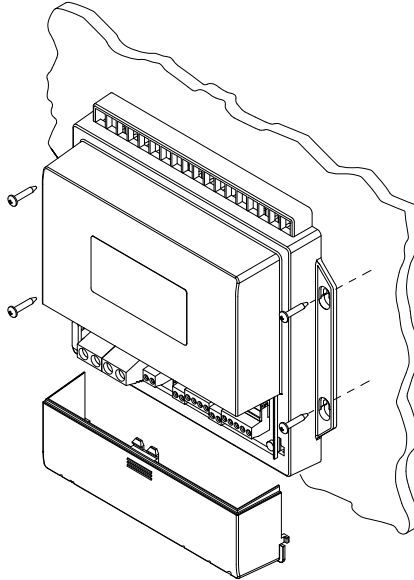


Figure 2-3 Autopilot computer mounting

### Cabling

Use only shielded cables and ready made SimNet cables and accessories. This includes motor supply, drive unit cables and, if necessary, extension of the optional rudder feedback cable(s). The clutch/bypass cable and the solenoid cable should be 1,5 mm<sup>2</sup> (AWG14).

The motor supply cable and the drive unit motor cable should have sufficient wire gauge. This will minimize voltage drop and allow the drive unit to operate at full power.

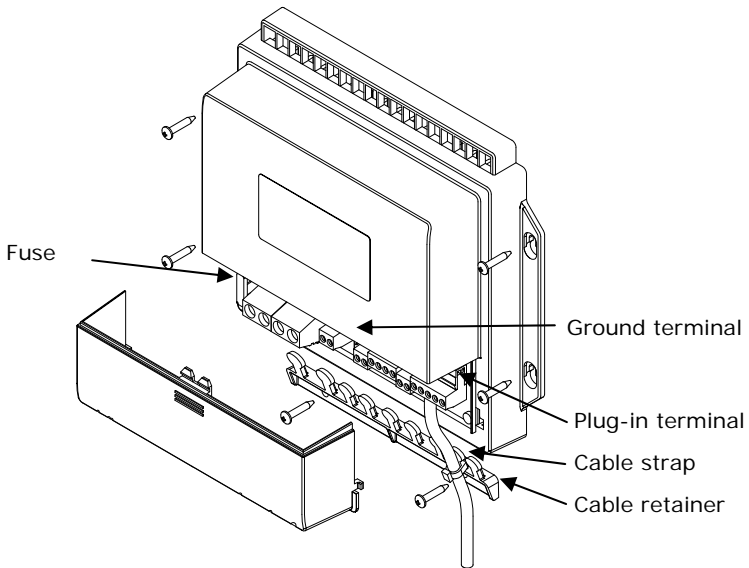
Refer to the table below for recommended cable sizes.

Cable length	Drive unit voltage			
	12 V		24 V	
1. Breaker panel to autopilot computer.	AWG	mm <sup>2</sup>	AWG	mm <sup>2</sup>
2. Autopilot computer to drive unit motor (Length refers to each of the two cables)				
Up to 3 m (10 ft.)	12	2,5	12	2,5
Up to 6 m (20 ft.)	10	4	10	2,5
Up to 10 m (32 ft.)	8	6	10	4
Up to 16 m (52 ft.)	6	10	8	6

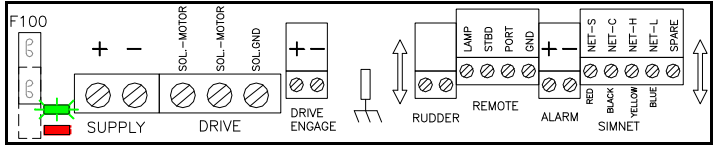
Remove the bottom cover to get access to the plug-in terminals.

Provide sufficient wire length so that the plug-in terminals can be easily connected and disconnected.

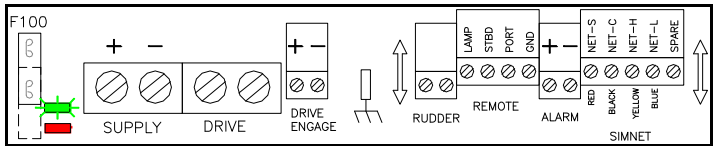
Pull out each terminal before connecting the wires. Remove all strands before putting back the terminal cover.



A SimNet cable is supplied with the autopilot computer. It has a connector only at the control unit end. The other end is prepared for screw terminals.



AC12 Board Terminals



AC42 Board Terminals

### Polarity protection



*The fuse located in the lower left corner of the AC board is not put in its final position when supplied from factory.*

When the motor supply is connected to the terminal, a diode will light. If the light is red, you have to swap the wires. When the light is green, the polarity is correct. Switch off the supply voltage and put the fuse into correct position.

### Radio Frequency Interference (RFI)

The autopilot system has excellent RFI protection as per EMC Directive 2004/108/EC.

SimNet cables and other signal cables (feedback, NMEA) should not be run in parallel with other cables carrying RF or high current, such as VHF and SSB transmitters, battery chargers/ generators, winches and thrusters.



*If problems occur with RFI, make provisions to connect the supply cable shield to the fast-on ground terminal. This terminal must also be connected to the hull bonding.*

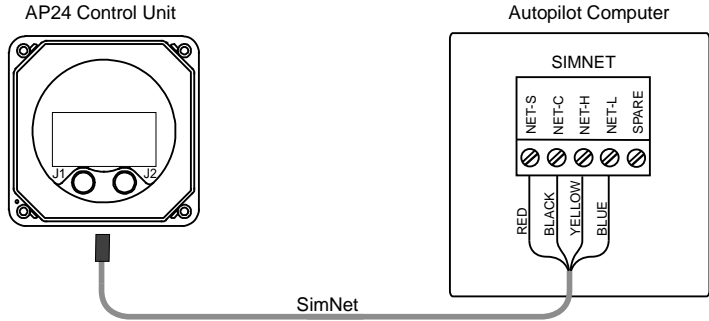


Figure 2-4 Control unit connection

J1 and J2 are the SimNet connectors.

## 2.6 Rudder feedback installation

The RF300 and RF25 Rudder feedback units mount close to the rudder, and are mechanically linked to the rudder tiller arm or rudder quadrant. Refer to Figure 2-5 for the recommended mounting arrangement.



*Do not remove the transmitter lever from the feedback unit. The unit is factory adjusted and need no further adjustment at installation than described below.*

Turn the helm wheel to set the rudder tiller arm to approximate centre position.

Set the mounting location to be in accordance with Figure 2-5. The centre of the feedback unit should be in line with the centre of the rudder post. Mount the feedback unit to a suitable platform using the screws provided. If necessary, add blocking material under the feedback unit to adjust the height of the transmitter lever to be level with the rudder tiller arm.



*Due to space limitations, it may be necessary to cut the length of the transmitter rod to move the feedback unit closer to the rudder post.*

Rotate the feedback transmitter lever to centre position. (Use the alignment mark to line up the transmitter lever to be opposite the cable entry into the feedback).



Carefully observe the alignment marks. A rudder feedback alarm may be the result if the alignment instructions as per Figure 2-5 are neglected.

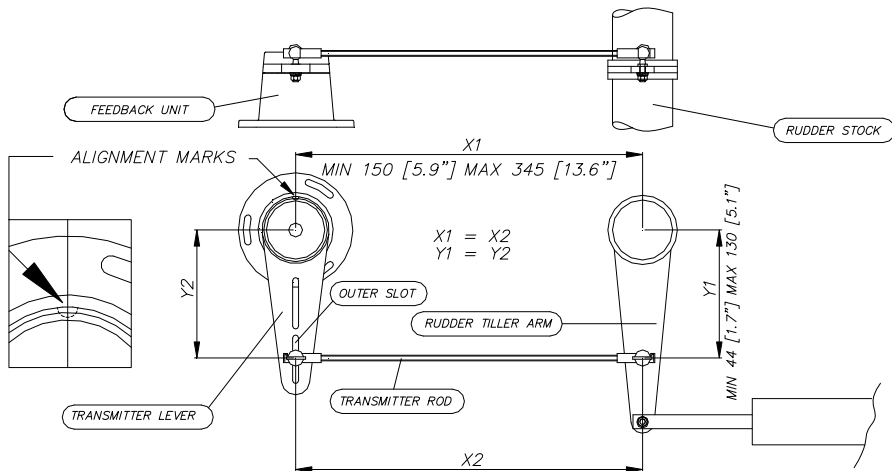


Figure 2-5 Rudder feedback mounting (019356)

Note that the transmitter lever has two slots for the transmitter link. The slots enable maximum flexibility to provide the 1:1 mechanical linkage relationship. As a starting point, set the transmitter rod to the inner limit of the outer slot if possible. (Refer to Figure 2-5). Drill and tap the rudder tiller arm so that the Y1 dimension is equal to the Y2 dimension (Use 4.2 mm drill and 5 mm tap). Attach the ball joint to the tiller arm, and connect the transmitter rod to the ball joint at the rudder tiller arm.

Tighten the mounting screws for both the feedback unit and the transmitter rod ball joint.

Observe the feedback unit while someone turns the helm wheel through the complete travel H.O. to H.O. and verify that the mechanical linkage moves freely.



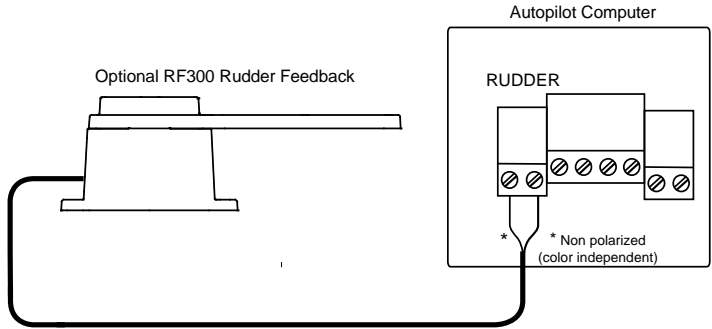


Figure 2-6 RF300 connection

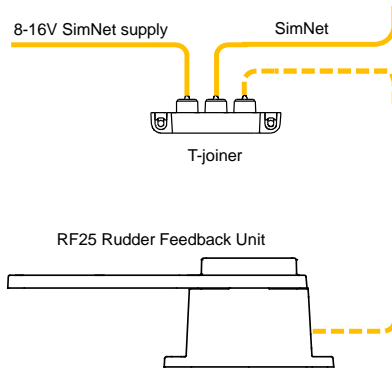


Figure 2-7 RF25 connection to SimNet

## 2.7 LF3000 Linear Feedback



***The rod of the LF3000 is not locked in place in the cylinder. Pay attention as it may slip out of its housing and end up on the seabed.***

The LF3000 is a waterproof feedback unit. It has a 300 mm (11,8") stroke and comes with a special mounting bracket which secures the LF3000 to the cylinder of the existing outboard drive unit.

The 8,5 m (28') cable is terminated in the LFI3000 Mk2 Linear Feedback Interface according to Figure 2-9.

The mounting hardware provided is made to interface with Teleflex HC5340 cylinders and Hynautic K7 and K10

Cylinders. The hardware may not be appropriate for other systems.

Center the drives. Loosely secure the LF3000 to the supplied mounting bracket, across the center of the drive unit cylinder. Either cylinder may be used if there is a dual set up. You may mount the feedback in either direction, i.e. the shaft of LF3000 may point to port or starboard.

Loosen the end bolt (a) used to secure the cylinder to the drive unit mount. Insert the rod retaining assembly (b) and retighten the bolt. Secure the feedback rod to the retainer plate using the two washers and the cap nut provided. Adjust the location of the LF3000 Linear Feedback to allow full travel of the hydraulic cylinder without causing the retainer plate to hit the end of the cylinder. Check that the outboard motor can be tilted freely. Tighten all nuts and the mounting bracket.

Turn the helm slowly by hand to the stop on either side, check that the rod does not bind up in any direction. Make a "drip nose" (c) on the cable to the unit and clamp the cable to allow full engine movement to port and starboard.

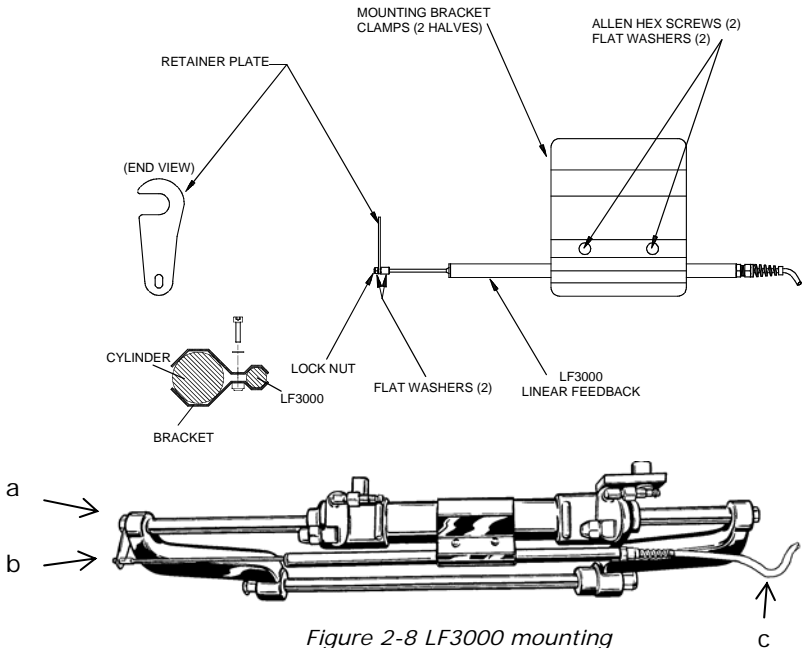


Figure 2-8 LF3000 mounting

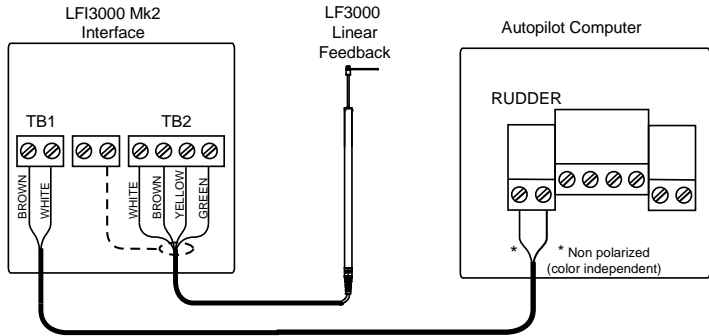


Figure 2-9 LF3000/LFI3000 Mk2 connections

## 2.8 Drive unit installation

The relations between drive units, drive unit voltage, autopilot computer, drive performance and interface to the steering gear are shown in the tables below.

Refer to the connecting diagram for the different drive units on page 19 onwards.

Installation instruction for the drive units are found in the manual for the individual units.

The maximum drive current capability of the AC12 and AC42 autopilot computers are different. Use the table below as reference and observe the notes on next page.

### HYDRAULIC PUMPS

MODEL	MOTOR VOLTS	AUTO-PILOT COMPUTER	RAM CAPACITY		FLOW RATE AT 10 bar cm <sup>3</sup> /min (cu. in./min)	MAX PRESSURE bar	PWR. CONSUMPTION
			MIN cm <sup>3</sup> (cu. in.)	MAX cm <sup>3</sup> (cu. in.)			
RPU80	12V	AC12	80 (4,9)	250 (15,2)	800 (49)	50	2,5-6 A
RPU160	12V	AC42	160 (9,8)	550 (33,5)	1600 (98)	60	3-10 A
RPU300	12V	AC42	290 (17,7)	960 (58,5)	3000 (183)	60	5-25 A
RPU300	24V	AC42	290 (17,7)	960 (58,5)	3000 (183)	60	2,5-12 A

## LINEAR DRIVE UNITS

MODEL	MOTOR VOLTS	AUTO-PILOT COMPUTER	MAX STROKE mm (in.)	PEAK THRUST kg (lb.)	MAX RUDDER TORQUE Nm (lb.in.)	HARD-OVER TIME sec. (30% load)	PWR. CON-SUMP.	TILLER ARM mm (in.)
DD15	12V	AC42	–	–	150 Kgm		2 A	–
HLD350	12V	AC12	200 (7,9)	350 (770)	610 (5400)	12	2,5-8 A	175 (6,9)
HLD2000L	12V	AC42	340 (13,4)	500 (1100)	1460 (12850)	19	3-10 A	298 (11,7)
HLD2000D	24V	AC42	200 (7,9)	1050 (2310)	1800 (15900)	11	3-10 A	175 (6,9)
HLD2000LD	24V	AC42	340 (13,4)	1050 (2310)	3180 (28000)	19	3-10 A	298 (11,7)
MSD50*	12V	AC12	190 (7,5)	60 (132)	–	15	0,8-2 A	–

Steering gear interface: Connects to quadrant or tiller.

\* For stern drive power assisted steering only.



1. For 12V drive units the motor voltage is stepped down by the autopilot computer when operating from 24V supply.
2. The specified autopilot computer is necessary to achieve max drive unit capacity.
3. Recommended operational thrust or torque is 70% of listed peak value.
4. Typical average power consumption is 40% of listed maximum value.

### Connecting a reversible pump

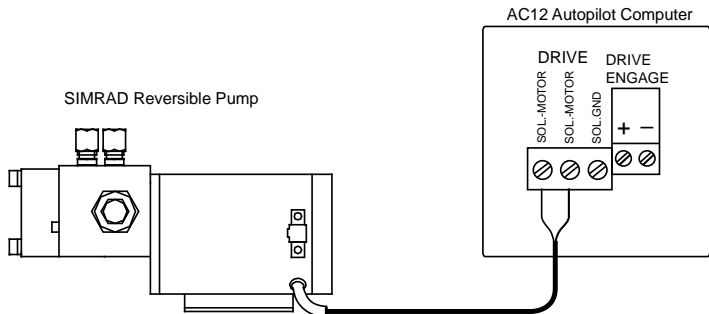


Figure 2-10 Connecting a reversible pump

## Connecting a hydraulic linear drive

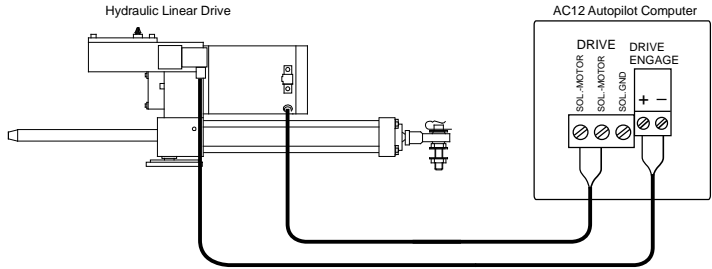


Figure 2-11 Connecting a hydraulic linear drive

## Connecting a solenoid valve

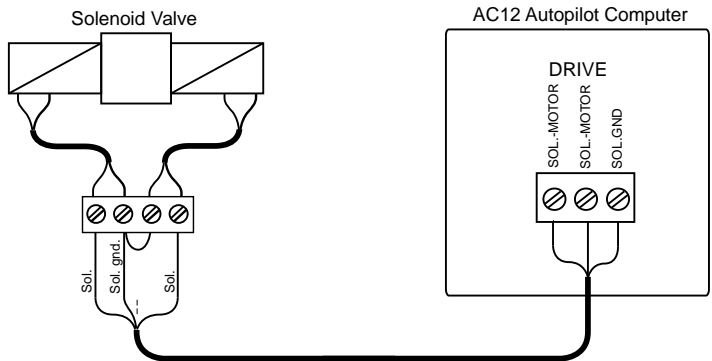


Figure 2-12 Connecting a solenoid valve

## 2.9 AP24 and AP28 Control unit installation

Avoid mounting the control unit(s) where it is easily exposed to sunlight, as this will shorten the lifetime of the display.



**Do not install the control unit where moisture is present at the rear. It may cause damage by entering the breathing hole or by coming into contact with the electrical connectors.**

## Panel mounting

The mounting surface must be flat and even to within 0.5 mm.

- Drill the 4 mounting holes and make a panel cut-out according to supplied template.
- Connect the SimNet cable(s) to the control unit connector(s)
- To daisy chain units remove the blocking plug with a pair of pliers.
- Use the supplied 19 mm screws to fasten the control unit to the panel.
- Apply the front panel corners.

**Do not over-tighten the mounting screws!**

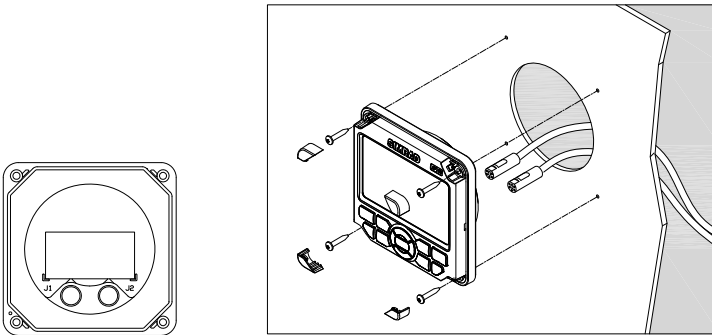


Figure 2-13 AP24 Panel mounting

## Optional bracket mounting

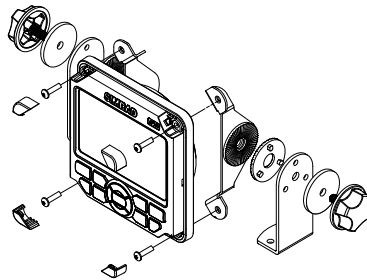


Figure 2-14 AP24 Bracket mounting

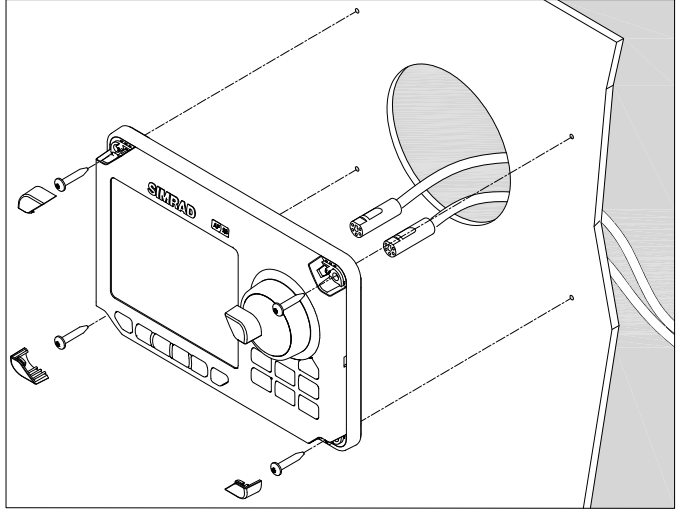


Figure 2-15 AP28 Panel mounting

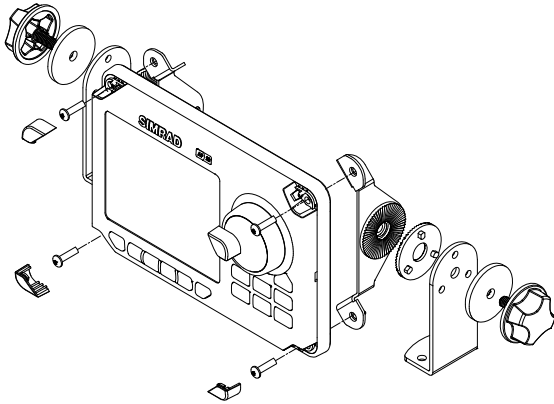


Figure 2-16 AP28 Bracket mounting

## 2.10 FC40 and RC42 Compass installation

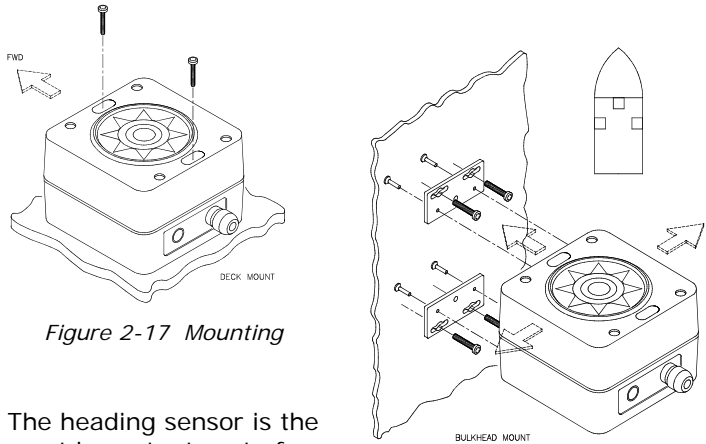


Figure 2-17 Mounting

The heading sensor is the most important part of the autopilot system and great care should be taken when deciding the mounting location. As the heading is displayed on the control unit, the heading sensor can be mounted at a remote location.

The compass can be mounted on deck or bulkhead, athwart ship or along ship. Some of the products connected to the SimNet network may have a heading offset feature. This will compensate for the mechanical offsets that may be a result of the selected location and orientation of the compass.



*If the connected products have no offset feature, the compass must be deck or bulkhead mounted athwart ship with the cable gland pointing back.*

Select a location that provides a solid mounting place free from vibration, and as close to the vessel's centre of roll and pitch as possible, i.e. close to the water line. It should be as far as possible from disturbing magnetic interference e.g. engines (min. 2 meters), engine ignition cables, other large metal objects and particularly the autopilot drive unit. On steel hull boats it should be mounted 0,75-1 m above the wheel house on a non magnetic stand.





The compass face plate is the TOP. Never mount it upside down! Level the sensor as close to horizontal as possible.

Use the supplied mounting kit and drill holes through the centre of the slots.

Connect the compass to an available SimNet connector in the SimNet “backbone”.

## 2.11 R3000X Remote Control installation

R3000X should be mounted in the supplied bracket that can be fixed by four mounting screws. The unit is weather proof and can be mounted outdoor.

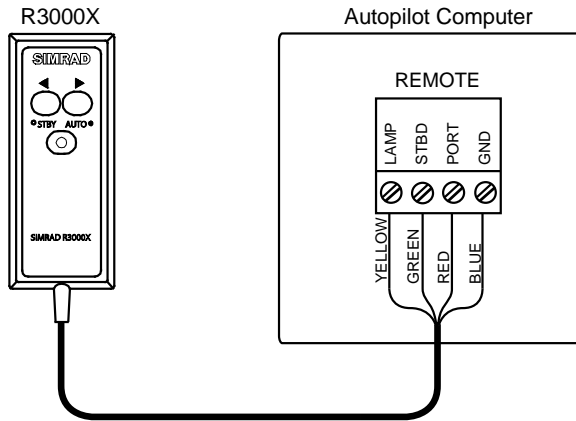


Figure 2-18 R3000X connection

## 2.12 JS10 Joystick

Refer to separate installation instructions supplied with the JS10 Joystick.

## 2.13 S35 NFU Lever installation

The unit is mounted to a bulkhead or panel by two screws from the front. The cable is connected to the autopilot computer according to Figure 2-19. Interchange the Port and Stbd wires to the screw terminals if necessary to make the direction of the lever movement coincide with the direction of the rudder movement.

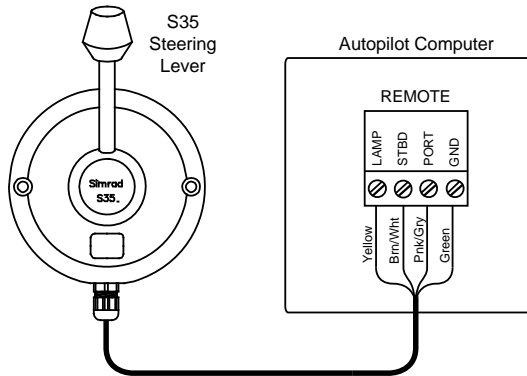


Figure 2-19 S35 connections

The unit is opened by removing the three screws on the back cover. Inside are two sets of micro-switches, a printed circuit board with a plug-in terminal and a jumper strap.

## 2.14 Interfacing

With the autopilot system there are several possibilities to connect to other equipment for data collection and exchange:

- 1 Use SimNet
- 2 Use SimNet via AT10 Universal SimNet/NMEA Converter
- 3 Connect to a NMEA2000 network via adapter (drop) cable, part no. 24005729.

The different connecting diagrams on the following pages illustrate the interface possibilities of the autopilots.

## 2.15 SimNet

The SimNet cable system with very small plugs in both ends makes it easy to run the cables, only 10 mm (3/8") holes are required through panels and bulkheads. The SimNet accessory program contains the necessary items to make a successful installation. Refer to ***SimNet cables and accessories***, page 33.

### SimNet network cables

A SimNet unit has one or two yellow SimNet connectors. There are no dedicated "in" or "out" connectors. Route the SimNet cables with Figure 2-20, Figure 2-21 or Figure 2-22 as a guideline. Select cables and accessories from the SimNet accessory program. Connect products with two SimNet connectors in a daisy chain and use drop cables and T-joiners when required. For cable extension in-line cable joiners are available. Total length of SimNet cable installed in a system should not exceed 150 meter (500').

If you plan to extend your SimNet system in the future it may be advantageous to prepare for it by adding a few T-joiners in central locations. The T-joiners provide easy access to the network and can be replaced with a new product, or the new product can be connected via a drop cable.



*The connectors are weather proof according to IP66, when properly installed. All unused SimNet connectors must be fitted with the plastic cap to protect them against dirt and moisture.*

### SimNet power and termination

The following rules should be observed when installing SimNet.

- 1** It must have a separate 12VDC power from the battery bus or the circuit breaker board to reduce interference
- 2** It must not be connected to the supply voltage terminals on the Autopilot Computer.

- 3 It will power a SimNet compatible instrument system. Hence SimNet to other equipment can be supplied via the autopilot, see Figure 2-20, Figure 2-21 and Figure 2-22.
- 4 SimNet must be properly terminated, i.e. unless it is a small system (see Figure 2-20) there must be terminations at each end of the Simrad backbone.

The SimNet network has to be terminated according to the number and type of products connected.

In a small system consisting of maximum 5 SimNet products and a total length of 5 m SimNet backbone cable you only need the SimNet power cable with built in termination (red disc on cable plug).

For additional information about SimNet ask for the separate SimNet Manual.

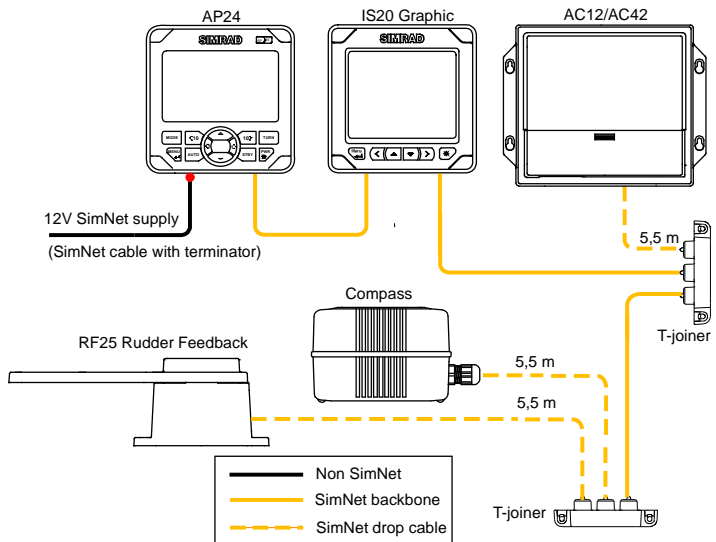


Figure 2-20 SimNet network, small system

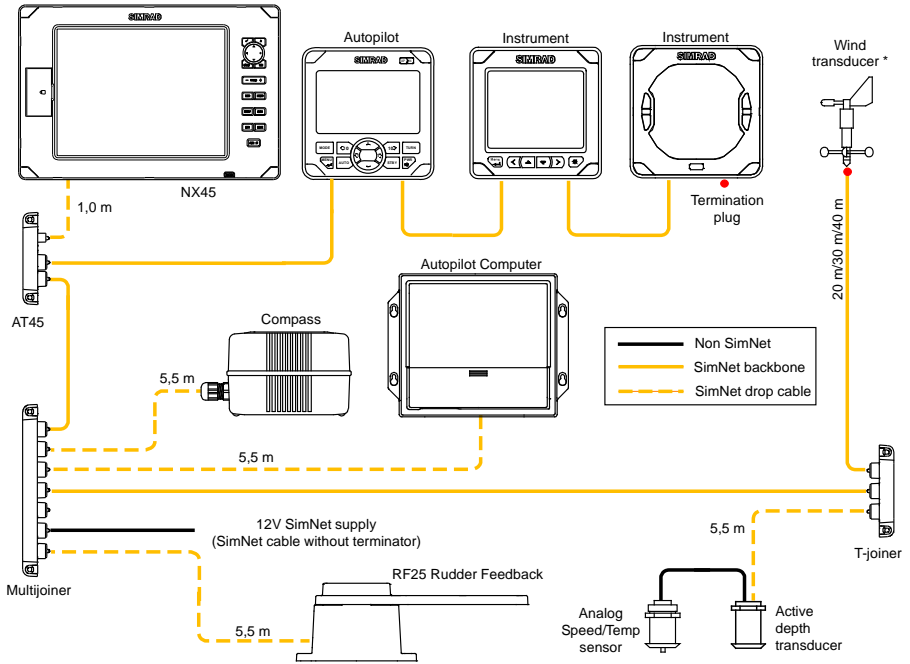


Figure 2-21 SimNet network, medium system

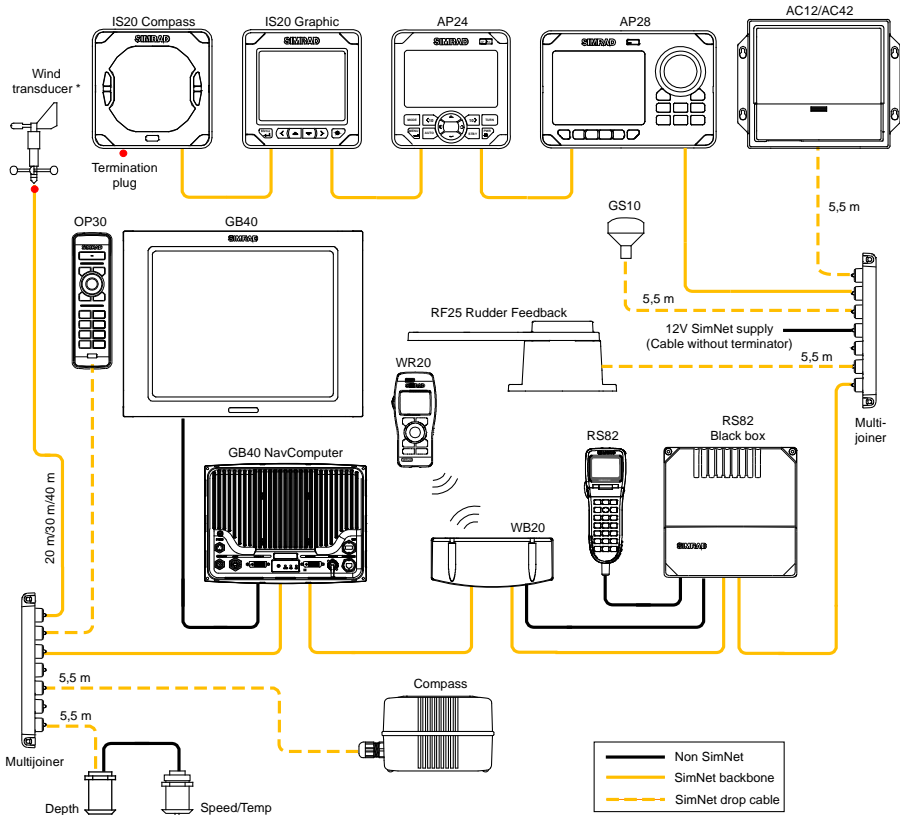


Figure 2-22 SimNet network, expanded system



1. Maximum total length of SimNet cables is 150 m (500 ft.)
2. Drop cables must not exceed 6 m (19 ft) of length and the total length of drop cables must not exceed 60 m (200 ft).
3. Equipment should not be daisy-chained in a drop cable.
4. The wind transducer (\*) has a built in terminator.

## 2.16 External alarm

The external alarm circuit has an open collector output for an external alarm relay or buzzer. The operating voltage for the circuit is the main supply voltage. Max. load on external alarm output is 0.75 Amp.

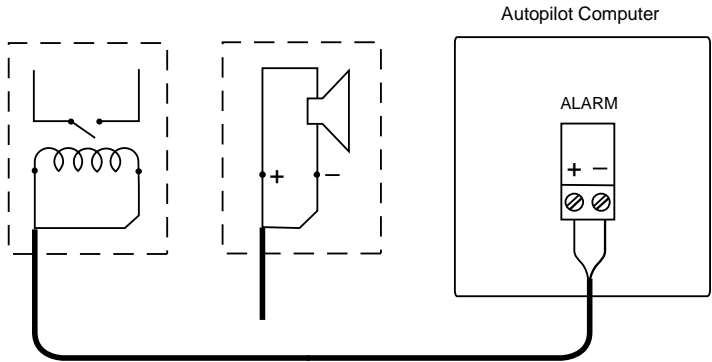


Figure 2-23 External alarm connection

## 3 Spare parts

### AP24 Control Unit

22096614	AP24 Control Unit
22096630	Mounting kit consisting of:
22095483	Cabinet corners (6)
44165181	Screw 3,5x19 (4)
24006355	SimNet blocking plug
22096820	Optional mounting bracket
24006355	SimNet blocking plug
22096515	AP24 Weather Cover

### AP28 Control Unit

22096622	AP28 Control Unit
22096630	Mounting kit consisting of:
22095483	Cabinet corners (6)
44165181	Screw 3,5x19 (4)
24006355	SimNet blocking plug
22096820	Optional mounting bracket
24006355	SimNet blocking plug
22096572	AP28 Weather Cover

### Autopilot Computers

22089841	AC12 Autopilot Computer
22097166	AC12 Installation accessories
22089858	AC42 Autopilot Computer
22097125	AC42 Installation accessories
22096986	Terminal cover
44161974	Fuse blade fast acting 15A/32V Blue (AC12)
44143022	Fuse blade fast acting 30A/32V Green (AC42)



### **FC40 Electronic Fluxgate Compass**

22090187	FC40 Fluxgate Compass w/accessories
22081442	Installation accessories consisting of:
20104972	Mounting plate (2)
44140762	Screw 3.5x25 (2)
44140770	Screw 30x9 (4)
22081376	Plug (2)
24006363	SimNet Cable, 5.5 m (18') with one plug

### **RC42 Rate Compass**

22090195	RC42 Rate Compass w/accessories
22081442	Installation Accessories Consisting of:
20104972	Mounting plate (2)
44140762	Screw 3.5x25 (2)
44140770	Screw 30x9 (4)
22081376	Plug (2)
24006363	SimNet Cable, 5.5 m (18') with one plug

### **RF300 Rudder Feedback Unit**

20193462	RF300 Rudder Feedback
20193454	Transmitter link
44133122	Transmitter rod M5x325mm
20193624	Ball joint Ass'y (2)

### **RF25 Rudder Feedback Unit**

22014302	RF25 Rudder Feedback
24005241	SimNet cable 5 m
20193454	Transmitter link
44133122	Transmitter rod M5x325mm
20193624	Ball joint Ass'y (2)

## **SimNet cables and accessories**

24005829	SimNet cable 0.3 m (1')
24005837	SimNet cable 2 m (6.6')
24005845	SimNet cable 5 m (16.6')
24005852	SimNet cable 10 m (33')
24006363	SimNet Cable, 5.5 m (18') with one plug
24005902	SimNet power w/termination 2 m (6.6')
24005910	SimNet power w/o termination 2 m (6.6')
24005729	SimNet cable to Micro-C. Adapter cable for SimNet products in a NMEA2000 network.
24005860	SimNet T-joiner (3p)
24006298	SimNet multijoiner (7p)
24005878	SimNet cable gland
24005886	SimNet protection plug
24006355	SimNet blocking plug
24005894	SimNet termination plug
24005928	SimNet cable protection cap
44172260	SimNet In-line joiner w/o termination
44172278	SimNet In-line joiner w/termination
24005936	AT10 Universal NMEA0183 converter
24005944	AT15 Active Tee w/connector, IS15
24006694	AT10HD Heading NMEA0183 converter
AS000469	AT40 NX40 Gateway
AA010169	AT45 NX45 Gateway

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## 4 Technical specifications

### 4.1 Autopilot System

Boat type and size: ..... Sail- and Motor boat (displacement and planning), up to 80 ft.\*

Steering system types: ..... Hydraulic, Mechanical

Inter-unit connection: ..... SimNet network

Maximum number of products connected in a network: ..... 50

System ON/OFF: ..... From control units

Supply voltage: ..... See system units

Power consumption: ..... Dependent on system configuration

EMC protection: ..... CE IEC60945 Fourth edition 2002-08

Automatic Steering control:

Rudder Drive: ..... Proportional rate or solenoid on/off

Parameter selection: ..... Automatic (Autotune) with manual override

Sea state control: ..... Adaptive sea state filter or manual

Language selection: ..... Dutch, English, French, German, Italian, Norwegian, Spanish, Swedish.

NMEA2000 interface: ..... Via SimNet port and SimNet/NMEA2000 adapter cable

Heading sensors:

Standard: ..... RC42 Rate Compass

Options: ..... FC40 Fluxgate compass

Rudder feedback units: RF25, RF300 (optional), LF3000 (optional)

Course Selection: ..... Push keys, Rotary knob (AP28)

Alarms: ..... Audible and visual, optional external

Alarm modes: ..... Off course, system failures, overload

---

\* Depending on hull and steering type, displacement and drive type, it may steer boats up to approximately 110 ft.

Steering modes: ..... Standby, Power steering, Auto, NoDrift, Nav, Wind, Wind<sub>NAV</sub>

Special Turn modes: ..... Tack, Gybe, U-Turn, C-Turn, Spiral, Zigzag, Square, Lazy S, Depth Contour Tracking DTC.

Instrument data page interface:

<b>Instrument screen</b>	<b>SimNet/NMEA2000 PGN*</b>
Heading	PGN127250, PGN130577
Rudder angle	PGN127245
Speed	PGN128259, PGN129026, PGN130577
Depth	PGN128267
Wind angle, speed and direction	PGN130306
Position	PGN126992, PGN127250, PGN127258, PGN129025, PGN129026, PGN129029, PGN129033, PGN130577
NAV	PGN129283, PGN129284, PGN129285, PGN129029, PGN129291
Log	PGN128275
Sea temperature	PGN130310, PGN130311

\* Parameter Group Number

## 4.2 AP24 Control Unit

Dimensions: ..... See Figure 4-1  
 Weight: ..... 0,3 kg (0,7 lbs)  
 Material: ..... Front: Black ABS+PC, Back: Dark gray ABS+GF  
 Supply and interface: ..... 8-16V via SimNet  
 Power consumption ..... 1,2 W  
 SimNet Network load factor (NL): ..... 2  
 SimNet ports (input/output): ..... 2  
 Display:  
     Type: ..... Backlit LCD matrix display  
     Resolution: ..... 130 x 79 pixels  
     Illumination (Red or white): ..... Adjustable in 10 steps  
 Safe distance to compass: ..... 0.3 m (1.0 ft.)  
 Environmental Protection: ..... IP56 from front, IP43 from back  
 Temperature:  
     Operating: ..... 0 to +55 °C (+32 to +130 °F)  
     Storage: ..... -30 to +70 °C (-22 to +158 °F)

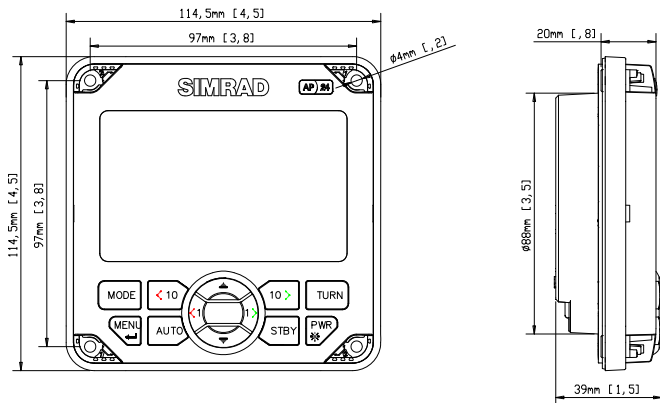


Figure 4-1 AP24 Control Unit – dimensions  
 (Mounting bracket is optional equipment)

### 4.3 AP28 Control Unit

- Dimensions: ..... See Figure 4-2
- Weight: ..... 0,5 kg (1.1 lbs)
- Material: ..... Front: Black ABS+PC, Back: Dark gray ABS+GF
- Supply and interface: ..... 8-16V via SimNet
- Power consumption ..... 1,7 W
- SimNet Network load factor (NL): ..... 3
- SimNet ports (input/output): ..... 2
- Display:
  - Type: ..... Backlit LCD matrix display
  - Resolution: ..... 130 x 104 pixels
  - Illumination (Red or white): ..... Adjustable in 10 steps
  - Safe distance to compass: ..... 0.3 m (1.0 ft.)
  - Environmental Protection: ..... IP56 from front, IP43 from back.
  - Temperature:
    - Operating: ..... 0 to +55 °C (+32 to +130 °F)
    - Storage: ..... -30 to +70 °C (-22 to +158 °F)

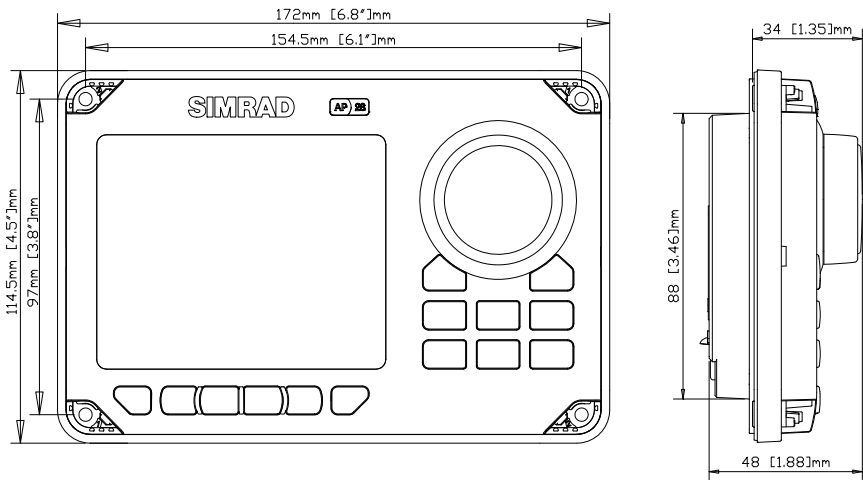


Figure 4-2 AP28 Control Unit – dimensions  
(Mounting bracket is optional equipment)

## 4.4 Autopilot Computers

Dimensions:	See Figure 4-3 and Figure 4-4
Weight:	
AC12	1,3 kg (2,9 lbs.)
AC42	2,8 kg (6,2 lbs)
Material:	Anodized aluminum and black ABS
SimNet supply and interface:	8-16V via SimNet
Supply voltage: AC12/AC42	12-24V DC
Power consumption:	5 W (electronics) 0,5 W (SimNet)
SimNet Network load factor (NL):	1
SimNet ports (input/output):	1
Clutch/bypass current:	0,6 mA - 3 A
Reverse voltage indication:	Yes
Motor / solenoid drive:	
AC12:	8 A continuous, 16 A for 1 sec. peak
AC42:	30 A continuous, 50 A for 1 sec. peak
Heading Sensor input:	SimNet/NMEA2000 PGN127250, PGN130577
NFU control input:	Yes
Rudder feedback input:	SimNet/NMEA2000 PGN127245
Optional rudder feedback input:	Frequency signal, 3400 Hz, 20 Hz/deg.
Solenoid output:	AC12 only
External Alarm:	Open collector
Temperature range:	
Operation:	0 to +55 °C (+32 to +130 °F)
Storage:	-30 to +70 °C (-22 to +158 °F)
Mounting:	Bulkhead mount



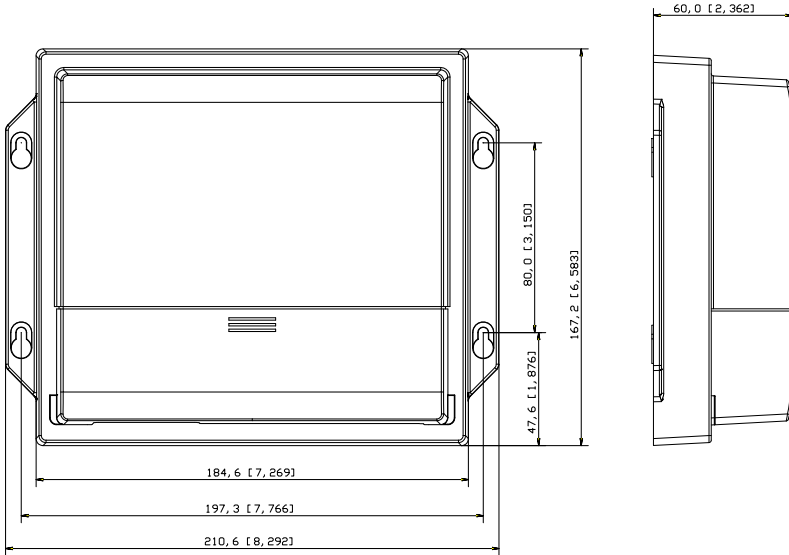


Figure 4-3 AC12 Autopilot Computer - Dimensions

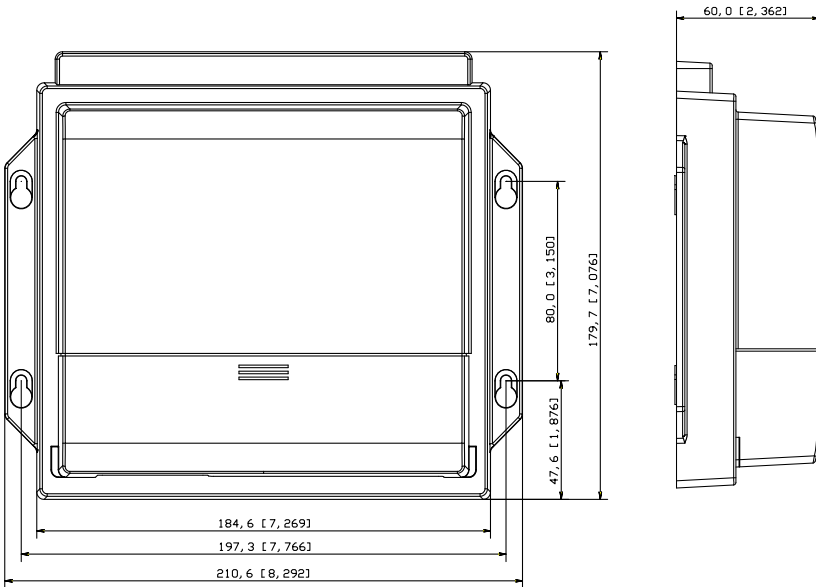


Figure 4-4 AC42 Autopilot Computer – Dimensions

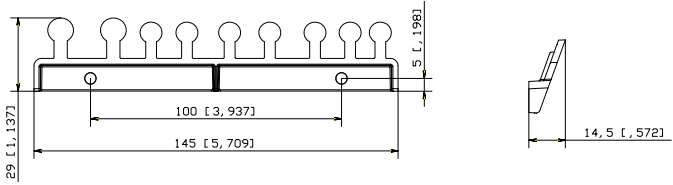


Figure 4-5 AC12/AC42 Cable retainer

## 4.5 FC40 Fluxgate Compass

Dimensions: ..... See Figure 4-6

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

Material: ..... Black ABS

Environmental Protection: ..... IP56

Temperature range:

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

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

Supply and interface: ..... 8-16V via SimNet

Power consumption: ..... 1,4 W

SimNet Network load factor (NL): ..... 3

SimNet ports (input/output): ..... 1

Cable supplied: ..... 5.5 m (18') SimNet cable with connector

Mounting: ..... Deck or bulkhead

Automatic Performance:

Calibration: ..... Automatically activated from control head

Gain control: ..... Automatically adjusted continuously

Deviation control: ..... Automatic

Static Performance:

Roll/Pitch: .....  $\pm 35^\circ$

Accuracy: .....  $\pm 3^\circ$  after calibration

Repeatability: .....  $\pm 1.0^\circ$

Dynamic Performance:

With random excitation of  $\pm 10^\circ$  at max. 1 Hz:

Heading error  $< 5^\circ$

With heading step input of  $90^\circ$  at a rate of  $10^\circ/\text{s}$ :

Heading error 10 sec after turn  $< 5^\circ$

Output signal: ..... PGN127250

NMEA2000 compliant

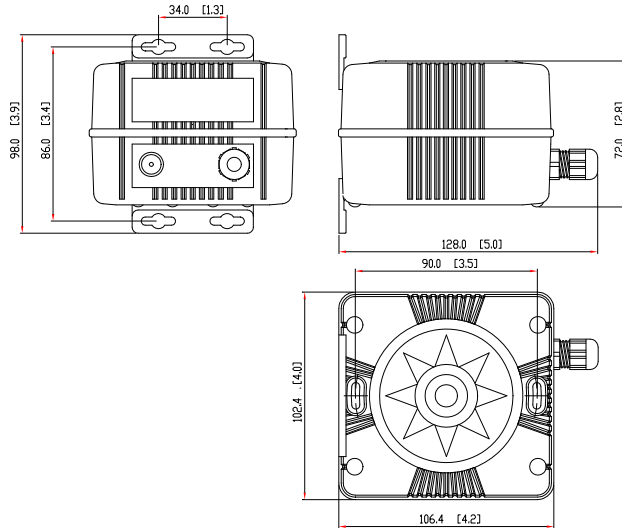


Figure 4-6 FC40 Fluxgate Compass - Dimensions

## 4.6 RC42 Rate Compass

Dimensions: ..... Same as FC40. See Figure 4-6

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

Material: ..... Off-white ABS

Environmental Protection: ..... IP56

Temperature range:

Operation: ..... 0 to  $+55^\circ\text{C}$  ( $+32$  to  $+130^\circ\text{F}$ )

Storage: .....  $-30$  to  $+70^\circ\text{C}$  ( $-22$  to  $+158^\circ\text{F}$ )

Supply and interface: ..... 8-16V via SimNet

Power consumption: ..... 1,4 W  
 SimNet Network load factor (NL): ..... 3  
 SimNet ports (input/output): ..... 1  
 Cable supplied: ..... 5.5 m (18') SimNet cable with connector  
 Mounting: ..... Deck or bulkhead  
 Automatic Performance:  
     Calibration: ..... Automatically activated from control head  
     Gain control: ..... Automatically adjusted continuously  
     Deviation control: ..... Automatic  
     Heading output: ..... Rate sensor stabilized  
 Static Performance:  
     Roll/Pitch: .....  $\pm 35^\circ$   
     Accuracy: .....  $\pm 3$  degrees after calibration  
     Repeatability: .....  $\pm 1.0^\circ$   
 Dynamic Performance:  
     With random excitation of  $\pm 10^\circ$  at max. 1 Hz:  
         Heading error  $< 2^\circ$   
     With heading step input of  $90^\circ$  at a rate of  $10^\circ/\text{s}$ :  
         Heading error 10 sec after turn  $< 2^\circ$   
 Output signal ..... PGN127250, 127251  
 NMEA2000 compliant

## 4.7 RF300 Rudder Feedback

Dimensions: ..... See Figure 4-7 and Figure 4-8.  
 Weight: ..... 0,5 kg (1,1 lbs)  
 Material: ..... Arnite T06 200 PBT  
 Environmental Protection: ..... IP56  
 Temperature range:  
     Operation: .....  $-25$  to  $+55^\circ\text{C}$  ( $-13$  to  $+130^\circ\text{F}$ )  
     Storage: .....  $-30$  to  $+70^\circ\text{C}$  ( $-22$  to  $+158^\circ\text{F}$ )  
 Mounting: ..... Horizontal, vertical, or upside down

Cable supplied: ..... 10 m (33 ft.) twisted pair shielded cable

Rudder angle: .....  $\pm 90^\circ$

Output signal: ..... Polarity independent two wire frequency signal

Frequency resolution: ..... Centre: 3400 Hz, 20 Hz/degree of change

Linearity: .....  $\pm 3^\circ$  up to  $45^\circ$  of rudder

Transmitter link: ..... Stainless 345 mm (13.6") with 2 ball joints.

Ball joint stud for rudder arm requires 4.2 mm diameter hole and 5 mm tap.

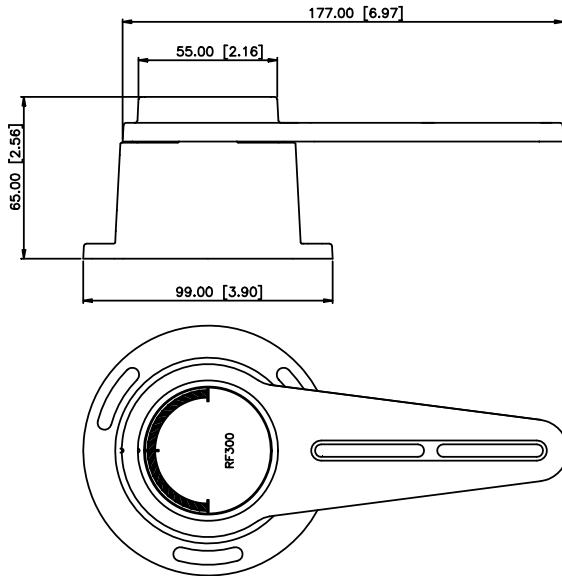


Figure 4-7 Rudder Feedback - Dimensions

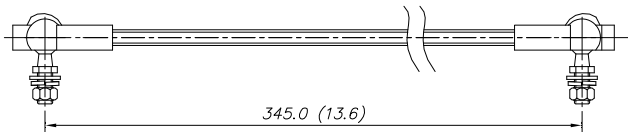


Figure 4-8 Transmitter link - Dimensions

## 4.8 RF25 Rudder Feedback

Dimensions: ..... See Figure 4-7 and Figure 4-8.  
Weight: .....0,5 kg (1,1 lbs)  
Material: ..... Arnite T06 200 PBT  
Environmental Protection: ..... IP56  
Temperature range:  
    Operation: ..... -25 to +55 °C (-13 to +130 °F)  
    Storage: ..... -30 to +70 °C (-22 to + 158 °F)  
Mounting: ..... Horizontal, vertical, or upside down  
Supply and interface: ..... 8-16V via SimNet  
Power consumption: ..... 0,4 W  
SimNet Network load factor (NL): ..... 1  
SimNet ports (input/output): ..... 1  
Cable supplied: ..... 5,5 m (18') SimNet cable with connector  
Rudder angle: ..... ±120 degrees  
Output signal: ..... SimNet/NMEA2000 PGN127245  
    Accuracy: ..... ±0.7°  
    Repeatability: ..... ±0.1°  
Transmitter link: ..... Stainless 345 mm (13.6") with 2 ball joints.  
    Ball joint stud for rudder arm requires  
    4.2 mm diameter hole and 5 mm tap.  
NMEA2000 compliant

## 4.9 R3000X Remote Control

Dimensions: ..... See Figure 4-9  
Weight: .....0,4 kg (0,9 lbs)  
Material: ..... Epoxy coated aluminum  
Environmental Protection ..... IP56  
Safe distance to compass: ..... 0.15 m (0.5 ft.)  
Temperature range:  
    Operation: ..... -25 to +55 °C (-13 to +130 °F)  
    Storage: ..... -30 to +70 °C (-22 to + 158 °F)

Cable length: .....7 m, shielded  
 Mounting bracket: ..... Supplied

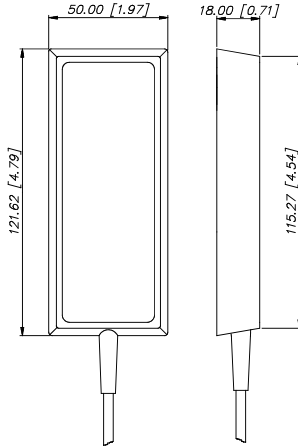


Figure 4-9 R3000X - Dimensions

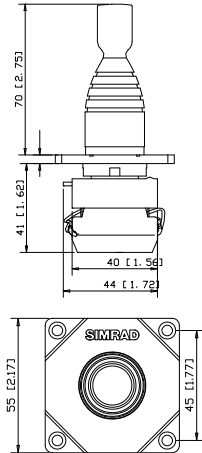


Figure 4-10 JS10 Joystick Dimensions

## 4.10 JS10 Joystick

Dimensions: ..... See Figure 4-10  
 Weight: .....0.5 kg (1.1 lbs.)

Environmental Protection:

Joystick ..... IP66

Terminals ..... IP20

Safe distance to compass: ..... 0.15 m (0.5 ft.)

Temperature range:

Operation: ..... -25 to +70 °C (-13 to +158 °F)

Storage: ..... -40 to +70 °C (-40 to +158 °F)

Mounting: ..... Panel-mount

Cable: ..... 10 meters (33 ft.)

Shock resistance (according to MIL 202 B method 202 A):

1/2 sinusoid 11 ms: No damage or disassembling at 100g

Vibration resistance (according to IEC 68-2-6):

16 g with frequency range from 40 to 500 Hz and maximum shifting 0,75 mm (peak -to- peak)

## 4.11 SimNet

Maximum number of products connected in a network: ..... 50

Maximum cable length: ..... 150 m (500')

Bit rate of the bus: ..... 250 Kbit/second

Maximum DC current through a single SimNet plug..... 5A

SimNet power supply: ..... 12VDC

Maximum drop cable length: ..... 6 m (20')

Maximum total length of all drop cables (accumulated): 60 m (200')

Environmental protection: Cable and plug/connector system IP66

Maximum temperature: ..... 70 °C (158 °F)

## 4.12 IP protection

Each part of a Simrad autopilot system has a two digits IP protection code.

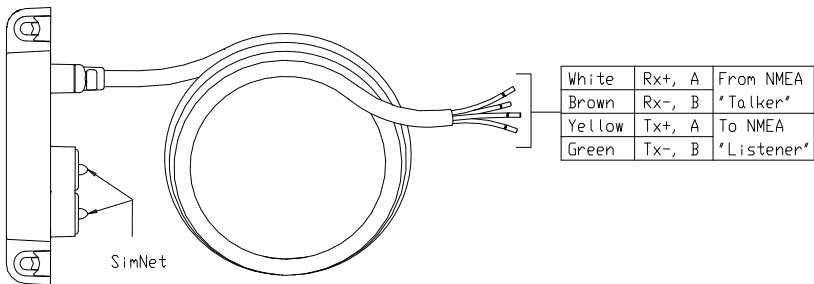
The IP rating is a method to classify the degree of protection against solid objects, water ingress and impact afforded by electrical equipment and enclosures. The system is recognized in most European countries and is set out in a number of British and European standards.

The first code number describes the protection against solid objects, and the second number describes the protection against liquids.



	<b>FIRST NUMBER</b> Protection against solid objects		<b>SECOND NUMBER</b> Protection against liquids
IP	TESTS	IP	TESTS
0	No protection	0	No protection
1	Protection against solid objects up to 50 mm, e.g. accidental touches by hands.	1	Protected against vertically falling drops of water (e.g. condensation).
2	Protection against solid objects up to 12 mm, e.g. fingers.	2	Protected against direct sprays of water up to 15° from the vertical.
3	Protection against solid objects over 2.5 mm (tools + wires)	3	Protected against sprays to 60° from the vertical.
4	Protection against solid objects over 1 mm (tools + wires + small wires)	4	Protected against water sprayed from any direction.
5	Protection against dust - limited ingress (no harmful deposit)	5	Protected against low pressure jets of water from all directions - limited ingress permitted.
6	Totally protected against dust	6	Protected against strong jets of water, e.g. for use on ship decks - limited ingress permitted.
		7	Protected against the effects of immersion between 15 cm and 1 m.
		8	Protected against long periods of immersion under pressure.

### 4.13 AT10 SimNet/NMEA0183 converter



Data converted from SimNet/NMEA2000 to NMEA0183 (TX) and vice versa (RX).

NMEA0183 sentence	TX (max rate [Hz])	RX
APB	0.5	x
BWC	0.5	x
BWR		x
DBT		x
DPT	0.5 1 <sup>1)</sup>	x
GGA		x
GLL	0.5 <sup>2)</sup>	x
HDG	4	x
HDM		x <sup>2)</sup>
HDT	4	x
HSC	0.1	
MTW	0.2	x
MWV Relative Wind	1	x
MWV True Wind	1	x
RMA		x
RMB	0.5	x
RMC	0.5	x
RSA	3.33	
VHW	0.5	x
VTG	0.5	x
VLW	0.2 0.5 <sup>1)</sup>	x
VWR		x
WPL		x
XTE		x
ZDA	0.5	x
ZTG		x

Open cells indicates no transmission or reception.

<sup>1)</sup> Applies only for units with P/N – S/N code AA

<sup>2)</sup> Applies for units with P/N – S/N code BA onwards



## 5 Index

### A

autopilot computer  
  installation, 11  
  specifications, 39

### C

cable  
  specifications, 11  
control unit  
  specifications, 37, 38

### D

drive unit  
  hydraulic pumps, 18  
  linear drive, 18

### E

external alarm, 30

### F

fluxgate compass  
  specifications, 41

### G

grounding, 13

### I

interfacing, 25  
IP protection code, 47

### N

NMEA0183, 49  
NMEA2000, 49

### P

polarity, 13

### R

remote control  
  specifications, 46  
rudder feedback  
  installation, 14  
  specifications, 43, 45

### S

SimNet, 26  
specifications, 35  
steering lever  
  installation, 25  
system  
  specifications, 35

### T

terminal board, 13

### V

virtual feedback, 8

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AP24/AP28 with AC12/AC42 Autopilot Computer manual EN, Doc.no.20222568



Master the Elements