SILVA 4000

WIND INSTRUMENT

Directions for use

CONTENTS

PLEASE NOTE

Silva instruments are designed for long and reliable performance.
In order to get the greatest pleasure and use from the instrument please,

1. Read the manual 2. Follow the manual

Calibration values for the mast top unit

The enclosed label is used for identification of the mast top unit. The values **H L U c** and **d** given, should be set according to the handbook, chapter 2.

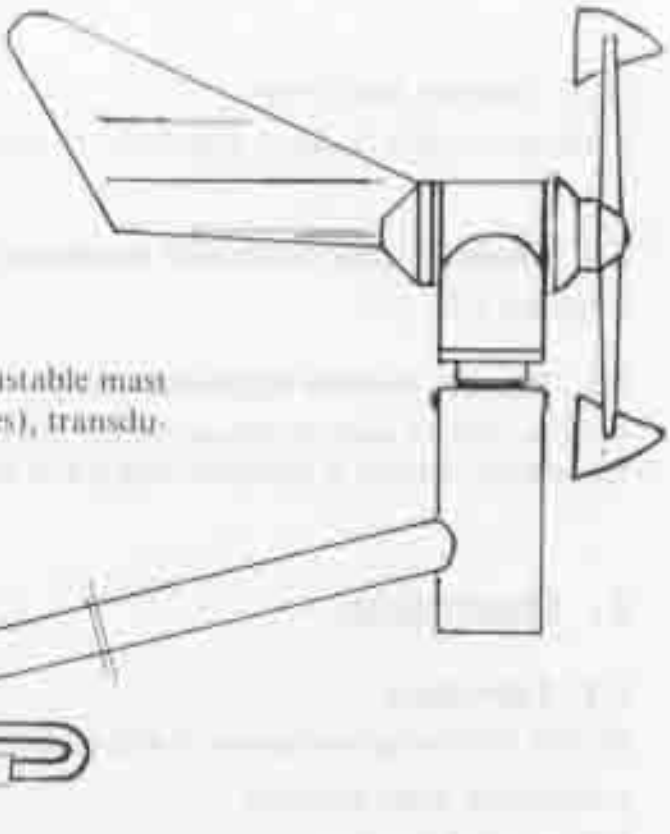
The mast top unit serial number is marked on the side of the propeller housing.

1. Description of components incorporated in the SILVA 4000

The Silva 4000 wind instrument consists of the following components:
Instrument, mast top unit, mast cable and instrument cable.
As optional extras: Log transducer, through deck connector and remote control.
(Owners of any Silva knotmeter can use their existing transducer to prevent accidental removal.)

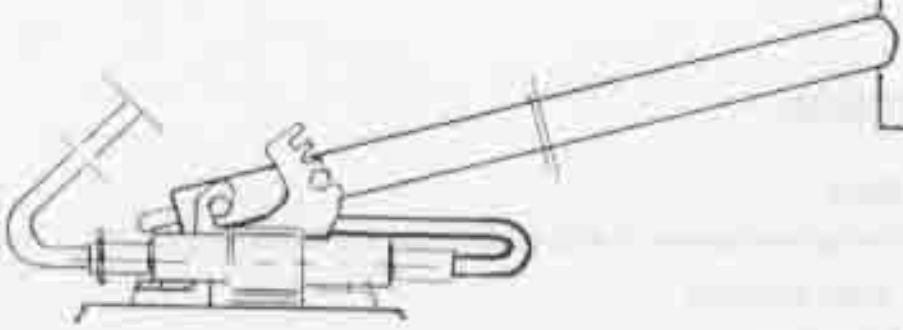
1.1. Instrument housing

The instrument is moulded in tough, weatherproof plastic. At the front, there are push-buttons and a window containing an LCD-display. These are all waterproof.



1.2. Mast top unit

The mast top unit consists of an adjustable mast top fitting (for various mast top angles), transducer unit and mast cable.



1.3. Log transducer (optional extra)

The log transducer consists of a transducer, through hull fitting and dummy plug.

1.3.1. Paddle wheel log transducer

The transducer consists of a transducer-plug with handle and a paddlewheel with axle. Two O-rings provide a tight seal between the plug and through hull fitting.

1.3.2. Dummy plug

When the paddle wheel is removed, it is replaced by the dummy plug. It also has two O-rings, to provide a good seal.

1.3.3. Through hull fitting

A safety clamp is supplied with both the plug and transducer.

1.4. Through deck connector (optional extra)

See point 3.4.

1.5. Remote control (optional extra)

With the remote control connected, the wind instrument can be operated at a distance. The remote control is provided with a 6 m cable.

2. Operation

2.1. Indication

SILVA 4000 wind instrument is able to indicate the following values:

- Apparent wind direction
- True wind direction *
- Apparent wind speed *
- Close hauled reference line
- VMG (Velocity Made Good) *

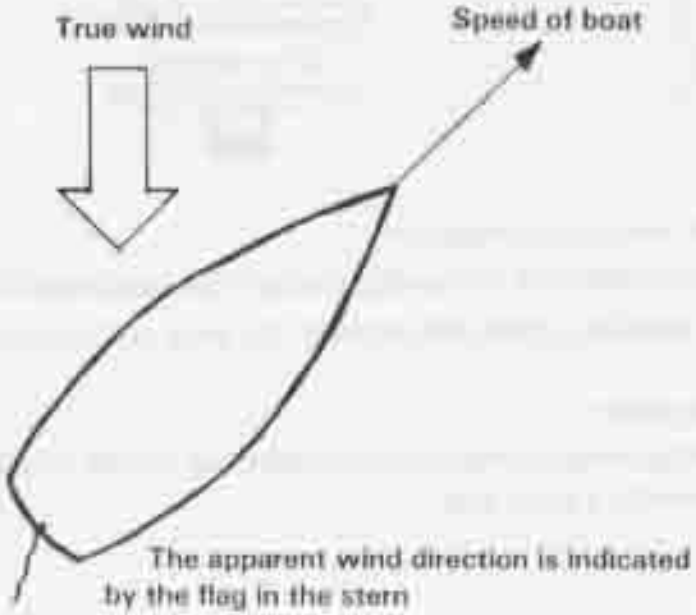
* Available when interfaced with log transducer

A short explanation af these aspects is given below.

- *Apparent and true wind (Relative to the boat)*

A stationary wind instrument measures true wind direction and true wind speed.

A wind instrument mounted on a boat which is moving through the water, measures *apparent wind direction* and *apparent wind speed* (see diagram below). The boat is moving at a certain speed and at a certain angle to the wind, therefore the boat's direction and velocity have an affect on the readings. It ''feels'' different than the true wind strength and direction, thus the term ''apparent wind'' and ''true wind''.



The combined effect of the TRUE wind speed and the boat speed produces the APPARENT wind speed. The wind instrument measures the apparent wind direction and wind speed. By measuring the speed of the boat, the true wind direction and the wind speed relative to the boat, can be calculated.

This is what the instrument shows:

The analog scale shows apparent and true wind direction simultaneously. *The true value reading requires that the log transducer must be connected.*

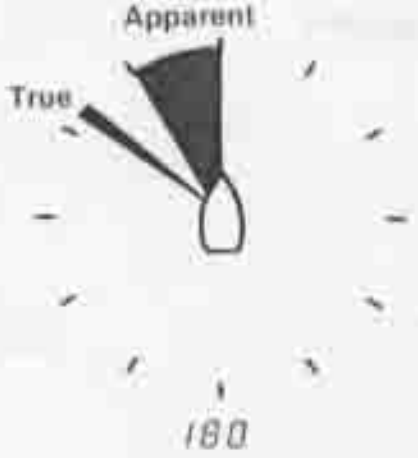
The wind speed is continually shown by digits. The choice between true and apparent display (TRUE and APP) is made with a pushbutton.

It is worth mentioning at this point, the advantage of knowing the true values. Setting of sails, hauling home the sheets and steering are influenced by the apparent wind. If the boat is going to change course, the conditions for the new course can be calculated in advance. Knowledge of the true wind can influence decisions on course and sail-setting, making it possible for the boat to be sailed faster and more safely.

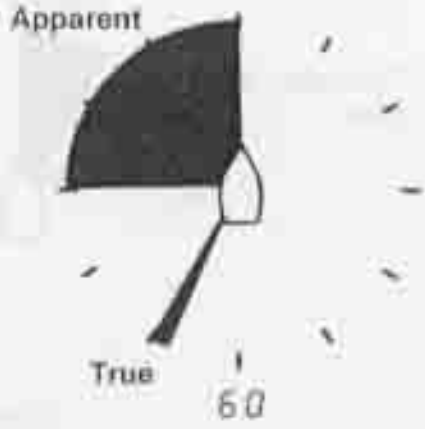
The scale shows either the wind direction from a full 360 degrees view, or from a close resolution 0—60 degrees. The selection is made with the upper pushbutton and is indicated by the figure 180 or 60 at the lower edge of the scale.

A 60 degree close resolution gives a more accurate and sensitive reading while beating to windward or when sailing broad to the wind. When reaching the wind angle is indicated relatively the boat's stern.

CLOSE HAULED

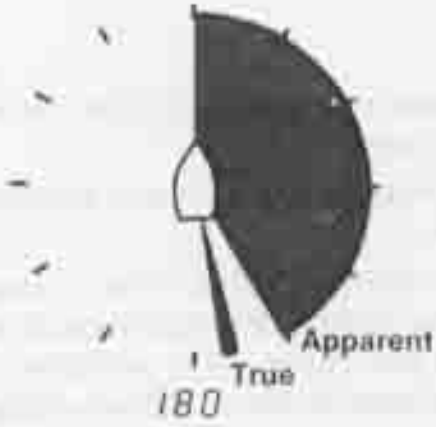


CLOSE HAULED
Apparent wind direction
30° port
True wind direction 50°

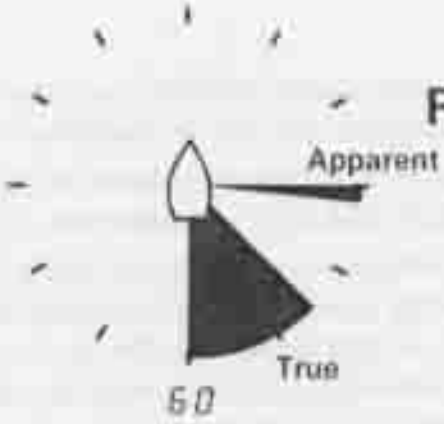


CLOSE HAULED
Apparent wind direction
30° port
True wind direction 50°

REACHING



REACHING
Apparent wind direction
150° starboard
True wind direction 165°



REACHING
Apparent wind direction
30° from the stern
True wind direction 15°
from the stern
Observe that the angle
is indicated relatively, astern

RUNNING

RUNNING
(at jybe risk, the indication
flickers from one side to the other)

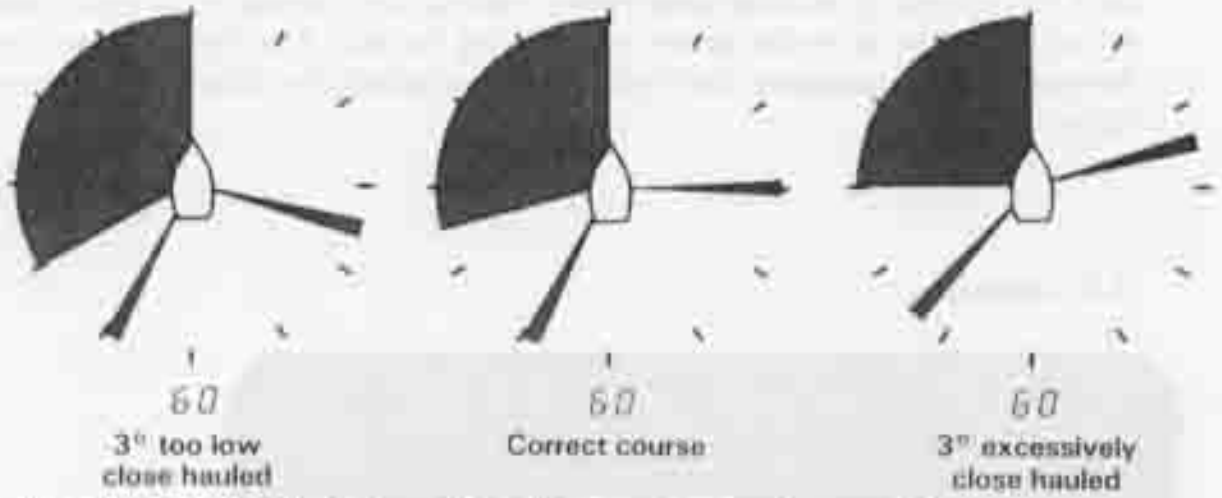
• *Close hauled reference line*

When the 60 degree close resolution indication is selected, adjustable reference lines are shown opposite the display of wind direction. These can be set to correspond to the boat's optimal close hauled angle. Therefore they will be different for various boats and under varying conditions.

When steering close hauled you know immediately if you are either too high (too close) or to low (too far away). This facilities the steering essentially, especially during the night.

When the actual and required close hauled angles correspond to each other, the reference line is horizontal. Any change in that angle will cause the reference line to move up or down.

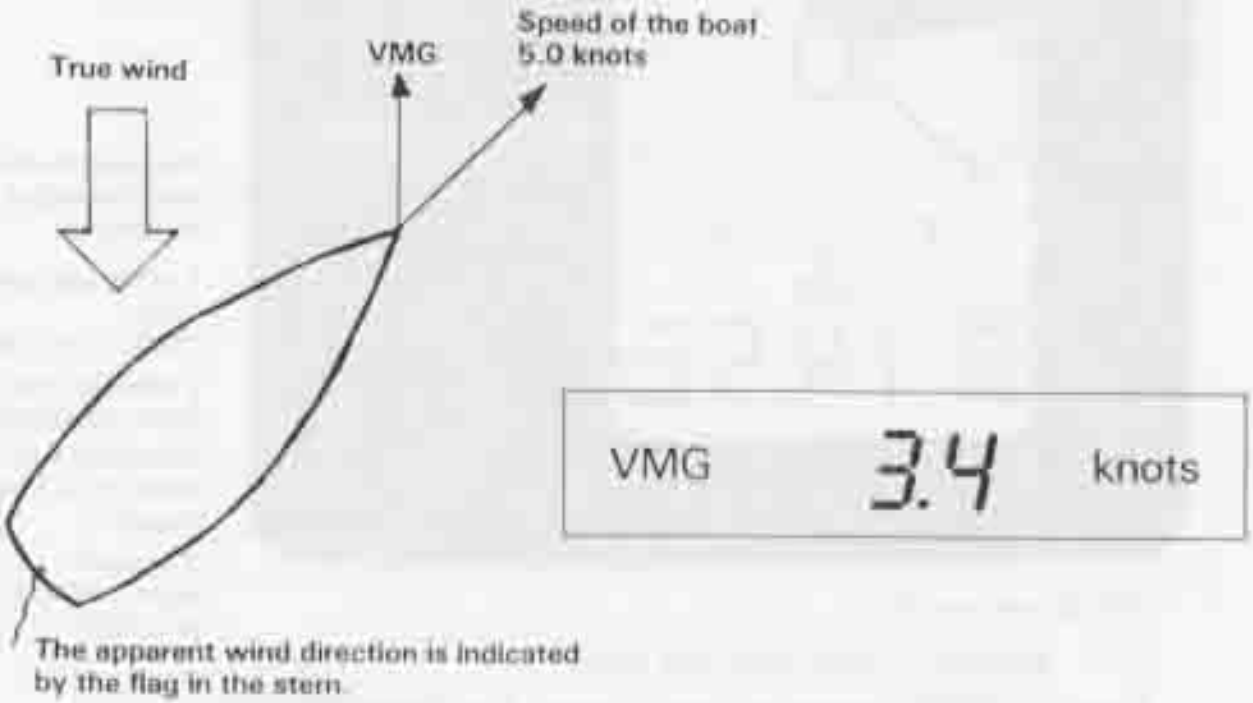
In the example below, the required close hauled angle has been set at 35°.



The reference line disappears when the normal range is exceeded.

• *VMG (Velocity Made Good — Effective speed)*

This refers to the speed of the boat towards the wind (when sailing close hauled) or from the wind (when reaching or running).



If the boat is steered too close to the wind, distance is gained but speed is lost. If the boat is steered too far off close hauled, speed is gained but distance is lost. Similar conditions apply when running with the wind. Only one angle gives an optimum speed into the wind or running with it.

If the boat is steered so that the maximum VMG is attained, it is being sailed as efficiently as possible i.e. with the correct angle to the wind.

It is important to note that luffing up beyond close hauled can give a deceptively high VMG for a moment or so because the momentum of the boat keeps the speed up briefly while the angle is reduced. VMG-measurements should therefore be taken while making small rudder adjustments and for reasonable periods of time so that true values are obtained.

Properly used the VMG-function is an invaluable aid. We recommend yachtmen to use the VMG accurately on close haule during training, then, having set the right close hauled reference line as per the above, use it during the race. For those who wish to tack downwind under spinnaker, the VMG is extremely helpful for determining the most efficient angles.

2.2. Operation

This pushbutton changes between indication of 0–180° and 0–60° wind angle.

This pushbutton controls the digital indication:

1 press and hold:
Select
TRUE, VMG, APP

2 presses and hold:
Select dampening

3 presses and hold:
Select m/s, knots, Beaufort

4 presses:
Begin calibration procedure

This is how you do it:

2.2.1. Selection of wind speed and VMG

Press the SPEED button and hold it down. The display then indicates:

→ TRUE → VMG → APP

Release the button when the required symbol is shown.

Depress the ANGLE button and the instrument returns to desired display. This occurs automatically after approx. 8 seconds.

2.2.2. Setting of damping constant

Depress the SPEED button twice. The second time keep the button depressed.

The display shows → 6 → 20 → 2

Release the button when the required damping constant is shown.

Press the ANGLE button and the instrument returns to the normal display. This occurs automatically after approx 8 seconds.

For normal sailing, a 2-seconds damping period is recommended. For open sea conditions where the rolling of the boat in the waves can influence the accuracy of the reading, 6 or 20 second damping period is used.

2.2.3. Selection of m/s, knots or Beaufort

Depress the SPEED button 3 times. The third time, hold the button down.

The display shows → m/s → knots → Beau

Release the button when the desired unit is shown.

Depress the ANGLE button. The instrument returns to the normal display. This occurs automatically after approx 8 seconds.

Practise this so you will not forget it. For a reminder place the function sticker on the bulkhead below the display!

If the helmsman is to control the instrument and can not reach it easily, we recommend our remote control panel, which is available as an option (Art. No 2002).

2.3. Calibration of the masthead unit

The calibration values are set with the push buttons. This normally only needs to be done when the instrument is being installed for the first time. The values are stored in the instrument, even if the power is shut off. To prevent unintentional alteration of the calibration values, a special procedure must be followed.

If this procedure is started in error, the normal display can be regained by pressing the "ANGLE" button.

2.3.1. Procedure

Press the "SPEED" button four times. The display shows P00 and nothing else.

Press the "SPEED" button again and run the display to P91

The display advances 5 steps slowly, then proceeds rapidly. For the final few digits before "P91", push the "SPEED" button repeatedly for single digit advancement.

P91 is the "key" that opens the calibration routine.

2.3.2. Selection of calibration values

Press and hold the "ANGLE" button. The display runs as follows:

A C E F H L U c d h n r u

Release the button when the required letter is shown.

2.3.3. Alteration of calibration values

Press and hold the "SPEED" button. The calibration values advance. Release the button when the required value is shown.

The instrument returns to normal display when all the letters have been displayed in accordance with instruction 2.4.

The values to be given to each letter are listed in instruction 2.4. READ ON! This is where your Silva 4000 is truly customised for optimal performance on your boat.

2.4. Masthead unit. Calibration values

The letter indicates the function being calibrated.

2.4.1. A and C

A = degrees in multiples of ten

C = degrees in tenths of a degree

If the unit is aimed precisely forward no compensation should be done

(A and C = 00)

To determine any error of alignment of the mast head, choose a totally calm day and motor at full speed. The reading of the wind angle should be "0". Any other reading to starboard or to port is an alignement error. This error can be adjusted electronically through your Silva 4000.

Example:

Assume that the unit is at 45° to starboard. The compensation figure displayed would therefore be 45.

A is set at 04: A04 = 40°

C is set at 50: C50 = 5°

result = 45°

If the unit is at 45° to port, the corresponding compensation will be 315 (360—45).

The compensation covers the whole circle, which means that the mast top unit can be pointed in any direction.

2.4.2. Calibration of the log transducer

E E00 = —50 %

E50 = no calibration

E99 = +49 %

Disconnect the mast top unit

Adjust the instrument so that VMG is shown and set the E-value so that the VMG-speed is the same as the log's speed. The log must first be calibrated of course. Connect the mast top unit again.

2.4.3. Calibration of wind speed

F

This is normally already set by the factory.
The value for a mast top unit with "straight" propeller = 84.
The value for a mast top unit with "Delta" propeller = 70.

2.4.4. Calibration of mast top unit

H L U c d

These values should be set in accordance with the sticky label which is enclosed in the handbook. This should ensure that every instrument obtains the best possible accuracy.

For rough adjustment H L and U are set at 50. c and d at 00.

2.4.5. Adjustment of the close hauled reference line

h

Every numeral corresponds to 1 degree.

If it is desired that the reference line should be set at e.g. 30°, the corresponding figure is set on the numeral display.

Observe that the line will always be horizontal when the desired and true tacking angle are the same. The line is moved upwards or downwards depending on whether the boat is being sailed too close hauled or not close hauled enough.

If the optimum tacking angles are different at port and starboard tacks, this can be adjusted by using the C-function. This will make the close haul reference lines agree at both tacks.

If the value is set at 00 the function is disconnected and will not appear on the display.

2.4.6. Other letters

n, r and u are not used.

3. Installation

3.1. Mounting of the instrument housing

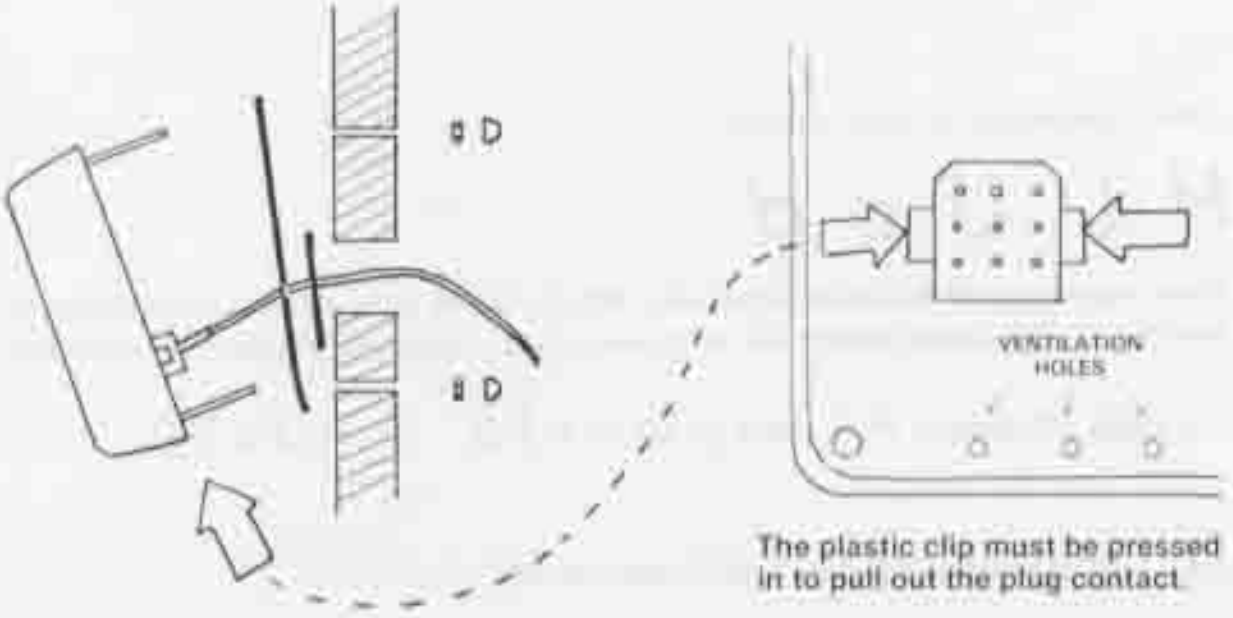
After drilling holes as per the enclosed drill template, the instrument is then mounted with the bolts and plastic nuts. The supplied gasket is used for sealing between the instrument and the bulkhead.

IMPORTANT! *Do not block the rear cover or instrument case ventilation holes with the gasket or any sealing compound you may use.*

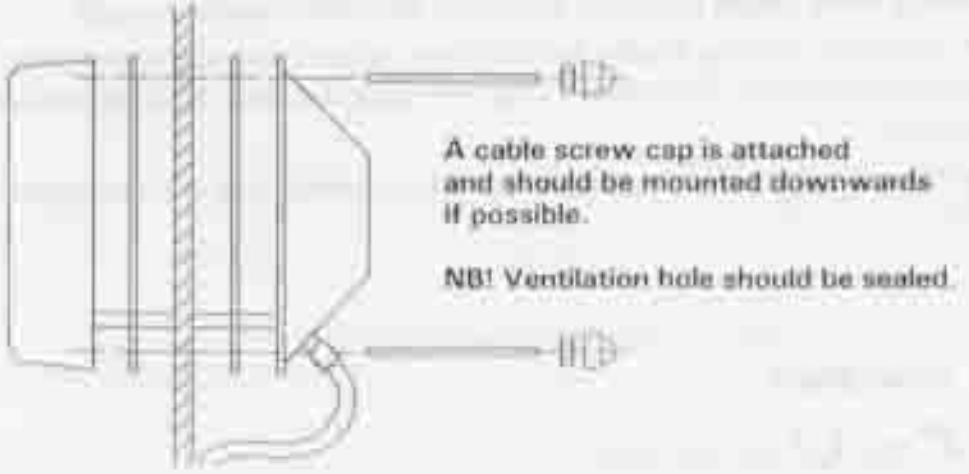
To avoid condensation on the instrument glass:

Make sure that a good seal is obtained where the instrument cable passes through the bulkhead so that no humidity can enter the instrument from the cabin.

This could cause condensation on the instrument glass.



If there is risk of water or humidity passing through to the instrument housing via the cable hole, this can be prevented with the Silva back cover, available as an option (part No 8935).



3.2. Mast top unit

3.2.1. Mast fitting

The three grooves in the fitting's front edge are intended for use on mast tops with a standard rake, i.e. 15° and 25°. If the mast top is not raked at one of these angles, a wedge-shaped piece must be made, to fit the mast fitting.

The mast fitting is fastened on the mast head with screws or rivets. 2M16 × 12 screws and 2 lock nuts are supplied. If the mast top is made of cast aluminium, it is a good idea to cut threads in the hole. If this is done, the screws should be secured with Loctite or a similar substance.

3.2.2. Transducer unit

The transducer unit must be mounted so that the propeller is vertical when the rig's backstay is fully tensioned. Choose the correct slot in the mast head bracket to ensure that this alignment is correct. The transducer unit and mast fitting is secured with lock nuts.

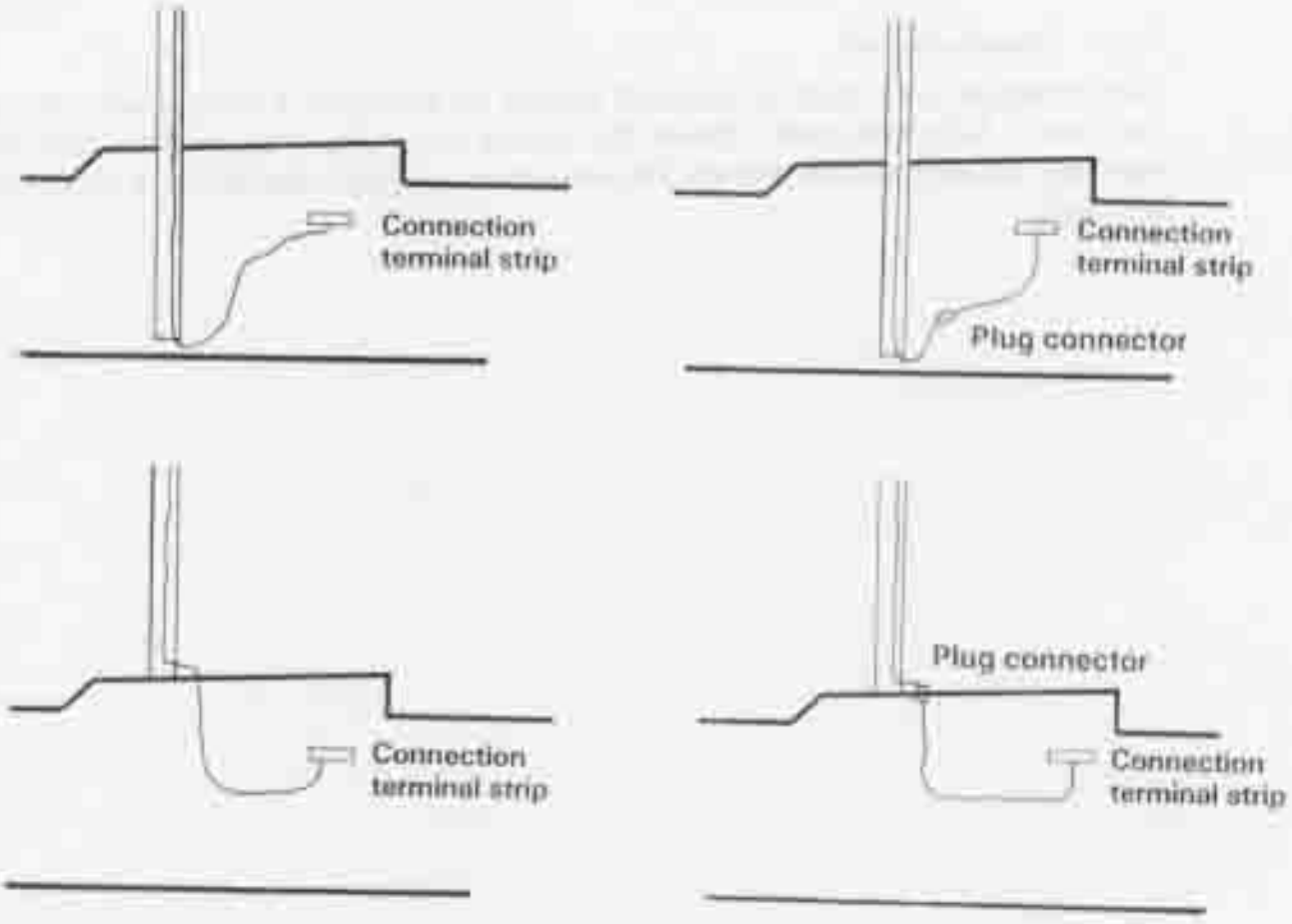
3.3. Mast cable

The 22 m long mast cable is fitted with a waterproof connector, which fits a socket in the mast top unit.

The connector units are pressed firmly together.

The mast cable must be drawn down inside the mast. The boat builder should be contacted concerning this. Ideally, conduit is already installed inside the mast for this purpose. If not, be careful to avoid twisting the mast cable around sail halyards.

The cable can be drawn directly to the connection terminal strip. As an alternative, a plug connector can be installed where convenient to allow for easy removal of the mast.

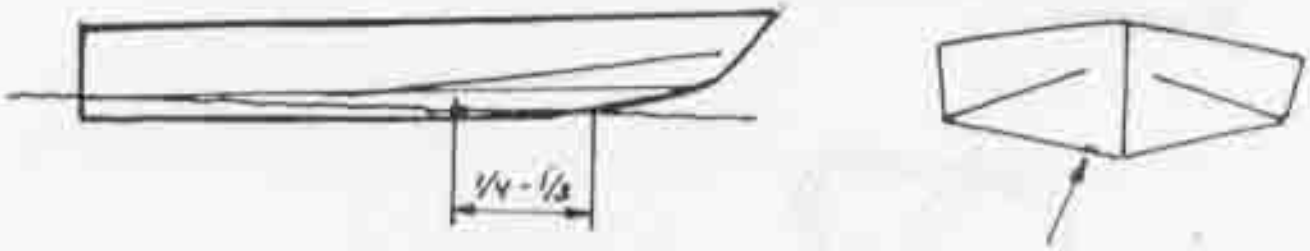


3.4. Through deck connector

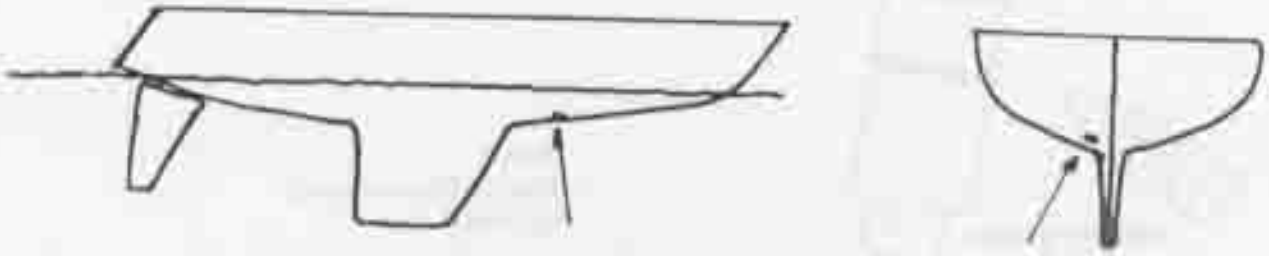
Only connectors designed for marine environments should be used. Silva can supply a connector as an optional extra. Part No 8501.

3.5. Mounting of paddlewheel transducer

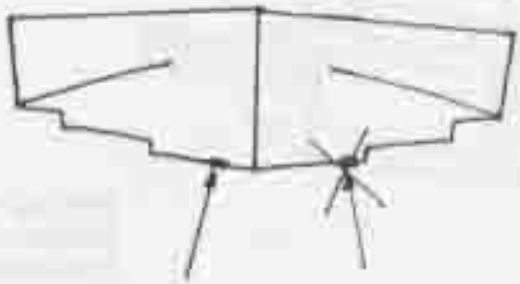
The correct position of the paddle-wheel transducer is of prime importance for the accuracy of the instrument. Generally the transducer is placed 1/4 or 1/3 along the water line measured from the bow (in normal conditions) and close to the centre line.



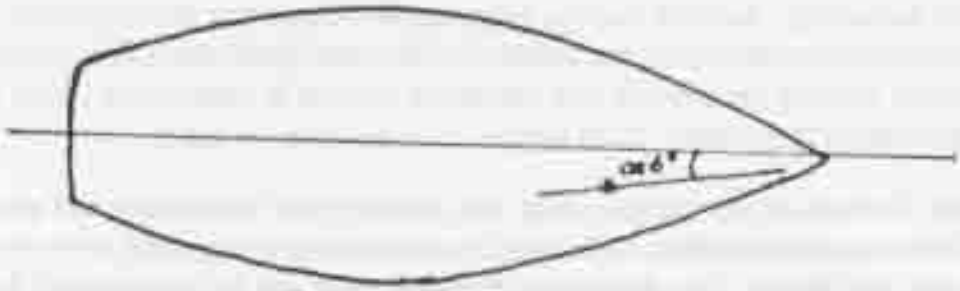
Sailboats with fen keels must have the transducer placed approximately 250—350 mm forward of the keel and just off the centreline.



Avoid placing the transducer close to sharp chines where transverse water-streams can disturb the function of the log.



On sailingboats with a pronounced V-shape, for example full-keeled boats, it might be favourable to slightly align the transducer towards the stern in order to get equal characteristic at different bows.

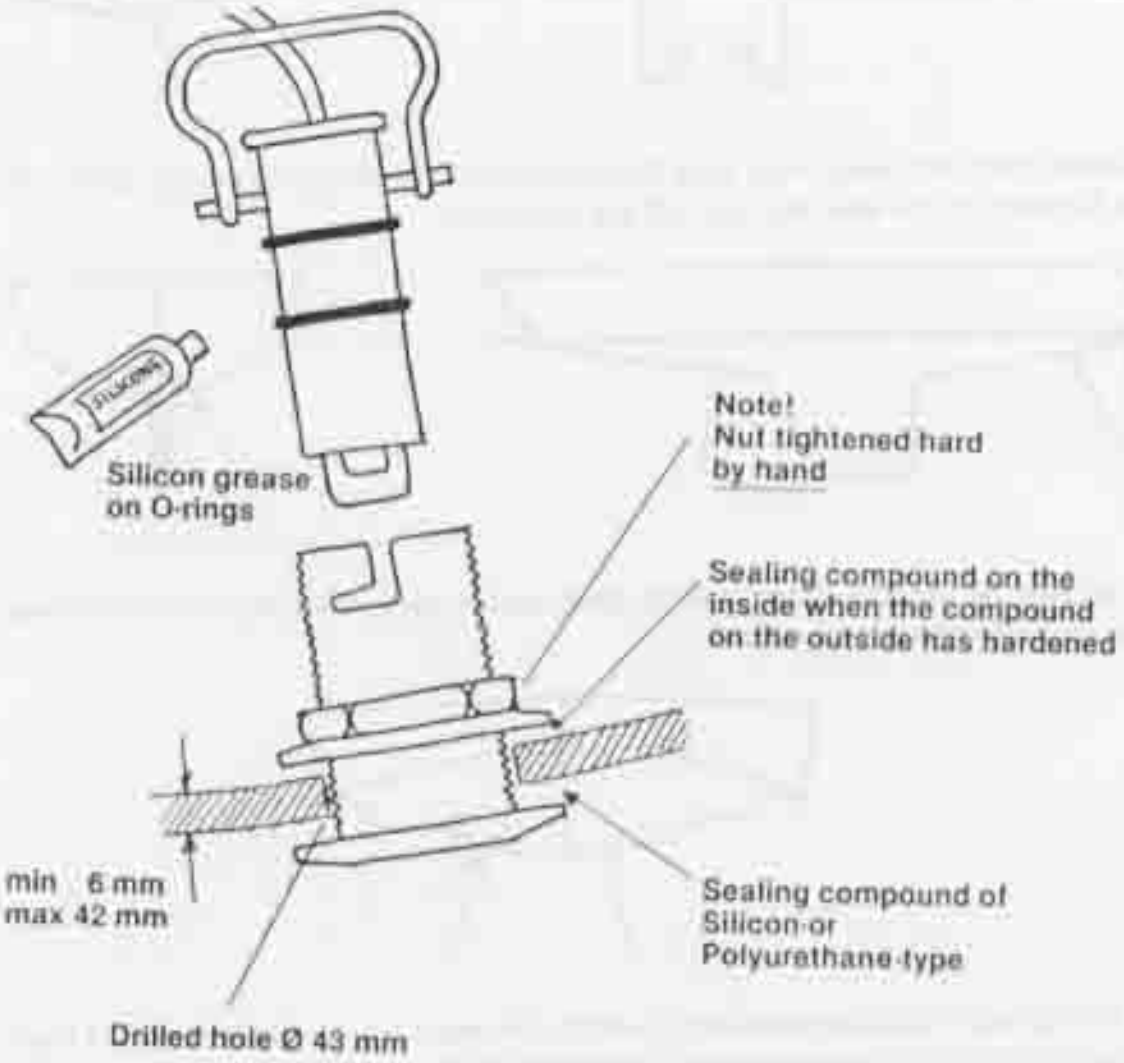


Consult your boatyard, owners of identical boats to yours with a similar type of transducer, or your Silva distributor for advice.

Usually the position of the paddlewheel transducer becomes a compromise, since one has to consider the problem of access from the inside.

The through-hull fitting should be mounted in a hole with a diameter of 43 mm. Around the hole the hull should have an even thickness.

When mounting the through-hull fitting the dummy plug should be in position. The through-hull fitting should be mounted so that the dummy plug's handle is transverse to the centreline.



When mounting, put the sealing compound around the through-hull fitting's outer flange and screw the nut on the inside, so tight that the compound is pressed well. When the outer sealing compound has hardened the nut is released in order to put sealing compound on the inside. Then tighten the nut hard *by hand*.

Fit the O-rings on the dummy plug and paddlewheel transducer and grease them with the Silicon grease supplied. Take away surplus sealing compound from the outside of the through-hull fitting. The through-hull fitting must not be countersunk in the hull.

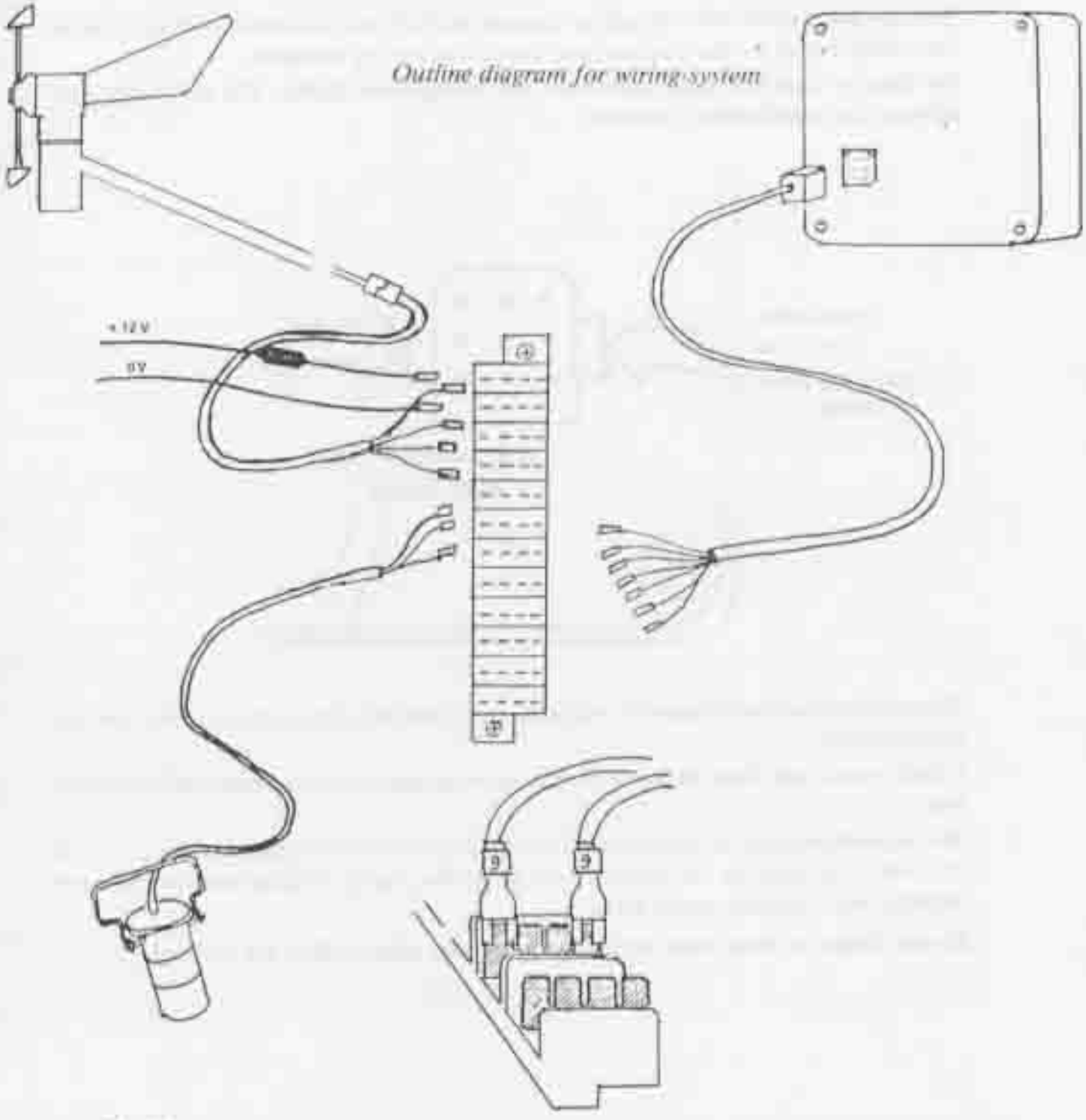
3.6. Electrical installation

Most faults in electronic equipment originate from incorrect or faulty wiring. Therefore, one must ensure protection of the cables from chafing, vibration etc.

Connect as per wiring diagram in section 7.

Do not forget to fit the fuse supplied. (If there is no circuit panel on board your boat).

Outline diagram for wiring system



All cables are supplied with numbered connectors, which must be connected to the terminal strip as shown in the figure and wiring diagrams.

The numbers of the wires to be connected to each other via the connector block, must match.

If a number is missing, the colours shown in the wiring diagram, are to be taken as valid. (Applies to system with screw terminals).

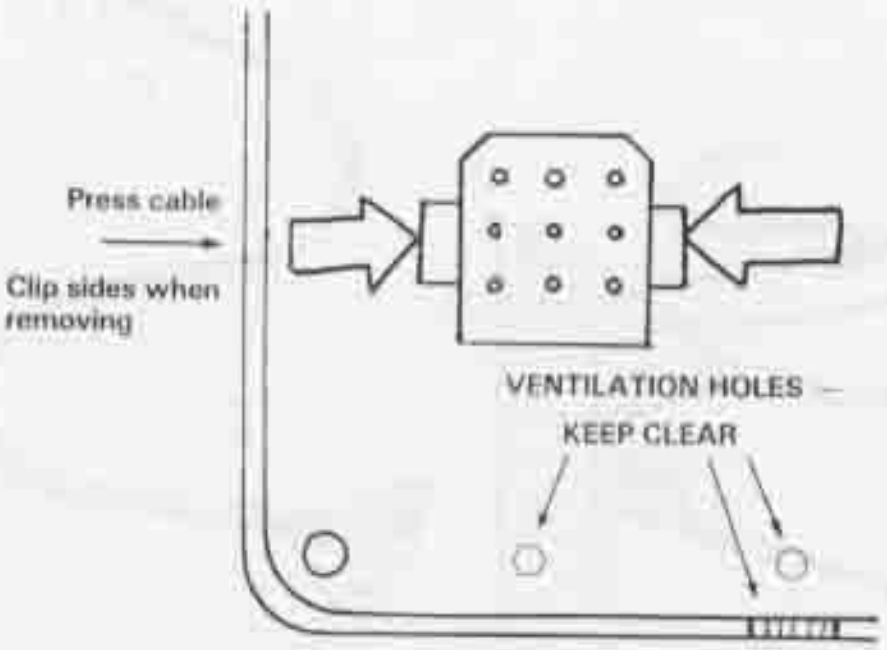
4. Maintenance

Cleaning and checking of the paddle-wheel transducer

The transducer can easily be removed for cleaning. Pull out the safety mounting and put in the dummy plug. If this is done quickly, only a little water comes in. The axle of the paddle-wheel can easily be taken out by putting a thin pin or similar through the hole to push out the axle.

The axle and paddle-wheel should be cleaned carefully and reassembled. Then blow on the paddle-wheel so that it rotates and check that the log operates.

See that no anti-foul paint penetrates the through-hull fitting. The paint-edge may obstruct the paddlewheel's rotation.



The paddle-wheel can be painted with a modern, thin anti-foul paint in order to prevent weed growth.

Check once a year that the screws in the screw terminal are tight and that no cable is worn.

We recommend that the instrument is removed and stored at room temperature, when the boat is layed up for the winter. At the same time, spray the plug contacts and screw terminal with moisture-proof spray.

Do not forget to press in the instrument cable-clip when pulling out the plug.

5. Trouble shooting

Most faults on electronic equipment can be found in the installation wiring and this should always be checked first, if a fault arises.

Check that:

- the connection is made properly, as per the wiring diagram.
- screw terminals tight.
- no loose ends in the wires causing short-circuits.
- no cable squashed or worn.

Fault-symptom	Check:
No indication (blank display)	— is there voltage going to the instrument? — fuse
The instrument shows 1.8.8. constant or unstable values	— battery voltage too low
No windangle indication, but instrument otherwise quite normal	— faulty mast top unit or faulty connection to mast top unit
If VMG and true wind speed error is shown	— check the calibration as per 2.7. — paddle wheel does not rotate (take it out and clean it) — faulty connection of the transducer

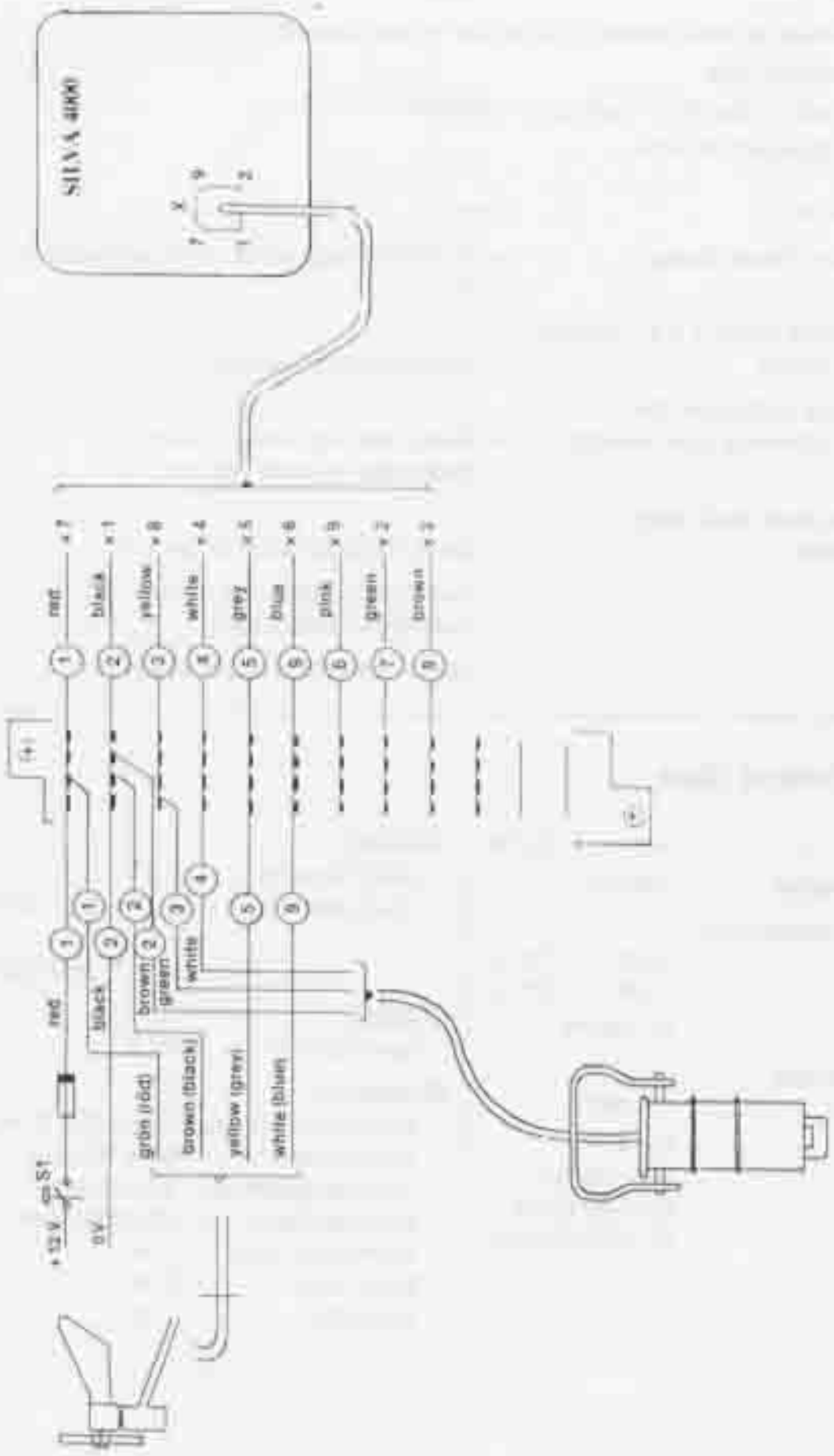
6. Technical data

Voltage	+ 9 — + 18 VDC
Current consumption	100 mA
Environmental temperature	
operation	—10 — + 70° C
storage	—30 — + 85° C
Humidity	0—100 %
Field of measurement	
wind direction	0—360°
	0—±60°
wind speed	0.2—40 m/s
	0.5—80 knots
	0—12.9 Beaufort

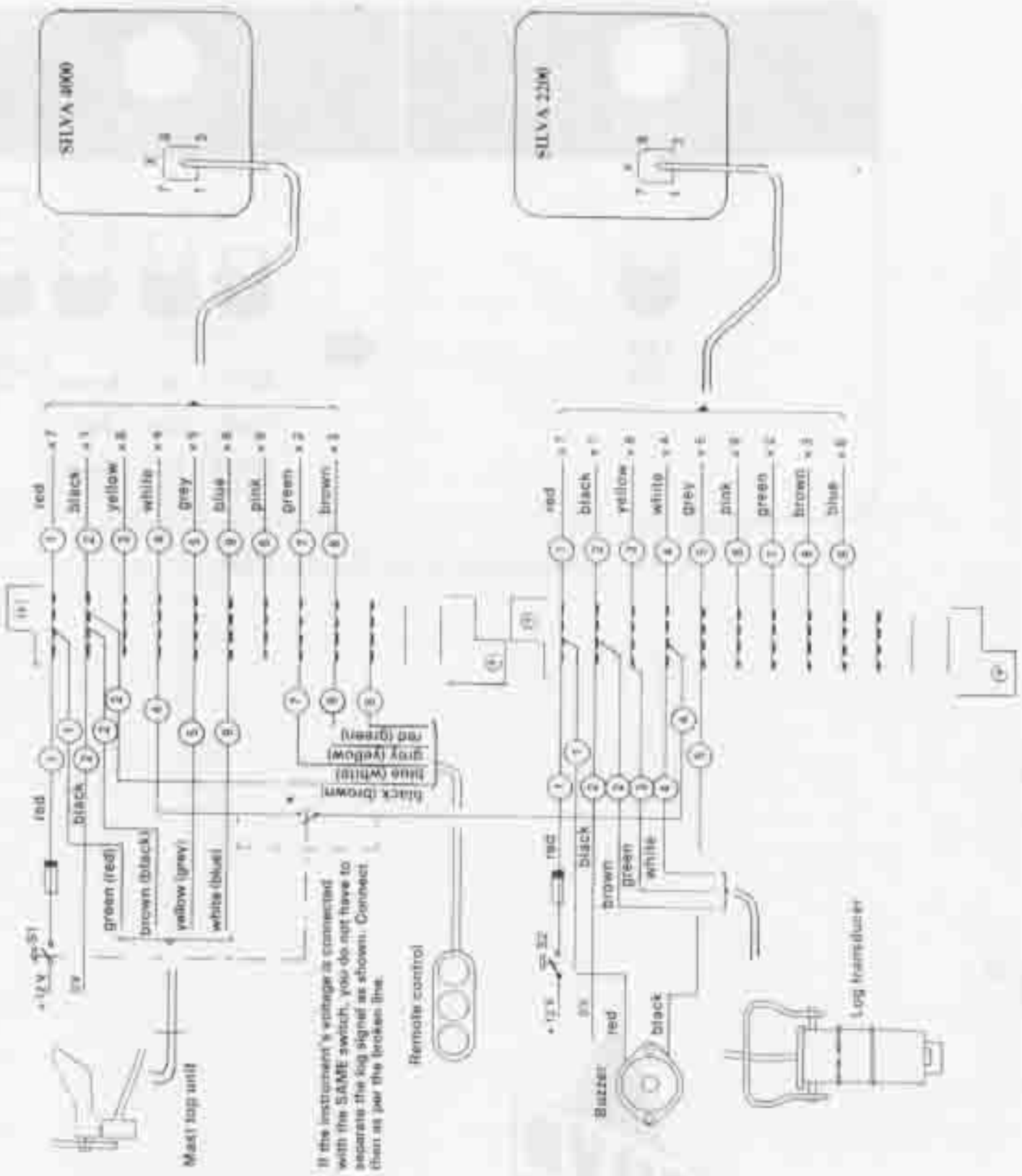
Accuracy	
wind direction	± 2°
wind speed	± 2 % at 0—15° heel
	+2
	—10 % at 0—25° heel
Weight:	
mast top unit	380 g
Dimensions:	
Instrument housing	125 × 125 × 35 mm
Mast top unit	450 × 300 mm
Mast top fastening	82 × 28 mm
Insert section	82 × Ø42 mm
Instrument cable	3 m
Mast cable	22 m
Log cable	7 m

7. Wiring diagram

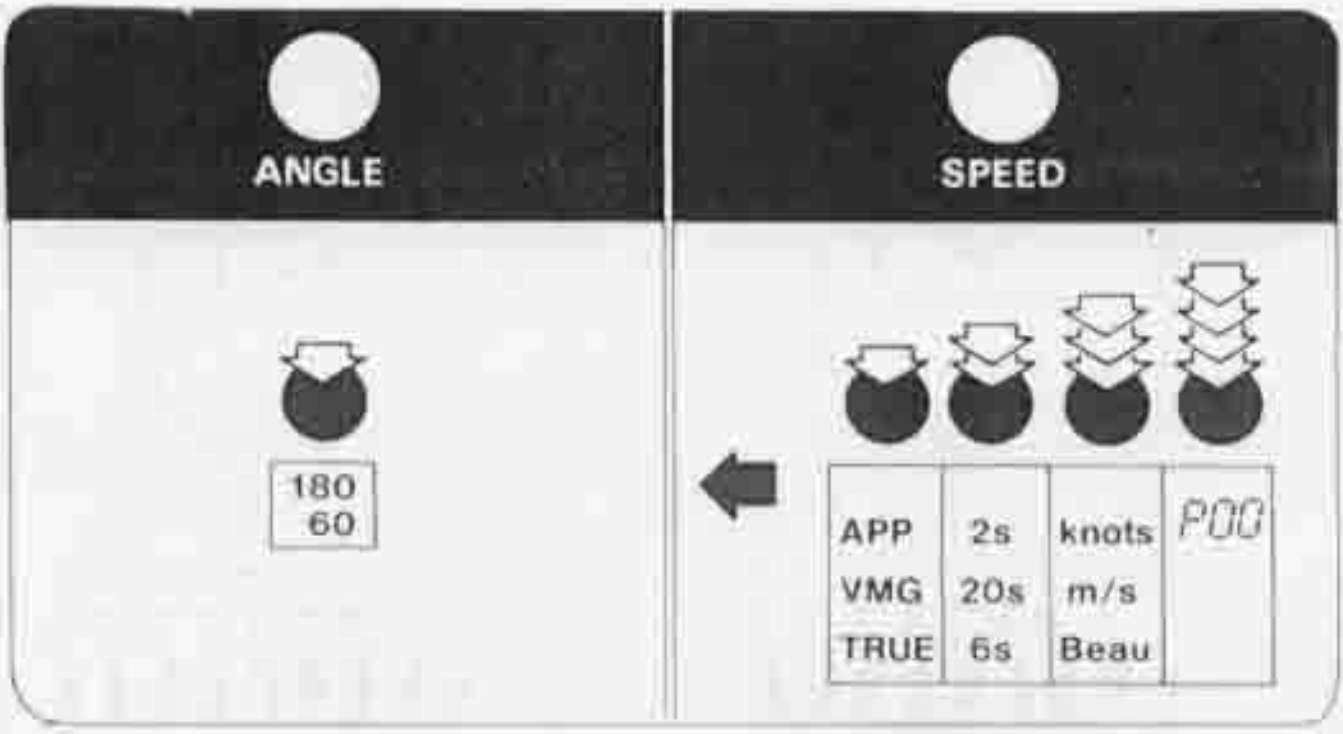
7.1. SILVA 4000



7.2. Interconnection of SILVA 2200 and 4000



SILVA 4000



This is how to use the Silva 4000

SILVA Sweden AB
Kuskvägen 4, S-191 47 Sollentuna
Sweden