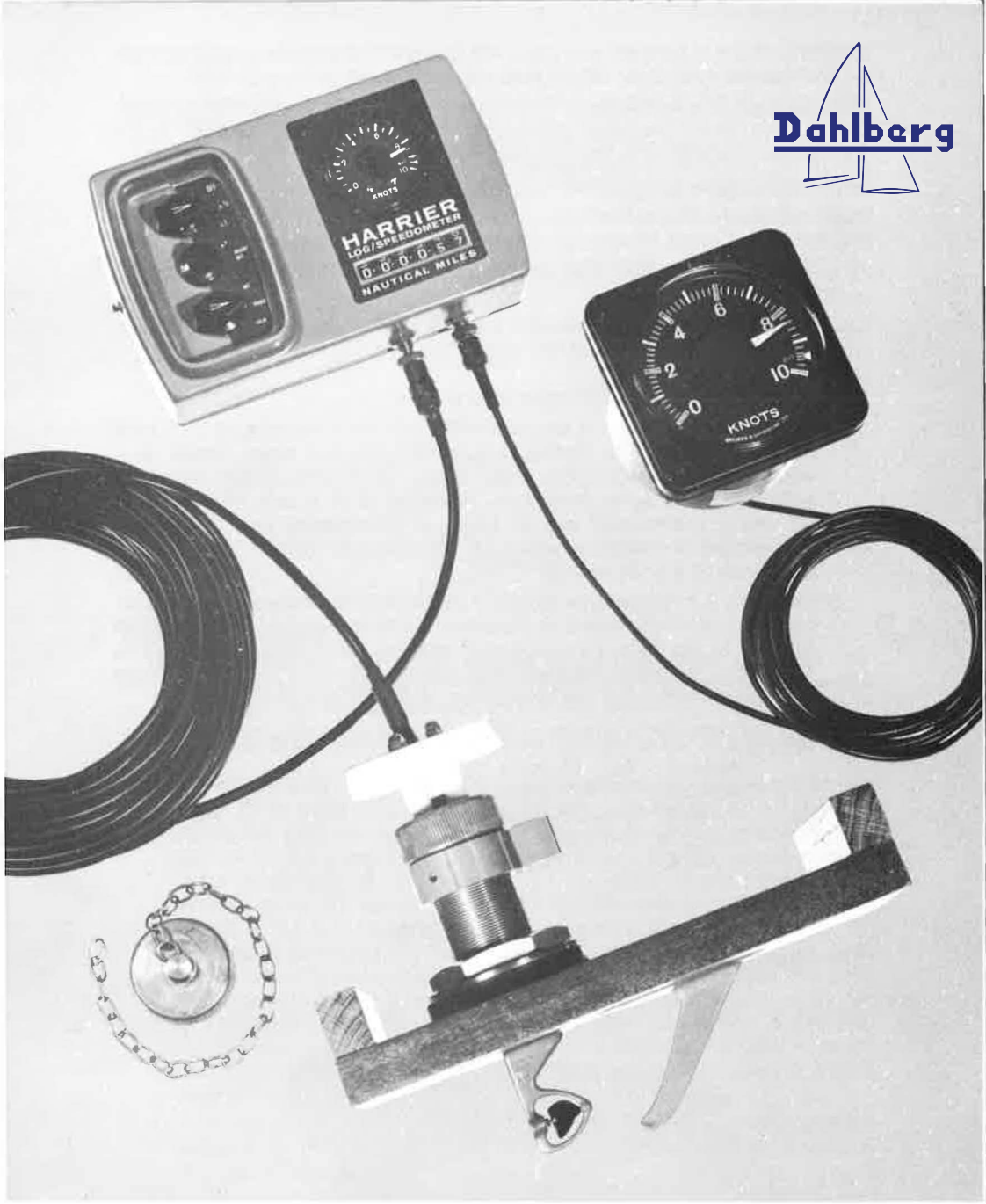


THE HARRIER LOG/SPEEDOMETER

Designed and Manufactured by

BROOKES & GATEHOUSE LTD

HARRIER is a combined electronic log and speedometer for yachts and the smaller commercial craft, offering the advantages of:

High accuracy and consistency. The log operates on digital principles throughout and retains its accuracy indefinitely. The instrumental accuracy figure for the speedometer is ± 5% of speed.

High sensitivity to speed changes. (0·1 knot is easily discernible in Model A).

High reliability through simple and robust mechanical design, complete weatherproofing and the use of high-grade electronic components.

A retractable underwater unit of low drag, easily replaceable if damaged, even when afloat.

Compactness. The control unit with log and speed indicators measures only 8¼″ × 4⅞″ × 3⅜″ overall (21·0 × 12·4 × 8·6 cm.).

HARRIER provides the following information:

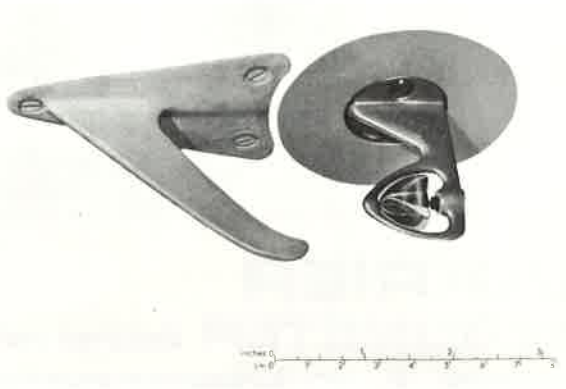
1. **Distance run** in steps of one-hundredth of a nautical mile up to a total of 10,000 miles. The figures, which are bold and clear, appear in a window in the instrument case. After completing 10,000 miles the indicator starts again from zero. Accuracy is of a very high order at all speeds between 0·7 and 60 knots. A log repeater can, if required, be installed anywhere in the ship. This repeater can be reset to zero by means of a push button.
2. **Speed** on a 2″ meter-type indicator in the instrument case. One or more repeaters of 4″ diameter, as illustrated, may be installed at any desired place(s) in the ship. This large dial enables speed changes as small as 0·1 knot to be easily observed. Still greater sensitivity to speed changes is obtainable through the installation of our HOUND amplifier.

Five instruments are available, covering the following speed ranges:

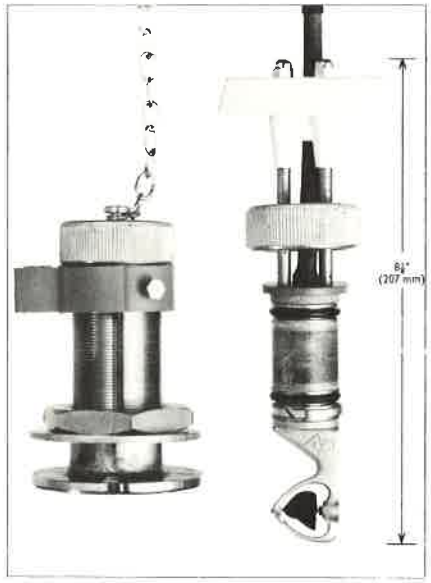
Model A	0·5 – 10 knots
Model B	0·5 – 20 knots
Model C	4 – 30 knots
Model D	4 – 40 knots
Model E	4 – 60 knots

DESCRIPTION

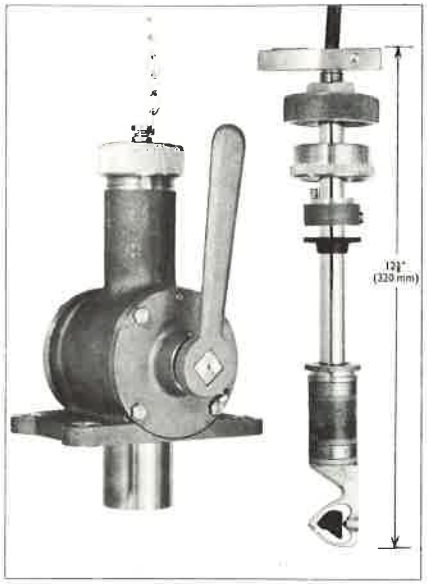
The Underwater Unit



A moulded nylon screw-type impeller, the diameter of which is only ¾″ (1·9 cm.), is mounted in free-running stainless steel and P.T.F.E. bearings near the tip of a streamlined stainless steel fin projecting 2⅜″ (6·1 cm.) from the bottom planking. Impeller slip is negligible at speeds above 0·5 knot. The impeller and fin unit can be retracted into a tubular bronze housing to protect it from damage by warps or when the boat grounds on a falling tide, or it may be withdrawn completely into the boat for cleaning or repair. The rotary valve type of housing is strongly recommended for all installations where 9″ (23 cm.) or more clearance is available in the bilge. The impeller unit can be withdrawn without admitting any water. The use of this fitting is essential when the unit is installed at depths greater than about three feet below the waterline. Alternatively a simple valveless housing is available for use where the depth of installation does not exceed three feet. A sealing cap is screwed down over the mouth of the tube after withdrawing the impeller unit. A sliding-valve unit conforming with Lloyd's requirements for passenger-carrying ships (the "Big Ship" housing) is also available. A weed deflector is supplied, the base plate of which is fixed by three screws to the ship's bottom ahead of the impeller. Since there are no electrical connections between the impeller and the hull unit, the impeller, the fin or both can easily be replaced following accidental damage by grounding or passing driftwood.



Valveless Unit



Rotary Valve Unit

The Instrument Case

This is similar to that of our HECTA echo-sounder and HOMER receiver. The following controls are provided:

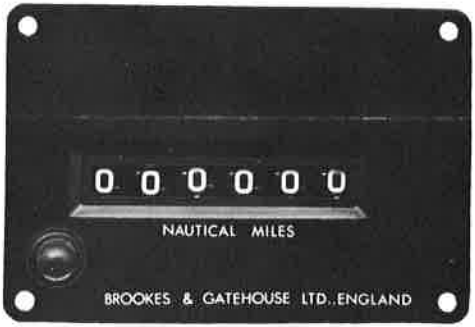
1. **ON/OFF and speed range selector switch.** This switch can be used to double the sensitivity of the speedometer so that small changes in speed can more easily be seen when the vessel is sailing slowly.
2. **Battery test and damping switch.** At the test position, the speed indicator becomes a voltmeter and indicates the state of the battery. At the "rough" position the speed indicator is heavily damped to smooth out fluctuations due to wave motion. The "calm" position may be used in

light weather sailing conditions if more rapid response is required.

3. **Log Calibrator.** A 6-position rotary switch in the rear cover of the case enables the log to be calibrated with an accuracy better than ± 1½% following a run over the measured mile. This correction is a function of hull shape and the position of the impeller in the ship's bottom and, once made, requires no further attention.
4. **Speed Calibrator.** Since the speed and distance measuring circuits are entirely separate, each requires its own calibrator. Once the log has been calibrated on the measured mile the speed indicator is simply adjusted at any subsequent time by the use of a stop-watch. The speed calibrator is also fitted in the rear cover of the instrument.

The case is hermetically sealed and is of nylon-coated aluminium alloy. A mounting bracket is supplied enabling the instrument to be installed on a bulkhead. Watertight brass sockets, palladium coated to resist sea water corrosion, are fitted in the case for making connection with the underwater unit, the repeater(s) and, in externally powered models, to the ship's D.C. supply. A loudspeaker and oscillator are fitted inside the instrument to give audible warning that the instrument has not been switched off when the yacht is stationary or that the impeller has become fouled.

Indicators. A 2″ diameter speed indicator and a log counter are fitted in the instrument case. Repeaters of 4″ diameter may be installed elsewhere in the ship if required. They are hermetically sealed and are designed to be set into a bulkhead. Both pointer and graduations are illuminated by "Betalights" which consume no current and remain effective for many years. A log repeater, also bulkhead mounting, is available and this can be supplied with a reset mechanism.

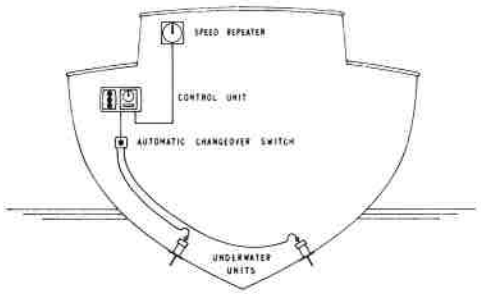


Log Repeater

The Power Supply. Power is supplied by a battery comprising four standard mercury cells, Mallory type ZM.9 or equivalent. These are contained in a separate watertight compartment in the rear cover of the instrument case. The endurance of one set of cells is about 500 hours or approximately 5,000 miles at 10 knots. Alternatively, accumulator cells may be supplied in place of the mercury cells, and provision is then made for these to receive a constant trickle charge from the ship's D.C. supply. The charging current is only 0·008 amp. In the event of failure of the ship's supply, the accumulator cells will maintain operation of HARRIER for 100 hours. **Please specify ship's voltage when ordering.**

Installation

Installation involves the boring of a hole of 1⅝″ (4·1 cm.) diameter in the bottom planking and inserting the bronze housing, the flange of which may be recessed flush with the planking. The various types of housing are illustrated. A position well forward and close to the centre-line is recommended. If in a sailing yacht, owing to restrictions caused by tanks, etc., it is impracticable to approach the centre-line, the use of two underwater units is recommended. The electrical signals from the lee-side unit, which will remain always immersed, are selected by means of a special watertight gravity switch which operates automatically but has manual over-riding control.



Principles of Operation

The nylon impeller which has a pitch of 2·80″ contains a magnet, the rotating field of which induces very small pulses of current in a coil contained in the "plunger" of the underwater unit. These pulses are fed by screened cable into the instrument case where they are amplified and then caused to actuate:

1. A "binary-scale" counter which produces a single output pulse for every 256th input pulse when the calibrator control is set to zero. The output of this counter actuates the decimal scale electro-magnetic counter on the instrument face, the last digit of which changes at every 256th revolution of the impeller; i.e. at every one-hundredth of a nautical mile. By means of pulse feed-back circuits, selectable by a switch in the rear cover of the instrument case (the calibrator control) the overall dividing ratio of the binary circuits may be decreased from 256 by five 3% increments. Thus, after making a run on the measured mile, correction may be made for errors due to the flow-rate under the hull being less than the true speed of the ship. It has been found that the correction, once made, is accurate in a displacement hull over the full range of boat speed from 0·7 knot upwards. In a planing hull it remains accurate over the full range of planing speeds.
2. A frequency measuring circuit which converts the rate of arrival of the pulses from the impeller into a proportional direct current to operate the speed meter(s).

Twenty-seven silicon planar transistors are incorporated in the circuits. The mean power consumed by the complete instrument at 10 knots is only 0·025 watt (or one-twentieth of that consumed by a small torch bulb).

HOUND

The HOUND amplifier, which is described on a separate sheet, is now available as an accessory to HARRIER or HERMES. It permits the existing remote indicator, or a separate one, to show very small increases or decreases in speed, the scale in effect being magnified five times. This facility is particularly useful when tuning or trimming a racing yacht in light weather. The speed indicator on the HARRIER instrument will continue to give the correct, unmagnified reading.

SPECIFICATION

Sizes

Valveless underwater unit:	
Retracted height OA	8¼″ (21 cm.)
Withdrawal clearance	12¼″ (31 cm.)
Flange	3″ dia. (7·6 cm.)
Rotary valve underwater unit:	
Retracted height OA	11″ (28 cm.)
Withdrawal clearance	22″ (56 cm.)
Flange	5⅛″ × 3½″ (13 × 8·9 cm.)
Sliding valve underwater unit:	
Retracted length OA	20½″ (52 cm.)
Withdrawal clearance	26½″ (67 cm.)
Flange	4¾″ dia. (2·1 cm.)

Dimensions measured from outer surface of ship's bottom. "Withdrawal" clearances are those required for complete removal of transducer unit from housing.

Control unit 8¼″ × 4⅞″ × 3⅜″ overall (21·0 × 12·4 × 8·6 cm.)

Weight

Valveless underwater unit complete	3 lb. (1·35 kgm.)
Rotary valve underwater unit complete	14½ lb. (6·5 kgm.)
Sliding valve underwater unit complete	14¾ lb. (6·7 kgm.)
Control unit	4½ lb. (2·0 kgm.)
Indicators	4″ dia. – 4¼ lb. (1·9 kgm.)

Speed Ranges

Model A	0·5 – 10 knots
Model B	0·5 – 20 knots
Model C	4·0 – 30 knots
Model D	4·0 – 40 knots
Model E	4·0 – 60 knots

Accuracy

After calibration, the error of the log will not exceed 1½% of the distance run. For speed, the error will not exceed 5% or 0·2 knot, whichever is the greater. Screwdriver-operated controls are provided by means of which corrections may be applied.

Power Supply

Battery of four mercury cells, Mallory type ZM.9 or equivalent. Mean current 4·0 mA. Endurance 500 hours. Alternatively four DEAC accumulator cells which remain on "trickle" charge from the ship's D.C. main at 8·0 mA.

Pan Climatic operation

The specified accuracy is maintained at all ambient temperatures from 32° to 150° F (0° to 65° C) and at all humidities.

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