SPEED LOGS

EM LOG:

Principle: An **Electromagnetic Log**, sometimes called an "EM Log", measures the speed of a vessel through water.

It operates on the principle that:

- when a conductor (such as water) passes through an electromagnetic field, a voltage is created and
- The amount of voltage created increases as the speed of the conductor increases.

The process involved in speed measurement is

1. The EM Log creates an electromagnetic field.
2. A voltage is induced in the water; the magnitude of the voltage varies depending upon the speed of the water flow past the sensor.
3. The EM Log measures the voltage created and translates this into the vessel's speed through water.

OPERATION: The operation relies on the principle that any conductor which is moved across a magnetic field will have induced into itself a small electromagnetic field. The magnitude of the induced emf is directly proportional to the speed of movement of the conductor. The magnetic field is produced by a solenoid which may project in the water (called rod meter or flow sensor).

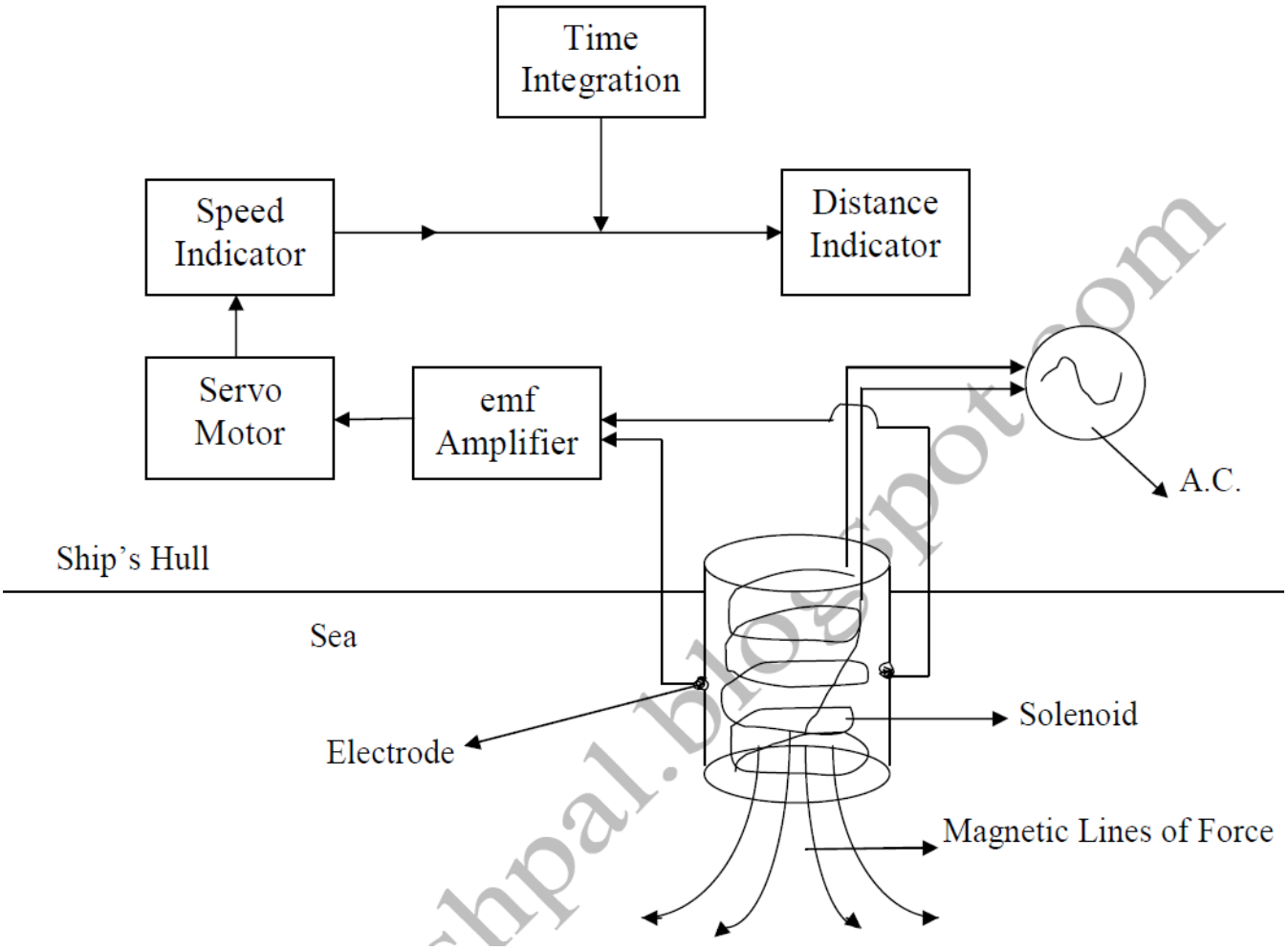
As the vessel moves, the sea water (conductor) relatively moving through the magnetic field induces a small emf into it. This emf is detected and measured by two sensors on the outer side of the rodmeter. Within the rodmeter or flow probe, the solenoid coil which produces the magnetic field is fitted.

The speed signal voltage emf of the sensor is amplified and a servomotor is driven which in turn indicates speed on the log speed indicator. Very small EMFs of the order of micro volts are involved.
Because of the difficulty of amplifying small DC voltages and because other effects (e.g. galvanic action between dissimilar metals) may cause DC EMFs of this order, electromagnetic logs use low frequency AC of the order of 50 Hz to excite the coil and an alternating EMF is then induced between the electrodes.

Non linearity between ships speed electrode voltage occur mainly due to changes in water flow pattern around the hull of the ship and EM logs are therefore require careful calibration after fitting. They can then give speeds of accuracy of 1% (0.1 knot)

THE FLOW SENSOR: The flow sensor has a streamlined shape. This not only decreases the friction experienced by the sensor on a moving vessel but it also prevents the surrounding water from being dragged with the ship. If any water drag is experienced this would affect the accuracy of the speed measurement. Analogue or digital display can both be used to display the speed.

DISTANCE INTEGRATION: The speed indicator signal is supplied to special generator which produces a number of pulses per minute which is proportional to the speed (say 200 pulses per nautical mile). This generator is connected to distance run recorder which counts the pulses and hence the number of miles traveled. Accuracy is about 1 – 2 % of actual distance.



PRESSURE LOG (PITOT LOG):

If a tube (which is closed at one end and open at the other) is immersed in water open end down, a static pressure will be seen to develop in the tube which is proportional to the depth of the orifice or opening below the water.

If another tube similar to the first one , but with an opening sideways is also immersed to the same depth and moved at a constant speed with its orifice in front , then the pressure in that tube will be the sum of the static pressure (due to depth) and the dynamic pressure (due to motion). This implies that if the difference of these two pressures, that is dynamic pressure is obtained, this will be a measure of the motion (ship's speed)

INSTRUMENT: Two fine tubes are fitted within a larger diameter tube (C) one opening to the bottom end called static tube (A) and the other opening at nearly the same depth but facing forward, called the dynamic tube (B).

Tube (C) can be retracted or lowered down as required both from E/R as well as from bridge. After retracting tube (C) the sluice valve may be shut and maintenance carried out.
Tubes A and B are connected to a set of mercury filled pressure differential chambers so that they oppose one another and he difference in pressure i.e. the dynamic pressure will be indicated by the level of the mercury.

E.g. if the ship is stopped, the pressure in both tubes will be equal (=static) and the mercury level will be steady and will correspond to zero speed through water. If ship starts moving at 10 knots, this will cause an additional dynamic pressure to be exerted in tube B and hence the level of mercury in the centre chamber will rise. The weighted float on the mercury will rise causing the cam and speed indicator to rotate clockwise and indicate speed of 10 knots. The cam has a spiral periphery to convert the non linear pressure differential speed relationship to a linear speed indicator motion. The mechanical rotation of the cam can be converted to electrical signals which are transmitted to the Bridge where the speed is integrated with time and distance indicated. Repeaters can easily be led off from the speed scale.

General characteristics of pressure logs:

i) There are no external moving parts, so there is little likelihood of the log being fouled by weed or other obstructions
ii) A direct indication of speed is obtained. The registration of distance is dependent on satisfactory working of an integrating mechanism
iii) The log does not register very low speeds, generally below 1 knot.
iv) Once calibrated, it is not possible to adjust any error, except by fitting a new cam.

COMPARISONS BETWEEN DIFFERENT LOGS

DOPPLER	PRESSURE	EM LOG
Principle: Doppler effect	Speed proportional to dynamic hydro pressure	Speed proportional to emf induced
Provides SMG & STW	STW	STW
Provides Dual axis speed	speed in forward direction only	Speed in Fore &Aft direction
Affected by weather temp & density to lesser extent but effect resolved by using thermistor.	Affected by weather	Affected by weather temp & density
Affected by vessel's motion but errors rectified by Janus configuration	Yes because of pressure fluctuations	No
Affected by aeration but to lesser extent	Affected	Affected
Installation is easy & no special arrangements required	Needs special arrangements, W/T box and sluice v/v arrangement	Needs special arrangements, W/T box and sluice v/v arrangement
Affected by ship's voltage as fluctuation will affect transmitted frequency	No effect	Affected to lesser extent
Interface with other equipment is very easy	Not easy	very easy
Calibration is easy	Difficult because pressure speed relation not linear	Easy
Can be used as an aid during anchor watch	No	No