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THE 'AIST' DIGITAL HYDROPHYSICAL PROBE (TSIFROVOY GIDROFIZICHES--ETC(U)
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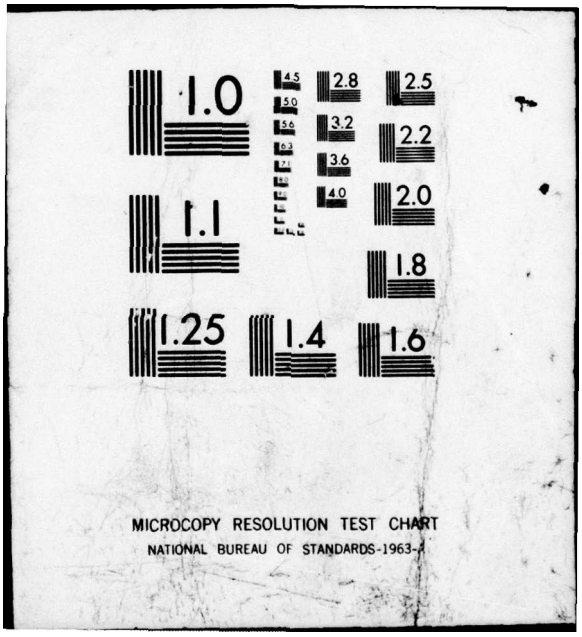
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THE "AIST" DIGITAL HYDROPHYSICAL PROBE

[Borkovskiy, M. M., A. G. Voluchkov, V. I. Prokhorov, V. D. Pudov, O. G. Sorokhtin, and B. V. Shekhvatov, Tsifrovoy gidrofizicheskiy zond "Aist," in: Fourth All-Union Symposium on the Automation of Scientific Research in the Seas and Oceans (Avtomatizatsiya nauchnykh issledovaniy morey i okeanov, Simpozium), Part 1, Sevastopol', 1972, pp. 41-43, 46; Russian]

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One of the first Soviet hydrophysical "Aist" probes, an automatic salinity and temperature meter, was constructed in 1968 at the P. P. Shirshov Oceanology Institute of the USSR Academy of Sciences. The "Aist" probe is designed for automatic measurement and recording of the vertical distribution of the temperature and electrical conductivity of seawater down to a depth of 3.5 km from a drifting ship. The apparatus includes a submersible measuring probe and an on-board system. Information is transferred to the on-board system and the supply voltage is fed to the submersible probe by means of a single-core cable. Information arrives on board in the form of a serial pulse code with frequency filling. Decoding and conversion of the information take place in the on-board system by means of code-code and code-analog converters. The data are recorded in graphical form with two-coordinate potentiometers and in digital form on a tape puncher and in magnetic storage.

Submersible Probe

The submersible measuring probe includes the following main components: measuring sensors, measuring circuits, analog-code converter and encoding circuit, all placed in a sealed housing with a mount and the cable lead. A block diagram of the "Aist" probe is shown in Fig. 1.

Sensors and Measuring Circuits

The sensors mounted in the probe are among the most accurate measuring elements employed at the present time in hydrophysical equipment. The temperature gauge is /42
a platinum resistance thermometer enclosed in a metallic housing and capable of withstanding the calculated hydrostatic pressure. It is mounted in the head of the /43
probe at right angles to the latter; this improves the conditions of flow past the gauge, both when the probe is lowered and when it is raised. The time constant of the gauge in the sounding regime does not exceed 1 sec. The installation of a "Soleks" semiconductor thermistor with a time constant of 0.4 sec is provided for. The gauge is connected to an ac bridge with symmetry $R_1 = R_2$, $R_3 = R_4$ of the arms (Fig. 2). The resistors of the bridge arms are placed in an air thermostat with a stabilization temperature of 27°C.

The electrical conductivity is measured by using an inductance pickup, which is an independent transformer bridge. The pickup is mounted in the head section of the probe, so that its opening coincides with the sounding direction. This improves the flow of water through the pickup. The effective measured volume is approximately 28 cm^3.

The supply voltage frequency of the measuring bridges was 10 kHz.

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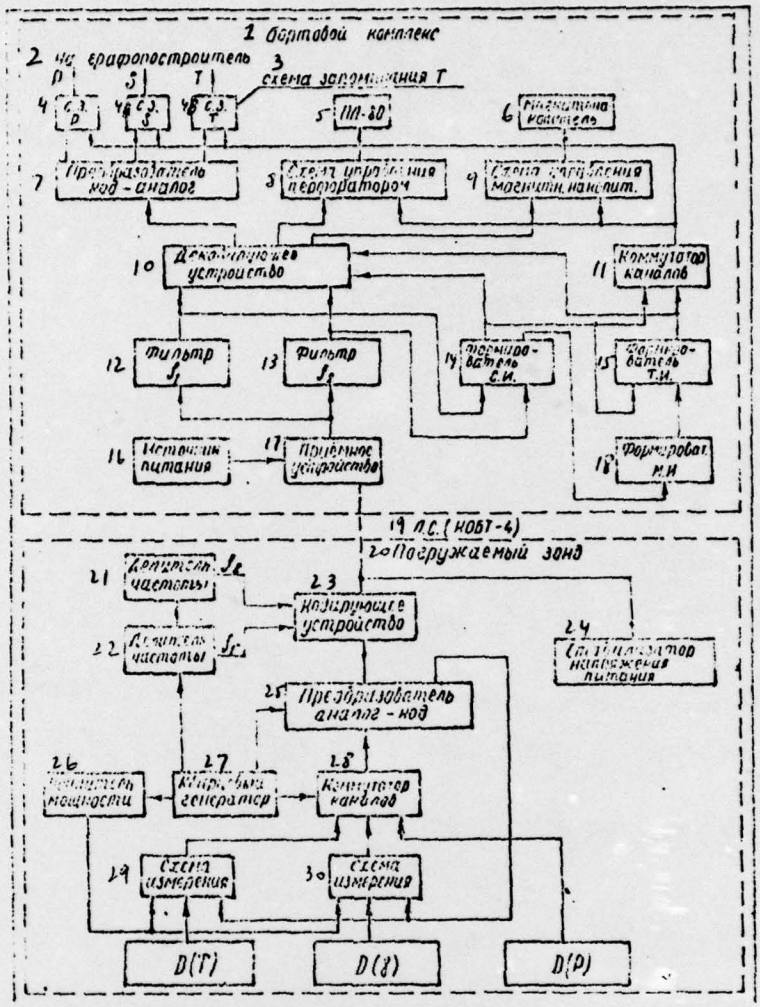

Figure 1. Block diagram of the "Aist" probe

1 - on-board system; 2 - to plotter; 3 - memory circuit T; 4 - m.c. P; 4a - m.c. S; 4b - m.c. T; 5 - PL-80; 6 - magnetic storage; 7 - code-analog converter; 8 - puncher control circuit; 9 - magnetic storage control circuit; 10 - decoder; 11 - channel commutator; 12 - filter f_1; 13 - filter f_2; 14 - s.p. shaper; 15 - c.p. shaper; 16 - power supply; 17 - receiver; 18 - m.p. shaper; 19 - "l.s." (KOBT-4); 20 - submersible probe; 21 - frequency divider f_2; 22 - frequency divider f_1; 23 - coder; 24 - supply voltage regulator; 25 - analog-code converter; 26 - power amplifier; 27 - quartz oscillator; 28 - channel commutator; 29 - measuring circuit; 30 - measuring circuit.

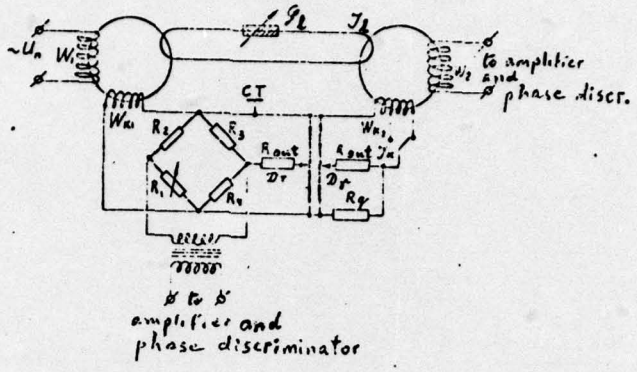

Figure 2. Schematic diagram of electrical conductivity and temperature measurement. D_t, D_γ - voltage dividers of automatic compensator - converter (code-analog) of temperature and electrical conductivity channels; R_{out} - output resistance of voltage divider; R_q - resistance establishing the start of the electrical conductivity range; ϕ_ℓ - conductivity of water "loop."

Conclusion

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In 1968-71, "Aist" probes were successfully operated on ships of the institute. An observational method and processing of data taking the optimum advantage of the capabilities of the probe were developed. The "Aist" probe was used in standard hydrological observations, and also in studies of the variability of physical fields on a small scale. Particularly interesting results were obtained by repeated and frequent sounding in the active layer of the ocean.

Experience showed that the "Aist" probe has high technical and operational qualities which meet the world standards. The high accuracy of the measurement and recording, ease of information handling, operational simplicity and reliability make it possible to recommend the "Aist" probe for extensive application on scientific research and expedition ships of various services.