



DIRECT READ OUT SYSTEM FOR AANDERAA CURRENTMETER

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ABSTRACT

Self recording Aanderaa Currentmeters are widely used by Oceanographers and Ocean engineers all over the world for current measurements in estuaries, nearshore and offshore regions. Before deployment and subsequent retrieval of these currentmeters, it is very essential to check all the sensor parameters getting recorded on the magnetic spool. This paper outlines the main features of the currentmeter and discusses a scheme developed at NIO, Goa for online reading of the sensor parameters separately on the LED display. The binary coded electrical signal available at the top end plate of the currentmeter is tapped and after suitable inversion, is fed to the system designed around a commercially available microprocessor board. The system sequentially displays N-value of the six sensor parameters including the reference number of the currentmeter during the measuring cycle. This system is routinely used for checking and calibrating the currentmeters in NIO laboratory and onboard vessels. In conjunction with hydrophone transducer, it can be used for real time monitoring of the data being recorded in the moored currentmeter. Use of commercially available microprocessor board has speeded up development time and produced reliable hardware.

1. INTRODUCTION

Recording currentmeter model 4 and model 5 manufactured by M/s.Aanderaa Instruments, Norway are self recording type and are deployed in the sea for extended period of time for ocean current speed measurement. They are widely used by oceanographers all over the world. Their use necessitates practical insight into several fields such as the field of mooring and retrieving instruments, operating and maintaining instruments, calibration of sensors, tape reading and data processing. Fig.1 shows two typical ways of mooring this instrument in "U-anchoring" and "I-anchoring". The first type of mooring is suitable for shallow water while the other type can be used for all depths as long as the depth capability of the release device or currentmeter is not exceeded.

For obtaining good reliable data it is equally important to check the performance of currentmeter in laboratory, prior to deployment and after its recovery. For this purpose a direct read out of the digital data which is simultaneously recorded on 1/4"magnetic tape inside the equipment, is very essential. A Microprocessor based system displaying the recording parameters developed for the above purpose is presented and discussed in this paper.

2. DESCRIPTION OF AANDERAA CURRENTMETER

This instrument consists of a recording unit and a Vane assembly (Aanderaa Instruments, 1981) which is equipped with a spindle that can be shackled into the mooring line. This arrangement permits the instrument to swing freely and to align itself in the direction of current. The current speed is measured by a rotor, temperature by a thermister, conductivity by an inductive type conductivity sensor, hydrostatic pressure by a Bourdon-tube driven potentiometer and current direction by a magnetic compass.

A built-in quartz clock triggers the measuring cycle of instrument at regular intervals. When triggered, the instrument will take a reference reading for identifying individual instrument and then it will read other sensor parameters in sequence. Each reading results in a 10-bit binary word, which is sequentially recorded on 1/4 inch magnetic tape. The sampling rate of this instrument can be set by an interval selector switch. When a sampling rate of 10 minutes is used, the operating period of the instrument will be about two months.

Simultaneously as the reading takes place, this data is available at the top end plate via an electrical terminal as 5 volts negative, short and long pulses key on and off an acoustic carrier emitted

by an acoustic transducer. These acoustic signals can be detected at a distance by a tuned hydrophone. This allows monitoring of the performance of moored instruments from the surface.

3. DESIGN OF DIRECT READ OUT SYSTEM

The output pulses available at the electrical terminal of the currentmeter are generated by the rotary encoder during the measuring process and consist of 10 short or long pulses (ref.fig.2) called a word for each channel. As set of six words makes one record covering about 26 seconds period, it is possible to tap the each word, display and hold it till the next word arrives. For this, a system was developed around a commercially available Microprocessor board. This microprocessor board is versatile, powerful and easily configured, thereby speeding up development time and producing reliable hardware. It has 10 K program memory, 48 I/O lines and Serial interface.

Fig.2 shows the schematic of Direct Read Out System. The electrical signal available at the currentmeter top end plate has a 5 volt negative binary logic and to make it compatible to SID (serial Input Data) line of microprocessor 8085 an operational amplifier based inverter (Ahmed,H.1973) is introduced. The hardware architecture of the microprocessor board is shown in fig.3.

The Microprocessor software (Intel Corporation,1983) is developed so as to monitor the output, track the binary zeros and ones flowing into calculate their decimal equivalent and present it on the seven segment LED display. Flow chart of the algorithm is represented in fig.4. Initially program senses the status of SID line and ignores it when low. Once the SID line goes high it will remain so till 30m sec or 90m sec as seen from fig.2 before it goes low again. A counter starting from zero is incremented by one unit regularly after calling a delay of 1m. sec. Once the SID line goes low, the counter is compared with 60 to see if binary '1'(counter less than 60) or binary '0' (counter greater than 60) has been output by the currentmeter. Once the incoming bit is identified, it is transferred in HL register pair where ultimately 10 bit word is stored. This binary number is converted to 4 digit decimal number and each digit is stored as a character in 4 successive memory locations.

To display these characters, a monitor routine called OUTPUT (Professional Electronics Products,1981) has been used. The OUTPUT routine displays in

the address field of the seven segment LED, the characters stored in the four successive memory locations with the starting address pointed to by HL pair. The OUTPUT routine destroys all registers once it is used. The Decimal equivalent of the number is displayed till the arrival of next-word. A counter set to 6 is reduced by one after the display of each word. Thus decimal values of all six words will be displayed one by one.

4. DISCUSSIONS AND CONCLUSIONS

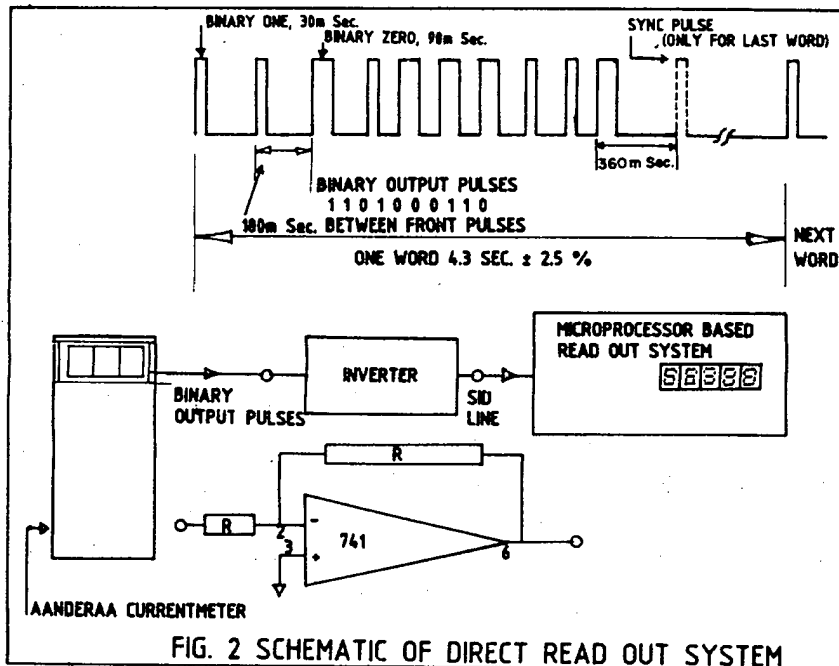
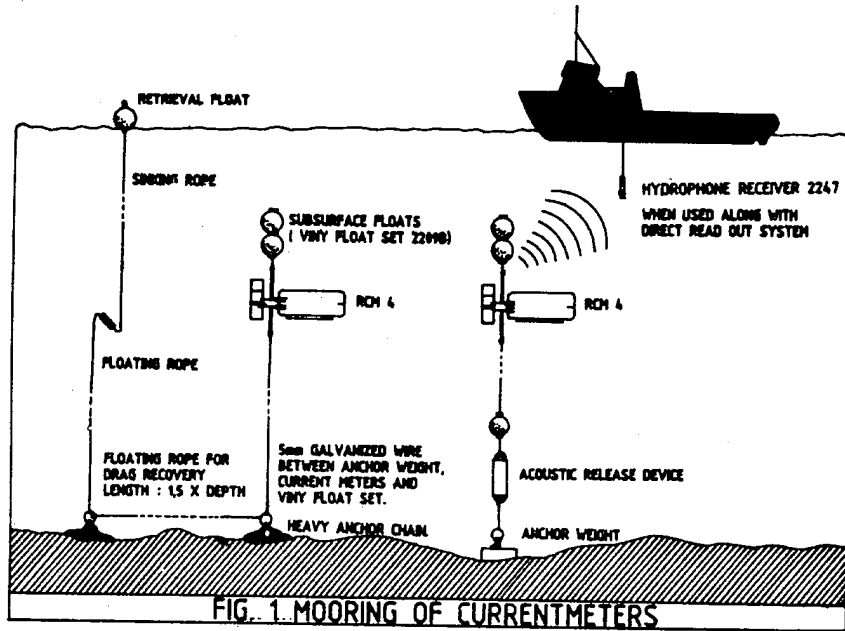
The output of the direct read out system was compared with recorded values on magnetic tape and found to agree within an accuracy of ± 1 bit. This system has been found very useful for checking R.C M 4/R C M 5 Currentmeters after servicing prior to each deployment and is routinely used in the NIO laboratory (Fig.5). It is also useful for calibration of RCM 4/RCM 5 Currentmeters and can also be extended for real time reading of sensor data by hardwiring of suspended/moored currentmeter to the suitably programmed Read out unit on board a stable platform/vessel. It can also be connected to Aanderaa tuned hydrophone receiver 2247 (fig.1) which picks up acoustic signals emitted by the RCM 4 Currentmeter, thus enabling to monitor the moored currentmeter.

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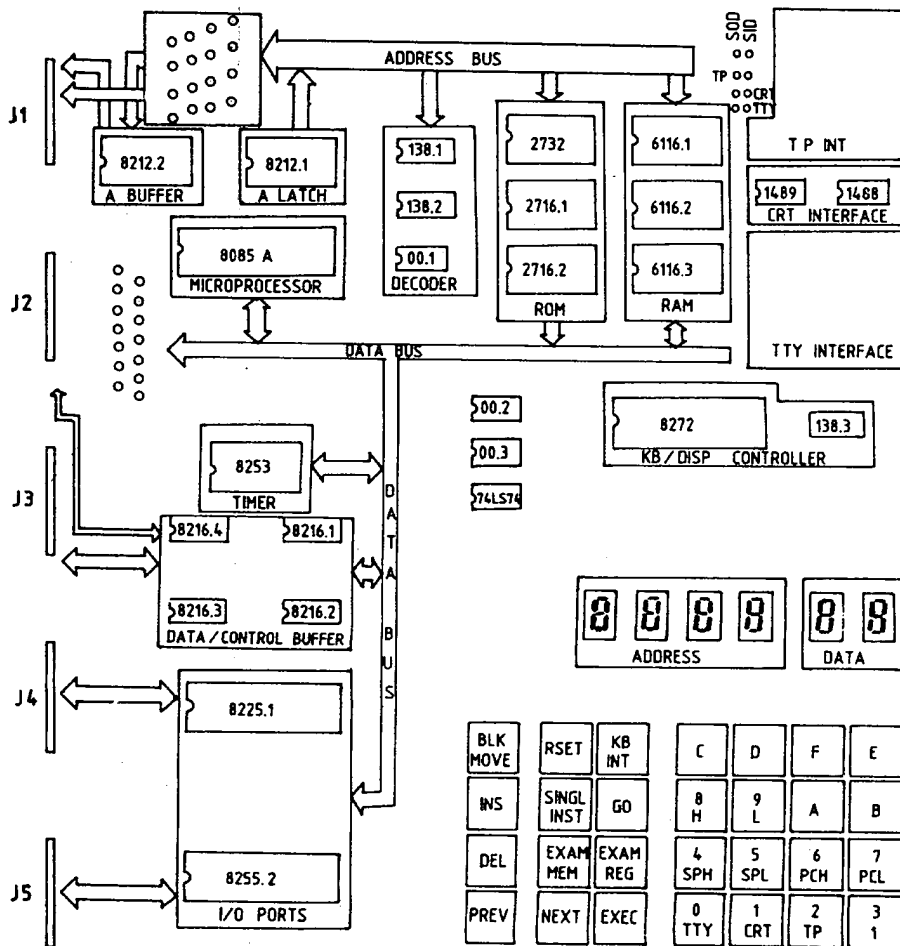


FIG. 3. HARDWARE DIAGRAM OF MICROPROCESSOR BOARD

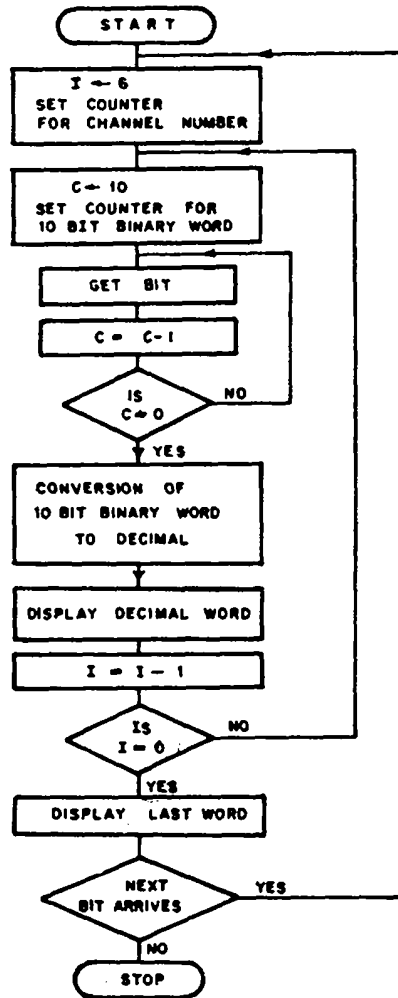


Fig.4. FLOW CHART FOR DIRECT READOUT SYSTEM.

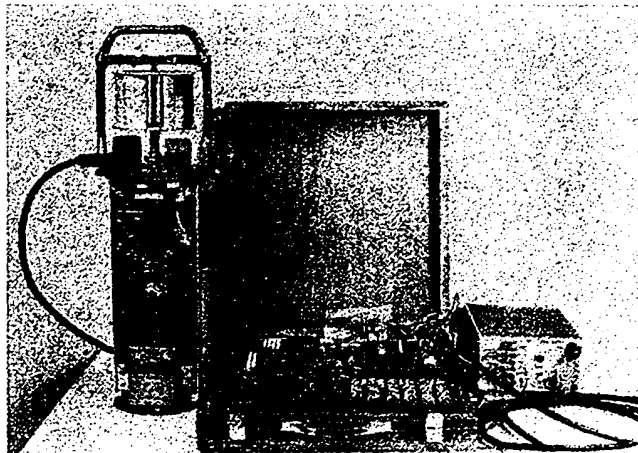


Fig. 5. RCM-4 CURRENTMETER CONNECTED TO DROS