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Microprocessor based direct read out system for Aanderaa currentmeter

S G Diwan, K Ashok Kumar & R G Prabhu Desai
National Institute of Oceanography, Dona Paula, Goa 403 004, India

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Before deployment and subsequent retrieval of currentmeters, it is essential to check all the sensor parameters getting recorded on the magnetic spool. This paper outlines a scheme, developed at NIO, for online reading of the sensor parameters separately on the LED. 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 6 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 and onboard vessels. In conjunction with hydrophone transducer, it can be used for real time monitoring of data recorded in the moored currentmeter.

Recording currentmeters model-4 and model-5 manufactured by M/s Aanderaa Instruments, Norway are self recording type and are deployed in the sea for extended periods for ocean current speed measurement. Their use necessitates practical insight into several fields such as mooring and retrieving instruments, operating and maintaining instruments, calibration of sensors, tape reading and data processing. In Aanderaa currentmeter[1] 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.

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 digital data which are simultaneously recorded on 1/4 in. 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.

Method

The output pulses at the electrical terminal of the currentmeter are generated by the rotary encoder during the measuring process and consists of 10 short or long pulses (Fig. 1) called a word for each channel. As set of 6 words makes one record covering about 26 sec period, it is possible to tap the each word, display and hold it till the next word arrives. For this, a system has been developed around a commercially available microprocessor board. This 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.

Schematic representation of direct read out system is given in Fig. 1. The electrical signal available at the currentmeter top end plate has a 5 V negative binary logic and to make it compatible to SID (Serial Input Data) line of microprocessor 8085 an operational amplifier based inverter[2] is introduced. The hardware architecture of the microprocessor board is shown in Fig. 2.

The microprocessor software is developed so as to monitor the output, track the binary zeros and ones flowing in to calculate their decimal equivalent and present it on the 7 segment LED. Flow chart of the algorithm is represented in Fig. 3. Initially, program senses the status of SID line and ignores it when low. Once the SID line goes low, the counter is compared with 60 to see if binary '1' (counter < 60) or binary '0' (counter > 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 these 4 digits are stored in 4 successive memory locations.

To display these characters, a monitor routine called OUTPUT[3] has been used. The OUTPUT routine displays in the address field of segment LED, the characters stored in successive memory locations with the starting address pointed to by HL pair. The OUTPUT routine destroys all registers

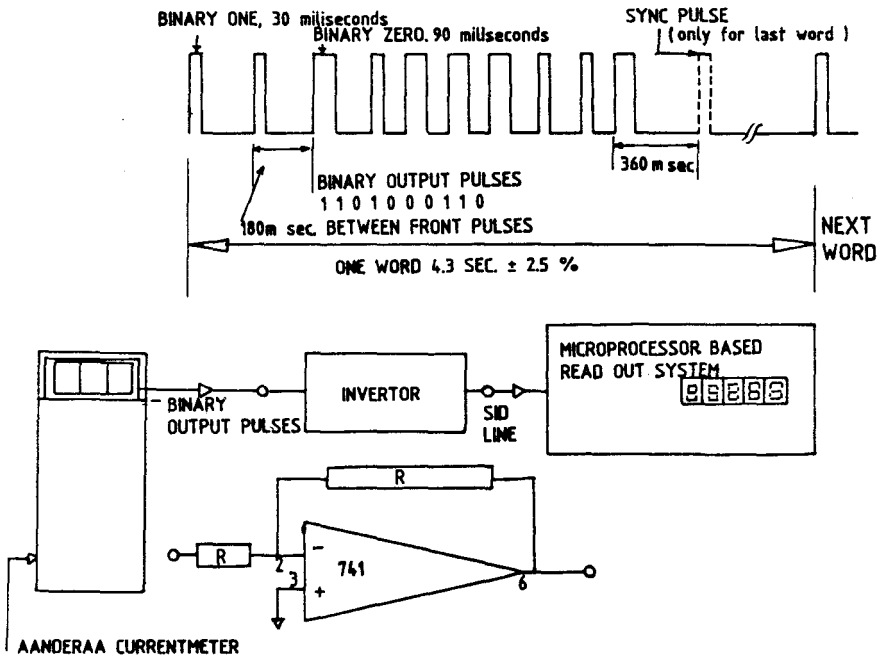

Fig. 1—Direct read out system (schematic)

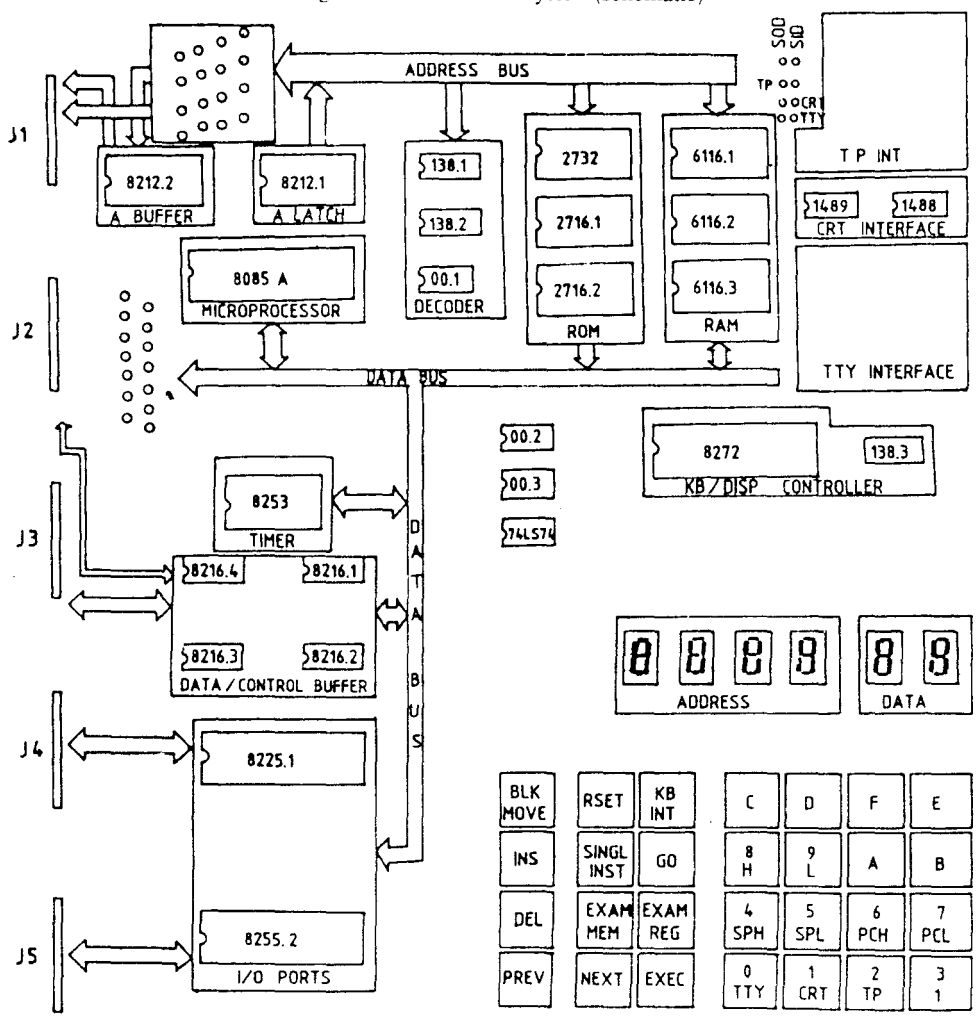

Fig. 2—Hardware architecture of microprocessor board

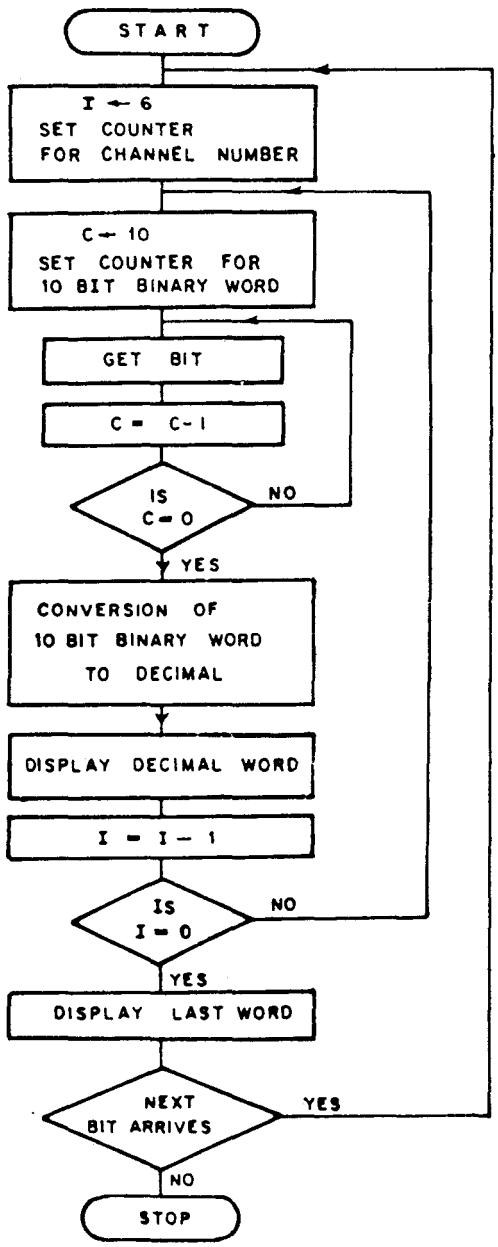

Fig. 3—Flow chart for direct read out system

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 1 after the display of each word. Thus decimal values of all 6 words will be displayed one by one.

Aanderaa currentmeter is interfaced with the direct read out system which is first put on. After this the currentmeter is made on. The direct read out software is looking for output line of currentmeter for long off period which is found only in the beginning of the transmission frame. Hence when built in quartz clock triggers the measuring cycle, the first 10 bit binary word starts flowing out at the electrical terminal of the currentmeter. Then the SID line of the microprocessor starts sensing the incoming bits. Thus the interlocking of currentmeter and direct read out system occurs at this instance when first bit appears at the SID line.

Results and Discussion

The output of the direct read out system has been compared with recorded values on magnetic tape and is found to agree within an accuracy of ± 1 bit. This system is very useful for checking RCM 4/RCM 5 currentmeters after servicing prior to each deployment in mooring line and is routinely used. 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 which picks up acoustic signals emitted by the RCM 4 currentmeter, thus enabling to monitor the moored currentmeter.

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