

THE OUTPUTS OF A TIDE GAUGE

Storage of tidal data on EPROMs (Erasable Programmable Read-Only Memories) avoids the use of conventional type of trouble-prone and unwieldy chart recorder and printer in the field. The software described allows the user access to the stored data via the medium of 7 segment display, printer and chart recorder. The technique is applicable to any type of data recorded on PROMs and the methodology is applicable to most types of "microbased" hardware. Tidal data collected from Hugli Point Station, Calcutta is presented in the form of Chart recorder trace.

AN AUTOMATIC TIDE-GAUGE system has been developed and field-tested at the National Institute of Oceanography, Goa.

Previous tide-gauges in the country have been mechanical types recording on some form of chart. The present unit records tidal data on EPROMs. Since peripherals such as printers and chart recorders require attendance whilst in operation, the concept of an autonomous system recording on EPROMs is both economical and trouble-free. This is especially the case when a matrix of tide-gauges has to be deployed—as is usually the case. The software described was developed around the 8085 microcomputer board designed at the Institute.

DESCRIPTION

In the unit described here, data in 16-bit form is stored sequentially in Intel 2716 EPROMs (ref. 1) with the lower order data byte in the lower order address. While data is ready to be stored, the acquisition programme identifies the next unwritten location and configures the memory in the write mode with its \overline{OE} pin held high and applying a high level TTL pulse at its \overline{CE}/PGM pin and +25 V at its V_{pp} pin for a duration of 50 ms for each of its locations.

The software described retrieves the data from memory and displays it on 7-segment LED, printer or chart recorder dictated by the status of front panel toggle switches on the unit. These switches are connected to I/O ports on the cpu board. The procedure for the retrieval of data in the three forms mentioned above is developed as two modules called the DISPLAY/PRINT module (Fig. 1) and the CHART module (Fig. 2). These two modules have been linked to the data acquisition programme on an Intel's MDS 230 system. Each module is separately discussed below.

Display/Print Module

The terminology 'module' is used, as it is self-contained and includes all the required sub-routines. It is independent and may be executed as a full programme. However, the main acquisition programme "sees" this as its subroutine and calls it when the "DISPLAY/PRINT CONTROL" switch is in the ON position. This module is described below in three steps.

In the first step, the ten most recent data are displayed, beginning with the most recent data (This explains the 'set counter 10' in the flow-chart of Fig. 1. This step is useful during trouble shooting and testing of the system). After display of each data, a beep is generated for a short duration, at the same time blanking the display. After displaying the last ten data, all zeros are displayed to indicate to the user that the display set is over.

The second and third steps provide the user a choice of visual display or print out of all data, dictated by the status of DISPLAY/

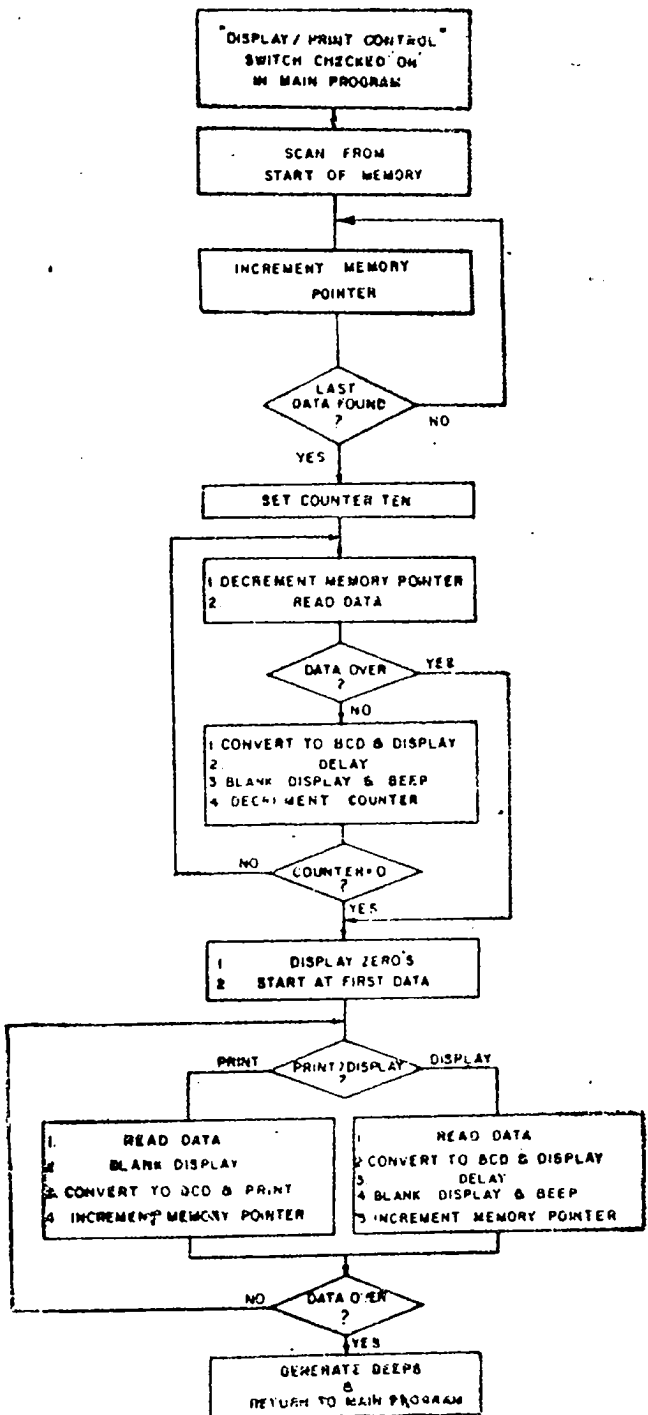


Fig 1. Display print module.

PRINT switch on the front panel of the unit. During printing, the microcomputer issues a blanking signal to the LEDs to conserve power. The end of data is signalled by an audible beep from a beeper on the front panel.

Chart Module

Though data in binary format is necessary for computer analysis, in order to have an overall idea about a continuously varying parameter

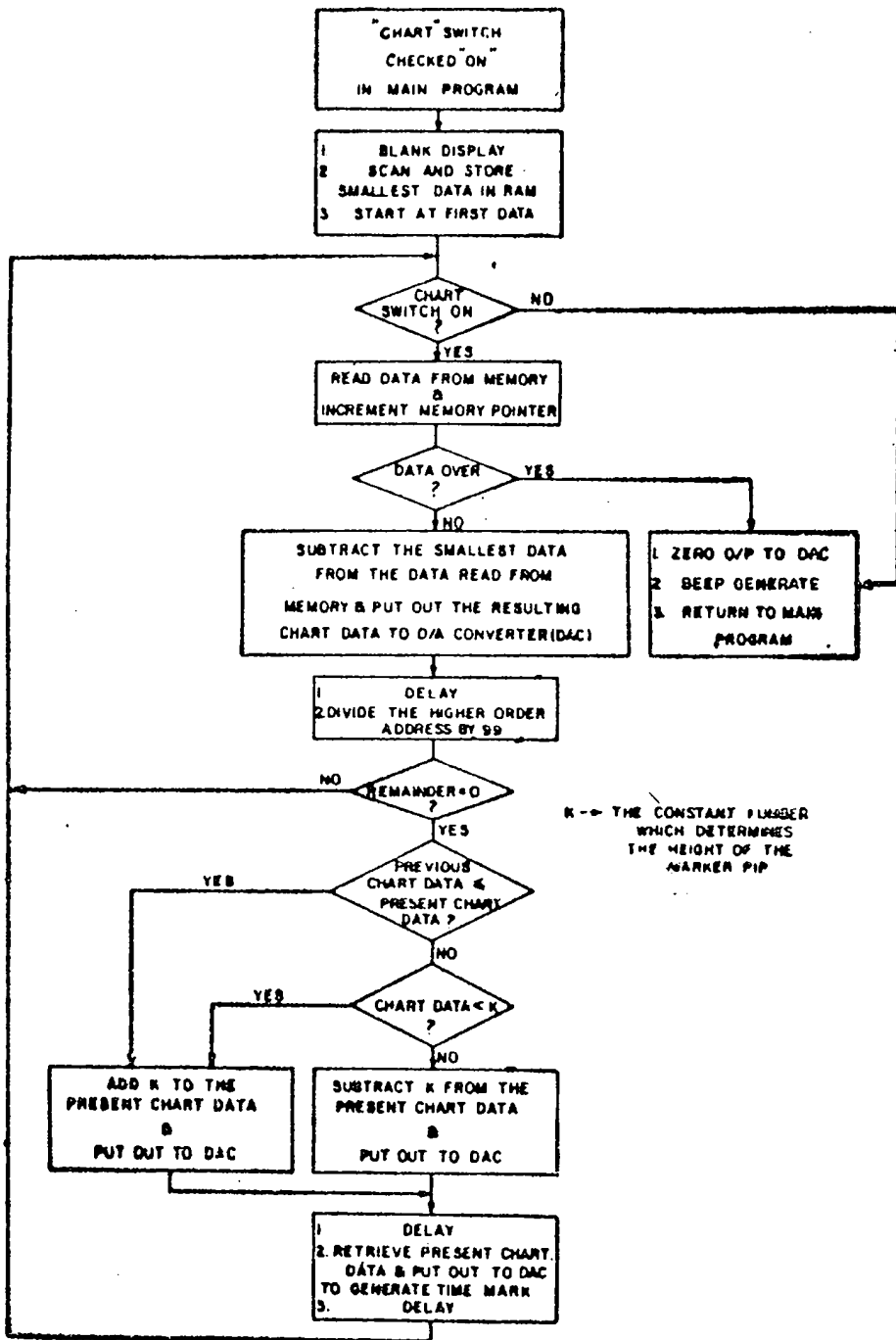


Fig. 2. Chart module.

such as tide, a graphical representation is often useful. The chart module described serves this purpose. This module provides an automatic offsetting of data so that the tidal variation can be traced on the largest possible scale of the chart recorder, independent of the datum at which the depth sensor had been placed during data acquisition.

Another useful facility that the chart module provides is the generation of marker pips on the trace. This is useful where data stored in memory had been acquired at certain known intervals of time. Once

the initial time (say X) of acquisition of the first data and the interval (say Y) of data collection are known, the marker pips help the user to have an easy understanding of the magnitude and nature of variation of the parameter of interest at any desired time or date.

The programme flow is as follows. To begin with, the complete data in the memory is scanned and the one having the smallest value is identified. This value is then subtracted from the first data and this offsetted value, which is the desired variation, is traced on the chart recorder. This procedure is repeated for each successive data. After

the N^{th} or multiple of N^{th} data is identified, a constant number k is added to the offsetted data and put out to the D/A Converter again for the generation of marker pip. The sign of k is decided by the slope of the trace. The slope, in turn, is determined by comparing each data

with the previous one. This method ensures that in most cases, the marker pip points in the direction of change of the trace and hence its shape remains undistorted by the generation of marker pips. As the N^{th} or multiple of N^{th} data is identified by dividing the address of higher order byte of data by N , the first marker pip will be generated at time $X+Y(N+1)/2$ and the time difference between each successive marker pip is YN . In this programme, N equals 99.

Once all the data have been traced out, the programme energizes the beeper on the front panel to alert the user that the data set is over. A typical trace of the tidal data collected from Hugli Point Station, Calcutta is shown in Fig. 3.

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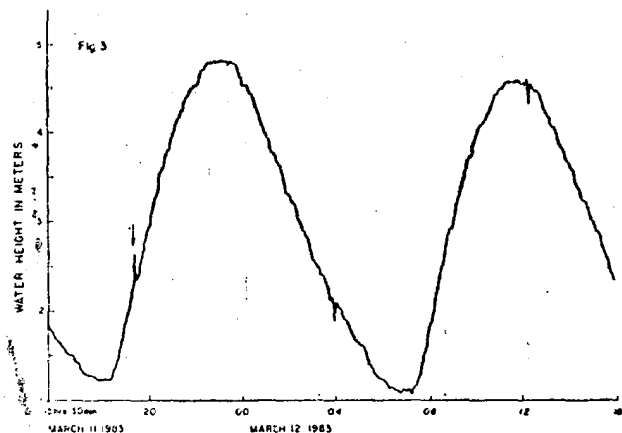


Fig. 3. Chart recorder trace of Tidal oscillations observed at Hugli point station, Calcutta port trust. Arrow indicates position of marker pips.