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ENGINEERING MEMO #122

Data Collection for 140-foot Measurement Using the Stepping Bar

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1. Introduction

J. Ralston's Memo #121 gave an overall view of the steps to be taken to measure the 140-foot surface. The present Memo is a series of notes on the way the stepping bar data will be recorded on the HP 9825A mini-computer. The data to be recorded for each step along a radius are:

(a) A number (probably 10) of readings of the tilt-sensor voltage. This varies from +5 to -5 volts as the tilt angle goes through $\pm$ 15 degrees. Each voltage will read on the Data Precision 3500 DVM to the nearest 100 μV. The rate of reading is set by the DVM.

(b) A smaller number (probably 5) of readings of the distance-sensor voltage will be read, also by the DVM, to the same precision.

2. The Data System

The system is shown in a simple form in Figure 1. The HP 9825A is programmed to control the whole of a data-taking cycle. The tilt and length-sensor volts arrive from the telescope Cassegrain house via telescope cables and are connected to inputs A and B of the switch. The tilt-sensor input (A) will be monitored also for noise with an oscilloscope. The switch (made from a DG200B with the help of R. Weimer) connects either A or B to the DVM under computer control. The switch needs $\pm$ 15 volts.

The computer controls the switch via a control box and interface cable (Bill Vrable). The code (wtc 15, 1) switches to input A and (wtc 15, 2) switches to B. The DVM sends digital data to the 9825A via a multi-connector and the DVM interface box. The DVM is set on the $\pm$ 10 volt range and, of course, alters sign automatically.

The simple 9825A program reads 10 values of tilt, 5 of length, prints all readings and mean values. It also gives the RMS tilt in arc seconds. When used on the telescope it will convert tilt volts to angle, store all readings taken on a given radius and write all readings on tape. All 48 radii can be written on one track of a tape cassette.

3. System Tests

The following points have been tested:

(a) Does the system accurately transfer voltages through the switch to the computer print-out? An instrument calibrator used over $\pm$ 5 volts was applied to each of the switch inputs separately. The other input was held at 0 volts. The computer output, when plotted against voltage input showed a straight line of slope 0.99965 $\pm$ .00005. This is as close to unity as one would expect the calibrator and DVM to agree.

(b) Is there "cross-talk" between the switched lines? The B input was varied between +5 and -5 volts with the A input held at "zero" volts. (A 1000 ohm resistor was used across the A input to simulate the sensor impedance). The voltage read across A changed by 20 μV as B went from +5 to -5 volts. This is well within the accuracy of the test.

(c) Is there "sensor" cross-talk? The important sensor is the tilt sensor. The bar was placed on the level granite slab at such an angle that the tilt sensor read about -4.8 volts. The depth sensor was moved between settings of about 0 volts and -8 volts. The tilt sensor reading changed by (60 $\pm$ 200) μV - essentially zero. The larger RMS here is due to tilt-sensor vibration.

4. Operating Notes

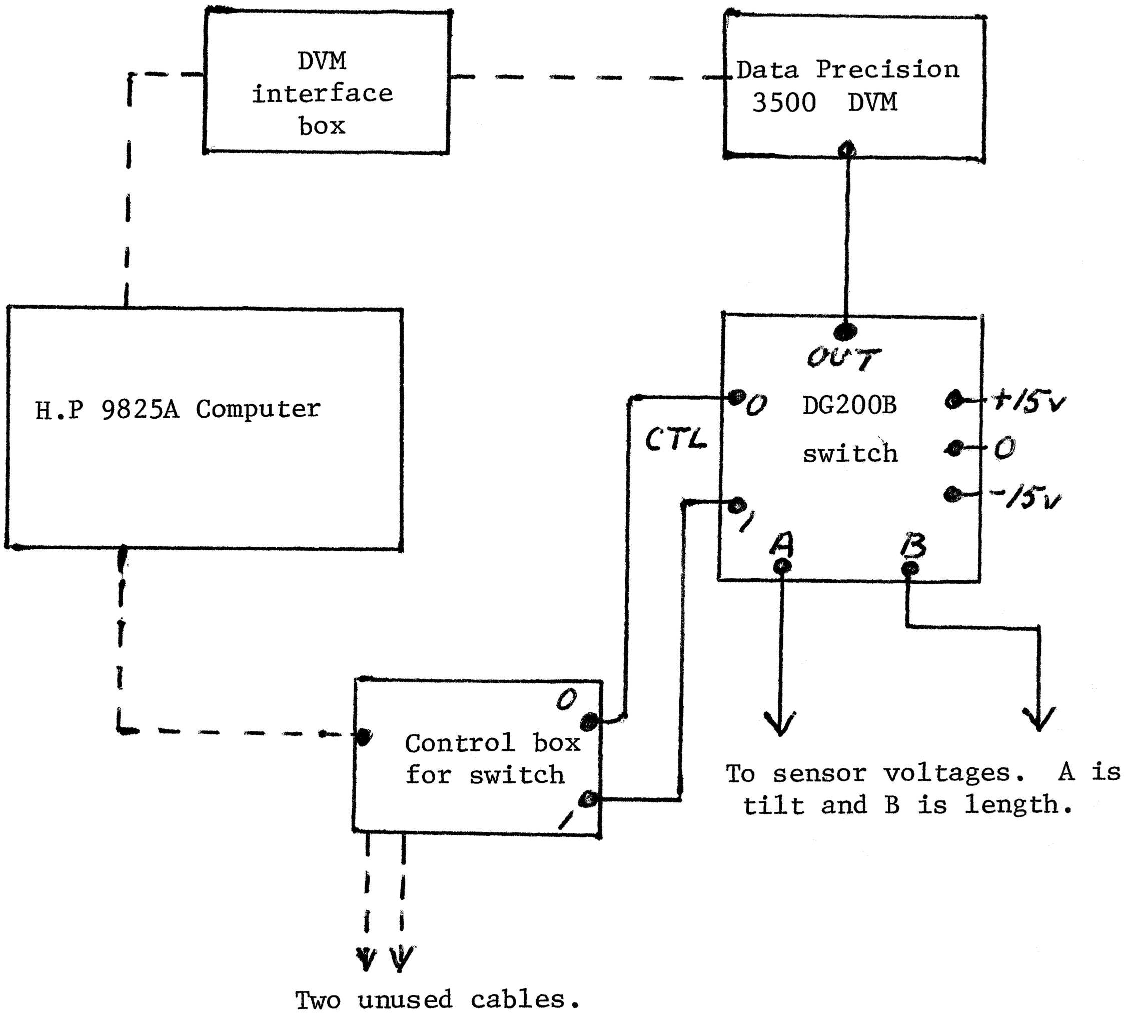
(a) Supply AC power to the HP 9825A, DVM, DVM interface box, the switch control box and the bar-power box.

(b) Supply $\pm$ 15 volts (be careful not to over-voltage) to the switch.

(c) Read in the program (File #1 on tape) by keying LOAD, 1, EXECUTE.

(d) Check program is in by LIST, EXECUTE.

(e) To read sensors, press RUN.



Interface cables are
shown dashed.

<u>Figure 1</u>

A Block Diagram of the System.