Development of a Multichannel Data System

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INTRODUCTION

A complete data system which can accept ten channels of millivolt data has been designed and developed at N.A.L., Bangalore. The system uses a maximum number of indigenous components. The shaft digitiser and translator are made at N.A.L. The basic sensing element is a self-balancing type potentiometric recorder. The system is modular in construction and capable of different degrees of sophistication. Also different printing formats can be accomodated without difficulty. The system finds extensive applications in quasi-static measurements of strain gauge outputs.

General Description

A uniselector scanner accepts as many as ten (in special cases fifty) channels of information. The scanning rate is variable with a minimum time of 1 second between channels (limited by the response of the strip chart recorder). The scanned output goes to a strip chart recorder, which provides a graphic plot. Also attached to the shaft of the recorder is a digitiser (N.A.L. design) which provides a 12 bit binary output in the form of contact closures. A solid state translator connected to the digitiser provides translation of the coded information into decimal form and displays this number on a 3 digit lamp display. The decimal output of the translator is further modified and mixed with other information such as format, carriage return, line feed etc., to drive a teleprinter. The teleprinter incorporates a page printer and paper tape perforating equipment so that in-formation is available in a form directly acceptable by a computer.

Scanner

The scanner is of N.A.L. design and is built around a uniselector (manufactured by Indian Telephone Industries), which connects the desired channel to the strip chart recorder either on manual command or automatic program (at fixed intervals). The uniselector is a reliable scanning unit and the errors introduced due to its contacts are insignificant for full scale voltages at least as low as 5 millivolts. Fig. 3 shows the scanner circuit, and is self-explanatory.

Strip Chart Recorder

This is a standard commercially available unit. Following is the brief specification of the recorder used in system :
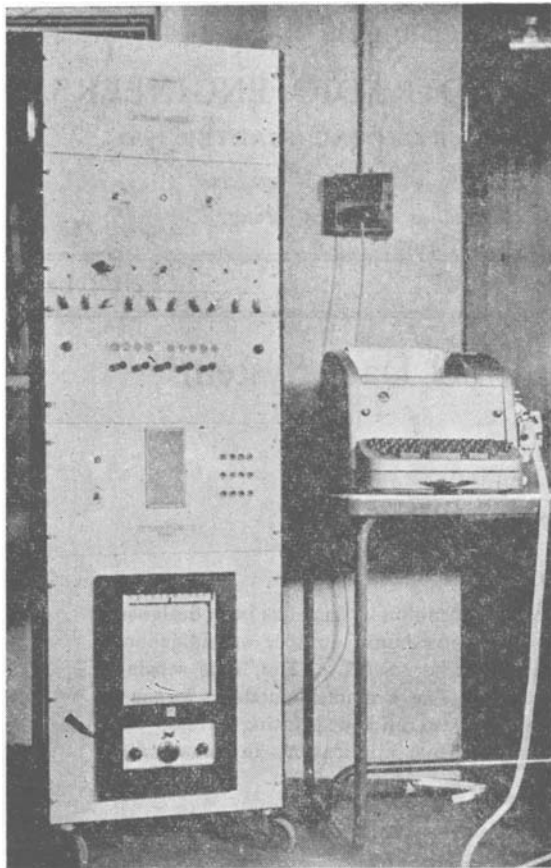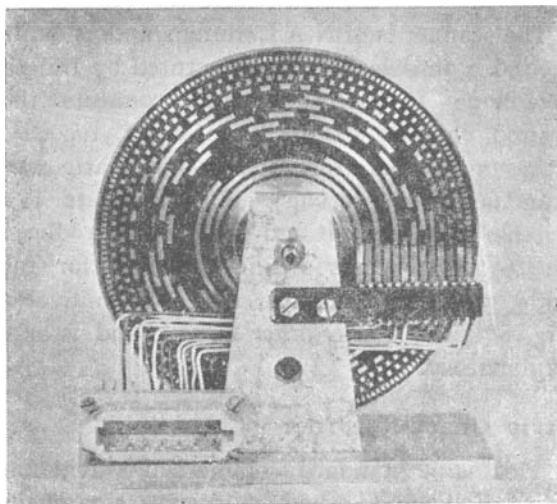
1

FIG. 1

FIG. 2

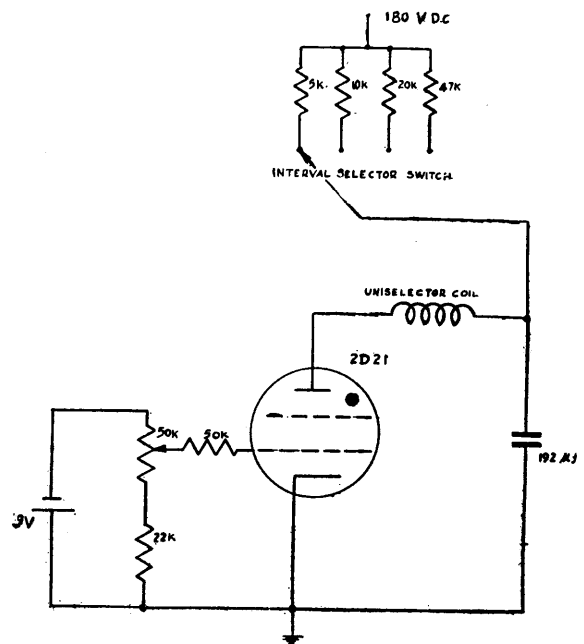FIG. 3

a) Chart width   6″

b) Pen speed   1·5 sec. for full scale travel

c) Zero suppression   upto ± 50 mV

d) Recorder range   0-1 mV to 0-20 mV variable.

Shaft Position Digitiser (FIG. 4)

This unit is of N.A.L. design. The primary requirements of the digitiser are:

1. The inertia load imposed on the shaft of the S.C.R. should not affect the recorder response materially.

2. The coding must be unambiguous. The question of ambiguity arises if more than one digit is to change at a time (e.g. in the simple decimal system successive numbers 99 and 100 differ in three digits.) A mechanisation of this process results in an ambiguity during change-over, since it is difficult to
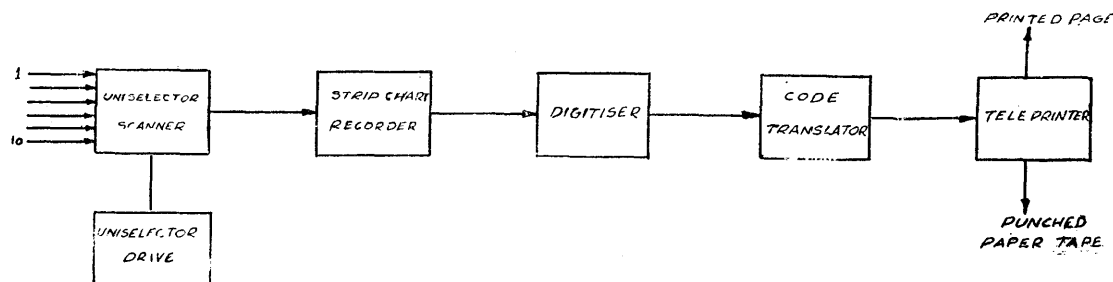
FIG. 4

achieve absolute simultaneity. In unambiguous codes, only one digit changes between any two successive numbers.

Code Translator

This accepts the coded digitiser outputs and converts them into decimal information. This unit is completely transistorised and has a built-in in-line decimal display.

Teleprinter Drive

This circuit converts decimal output from the code translator and provides the drive voltage to the teleprinter magnet. It also provides the standard code drives necessary from considerations of the printing format, such as a new line for each channel or a space between channels.

Teleprinter

A creed teleprinter is used. This provides a punched paper tape as well as a printed page. Punching speed is 10 characters per second. Hindustan teleprinters made in Madras can be used without any change in the system.

Transducer Power Supplies

It is possible to keep the strain gauge bridge "hot" by applying an unregulated a.c. voltage. When a particular channel is selected however a highly stabilised d.c. voltage is used to excite this channel only. This drastically reduces

the power required from the highly stabilised supply. 6.0 volt a.c. is applied to transducers not selected, and a highly stabilised 6.0 volt d.c. is applied to the selected transducer.

Accuracy of the System

The overall accuracy of the system is better than $\pm\ 0.5\%$. The different sources of error are:

1. Dead-band and mechanical sloppiness of recorder

2. S.C.R. slide wire resolution

3. Digitiser resolution

   The accuracy achieved is found adequate for most data acquisition work.

Conclusion

The system is modular in construction so that a variety of modifications can be realised, by merely adding or removing standard units. The system is capable of modification to include any number of channels and also higher speed of operation using faster recorders/digital voltmeters. Because of its versatility and speed, the system is likely to find wide applications in various fields such as structural engineering, multiple pressure measurements etc. In fact the system will be of considerable use whenever a large amount of data has to be collected in a comparatively short time.