Automated Frequency Standard Stability Data Reduction

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This article describes a design using a medium-sized computer, a fiber optic communication link, and a desk top computer to reduce data collected at a remote site for analysis of frequency standard tests.

I. Introduction

In the past, the reduction of data acquired at the Interim Frequency Standards Test Facility was performed by hand. However, increased testing of frequency standards resulted in the need for a faster method of data reduction. With this need in mind a design was initiated that would allow data input to the Xerox Sigma V computer to be analyzed (by a program developed as a part of this effort), then transmitted via a fiber optic link to a desk top computer, where the results could be plotted automatically on a printer/plotter.

II. Description

Data generated at the Interim Frequency Standards Test Facility is collected on magnetic tape, which is then transported to the Xerox Sigma V computer. An Allan Variance (two sample variance) is then calculated. The Allan Variance (sigma vs tau) is then written to a data file in the Sigma V.

A fiber optic communication link between the Sigma V and a desk top computer (located in a remote laboratory) was designed to transmit data in the Sigma V file to the desk top computer. The fiber optic link consists of a module to house the power supply for the fiber optic link as well as the wiring for data transfer (Figs. 1 and 2). The fiber optic link (a standard RS232 full duplex link) operates at data rates of up to 100k baud over a distance of 200 meters.

A program was written for the desk top computer that will automatically access the data file in the Sigma V, process the data and provide a data plot (Fig. 3). An overall block diagram of this system is shown in Fig. 4.

III. Conclusion

The Automated Data Reduction System is now operating and has improved data reduction by a factor of 10 over the hand method. An example of a typical data output is shown in Fig. 5. A fiber optic link has been installed between the Mesa and the Timing and Frequency Systems and Research Laboratory at JPL. This link will be connected to the Interim Frequency Standards Test Facility and the desk top computer in the laboratory where the Allan Variance computation will be performed and the data plotted in real-time, eliminating the need for magnetic tape transports and the use of the Sigma V computer.

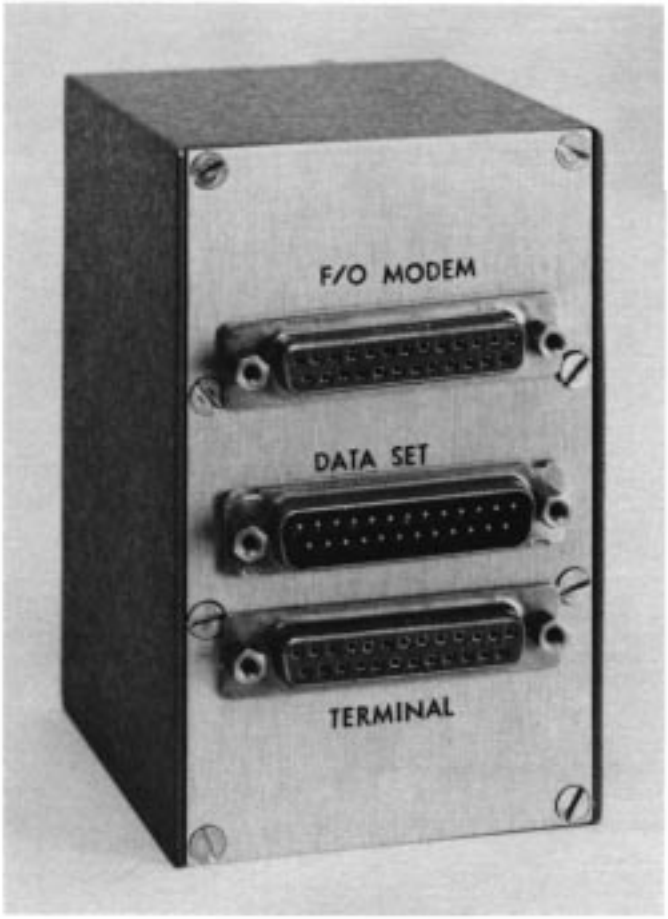

Fig. 1. Fiber optic-RS232 interface module

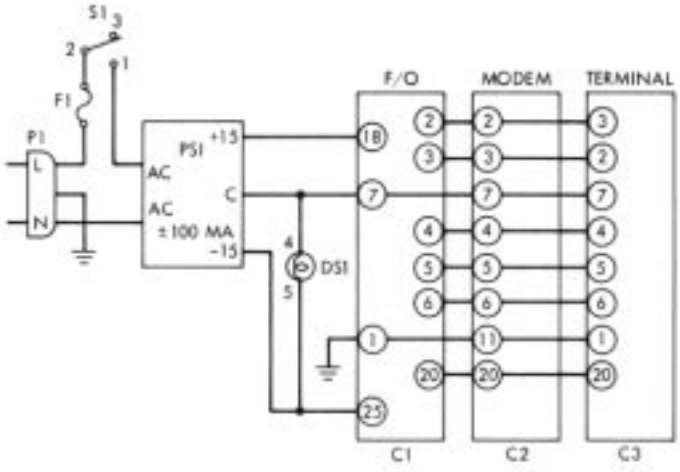

Fig. 2. Fiber optic-RS232 interface schematic

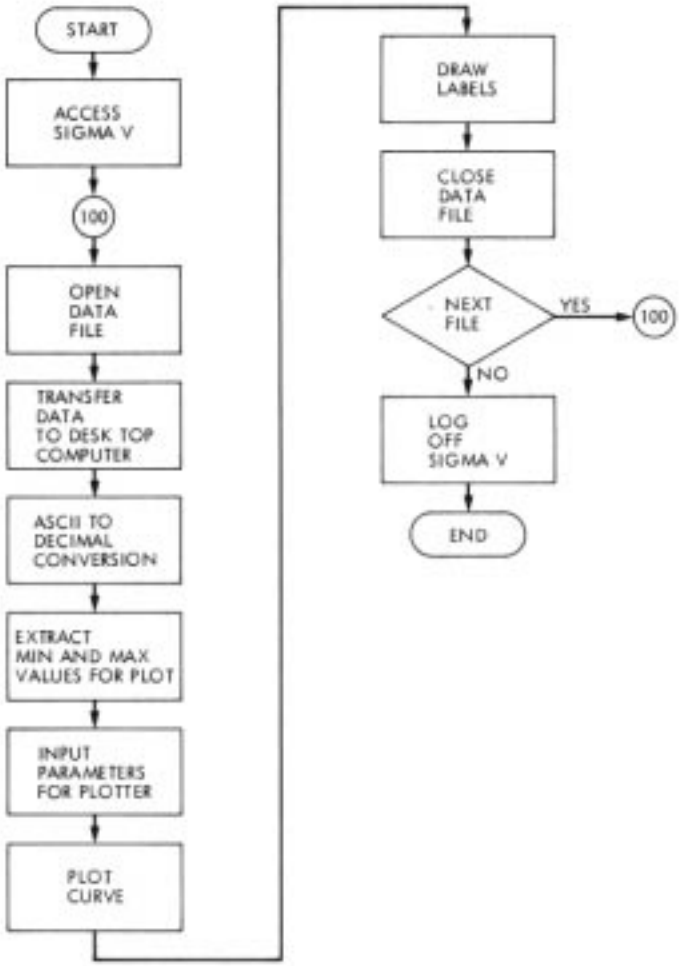

Fig. 3. Program flowchart for data transfer and manipulation

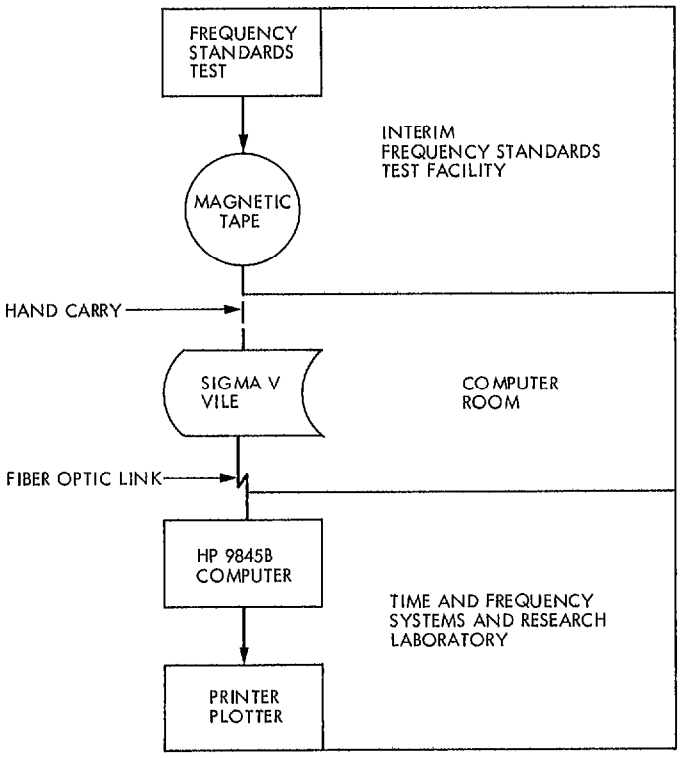

Fig. 4. Allan Variance data flow

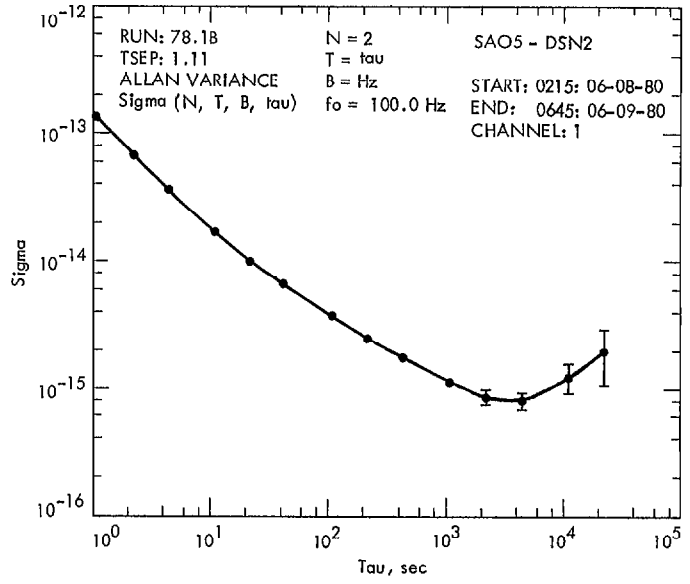

Fig. 5. Typical Allan Variance plot, sigma vs tau