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A UNIFORM FORMAT FOR EXPERIMENTAL DATA

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US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
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TABLE OF CONTENTS

	Page
I. INTRODUCTION	5
II. OVERALL ORGANIZATION	5
III. DATA FORMAT.	5
IV. EXAMPLE.	8
DISTRIBUTION LIST.	11

I. INTRODUCTION

A flexible form for packaging experimental data sampled at equally-spaced time intervals for transmission to and use by FORTRAN digital computer programs is outlined. If adhered to, this proposed standard would allow the distribution of data acquired at various sites to be exchanged with other installations for immediate use or translation to desired formats. Although neither completely universal in scope nor free from all representational and other computer-vs-computer differences, the format has been designed for as widespread a mini- and mainframe-compatibility as possible. Distribution using this format has been successful by means of magnetic tape and direct transmission via data communications line, but punch cards or other media can be employed as well.

II. OVERALL ORGANIZATION

To sidestep the problems of computer word length, internal representation, and file structure, the information is in the form of character-formatted, 80-column cards or card images. Each data acquisition is written as a separate file with no subdivisions by special sentinels but, where applicable, terminated by a single end-of-file. These restrictions reduce any compatibility problems to the seemingly irreducible ones of character code employed and, in the event magnetic tape is the distribution medium, blocking, number of tracks, etc. Naturally, the donor and recipient of any tape must agree on these points.

III. DATA FORMAT

The format includes a certain amount of purely descriptive information plus sufficient data to transform the supplied raw data values to physical units. Data layout is depicted in Figure 1 where the usual FORMAT specifiers of FORTRAN are observed. The first card (or card image) contains overall information. The first field of five columns contains an integer, currently 2, designating the version of the file format. This will be changed if the structure is ever altered. The next 30 columns contain the name of the experimental project. This is followed by the date and time of the event, and a sequence number to distinguish this particular acquisition from any others in the same series or project. Finally, the last field indicates how many A-D converters or other data-gathering devices were utilized for capturing the event. This number is naturally at least 1, but would be greater if several separate recording instruments were employed.

Following this first card are as many groups of cards as instruments used, one per device, each group of cards embodying the complete data from a single such device. The first card in each group provides overall information about the data-recorder. The first field is reserved for its name or description. The second notes the number of data channels. Next follow fields containing the number of calibration values per channel, the number of data values per channel, the time (ms) between

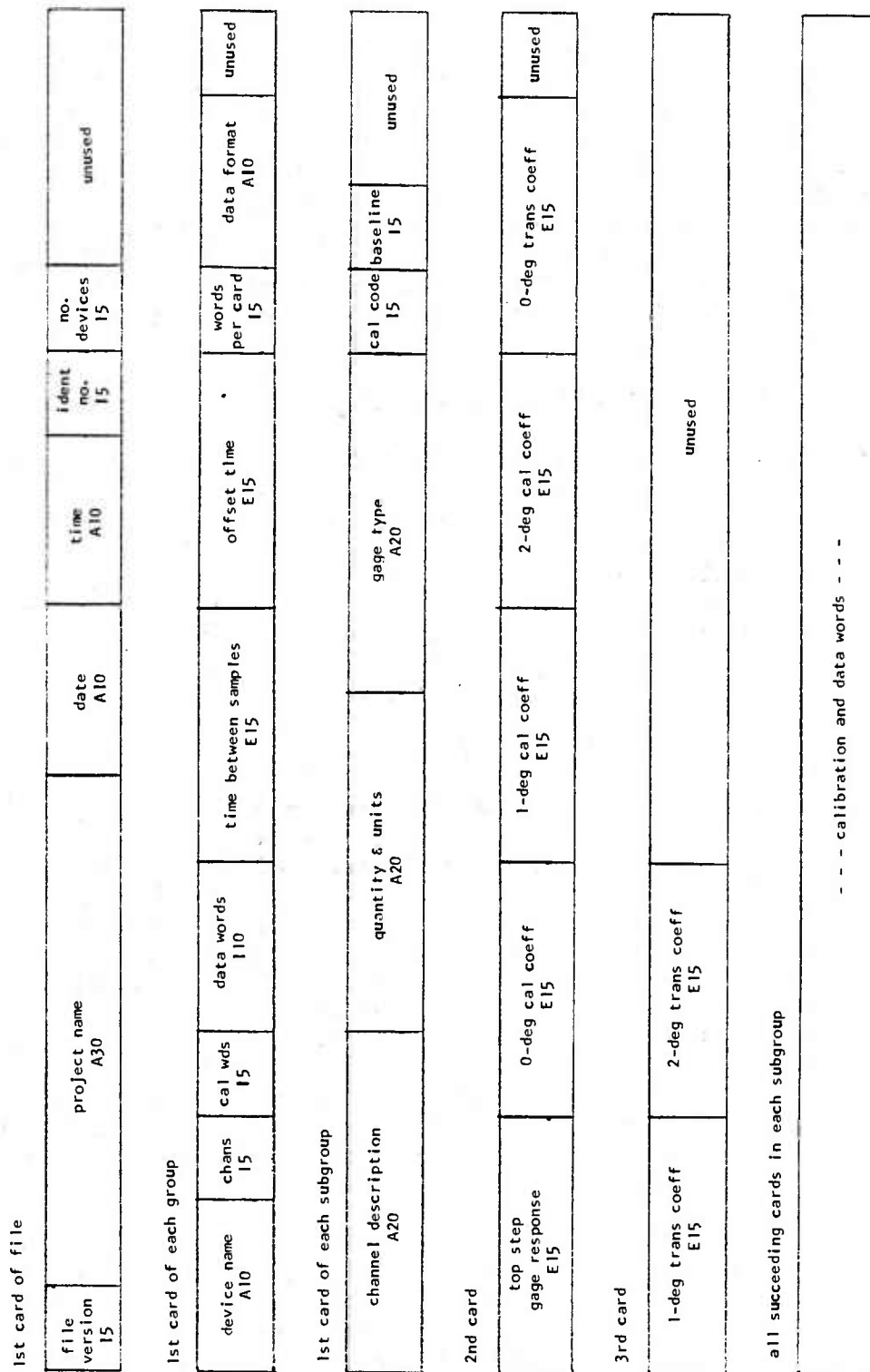


Figure 1. Card Schematics

consecutive samples in each channel, and the offset time (ms) from some initial experiment zero time to the start of the data in each channel. The final two fields specify the number of calibration and data values per card and the format to be employed in reading them. This format should be floating point to allow the application program to be perfectly general. For raw data expressed in integers, a zero-decimal format, such as (16F5.0), should be used.

Following the group card are subgroups of cards, one for each data channel on the recording device. Each subgroup is itself headed by three cards completely describing the associated channel. The remainder of each channel subgroup is a series of cards containing the calibration values, if any, followed by the data values, all written according to the specifications present on the group card as described above.

The first subgroup card contains descriptive information about what was measured on that channel, the physical quantity and units of the transformed data, and the transducer used. The fourth field is coded 1 if the channel is calibratable or 0 if it is not. The last field supplies the raw-data baseline in A-D counts from the calibration or a zero if the channel is not a calibratable one. The second and third subgroup cards provide all information necessary to transform the data values to physical units. The first field contains the value, in electrical units, of the highest step in the calibration. The next three fields contain the quadratic calibration coefficients used to convert each raw datum - offset by the baseline - into electrical units. Finally, the last field on the second card and the two fields on the third contain the quadratic transformation coefficients used to convert electrical units to physical units. That is, if a raw datum is given by "d", the baseline by "k", and the above-mentioned coefficients by "a", "b", "c", "α", "β", "γ", respectively, then,

$$D = f(g(d-k))$$

yields the transformed datum D in physical units where

$$\begin{aligned} g(x) &= a+bx+cx^2, \quad x = d-k \\ f(y) &= \alpha+\beta y+\gamma y^2, \quad y = g(x) \end{aligned}$$

Should the channel be uncalibratable, supply a = 0., b = 1., c = 0. It is understood that the donor should provide all the information necessary to transform the data. The calibration values are passed on to allow the recipient to re-calibrate if desired using, perhaps, preferred fitting algorithms.

IV. EXAMPLE

Figure 2 depicts an excerpt from a data file created in the manner described as an example of the application of the procedure.

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