12/10-14-93 JSD①

UCRL-ID-114808

Post-Experimental Plots for High Speed Data Acquisition Program

G. Koide
University of Hawaii, Hilo Campus, HI

T.R. Metz
Lawrence Livermore National Laboratory, Livermore, CA

July, 1993

Lawrence
Livermore
National
Laboratory

This is an informal report intended primarily for internal or limited external distribution. The opinions and conclusions stated are those of the author and may or may not be those of the Laboratory.
Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

Disclaimer

This document was prepared as an individual account of work accomplished by the authors in response to certain needs and interests expressed by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial products, process, or service by trade name, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of the authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California and shall not be used for advertising or product endorsement purposes.

This report has been reproduced
directly from the best available copy.

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information
P.O. Box 62, Oak Ridge, TN 37831
Prices available from (615) 576-8401, FTS 626-8401

Available to the public from the
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Rd.,
Springfield, VA 22161

Foreword

by Jay Brentjes, Group Leader High Pressure Systems, LLNL

Dr. George Koide is presently a Professor of Engineering and Computer Science at the University of Hawaii at Hilo. He has been a consultant and was employed by LLNL while on sabbatical leave in 1988. During this time he became deeply involved in preparing software systems for computer controlled test equipment used in the High Pressure Laboratory (HPL) as well as writing software programs for computer aided design and drafting for the former Nuclear Explosive Engineering Division. As a result of his personal interest in preparing a software program for data acquisition routines used on a MacIntosh computer, he maintained a close liaison with individuals in HPL and formulated the programs which are described in this and an other referenced report. Tom Metz, a technologist at LLNL, worked closely with Dr. Koide and has adapted the programs for use in the High Pressure Laboratory.

I would like to extend a personal note of thanks to Dr. Koide and Tom and encourage the reader to contact the authors for further information regarding this unique and useful software program. It is worth noting that the data acquisition program may be readily adapted to other test systems which have transducer outputs and require a real time display of data.

MASTER

4B

Abstract

The post-experimental plot program allows the user to obtain hard copy outputs for the data acquisition program. Both single channel and multiple channels can be plotted for the customer. Another feature is the telescopic plots of any section of the given data. In addition, the user has a choice of papers, 8.5 x 11 inch or 11 x 17 inch and the graphs may be rotated by 90 degrees. Before making a plot, the experimental curves can be displayed on the screen.

Table of Contents

	Page
Abstract	4
Table of Contents	5
I Introduction	6
II Procedures for Obtaining Post-Experimental Plots	6
A. Entering the Name of the Test	6
B. Selection of Channels	7
C. Type of Plots	7
D. Selection of Time Interval and Range of Primary Channel	8
E. Plot of the Data	9
III Summary	9
IV References	10
Figure 4-Post Experimental Plot	11
Figure 5-Telescopic view of Figure 4	12

I. Introduction:

An experimenter can get hard copies of the data gathered by the high speed data acquisition program described in reference 1. The operator runs the project called Graph to plot the data with an HP 7550A plotter. With this program, the user may first select the option to display the results on the screen. Then the plotter draws the results on either 8.5 x 11 inch or 11 x 17 inch paper. Also this software allows the user to rotate the graph by 90° so the horizontal axis is parallel to the longer side of the paper. Finally, this project can draw telescopic views of any section of the graph.

This software uses a menu which permits the user to select the plotted channels. Before executing the software, both the master and data files must be in the same folder as the Graph program and the plotter must be turned on and loaded with the appropriate size paper. For any given plot, the operator can select a maximum of four channels.

II. Procedure for Obtaining Post-Experimental Plots

The operator executes the post-experimental plot program by selecting the Graph icon or the name of the program. Then he/she must do four steps. The first is to enter the correct name of the test. Second he/she selects the channels to be plotted. Next the operator chooses the type of plots to be made. Finally the user types into the computer the time interval and minimum and maximum values of the primary channel. This process repeats indefinitely until the user quits the program. A summary of these four steps is shown as follows:

1. Enter the Name of the Test
2. Select Channels for Plotting
3. Size of Plot
4. Selection of Time Interval and Ordinate Values

After the user enters the time interval, the software automatically draws the graph with the plotter. Then the user may repeat, change any of the parameters, or exit the program.

A. Entering the Name of the Test:

When the user executes the Graph program, he/she must enter the title of the test to be plotted. This program will run if both the master and data files are on the drive. Then the program will ask the user to select the channels to be plotted. However if the test files are missing, the program will ask the user to reenter the title of the test. Otherwise the operator can exit from this program.

B. Selection of Channels:

After the operator enters the correct name of the test, he/she selects the channels to be plotted. The first channel selected is the primary one. When all of the channels have been chosen, a summary shows the user to change, add, or delete any channel. If everything is satisfactory, the user continues to the next menu to select the size of paper and its orientation.

The following figure shows a typical test using two channels.

```
0  Pressure in PSIG
1  Temperature in Degree C
2  Continue
3  Redo Selections
4  Change Name of Test
5  Exit
Channels Selected
Select a channel or other option
```

Figure 1. Menu to choose channels for plotting.

C. Type of Plots:

The user selects the types of plots made either on 8.5 x 11 inch or 11 x 17 inch paper. However before obtaining a hard copy, the plots may be displayed on the monitor for the user to observe the data. Then the software draws a hard copy on the HP 7550A plotter. Before getting it, the user must insert the correct size paper into the plotter and properly load it. The menu to select the type of plot is shown in Figure 2.

1	8.5 x 11	PLOT
2	11 x 8.5	PLOT
3	11 x 17	PLOT
4	17 x 11	PLOT
5	Screen Display	
6	Change Title of Test	
7	Exit	
- Select option 1 or 2 for 8.5 x 11 paper
Select option 3 or 4 for 11 x 17 paper
enter option number

Figure 2. Selection of size and type of plot.

The first two options use the 8.5 by 11 inch paper while the next two options use the 11 by 17 paper. Option 5 allows the user to inspect the plot before obtaining a hard copy. The plot to draw the grid lines is pen 1 and the primary color for the main curve is pen 5. For the other curves, the pens are located in slots two through four respectively.

For option 1, the plotter draws the time axis along the width of the paper, i.e. the 8.5 inch edge. To increase the resolution of the time axis, select option 2. Now the time axis is parallel with the 11 inch edge. However, this will diminish the resolution of the channels to be displayed. Figure 4 shows a typical plot of an experiment. Here the program plots pressure measured in psig versus time with its axis parallel to the 11 inch edge. This is option 2 of the type of plot selection which rotates the graph by 90 degrees.

D. Selection of Time Interval and Range for Primary Channel:

When the computer displays the time interval menu, the elapsed time of the test and the minimum and maximum values of the primary channel are shown. The operator may change both the start and end times and the minimum and maximum values of the primary channel for the horizontal and vertical axes respectively. The computer will automatically re-scale these values and use them for the dimensions of the axes. Figure 3 shows the menu for the selection of the time interval.

- 1 Start Time in Minutes 0
- 2 End Time in Minutes 5
- 3 Maximum Value 100
- 4 Minimum Value 0
- 5 Continue
- 6 Return to previous menu
- 7 Exit

Select an option

Figure 3. Selection of time intervals and ordinate range of the primary channel.

To zoom on a section of the plot, the user may change the start and end times for the plots. Also the expected minimum and maximum values should be changed by the user to correspond to that part of the curve. If the plot exceeds the range, then the boundary value of the graph will be selected. Thus the data may not be valid for any plots which occur at the boundary of the graph. Figure 5 shows a telescopic view of the pressure of Figure 4.

E. Plot of the Data

The screen display is always shown for all selections of plots. After the plot is done, the user clicks on the mouse to return to the Time Interval Menu. Finally, the user either draws another graph or exits from this program.

Figure 4 shows a typical plot of pressure versus time. To examine the maximum value, the computer can draw a telescopic view of this curve. By choosing a smaller time interval of 1.2 to 2.0 minutes, Figure 5 shows a zoom view of the maximum value of pressure.

III Summary

The Graph software accompanies the fast data acquisition program of 2000 samples per second to obtain hard copies. With zoom views, the experimenter chooses any portion of a curve drawn in finer detail. With the software displaying menus, a user can simply step through them to get hard copies.

IV References

1. G. Koide, T. Metz, "High Speed Data Acquisition for the High Pressure Laboratory", UCRL-ID-114807, July 1993.
2. "Operation and Interconnection Manual, HP 7550A Graphics Plotter", Hewlett Packard Part No. 07550-90002, July 1986.
3. "LabView 2, Operations Manuals", National Instruments, February 1992 Edition.

Figure 4. Post-Experimental plot of pressure versus time.

Figure 5. Telescopic view of Figure 4.

NAME OF EXPERIMENTER
 NAME OF OPERATOR
 1 psig

Koide
 George
 Max Value = 96.4

END

DATE

FILMED

11/16/93