Conv2BPA | BioAD | BioProc
2.26   1.31   1.61

Quick Reference Guide

These programs function together as a data acquisition and analysis system. It is possible, however, to use the BioProc program on data collected from other sources. The BioAD program, being hardware dependent, is hardware specific. Currently it is designed to run with a LabMaster A/D board and is only able to run from certain computer platforms. (At present the software can only be run on a Compaq 386 and a Toshiba 3200.) The BioProc program is suitable for any 386 computer or better (8086 and 286 versions are available) with a VGA graphics board. Both programs use VGA graphics (640x480) by default but can be run on an EGA board (640x350) by using the /EGA switch in the command line. E.g.,

      BioAD /EGA ...

Both programs can use command line switches to automate some of their functions. Usually they are started without switches (unless you do not have a VGA board or better). For a complete list of the command line switches use the /? switch. E.g.,

      BioAD /?   or   **BioProc /?**   or   **Conv2BPA /?**

Once the programs are running the user selects, by means of menus or by pressing functions keys, the operations that are needed to collect or process data. To obtain information about the various function keys, messages will appear in an appropriate window. Context-based help may be obtained by pressing the **F1** key.

      Copy the programs, BioAD and BioProc, to a drive and subdirectory of your choice, for example, C:\BIOAD. To use them on data stored in another drive, first go to the drive and subdirectory containing the data. E.g., to use the data in subdirectory A:\DATA of your floppy A: drive, enter the following commands from the DOS prompt:

      A:
      CD \DATA
      C:\BIOAD\BioProc

This will start the program, BioProc, which must reside in the subdirectory, C:\BIOAD, of your hard drive, C:. Note, all files that these programs create will be stored, by default, to the current subdirectory unless you enter a full "pathname" in the filename menus.

      You may also want to use the BioProc program on data obtained from other data acquisition systems. You must first convert the datafile to a form suitable to BioProc. The utility program, Conv2BPA, can do this for you if your datafile is stored in 10 column fields and stored in ASCII form (i.e., printable form).

Conv2BPA

To use the BioProc program with data obtained from other sources a program called, **Conv2BPA**, has been provided. This program converts an ASCII-type file to a file that is compatible with the BioProc program. The input ASCII file may have comment lines at the beginning followed by the data. Comment lines, containing text or numeric information, must start with a non-numeric (nonblank) character (e.g., a ">" or a "*") as illustrated in Figures 1 and 2. The data must be arranged in columns with a maximum of sixteen channels or seventeen if the first channel is time (in seconds). Each datum should include a decimal point. If the data file is

```
* Comments are permitted at the beginning of the file as long as the first character on each line
* is not a blank or number.
0.0000 3.110 -3.122 0.000 -16.859 -16.794 24.737 0.000 0.000 24.737 0.000 -1.953 0.000 0.000 0.000
0.0200 3.110 -3.122 0.000 -16.859 -16.794 24.737 0.000 0.000 24.737 0.000 0.000 0.975 0.000 3.609
0.0400 0.000 -3.122 0.000 -16.859 0.000 86.939 0.000 0.000 86.939 0.000 0.000 0.000 4.883 -107.422
0.0600 0.000 -6.244 0.000 -33.718 0.000 0.000 0.000 0.000 0.000 0.000 -1.953 0.000 9.766 0.000
0.0800 3.110 -3.122 -6.309 109.312 58.908 24.737 0.000 0.000 24.737 0.000 0.977 0.000 0.000 0.000
0.1000 3.110 -9.366 12.617 201.765 -16.794 24.737 0.000 0.000 24.737 0.000 -1.953 0.975 0.000 3.609
      .       .       .       .       .       .       .       .       .       .       .       .       .       .       .
      .       .       .       .       .       .       .       .       .       .       .       .       .       .       .
      .       .       .       .       .       .       .       .       .       .       .       .       .       .       .
```

Figure 1. Example of an ASCII file suitable for conversion by Conv2BPA.

from a FORTRAN program they should be arranged in 10 column fields with 8 fields per line. (This corresponds to a FORTRAN format specification of 8F10.0). A maximum of 16 fields (signals) may be processed by the BioProc program therefore it may take one or two lines of the ASCII file to represent one instant in time for FORTRAN-type files. Other ASCII files which

```
> Filename: WK13CB.RF              Sampling rate (Hz):    50.0
> Body mass (kg):        0.00        Body weight (N):   680.0
> Date:  1990-01-16  15:49:57
> Bias levels (V) are:
>   -0.2296    -0.1808    -0.1690    -0.2467    -0.1851    -0.2443
> Fx,Fy,Fz factors:    100.0  100.0  500.0  Minimum Fz force:    50.0  10.0
>     Fx        Fy        Fz        Ax        Ay        Mz      Foot Sw.
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
   -13.0425  -14.8852   89.5848    0.0689   17.7567    9.8561   -0.0051
     5.7196  -19.9560  244.2450   -3.0401   17.5848   -4.1729   -0.0051
    17.3825  -70.1573  386.2290   -2.4812   16.8177   -4.0587    3.3315
    22.9604  -83.3414  497.7870   -3.0737   15.9591    3.2242    3.3265
    13.8330  -97.0327  583.9910   -3.1331   14.7248   18.5213    3.3315
      .         .         .         .         .         .         .
      .         .         .         .         .         .         .
      .         .         .         .         .         .         .
```

Figure 2. Example of a FORTRAN-type file suitable for conversion by Conv2BPA.

have variable length records must have all channels on the same line. A sample non-FORTRAN data file is presented in Figure 1. A FORTRAN type file is illustrated in Figure 2.

Conv2BPA will first try to recognize the data format. If it cannot determine the filetype and sampling rate, you will be asked for the sampling rate of the data, in hertz (samples per second). In the example given each channel was sampled at 50 samples per second (Hz). Next, the program will ask how many data fields are expected in the input file. In the example given in Figure 1, there are fifteen data while in Figure 2, seven data fields are provided. Next, the program will ask if the data are arranged in 80 column fields. The data in Figure 1 are NOT while the data in Figure 2 are arranged in 80 column fields. Finally, a descriptive title will be requested as well as brief names for each data field. For the default labels enter <Ctrl-Z>.

The converted data will be stored in a file, with the file extension, .BPA. A sample of this file appears in Figure 3. This file could be used as into to the BioProc program. Notice that the first column contains the sample times and the following columns correspond to the data fields in the input file.

```
*  WALK. BPA
*  WALK. RF
*  Normal speed, level walking.
*     50.00      0.760
*        0         38
*  Channel:       0         1         2         3         4         5         6
*  Time    Fx        Fy        Fz        Ax        Ay        Mz        Foot sw.
*              50.000    50.000    50.000    50.000    50.000    50.000    50.000
    0.0000      0.000     0.000     0.000     0.000     0.000     0.000     0.000
    0.0200    -13.042   -14.885    89.585     0.069    17.757     9.856    -0.005
    0.0400      5.720   -19.956   244.245    -3.040    17.585    -4.173    -0.005
    0.0600     17.382   -70.157   386.229    -2.481    16.818    -4.059     3.332
    0.0800     22.960   -83.341   497.787    -3.074    15.959     3.224     3.326
    0.1000     13.833   -97.033   583.991    -3.133    14.725    18.521     3.332
    0.1200    -24.198  -119.851   690.479    -2.697    12.677    25.942     3.326
       .          .         .         .         .         .         .         .
       .          .         .         .         .         .         .         .
       .          .         .         .         .         .         .         .
```

Figure 2. Output file produced by Conv2BPA and suitable as an ASCII input file to program, BioProc.

BioAD

BioAD was designed to be data acquisition program only. It has limited graphics and no data processing capability. These features are provided by BioProc. Once BioAD is started, you must **Create** or **Open** an existing SETUP file. This file describes the maximum sampling rate and the individual sampling rates for each data channel. It is possible to sample a channel at a integral division of the maximum sampling rate. For example, if the maximum sampling rate is 1000 Hz, individual channels could be sampled at 500 Hz or 50 Hz but not 800 Hz. After completing the remaining fields in the **Configure setup** menu, you may **Save** the setup for future use or modification. (A copy will automatically be stored with the sampled analog data.)

Once the data collection setup has been defined you may enter subject characteristics and/or information about the camera/filming system, if appropriate, using the **Information** menu. You can then acquire data with the **Get data** menu. This menu allows you to choose between **Single** or **Multi-axis**, real-time, graphical display or **Numeric**. Usually choose multiaxis. The program will then switch to graphics mode and draw the axes and pause. When you press the "space bar" the program will start collecting from the analog input lines.

After the data have been collected, you may redisplay the data in their entirety with the **View data** menu or store the data with the **Save data** menu. You may save the data in **BioAD** format (machine language) or in **AS**CII format. Preferably choose the **BioAD** method that takes up less memory, requires less writing time and saves complete information about how the data were collected and displayed. Note that you can create a COMMENTS file with information about what happened during the data collection phase. Do this before saving the data. When data are stored in machine language a subdirectory is created with copies of the setup, filming, comments and subject information files stored with the data from each channel. When data are stored in an ASCII file, only part of the setup information is stored with the data. The associated files are not stored with the data in the current directory. It may be desirable to store data in both formats.

More trials may be collected or you may decide to process the data with the BioProc program. It is also possible to test the LabMaster board itself. The **Test** menu allows you to test and check the signal levels present on each analog input or output channel. For more information about this mode press the help key, **F1**, when in test mode.

BioProc

The **BioProc** program is a general purpose data processing, analyzing and displaying system. Once running you must first read your data file using the **Open menu** (**F2**). If you load a **BioAD** file you have the option of loading all or selected channels. If the data files are very long and computer memory is scarce you may have to load one channel at a time.

Once the data are loaded you may want to view the data graphically. Press **F9** to plot the data on a single axis or **F10** to plot on multiple axes. There are many features built into the graphics system. Experiment with the function keys to see how these options affect the display. To change the labels, colours and positions of the graphs before plotting use the **Graph setup** (**F8**) option in the **Edit menu**. You are allowed to plot one set of data in the same position as another, however, the scaling information on the right side will not be shown for each signal.

Within the graphics display press **F1** to obtain information about how to move the two vertical "cursor" lines. You may zoom-in on selected portions of the curves by setting the two cursors on either side of the region that you want to magnify and then pressing the **F3** (window) key. To zoom out, press the **F3** again. To alternate which cursor you are moving press the **Enter** key or drag the left or right cursors with the left or right mouse buttons, respectively. Press the **F2** (reset) key or the **F4** (unzoom) key to redisplay the whole data file. Note that some processing options, such as, **Descriptive statics** and **Integration** will operate only on the data contained between the two cursors; whereas, operations, such as, **Filtering** operate on the whole data file despite the positions of the cursors. Some functions keys, such as, **F1** (help) and **F10** (# axes) cycle through a series of optional features depending on the number of data channels or display options.

To produce a hard copy of a displayed graph you have three choices. If you have an Epson, HP or IBM compatible printer you may press the **F5** (print) key. Alternately, you may use the **PrintScreen** key if you are using the DOS GRAPHICS driver and a compatible printer. For example, if you have a HP LaserJet (II or III) enter the following DOS command before starting BioProc.

C:\DOS\GRAPHICS LASERJETII

This command only needs to be entered once during a computer session since the GRAPHICS program is a memory resident (TSR) application. Note that the LASERJETII option only became available with DOS 5.0 or later. Earlier DOS versions support certain IBM printers, such as, the Proprinter, the Quietwriter or compatibles. Consult the appropriate DOS manuals for details.

A useful feature is the **Duplicate** function in the **Channel** menu. This function copies the data from selected channels to any unused channel. This feature allows you to examine, for example, the differences between one filter cutoff frequency and another or to display a signal,

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simultaneously, with its time derivatives. The ASCII data file, FILTERS.BPA, is an example of single signal that was loaded, copied three times and then filtered in different ways.

The **Analyze menu** (**F3**) offers many data analysis and processing functions. Fourier analysis (one channel at a time) is provided under the heading **Fourier anal**. **Time base** normalization and **Ensemble** averaging are also possible. Offsets or bias levels may be removed and the data rescaled using the **Bias removal** and **Scaling** options, respectively. Usually no processing will be done until you press the **PageUp** or **PageDown** keys. The **PageDown** key generally means process all channels, whereas the **PageUp** key means process only the selected channels. The **PageDown** key is available for only some processing operations.

Finally, after you have processed your data, it is possible using the **Save menu** menu to store your processed signals in an ASCII data file for later processing or in an Lotus worksheet format for importing into spreadsheet or other suitable programs. It is not possible to save your data in the BioAD format; therefore, you can never affect your original data. You can, however, overwrite an existing ASCII data file or preferably in the BioProc binary format. The later can only be read by BioProc but retains more graphics settings than the BioProc ASCII format (.BPA format).