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TITLE	TIME INTERVAL HISTOGRAM PROGRAM
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TIME INTERVAL HISTOGRAM PROGRAM
LAB-8/L OR 8/I

ABSTRACT

The Time Interval Histogram Program records the time between sequential events occurring on Schmitt trigger II of the LAB-8. Usually, the spontaneous output of a single nerve cell is monitored in this manner. The display is a frequency distribution showing the duration of the interval vs. its frequency of occurrence. The total run time of the program is defined by a number of time segments or epochs. The amount of activity during each epoch is available to the user in a separate display called the zero order histogram.

The Time Interval Histogram Program is very similar to the PST program (DECUS 8-339). This description should be used in conjunction with the PST description to understand the fine points of the program.

The collection algorithm for the Time Interval Histogram is the following: The time between events seen on Schmitt trigger 2 is measured and then recorded in the appropriate bin. If the time interval measured was 2.5 milliseconds and the histogram had no minimum time constraints with a bin width of 1 millisecond; the third bin of the histogram would receive a count. The first bin is bin Ø so bin #2 would be incremented by one. If a minimum time is specified, the underflow bin, or the minimum time bin is bin Ø. The overflow bin is always the last bin.

SET-UP:

Time Scale: Since the LAB-8 is a digital device, time must be counted in increments rather than as a continuous function. The finer the increments, the more closely the real situation is approached. The majority of biological phenomena occur slowly enough that this departure from the real time world does not impose severe restrictions. Therefore, the first parameter we must assign is the time scale increment, or resolution. This is called the bin width. Since approximately 100 μsec are required to acknowledge the tick of a clock, bin widths are defined in multiples of 1ØØ μsec.

Once the units of the time scale are defined, the length and range of scale must be assigned. This is done by supplying the number of bins which should be recognized, i.e., (bin width) x (number of bins) yields time scale length and time at which the time scale should begin. The latter parameter is defined in answer to the question "Minimum time?" (where minimum time is in terms of bins). As an example: a histogram is defined as having bin widths of 5.Ø milliseconds It consists of 1ØØ bins and has a minimum time of Ø bins. The time scale would start at time zero (time zero is defined by the occurrence of each event, and range in increments of 5 milliseconds to time = 5ØØ milliseconds (5.Ø milliseconds x 1ØØ). If a minimum time had been specified, the starting and ending times of the range would be incremented by that amount (e.g., minimum time = 2 bins; therefore, 2 x bin width= 1Ø milliseconds total delay of the start of the range; thus the range would start at 1Ø milliseconds and end at 51Ø milliseconds.

Minimum time is used usually for one of two reasons. Either it is used to avoid artifacts which the stimulus might cause or it is used to move the time scale to the time of interest (i.e., if precise measurements had to be obtained at a specified time after the stimulus and no other time was of importance in the study).

The total time for the run is defined by specifying a basic time unit and the number of times this unit should occur from the time data collection is started. The timing feature is useful in studies where the nerve cell is prone to fatigue. After the preset time has elapsed, the program will notify the user and he can either output his data or return and take more data.

The output from the nerve cell should be connected to S2 (Schmitt trigger 2) on the AXØ8.

Load the program with the binary loader. SA=200

Trigger Initialization

At this point, adjust the Schmitt trigger thresholds by moving the knobs nearest the inputs so that the trigger is firing on data and not noise spikes.

When the trigger fires, the scope will show a line across its face. The presence or absence of this line indicates whether or not the Schmitt trigger is firing. If desired, a line may be attached in parallel (with the line going to the Schmitt trigger input) to the analog input number 2. Now, whenever the trigger fires, two traces will appear on the oscilloscope. One is a sweep of the analog input and the other is a base line to represent the voltage at which the trigger fired. This feature is useful if a slowly varying analog signal is used to fire the trigger. By viewing the input, you can see where on the waveform the trigger is firing. The sampling rate of the analog channel is set by timing knob in the front of the laboratory peripheral panel; counter-clockwise to sample faster, clockwise to sample more slowly.

Once the trigger thresholds are set satisfactorily, all leads except S2 should be removed to avoid confusion. Type the Return key to advance the program.

NOTE

After the program has left the trigger section,

it is impossible to return to this section under program control. The program must be restarted by the switches at location 7456. If data has been collected, this section may have been overwritten by data. If this is the case, the program must be reloaded to recalibrate the Schmitt triggers.

Parameter Setup

The user must now define the histogram by answering a series of questions. The questions will be asked and the user must respond in the format described below. The user must type the RETURN key after all answers. Leading zeros are not required. If the question is improperly answered a ? will be typed and the question will be repeated. If the user wishes to back up one question to redefine a parameter, he should type the LINE FEED key. If a mistake in answering is made and he wishes the current question repeated, he should type the RUBOUT key. If he wishes to redefine all of the parameters, he should type CTRL/A (this is read as "control A". To type it, the user holds down the CTRL key and types A.) CTRL/C will return control to the Monitor, if one exists, at any time during the program. If no Monitor exists, the user should refrain from issuing this command.

Question 1

BIMW= The question is asking for the bin width. The bin width is the basic time unit for the time scale used in building the histogram.

Answer A number between Ø.1 and 4Ø9.5 The number is interpreted as milliseconds and must be in the form x.x↓.

Question 2

BINS= The number of bins and bin width determine the range of the time scale.

Answer A number between Ø and 1891. If more bins are requested, there will not be enough core for data storage; the message CORE? will be typed then the question will be asked again.

Question 3

MINTIM= This question asks the starting time of the time range under consideration.

Answer A number between Ø and 4Ø94. The units are bin widths.

Question 4

TIME/UNIT= This questions asks what the basic time unit is for timing the experimental trial. It is unrelated to the histogram time units.

Answer A number between Ø.1 and 4Ø95. The number is interpreted as milliseconds and must be in the form of x.x↓

Question 4

#UNITS= Here the user must specify how many of the basic time units defined in the previous question he wishes his experimental trial to consist of.

Answer A number between Ø and (1891-# bins). Again, it is possible for this answer to request for more core than is available. The zeroth histogram is a graph showing how many firings were recorded consequent to each stimulus. Therefore, a core location is needed to record the count for each epoch. If core is exceeded, the message CORE? will be typed and the question will be asked again. Simply reduce the number of epochs or the number of bins until the answer is accepted.

After the last question is answered, the program will wait for CTRL/S to start data collection. (CTRL/A will repeat all questions. CTRL/C will return to Monitor)

Refer to writeup of DECUS 8-339 for description of data taking commands and output commands.