TECHNICAL NOTE

*MODIFICATION OF SIGNAL ANALYZER FOR EVALUATING
LATENCY HISTOGRAMS OF TWO EVENTS SIMULTANEOUSLY*

One of the important functions performed on-line by modern signal analyzers¹ is to compile histograms of latencies or reaction times. These are histograms of time intervals between a stimulus presentation and the occurrence of the analyzed event. Evaluation of two such histograms simultaneously is useful in running two identical experiments simultaneously in two boxes to save time or to detect a relationship between the response times of two subjects. This may be desirable, for example, in social experiments. Another

possible application is the evaluation of reaction times of both acts in two-act response experiments. A simple modification of a signal analyzer allows evaluation of two such histograms simultaneously. Although some commercially available analyzers will do this, our design represents a simpler solution.

Proposed modifications consist of two parts: (a) The separate control of the most significant bit of the address register of the analyzer; (b) an input anticoincidence circuit.

(a) Two resultant histograms corresponding to the two input channels are stored in different halves of the memory of the analyzer. Therefore, the state of the flip-flop of the most significant bit of the address register must be controlled separately in such a way that each state corresponds to one of the two input channels. Each analyzed pulse triggers (after a delay necessary for setting the most significant bit of the address register) the generator of the sequence of control pulses, which are responsible for an increment of one in the particular memory cell.

(b) Simultaneously incoming pulses must be processed consecutively. That is, if another analyzed pulse

Fig. 1. Block scheme of the modified signal analyzer and external circuitry for evaluation of latency histograms of two events simultaneously.

Fig. 2. Poststimulus time histogram of two neurons as reproduced from the CRT screen of the modified analyzer.

appears on the input during the processing of a previous one this second pulse must be delayed. This is done by the anticoincidence circuit, which has two arms corresponding to the two inputs. Each arm consists of an input and output one-shot multivibrator and a gate. The input multivibrator is triggered by the leading edge of an input pulse in a particular channel. The leading edge of the input multivibrator's pulse triggers the output multivibrator if the gate in between is in the open state. The pulse of the output multivibrator triggers the series of control pulses of the analyzer and simultaneously inhibits the gate in the opposite arm for a particular time period (see Fig. 1). The only condition that must be fulfilled is that the minimal interval between pulses in each separate input must be greater than $2\Delta t$ (Δt 10-30 μ s); Δt represents the time necessary for the processing of one pulse, i.e., for the performing of the set of the operations triggered by the series of control pulses.

The described modification has proved effective with the KFKI NK 103 pulse height analyzer adapted earlier for on-line analysis of physiological data. We applied these modifications in the processing of stimulated unit activity of two neurons recorded simultaneously i.e., two poststimulus time histograms (PSTH) were

evaluated. A result of the processing i.e., the picture taken from the analyzer's CRT is reproduced on Fig. 2. Both histograms were displayed simultaneously, each positioned in one half of the CRT's screen. The PSTH in the left half of the picture (having a peak at the short intervals) represents the neuron with strictly related unit response to the given stimulus. The PSTH positioned in the right half of the picture leads (on the basis of its flat form) to the conclusion that the firing of this neuron has no relation to the stimulus presentation.

We hope that our proposal will be useful in the above mentioned domains of behavioral experiments (especially in social ones) giving the opportunity for more detailed descriptions of results; using the analyzer, the histogram with a minimum of hundred classes could be evaluated easily.

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