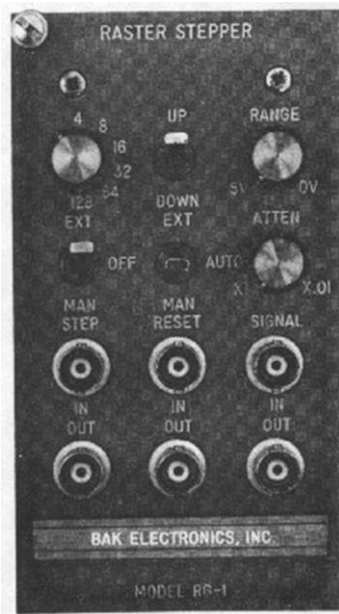


Raster Stepper

Model RG-1



EXPANDS THE CAPABILITY OF OSCILLOSCOPES

CONTOUR DISPLAYS

INTERNALLY SUMS ANALOG DATA

DOT DISPLAYS

AVERAGE RATE DISPLAYS

STEPS UP OR DOWN

CAN BE RESET MANUALLY, AUTOMATICALLY, OR EXTERNALLY

Description:

The Model RG-1 Raster Stepper is a simple but versatile instrument for condensing large quantities of analog or event data into a number of different easily viewed formats. Certain additional features and control modes facilitate more general automated and manual use of the counting function than is possible with other comparable devices.

A digital counter whose steps are under manual or external electronic control drives a digital to analog circuit which produces successive UPward or DOWNward output voltage increments starting at 0 volts. The amplitude of the steps is selectable from zero to five volts RANGE and an external analog SIGNAL with a variable ATTENUATION factor may be added internally to this stepped output.

The occurrence of a STEP, manual or electronic generates a 5 V TTL STEP OUT pulse for synchronization and may be temporarily suspended without loss of count by placing STEP switch in the OFF position. Several different counting and reset modes control the number of output steps. In the AUTO-RESET mode, the stepper automatically generates a reset after the selected number of steps have occurred (4 to 128 in binary intervals).

This returns the out-put state immediately to zero and stepping in response to input steps continues. The automatic count can be aborted prematurely by either a MANUAL RESET or input of an electronic RESET (+5 V TTL pulse). The occurrence of a reset (automatic, external, or -manual) generates a RESET OUT pulse for synchronization of other equipment. In the EXTERNAL RESET mode, the stepper halts after the selected number of steps.

Further INPUT STEPS are ignored, no longer producing OUTPUT STEP pulses or output voltage changes. The output voltage is reset and stepping resumes only after an EXT RESET pulse or MANUAL RESET is received. A unique feature of the circuit design is that step amplitude, once selected by the RANGE control, remains constant as the number of steps is changed (up to the approx. +12 V output capability), so that the attenuation factor of the mixed input signal does not have to be resealed and rate meter functions (as - described below) remain calibrated.

Applications:

1. Wrap-Around Oscilloscope Displays - It is often desirable to show a longer record of activity than can be produced on a single display line. The Raster Stepper can be used to reposition the track position each sweep by adding a voltage step to the analog signal. This is done internally in the instrument with controls to facilitate independent scaling of the signal and step amplitudes, thus requiring only a single ended oscilloscope input. The hold- after-count mode prevents over-writing on the screen until reset is desired. The reset out pulse may be used to control a camera shutter, erase a storage CRT screen or reactivate a stimulus or trial generator.

One commonly used variation of this kind of display is the Dot Raster, in which events such as single neuron firings are shown as dots along a succession of horizontal time lines whose origin indicates some event such as a stimulus or behavioral activity. These events are used to step the vertical deflection voltage to an oscilloscope whose beam (Z-axis) is turned on briefly only when such firings occur (for example, connect the acceptance pulse output of the DIS-I Window Discriminator to the CRT external cathode input). One commonly used modification of this display is to indicate when an additional event (such as a behavioral response to an electrical stimulation has occurred. This may be done by setting an input signal to cause a small additional deflection of the raster line when this has occurred. Another modification for both event and analog signal rasters is to show some of the signals which occurred before the triggering event. This is easily accomplished by delaying the displayed signals by passing them through either the AD-3,6 Analog Delay or DD -1 Digital Delay modules before going to the RG -1 signal input or CRT external cathode input respectively.

2. Behavioral Response Rate-Metering - It is often most meaningful to show frequently occurring events such as lever pressing as cumulative or integral responses whose upward slope indicates rate. Each event generates a step upward of a slowly moving horizontal trace which automatically is reset after a fixed count is reached. This count may itself be significant, for example, by connecting the RESET OUT pulse to reward delivery. Alternatively, the EXTernal RESET mode can be used to generate resets after some fixed time interval set by an external timer. In this condition, the peak step reached each interval represents the number of responses per unit time or average response rate. The manual step and reset over-rides facilitate behavioral shaping or recording of response requiring an observer. The external reset mode stops generating responses to inputs after a fixed number is reached, which can be used to space out sequences of trials without requiring an external counter.

3. Nested Operations - There are a number of applications in which it is desirable to group lines of a raster into subgroups or in which each line of a raster depicts an integrated response rate. These applications require two (or more) raster generators, one to generate the smaller increments within each raster group or rate display line and another to generate the larger steps separating them into display groups. The internal summing circuitry of the RG-I facilitates simply chaining the steppers together by connecting the summed output of the preceding stage into the SIGNAL IN of the next stage and attenuating and adjusting step size as desired. Furthermore, an automatic reset generated by the first stage can be used to generate the Step input to the second stage without additional external timing or sequencing devices.

Specifications:

Modes of Operation (triggering)	3 position switch, manual (single frame), no output (OFF) and external stepping
Modes of Operation (reset)	3 position switch, manual, external and automatic
Output	Analog stepped voltage with or without summing of external signal
Raster Rate	80 kilohertz max.
Output Steps	4,8,16,32,64 or 128 selected by switch
Output Range	0 to plus 5 volts or 0 to minus 5 volts, switched and continuously adjustable for 4 step mode, 0 to plus or minus 12 volts for all other step ranges
Output Impedance	100 ohms
Step Rise Time	10 microseconds
Input Step Trigger	Positive pulse, 3 volt mm., 15 volt max.100 ns min.
Input External Reset	Positive pulse, 3 volt mm., 15 volt max.100 ns min.
Analog Input Attenuation	0.01 to 1.0 times the input signal - continuously adjustable
Analog Input Dynamic Range	30 volts peak to peak
Output Step Trigger Positive	Positive TTL level
Output Reset Trigger	Positive TTL level
Power Requirements	+15 volts at (32) ma -15 volts at (35) ma +5 volts at (18) ma
Size2.8"w x 5.25"h x 7.25"d
Weight	1 lb.

Other BAK Equipment often used with the Model RG-1:

DDDS- 1	Dual Window Discriminator
DIS-1	Window Discriminator
AD-3 or AD-6	Analog Delay
ISI-1	Interspike Interval Converter
MDA-3 or MDA-4	AC Differential Amplifier
PF-1	Paynter Filter
ABI-1	AC Bridge Integrator
BPG-1,2	Biphasic pulse generator
BSI-1	Biphasic Stimulus Isolator

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