CONSTRUCTION

Build a Digital Pattern Generator.

by John Blacet

The **Digital Pattern Generator** is a control voltage source capable of producing up to fourteen step sequences. This is accomplished with four level controls, each operating in a separate time division, by multiples of two from each other. This enables the device to produce patterns whose steps do not necessarily have the same duration. When connected to a VCO, the results are quite rythmical.

The **DPG** can be gated, triggered, and run up or down by external control. In addition, the pattern can be made to alternate direction on successive triggers.

The circuit uses as few as five IC's, and operates over a wide power supply range.

About the circuit.

The DPG is based around a four bit binary up/down counter IC, the 4516. Pulses from the variable speed clock formed by two sections of IC 6, enter at pin 15 of IC 1 where they are divided by 2, 4, 8, and 16, and appear at pins 6, 11, 14, and 2. These pulses are buffered by the remaining four sections of IC 6, and activate the four LED's when a high is present. The output of IC 1 is also fed to the four level controls and summed in a diode network. The 741 type OP AMPS buffer the output and provide a glide function. One of each type of buffer is shown and more may be added at the slider of the output level control.

The functions of the 4516 are controlled by IC 2 and IC 3. The up/down control (pin 10) is held high by the I M resister to allow up counting when no other input is present. An external signal at this input provides a down count when a ground or low, is applied. When the **up/down toggle** switch is closed, successive triggers will alternate the count direction, provided the pattern has been completed on each occasion.

The unit can be gated or triggered, both at the same input. A positive pulse (trigger) will result in one complete sequence. A positive step (gate) will result in complete sequences until removed. The sequence will complete itself and end. The **run** switch will accomplish the same functions by either a momentary or continuous depression.

The high initiated by any of the above pulls the output of IC 3b low and causes IC 3d to output a positive pulse. This resets both IC 1 and IC 2a and allows the sequence to proceed. IC3c and related components form a schmitt trigger used to debounce the toggle switch.

With no input present at the **trig/gate**, the 1 M resistor to ground pulls the output of IC 3b high and in turn the output of monostable IC 3d low. This low appears at pin 9 of IC 1 and allows a started pattern to run to completion. At this point, the high at the output of IC 3b is clocked through flip-flop IC 2a by the inverted signal from pin 7 IC 1, and appears at the Q output. This high is applied to pin 5 IC 1, stopping the clock and thus the sequence. The output of IC 2a also provides a D input for flip-flop IC 2b which is clocked through by a high from pin 7 IC 1 and, providing the switch on the Q output is closed, sends either a high or low to pin 10 IC 1 to determine sequence direction.

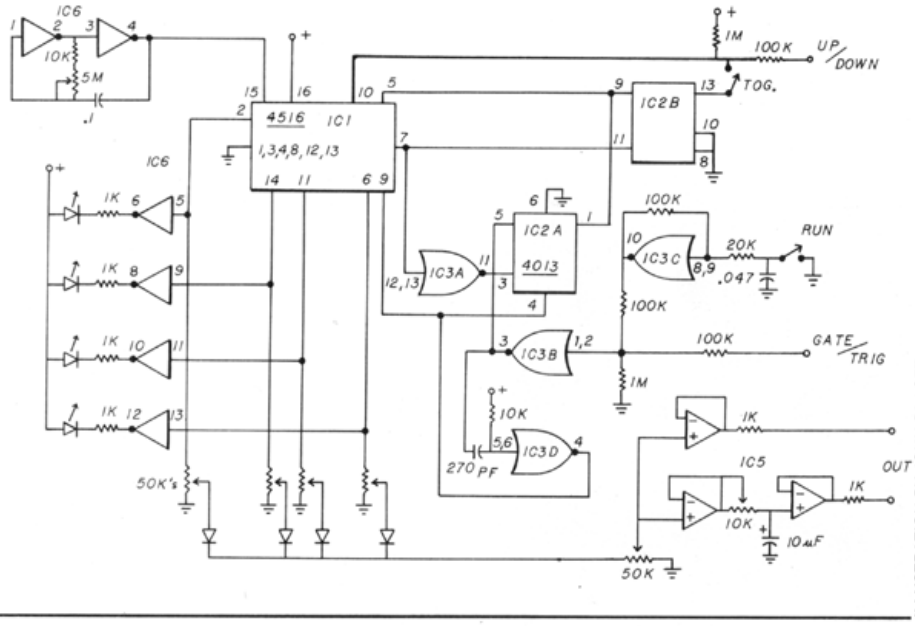

ILLUSTRATION BY JOHN BLACET

Digital Pattern Generator schematic.

Construction.

Almost any method may be used to construct the DPG. Perhaps the simplest is to use a predrilled and etched PC board such as those available at Radio Shack. Use precautions against static electricity when using the CMOS IC's; such as grouding the tip of your soldering iron and not wearing static prone clothing.

The power supply connections and the pin numbers for the op amps are not shown because they differ for various amps. You can use any convenient general purpose device such as a 741, a 5558 dual, or a 4136 quad. The op amps run off dual plus and minus supplies and the CMOS off a positive supply. You should try to use +/- 10 to +/- 15 volts. Fifteen volts is maximum and both supplies should be regulated. Use at least one .05 uf disc and one 1.0 uf electrolytic capacitor on the board for bypassing each supply.

Craig Anderton's book *Electronic Projects For Musicians** offers basic practices for persons unfamiliar with electronic construction and troubleshooting.

A kit consisting of a PC board, all parts, ICs and pots is available from Blacet Music. The address can be found under *Listings*.

Operation.

The DPG may be used much like you would use a conventional sequencer module. The main difference is in the feel of the level controls. One of the first things that can be observed from operating these controls and observing the led's is that each is 2X faster than the previous one. Each control therefore operates in a separate time division as well as determining voltage level. You will also note that, in contrast to a regular analog

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sequencer, that several leds may be on at once. In this case, the control with the highest level determines the output voltage.

If all leds light, the sequence will be at its end; and if all are unlit, the sequence will be at its beginning. This is a good way to observe sequence direction.

Voltages at the **up/down** and **gate/trig** inputs should be at least 70% of the positive supply voltage, with ground initiating down counting and a positive voltage, a gate or trigger.

When first applying power to the module with the **gate/trig** input connected, the sequence may not start. In this case, briefly disconnect the input.

The **up/down toggle** switch can be used as a direction control when the Pattern Generator is running continuously.

An external voltage controlled clock can be substituted for the built in one by breaking the connection between pin 15 IC 1 and pin 4 IC 6; then applying the external clock through a 10 K resistor. The clock must have fast rise and fall times and have a level of at least 70% of the DPG positive supply voltage.

Coming soon will be a voltage controlled clock which can be used with the DPG or any other sequential device. In the meantime, see (hear) what dimensions of sound are accessible with this project. —∿∿—

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Parts list:

IC 1 4516 CMOS up/down counter
IC 2 4013 CMOS flip-flop
IC 3 4001 CMOS quad nor gate
IC 5 741, 5558, or 4136 op amp (see text)
IC 6 4069 CMOS hex inverter

Resistors, 1/4 watt.
6 1K
2 10K
1 20K
4 100K
2 1M

Potentiometers, linear.
1 5M
5 50K
1 10K

Capacitors.
1 .1 uf mylar
1 270 pf polystyrene or ceramic
3 .047 or .05 ceramic
2 1.0 uf electrolytic

Miscellaneous.
4 IN4198 diodes
1 SPST toggle switch
4 1/8" jacks
4 LEDs

Synapse