

## UTILITY SWEEP GENERATOR - CIRCUIT DESCRIPTION

The USG incorporates a variety of interconnected circuit functions which collectively generate a highly adjustable voltage ramp output. This output voltage sweep is very useful for driving a wide variety of RF VFO's for use in sweep testing of filters, amplifiers, and the like. The USG can output variable DC, a settable sweep range about some DC center value, or a "start" - "stop" sweep wherein the end points are precisely settable. Ten-turn pots are used for good resolution of all these options.

The USG is based on a 555C (i.e. CMOS version) timer circuit surrounded with accessory functional circuits and controls. This timing function can free run or be manually triggered in "one-shot" fashion. The timer output is a linear sawtooth voltage having a buffered ramp voltage running from 4 volts to 8 volts nominal.

The sawtooth repetition rate is adjustable over the range of 0.05 to 10 Seconds selected by precision range steps and/or by variable control in between steps. These latter controls establish the timer capacitor charging current from a regulated electronic current supply and hence the ramp repetition rate.

Additional timer circuit functions include a convenient trigger output pulse, and a "rapid reset" switch should some longer single-shot ramp need be interrupted. An associated LED indicates when a ramp is being generated either in free run mode or during a one-shot cycle. An "AUTO - MANUAL" switch routes either this buffered ramp voltage or a buffered manually tunable, equivalent voltage swing to the remainder of the USG circuits.

The next-in-line circuits are associated with processing the above voltage swing to (a) provide 2 volt p-p drive for a 'scope "X" axis, and (b) provide the highly versatile and fully adjustable ramp voltage segments for the desired final sweep application parameters. The X-axis signal is a -1.0 to + 1.0 volt sweep for the 'scope horizontal for a full axis display at 0.2 V/division. The USG main output is a 0 to 16 volt positive going linear output ramp - or any selected portion thereof. A 0 to 5 volt output swing range option is also provided.

The circuitry that allows the selection of ANY portion of the sweeping ramp voltage is controlled by the circuits surrounding IC3c, IC3d, SW6, and R35 and R36 and the associated buffers. This is really the heart of USG adjustability - and its main feature.

The two named IC op amp sections provide balanced positive and negative going 4 volt pp (nominal) ramp voltages. These two opposite-moving voltages are in turn "allocated" or "routed" in proper combination and magnitude with certain fixed bias voltages to accomplish the above mentioned adjustability. This action is much more difficult to describe than too simply witness happening!

The sweep voltage established by all the above action is gain and offset scaled, and buffered out by IC4a. A divider and buffer IC4c output the same waveform over a smaller output swing range. Both the 16V and 5V pk. Swings have their own areas of application.

The USG is powered by a 24 VDC wall wart plug-in supplying less than 100 mA to all these circuits. An "active filter" or "capacitor multiplier" consisting of a TIP 29, 220 ohm resistor and 100 uF electrolytic smooth the wall wart output prior to it powering 18, 15, 12, and 5 volt regulator IC's. The latter 3-terminal fixed regulators power the USG, and optionally provide a fixed nominal 15 volt output to power external RF sweeper / generators otherwise controlled by the USG.

All the sweep timing and scaling circuits above are powered by the basic 12V power system. Most Op-amp IC's throughout the USG are supplied by 18 volts to provide voltage headroom for the internal USG signals; U4 is powered by +18 and - 2V (nom) to permit the +/- going "X" axis 'scope drive. The minimally loaded "-2V" supply is developed by USG current thru diodes D4, D5, and D6. This simple "trick" removes the need for a more sophisticated and independent negative voltage source thereby permitting operation with just one simple wall wart.

The optional built-in DVM panel meter is a convenient accessory for use in setting up output voltage conditions like the ramp start and stop values, for example. This function could also be accomplished with an external "bench" DVM connected in place of the internal instrument. This

would also eliminate the need for an internal meter battery or DC/DC converter as herein.

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