digisound

MODULE 80-11A
DUAL RING MODULATOR

1. INTRODUCTION

The DIGISOUND 80-11A Dual Ring Modulator is compatible with the earlier 80-11 and is AC coupled; will accept 10V p-p signal inputs and has a nominal unity gain. Signal feedthrough via the 'X' input, or so-called carrier input, may be suppressed to better than -50dB while the 'Y' input may be suppressed to -40dB, or better. The 80-11A is based on the MC 1496 (or LM 1496) balanced modulator IC, which is probably the most cost effective device to achieve the performance levels stated above.

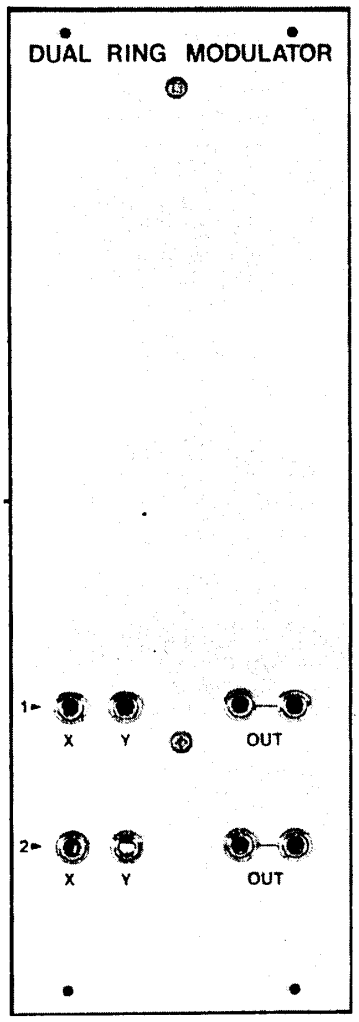


FIGURE 1. 80-11A PANEL

2. DESIGN

The two ring modulators in the 80-11A are completely independent, except for the common power supply and decoupling capacitors. The circuit diagram of each ring modulator is shown in Figure 2. The 1496 integrated circuit is designed for a variety of communications applications in which its output voltage is a product of a signal input (the 'Y' input) and a switching function, referred to as the carrier ('X' input).

The circuit is quite simple with the 'X' input being attenuated by R1 and R2 and the 'Y' input by R8 and R9. The signal to the latter may be much higher than the carrier input without adversely affecting feedthrough. The other resistors around the input provide the bias requirements for the IC while RV1 and RV2 and associated resistors allow trimming of the signal feedthrough. The output of IC1 goes to the differential amplifier built around IC2 which restores the signal to its original level, that is, two 10V p-p inputs will yield approximately a 10V p-p output. If, however, the module is used for frequency doubling by applying the same signal to both 'X' and 'Y' inputs then the output will be half the input signal.

3. CONSTRUCTION

The 80-11A PCB is printed with a component overlay which aids the construction stage. The overlay is reproduced in Figure 3 to allow checking of component placement after the module has been constructed. The separate ring modulators are also indicated since the same component numbers are used for both units.

Take the usual care with orientating the electrolytic capacitors (their negative wire is clearly indicated by a band of '-' symbols on the capacitor body) and also the integrated circuits. Even after installing the DIL sockets the number '1', denoting

pin 1, will still be visible on the PCB. In any event compare the completed PCB against Figure 3 and also carefully check its foil side for solder bridges before applying power.

The panel wiring is shown in Figure 4 and this diagram illustrates the components when viewed from the rear of the panel. The arrows and associated letters indicate that a wire connection must be made to the PCB from the position shown. The PCB has a connecting point on its front edge with letters corresponding to those in Figure 4.

The jack sockets in the diagram are of the type supplied by Digisound Limited. The top connection, as illustrated, is the connection made with the jack plug when the latter is inserted. The lower connection is disabled by insertion of a jack plug. Finally, the tab under the socket is the ground connection. It is recommended that all of the ground connections are wired to the 0V line since this facilitates connection of the module to other equipment which may be operating from a separate power supply. The ground tabs may be soldered together using tinned copper wire but other panel wiring should be made with insulated wire. 1/0.6mm. insulated wire is ideal for panel wiring since it retains any shaping and allows a neat appearance to be obtained. Wiring should be kept as short as practical.

4. CALIBRATION

Setting up the ring modulators is simple but needs to be done carefully. Connect a sinewave (or triangle) of about 1kHz from a VCO to the 'X' input of ring modulator 1 and connect its output to an oscilloscope; or a sensitive AC voltmeter; or to an amplifier. Adjust RV2 until the signal being measured, or heard, is at a minimum. This setting is quite critical and hence the use of multi-turn trimmers. Now connect the signal to the 'Y' input and adjust RV1 for minimum signal. Repeat these steps for the second ring modulator. Some minutes will now have elapsed since adjustment of the first unit was made and so repeat the whole procedure for both ring modulators. Mainly due to the biasing requirements of the 1496 it is desirable to operate the 80-11A from a stable power supply, such as the DIGISOUND 80-1 or 80-1A.

The importance of the above steps lies in the fact that the points of minimum feedthrough correspond with the correct balancing of the inputs for modulation.

The level of feedthrough obtained varies somewhat between IC's but typically with a 10V p-p signal the feedthrough of the 'X' input may be trimmed to between 10mV (-60dB) and 20mV (-54dB). Typical values for the 'Y' are between 40mV (-48dB) and 80mV (-42dB).

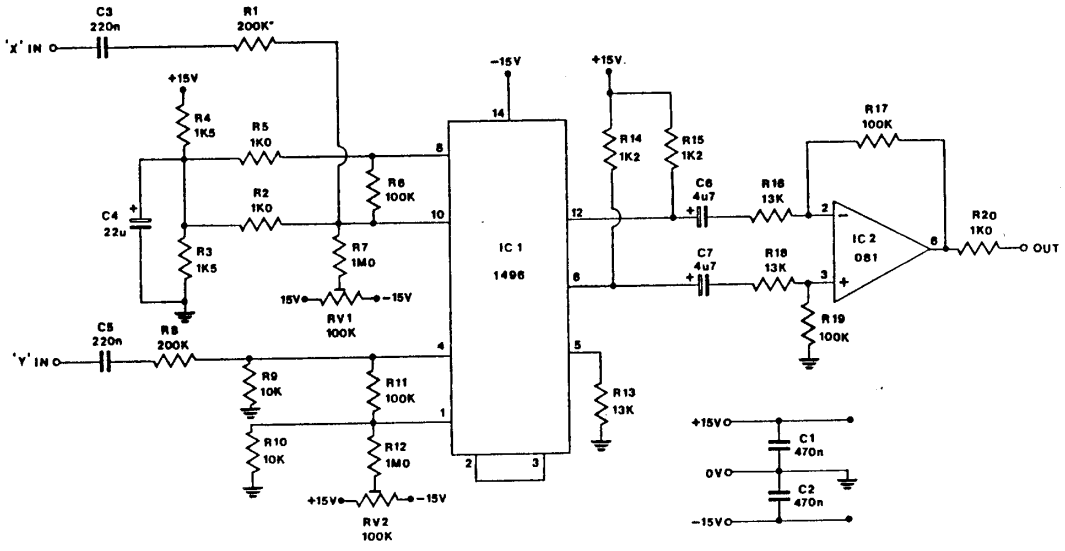


FIGURE 2. CIRCUIT DIAGRAM FOR ONE 80-11A RING MODULATOR

5. USING

The ring modulator has been widely used as a sound modifier right from the birth of electronic music. The popularity of the device lies in the fact that it produces the sum and difference of the frequencies of two signals applied to it. When these signals have high harmonic content the resultant combination of frequencies is extremely complex and bell-like in character. While a tolerable imitation of bells, gongs and chimes may quickly be obtained, a realistic synthesis reqires a great deal of patience and often the use of more than one ring modulator.

As inferred earlier, a ring modulator may also be used as a frequency doubler by applying the same signal to both the 'X' and 'Y' inputs. If, however, the signal is other than a pure sinewave the intermodulation of the harmonics will produce complex outputs.

In normal use, i.e., with two independent signals, it does not matter which signal is connected to the 'X' or 'Y' input - the end result is the same. The only point to note is that the original signal will be suppressed most when applied to the 'X' input and so this may govern selection in some instances. Signals should be within the normal audio range of 20Hz to 20,000Hz.

Further information on using ring modulators will be found in 'Using the DIGISOUND 80 Modular Synthesiser'.

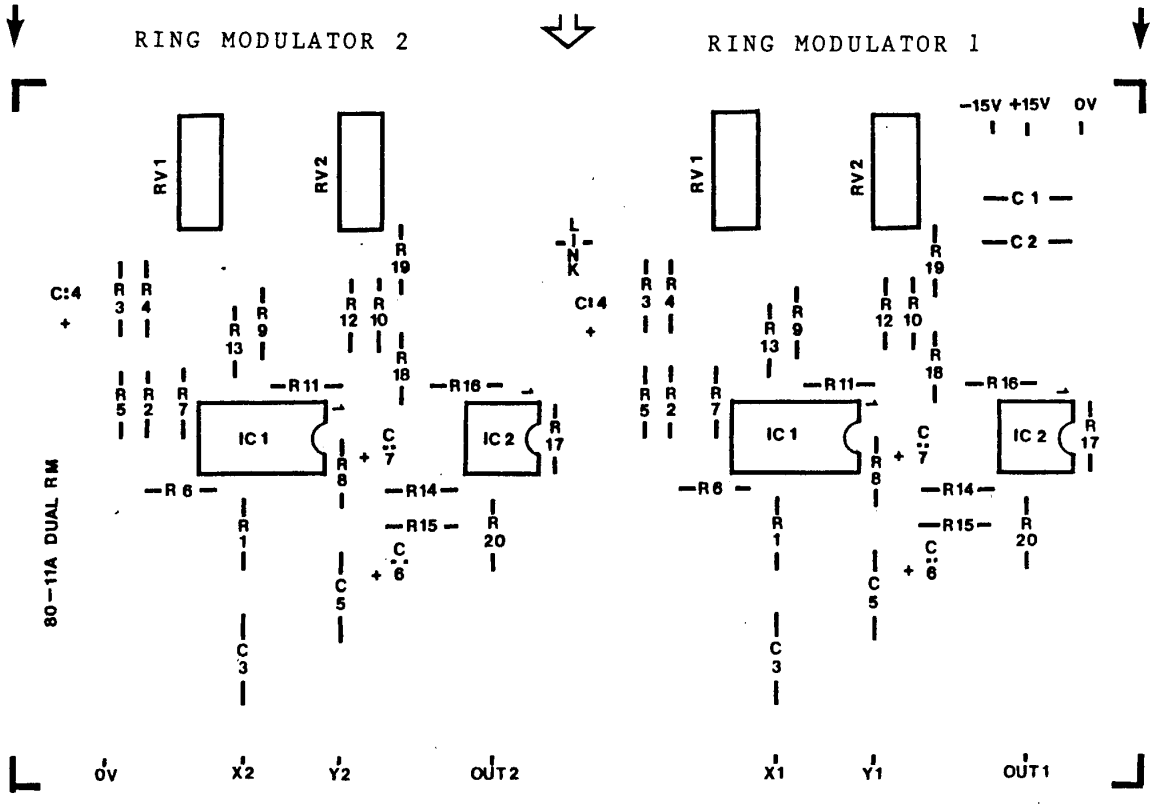


FIGURE 3. COMPONENT OVERLAY FOR 80-11A

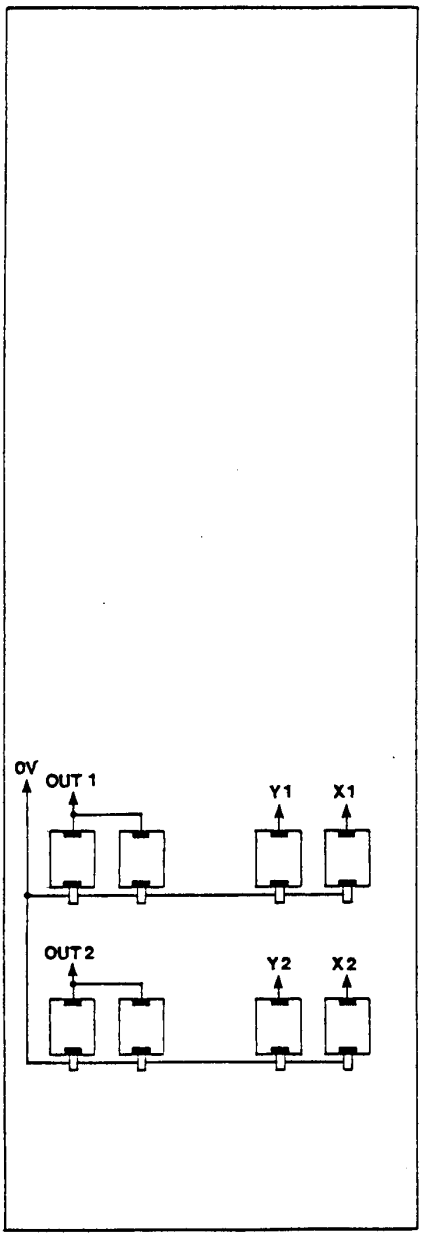


FIGURE 4. PANEL WIRING

6. COMPONENTS

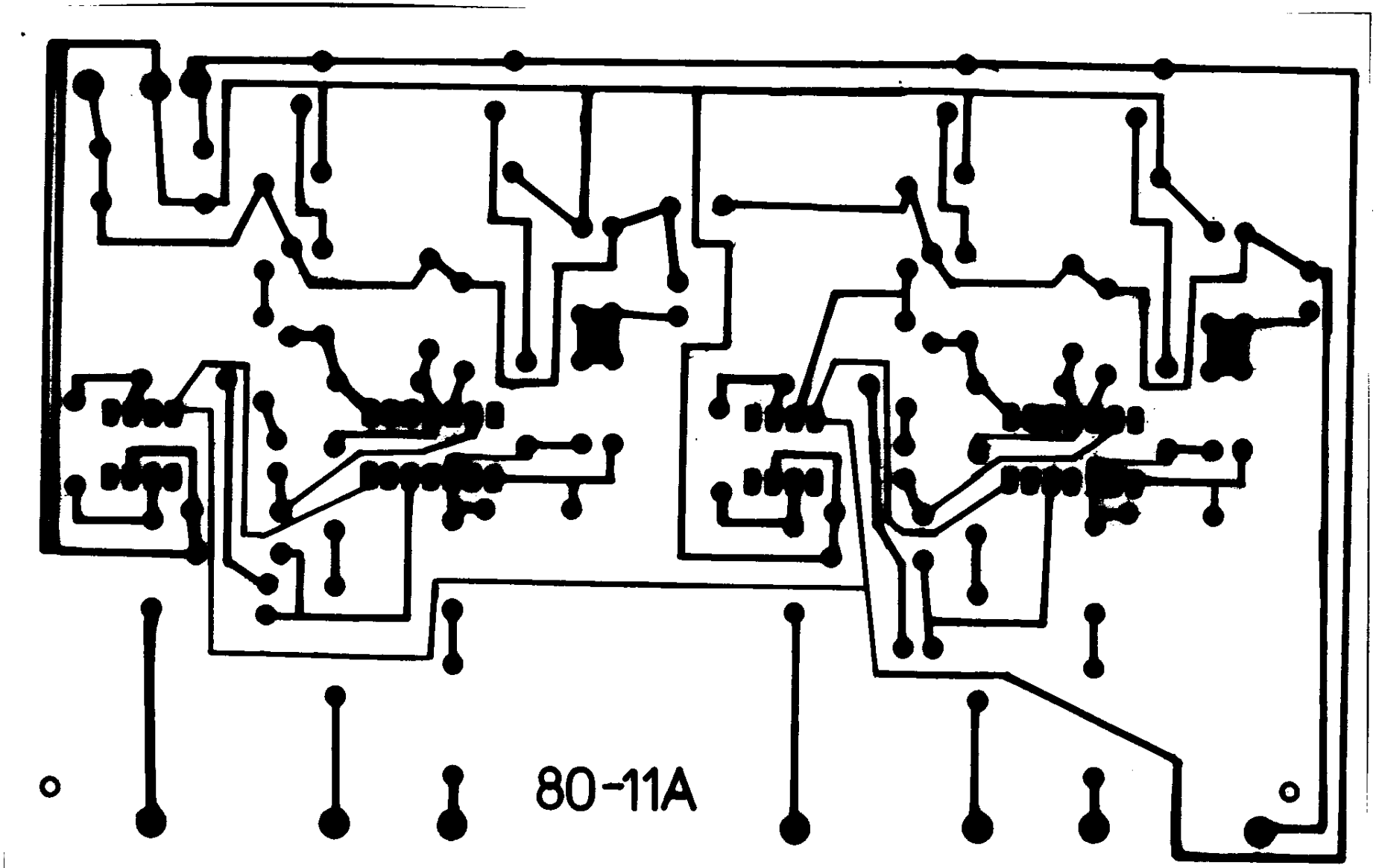
A kit will consist of two sets of the following components (plus DIL sockets), except for C1 and C2 which are common to the two units.

RESISTORS, 5%, 1/4w carbon film	
R1,8	200k
R2,5,20	1k0
R3,4	1k5
R6,11,17,19	100k
R7,12	1M0
R9,10	10k
R13,16,18	13k
R14,15	1k2

CAPACITORS	
C1,2	470n polyester
C3,5	220n polyester
C4	22u PCB electrolytic
C6,7	4u7 PCB electrolytic

TRIMMERS	
RV1,2	100k cermet multiturn

SEMICONDUCTORS	
IC1	MC 1496P (or LM 1496N)
IC2	TL 081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