THE FREQUENCY ADAM — KEN RUIZ G4SGF / ZB2MD

INTRODUCTION
To give it its full name, the Frequency Analogue-Digital-Analogue-Meter, describing the changes the signal undergoes as it moves along the circuit. By chance, my elder son's name is Adam....

A different type of frequency meter from that which we're used to seeing which, though by no means as accurate as a digital frequency meter, is a useful piece of test gear at a fraction of the cost. All components bought new save the meter and box should come to about £10 or thereabouts. Maplin appears to have everything required.

Specifications are -
- input impedance no idea
- sensitivity don't know
- range 5kHz in five decade steps. The smallest fraction of FSD that can be read accurately depends on the size and quality of the movement.

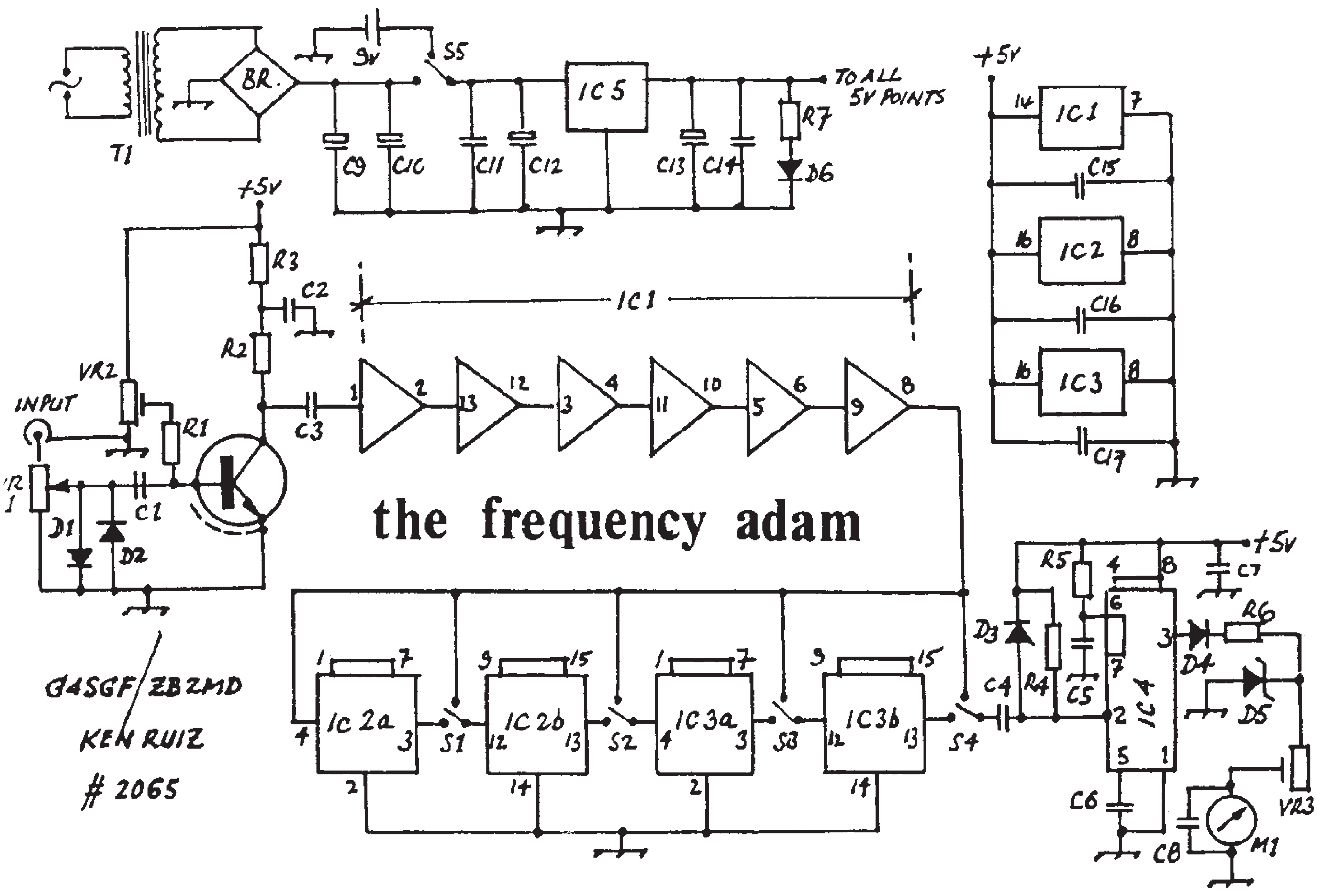
THE CIRCUIT
The circuit is perhaps best considered backwards.
IC4, a 555 timer, is in monostable mode. For every pulse presented at pin 2 a pulse appears at pin 3, the duration of which is fixed by R5 and C5 as (1.1*R5*C5) seconds. The amplitude of the pulse is the positive voltage rail, so that the mean voltage at pin 3 is proportional to the rate of pulses appearing at pin 2. IC4 is then a linear frequency-voltage converter. C4, D3 and R4 make it an edge-triggered AC-coupled device. M1 acts as a voltmeter.

ICs 2 and 3, 74HC390s, are each in effect dual 7490 types with a maximum count frequency of 60MHz. Using these instead of the more commonly seen 74LS90 increases the maximum count frequency of the instrument while keeping cost and the component number down. S1 and S4 select the number of counters in use and so the meter range. These latch switches can be replaced with a 4p5w switch if available.
IC1, a 74HCU04, is well suited to high speed analogue circuits and here is used as an a-d converter providing the counters with signals they can use. The use of six buffers is perhaps a smidge excessive, but they're all on the chip anyway.

TR1 is an untuned Rf amplifier as first seen in SPRAT 37 by G3AGX. Here it is preceded by D1 and 2 to limit the maximum signal presented to it, and VR1 an input attenuator/sensitivity control.

Construction of the prototype was a scraps of veroboard and it worked. The final version used the PCB shown, and incorporated a mains PSU. The meter was salvaged from a scrap-heap, the 'box' is in fact two boxes glued together, the bottoms having been removed. Why? They were free!

SET-UP
Setting up is simplicity itself. Tune in a station on the 7MHz band on the station receiver. Connect the station antenna to the frequency meter input and take the signal on IC1 PIN 1 to the receiver. Adjust VR2 for maximum signal (and quite a lot of noise!)>



COMPONENTS FOR THE ADAM

R1 6K8
R2 330R
R3 56R
R4 4K7
R5 150K
R6 1K
R7 270R
Shunt resistor to give 1mA FSD
VR1 10K
VR2 2K2 preset
VR3 5K preset

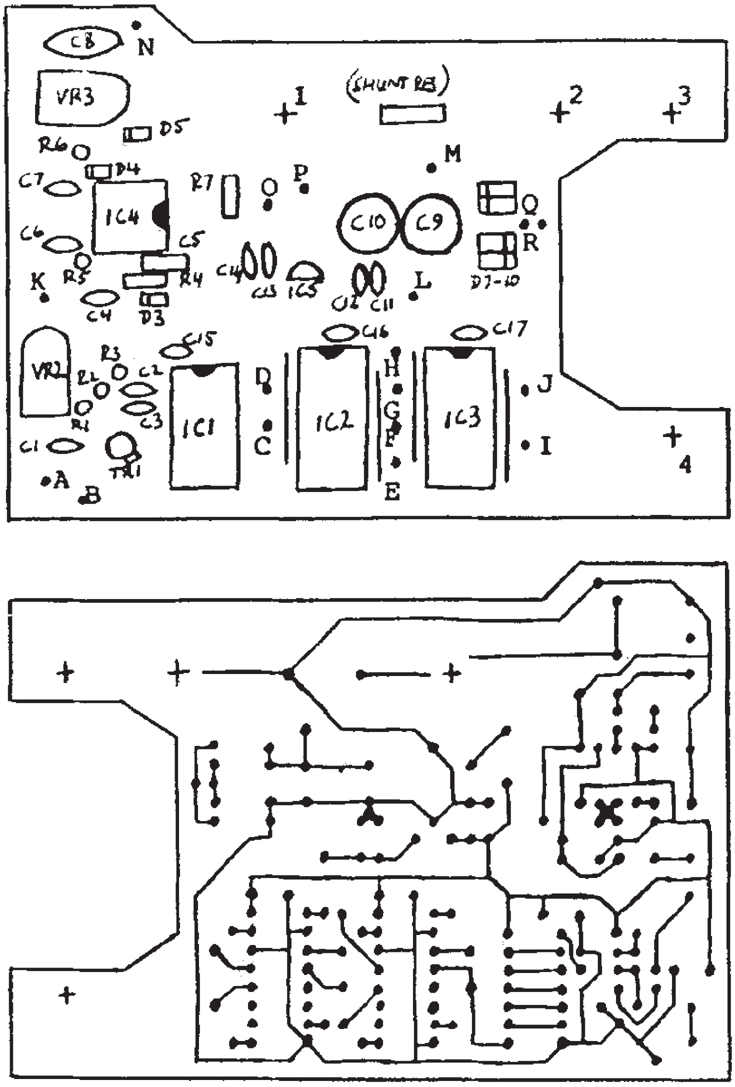
C1,2,3,4,7,11,14
15,16,17 10n cer
C5 820p poly
C6 100n poly
C8 0.47u poly
C9,10 100u 25v elec
C12,13 2u2 20v tant

D1,2,3,4 1N4148
D5 4v7 400mW
D6 LED
D7,8,9,10 1N4001
TR1 BFY90
IC1 74HCU04
IC2,3 74HC390
IC5 555
IC5 78L05

M1 1mA FSD
T1 0-9V 100mA TRANSFORMER
S1-4 Interlocked latchswitch, SPDT each
S5 SPDT

PCB, Veropins, Mounting Hardware, Knob, Box, Feet, Input Socket

RANGES: USING THE SWITCHES AS SHOWN
S4 ON-5KHz,S3 ON-50KHz,S2 ON-500KHz,S1 ON-5MHz, ALL OFF-50MHz



Veropin guide

A Signal in
B Signal braid
C 'On' S1-4
D 'Off' S1
E Pole S1
F Pole S2
G 'Off' S3
H 'Off' S2
I Pole S3
J 'Off' S4
K Pole S4
L Pole power selector switch
M Mains PSU option power selector
N Battery -ve
O LED (D6)
P LED
Q AC in from transformet secondary
R AC in from transformer secondary

Hole guide

1 Meter +ve
2 Meter -ve
3 Transformer mounting
4 Transformer mounting

D1 and D2 mounted on VR1 (front panel)

THE FREQUENCY ADAM : SUGGESTED LAYOUT : HALF-SIZE

There are three methods for setting FSD. The most popular would be to take a known signal, from a crystal oscillator to the input, select an appropriate range and set VR3 for a correct meter reading. Alternatively, use a calibrated audio oscillator set to the basic 555 FSD. Apply this to the input on the appropriate range and set VR3 for FSD. The third method is to apply to pin 3 of the 555 the voltage which would appear there for FSD, and set VR3 to show this. This voltage is given by V=4.7*(1.1*R5*C5)*FSD frequency, and is 3.18V for a 5kHz FSD. A fourth method would be to calibrate it using a digital frequency meter, but if you have one of those you won't want one of these....

Maximum frequency is 10,000 times the basic 555 range, 50MHz in my case. The 74HC390 should cope with 60MHz, and might manage 70MHz or higher.

To be really cheap, forget the meter, provide a couple of terminal posts and use your multimeter instead. A digital multimeter would turn it into a digital frequency meter!
A 600MHz prescaler chip can precede the counter circuitry here to give another decade, but will cost more than all of the circuitry shown here. I spent under £4 in new components and hardware to make mine!