

## Extending the usefulness of the Crystal Calibrator.

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Those of us who enjoy using classic receivers know the value of having a crystal calibrator for establishing band edges and for accurately calibrating the logging scale. Many handbooks give a suitable circuit using 7400 chips and a 1 MHz crystal giving outputs at 1 MHz, 100 kHz and 10 kHz. This article shows how the utility of such a unit can easily be extended.

### Step one

I have often found that the ten to one frequency ratio between pips is too large. If the receiver's bandspread is poor it can be difficult to count the 10 kHz pips between the 100 kHz pips. On the higher bands the same difficulty can apply with identifying the 100 kHz pips. Also at times, when using a dodgy receiver, I have not even been certain that the MHz calibrations were correct!

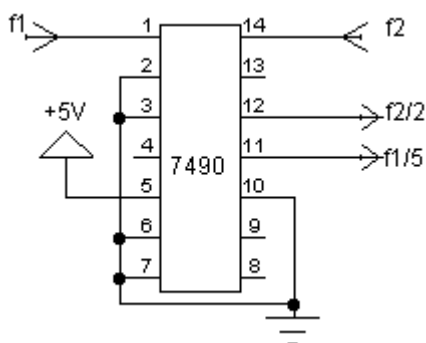


Fig.1. 7490 pin connections when used as separate divide by two and divide by five counters.

The 7490 decade divider contains unique divide by 2 and divide by 5 circuits. This means that it is possible to obtain from the above calibrator: 1 MHz, 500 or 200 kHz, 100 kHz, 50 or 20 kHz, and 10 kHz pips. Figure 1 shows the pin connections. If you wish to have these extra markers perhaps you can modify your existing calibrator. To get unique pips greater than every 1 MHz a higher frequency oscillator and more dividers are needed. For example, a 4 MHz oscillator and dividing by 4 to give 1 MHz. Other suitable start frequencies are 5 or 10 MHz. Alternatively you could use another oscillator solely to give coarser pips as an aid to positive identifications at the higher frequencies. This second

oscillator does not have to be an integer MHz frequency, for example a junk box crystal of 4.9 MHz would give a pip at 24.5 MHz and this would enable you to positively identify the next HF 1MHz pip as being 25 MHz, Other more useful frequencies such as 3560, 3500 kHz, readily spring to mind.

You are, of course, free to derive any pips that may please you. Some people may think that 10 kHz is too close so why not produce 20 or 25 kHz as your lowest frequency pip? The choice is yours.

### Step two

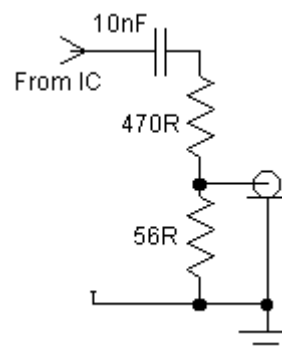


Fig.2. Attenuator circuit

Why not use the calibrator instead of a signal generator to align receivers? In this application it could be useful if the calibrator's output looked like 50 ohms. This is easy: just take the output to an attenuator as shown in figure 2. Note that you may then need to put in extra attenuation between the receiver and the calibrator but this is no problem.

### Step three

Wouldn't it be nice if all the pips were the same amplitude? If you are prepared to accept that only pips of the same frequency chain will have the same amplitude then the circuit shown in figure 3 will do the job. I freely acknowledge having lifted this idea from Ian Braithwaite's (G4COL) excellent article in RadCom (p15 June 1998) which also gives the theory. Another bonus of this circuit is that the difference in amplitude between the pips of different chains can be easily calculated. Consider a calibrator that puts out pips of 500 kHz, 100 kHz and 25 kHz, then compared with the amplitude of the 500 kHz pips the 100 kHz pips will be 14 dB down and the 25 kHz pips will be 26 dB down. The amplitude of the 500 kHz pips should be close to -50 dBm.

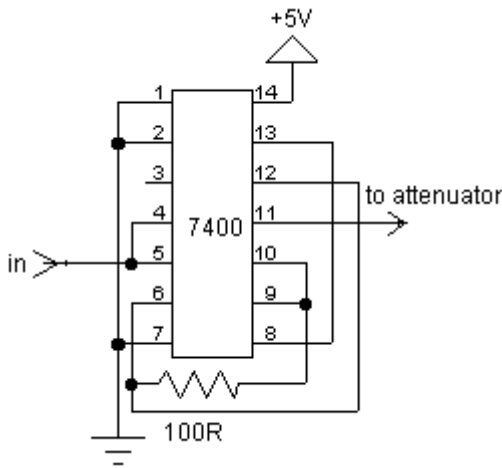


Fig.3. pulse generator

select which marker pip is fed to the output pulse generator. If you try to use a rotary switch directly you may have too much leakage and the amplitude of the pips may be affected. I know because I tried it! As the 74HC4066P only has four gates and I wanted to have a 4 MHz unique marker I used a separate output for the 4 MHz pip and accepted that it cannot be used for amplitude comparisons. A 7805 regulator can be used to derive the 5 volt supply from 12 volts.

**Results**

I do not have sophisticated test gear but am confident that the differences in amplitude are accurate. All pips of the same class seem to have the same amplitude to within  $\pm 2$  dB across the HF spectrum. I see no reason why similar results would not be obtained by anyone who makes this unit.

Pip	Level dBm
1MHz	-37
200kHz	-51
50kHz	-63
10kHz	-75

**An actual circuit**

Figure 4 shows the circuit of my calibrator which uses division ratios of four or five. The 74HC4066P provides switching to

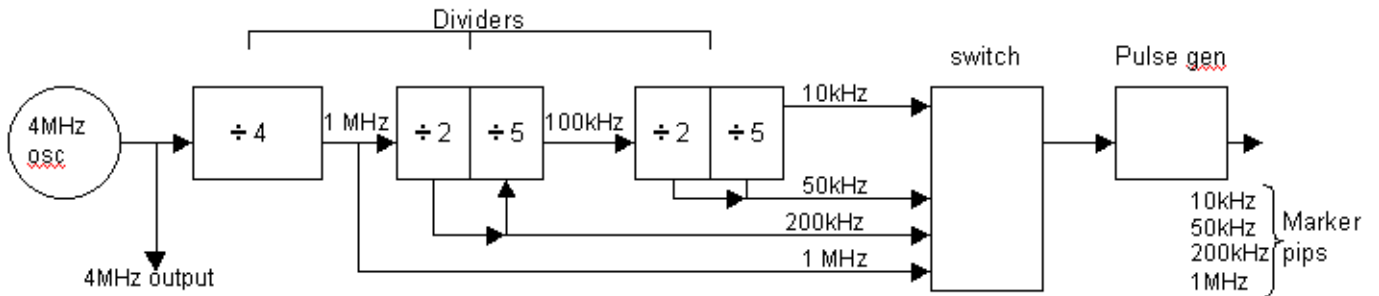


Fig. 4a. Block diagram

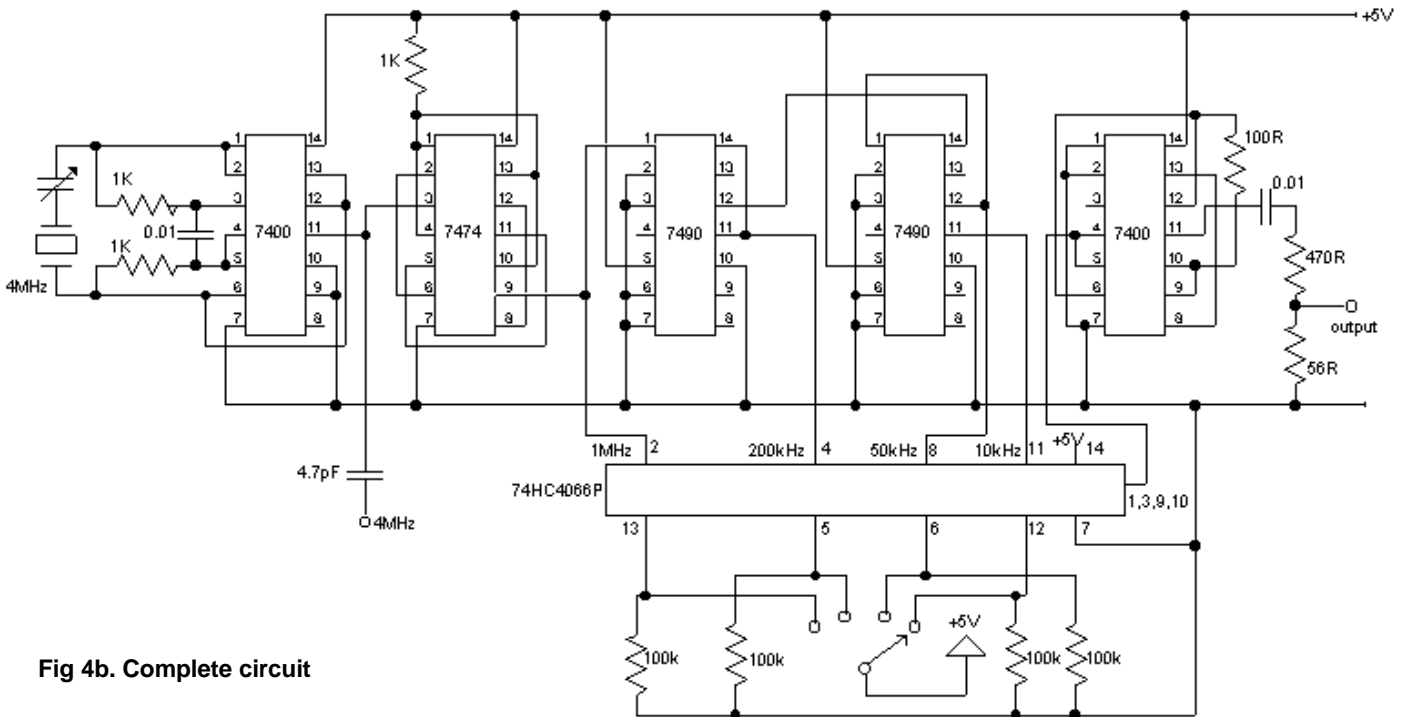


Fig 4b. Complete circuit