

Alignment procedure for the HP428 clone

Version 1.0 – 20 February 2017

1. 100kHz filters tuning

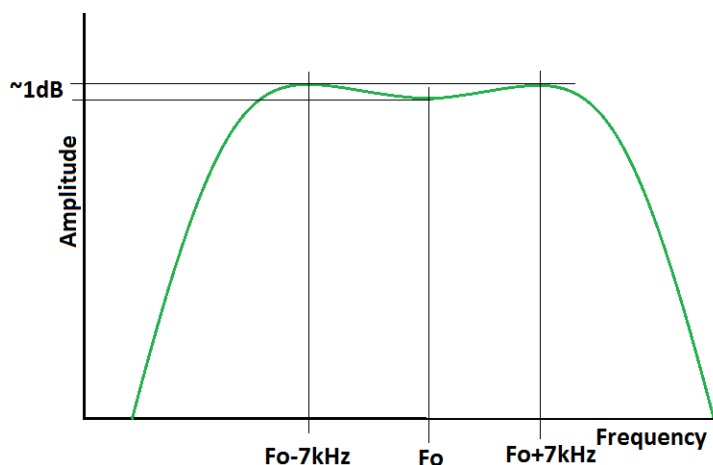
After basic sanity checks have been completed (PSU voltages, current consumptions, functionality of controls, etc...), place the instrument in the 20mA range, center all adjustments and controls, short X1 and inject a signal of a few volts pp (not critical) at twice the base frequency (101.562kHz if a 6.5MHz crystal is used) through a 10k resistor on P2 of the probe connector, with the probe connected.

Connect the oscilloscope probe to the collector of Q8, and adjust L5 for the maximum amplitude.

Change the generator's frequency to three times the base frequency (152.343kHz) and adjust the padding capacitor C14 for the minimum signal.

Move the probe to the collector of Q10, return the generator's frequency to 100kHz, and adjust the generator's amplitude to get ~1V pp.

Then, tweak C20, C22 and C21 to arrive at this frequency response:



This is easier if the generator has a wobulation capability, but with some time and patience, it is doable manually.

2. Drive amplitude

Remove the short across X1 and the injection resistor, position the oscilloscope probe on the collector of Q5 and increase the drive amplitude (R2) until clipping is observed. Note the value, it should be around 23V.

Reduce the drive amplitude by 1V from this clipping value.

3. Sample phase

Select the 200mA range and inject a 200mA DC current through the probe.

Connect the oscilloscope probe to the collector of Q10, and adjust sample phase (R31) for a minimum 100kHz amplitude.

Alternatively:

Short C31 and adjust the DC current through the probe for 1V pp on the collector of Q10.

Move the probe to the output of U3A and adjust sample phase for the maximum DC voltage.

4. Zero

Carefully demagnetize the probe in the traditional (physical) way, select the 2mA range, center the coarse and fine zero controls, and adjust R106 to read approximately 0mA DC.

Note that depending on the probe, R106 may need to be connected to the +12V or -12V.

5. DC calibration

Select the 200mA DC range, adjust the zero controls and inject 190mA $\pm 0.1\%$ through the probe.

Adjust DC gain (R80) to read 190.0mA.

Note: if R64 to 68 are in accurate powers of 10 ratios, the other ranges will implicitly be calibrated too.

6. AC calibration

Select the 200mA, AC rms range, inject a 400mA pp 400Hz sinusoidal current through the probe.

Adjust the calibration of the rms to DC converter to read 141.4mA.

Select the AC average mode, and adjust AC gain (R93) to read 127.3mA.

7. Transient response

Select the 200mA range, connect the oscilloscope to the auxiliary output and inject a 400mA pp squarewave through the probe.

Check that the response is satisfactory (an example of waveform is posted in the HP428 thread).

If it is not, C25, C26, C27, C28, C31, C30, C32, R51, R53, R57 can be tweaked, but the task is not easy.

For a very fine, finishing pass, many of the previous adjustments can be very lightly and very carefully altered: drive amplitude and filters.

When a satisfactory result is obtained, select the 20A range and inject a 400Hz squarewave through the probe. 40A pp is probably not realistic, but even 1A pp is already sufficient.

Adjust the 20A loop gain (R21) to display a response similar to the 200mA one.