

Specification For The MSB Design Pulse Period Counter PPC-1

Introduction

When you require to measure the duration of a signal such as a burst of tone, the period of a ringing cadence, or the length of a monostable pulse, if the period to be measured is in the order of hundreds of milliseconds then a storage 'scope is the usual instrument to use. Granted, a timer / counter can be used but these normally will only respond to the presence of a signal so the gap between pulses cannot be measured.

If you do not have a storage 'scope, and the units that can accurately display the period on-screen can be expensive, then the Pulse Period Counter PPC-1 will fill the gap and offers certain advantages as well.

The PPC-1 will measure and display any period in a four period train, that being two on periods and two off periods, with either dc pulses or an envelope of ac signals, to a period of 9.999 seconds.

Basically the unit is a counter with an internal timebase that can detect the edges of an envelope and trigger the counter from them. By selecting internal gating options the counter will respond to one of four edges to give the periods described above.

The best example of operation would be to measure the common PSTN ringing cadence of 400mS on, 200mS off, 400mS on and 2S off. If the PPC-1 is set up with period 1 selected then it will measure the first 400mS on; with period 2 selected it will measure the first 200mS off; with period 3 selected it will measure the second 400mS on; and with period 4 selected it will measure the 2S off.

The unit will operate with dc inputs, or ac inputs of from 20Hz to >100kHz, with input levels of 1v to 100v rms. Displays are latched after measurement until reset, and the display is on a 4-digit LED.

Features

The PPC-1 is quite straightforward to use providing care is taken to read the following and observe the recommendations for operation.

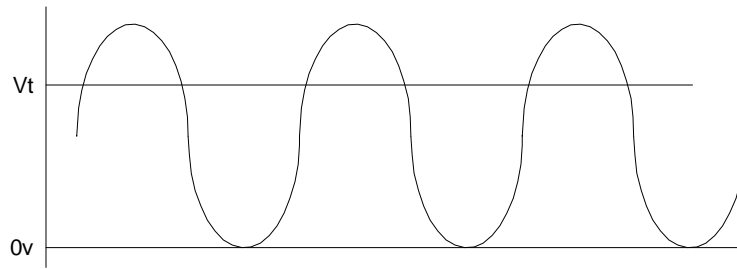
The unit is floating with respect to Earth, only the chassis being grounded, and thus input polarity will cause no problems, except that on the dc range the unit will only respond to positive going signals, so arrange for the correct sense signal at the input; of course, if the quiescent state is a negative voltage and you wish to measure the period for which it rises to 0v then this is just a positive transition and connecting the negative output to the PPC-1 0v and the apparatus 0v to the PPC-1 input will give the correct sense of input.

After switching on, the first thing to select is the input threshold; this is probably the most important stage in the setting up of measurements and should be fully understood. The threshold sets the voltage level below which the unit will not respond, and this has two important uses :-

a) if the signal to be measured is degraded by noise then the threshold can be set so that this noise does not trigger the counter; in this case the threshold switch should be set at its lowest position and rotated until the gate LED is extinguished.

b) refer to the following diagrams; in Fig.1 we see a sinewave that goes between 0v and +v; it is dc biased. Contrary to initial thoughts, this does not mean that the gate will be permanently on because of the dc bias, but it will be permanently off because the ac input only detects transitions through the threshold. We need to raise the threshold such that the trigger level is near the middle of the waveform to ensure accurate timing, so be aware of the range of the signal that you are measuring and select the threshold to suit. Of course absolute accuracy is not required and the increments in the threshold switch reflect this.

Fig.1



In Fig.2 we see a sinewave that is symmetrical about 0v and in this case we can select the lowest threshold position, providing that we do not need to cancel any noise as discussed in a) above.

Fig.2

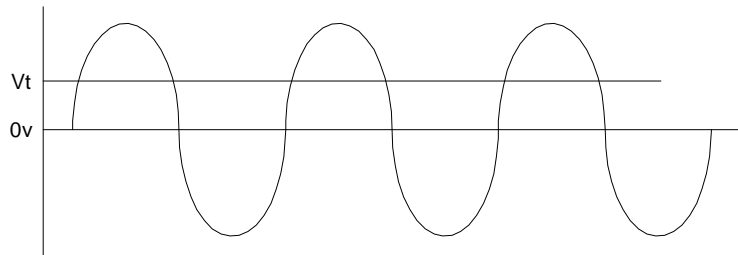
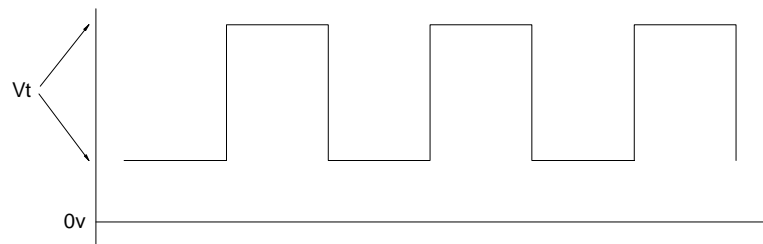


Fig.3 shows the similar situation for a dc input, where this time the gate would be permanently on below the waveform lower voltage, and the threshold must be raised, but can be anywhere within the range of the transition of the signal.

Fig.3



The next stage is to select the frequency range to be used; if you are using the dc range then this is not relevant - the frequency selection is disabled. The frequency referred to is the frequency of the 'carrier' or fundamental in the envelope to be detected. To use the PSTN cadence again as an example, the frequency would be 25Hz, it being the carrier in the 400mS envelope. The reason that frequency selection is required is as follows :-

in order to detect the envelope of a carrier the detection circuitry must ignore the transitions due to that carrier and hold until the carrier is deemed to have gone. This implies that there is a hold period and this period is what is selected when choosing the frequency range. You may ask why not just choose the longest hold period for all frequencies but there is a snag; due to this hold period, if the carrier cuts off when at its maximum voltage the hold circuit will allow it to decay slowly, and thus the timed period will be longer than expected. To minimise this error two things can be done :-

- a) as the hold period is shorter for higher frequencies choose the highest frequency range which includes the required frequency.
- b) take a series of measurements of the period, and for the 'on' period choose the lowest result, and for the 'off' period choose the highest result. About ten readings should suffice.

Note that the possible error is in the order of one half of the period of the carrier frequency (i.e. for a 25Hz carrier this would be about 20mS) and therefore above 500Hz the error becomes negligible.

Returning to the setting up procedure, having selected the frequency range and the threshold, you must choose between ac and dc input and this is done via the front panel toggle switch.

Lastly, choose the period that you require to measure via the front panel rotary switch, and you are ready to start measurements.

The count is activated by the front panel RS / ON switch which at the RS position will reset the display, and at the ON position will await the arrival of the first positive input. The incoming signal can be observed on the 'gate' LED which will be illuminated whilst the signal is being detected. If the LED flickers then the frequency range is too high, or an ac signal is being detected with dc selected. Once the measurement has been made the display will hold the result until the RS switch is made.

Uses

As with all test equipment the uses that it is put to will depend on the requirements of the user, but there follow some suggestions :-

- a) measurement of cadence periods for ringing signal
- b) measurement of make and break period of dial pulses
- c) measurement of DTMF tone bursts for tone diallers
- d) measurement of duration of modem signalling tones
- e) measurement of long monostable pulses
- f) measurement of slow oscillator duty cycles
- g) in the event that a frequency counter is unavailable then the PPC-1 can be used to give a reading of the frequency of the carrier; select dc and the period measured will be the first half cycle of the carrier cycle; the complete period (T) is then twice the reading displayed.

Then, the frequency (f)

$$f = \frac{1}{T}$$

Specification

maximum period	9.999 S
resolution	0.001 S
display	4-digit LED
input threshold	5 ranges 1, 5, 20, 50, 100v
frequency range	4 ranges 20Hz to 60Hz 60Hz to 110Hz 110Hz to 15kHz 15kHz to 100kHz
inputs	ac envelope detection dc pulse measurement
periods measured	1) first high to first low 2) first low to second high 3) second high to second low 4) second low to third high

The unit is housed in a steel / aluminium enclosure, with all switches and connectors on the front and rear panels. It is mains powered, via an IEC connector on the rear panel. Enclosure dimensions are 220mm x 220mm x 70mm.