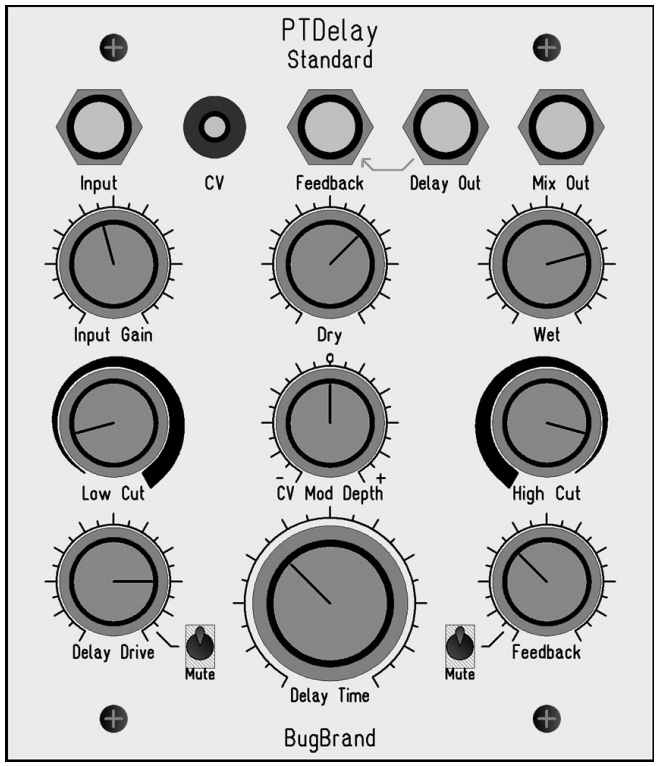
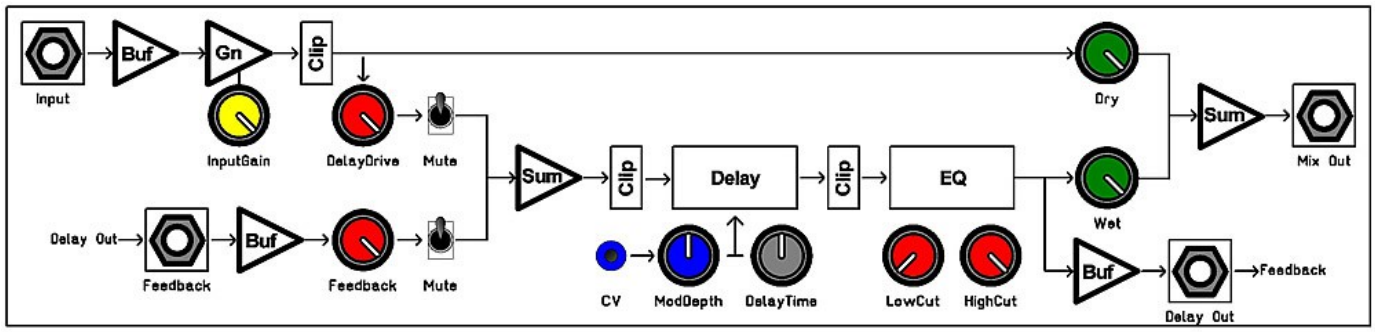


The ***BugBrand PT Delay Standard*** is built around the Princeton Technology PT2399 Digital Delay chip. While the PT2399 itself allows easy implementation of basic delay effects, it only really shines when wrapped up in supporting blanket of analogue circuitry. [Though, of course, once the chip feels safe & happy we start to abuse it, underclocking it so that it spits digital chatter.] Evolving over several years, the PT Delay has become a supremely charcterful and tactile delay processor.



Input Section:
The input is on mono unbalanced 1/4" jack and is designed for typical line level signals. A gain stage offers up to 20dB amplification to accommodate diverse input signals. This section features the first of three LED saturation /clipping stages (internal – you can't see them!) – these stages have been added so that signal amplitudes can be standardised throughout the unit, thus avoiding dramatic level changes (for example when feedback is overloaded), but they also open up avenues of creative overdrive sounds.
For typical usage, begin by adjusting the Input Gain until clipping starts to occur, then dial the control back a notch to give sufficient clean headroom.
Input Impedance = 66k Ohms Unbalanced

Delay Drive / Feedback:
The conditioned input signal is passed to the Delay core via the Delay Drive control and associated Mute switch, with these controls allowing the input feed level to be 'played', eg. for dub-style effects.
As can be seen in the block diagram, the Feedback path is also summed at this stage (normalised from Delay Out socket), again with a Feedback level control and Mute switch.
A clip stage prevents overload to the Delay chip input and saturates any overt Feedback drive.

Delay Core & Control:
The delay time from the PT2399 core is voltage controlled from two sources – the main Delay Time dial combined with any external Control Voltage (CV) via the CV input and polarizing CV Mod Depth control.
Using the Delay Time control alone covers times of approximately 35 mSec to 2.5 Sec. Short, clean delays cover the dial range up to around 1 o'clock (c. 300mS delay time) and beyond this point the delays become increasingly noisy – this is due to 'under-clocking' the delay-chip and is one of the most characteristic areas of the unit. It is normal for there to be background digital fuzz at extreme settings, even with no input.
Using external CV can take the delay time well beyond the 3.5sec mark, resulting in even more crunchy digital noises. The CV input is designed for typical CV signals with a range of 5 to 10V peak-to-peak (max. advised +/-10V) and any external modulation is summed with the voltage set by the main Delay Time control. The CV Modulation Depth control is polarizing – turning anticlockwise from centre gives inverted response while turning clockwise gives normal response, with the centre position being zero. Negative voltages will cause shorter delay times, while positive voltages will increase the delay time. Note that the delay time response is fairly non-linear – it is certainly not a perfect 1V/Oct response.
A final clip stage follows the Delay section to tame the otherwise-unruly signals when the chip is under-clocked.

EQ:
Following the delay core is an equalisation section with Low Cut (High Pass – 20Hz to 1.4kHz) and High Cut (Low Pass – 400 to 20kHz) filters to shape the delay signal (and resulting feedback behaviour). This section really adds character to the delay! Sounds can be tonally reshaped as they decay, resulting in sounds somewhat akin to those of tape delays. Some of the digital artefacts of longer delay times can also be tamed if required by cutting some high frequencies. Note that for no effect / pass-through, Low Cut should be fully counter-clockwise, while High Cut should be fully clockwise as standard.

Outputs:
Post-EQ, the delay signal is split to the Delay Out and to the Output Mix section. The Delay Output (buffered) presents just the delayed signal and also normalises to the Feedback input. This normalisation is broken when a plug is inserted to the Feedback input socket. Typically you would put an external processor (reverb, filter, BugCrusher, etc) in series between these points.
The Mix section allows blending of the Dry signal (post-input-gain) and the Wet (delayed) signals, and provides the output signal on mono 1/4” jack at typical line level amplitudes.
Both outputs are impedance-balanced (680 Ohm Impedance).

CV Interfacing:
As 4mm banana cables do not carry a ground connection, you must establish a ground reference between the PT Delay and any external device before patching Control Voltages (CVs).

Banana-to-Banana: External banana systems should have a Ground banana socket, usually located on the PSU. Connect a banana cable between this and the PT Delay's black GND banana socket.

Banana-to-Jack: The first connection is made with a two wire 'Grounded' cable which establishes the common ground reference. The Black cable (connecting to Jack Sleeve) plugs to the Black GND banana socket. The White cable (connecting to Jack Tip) plugs to the CV destination. Further connections between the same piece of equipment can then be made just with a single wire 'Signal' cable (purely Jack Tip to Banana).

Power:
The unit comes with a universal (90-264V AC) power supply which provides 12VDC @ 500mA on a centre positive 2.1mm DC plug. An internal DC-DC converter generates a bipolar +/-15VDC supply within the unit.

Guarantee:
The PT Delay Standard comes with a 2 year 'reasonable' warranty. If any mechanical or electronic failure occurs within the period, I will repair the fault free of charge. This excludes failure from maltreatment or modification and any cosmetic degradation. Contact should first be made via email to discuss the problem. Shipping to return the device is paid by the user and I cover return shipping. Failures that are not covered by this guarantee may be fixed at standard rates.

Enjoy! Tom Bugs – January 2015 – tom@bugbrand.co.uk – www.bugbrand.co.uk