

# MINIMOD

## DH-ADSR User Guide

### ADSR Envelope Generator with Delay, Hold and Retrigger

Thank you for purchasing the AJH Synth MiniMod DH-ADSR Envelope module, which like all AJH Synth Modules, has been designed and handbuilt in the UK from the very highest quality components. We hope that it will help and inspire you towards creating some great music and soundscapes!

The DH-ADSR is a full ADSR Envelope Generator with selectable Delay, Hold and Retrigger in a single 10hp wide Eurorack module. The discrete transistor circuitry is identical to that of the vintage Minimoog Model D Contour Generator, but with an added Release control to allow full ADSR control of envelopes. This faithfully recreates the original Model D fast and punchy envelope response, along with the multiple key retrigger behaviour which made it so musically useful. We have also added a manual trigger button, a Slow switch and an envelope status LED.

The DH-ADSR Module has three modes of operation:

**ADSR Mode** (DEL-HLD and RETRIG switches off) In this mode it is a regular ADSR envelope generator, with regular or slow envelope speeds.

**Delay-Hold Mode** (DEL-HLD Switch on, RETRIG switch off) In this mode allows a variable delay to be added between the external trigger pulse and the start of the envelope and it transfers control of gate length to the Hold control instead of the external gate.

**Delay-Hold-Retrigger Mode** (DEL-HLD switch on, RETRIG switch on) This allows self retriggering so that repeating ADSR envelopes with variable "off" time are possible and in this mode it will also function as a unipolar LFO with an ADSR waveshape.

Module width is 10 HP of Eurorack space and it is compatible with standard Eurorack cases. The height of the panel is 128.5mm and depth is 26mm. There are four mounting holes at the corners of the module and we provide 4 of M3 rack fixing screws along with a Eurorack compatible power cable. Current consumption is 30mA from the +12V supply rail and 12mA from the -12V supply rail.

All AJHSynth modules are covered by a two year guarantee against manufacturing defects.

*Note:*

*It is very important that the power supply ribbon cable is connected correctly, see the "adjustment and calibration" section for an illustration of the correct orientation.*



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# Controls, inputs and outputs



- ① Envelope LED : Gives a visual indication of the output level of the Envelope Generator
- ② Attack Control : Sets the speed of the Attack slope of the envelope, and it can be varied from around 10 milliseconds to 10 seconds. The Attack time will lengthen to between 40 m.sec to 40 seconds with Slow switch (7) down.
- ③ Decay Control : Sets the speed of the Decay slope of the envelope, which can be varied from around 10 milliseconds to 10 seconds if the Sustain control is set to zero - the time will be longer with the Slow switch (6) on. The Decay time will shorten as higher Sustain levels are selected, and with maximul Sustain level there will be almost zero decay slope  
  
The Decay cycle commences only after the Attack slope has reached it's maximum level of +8 Volts. As long as the Gate remains high then the output will decay to the level set by the Sustain control (between 0V and +8V) If the gate signal goes low before the Attack cycle has completed (i.e. it is to slow to have risen to +8V) Then the Release cycle will immediately commence and the Decay phase will be ignored.
- ④ Sustain Control : Sets the sustain level, between 0 to 8 volts for the envelope. It is only active when the gate is high, as soon as the gate goes low the Release cycle commences.
- ⑤ Retrigger Switch : When this switch is down (on) it causes the envelope to automatically retrigger when the release level has reduced to almost zero volts. It is only effective when Del-Hold mode is active, i.e. the DEL-HLD switch is in the down (on) position.  
  
*Note: Retrigger is also dependant upon the settings of the other envelope controls, for example some combinations of slow attack and a short gate will prevent successful retriggering as the the envelope cannot attain a high enough level before the gate goes low.*
- ⑥ Slow Switch : With the Slow switch down (on) the envelope speed is reduced so that the Attack, Decay and Release times are approximately four times longer, so that very slow, evolving envelopes are possible.

- ⑦ Gate Input : The Envelope Generator cycle is started (triggered) by patching a gate signal to this Input, alternatively it can also be triggered using the Manual Trigger switch (8). Any Gate voltage above +2V will successfully trigger the envelope and gate voltage levels up to +11V are acceptable. If no patch cable is inserted into the Gate socket then the Gate input is normalised to the Gate Line of the Eurorack power bus.
- ⑧ Manual Trigger : Pressing this button triggers the Envelope Generator, sustain will be active for as long as the button is held down - it is the equivalent of pressing a note on a keyboard when using a Midi to CV converter.
- ⑨ Release Control : Sets the speed of the Release slope of the envelope, and it can be varied from around 10 milliseconds to 10 seconds. The Release phase starts when the Gate goes low. The Release time will lengthen to between 40 m.sec to 40 seconds with Slow switch (7) down.
- ⑩ Pre-Delay Control : The Pre-Delay control is only active when the Delay Hold Switch (12) is on (down). It sets the delay between the gate signal and the start of the Attack phase, so it sets the length of the Gate off or "do nothing" time before the envelope is triggered either by an external signal or by the Retrigger circuit if the Retrigger Switch (5) is on (down). The Pre-Delay can be varied from around 20ms to 10 seconds.
- ⑪ Hold Control : The Hold control is only active when the Delay Hold Switch (12) is on (down). It sets the length of the gate signal that is used to trigger the envelope. In Delay-Hold mode any external gate functions purely as a trigger, and the actual length of the gate for the envelope is determined by the setting of the Hold control. The Hold (Gate on time) can be varied from around 20ms to 10 seconds.
- ⑫ Delay Hold Switch : Switches between regular ADSR Mode (switch up) and Delay-Hold Mode (switch down). Please note that the Pre-Delay and Hold controls are only active in Delay-Hold Mode.
- ⑬ Envelope Output : The regular envelope output. This gives a voltage between zero and +8 Volts which tracks the envelope shape.
- ⑭ Inverted output : This output can be configured to give either a UniPolar or BiPolar Inverted output, see page 7 for a full description of these two waveforms.

## The DH-ADSR module has three different Envelope Modes:

### 1) Regular ADSR mode (DEL-HLD switch up, RETRIGGER switch up)

This is illustrated in Fig. 1 below. An attack, decay, sustain and release envelope is generated each time either a GATE signal is received, or the manual trigger button is pressed.. The PRE-DELAY and HOLD controls are not used and have no effect in this mode. If short gate pulses are received then the attack cycle does not start from zero - this is the same behaviour as the Minimoog Model D envelope (and our MiniMod Dual Contour module).

The ATTACK control sets the attack speed, or how long the envelope takes to reach maximum level, this is between approximately 10mS and 10 seconds. It rises in an exponential manner, i.e. more quickly at first and then more slowly as it gets towards maximum level, many synth users consider this to be more “musical” than simple linear envelope generators.

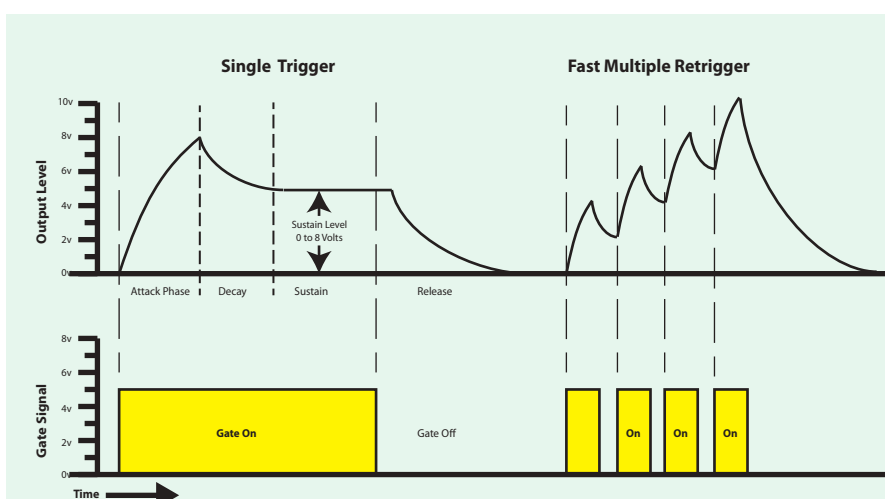
The DECAY control sets the speed at which the envelope decays after reaching maximum attack, again this follows an exponential curve.

The SUSTAIN control is only effective while the gate is high, and determines the level that the DECAY falls to. This can be between 0 and +8 Volts, depending on the setting of the Sustain control.

The RELEASE control only comes into play when the GATE (or HOLD when in DEL-HLD Mode) ends, and it determines the rate at which the envelope level decays from the Sustain level to zero volts. Again, the decay slope follows an exponential rather than linear slope.

The ADSR mode is identical to the original Minimoog Model D envelopes, however it removes the limitation of the Decay and Release slopes always having to be the same as they now have their own individual controls rather than a single, shared Decay control which covered both functions on the original Model D synth. This allows a much larger range of sounds to be created, such as fast attack and decay combined with a slow release and vice versa.

The DECAY and HOLD controls are out of circuit and have no effect in regular ADSR mode.



**Fig. 1 - An Illustration of regular ADSR Mode Envelopes**

## Envelope Modes (cont.)

### 2) DELAY- HOLD mode (DEL-HLD switch down, RETRIG switch up) -

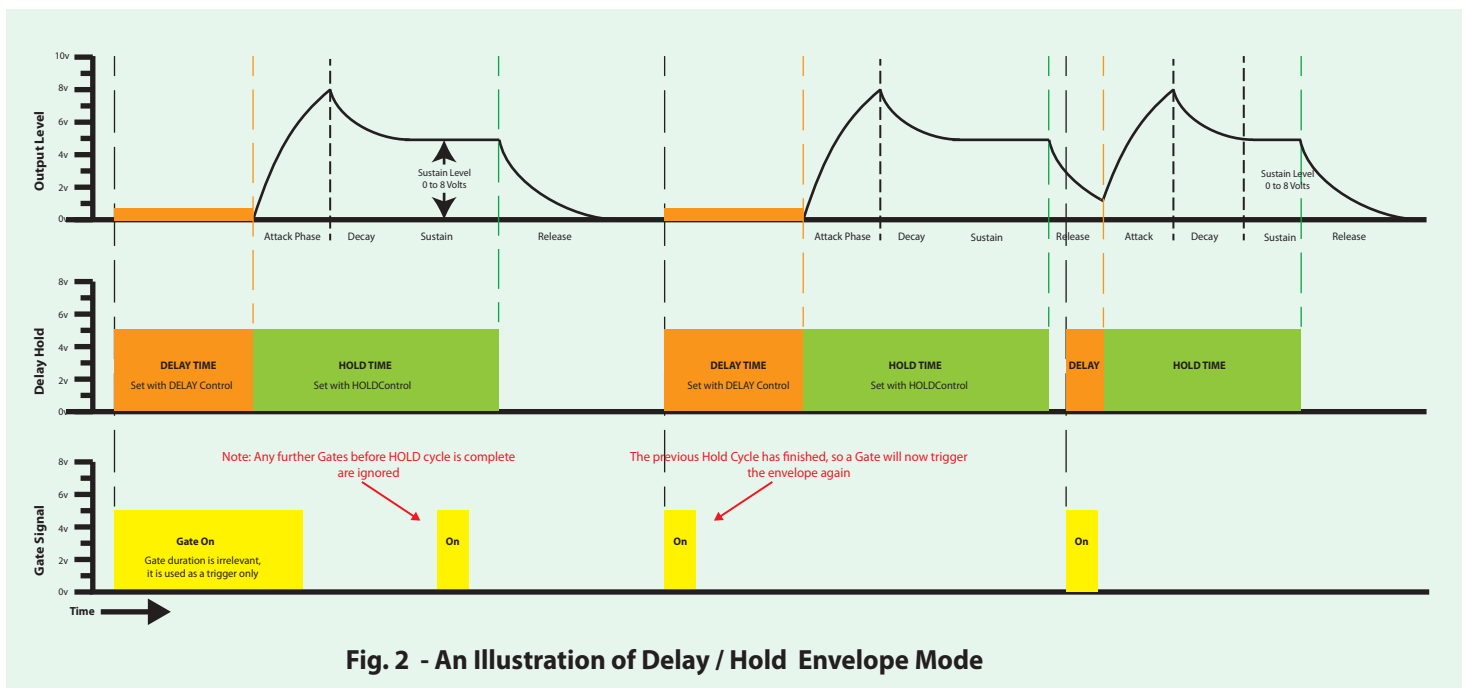
This mode is illustrated in Fig. 2 below. With the DEL-HLD switch down the DELAY and HOLD controls come into play. In this mode the incoming GATE signal is used as a trigger only, and the GATE length is irrelevant. A very short duration GATE or Trigger will initiate the envelope, and the length of the gate is not important, once the envelope has commenced the state of the gate signal is ignored

When a GATE signal is received the DELAY phase is started, and the length of this time can be between 20mS and 10 seconds, depending upon the setting of the PRE-DELAY control (10) - this effectively initiates a "do nothing" or "hold off" time before the envelope starts.

As soon as the PRE-DELAY period ends the HOLD period begins, and this now triggers an ADSR envelope, however (importantly!) the HOLD control (11) rather than the GATE sets the effective gate length of the envelope that is generated, and the HOLD time can be between approximately 20mS to 10 Seconds.

Once the DELAY-HOLD phase has started any subsequent GATE pulses are ignored until the DELAY-HOLD cycle has ended. However, gate pulses are recognised during the RELEASE phase, as can be seen below - if the HOLD cycle begins before the RELEASE level has fallen to zero then the ATTACK phase will begin at the current RELEASE level.

The SLOW switch (6) is active in DELAY-HOLD mode and will lengthen the attack, decay and release times, however it will not affect the DELAY or HOLD times, they remain identical with the SLOW switch on or off .



## Envelope Modes (cont.)

### 2) RE-TRIGGER mode (DEL-HLD switch down, RETRIG switch down) -

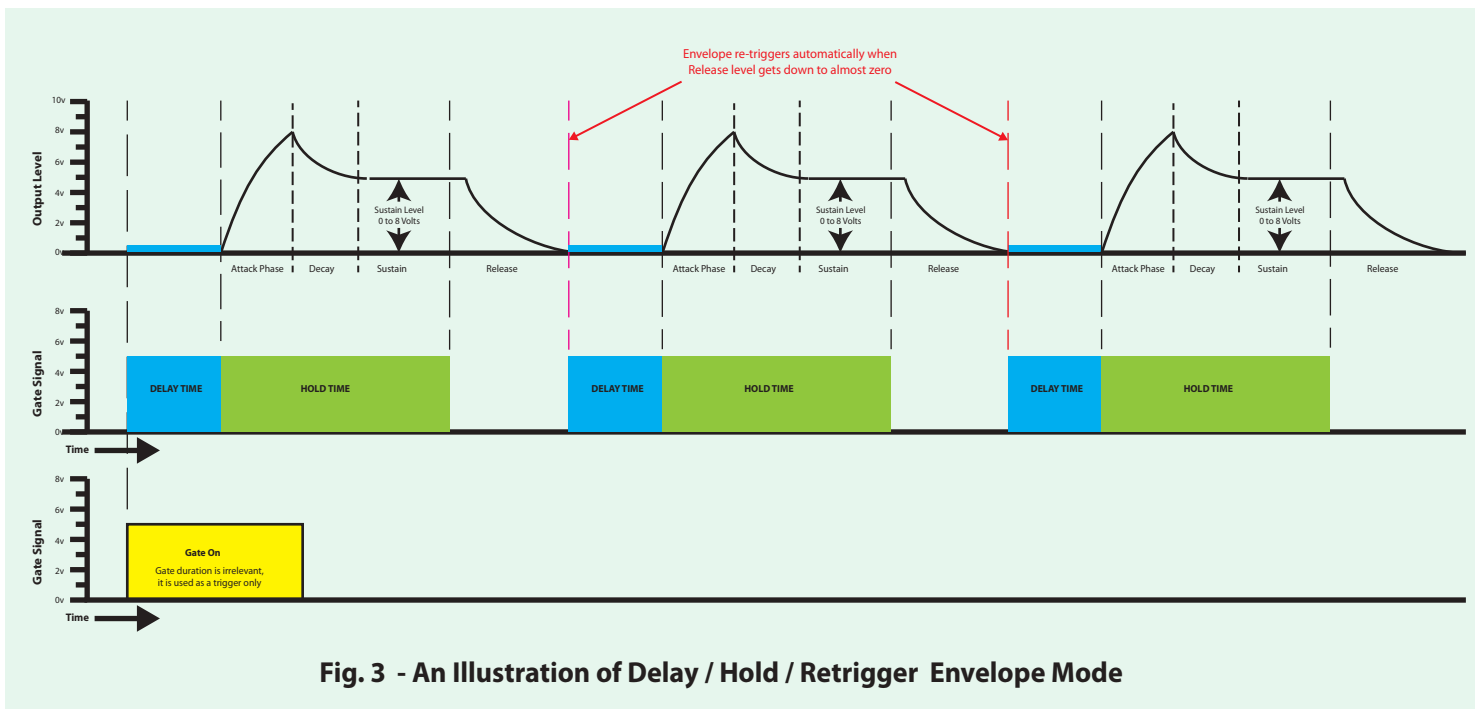
Retrigger mode is similar to DEL-HOLD Mode in that the gate length is set by the HOLD control, and the “do nothing” time is set by the PRE-DELAY control, however when the RELEASE curve drops to almost zero then a pulse created internally and this is used to trigger the DELAY - HOLD circuit again, ad infinitum, which creates an LFO like continually repeating envelope.

A full ADSR envelope is created each time, and the space between re-triggers is set by the PRE-DELAY control (10). The envelope “gate on” time is set with the HOLD control (11), and it can be from approximately 20mS to 10 seconds.

This repeating envelope can be used as a unipolar LFO with an amplitude of between 0 and +8V, and the waveshape and frequency can be altered by adjusting the DELAY, HOLD, ATTACK, DECAY, SUSTAIN and RELEASE controls to produce some fairly complex repeating waveshapes.

Retriggering can be initiated either by pressing the front panel trigger button, or by patching an external gate pulse to the GATE input, only a single pulse is needed.

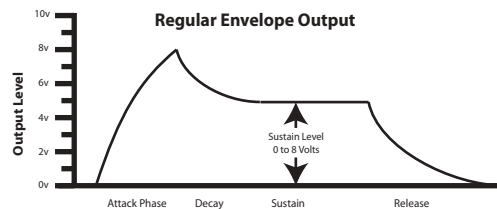
Note that with certain control settings repeating envelopes are not possible, for example by setting a long RELEASE time and a short DECAY time - in this case the RELEASE curve will not fall to a low enough level to re-trigger, so the envelope will become one shot and stop.



## Regular and Inverted outputs:

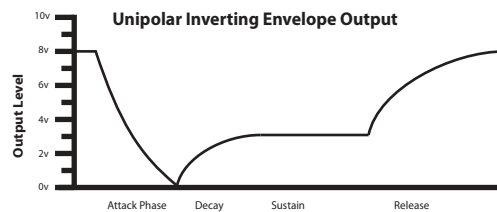
### Regular envelope output

This is available from the OUT jack (13), and varies in amplitude between 0 and +8 Volts. The status of the envelope is shown by the front panel LED (1), it gets progressively brighter as the envelope output voltage rises, reaching maximum brightness with a +8 Volt output.



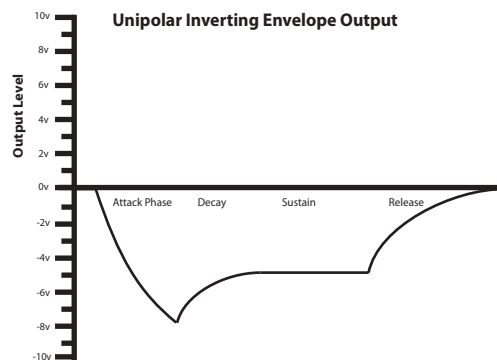
### UniPolar inverted envelope output

This waveform is available from the INV OUT jack (14) when the INV OUT TYPE jumper is fitted (JP1 - see page 8). This is the default waveform, and probably the more useful of the two inverted types. The output level will normally be at +8V, and the voltage will vary as shown below. It can be useful to connect to a filter external cutoff input, in which case the filter will "close" instead of "open" as the the envelope increases.



### BiPolar inverted envelope output

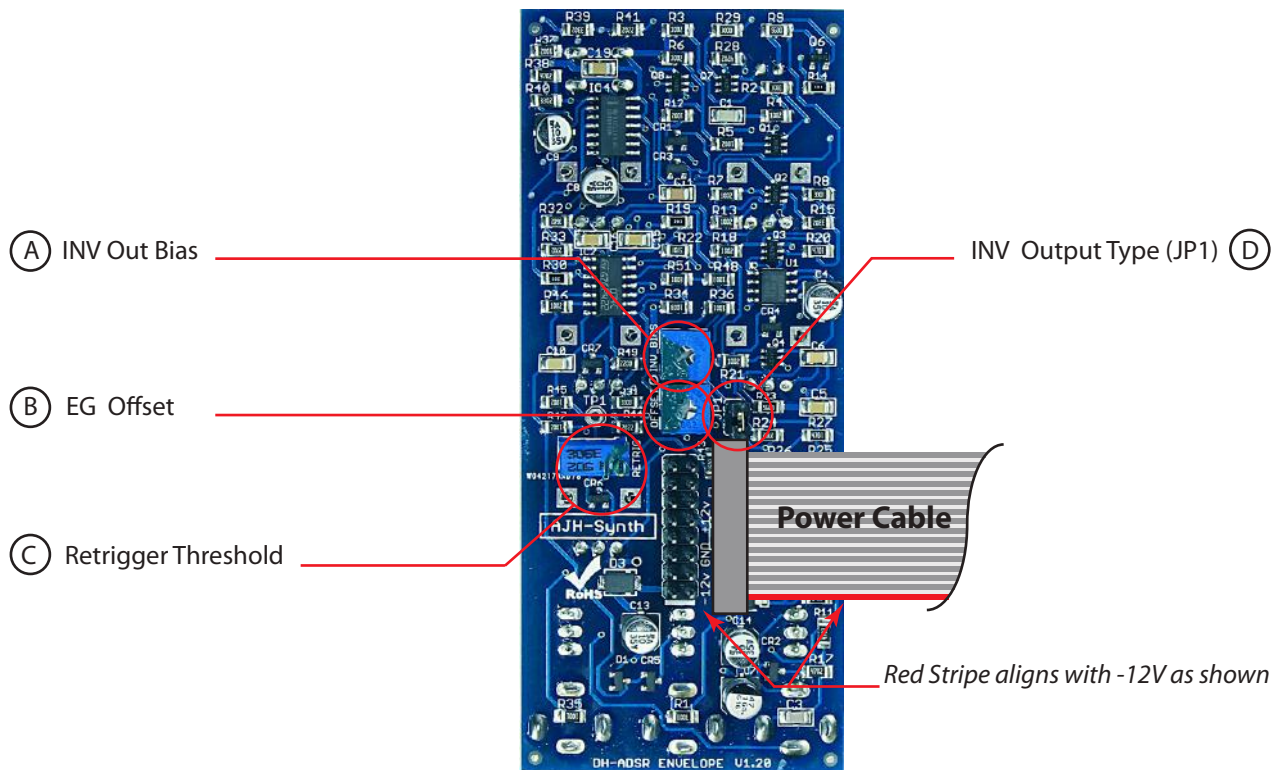
This waveform is available from the INV OUT jack (14) when the INV OUT TYPE jumper (JP1) is removed, or only connected to one pin. It starts at 0 Volts and progresses negatively as shown below.



## Adjustment and Calibration

**Note:**

*This information is given for completeness, the MiniMod DH-ADSR module is calibrated after manufacture and under normal circumstances should not require any user adjustment.*



- ① INV Out Bias : Sets the offset voltage for the INV Output when the INV Output jumper is in place. For manufacturer use only, as specialist equipment is needed to correctly calibrate the inv. bias offset voltage.
- ② EG Offset : This trimmer sets the EG output offset voltage. For manufacturer use only, as specialist equipment is needed to correctly calibrate the output offset voltage.
- ③ Retrigger Threshold : This trimmer sets the retrigger threshold voltage. For manufacturer use only, as specialist equipment is needed to correctly calibrate the retrigger threshold voltage.
- ④ INV Output Type : There are two modes for the INV output which are selected by JP1 as follows:
- 1) Jumper removed - The INV output is an inversion of the regular output around 0V, so the envelope will travel between 0V and -8V
  - 2) Jumper connected - The INV output is an inversion of the regular output, but biased upwards by +8V, so that it will traverse between +8V to 0V

If you need any help using this module or have any technical questions please feel free to contact us at [support@ajhsynth.com](mailto:support@ajhsynth.com)