CHIPPMANN
electronic musical instruments

CS-8 Series

Owners' manual DTG

User manual by Carsten Schippmann
Graphic design CS-8 Series: Carsten Schippmann
Concept and development: Carsten Schippmann

English translation by Carsten Schippmann

Contact:

Schippmann electronic musical instruments
Dipl.-Ing. Carsten Schippmann
Wartburgstr. 8
D-10823 Berlin

Web: www.schippmann-music.com
Email: info@schippmann-music.com

The manufacturer *Schippmann electronic musical instruments* is constantly striving for improvements and developments of their products. Therefore, we reserve the right to change technical specifications which improve our products at any time without notice. This includes the look of the unit which might differ from pictures in this manual.

PREFACE

First of all, congratulations on the purchase of this 3U Eurorack synthesizer module. This manual contains a condensed description of the functionality and addresses users with a certain level of elementary technical knowledge.

The present **DTG** of the CS-8 series is a very flexible and precise fully analogue **dual-transientgenerator**, with two time bases, each. One of it generates the analog transient waveform, the other provides either a **Gate** signal (0 V - +5 V) of definite length, independently of the input gate length **or** outputs (externally switchable) the incoming Gate transition by a definite delay time (**Delay**).

All times, Gate length/delay, Attack, Decay, Release as well as the Sustain level are **externally voltage controllable**. The Transient generator and also the Gate can be reset to 0 V output voltage, separately, via a jack. A **Hold** input allows to "freeze" immediately the current voltage output state of the transient output until enabling again. A **Decay-Active** output becomes "high" active (+5 V) during the Decay phase. Moreover, it is possible by a jack to set the **Sustain level between -10 V and +10 V**, meaning after achieving the regular final value of the attack phase (+5V) the transient output will further rise to the higher Sustain level above (>+5 V) asymptotically with the Decay time (second attack phase).

Conclusively, the concept is well-rounded by a **high-end-VCA** for continuously negative/positive output of the transient waveform from -5 V (inverse) crossing the exact zero to +10 V final attack value.

Design and implementation meet highest technical standards. The front panel is made from powdered and printed piece of aluminium sheet metal of 2 mm gauge. The entire design and production work was done in Germany.

Made in Germany

1. WARRANTY

1.1 Limited Warranty

Schippmann electronic musical instruments warrants the mechanical and electronic components of this product for a period of two (2) years from the original date of purchase, according to the warranty regulations described below. However, as a gesture of goodwill we give a lifetime warranty on our products. Nevertheless, this will be always a decision in an individual case. If the product exhibits any faults within the specified warranty period that are not excluded from this warranty, *Schippmann electronic musical instruments* shall, at its discretion, either replace or repair the product. This warranty exists in addition to the general terms of business of the manufacturer *Schippmann electronic musical instruments*.

1.2 Terms of Warranty

Schippmann electronic musical instruments reserves the right to execute warranty services only if the product comes with a copy of the dealer's original invoice. Final discretion of warranty coverage lies solely with *Schippmann electronic musical instruments*. Any *Schippmann electronic musical instruments* product deemed eligible for repair or replacement under the terms of this warranty will be repaired or replaced within 30 days after receiving the product at *Schippmann electronic musical instruments*. Damages or defects caused by improper handling or opening of the unit by unauthorized personnel (user included) are not covered by this warranty. Products which do not meet the terms of this warranty will be repaired exclusively at the buyer´s expense and returned C.O.D. with an invoice for labour, materials, return shipping, and insurance. Products repaired under warranty will be returned with shipping prepaid by *Schippmann electronic musical instruments*. **Outside Germany, products will be returned at the buyer´s expense**.

1.3 Warranty transferability

This warranty is extended to the original purchaser and cannot be transferred. No other person (retail dealer, etc) shall be entitled to give any warranty promise on behalf of *Schippmann electronic musical instruments*.

1.4 Claim for damages

Schippmann electronic musical instruments does not accept claims for damages of any kind, especially consequential loss or damage, direct or indirect of any kind however caused. Liability is limited to the value of this product. The general terms of business drawn up by *Schippmann electronic musical instruments* apply at all times.

Please note: The controls, switches and jacks are programming facilities, **no real-time controllers!** Tweak them carefully since we cannot be held liable for "abused" potentiometers and switches.

2. CE AND FCC COMPLIANCE STATEMENTS

This device has been tested and deemed to comply with the **DIN EN 60065** standards.

This device has been tested and deemed to comply with the requirements, listed in FCC Regulations, part 15. The device complies with **EN 55103-1** and **EN 55103-2** standards.

Because of the entirely analogue construction, this device does not generate radio frequencies and will not interfere with radio frequencies generated by other electronic devices.

3. DISPOSAL

This device has been manufactured to RoHS-standards, in compliance with the requirements of the European parliament and council and is thus free of lead, mercury, and cadmium.

!! Notice: This product is still special waste and is not to be disposed of through regular household waste !!

For disposal, please contact your local dealer or *Schippmann electronic musical instruments*

4. SAFETY INSTRUCTIONS

BEFORE USING THIS PRODUCT FOR THE FIRST TIME, PLEASE READ THE ENTIRE USER MANUAL THOROUGHLY.

- PLEASE AVOID SHARP BENDING OF ANY CORDS AND CABLES.
- CORDS SHOULD NOT BE INSTALLED WITHIN THE REACH OF CHILDREN OR PETS.
- DO NOT TREAD THE ENCLOSURE OF THE PRODUCT, DO NOT PLACE HEAVY OBJECTS ON IT.
- BEFORE REMOVING THE PRODUCT FROM THE RACK, PLEASE DISCONNECT THE POWER PLUG AND ALL OTHER CABLE CONNECTIONS.
- PLEASE DISCONNECT THE POWER PLUG FROM THE OUTLET IN CASE OF A THUNDERSTORM.
- NEVER OPEN THE ENCLOSURE OF THE PRODUCT! NEVER TRY TO MODIFY THE INTERNAL CIRCUITRY! ONLY QUALIFIED SERVICE PERSONNEL IS ALLOWED TO OPEN THE ENCLOSURE.
- DO NOT PLACE OPEN FIRE ON TOP OF THE PRODUCT (CANDLES, ASH TRAYS, HOT THAI CURRIES ETC).
- NEVER EXPOSE THE PRODUCT TO WATER, BEER, OR MOISTURE.
- ADULTS ARE TO MAKE SURE THAT CHILDREN FOLLOW ALL SAFETY INSTRUCTIONS. SAME THING GOES FOR PETS.
- AVOID MECHANICAL STRESS OR IMPACT. DO NOT DROP THE PRODUCT; EVEN IF THERE IS A CONTROL LABELLED "DROP"!
- DO NOT USE THE PRODUCT WITH TOO MANY OTHER ELECTRONIC DEVICES RUNNING FROM ONE SINGLE OUTLET, ESPECIALLY IN CONNECTION WITH EXTENSION CORDS. DO NOT ATTEMPT TO SAVE MONEY ON CHEAP SOLUTIONS. BUY PROPER HIGH-DUTY POWER DISTRIBUTORS AND CORDS!
- NEVER USE EXTENSION CORDS WITH LESS MAXIMUM LOAD THAN THE TOTAL POWER CONSUMPTION OF ALL DEVICES CONNECTED TO A SINGLE POWER OUTLET COMBINED. OVERLOADING EXTENSION CORDS CAN CAUSE FIRE.
- ***AVOID MECHANICAL STRESS ON JACKS AND KNOBS / SWITCHES.***
- ***PROTECT YOUR SPEAKERS AND EARS (!) AGAINST EXCESSIVE AUDIO***

LEVELS.

5. MAINTAINANCE/ CLEANING

- BEFORE CLEANING THE PRODUCT, PLEASE DISCONNECT THE POWER PLUG FROM THE OUTLET OR DISCONNECT THE MODULE FROM ITS POWER CONNECTOR BY PULLING THE FLAT RIBBON CABLE.
- USE A DRY OR SLIGHTLY MOIST CLOTH OR COMPRESSED AIR FOR CLEANING. NEVER USE ANY CLEANER OR THINNER (E.G. PAINT THINNER OR ACETON). PRINTS AND PAINTWORK WILL IMEDIATELY BE DESTROYED!! ALSO AVOID ALCOHOL (ISOPROPYLIC), GAS, SPIRITS (SCOTCH SINGLE MALTS, FOR A START) OR ABRASIVE HOUSEHOLD CLEANERS!

6. GETTING STARTET

6.1 Unpacking

The box should contain the following items:
- 1 x CS-8 Series VCF1E 3HU rack-mount module
- 1 x Ribbon cable (20 cm length with two 16 pole IDC-connectors)
- 4 x M3 screws
- 4 x polypropylene washers
- this owners' manual

If the content of the box turns out to be incomplete, please get in touch with your dealer or *Schippmann electronic musical instruments* immediately. In case of damage caused in transit, please get back to the responsible carrier and *Schippmann electronic musical instruments* immediately. We will support you in this case.

6.2 Installation

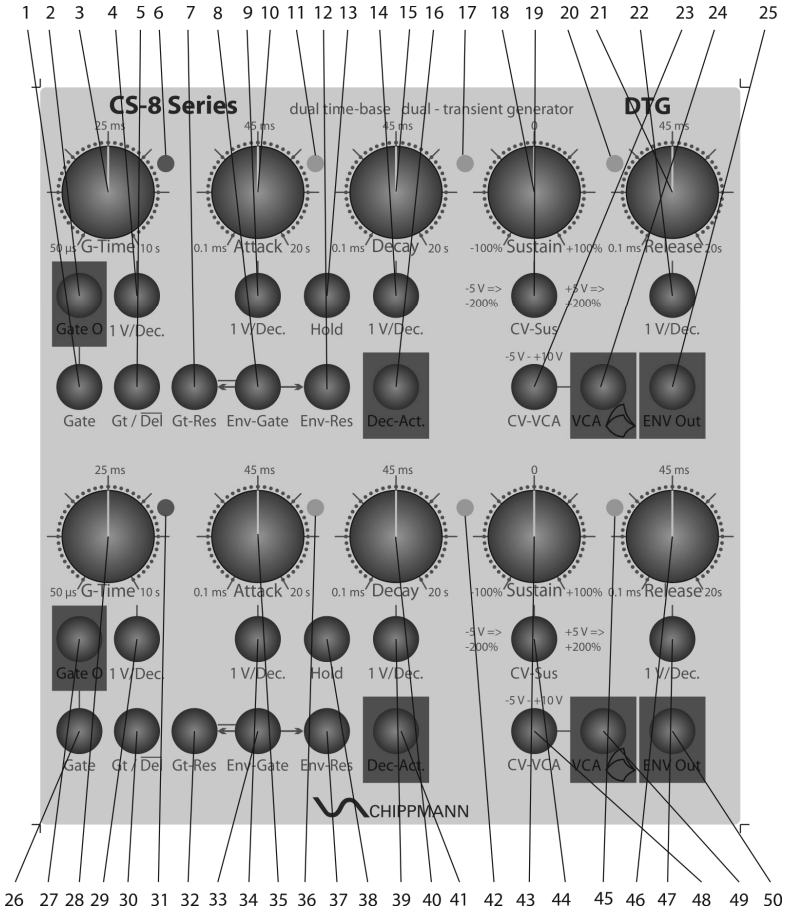
Place the unit on a clean, dry and sturdy surface, or use a suitable keyboard stand or 19" rack. For 19" rack mounting, a suitable rack (3U Eurorack with +/- 12V power supply rails) is required. The CS-8 DTG uses discrete all-analogue electronics. Thus certain parameters may be temperature-sensitive. We

recommend placing the DTG away from heat sources such as radiators, lamps or other units that produce heat (e.g. power amps or internal power supplies).

7. CONTROLS

7.1 Front panel

Fig. 1 shows the front panel with consecutively numbered controls and jacks.


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
CS-8 Series
dual time-base dual - transient generator
DTG
25 ms
45 ms
45 ms
0
45 ms
50 µs G-Time 10 s
0.1 ms Attack 20 s
0.1 ms Decay 20 s
-100% Sustain +100%
0.1 ms Release 20s
Gate O
1 V/Dec.
1 V/Dec.
Hold
1 V/Dec.
-5 V => -200%
+5 V => +200%
1 V/Dec.
-5 V - +10 V
Gate
Gt / Del
Gt-Res
Env-Gate
Env-Res
Dec-Act.
CV-Sus
CV-VCA
VCA
ENV Out
25 ms
45 ms
45 ms
0
45 ms
50 µs G-Time 10 s
0.1 ms Attack 20 s
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100% Sustain +100%
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Gate O
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CV-Sus
1 V/Dec.
-5 V - +10 V
Gate
Gt / Del
Gt-Res
Env-Gate
Env-Res
Dec-Act.
CV-VCA
VCA
ENV Out
CHIPPMANN
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

Fig. 1

1. **Gate** jack (input) – generates, caused by a 0 V -> +5 V transition, a +5 V Gate signal of definite length at *jack (2) (Gate O)*; or outputs it by a definite delay time at *jack (2)*
2. **Gate O** jack (output) – provides a +5 V Gate signal of definite length or by a definite delay time in relation to the Gate input *(1)*
3. **G-Time** controller – set the Gate length in Gate mode or the delay time in delay mode, resp. between 50 µs to 10 seconds
4. **1 V/Dec.** jack (input) – set by an external voltage the Gate length/delay time by a sensitivity of 1 V/decade, positive/negative voltage -> shorter/longer by a factor of 10 per volt from the current state *(3)*
5. **Gt/Del** jack (input) – selects between Gate mode and Delay mode, +5 V -> Gate, 0V -> Delay; is tied by a switching contact to +5 V and is unused in Gate mode
6. **LED** indicator – lights up in Delay mode firstly "red", when a Gate signal is incoming at *jack (1)* and changes to "green" when the Gate O at *jack (2)* becomes active
7. **Gt-Res** jack (input) – reset, as long as a +5 V input is applied, the active Gate at *jack (2)* and inhibits a new start *(1)* (not active in Delay mode); is tied by a switching contact to *jack (8)* (Env-Gate) and works inverse, means a "low" (0 V) at *jack (8)* causes a reset!
8. **Env-Gate** jack (input) – a +5 V starts the envelope attack or maintaining the decay phase; 0 V set the envelope always into the release phase
9. **1 V/Dec.** jack (input) – set by an external voltage the Attack time by a sensitivity of 1 V/decade, positive/negative voltage -> faster/slower by a factor of 10 per volt from the current state *(10)*
10. **Attack** controller – set the Attack time between 100 µs to 20 seconds
11. **LED indicator** – shows by its brightness the current envelope output value during the attack phase, "green" at positive output values, "red" for negative ones
12. **Env-Res** jack (input) – reset by a 0 V -> +5 V transition the envelope output to 0 V and the generator back to the attack phase; is tied by a switching contact to *jack (8)* (Env-Gate) and causes a reset with the envelope start
13. **Hold** jack (input) – "freezes", as long as a +5 V signal is applied and held, the envelope output to the current voltage state
14. **1 V/Dec.** jack (input) – set by an external voltage the Decay time by a sensitivity of 1 V/decade, positive/negative voltage -> faster/slower by a factor of 10 per volt from the current state *(15)*
15. **Decay** controller – set the Decay time between 100 µs to 20 seconds

16. **Dec-Act.** jack (output) - provides a +5 V signal during the decay phase
17. **LED indicator** – shows by its brightness the current envelope output value during the decay phase, "green" at positive output values, "red" for negative ones
18. **Sustain** controller – set the final value of the decay phase between -100% (-5 V) und +100% (+5 V)
19. **CV-Sus** jack (input) - set by an external voltage of -5 V - +5 V (at middle position of *(18)*) the final value of the decay phase between -200% (-10 V) und +200% (+10 V); decay becomes at >100% a second attack!
20. **LED indicator** – shows by its brightness the current envelope output value during the release phase, "green" at positive output values, "red" for negative ones
21. **Release** controller – set the release time between 100 µs to 20 seconds
22. **1 V/Dec.** jack (input) – set by an external voltage the release time by a sensitivity of 1 V/decade, positive/negative voltage -> faster/slower by a factor of 10 per volt from the current state *(21)*
23. **CV-VCA** jack (input) - controls by an external voltage between -5 V - +10 V the envelope amplitude between inverse (attack final value = -5 V) and +10 V
24. **VCA** jack (output) - provides the VCA controlled *(23)* envelope waveform
25. **Env Out** jack (output) - provides the envelope output with a fix +5 V attack final value
26. **Gate** jack (input) – generates, caused by a 0 V -> +5 V transition, a +5 V Gate signal of definite length at *jack (27) (Gate O)*; or outputs it by a definite delay time at *jack (27)*
27. **Gate O** jack (output) – provides a +5 V Gate signal of definite length or by a definite delay time in relation to the Gate input *(26)*
28. **G-Time** controller – set the Gate length in Gate mode or the delay time in delay mode, resp. between 50 µs to 10 seconds
29. **1 V/Dec.** jack (input) – set by an external voltage the Gate length/delay time by a sensitivity of 1 V/decade, positive/negative voltage -> shorter/longer by a factor of 10 per volt from the current state *(28)*
30. **Gt/Del** jack (input) – selects between Gate mode and Delay mode, +5 V -> Gate, 0V -> Delay; is tied by a switching contact to +5 V and is unused in Gate mode
31. **LED** indicator – lights up in Delay mode firstly "red", when a Gate signal is incoming at *jack (26)* and changes to "green" when the Gate O at *jack (27)* becomes active

32. **Gt-Res** jack (input) – reset, as long as a +5 V input is applied, the active Gate at *jack (27)* and inhibits a new start *(26)* (not active in Delay mode); is tied by a switching contact to *jack (33)* (Env-Gate) and works inverse, means a "low" (0 V) at *jack (33)* causes a reset!
33. **Env-Gate** jack (input) – a +5 V starts the envelope attack or maintaining the decay phase; 0 V set the envelope always into the release phase
34. **1 V/Dec.** jack (input) – set by an external voltage the Attack time by a sensitivity of 1 V/decade, positive/negative voltage -> faster/slower by a factor of 10 per volt from the current state *(35)*
35. **Attack** controller – set the Attack time between 100 µs to 20 seconds
36. **LED indicator** – shows by its brightness the current envelope output value during the attack phase, "green" at positive output values, "red" for negative ones
37. **Env-Res** jack (input) – reset by a 0 V -> +5 V transition the envelope output to 0 V and the generator back to the attack phase; is tied by a switching contact to *jack (33)* (Env-Gate) and causes a reset with the envelope start
38. **Hold** jack (input) – "freezes", as long as a +5 V signal is applied and held, the envelope output to the current voltage state
39. **1 V/Dec.** jack (input) – set by an external voltage the Decay time by a sensitivity of 1 V/decade, positive/negative voltage -> faster/slower by a factor of 10 per volt from the current state *(40)*
40. **Decay** controller – set the Decay time between 100 µs to 20 seconds
41. **Dec-Act.** jack (output) - provides a +5 V signal during the decay phase
42. **LED indicator** – shows by its brightness the current envelope output value during the decay phase, "green" at positive output values, "red" for negative ones
43. **Sustain** controller – set the final value of the decay phase between -100% (-5 V) und +100% (+5 V)
44. **CV-Sus** jack (input) - set by an external voltage of -5 V - +5 V (at middle position of *(43)*) the final value of the decay phase between -200% (-10 V) und +200% (+10 V); decay becomes at >100% a second attack!
45. **LED indicator** – shows by its brightness the current envelope output value during the release phase, "green" at positive output values, "red" for negative ones
46. **Release** controller – set the release time between 100 µs to 20 seconds
47. **1 V/Dec.** jack (input) – set by an external voltage the release time by a sensitivity of 1 V/decade, positive/negative voltage -> faster/slower by a factor of 10 per volt from the current state *(46)*

48. **CV-VCA** jack (input) - controls by an external voltage between -5 V - +10 V the envelope amplitude between inverse (attack final value = -5 V) and +10 V
49. **VCA** jack (output) - provides the VCA controlled *(48)* envelope waveform
50. **Env Out** jack (output) - provides the envelope output with a fix +5 V attack final value

7.2 Back

Fig. 2 shows the back of the module with consecutively numbered elements.

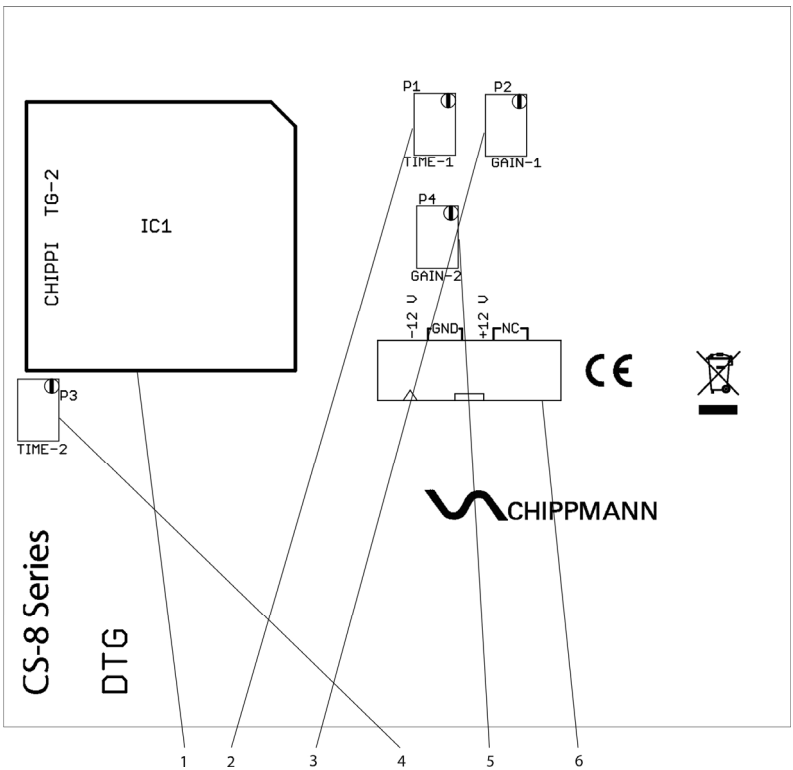

Fig. 2

1. **IC1** – pinned TG Modul
2. **P1** 12- gauge-trimmer – Attack time (DTG top) -> 100 µs
3. **P2** 12- gauge-trimmer – VCA out (DTG top) -> 0 V @ CV = 0 V
4. **P3** 12- gauge-trimmer – Attack time (DTG bottom) -> 100 µs
5. **P4** 12- gauge-trimmer – VCA out (DTG bottom) -> 0 V @ CV = 0 V
6. **16 Pin power supply box-header**

7.3 Initial operation

The power connector's **(6)** pin-out in top view (refer to fig. 2) is assigned as follows:
Bottom to top, left to right. Thus pin 1 is located at bottom left, pin 2 above pin 1 etc. Pin 15 is at bottom right, pin 16 at top right.

Pin 1, 2 = -12 V (labelled with a triangle)
Pin 3-8 = GND (ground, 0 V), located outward on all jacks
Pin 9, 10 = +12 V
Pin 11-16 = not in use

To hook up power to the module, connect one of the IDC-jacks of the included flat ribbon cable to the connector (refer to fig. 2). Observe guide key for the polarity of the connector in order to avoid pin reversal. The **red tag** of the cable **is to match the triangle-label**.

8. MODULE DESCRIPTION

8.1 Structure

The DTG is a combination of a Gate module and an Envelope generator in duplicate design. The Fig. 3 shows the structure of one of these two designs. In the following piece by piece every parts will be described and as the case may be exemplified with graphics. Because of the identity of the generators the following descriptions are referring to the elements 1-25 of the front panel.

Hint 1: All digital input jacks (Gate, Gate-Reset, Gt/Del, Env-Gate, Env-Reset, Hold) are so-called Schmitt-Trigger inputs, meaning they can be fed with any analog (also negative) voltages (max. ±12 V). The trigger point is about +3 V.

Hint 2: A positive voltage at every of the overall 8 CV-control jacks with a scale of 1 V/decade has an accelerating effect, means that the times of the phases will be reduced by a factor of 10 with every applied volt.

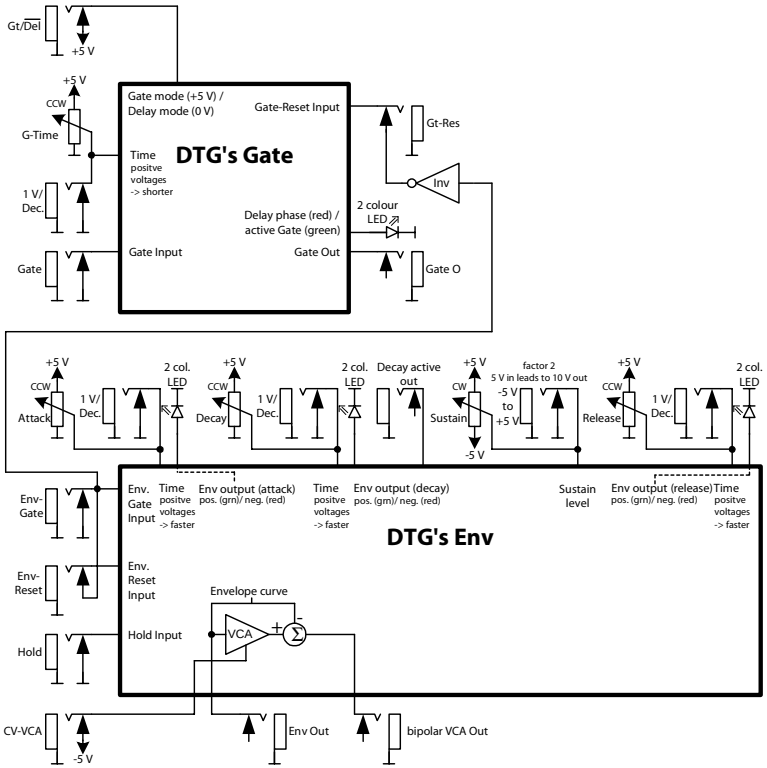

Fig. 3 Structure of the DTG (one of two)

8.2 The Gate/Delay section

This section includes the panel elements 1-7 (26-32). The jacks 1, 2, 5 and 7 are digital and receives or sending 0 V/+5 V. ***Jack 1*** is the **Gate input** and ***jack 2***

the **Gate output**. ***Jack 5*** selects via a control voltage between "Gate" mode and "Delay" mode. +5 V selects "Gate", 0 V selects "Delay". It lies via an internal switching contact at +5 V and, so, pre-selects normally the "Gate" mode. As soon as a cable is plugged in, even if the other end is open, the "Delay" function becomes active. Fig. 4 describes best the functional principal of the Gate mode.

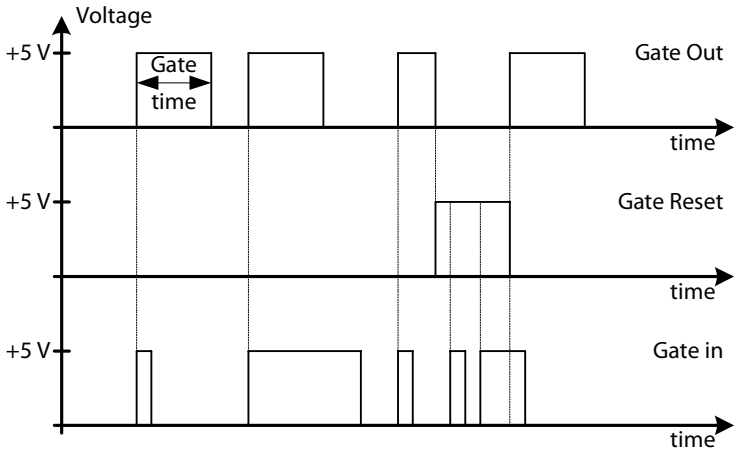

Fig. 4 Gate mode

As one can see, the Gate length is always the same, independently of the duration of the input Gate signal at ***jack 1***. The **Gate-Reset** is only active in Gate mode. The referring ***jack 7*** is connected internally via a switching contact to ***jack 8*** (**Envelope-Gate** input), namely **inverse!** The reason for that will be explained further down. For independently work of the Gate in Gate mode from the envelope generator it needs a **plug into *jack 7*** to untie this internal connection.

Fig. 5 shows the functional principal of the Gate in Delay mode. If one can see, no output will be generated when the incoming Gate is shorter than the Delay time. So, it's a delayed 0 V→+5 V transition as long the incoming Gate is held beyond the delay time.

The ***LED (6)*** lights up "green" in Gate mode as long as the Gate output (***jack 2***) is active. In Delay mode ***LED (6)*** shines basically not as long as no + 5 V are applied at ***jack 1***. With applying a +5 V signal the LED lights up initially "red" as long the delay phase persists and changes to "green" when the **Gate output** (***jack 2***) becomes active. With a 0 V at ***jack 1*** the LED goes off and the output (***jack 2***), too, immediately. The **Gate length** or the **Delay time**, resp., is changeable by ***controller 3*** (<50 µs - >10 s) or by a control voltage at ***jack 4*** (1V/decade).

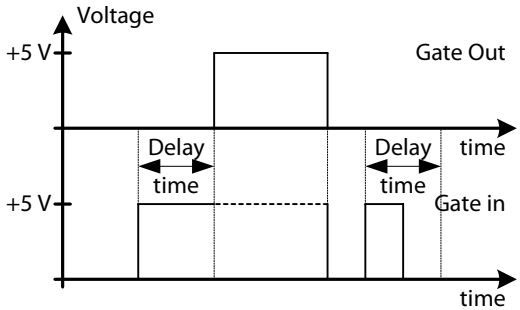

Fig. Delay mode

8.3 The envelope section

The envelope section includes the panel elements 8-25. Generally, it is a classical Envelope generator with the known phases "Attack", "Decay"/"Sustain" and Release. Jack 25 provides the envelope signal and is normalized to +5 V final Attack value. The **Attack time** can be set by ***controller 10*** (100 µs - 20 s) and via a control voltage at ***jack 9*** (1V/decade). The same scales are valid for **Decay time** (***controller 15, jack 14***) and for the **Release time** (***controller 21, jack 22***). The **Sustain value** can be set by ***controller 18*** between +5 V (final Attack value) and -5 V. A control voltage at ***jack 19*** (-5 V - +5 V) will additively change the Sustain value, though with the twice weight. If ***controller 18*** is set to the middle position an input voltage of ±2.5 V (***jack 19***) will has the same range as ***controller 18***. A further increase of the control voltage up to +5 V will raise the Sustain value beyond the final Attack value up to +10 V. Hence, the Decay phase becomes another rising phase, converge the

Sustain value asymptotically. A control voltage of down to -5 V leads to a Sustain value of -10 V. The **LED's *(11)***, ***(17)*** and ***(20)*** are monitoring the related phases by rising and falling brightness. For positive envelope output voltages they light up "green" and "red" for negative ones. Fig. 6 shows the mentioned relationships.

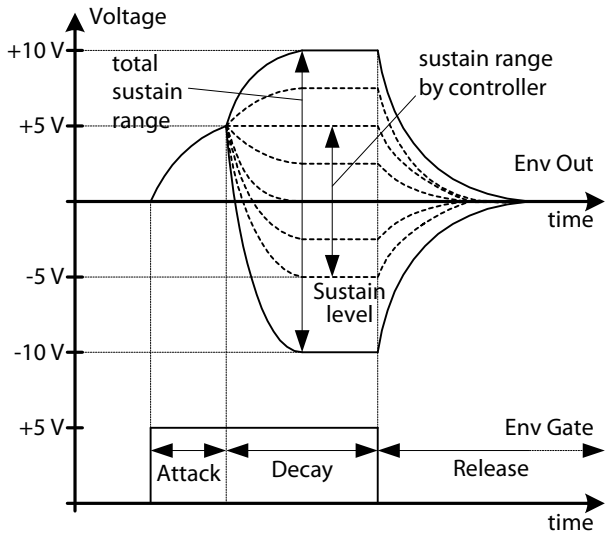

Fig. 6 Envelope ranges

8.4 Reset function

Jack 12 provides the **Reset** input of the envelope generator. This jack is tied via an internal switching contact to ***jack 8*** (**Env-Gate**), the envelope's start input. That means with a start gate signal at ***jack 8*** the envelope output will be set to 0 V and return to the Attack phase, immediately, independently of any states. Fig. 7 shows the effects of a reset, independently of ***jack 8*** (**Env-Gate**). The duration of the reset pulse is no matter, because the reset is done within about 3 µs, so, the reset pulse shouldn't be shorter. With a plug at ***jack 12***, even open ended, the internal connection to ***jack 8*** will be untied. The envelope curve runs up and down, continuously without any jumps.

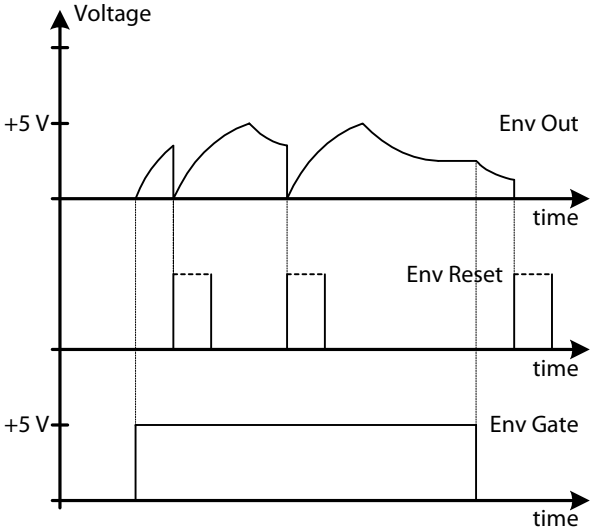

Fig. 7 Envelope reset

8.5 Hold & Decay active out

Jack 13 provides a **Hold** input function. A +5 V signal causes a "freezing" of the envelope output voltage, immediately. The current time phases (Attack/Decay/Release) are kept unaffected. The envelope continues its progress only again by deactivating the Hold input (0 V). With changing the Env-Gate state at ***jack 8*** during "Hold" the generator will initialized with another phase, but executed only after deactivating the "Hold". Presupposition is to untie the internal connection between Env-Reset (***jack 12***) and Env-Gate (***jack 8***), otherwise any new transition from 0 V to +5 V will cause a reset.
The **Decay active** output (***jack 16***) always provides a +5 V signal during the Decay-Phase. Fig. 8 illustrates the described processes.

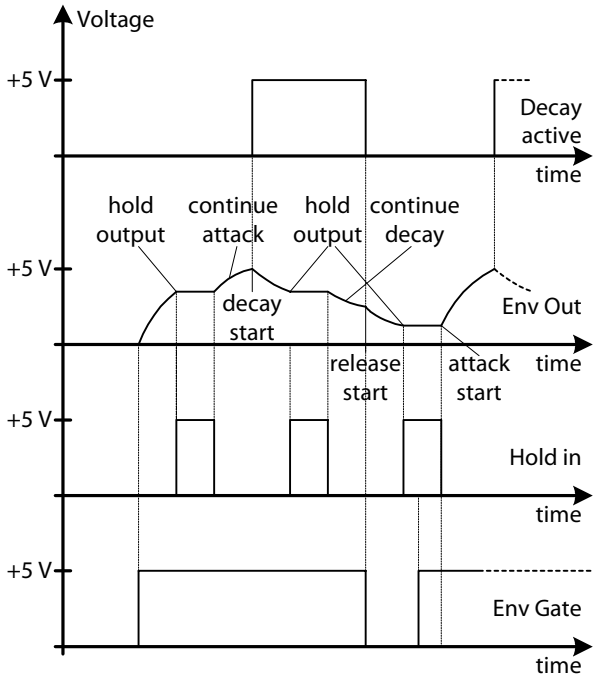

Fig. 8 Hold & Decay active out

8.6 Combination of Gate section and Envelope section

I only want to mention only one of many possibilities to combine the Gate and the envelope section, because, as mentioned above, there is a unique preparation by an internal pre wire between ***jack 8*** (Env-Gate) and ***jack 7*** (Gate-Reset). It's to insert a hold phase after the attack phase:

1.) The envelope will get started regular by Env-Gate (***jack 8***)
2.) Decay active out (***jack 16***) has to tie up to Gate (***jack 1***)
3.) Gate Out (***jack 2***) is to tie up to Hold (***jack 16***)

The attack phase is following now a hold phase, before the decay phase starts. But in case of returning the active Env-Gate input from +5 V to 0 V it is usually explicit desired to finish the hold phase, immediately and return to the release phase. This is provided by the internal and **inverse** connection between ***jack 8*** (Env-Gate) and ***jack 7*** (Gate-Reset). For other follies this unique pre-patch is easily to untie.

8.7 Output VCA

The whole stuff, finally, is well-rounded by a VCA. This includes the CV input control ***jack 23*** and its output ***jack 24***. ***Jack 23*** is internally tied up to -5 V, hence the output ***jack 24*** provides normally the inverse envelope output (final attack value of -5 V). The scale of ***jack 23*** is **1 V/V**. This refers to the final attack value, means ±X V at jack 23 are leading to a final attack value of ±X V. The **control range** reaches from **-5 V to +10 V** (double output voltage referring to the regular output (***jack 25***)). However, the **output voltage cannot exceed +10 V**, means in case of a Sustain value beyond the final attack value this is to take into account. Otherwise the envelope output curve will be limited, that's all.

8.8 Waveform shaping

By feed-back the envelope output to the time CV control jacks (***9***), (***14***) and (***22***) a very markedly change of the envelope curve is possible. This is shown in the Fig. 9 and Fig. 10. This feed-back will also affect the total phase time, which is correctable by counteracting either via the time controller (***10***), (***15***), (***21***) or by further adding correction voltages at the CV control jacks (***9***), (***14***) and (***22***). For the decay and release phases it could become some tricky, because the end state or the initial state, resp. is variable for these two phases. Hence, this state influences the grade of curve bending and the time correction. Nevertheless, very good results can achieved with this technique.

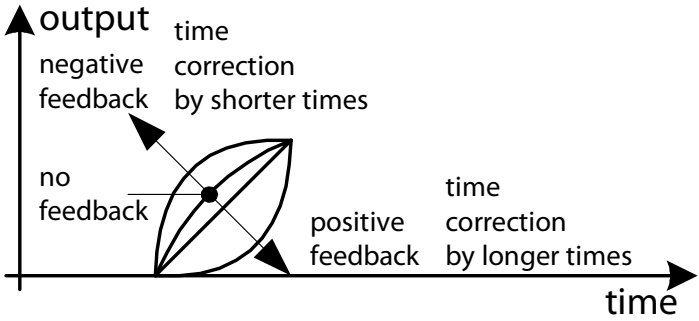

Fig. 9 waveshaping rising curves (Attack)

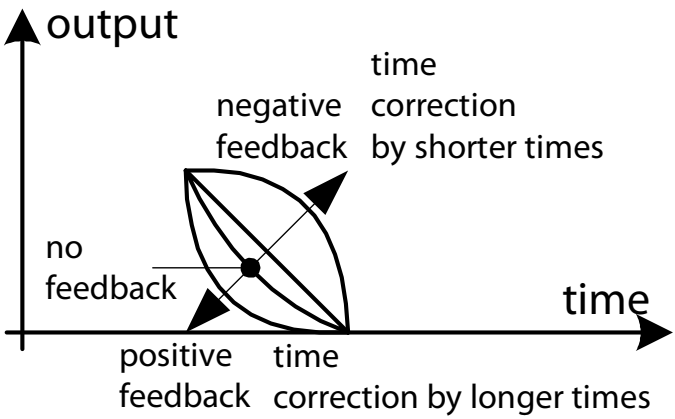

Fig. 10 waveshaping falling curves (Decay & Release)

9. TECHNICAL DATA AND SIGNAL VALUES

9.1 Technical Data (in general)

Input- and output-jacks:	mono jack jacks 3.5 mm (1/8")
Input jacks have grounded switch (0 V)	
Power:	-12 V / +12 V (polarity protection)
Power consumption:	typ. +70 mA/ -50 mA
Proper ambient temperature:	0 °C – +55 °C / 32F – 131F
Net weight (module only):	approx. 260 g / 0,57 lbs
Dimensions (W x H x D):	24 PU (121.92 mm) x 3 HU (128.5 mm) x 47 mm
Installation depth (behind the panel)	<30 mm

9.2 Signals and ratings

Maximum input voltage at every input jacks:	±12 V
time range Attack:	10 µs - 1500 s
time range Decay/Release:	20 µs - 1500 s
time range Gate/Delay:	20 µs - 500 s
voltage drift in Hold mode:	<1 - 4 mV/s