



UniSyn

Universal Audio to Synth Interface

User's Manual

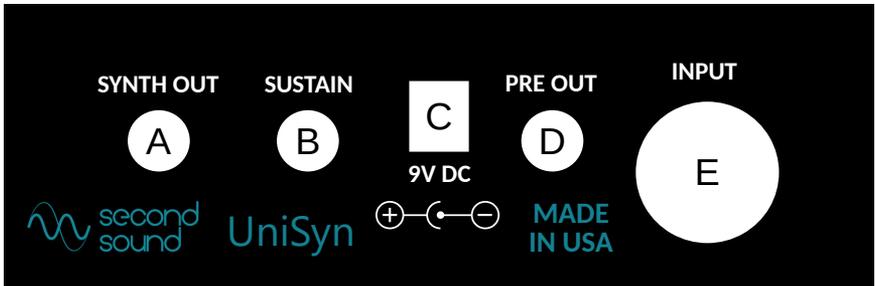
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UniSyn Universal Audio to Synth Interface User's Manual

Congratulations for purchasing a Second Sound UniSyn Audio to Synth Interface! Here is a summary of what your UniSyn can do:

- Convert audio from any monophonic source into sine and low-pass-filtered square or sawtooth waves, optionally pitch-shifted over a ± 2 octave range and with semitone resolution
- Apply envelope modulation of the built-in Voltage-Controlled Filter (VCF) with three modulation depth settings: no modulation, full modulation, and half depth modulation
- Convert audio to pitch, envelope, and gate control voltages (CVs) for controlling analog synths
- Convert audio to MIDI for controlling digital synths
- "Hold" the pitch and envelope of both the internal synth voices, CV and MIDI using an optional sustain pedal (not included)
- Provide a 1v/oct FM CV input for modulating the pitch of the internal synth voices as well as the CV and MIDI outs
- Provide capability to blend the internal synth mix of sine and square/sawtooth waves with the dry preamp output
- Provide +24v phantom power according to the IEC 61938 Standard for powering condenser mics
- Provide automatic gain control (AGC) over a 50dB range, yielding optimal preamp gain independent of source signal level
- Provide an audio preamp output at either +4dBu or -20dBu
- Optionally configure the AGC/preamp as an upward compressor with 3:1 compression ratio and threshold of -12dBFS, with attack time approaching zero and release time approaching 2 audio cycles
- Track the fundamental frequency of audio sources as diverse as voice, guitar, bass guitar, violin, trumpet, saxophone with minimal configuration required

Rear Panel of UniSyn

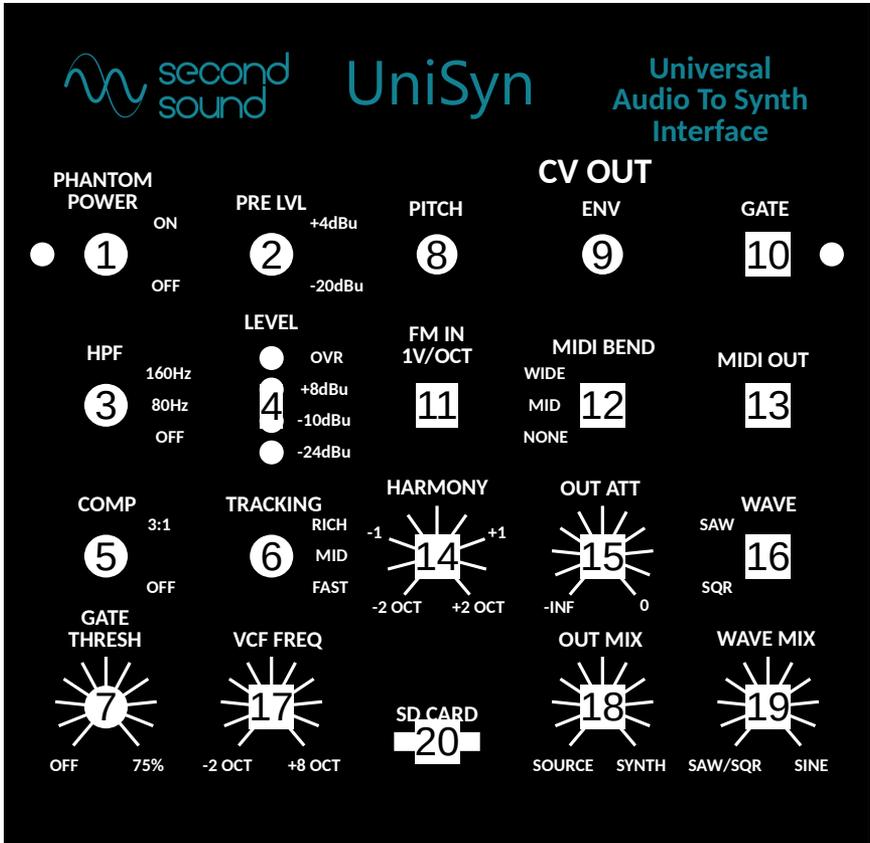


- A. 1/4" SYNTH OUT: Outputs mix of preamp output and internal synth voices as set by the OUT MIX knob.
- B. 1/4" SUSTAIN input: Connect normally-open sustain pedal here (not included) to "hold" the synth voice as well as CV and MIDI outputs.
- C. 9v DC input: Use included 2mm diameter center-negative PSU or equivalent. PSU must be able to provide minimum 100mA.
- D. 1/4" PRE OUT: +4dBu or -20dBu preamp output after automatic gain control (AGC).
- E. Combo XLR or balanced/unbalanced 1/4" INPUT: Monophonic* audio input, level can range from mic to line level.

*Note: The UniSyn is designed for monophonic audio inputs, meaning it is best suited for handling musical input played one note at a time. It is possible to achieve pleasing effects with some polyphonic inputs but the UniSyn will always try to interpret the input as a single note.

On a related note, the UniSyn can only produce a single pitch CV and a single envelope CV at a time and can only produce one MIDI note at a time, whose pitch may be modulated due to pitch bends.

Front Panel of UniSyn



Input Conditioning Section

1. +24v Phantom Power Switch: Adjacent LED lights up when phantom power is turned on. Be sure to turn off phantom power when using a 1/4" cable as it may degrade performance.
2. Preamp Level Selection Switch: +4dBu or -20dBu
3. High-Pass Filter Selection Switch: OFF, 80Hz, or 160Hz. The high-pass filter follows the preamp and is audible in the preamp out as well as source/synth mix.

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4. 4 LED Level Meter: All three LEDs should be lit at peaks and top red OVR LED should rarely illuminate, if at all.
5. 3:1 Compression Selection Switch: Compressor behavior described in more detail later.
6. Tracking Speed Switch: Use "FAST" for most inputs. Some very harmonically-rich inputs like bowed violin may exhibit tracking errors. For such inputs try "MID" or "RICH."
7. Gate Threshold: Turn clockwise if the UniSyn picks up noise or if notes sound "glitchy" at the beginning. Turn counter-clockwise if the UniSyn isn't picking up note attacks fast enough.

CV/MIDI Section

8. Pitch CV: 1v/octave pitch CV output. Output range = 0-8v.
9. Envelope CV: Envelope CV output. Output range = 0-6v.
10. Gate CV: Outputs +5v when note played, 0v otherwise. Adjacent Red LED is illuminated when gate is OFF.
11. FM CV input: CV input for modulating pitch of the internal synth voices as well as the CV and MIDI outs. Note that pitch shift is in discrete semitone steps over a ± 2 octave range.
12. MIDI bend: Sets both MIDI bend range and depth of envelope modulation of internal VCF. NONE disables MIDI pitch bend and disables envelope modulation of VCF; MID enables pitch bends over $\pm \frac{1}{2}$ semitone and enables half-range envelope modulation of VCF; WIDE enables pitch bends over ± 2 semitones and enables full-range envelope modulation of VCF.
13. MIDI out: $\frac{1}{8}$ " TRS output, can be converted to 5-pin DIN using Type B TRS-to-MIDI converter cable (included). MIDI outputs on Channel 1 (0x0) but this can be changed with an easy firmware update if desired.

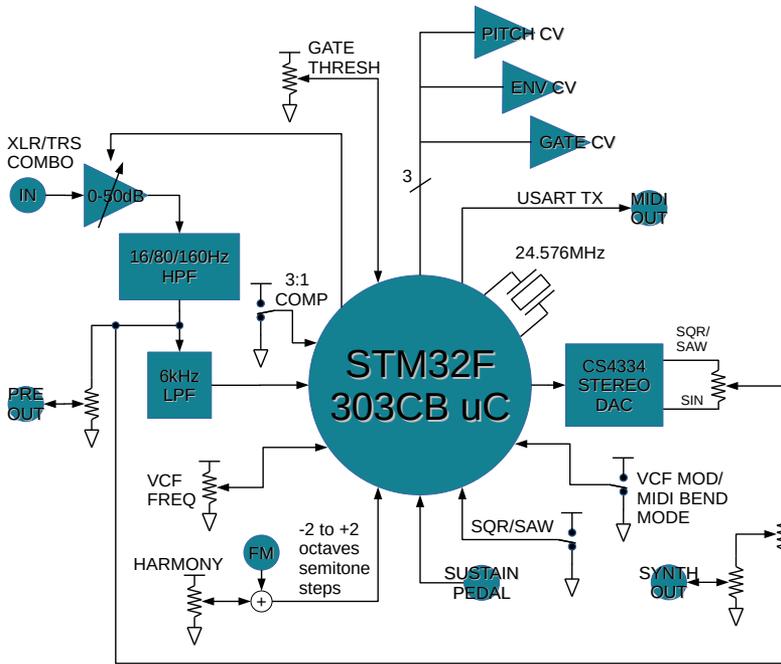
Internal Synth Section

14. Harmony Knob: Adjusts the pitch offset of the internal synth voices, pitch CV and MIDI notes in semitone steps over a ± 2 octave range. The harmony knob position is summed with the FM CV input.
15. Output Attenuation Knob: Master volume for SYNTH OUT
16. Wave Selection Switch: Toggles internal oscillator wave shape between sawtooth and square.
17. VCF Frequency Knob: Adjusts maximum cutoff frequency of VCF applied to sawtooth and square waves.
Also controls MIDI envelope modulation type:
Fully CCW: No envelope modulation
10 O'Clock: Envelope controls Aftertouch (Channel Pressure)
12 O'Clock: Envelope controls Mod Wheel CC
2 O'Clock: Envelope controls Breath Controller CC
Fully CW: Envelope controls Expression CC
18. Source/Synth Mix Knob: Adjusts mix of preamp output with internal synth voice.
19. Wave Mix Knob: Adjusts mix of post-VCF saw/square wave with sine wave.

SD Card Slot

20. SD Card Slot: This “future proofs” the UniSyn by making potential future firmware updates a piece of cake. All you need is a micro SD card and an updated binary (to be provided by Second Sound). You save the binary file to your micro SD card, insert the card in the slot, and power cycle the UniSyn (remove and apply power). The four LEDs will light up one at a time to show that the new firmware is being downloaded, and you can now enjoy your updated firmware!

Block Diagram of UniSyn Audio to Synth Interface



The block diagram helps to understand the signal flow inside the UniSyn. First the AGC is applied to the input signal, boosting it by a gain from 0-50dB to achieve the optimum preamp output level. The AGC preamp is followed by a switchable high-pass filter (HPF). The HPF output drives the preamp output and is the “Source” signal that gets mixed together with the internal synth signal. The HPF is followed by a fixed 6kHz low-pass filter (LPF), whose output goes into one of the ADC inputs of the STM32F303CB microcontroller (uC). The uC generates PITCH, ENV, GATE CV and MIDI outputs and drives a CS4334 stereo DAC to generate the sine and square/sawtooth waves. Various inputs to the uC control gate threshold, 3:1 compression, sustain, VCF frequency, harmony, MIDI bend mode, and square/saw waveform selection.

Quick Start Guide

Here are some basic instructions to make the most out of your UniSyn:

Basic Setup

- 1) Apply power via the included 9v power supply unit (PSU). This unit can handle 100-240VAC at its input so will work worldwide, possibly with only an adapter for your local electric socket required.
- 2) Connect any audio to the INPUT Neutrik combo jack (XLR or ¼" balanced or unbalanced).
- 3) Play your audio source at a comfortable volume and observe that AGC should automatically adjust to find the optimum preamp gain. Try both 3:1 compression and no compression settings.
- 4) Adjust the gate threshold so that the gate LED turns on when no audio is being played. With plucked string instruments like guitar it may take some tuning to get the gate to differentiate exactly when a note is being played from the low-level transients that occur when you mute the strings. Try to set the gate high enough so that the LED remains on when those quiet transient events occur.
- 5) For almost all cases the HPF can be left in its default, "open" setting (HPF OFF). In some cases more high-pass filtering can help, for example if you use a contact mic with a handheld instrument and want to filter out potential low-frequency knocks or percussive effects.

Listening to UniSyn Internal Synth Outputs

- 6) Listen to the main ¼" SYNTH output. To hear the dry + wet sound, adjust the OUT MIX knob to get the desired mix (fully CCW for dry, fully CW for wet). Adjust the OUT ATT knob to get the desired level coming out of the SYNTH output.

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7) Select SAW/SQR waves via the 2-way switch to hear the different waveforms and adjust the WAVE MIX knob to achieve the desired mix of saw/square + sine waves. Adjust the VCF FREQ knob to hear its effect on the sawtooth and square waves. Experiment with the MIDI BEND settings to observe the effect on the envelope to VCF modulation depth.

8) Adjust the TRACKING switch to optimize the frequency tracking for the audio source chosen. For most cases the FAST setting works well. There are some instruments with slower attack/decay and strong harmonics (like bowed strings) which can work better with the MID or RICH settings. As a rule of thumb, if you hear the UniSyn locking to higher harmonics of the fundamental, try the MID or RICH setting.

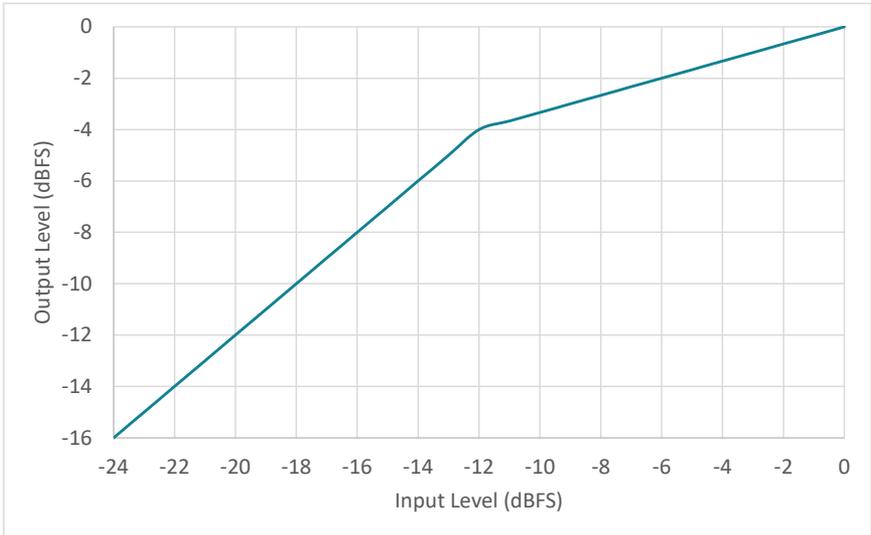
9) Adjust the HARMONY knob to hear the various pitch shift settings. Here it is especially useful to mix the dry and wet signals together so it's easier to hear what harmony interval is tuned. Note that the harmony knob is continuous, it does not give you "clicks" when moving from one harmony to another.

Controlling External Synths Via CV/MIDI

10) Patch the PITCH, GATE and ENV signals out to an analog synth of your choice and enjoy "playing" that synth with the audio source of your choice! Note that you can adjust the HARMONY knob to offset the Pitch CV out in discrete semitone steps over the entire +/-2v range to accommodate the pitch CV offset of virtually any analog synth.

11) Connect the MIDI output to the digital synth of your choice via the included TRS-to-MIDI adapter and a standard MIDI DIN5 cable and enjoy "playing" that synth with the audio source of your choice. Experiment with the three MIDI BEND options to understand how they impact the pitch accuracy and note on/off behavior using MIDI. Note that the HARMONY knob will pitch shift the MIDI note so adjust HARMONY to unison if you want MIDI in unison with your audio input.

3:1 Compression Curve



The UniSyn 3:1 compression utilizes upward compression, meaning the gain is increased as the signal level falls below full scale according to the compression ratio. As the signal level falls, the gain will increase by a maximum of 8dB before it stops increasing. The gain reaches this maximum increase of 8dB when the input level reaches -12dBFS, after which the output level will fall linearly as the input level keeps falling.

The compression attack time is nearly zero, chosen so to keep the input from clipping under all cases. The release time isn't a constant, but rather depends on the fundamental frequency of the audio. Release time is close to two cycles of the detected fundamental frequency. These compression parameters are chosen to make the compression as transparent and "musical" as possible.

UniSyn Troubleshooting Tips

Problem: Too much noise is being detected and converted to synth waves or CV or MIDI.

Solution: Try increasing gate threshold (turn clockwise).

Problem: MIDI notes don't always trigger when I play a new note.

Solution: This can happen if gate threshold is set either TOO HIGH or TOO LOW. The gate LED can help here as it should light up between notes and turn off when a note is played. If LED remains on when some notes are played, gate threshold is too high and must be reduced. If LED doesn't come on between notes, gate threshold is too low and must be increased.

Problem: High guitar notes on the high E string sound too weak.

Solution: Try enabling 3:1 compression, it is especially helpful for audio inputs with wide dynamic range like guitar, whose low E strings produce much stronger signals than fretted notes on the high E string.

Problem: UniSyn is locking to harmonics even when I play slowly.

Solution: Try changing TRACKING to MID or RICH settings.

Problem: MIDI notes all come out at the same volume no matter how loud I play.

Solution: Try setting one of the MIDI envelope modulation modes by adjusting the VCF FREQ knob. Fully clockwise enables envelope modulation of MIDI expression (volume) for example.

Problem: I'm hearing noise or poor frequency response when audio source is connected via a ¼" cable.

Solution: Make sure phantom power is turned OFF when using ¼" cable at input.



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