WT-QUAD LFO

User Manual

for firmware 2.5.1

Last edited March 14, 2025

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Introduction

The ACL WT-QUAD-LFO is a wavetable-based CV generator that offers flexible and accurate signal shaping. By converting custom waveforms into CV outputs, it covers both standard LFO duties and more complex signal manipulation. Its core design lets you transform almost any shape into a precise motion, adding depth to your patches. Whether you're after subtle evolving textures or complex rhythmic patterns, the WT-QUAD-LFO provides a powerful way to expand your creative range.

Key Features

- Four independent channels in a compact 14 HP format
- 1.8" Color OLED display
- USB connectivity for custom wavetable loading
- Per-channel parameter control
- Capability to play up to 4096 sample long custom wavetables
- Integration with the ACL LFO-Designer https://audiophilecircuitsleague.com/lfo-designer
- Firmware update support over USB

Technical Specifications

- Width: 14 HP
- Depth: 35mm
- Power Requirements:

  -12V: ca. 11mA

  +12V: ca. 170mA

Getting Started

Installation

- Ensure your system is powered down before installation
- Connect the included 16-pin power cable to your power bus, ensuring the connector is oriented correctly. Both the module and most modern bus boards use shrouded headers, which prevent incorrect cable orientation

Note: During extended operation, the module's back side can reach temperatures of up to 60°C on its right side. While this does not affect the Quad LFO's performance, it is recommended to avoid placing analog VCOs or temperature-sensitive modules immediately to its right, as the warmth could potentially influence their tuning stability or other heat-sensitive parameters.

Basic Operation

Display Navigation

- Use the 4 channel encoders to change LFO frequencies
- Press the encoders to access the channel settings
- Use the menu button for accessing settings

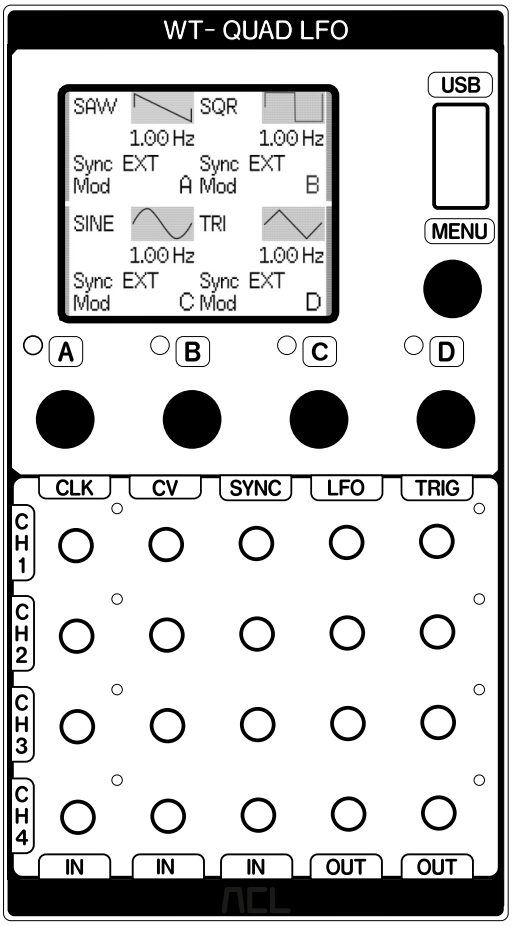
Quick Start

- Select a channel (1-4)
- Adjust the frequency using the dedicated encoder
- Select a waveform using the Wave parameter in the channel settings
- Connect the channel LFO output to your patch

Controls

Front Panel

Each channel features dedicated inputs and outputs and operates identically. For simplicity, this manual provides a unified explanation that applies to all channels:



Per Channel Patch Points

- Clock (CLK) Input: Accepts external clock signals to synchronize LFO
- CV Input: Enables external modulation of parameters such as frequency, attenuation and offset
- Sync Input: Resets the LFO phase in response to an external pulse
- LFO Output: Outputs the primary low-frequency oscillation signal of the channel
- Trigger Output: Generates a trigger signal at the start of each LFO cycle for synchronization with other

Per Channel Encoder

- Turn: Adjusts the LFO frequency in internal clock mode
- Press: Accesses channel-specific parameters, including waveform, sync, modulation and morph settings

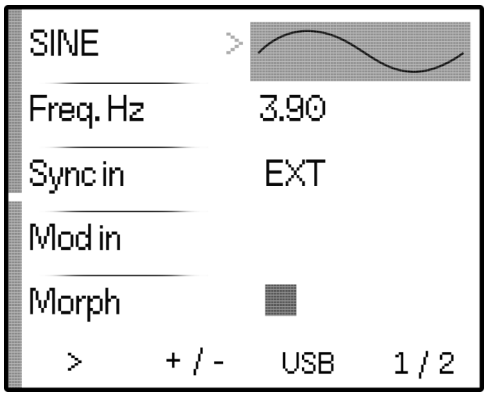
Display

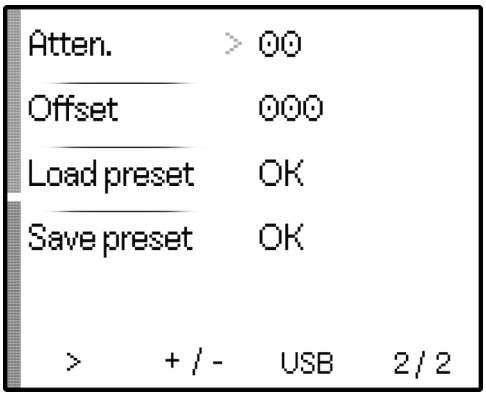
- Home Screen (Per Channel)
- Visual representation of the waveform
- Current frequency displayed in Hz
- Sync status indicator
- Vertical bars representing attenuation and offset ranges

Menus

Channel Settings

The Channel Settings menu allows you to configure each LFO channel's core parameters. These settings enable precise control over the waveform, frequency, synchronization, modulation, and output characteristics of each channel. Additionally, presets allow for quick recall of saved configurations.





Navigation

- >: Use the first encoder to move through parameters
- + / -: Adjust parameter values with the second encoder
- USB: Press the third encoder to load wavetables
- Page: Use the fourth encoder to navigate through pages of settings

Settings

- Waveform Selection

  Choose one of the factory waveforms (Sine, Square, Saw, Tri) or any loaded WAV file for the selected LFO

  Frequency (Freq. Hz)

- Adjust the LFO frequency within a wide range, from ultra-slow modulations at 0.0032 Hz to audio-rate oscillations up to 2 kHz

  This setting is available only when the LFO is not externally synchronized

- Sync Input

  Use an external trigger to restart the LFO phase

- Modulation Input (Mod In)

  Cross-modulate parameters of the current channel using the output of another channel

- Morph

  Assign the Wavetable from any other channel, for smoothly transitioning between waveforms using the CV input in morph mode

- Attenuation (Atten.)

  Scale the output signal amplitude from 0 to 100

  This value is also affected by the CV input when the CV is in attenuation mode

- Offset

  Apply a DC offset to shift the waveform vertically

  Note: it cannot offset a signal that already reaches its full amplitude. This requires either the loaded wavetable to be limited in range or the LFO to be internally attenuated

- Load Preset

  Recall a channel configuration

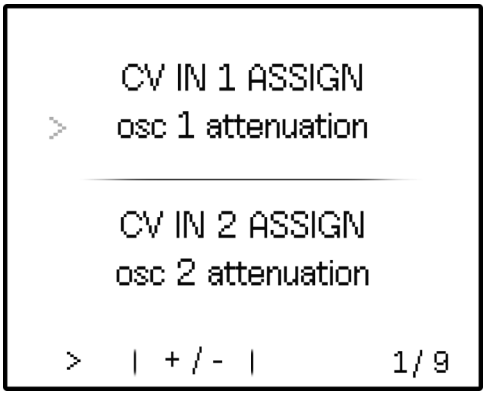
- Save Preset

  Store the current settings

  The presets are global, so they can be loaded in every channel

Main Menu

In the main menu it's possible to set the CV input assignment and synchronization settings for each channel, additionally managing loaded wavetables and firmware updates.



CV In Assign (for each channel)

Each channel CV input can modulate one of several parameters of the waveform. The input responds to voltages from -5 to +5 volts.

- Frequency Linear: sets the CV input for modulating the frequency of each LFO in a linear way
- Frequency Exponential: sets the CV input for modulating the frequency of each LFO in an exponential way
- Attenuation: the waveforms can be attenuated with bipolar CV input
  The attenuation amount is calculated adding input voltage to the attenuation value in the channel settings. For example: sending a positive voltage of 5V with an attenuation value of 50 would effectively generate 0 volts on the output
- Offset

  The waveforms can be offset with bipolar CV input

  The offset amount is calculated by adding the input voltage to the offset value in the channel settings

  Note: the current waveform after attenuation should not reach the full amplitude for this setting to take effect. The offset will stop when the peaks of the waveform reach its maximum amplitude

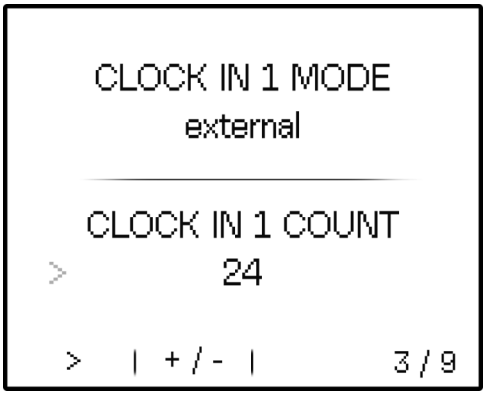
Sync Settings

- Clock Mode: each LFO can operate with its own internal clock or be synchronized to an external clock using the CLK Input
- Clock Count:

  Determines the number of triggers or pulses required for the LFO to complete one full cycle

  Allows precise synchronization with musical events, such as one beat, one bar, or multiple bars

  Example: if the input clock is at 24 PPQ, setting the clock count to 96 will result in a cycle length of exactly one bar (4 quarter notes) at the current tempo



- Sync In Pol (Sync Polarity)

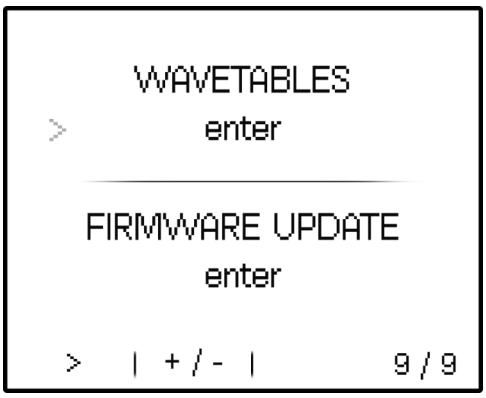
  Can be configured to trigger on the falling edge, rising edge, or both

  Allows precise adjustment of the signal used to reset the waveform

  Note: When the clock is set to external, the LFO calculates its frequency based on the incoming clock pulses. This process can take some time to adjust to changes in the clock's tempo, which may cause the LFO to initially be out of phase with your modular setup. To synchronize the start of the cycle, you can send a trigger to the Sync Input after the first cycle to restart the waveform, or stop and restart the main clock to align it to the rest of your modular setup.

Wavetable Menu

View or delete any loaded wavetable on the module.



Firmware Update

The Firmware Update menu option allows you to update the module's firmware. To download the latest firmware version, visit the downloads page.

Update Instructions

1. Copy the firmware file (.bin) to a USB flash drive
2. Insert the USB flash drive into the module's USB port
3. Navigate to the Firmware Update option in the main menu
4. Select the firmware file when prompted
5. Wait for the module to install the update and restart

> Important: After installing the new firmware, it is recommended to reset the EEPROM to factory defaults. This process will erase all custom waveforms. To reset, follow these steps:

Custom Wavetables Loading

Loading Process

1. Copy the .WAV files to the USB flash drive root folder
2. Safely eject the device
3. Access custom tables via the USB menu button
4. You can leave the USB flash drive inserted or remove it after loading wavetables

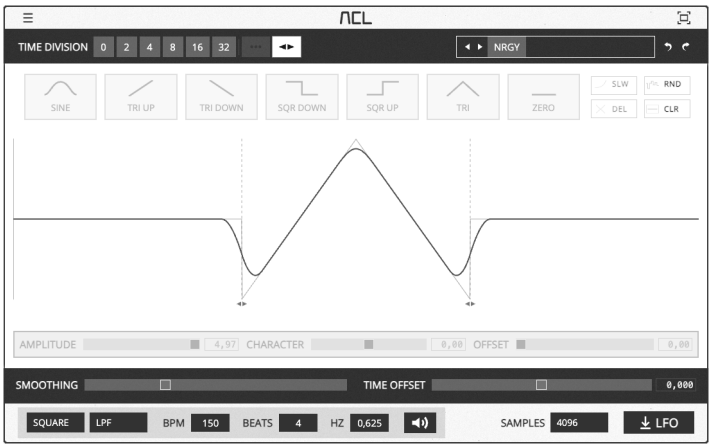
File Requirements

- Format: .WAV files (16-bit, 44.1kHz)
- Length: up to 4096 samples
- Maximum storage: 12 wavetables

LFO Designer

http://audiophilecircuitsleague.com/lfo-designer/

The LFO Designer is a web-based tool that enables the creation of custom Low-Frequency Oscillator (LFO) waveforms through an intuitive visual interface. It generates wavetable data compatible with the WT-QUAD-LFO, allowing for unique modulation shapes and audio effects.



Key Features

Visual Waveform Editor

- Canvas-based interface for real-time waveform visualization
- Flexible time division options: 2, 4, 8, 16, 32, or no divisions
- Draggable handles for precise waveform boundary adjustments
- Amplitude, character and offset control for each segment
- Smoothing and Time offset post-processing
- Sound preview with different sound sources, filters or modulation
- Random, delete, slew functions

Preset System

- Comprehensive factory presets divided by category
- User presets with backup and restore function

Waveform Creation

- Choose from various waveform types: sine, ramp up/down, square, triangle, and zero
- Adjust amplitude, character and DC-offset per division
- Create slides by selecting two or more divisions and clicking the 'Slew' button
- Change continuously the starting and ending point of any waveform division using the <> handles

Audio Preview

- Real-time audio preview with multiple sound sources: white noise, square wave, sawtooth (up/down)
- BPM-synchronized playback with a click track
- Multiple processing modes:

    Low-pass filter (LPF)

    High-pass filter (HPF)

    Amplitude modulation

    1V/octave pitch tracking

WAV File Generation

- Converts visual waveforms into WAV format
- Exports 16-bit mono files at a 44.1kHz sample rate
- Compatible with the WT-QUAD-LFO and other audio software

Troubleshooting

Common Issues

- USB Not Recognized on the module

  Try formatting the USB flash drive to FAT32 or ExFAT

  Try an alternative USB flash drive

- Erratic Behavior

  Check for firmware updates

  Perform factory reset

- LFO Gets Out of Sync After a Longer Period of Time

  Due to natural clock jitters and tempo calculation errors, the LFO can become offset over time. It is recommended to send a reset trigger to the Sync Input every LFO cycle or after a certain amount of time to maintain synchronization over long periods when using an external clock source.

Factory Reset

1. Press and hold the Home button for at least 2 seconds
2. While holding the Home button, press Encoder 1
3. Release both buttons
4. Confirm the reset when prompted

FAQ & Support

Frequently Asked Questions

- Can I use wavetables from other devices?

  Yes, if properly formatted

  May require sample rate conversion to 16 bit 44.1 khz mono

- Maximum number of custom waves?

  12 custom wavetables

  Manageable via USB

- Can I load more than 12 wavetables?

  The module can hold up to 12 wavetables in memory, shared across all LFO channels. However, you can store additional wavetables on the USB flash drive, which can remain inserted in the module while it is operating.

- Can I let the USB flash drive remain in the module permanently?

  Yes. You can leave it for quick loading of stored wavetables.

- Do I have to turn off the module to remove or insert the USB flash drive?

  No! You can insert or remove the USB flash drive while the module is powered on. The USB flash drive is accessed only shortly after inserting it and when loading new wavetables.

Support Contact

- Email: support@audiophilecircuitsleague.com
- Website: www.audiophilecircuitsleague.com

Warranty Information

- 1-year limited warranty
- Coverage excludes physical damage