WAVE RACLE™

inspiring curiosity about signals™

User Manual

Rev 1.0

1. Welcome to Wave Oracle

Wave Oracle™ exists to inspire curiosity about signals—and creativity in what you do with them. Your synthesizer makes voltages, but you usually experience the result through your ears. Wave Oracle adds another way to explore: you can see what is happening while you listen.

See What Your Patch Is Doing

An envelope becomes a visible rise and fall. A filter reshapes a waveform and its harmonics. Two oscillators turn their relationship into a moving pattern, and a familiar sound can become something unexpectedly beautiful. The screen gives you another clue when you wonder why a patch behaves as it does.

You do not need a background in electronics or test equipment. Start with a signal you know, change something and watch. The controls become useful as your questions become more specific.

Seven Ways to Explore

Mode	What it lets you explore
SCOPE	Voltage changing over time: waveform shape, timing and modulation.
XY	The relationship between Inputs 1 and 2, drawn as shapes.
FFT	The frequencies and harmonics that make up a sound.
TUNER	Frequency expressed as musical pitch and tuning error.
METERS	The levels of four signals at a glance.
ART	Audio-responsive pictures that invite creative exploration.
LEARN	Signal concepts through built-in demonstrations and experiments.

Start With Curiosity

This manual begins with the controls and a few useful signal ideas, then introduces each mode. Read it in order if you like, or go straight to the view you want to try. LEARN supplies its own demonstration signals, so you can explore its lessons without patching anything in.

Wave Oracle is made for the synthesizer environment. It can help you investigate a patch, learn a concept or find a new creative direction. You decide which question to ask next.

2. Getting Started

The five buttons and push encoder are your way into Wave Oracle. The display tells you what the buttons do, and the same basic interaction carries through the main modes.

Five physical buttons below the display, a push encoder and four paired inputs.

Connections

Wave Oracle has four signal inputs, Channels 1–4. Each has two connected jacks carrying the same signal. Patch into one jack and use the paired jack to carry that signal onward to another module, so you can observe it while the patch keeps playing. The pair is one input channel, not two separate inputs.

For a first experiment, use a simple oscillator signal connected to Input 1. With your system powered and Wave Oracle running, select SCOPE to see its waveform. Use signals from your synthesizer; Wave Oracle is not intended for mains voltage or high-voltage testing.

Buttons and Their Screen Labels

The labels along the bottom of the display correspond to the five physical buttons directly below them. Press the button below the function you want. Its label changes with the mode, so the screen always tells you what that button currently does.

The grey, leftmost button opens the mode menu. Turn the encoder to highlight a mode, then press the encoder to select it. The remaining buttons open the functions appropriate to that mode.

Turn to Highlight, Press to Select

To use a popup menu, turn the encoder to move the highlight through its items. Press the encoder to select the highlighted item. Some selections open a secondary menu for that item's specific settings; others put a value into edit mode. Blue typically indicates that you are editing a value. Turn the encoder to adjust it.

Changes take effect as you make them. Press the associated physical button at any time to close the popup. Closing it does not undo changes already made; to restore an earlier value, adjust it again.

Touchscreen — Hold the View

Menu selection uses the physical buttons and encoder. There is no need to aim at small touchscreen targets or use a stylus, and ordinary physical button actions use a simple press and release.

In most display modes, you can tap the main display area to ***hold*** the current view, then tap again to resume. HOLD lets you inspect what you saw without changing the synthesizer patch. In SCOPE, HOLD is available in AUTO and NORM; SINGLE has its own WAIT action, explained in Chapter 5.

Your First Experiment

Start with a sine wave in SCOPE, then try triangle, sawtooth and square. Change the oscillator's frequency and notice how the cycles fit across the screen. Adjust the vertical scale and the timebase as needed; these change the view, not the signal coming from your synthesizer.

Now switch to FFT and try those waveforms again. Their shapes have become patterns of frequency peaks. You do not need to understand every label yet: just look for the connection between what you change, what you hear and what you see.

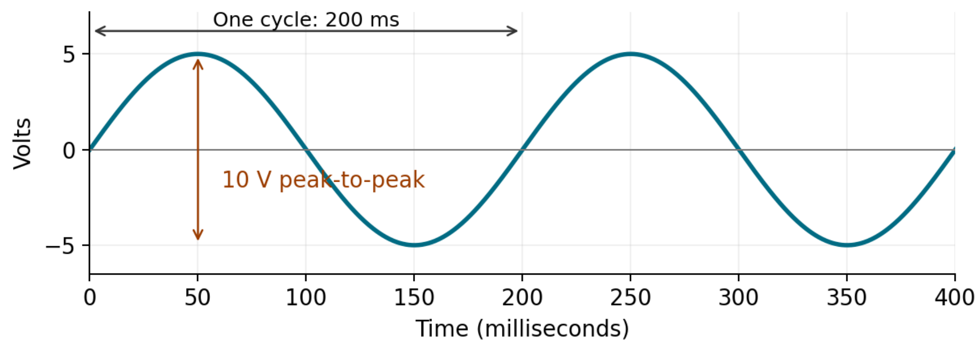
3. Signals — The Few Things Worth Knowing

A few signal ideas make the display much easier to read. They also explain much of what your synthesizer is doing, whether the signal is a sound, a slow modulation or a voltage holding a setting in place.

Voltage and Amplitude

Voltage is how modules communicate. An audio oscillator produces a rapidly changing voltage, an LFO changes more slowly, and an envelope rises and falls through its stages. A control voltage, or CV, uses that voltage to change something else, such as pitch, filter cutoff or VCA level.

Amplitude tells you how large the signal is. A waveform swinging from −5 V to +5 V covers 10 volts from its lowest point to its highest: 10 V peak-to-peak, abbreviated Vpp. That is different from saying its positive peak is +5 V.



One signal, two useful observations: its voltage swing and the time taken by one cycle.

Frequency and Period

Frequency tells you how often a repeating signal completes a cycle. Hertz, or Hz, means cycles per second: a 5 Hz LFO repeats five times each second. Its ***period***—the time for one cycle—is therefore 200 milliseconds.

If you like math: frequency is the reciprocal of period, and vice versa.

Frequency $(f) = \frac{1}{T}$ (measured in Hertz or cycles per second)

Period $(T) = \frac{1}{f}$ (measured in seconds per cycle)

In SCOPE, time runs across the screen. Raise an oscillator's frequency and each cycle takes less time, so more cycles fit into the same displayed interval. Lower its frequency and fewer cycles fit. You can change the timebase to keep the part you want to examine comfortably visible.

Audio and Modulation

An oscillator does not become a different kind of electrical signal when it slows below the audible range. It still produces changing voltage. Used slowly, it can move a parameter; used quickly, it can become a tone or add audio-rate modulation. The destination and the speed help determine what you hear.

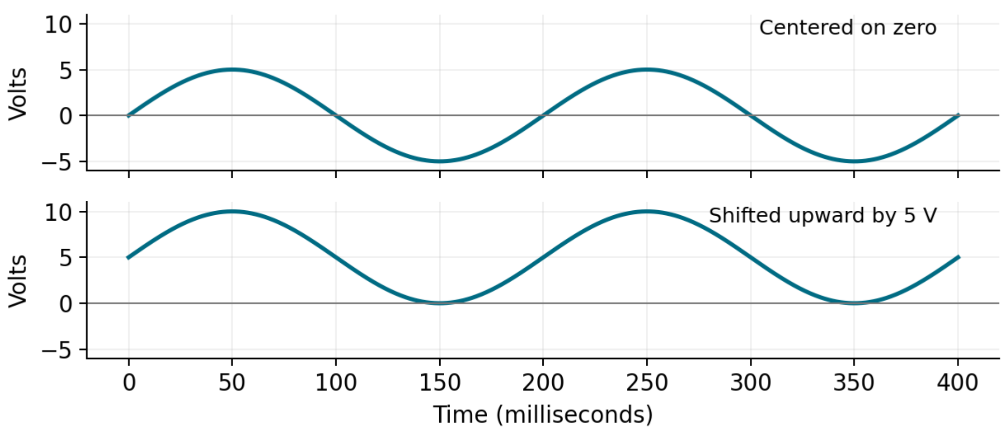
Above, Below and Around Zero

Some signals move both above and below zero volts. These are called bipolar signals. Others, such as many envelopes, stay on the positive side of zero and are called unipolar. Neither is better; the useful question is what the voltage does in your patch.

For a familiar example, use an LFO to add vibrato to a VCO through its pitch modulation input. At zero volts, the LFO adds no pitch change. Positive voltage raises the pitch, and negative voltage lowers it. A ± meter range shows both halves of that movement; a 0– range suits a signal that stays positive.

DC Offset — Moving the Whole Signal

A waveform can keep the same shape and size while moving above or below zero. A signal swinging between −5 V and +5 V has the same 10 V peak-to-peak size as one swinging between 0 V and +10 V. The second has been shifted upward by 5 V: it has a positive DC offset.



The same changing waveform, with a different position relative to zero volts.

That shift matters in modulation. An LFO centered on zero moves a destination around its starting setting; adding an offset changes the center of that movement. An envelope holding a steady voltage is also carrying useful information, even though that part of the signal is not changing.

AC and DC Coupling

DC coupling preserves the steady component as well as the changing waveform, so you can see where the signal sits relative to zero. Use it when the actual voltage matters, as it often does with envelopes and other control voltages.

AC coupling removes the steady component to emphasize the changing part. It can help you examine a waveform riding on an offset, but it does not show the original absolute voltage. The coupling controls in SCOPE and XY are explained in their chapters.

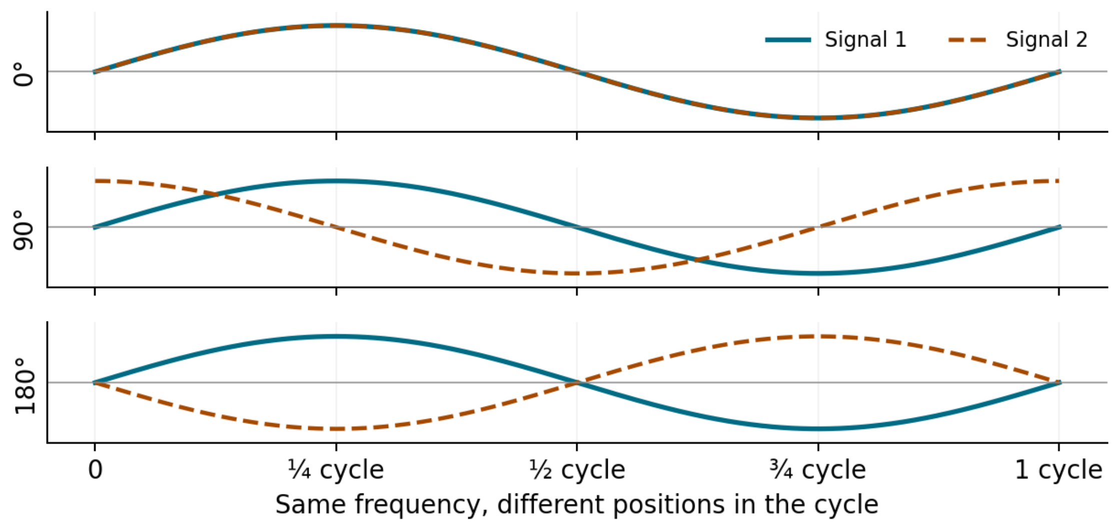
4. Phase — When Timing Becomes a Relationship

Two repeating signals can have the same frequency without reaching the same point in their cycles at the same instant. Phase describes that relationship. It helps explain what happens when signals are mixed, and it gives XY some of its most interesting shapes.

Wave Oracle's XY mode allows you to easily watch these phase relationships in real-time.

A Cycle Is a Complete Turn

We describe one cycle as 360 degrees. Two matching waveforms that rise, peak and cross zero together are in phase: 0°. A quarter-cycle separation is 90°, and half a cycle is 180°. At 360°, the relationship has come all the way around to 0° again.



The signals repeat at the same rate; their positions within each cycle differ.

Reinforcement and Cancellation

Mix two identical sine waves with equal levels and matching phase, and they add together. Shift one by half a cycle and its positive voltage meets the other's equal negative voltage. In an ideal sum, they cancel. Real signals and signal paths may differ enough to leave some sound behind.

This is why a patch can sound different after you split a signal, process the paths differently and mix them again. Filters and other processing can alter the phase relationship as well as the level. A loss of sound may be a clue about that relationship, rather than a missing signal.

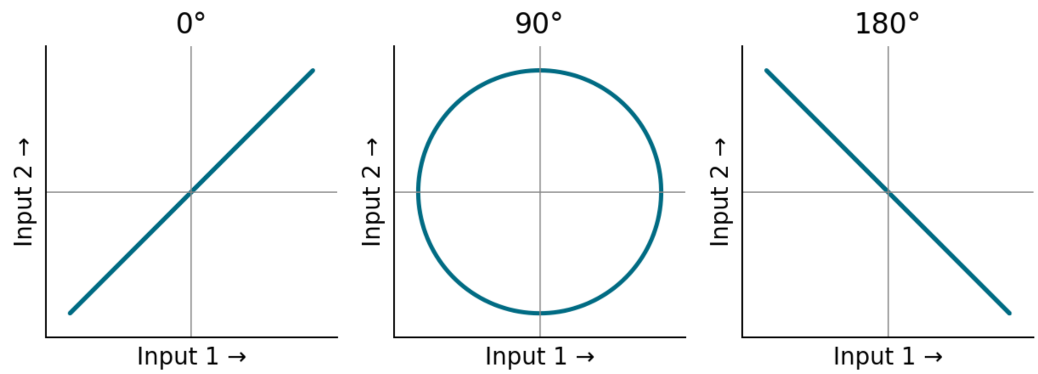
Phase Needs a Reference

A phase difference is always relative to something else: another signal, another point in a circuit or a defined starting point. In Wave Oracle, comparing two signals is a useful way to make that relationship visible.

See It in SCOPE and XY

In SCOPE, compare corresponding points in two waveforms: do their peaks line up, or does one cross zero while the other reaches a peak? Their horizontal separation shows the relative timing. If the frequencies differ slightly, that separation changes as you watch.

XY draws Input 1 horizontally and Input 2 vertically. With two clean sine waves at the same frequency, phase becomes geometry. Matching phase gives a rising diagonal line. A quarter-cycle difference gives a circle when the displayed X and Y amplitudes match, and half a cycle gives the opposite diagonal.



Equal displayed sine-wave amplitudes turn these phase relationships into simple XY shapes.

Detuning and Beating

Two oscillators tuned almost alike do not stay in step. If one runs at 100 Hz and the other at 101 Hz, the faster signal gains one complete cycle each second. Their phase relationship keeps changing.

When those signals are mixed, they alternately reinforce and cancel to varying degrees. You hear that rise and fall as beating. For two nearby sine-wave frequencies, the beat rate is their difference: in this example, once per second. In XY, their changing relationship becomes a moving figure.

Try It — Hear the Relationship

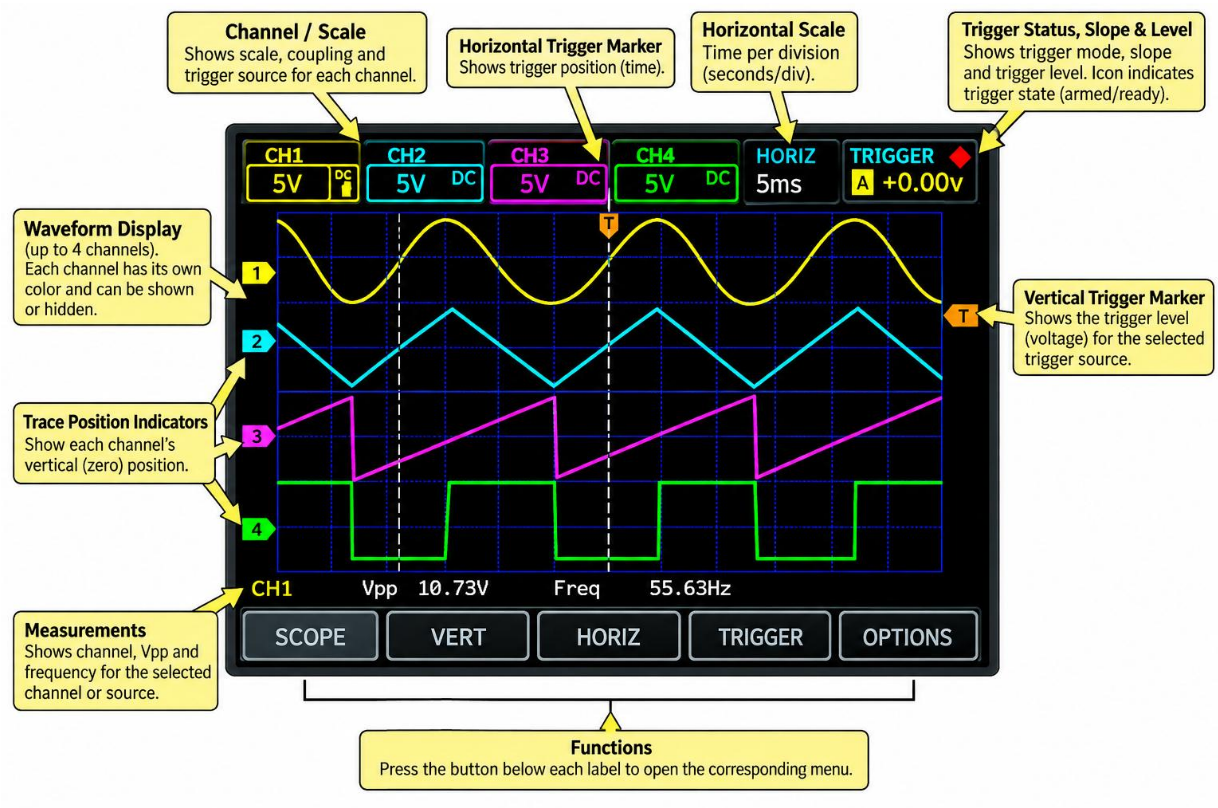
Send the same oscillator signal to Inputs 1 and 2 and choose XY. With matching displayed scales, you should see a stable rising diagonal. Both axes are receiving the same signal at the same time.

Next, use two sine-wave oscillators tuned as closely together as you can. Watch the figure change as their relative phase drifts, and listen to their mixed sound. Detune one a little farther and both the motion and beating become faster. You are seeing and hearing different consequences of the same relationship.

5. SCOPE — Seeing Voltage Happen

SCOPE displays up to four input channels as voltage versus time. Use it to examine oscillator waveforms, envelopes, LFOs, gates, modulation, clipping, DC offset and other signal behavior, with independent channel scaling, adjustable timebase and triggering.

Screen Overview



The top row reports channel, horizontal and trigger settings; the center is the waveform display; and the bottom labels identify the five physical function buttons directly below the display. Press the button below each label to open the corresponding menu.

VERT — Set Up a Channel

Press VERT and select Channel 1–4. Watch how it highlights the channels at the top. Each channel has independent SCALE, POSITION, COUPLING and VISIBLE settings, allowing signals with very different amplitudes to be compared.

SCALE

SCALE sets the volts represented by each vertical division. Use a larger volts/div setting when a waveform is too large for the display, or a more sensitive setting when the trace occupies only a small part of it. SCALE changes the view, not the signal itself.

Available settings are 0.1, 0.2, 0.5, 1, 2 and 5 V/div.

POSITION

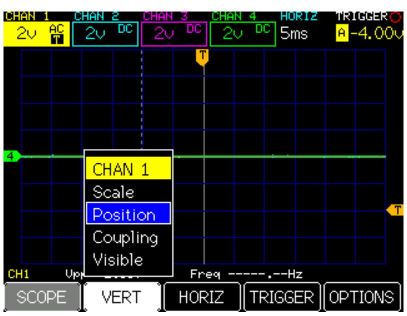
POSITION moves the selected trace vertically so several channels can be separated or aligned for comparison. Watch the zero volt baseline and the numbered arrow in left column change vertically as you rotate the encoder.

COUPLING

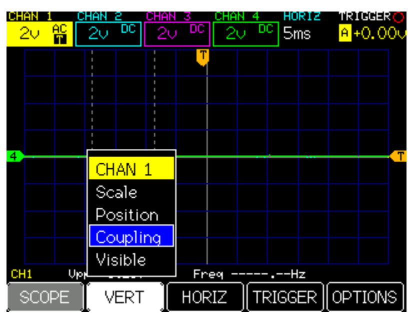
DC coupling preserves absolute voltage; AC coupling removes the steady DC component so the changing portion can be examined more easily. Watch channel’s small “AC” / “DC” change as you rotate the encoder.

VISIBLE

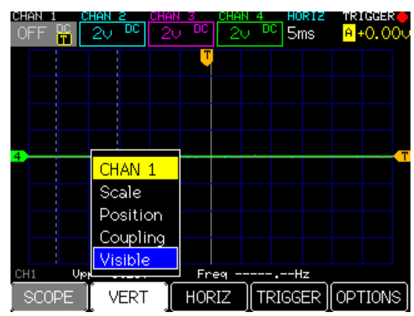
Shows or hides the selected channel without changing its settings. Setting channel visibility to OFF will hide the waveform trace and change the channel color at the top to grey.



POSITION



COUPLING



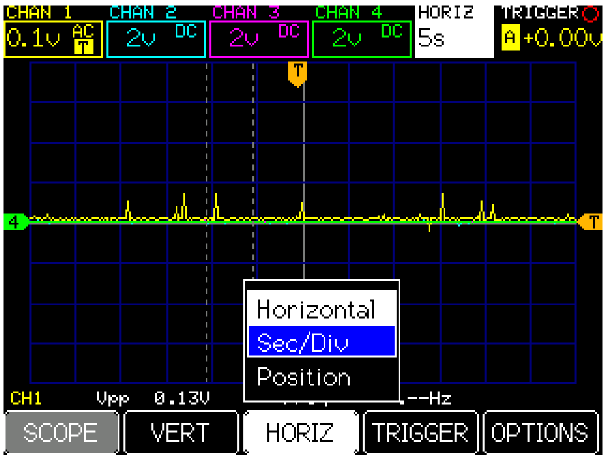
VISIBLE

HORIZ — Timebase and Horizontal Position

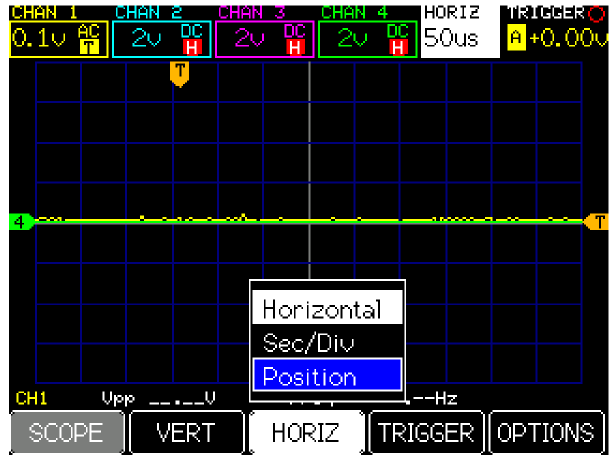
Press $\boxed{\text{HORIZ}}$ button to select TIMEBASE (Sec/Div) or POSITION with the encoder.

TIMEBASE

Sec/Div determines how much time each horizontal division represents: fast settings expose individual audio cycles, while slower settings show LFOs, envelopes and other long events.



SEC/DIV



POSITION

POSITION (Horizontal)

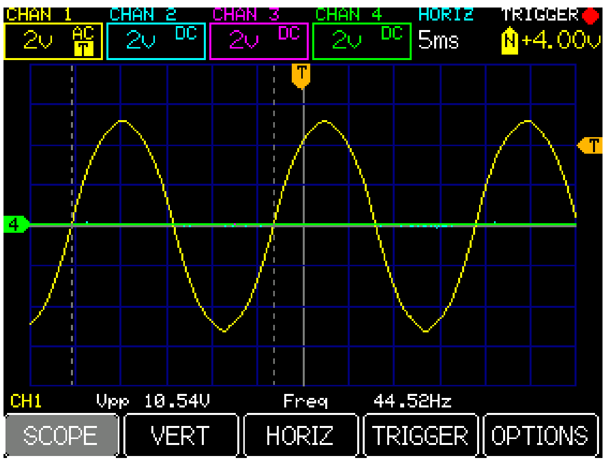
Position determines where the next valid trigger appears on the screen. Moving the trigger left shows more of what follows the event; moving it right preserves more pre-trigger activity. The Horizontal Trigger Marker [T] at the top of the waveform area moves with this setting.

TRIGGER — Stabilize or Capture an Event

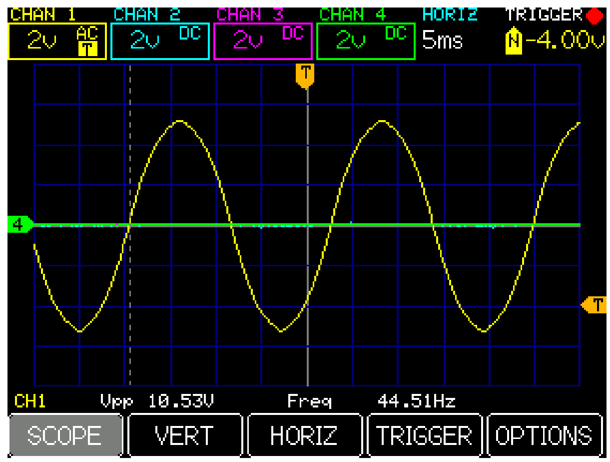
Press TRIGGER button to select. Triggering gives successive acquisitions a consistent reference. Wave Oracle watches the selected trigger channel for a crossing at the selected LEVEL and slope, then places that event at the Horizontal Trigger Marker.

LEVEL

LEVEL sets the voltage crossing used as the trigger event. Moving the level selects a different point on the waveform, and the Vertical Trigger Marker at the right side of the display moves with it. These examples use the same sine wave and NORM (+) triggering; only the trigger level changes.



+4.00 V

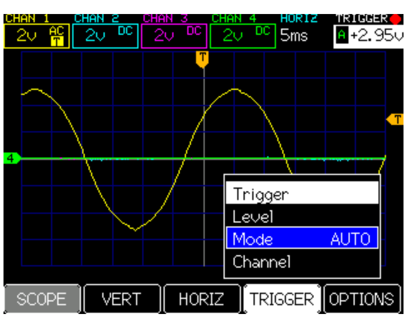


−4.00 V

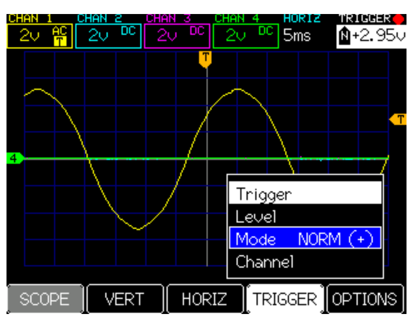
MODE (AUTO, NORM and SING)

AUTO is the forgiving everyday trigger mode and a good starting point when exploring an unfamiliar signal. When valid triggers are present, the waveform locks normally; if they disappear, SCOPE keeps the display updating rather than waiting indefinitely.

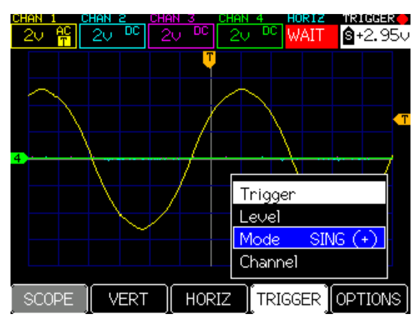
Think of **NORM** as a movie and **SING** (single) as a snapshot. NORM continues acquiring each time the trigger condition is met, so the signal repeatedly updates. SING waits for one valid trigger, captures that event and stops so you can inspect it.



AUTO



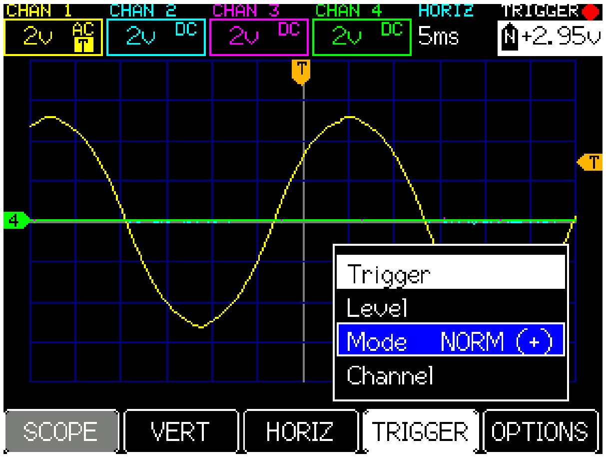
NORM (+)



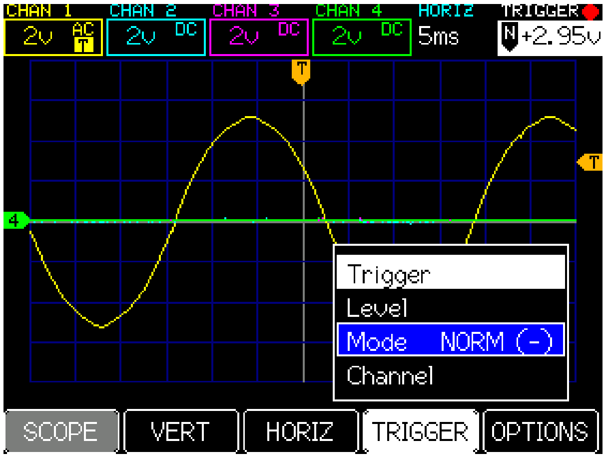
SING (+)

SLOPE (+ / -)

Part of the Mode selection is SLOPE. A repetitive waveform can cross the same voltage while rising and while falling. Positive (+) slope triggers on the rising crossing; negative (−) slope triggers on the falling crossing.



NORM (+)

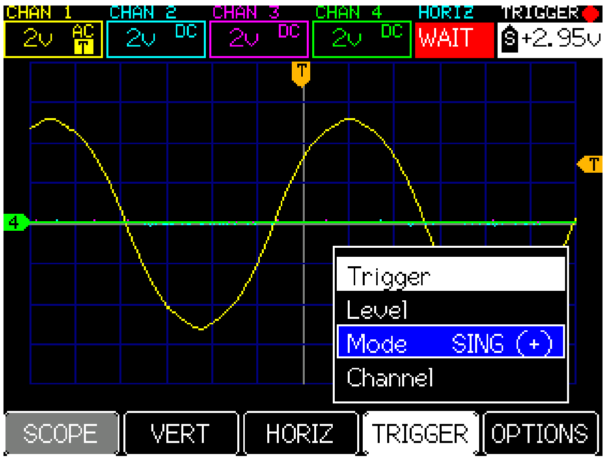


NORM (−)

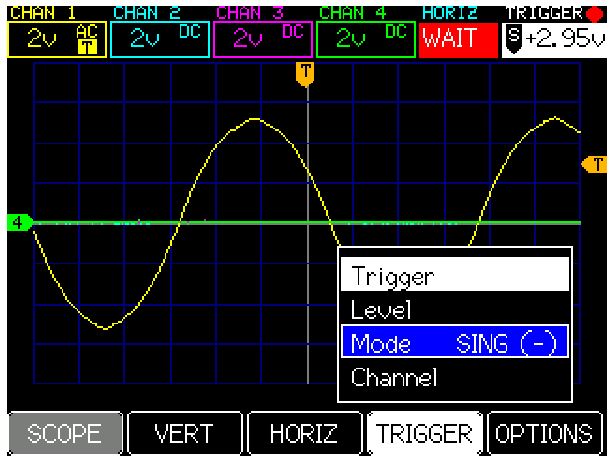
SINGLE and WAIT

Here's a little more detail about Single mode.

In SING (single) mode, SCOPE waits for one qualifying trigger, captures the event and stops with a red "WAIT". Touch the display screen to reset and re-arm SINGLE triggering for the next event. Positive and negative slope work the same way as in NORM; they simply determine which crossing causes the one-shot trigger / capture.



SING (+)

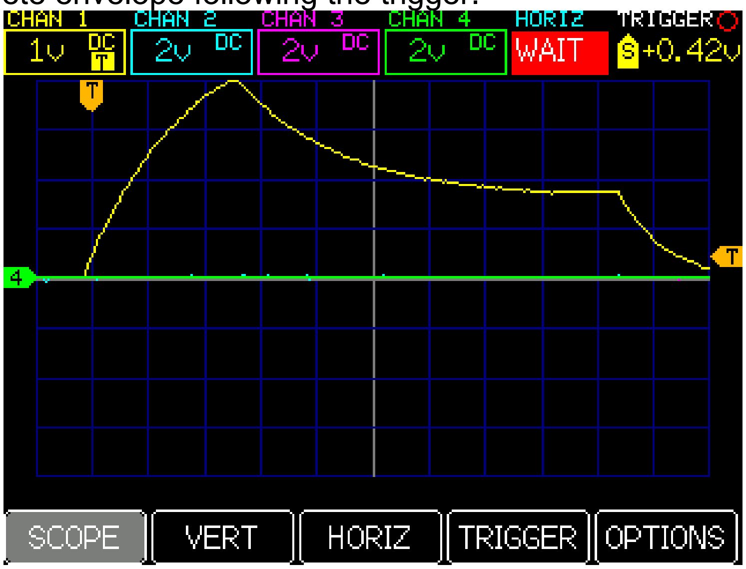


SING (−)

SINGLE and One-Time Events

One-time events such as ADSR envelopes are a good example of why SCOPE has SINGLE triggering. Unlike a continuously running oscillator, an envelope occurs when it is triggered and then it is gone. In NORM mode, another qualifying event can immediately replace the previous acquisition, but SING captures one event and leaves it on the screen for inspection.

With SING selected, set the trigger level and slope for the beginning of the envelope and press WAIT to arm the capture. When the envelope crosses the trigger level, SCOPE captures the event and stops. You can then examine the attack, decay, sustain and release without another envelope overwriting it. Press WAIT again when you are ready to capture the next one. Notice how Horizontal Position and Trigger Level are working together here. The Horizontal Trigger Marker sets where the event begins in time, while the Vertical Trigger Marker shows the voltage at which the trigger occurs. Visualize the intersection of those two points: it falls right at the beginning of the ADSR envelope's Attack phase. That gives us useful pre-trigger information to the left and the complete envelope following the trigger.



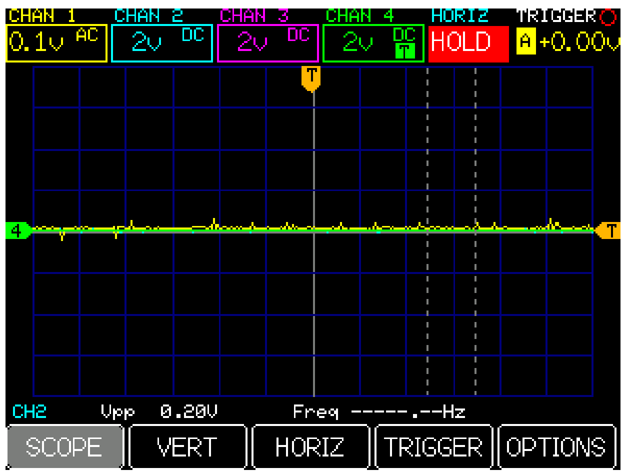
WAIT is not HOLD

WAIT is part of SINGLE triggering. In SING mode, SCOPE waits for one qualifying trigger, captures the event and stops so you can inspect it. Touch WAIT to reset and re-arm SCOPE for the next event.

HOLD is different. In AUTO or NORM, tapping the display freezes the current display screen immediately; tap again to resume.

HOLD is disabled in SING mode because SINGLE triggering already provides its own capture-and-wait behavior.

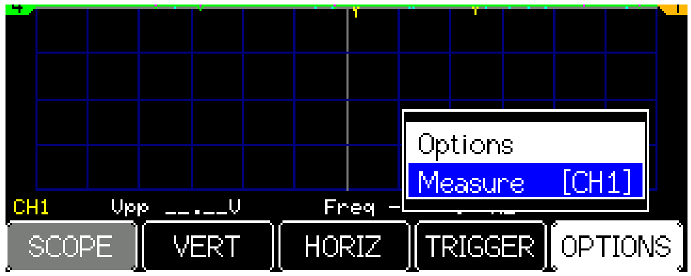
WAIT = reset/re-arm SINGLE.
HOLD = freeze/resume AUTO or NORM. *(HOLD is not available in SING.)*



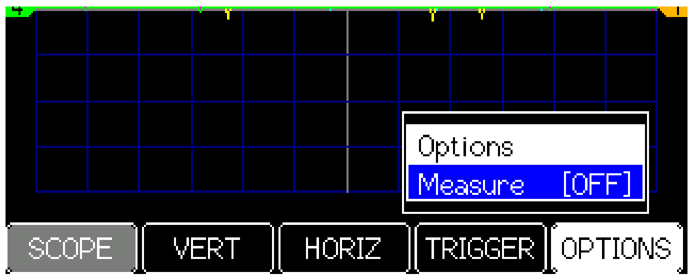
HOLD freezes the current display in AUTO or NORM.

OPTIONS — Measurements

OPTIONS button selects which SCOPE channel (1 – 4, or OFF) is used for the measurement readout, or turns the measurement display off. When enabled, the bottom Info Bar reports the selected channel together with Vpp (peak-to-peak voltage) and frequency when a usable measurement is available. Vpp is the difference between the measured positive and negative peaks; frequency reports cycles per second.



MEASURE [CH1] — measurements are shown in the Info Bar.



MEASURE [OFF] — the measurement readout is hidden.

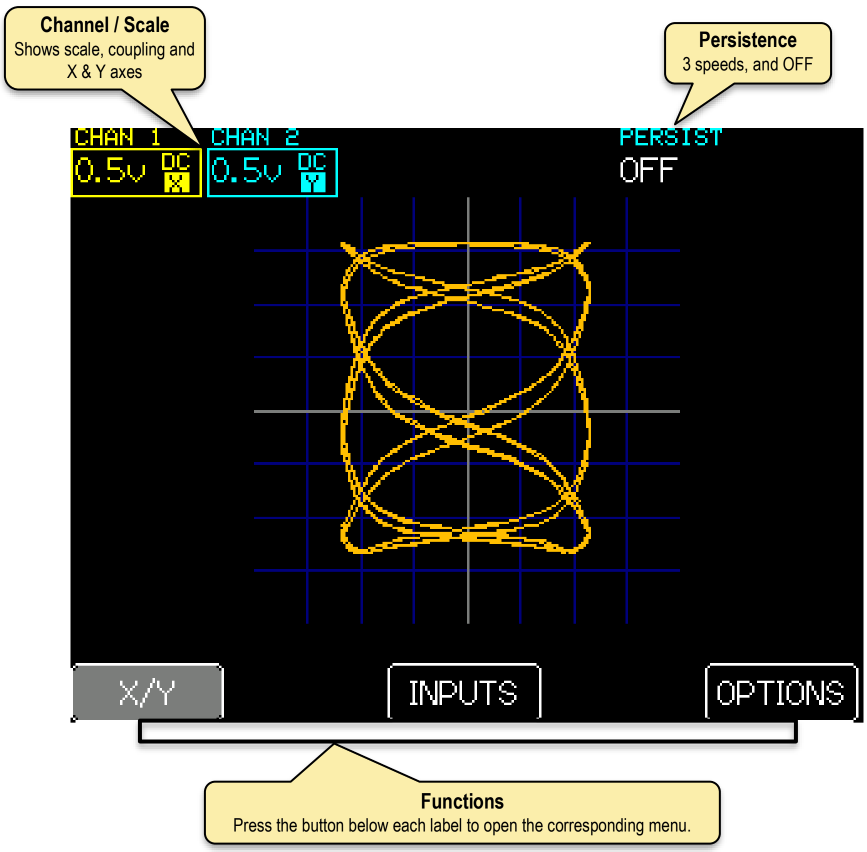
6. XY — See How Two Signals Relate

SCOPE shows voltage changing over time. XY mode does something different: it plots one signal against another. Channel 1 controls horizontal movement (X), and Channel 2 controls vertical movement (Y). Time is no longer one of the display axes.

Feed related signals into Channels 1 and 2 and the moving point traces a shape called a **Lissajous** figure. Circles, ellipses, loops and more complicated patterns can reveal frequency and phase relationships that are not nearly as obvious when looking at two conventional waveforms.

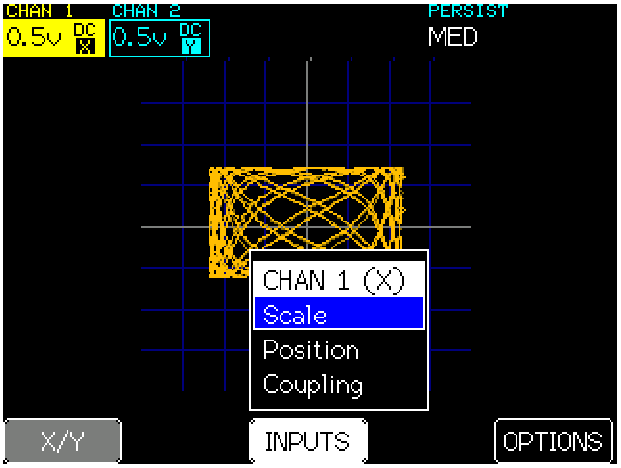
XY always uses Channel 1 for X and Channel 2 for Y.

Screen Overview



The center of the screen plots the instantaneous voltage of Channel 1 (X / Horizontal) against Channel 2 (Y / Vertical). Unlike SCOPE, XY mode only has two display channels.

INPUTS — Size and Position the Pattern



Press INPUTS to adjust the two signals used by the XY display. X controls affect Channel 1 and the horizontal dimension of the figure; Y controls affect Channel 2 and the vertical dimension.

SCALE

X SCALE changes the horizontal size of the figure, while Y SCALE changes its vertical size. If one signal is much larger than the other, the pattern may look extremely wide or tall. Adjust the two scales independently until the relationship is easy to see. SCALE changes the view, not the incoming signal.

POSITION

X POSITION moves the figure left or right, and Y POSITION moves it up or down. Normally you will use these controls to center the pattern or compensate for an offset signal. POSITION changes only where the signal is drawn on the display.

COUPLING

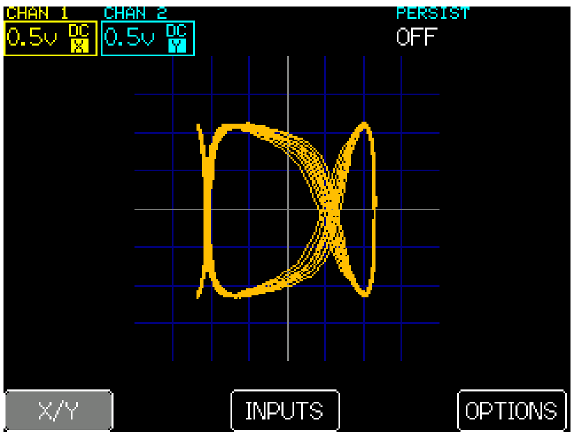
DC coupling preserves the actual input voltage, including DC offset. AC coupling removes the steady DC component so you can concentrate on the changing part of the signal. For many audio-frequency XY displays, AC coupling makes the figure easier to center; use DC when the actual voltage relationship, including offset, matters.

What Am I Looking At?

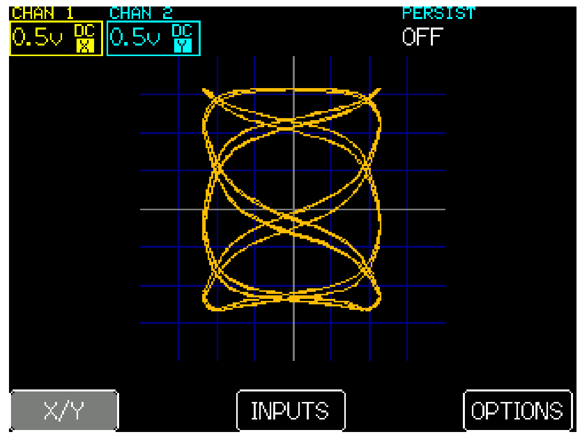
Start with two related sine waves. If X and Y have the same frequency and rise and fall together, the display tends toward a diagonal line. Change the phase of one signal and the line opens into an ellipse; with equal amplitudes and about a quarter-cycle phase difference, it can become a circle.

Change the frequency relationship and things get much more interesting. The loops are not decorative graphics generated by Wave Oracle — the incoming voltages are drawing them. Change either signal and the figure changes with it.

That is really the point of XY mode: instead of asking "What does each signal look like?" we are asking **"What are these two signals doing to each other?"**



A simpler relationship



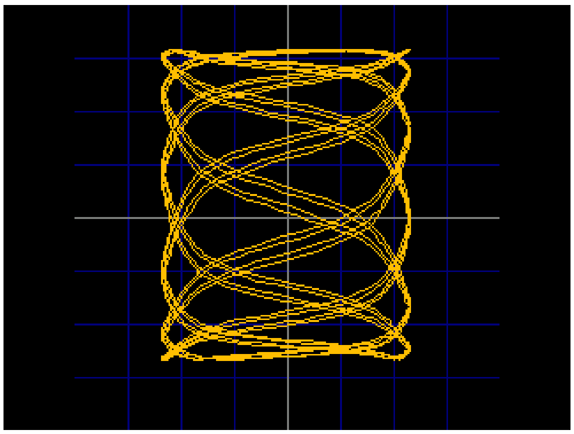
A more complex relationship

Frequency Relationships

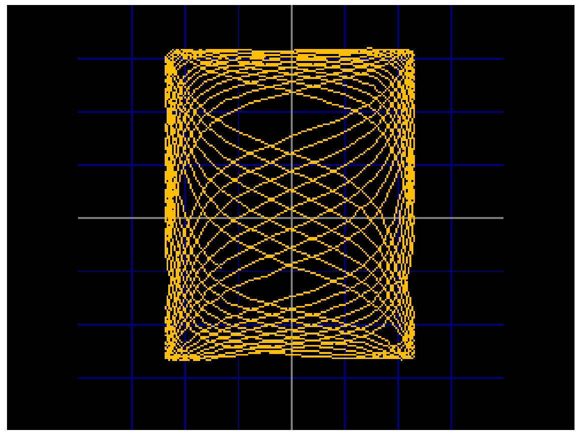
When X and Y have frequencies related by simple ratios, the XY figure can settle into repeating patterns. A 1:1 relationship may produce a line, ellipse or circle depending on phase and amplitude, while other ratios produce multiple loops.

You do not have to learn to decode every Lissajous pattern to find XY useful. Often the most useful clue is simply whether the figure is stable. A stable pattern tells you the two signals have a stable frequency relationship; a slowly rotating or changing pattern tells you that relationship is changing.

And sometimes they are just really cool to watch.

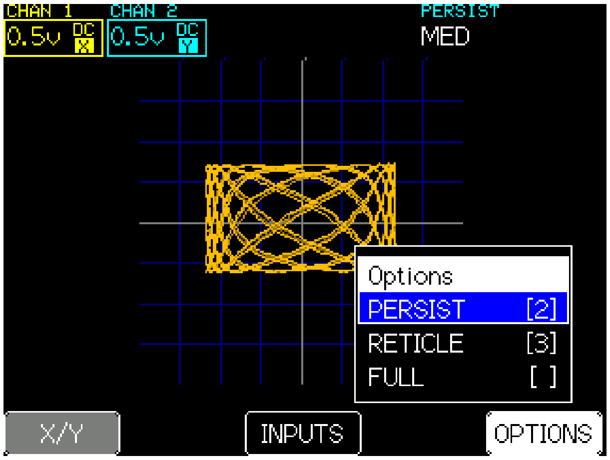


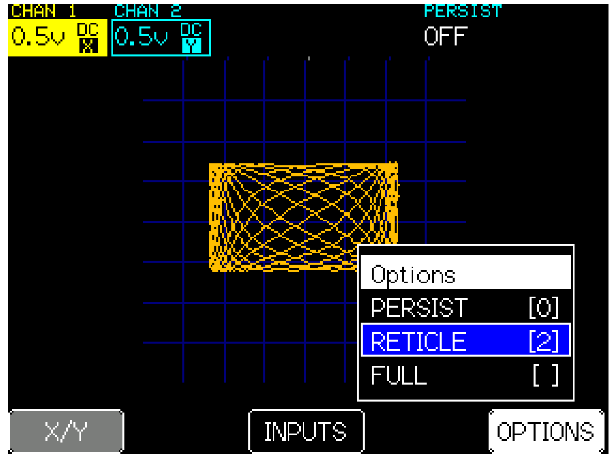
Related signals



More loops

OPTIONS





Press $\boxed{\text{OPTIONS}}$ to adjust how you can view your patterns.

PERSIST — Let the Pattern Hang Around

PERSIST controls how long previous parts of the XY trace remain visible. Short persistence emphasizes what the signals are doing right now; longer persistence lets the figure build up and can make complex or slowly changing relationships easier to see.

This is one of those controls that is easier to understand by turning it than by reading about it.

RETICULE

RETICULE shows or hides the XY reference grid. Turn it OFF for a cleaner, unobstructed view of the XY pattern.

FULLSCREEN

Fullscreen removes most of the controls and gives the XY figure more room to breathe. It is useful when you are interested in watching the relationship between the signals rather than adjusting it.

And yes, this is also where XY mode becomes a pretty good light show.

7. FFT — Seeing What a Signal Is Made Of

Harmonics are a big part of what gives a sound its character. They're one reason your ears can easily tell the difference between a flute and a cello playing the same note.

While a **SCOPE** shows how a signal changes over time, **FFT** looks at that same signal from a different perspective.

FFT (*Fast Fourier Transform*) is a mathematical technique for breaking a signal into its individual frequency components (harmonics) and determines how strong each one is. Wave Oracle performs this analysis continuously, then gives you several different ways to view the results.

Display modes FFT, SPECTRUM, WATERFALL, VOICE PRINT and BARS (covered below) all begin with the same underlying FFT analysis. What changes from one display mode to another is how that frequency information is presented — and what makes the harmonics easiest to see.

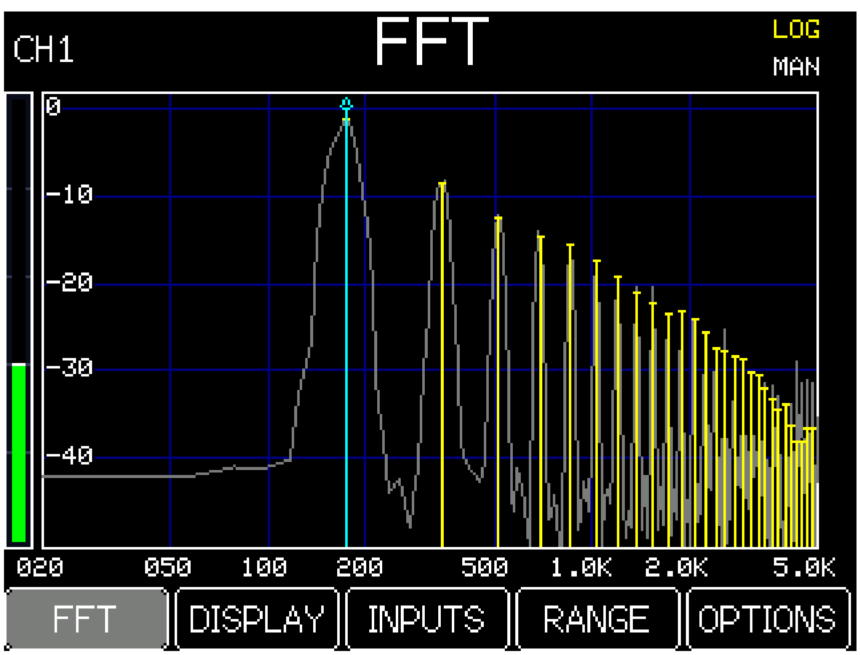
FFT is Wave Oracle's primary frequency-domain display. It presents frequency across the horizontal axis and level on the vertical axis.

Start with FFT. Once you understand what you are seeing here, the other display modes are simply different ways of looking at the same information.

7.1 FFT — The Primary Display

What Am I Looking At?

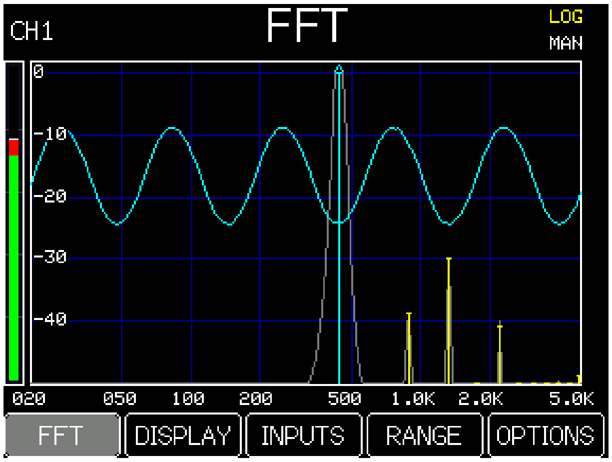
Each yellow peak represents energy at a particular frequency. The strongest low-frequency peak is often the fundamental — the pitch we hear as the basic note — while peaks above it are harmonics that help determine the character of the sound. A simple waveform may produce only a few obvious peaks; a harmonically rich waveform can produce a whole forest of them.



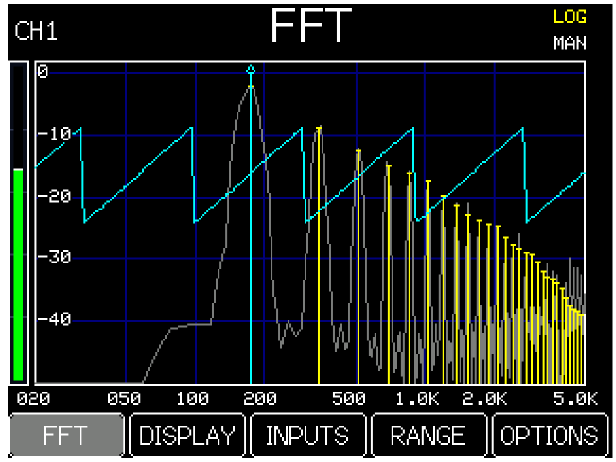
A harmonically rich sawtooth signal in the primary FFT display.

Fundamental and Harmonics

A sine wave is the simplest useful example: ideally, nearly all of its energy appears at one frequency. Sawtooth and square waves contain additional harmonics, so their FFT displays show a series of peaks extending above the fundamental. This is one of FFT's most useful tricks: two waveforms that may look broadly similar in SCOPE can reveal very different frequency content here.



A mostly sinusoidal signal



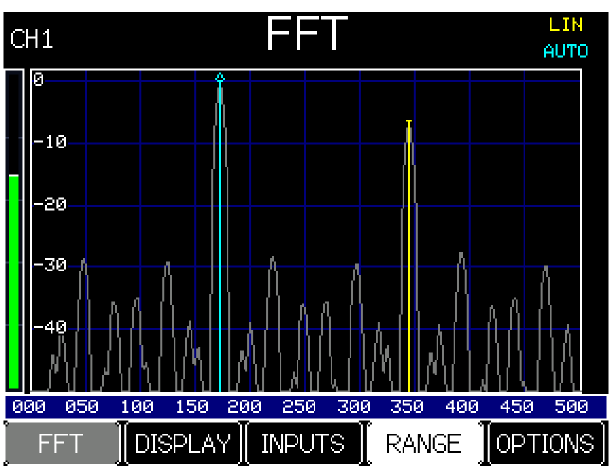
A rich harmonic series

The vertical axis shows level in decibels (dB). Peaks near the top are stronger; peaks farther down are weaker.

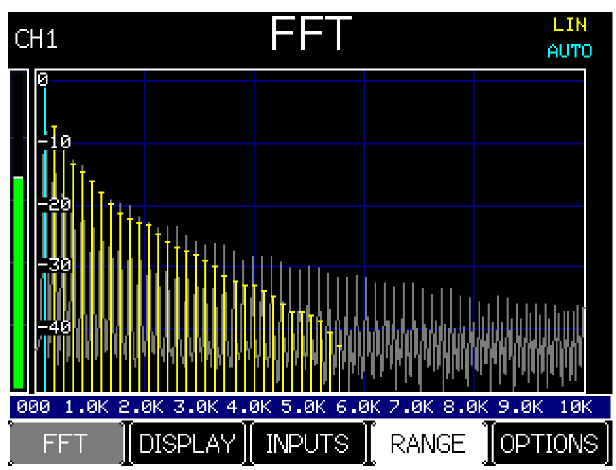
The cyan trace is the incoming waveform shown in the time domain. Comparing it with the yellow FFT peaks lets you see the waveform and its harmonic content at the same time. You can turn this overlay on or off with WAVE in OPTIONS.

RANGE — Choose How Much Spectrum to See

Press RANGE and turn the encoder to change the frequency span. A narrower range spreads the lower frequencies across more of the screen, making individual peaks easier to inspect. A wider range shows more of the spectrum at once. RANGE intentionally has no popup — watch the frequency labels along the bottom of the graph as you turn the encoder.



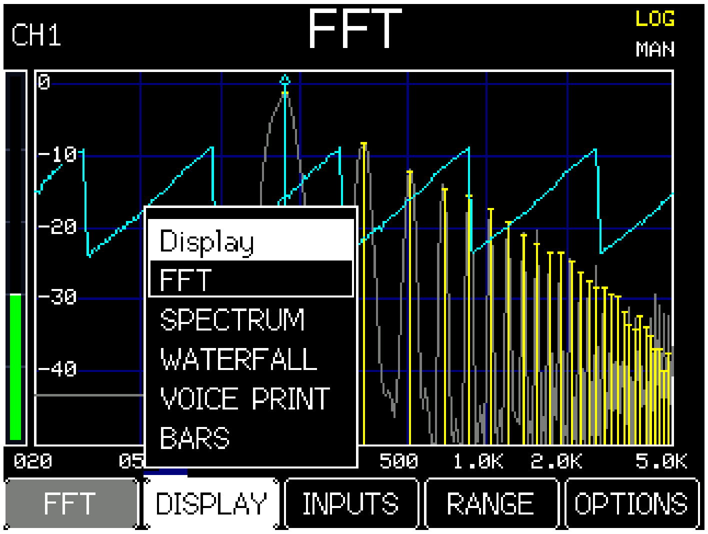
Narrower range



Wider range

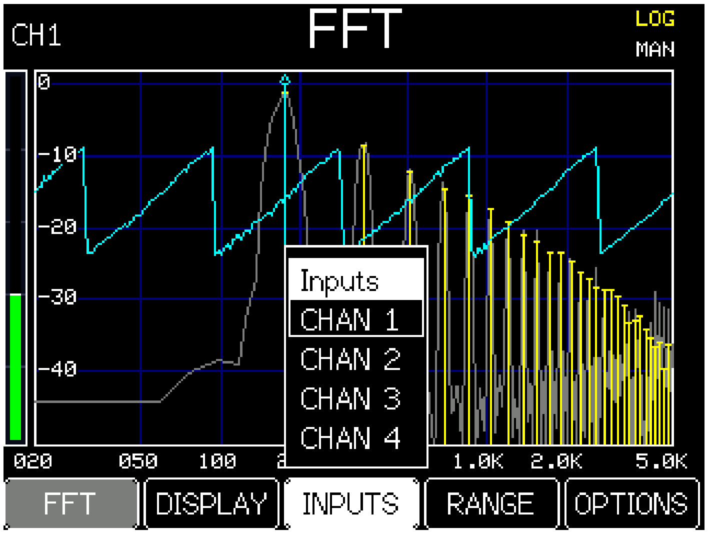
DISPLAY — Choose the FFT View

Press DISPLAY to choose FFT, SPECTRUM, WATERFALL, VOICE PRINT or BARS. FFT is the primary display described here; the remaining views are covered in Sections 7.2 through 7.5.



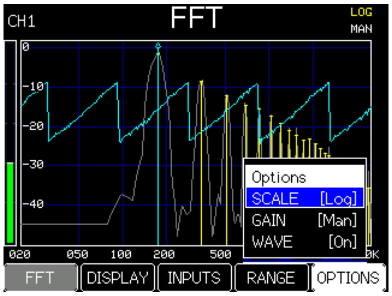
INPUTS — Select the Signal

Press INPUTS to select Channel 1, 2, 3 or 4 as the source for the FFT analysis. The selected channel appears in the top left corner of the display. Only one input channel is analyzed at a time.

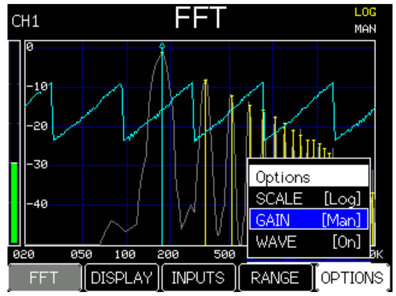


OPTIONS — Scale, Gain and Waveform

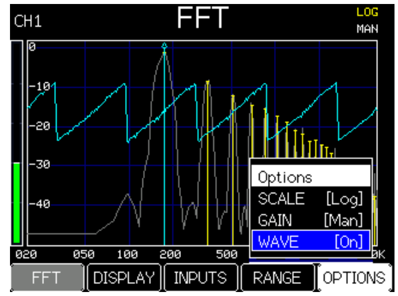
OPTIONS controls how the FFT is presented.



SCALE



GAIN



WAVE

SCALE (LOG and LIN)

LOG and LIN control how frequency is displayed across the horizontal axis. LOG spreads the lower frequencies farther apart and compresses the higher frequencies, which is often useful for viewing audio signals across a wide frequency range. LIN spaces equal frequency intervals equally across the screen, making harmonic spacing particularly easy to see.

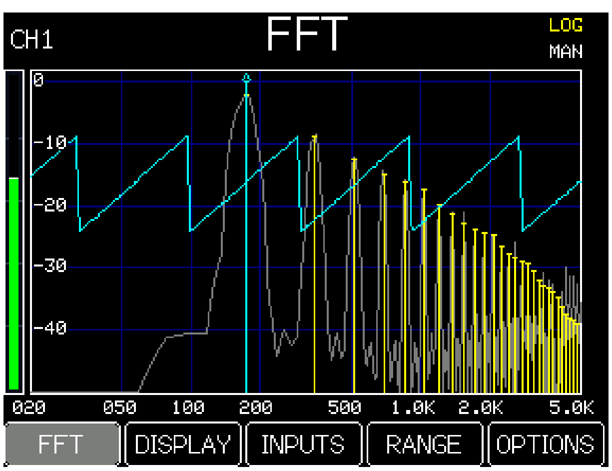
Neither setting changes the signal or the FFT data; it only changes how frequency is arranged across the display. The **vertical axis remains dB in both cases.**

GAIN (AUTO and MAN)

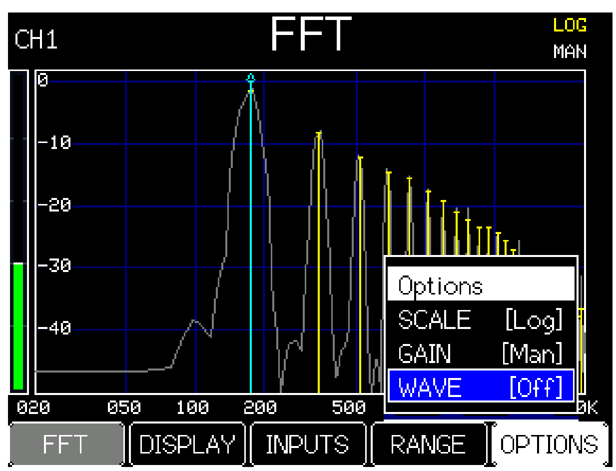
AUTO adjusts the display gain so changing signal levels remain easy to see. MAN keeps the display gain under manual control, which is useful when you want a consistent visual reference while comparing signals or watching level changes.

WAVE (ON/OFF) See Both Domains at Once

With WAVE ON, the time-domain waveform is drawn over the FFT display. Turn it OFF when you want an unobstructed spectrum. The overlay is especially useful while learning FFT because it lets you see the waveform shape and its harmonic content at the same time.



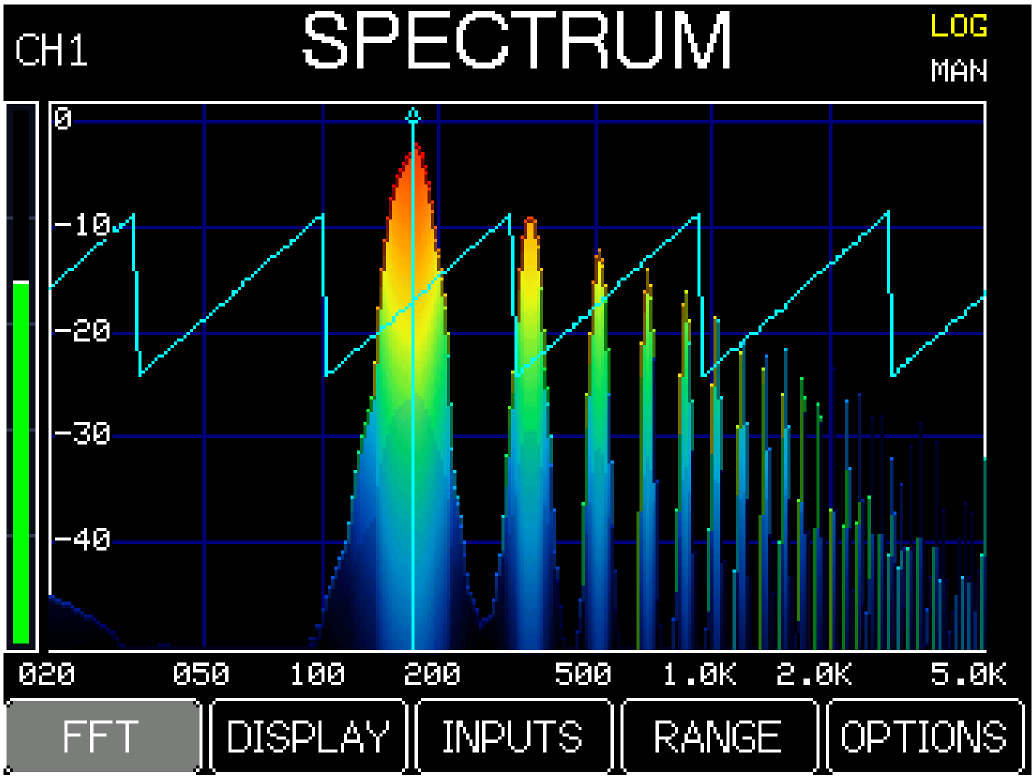
WAVE ON



WAVE OFF

7.2 SPECTRUM — Harmonic Levels at a Glance

SPECTRUM uses the same underlying FFT analysis as the primary FFT display, but adds color to make harmonic levels easier to compare at a glance. Nothing about the signal or the analysis changes — only the way the results are presented.

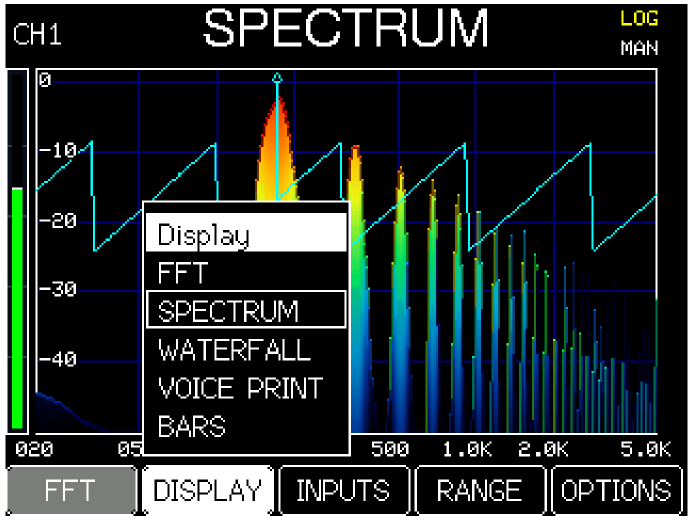


The same harmonic-rich sawtooth, shown in SPECTRUM.

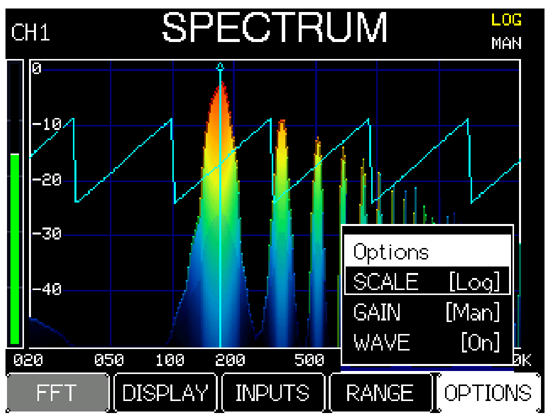
What Am I Looking At?

The horizontal axis is still frequency and the vertical axis is still level in decibels (dB). The familiar harmonic peaks are now filled with color, so their relative levels stand out more clearly. Stronger portions of the spectrum move toward the warmer colors, while weaker portions fall through green and blue.

Selecting SPECTRUM



Press DISPLAY and select SPECTRUM.



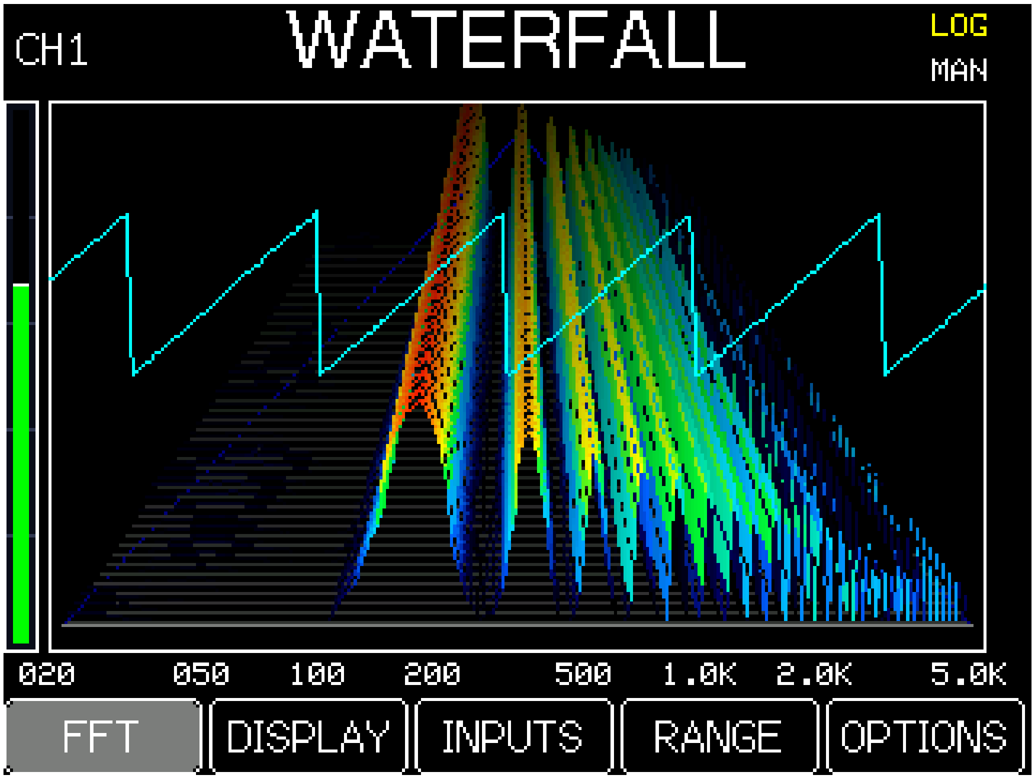
INPUTS, RANGE and OPTIONS work the same familiar way as described in Section 7.1, so there is nothing new to learn before using this view.

Why Use SPECTRUM?

Use SPECTRUM when you want the frequency detail of FFT but prefer a faster visual read of harmonic strength. Color gives your eye a second clue in addition to peak height, which is especially useful for comparing rich waveforms, watching a filter reshape a sound, or simply seeing which parts of a complex spectrum dominate.

7.3 WATERFALL — Watch the Spectrum Change Over Time

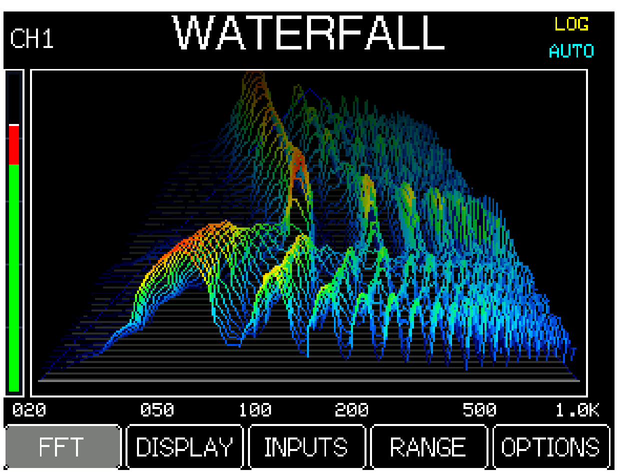
WATERFALL adds history to the FFT display. Each new spectrum appears at the front while earlier spectra move into the background, letting you see how a signal's frequency content changes over time.



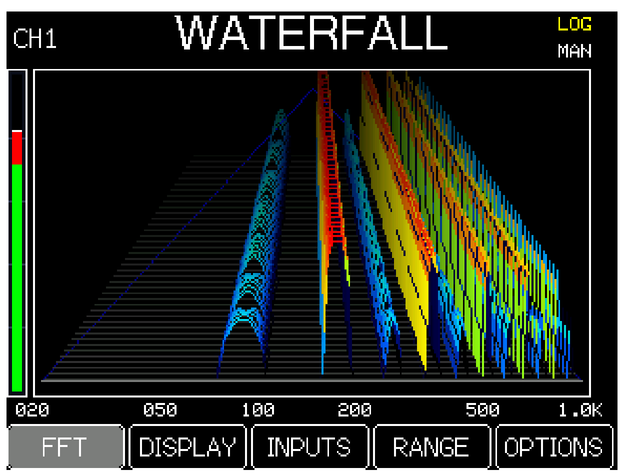
The same harmonic-rich sawtooth, now shown with its recent spectral history.

Reading the Waterfall

Frequency still runs across the horizontal axis, while color helps show level. Successive FFT results extend into the screen, so a steady signal produces repeating ridges. When frequency or harmonic content changes, those ridges move, appear, disappear or change strength.



Changing spectral activity



WAVE OFF for an unobstructed history

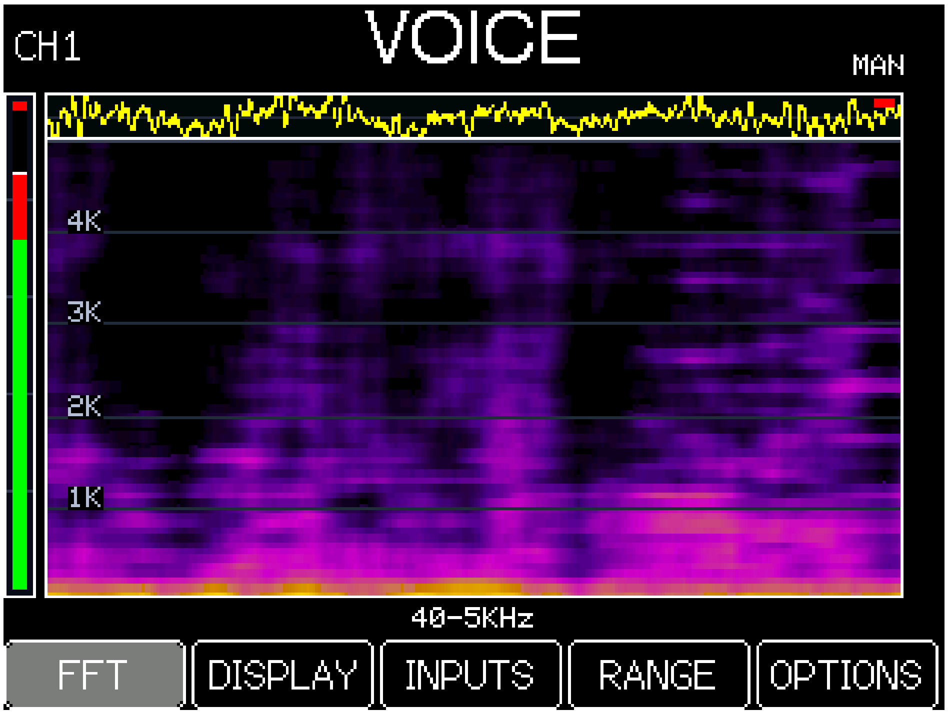
Why Use WATERFALL?

Use WATERFALL when the change itself matters. Filter sweeps, modulation, evolving sounds and other moving spectra leave a visible trail, making behavior that can be difficult to catch in a single FFT frame much easier to recognize.

FFT shows what is in the signal now. WATERFALL shows how it got there.

7.4 VOICE PRINT — See the Spectrum Move Through Time

VOICE PRINT turns the FFT analysis sideways and lets it build a history. Frequency runs vertically, while new spectral information enters at the right and earlier information moves across the display. Stronger frequency components appear brighter, so changes in a sound leave visible shapes and trails rather than a single set of peaks.



VOICE PRINT turns changing frequency content into a moving spectral history.

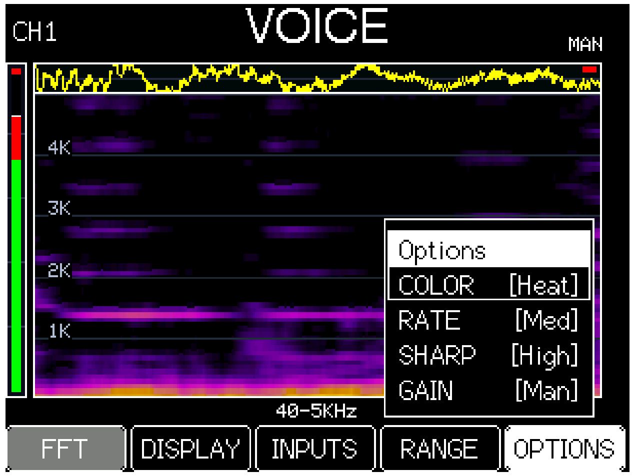
What Am I Looking At?

Low frequencies are near the bottom and higher frequencies rise toward the top. Time moves horizontally as the display updates, so steady tones form continuous bands while changing harmonics bend, appear, disappear or change intensity. This makes VOICE PRINT especially good at showing how complex sounds evolve.

The yellow trace across the top is the incoming waveform display. It is deliberately shrunken and moved above the main VOICE PRINT area so you can still see the time-domain signal without covering the spectral history.

OPTIONS — Shape the VOICE PRINT Display

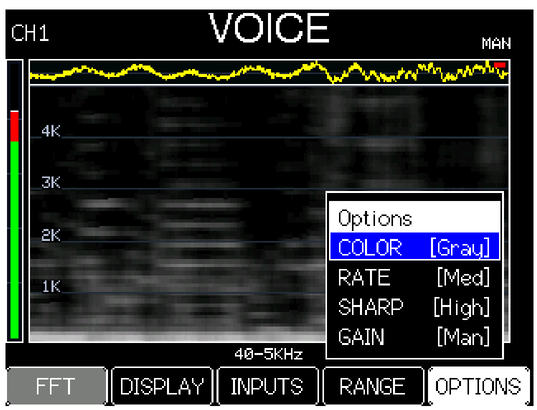
VOICE PRINT has its own presentation controls. These change how the history is drawn; they do not change the incoming signal or the underlying FFT analysis.



VOICE PRINT OPTIONS: COLOR, RATE, SHARP and GAIN.

COLOR (HEAT / GRAY)

HEAT uses color to make stronger spectral energy stand out quickly. GRAY presents the same information as brightness alone. Choose whichever makes the structure easiest for you to read.



GRAY removes the color coding while preserving the spectral history.

RATE, SHARP and GAIN

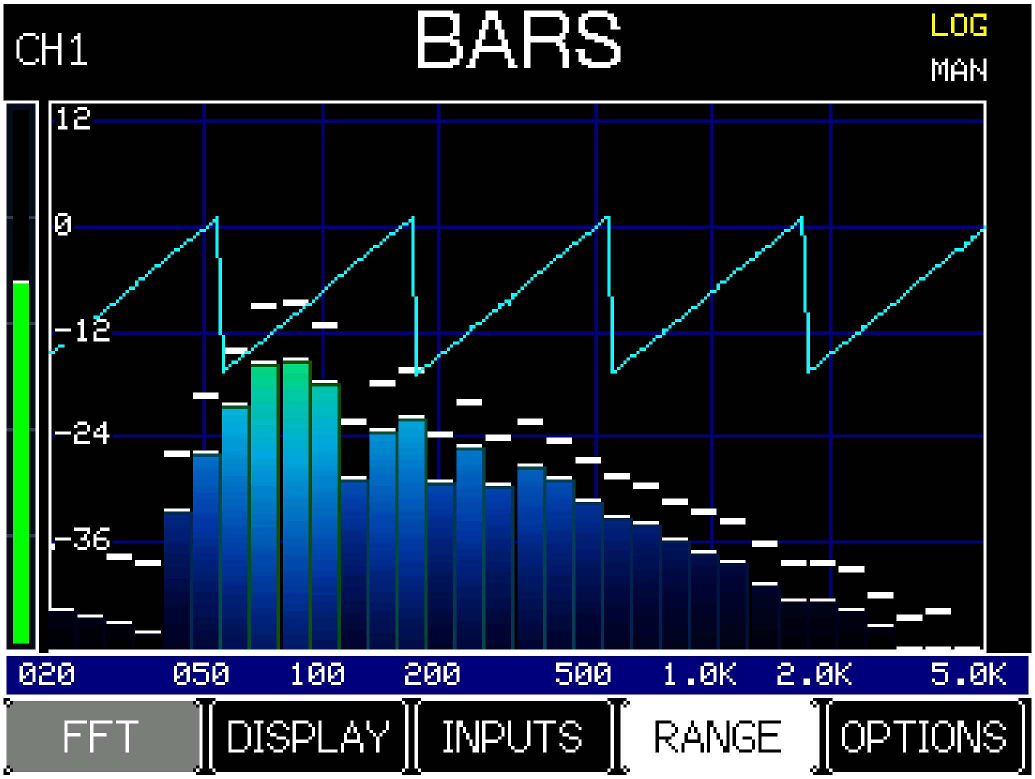
RATE controls how quickly the history moves across the display. SHARP changes the visual shaping of spectral detail, from softer to more strongly defined. GAIN sets the display gain; MAN keeps the visual reference fixed while AUTO can follow changing signal levels.

Why Use VOICE PRINT?

Use VOICE PRINT when the way a sound changes matters as much as the frequencies it contains. Speech, vocals, filter movement and other evolving sounds can produce patterns that are much easier to recognize here than in a single FFT frame.

7.5 BARS — Frequency Levels at a Glance

BARS groups the FFT results into frequency bands, providing a simpler view that can make the overall frequency balance easier to see at a glance. Sometimes this is simply a much easier way to see the same information.



The same harmonic-rich sawtooth, shown in BARS.

Peak Level Indicators

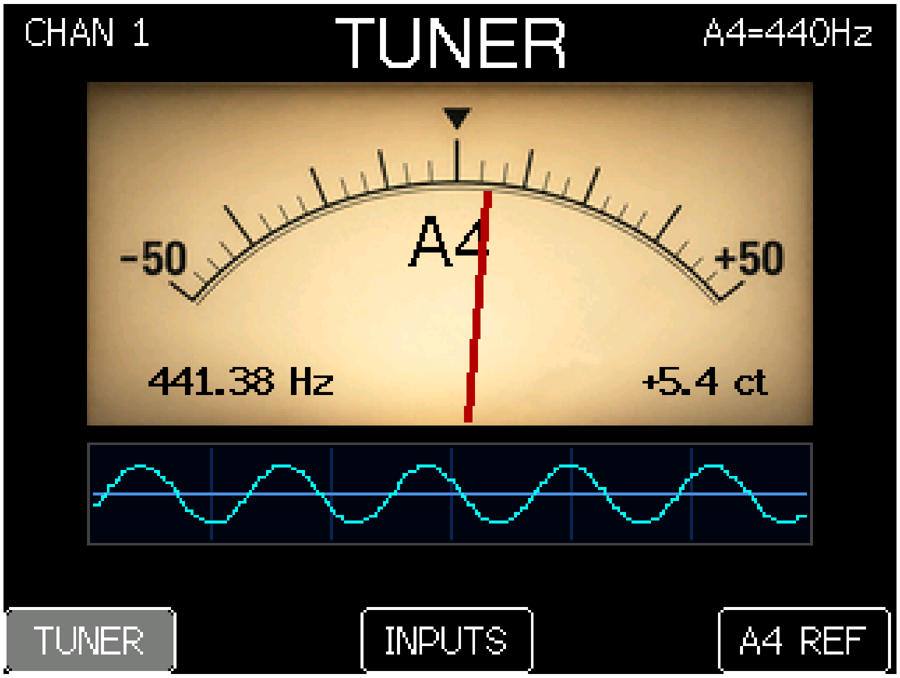
The small markers above each bar hold the recent peak level for that frequency band, then fall back as the peak ages. The markers make brief peaks easier to spot and let you compare the signal's recent maximum with its current level.

Why Use BARS?

Use BARS when the overall distribution of energy matters more than individual FFT peaks. The grouped display makes broad changes in frequency balance quick to recognize without giving up the underlying FFT analysis.

8. TUNER — Finding the Pitch

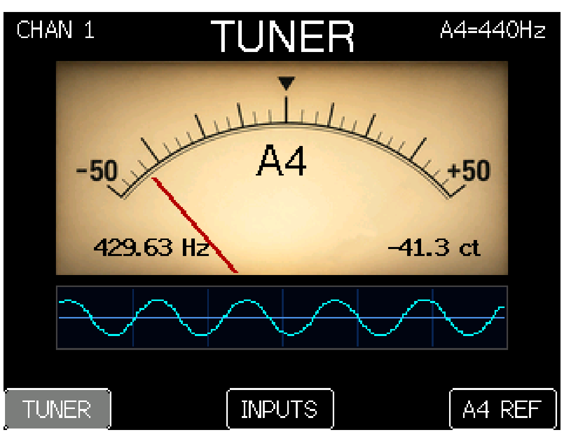
TUNER identifies the pitch of a periodic input signal and shows how far it is from the nearest musical note. The large note name tells you what Wave Oracle hears, while the red pointer and cents readout show whether the pitch is flat, sharp or centered.



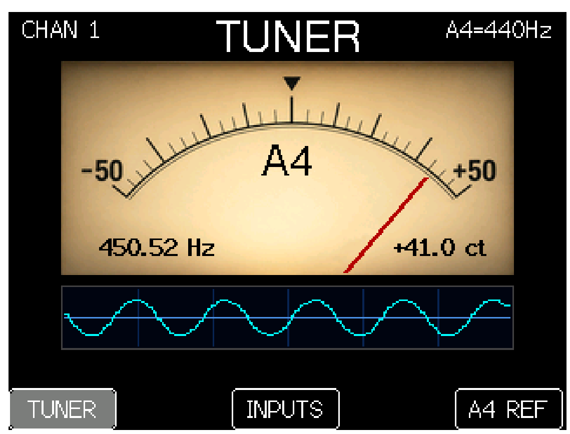
A4 detected slightly sharp: 441.38 Hz, +5.4 cents.

Reading the Tuner

The center mark is in tune. A pointer to the left means the detected pitch is flat; a pointer to the right means it is sharp. The frequency readout at lower left shows the measured signal in hertz, and the cents readout at lower right shows the tuning error relative to the selected A4 reference. One hundred cents equals one semitone.



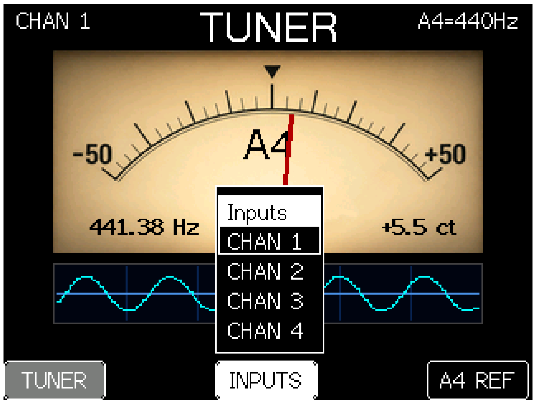
Flat: −41.3 cents



Sharp: +41.0 cents

INPUTS and NO WAVE

Press INPUTS to select Channel 1, 2, 3 or 4 as the source for TUNER. Only the selected channel is analyzed. If that input has no signal, or not enough usable periodic signal for Wave Oracle to determine a reliable pitch, TUNER displays NO WAVE. Once a suitable signal is detected, tuning information returns automatically.



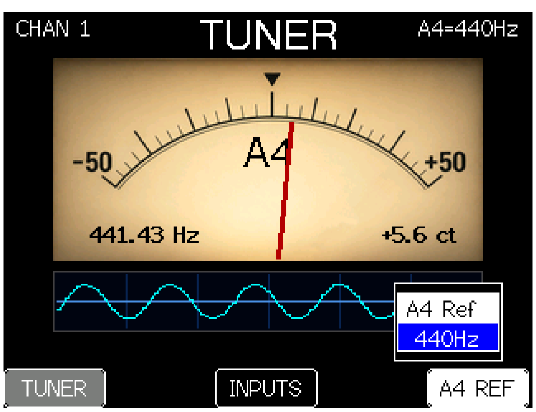
INPUTS selects Channel 1–4

NO WAVE: not enough usable signal

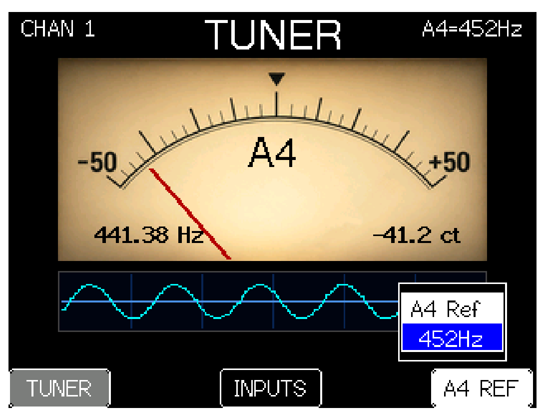
A4 REF — Set the Tuning Reference

Modern musical instruments are commonly tuned using A4 = 440 Hz, but pitch standards have varied over time and different orchestras, ensembles and historical-performance practices may use a slightly higher or lower reference. A4 REF lets Wave Oracle match the tuning standard you are working with.

Changing A4 REF changes the reference used for every note, not just A. The detected input frequency does not change; what changes is whether that frequency is considered flat, sharp or in tune relative to the selected reference.



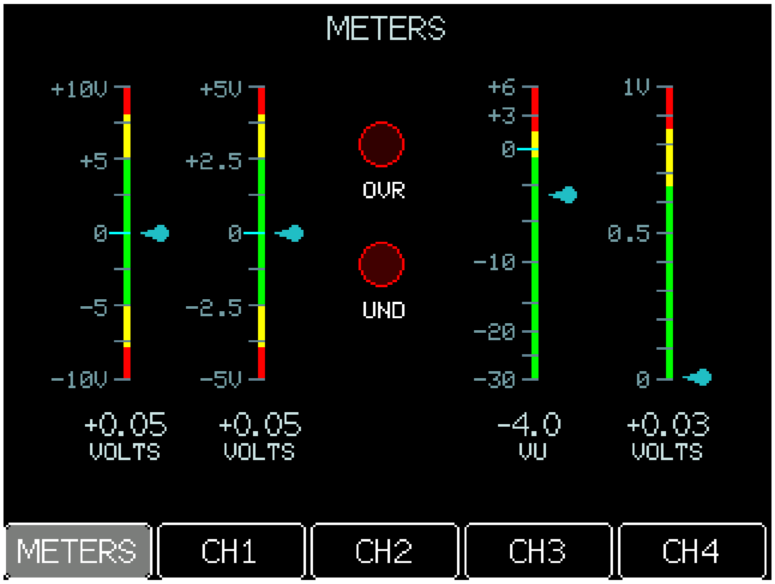
A4 reference: 440 Hz



A4 reference changed to 452 Hz

9. METERS — Four Signals at a Glance

METERS lets you watch all four Wave Oracle inputs at once. Each channel has its own meter, and you can set each one independently to suit the signal you want to observe. Use it to compare levels, follow a slowly changing control voltage or keep an eye on audio while your patch plays.



Four inputs, four independent meters: ±10 V, ±5 V, VU and 0–1 V.

Reading the Meters

The meters run from CH1 on the left to CH4 on the right. Each scale shows the selected range, the pointer follows the signal and the number below gives the reading in volts or VU. You can mix meter types, as shown above; all four channels remain visible together.

Voltage Ranges — For DC / Steady Voltage

Use a ± range for signals that move above and below zero, and a 0– range for signals that stay positive. Both offer 1, 2, 5 and 10 volt ranges. Choose a range that contains the signal while giving its movement enough room to see: a small signal is easier to read on a small range.

Voltage meters can show a steady voltage as well as one that changes. That makes them useful for checking a fixed control voltage or watching the rise and fall of an envelope.

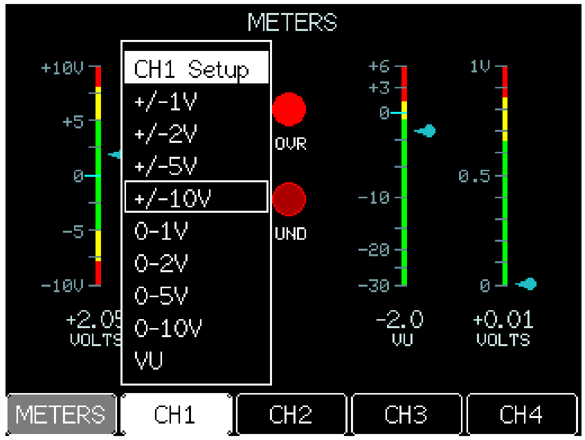
VU — For Audio Levels

Choose VU when you want to judge audio level. Its pointer moves smoothly, like a traditional VU meter, so you can follow the general level without chasing every brief peak. Zero VU is an audio reference level, not silence.

The cooler colors lead toward zero VU, yellow marks 0 through +2 VU and red marks higher levels. Red is a useful heads-up; it does not by itself mean the audio is distorted. OVR is a separate warning that the signal has exceeded the displayed range.

Setting Up a Channel

Press the physical button below CH1, CH2, CH3 or CH4 to open that channel's Setup menu, then choose the range you want. Each channel uses the same choices, and changing one channel leaves the others as you set them.



The channel Setup menu offers voltage ranges and VU.

OVR and UND

OVR means the signal has gone above the selected range; UND means it has gone below it. These red indicators can flash and fade as the signal moves outside the scale. Choose a wider range, or a ± range if the signal is dipping below zero on a positive-only meter.

Try It — Watch Vibrato Happen

Patch an LFO into one jack of a Wave Oracle input, then use that input's paired jack to carry the same signal onward to a VCO's pitch modulation input. Select a ± voltage range and use a small modulation amount so the pitch change is easy to follow.

At zero volts, the LFO adds no pitch change. Positive voltage raises the pitch, and negative voltage lowers it. Slow the LFO down and watch the pointer move while you listen: now you can see the voltage behind the vibrato.

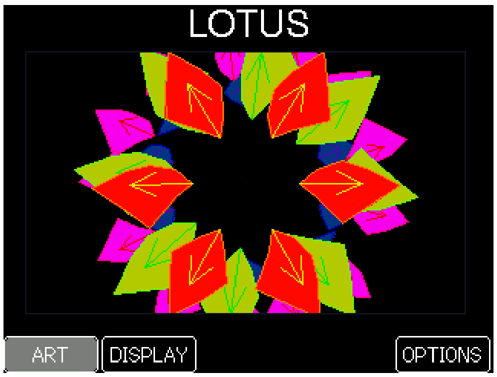
10. ART — Inspire Creativity

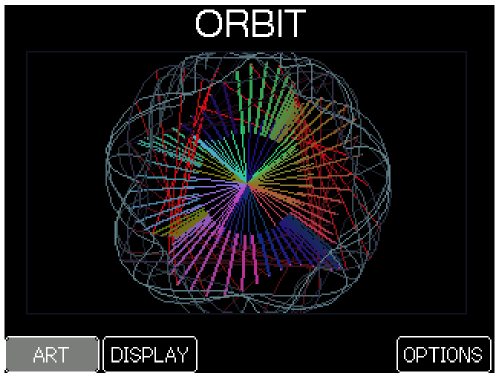
ART is proof that Wave Oracle is here to inspire creativity. Your sound becomes color, shape and movement, giving you another way to experience the patch you are making. Try a different waveform, move a filter or change the rhythm, and see where the picture takes you.

ART uses only Input 1. *Inputs 2, 3 and 4 are not used in this mode.*

Five Ways to Play

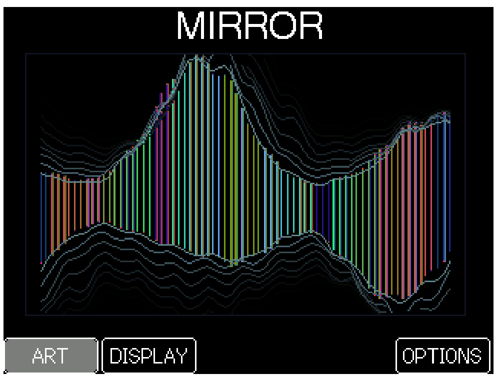
Press the physical DISPLAY button to choose LOTUS, ORBIT, MIRROR, RADIAL or TRACE. Each gives the same input a different visual personality, so changing the pattern is a good place to start exploring.

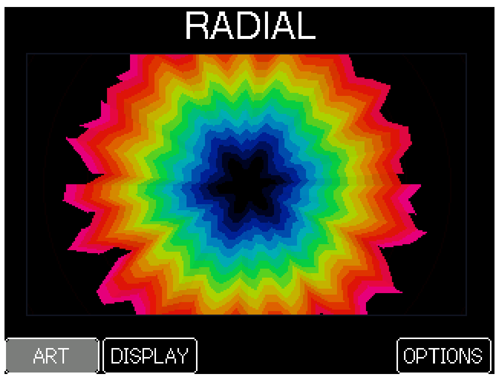




LOTUS (left) and ORBIT (right).

LOTUS makes bold, petal-like shapes, while ORBIT draws intricate loops around a center. Both invite you to watch how a change in the sound changes the picture.

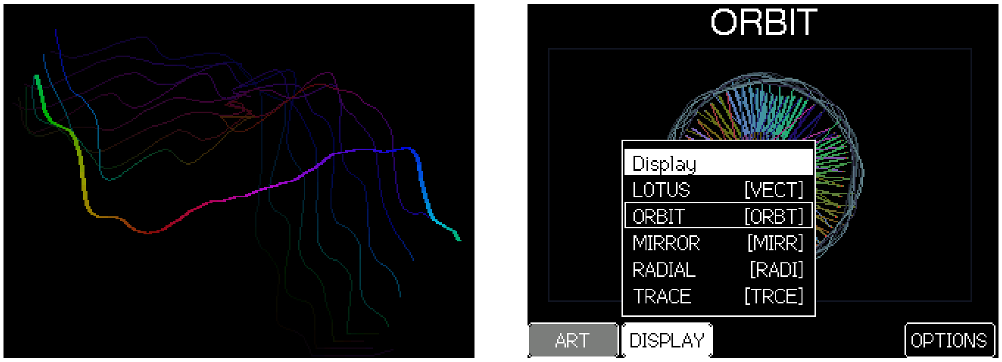




MIRROR (left) and RADIAL (right).

MIRROR spreads the movement across the screen in reflected shapes. RADIAL sends it outward in colorful rings. Try the same patch in each and discover which view catches your eye.

TRACE — Let the Signal Draw

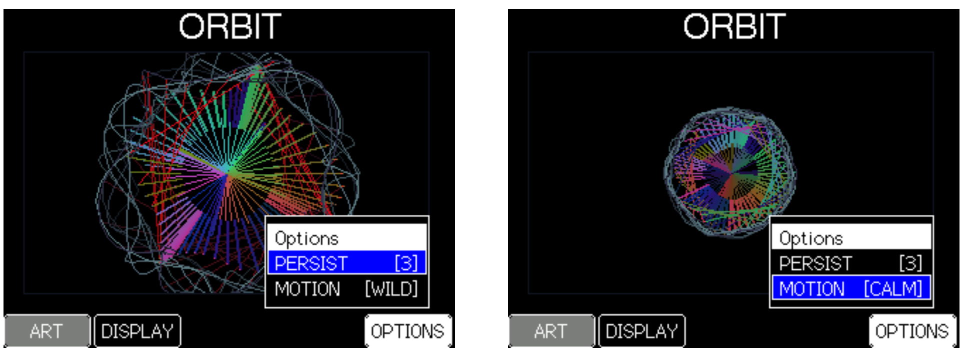


TRACE (left), and the DISPLAY menu (right).

TRACE turns the signal into flowing colored lines, with earlier traces adding a sense of movement. Like the other patterns, it is a creative view: let the picture suggest something to try with your sound.

OPTIONS — Shape the Movement

Press the physical OPTIONS button to adjust PERSIST and MOTION. These change the visual behavior, so you can try them while the same patch continues to play.



ORBIT with MOTION set to WILD (left) and CALM (right).

PERSIST — Leave a Trail

PERSIST controls how much of the earlier picture remains visible. OFF gives a cleaner view of the current drawing; higher settings leave more history, letting shapes build up and overlap. Try a shorter trail for a busy patch and a longer one for slower movement.

MOTION — Choose the Energy

Choose CALM, NORM or WILD to change the character of the movement. Start with NORM, then try CALM for a gentler presentation or WILD for something more energetic. The effect depends on the pattern and the signal, so let your eyes choose.

Try It — Follow Your Curiosity

Send a sound from your patch to Input 1 and choose a pattern. Slowly move a filter or vary the waveform while you watch, then try the same sound with a different pattern and MOTION setting. You may find yourself shaping the sound to make a picture you like—and hearing something new along the way.

11. LEARN — Explore the Ideas

LEARN puts the ideas behind Wave Oracle on the screen, with short explanations and demonstrations you can explore. Some pages introduce a concept, while others invite you to change something and watch what happens. You can follow a topic from the beginning or choose one that catches your curiosity.

The lessons generate their own demonstration signals, so you do not need to patch anything into Wave Oracle. Each provides a consistent example, ready whenever you want to explore.

Start Where You Are

Entering LEARN opens the first lesson for the major mode you are currently using. For example, enter LEARN from SCOPE and you will start with the SCOPE lessons, ready to explore its settings and functions.

The first SCOPE lesson (left), and the lesson topics screen (right).

TOPICS and BACK — Explore and Return

Press the bottom-left physical button, labeled TOPICS, to choose another lesson topic. On the topics screen, that button becomes BACK. Press BACK to enter the major mode matching the selected topic—for example, select FFT and BACK takes you to FFT.

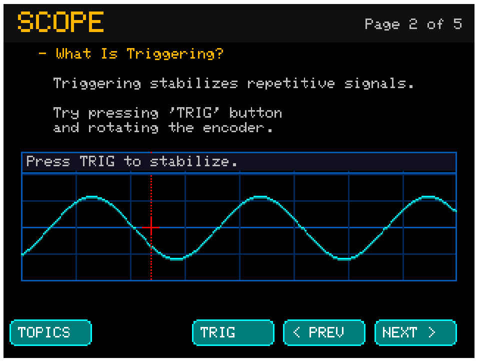
The topics are SCOPE, XY, FFT, TUNER, METERS and ART. Choose the topic you want to explore, then press the physical SELECT button to open its lessons.

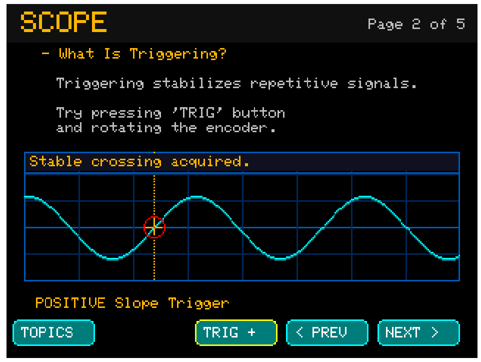
Follow the Page

The page number at the upper right shows where you are in the topic. Use NEXT and PREV, when shown, to move through its pages. The labels along the bottom identify the physical buttons below the display.

Some pages offer options through these buttons, while others invite you to use both the buttons and encoder. Follow the instructions on each page: the controls belong to that demonstration, so there is no need to remember one set of adjustments for every lesson.

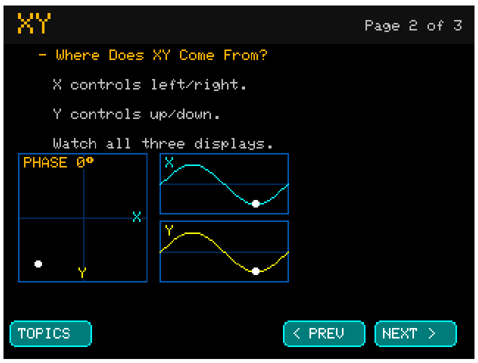
Try Something and Watch It Change

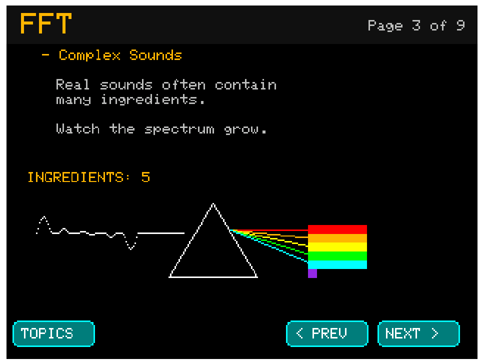




A moving waveform (left), and the same lesson after acquiring a positive-slope trigger (right).

The SCOPE triggering lesson gives you something to try immediately. Press TRIG and use the encoder as the page invites you to do, then watch the waveform settle around a stable crossing. The explanation and the result are right there together.





XY connects two waveforms to a pattern (left); FFT explores a sound's ingredients (right).

In XY, you can see the horizontal and vertical signals alongside the pattern they produce. In FFT, a waveform and its spectrum help connect a sound to its ingredients. These are small experiments you can revisit until the relationship makes sense.

TUNER brings frequency, note and tuning error together, while METERS shows how a smoother meter follows audio level. Explore whichever idea is useful to you now; there is no required order and nothing to pass before moving on.

ART LESSON — A Little Inspiration

The ART lesson topic begins with a brief description, then displays a slideshow of still images. It offers a different kind of exploration: a little visual inspiration alongside the interactive lessons.

12. Specifications

Wave Oracle™ brings signal viewing, measurement, audio visualization and built-in lessons to an MU synthesizer system.

Item	Specification
Model	1910 — Wave Oracle™
Format	2 MU; standard Synthesizers.com (Dotcom) format
Inputs	Four channels (Inputs 1–4), each with two connected signal jacks
Controls	Five physical push buttons and one rotary push encoder
Display	320 × 240 color TFT LCD; tap-to-HOLD (where available)e
Modes	SCOPE, XY, FFT, TUNER, METERS, ART and LEARN
XY inputs	Input 1 = X; Input 2 = Y
ART input	Input 1
LEARN signals	Built-in demonstrations; no external signal required
Power connection	Standard Synthesizers.com 6 pin power header
Approximate current draw	+15 V DC: 55 mA +5 V DC: 100 mA −15 V DC: 35 mA
Width	4.25 inches (2 MU)
Depth behind panel	Approximately 1.25 inches

13. Glossary

A quick reference to the signal and display terms used in this manual.

AC coupling — Removes a signal's steady DC component so you can examine its changing part. Useful for viewing a waveform riding on an offset.

Amplitude — The size of a signal. A peak value and a peak-to-peak value describe different ways of measuring that size.

Bipolar — Moving both above and below zero volts. A ± meter range shows both sides of that movement.

Cent — One hundredth of a semitone. A tuner reading in cents tells you how far a note is sharp or flat.

Control voltage (CV) — A voltage that controls another parameter, such as oscillator pitch, filter cutoff or VCA level.

DC coupling — Shows the changing and steady parts of a signal, preserving its position relative to zero volts.

DC offset — A steady voltage that shifts a signal above or below zero without changing its waveform shape.

FFT — Fast Fourier Transform: the calculation used to separate a signal into its frequency components for a spectrum display.

Frequency — How often a repeating signal completes a cycle. Measured in hertz (Hz), or cycles per second.

Fundamental — The basic repeating frequency of a periodic sound. Its harmonics occur at whole-number multiples of that frequency.

Glossary continued

Harmonic — A frequency component at a whole-number multiple of the fundamental. Different mixtures of harmonics help give sounds their character.

HOLD — Pauses the live view for inspection. Tap again to resume where supported; SCOPE SINGLE uses WAIT instead.

LFO — Low-frequency oscillator: a slowly changing signal commonly used for modulation, such as vibrato or filter movement.

Period — The time taken by one complete cycle. A 5 Hz signal has a period of 0.2 seconds, or 200 milliseconds.

Phase — The relative position of two repeating signals within their cycles, often expressed in degrees.

Spectrum — A view of the frequencies present in a signal and their relative levels.

Timebase — The horizontal time scale in SCOPE, shown as time per division. Changing it changes how much time you see.

Trigger — An event used to start or align a SCOPE acquisition, such as a signal crossing a chosen voltage in a chosen direction.

Vpp — Volts peak-to-peak: the difference between the highest and lowest voltages. A signal swinging from −5 V to +5 V is 10 Vpp.

VU — An audio-level meter with a deliberately smooth response, useful for judging general level rather than every brief peak.

WAIT — The SCOPE SINGLE action that resets and re-arms the acquisition so another qualifying trigger can be captured.

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(Props to: Dr. McCoy and Pink Floyd)