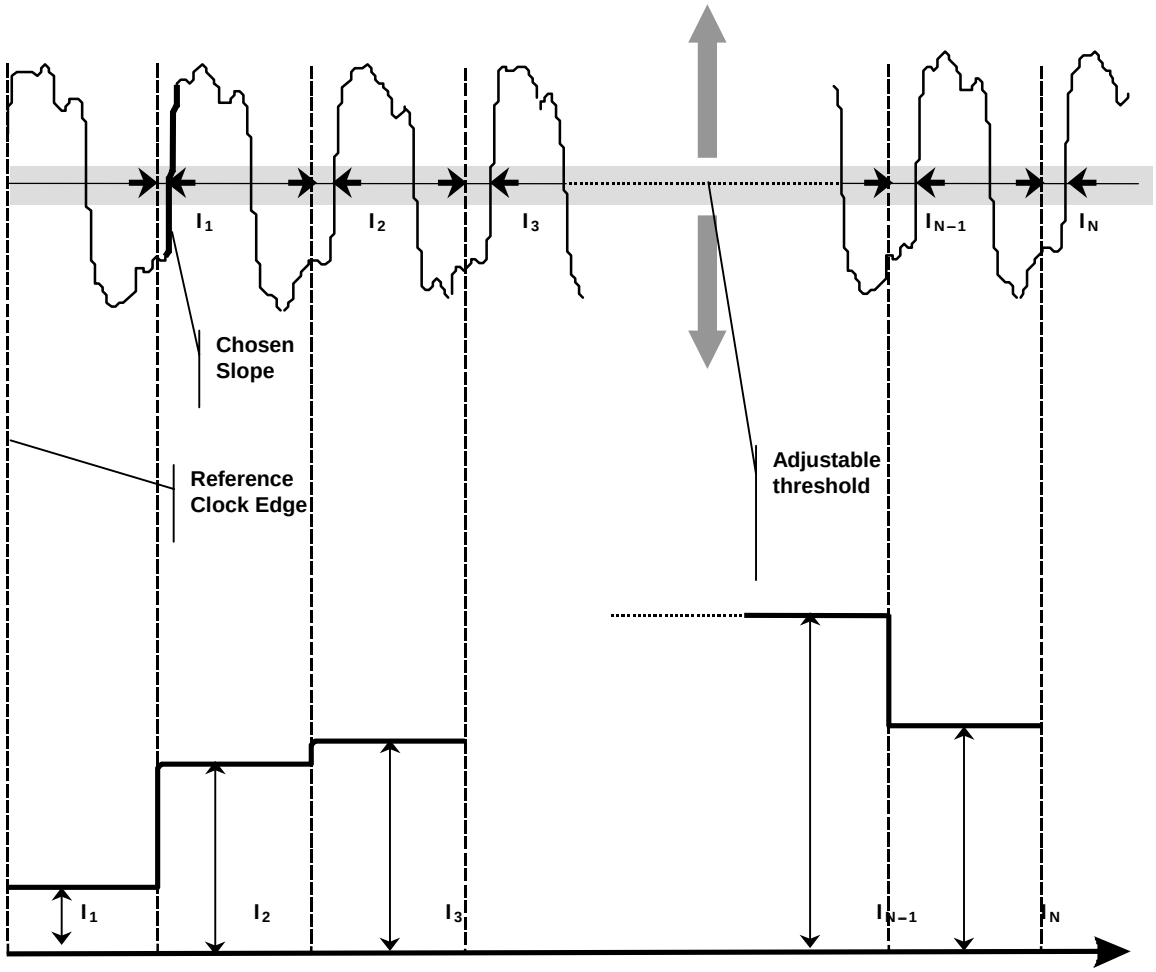
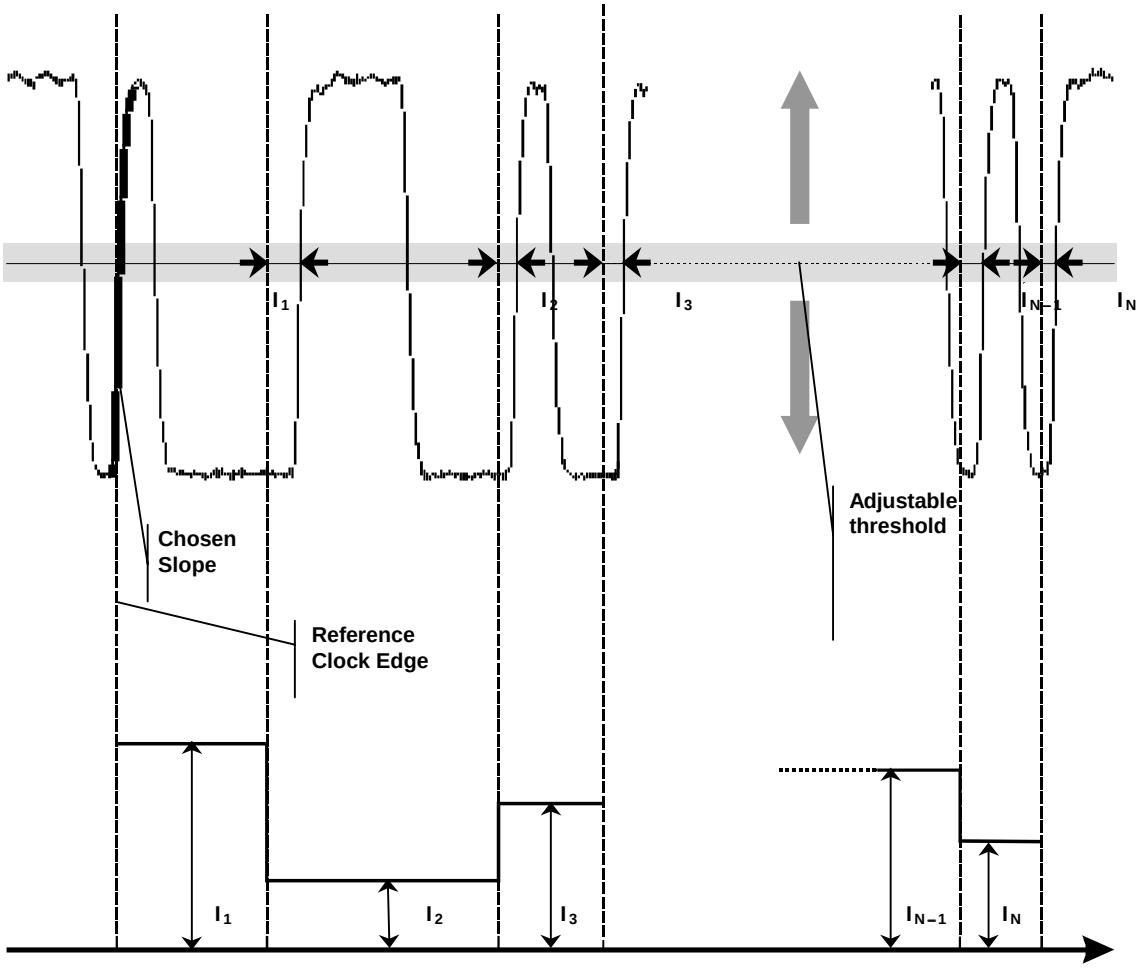
How JitterTrack™ Tracks Down Jitter…



…Using Clock or Data

Use this function to plot as a bar chart the evolution over time of this and five other waveform attributes in simple steps. **Illustration this page:** How **JitterTrack's** Interval Error works when Clock Mode is selected**; Illustration next page:** When Data Mode is selected.

1. **Set the desired reference clock frequency for an ideal position against which the signal is to be compared, or use "Find Frequency."**
2. **Specify the level at which the jitter measurement is to be made, as well as the rising or falling edge on which the measurement is to start.**
3. **Timing errors are graphically revealed.**



When to Use JitterTrack

The JitterTrack Function charts the evolution in time of these waveform attributes:

Cycle-to-Cycle deviation

Duty Cycle

Time Interval Error

Period

Half Period

Frequency

Width (Pulse)

Skew

Setup

Hold

Each is time-correlated to its source trace and contains the same number of points as the waveform.

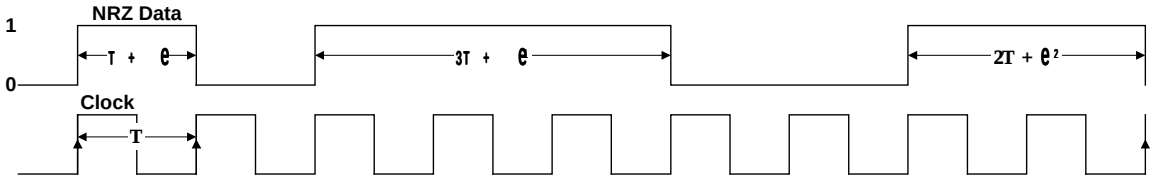
JitterTrack or Trend?

Whether it is more appropriate to use **JitterTrack** or the statistical tool, Trend (described in Chapter 8), will largely depend on the application, as well as the other factors set out in the tables below. While **JitterTrack** sample points are evenly spaced in time, those of Trend are not. Trend plots any parameter available in the instrument against its event count, as in a scatter or an XY diagram.

Characteristic	Trend	JitterTrack
Representation	parameter value vs. events	attribute value vs. time
Attributes or Parameters Supported	All Parameters (See Chapter 11 of the instrument operator's manual for a complete list and description)	Cycle-Cycle Duty Cycle Time Interval Error Period Half Period Frequency Pulse Width

		Skew Setup Hold
Behavior	Cumulative over several acquisitions up to 20 000 events	Non-cumulative (resets after every acquisition) Unlimited number of events

When you need to…	Use…
Monitor the evolution of a waveform parameter or attribute over several acquisitions...	***Trend*** — Jitter works only on one acquisition at a time
Time-correlate an event and a parameter value...	***JitterTrack***
Monitor an evolution in the frequency domain...	***JitterTrack*** — Trend points are not evenly spaced in time and therefore cannot be used for FFT (Fast Fourier Transform).
Monitor parameters that are not specific to Jitter and Timing measurement	***Trend***



Random NRZ (Non-Return to Zero) data stream and its corresponding clock signal (see next page).

Clock or Data?

For most waveform attributes, JitterTrack offers the choice of Clock or Data modes for measuring clock signals or data streams. "Data" should be used — where available — when the pulse widths, intervals, periods or other significant instants being measured are randomly distributed and contain multiples of the clock period.

On the one hand, apart from jitter, clock signals ought to be regular. On the other hand, data streams by their very nature have irregular pulse widths.

A clock signal is normally required to characterize jitter. But such a signal will not be available if the waveform being measured is a data stream, whose very randomness hides the clock signal. To overcome this, **JitterTrack** provides both Clock and Data modes. Selecting **Datastream** from the *Setup Wizard* **Measure** menu, or **Data** from the **Type** menu in the math setup for **JitterTrack**, gives the superior timing resolution through normalization (*see below*) required for correctly measuring jitter in data signals.

The diagram on the previous page shows a data stream in relation to its clock signal. It illustrates how data pulses contain, within themselves, multiples of their clock-signal pulse widths. Analyzing the positive pulses in the data stream, we observe a great variance between each sample in, for instance, the range T to 3T. In fact, it is the small variations (the jitter) that are important. And they could be normalized if clock frequency, and clock frequency over pulse width, were known. This normalization, provided by **JitterTrack,** reduces pulse variations and increases timing resolution so that errors (ε) can be clearly observed. It does this by reducing the jitter range, dividing each measurement equal to $n \times T$ by n.

Modes	CLOCK	DATA
Jitter Range	$3T + \varepsilon$	$\varepsilon << 3T$
Resolution	coarse	fine

Comparing a random data stream analyzed using Clock and Datastream/ Data modes.

Advanced JitterTrack Setup and Configuration

Quickly displaying a JitterTrack of a clock or data signal was already discussed in Chapter 1 when the operation of the JITTER VIEWS TOOLBAR was described. However, there are times when you may want to trade off the ease of use of the JitterTrack button for more flexibility. This section is intended to provide you with the detail on how to set up a JitterTrack, or multiple JitterTracks, on any of the Math Traces.

1. Press MATH TOOLS on the Jitter and Timing Analyzer front panel to display the **Zoom + Math** menus. They allow redefinition of any of the four traces A, B, C and D. Access their **Setup** menus. (Alternately, press the Trace A, B, C, or D button to access the **Setup** menu directly, and skip step 2 below).
2. Press the menu key for **Redefine A**, to configure the function — on Trace A for this example.
3. Select **Jitter** from the "Math Type" menu and use the menus shown here to configure any of the 10 *JitterTrack* types described on the pages that follow.

Use Math?

To choose a math function, in this case a **JitterTrack**.

Math Type

For selecting **Jitter**.

MORE JITTER SETUP

To access the **Jitter B** menu group (next page).

FIND JITTER TRACE

Scales **JitterTrack** automatically, once calculated. The instrument accumulates all timing values contained in the source waveform and then, when the corresponding menu button is pressed, automatically scales the **JitterTrack** to display the highest and lowest values that mark the limits of the range.

Type

For selecting one of **JitterTrack's** 11 waveform attributes, using the associated menu knob. And, where the chosen attribute allows it, to additionally select either the **Clock** or **Data** mode (see previous pages), using the corresponding menu button. Here**, Interval Error** and **Data** are chosen, and are used for the examples that follow.

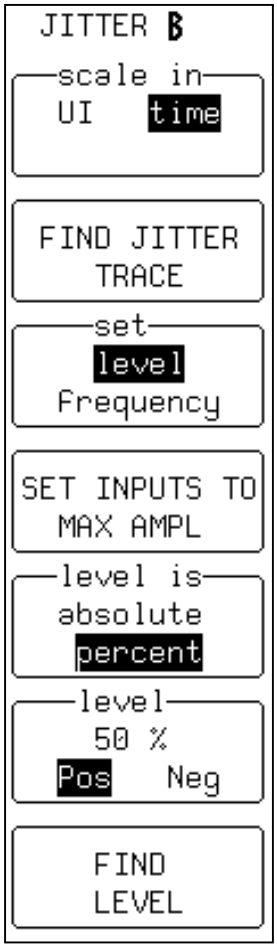
Of

For selecting the source trace. This will default to the source chosen in the *Setup Wizard* menu, if the *Setup Wizard* was used.

The menus shown on this and the following pages are displayed when Interval Error is the selected waveform attribute and the menu button for MORE JITTER SETUP is pressed. Other JitterTrack functions may not display the same menus. However, the menus shown here, as well as their descriptions, are representative of those that serve all 11 attributes.

JITTER (Level):

These menus appear when **level** is chosen from **set**, below.



scale in

Expresses the attribute in either **UI** unit intervals or seconds (**time**).

FIND JITTER TRACE

Scales **JitterTrack** automatically, once calculated.

set

Enables the choice of either **level** or **frequency** setup (see next page). When **level** is chosen, the menus below reflect this.

level is

Appears when **level** is selected from the **set** menu (see above). Determines whether the levels should be set in **absolute** – in volts – or as a **percent**(age) of signal amplitude.

SET INPUT TO MAX AMPL

If the source is a channel, pressing this button is equivalent to selecting VAR gain and pressing FIND, for the source channel. This maximizes SNR, which can improve measured jitter.

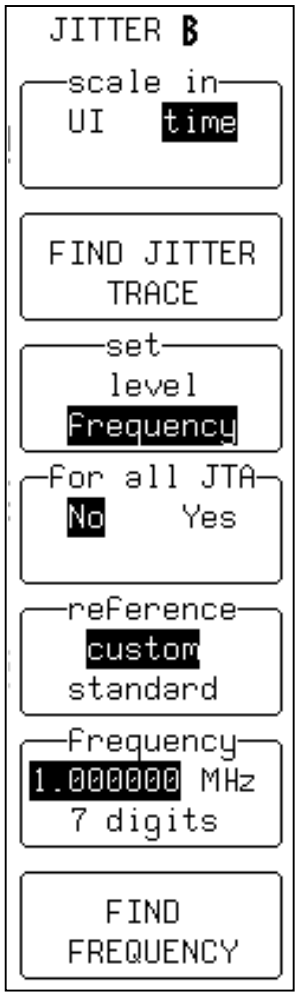
level

Appears when **level** is selected from the **set** menu (above), for selecting the voltage or amplitude-percentage setting of the level on the waveform at which the timing is to be measured. Also to select whether the measurement should be made on a **Pos**(itive or rising) edge, or a **Neg**(ative or falling) edge.

FIND LEVEL

Appears when **level** is selected from the **set** menu (above). Automatically finds and sets the threshold to the appropriate level.

JITTER (Frequency): These menus appear when **frequency** is chosen from **set**, below.



scale in

Expresses the attribute in either **UI** (unit intervals) or **time** (in seconds).

FIND JITTER TRACE

Scales **JitterTrack** automatically, once calculated.

set

Enables the choice of either **level** or **frequency** (see next page) setup. When **frequency** is chosen, the menus below reflect this.

For all JTA

Global effect: when **YES**, the frequency will apply to all jitter and timing parameters for which data is available.

reference

Enables the choice for the reference clock of either a **custom**, user-defined, frequency or selection from a list of **standard**, pre-defined, frequencies. The frequency is adjusted using the menu immediately below.

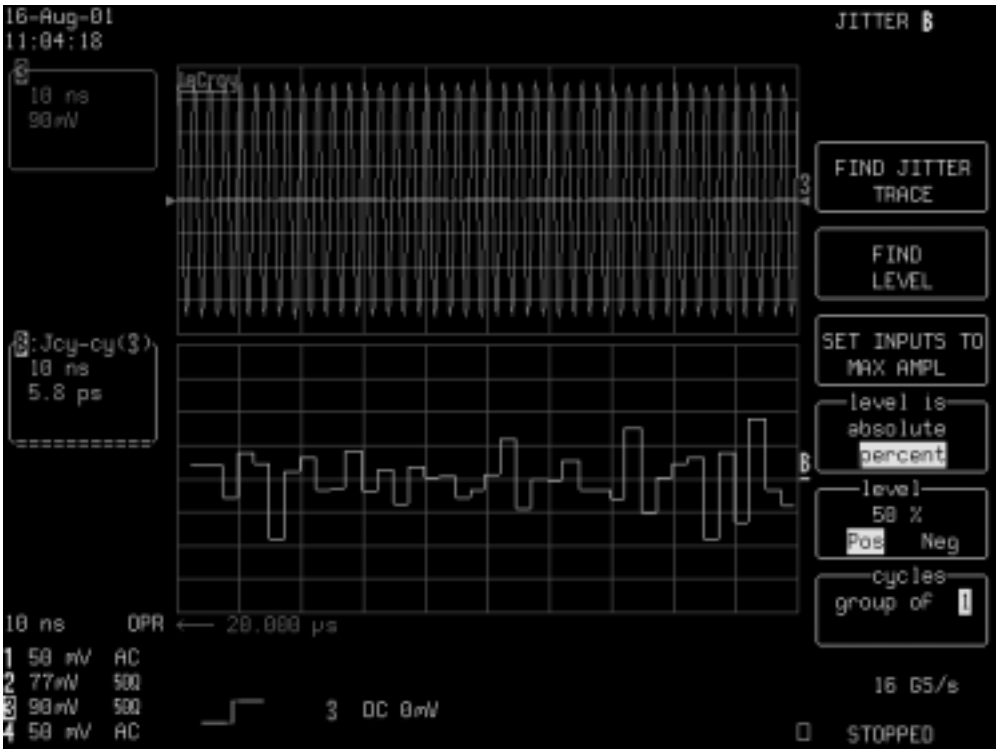
frequency

When **custom** is chosen from the **Reference** menu, a particular user-defined frequency can be selected. The corresponding button for this menu highlights either the mantissa, or the frequency decade or number of digits, while the associated knob changes the value highlighted. When **standard** is chosen, selection from a number of pre-defined frequencies can be made for the reference clock, using the menu button.

FIND FREQUENCY

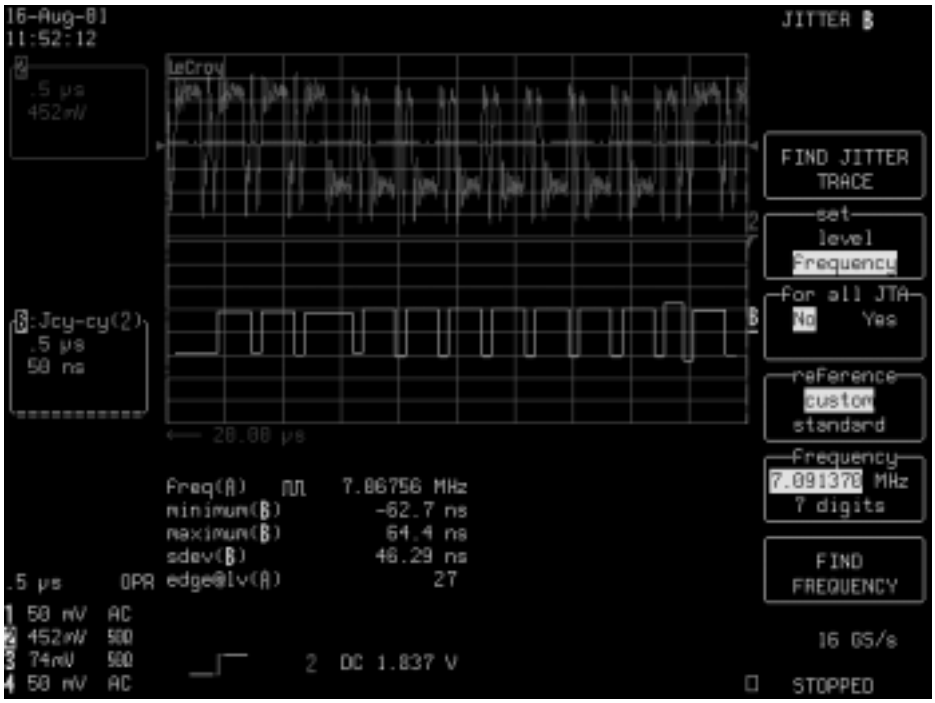
Appears when **frequency** is selected from the set menu (above). Automatically detects frequency and sets the bit rate.

Cycle-Cycle: Clock



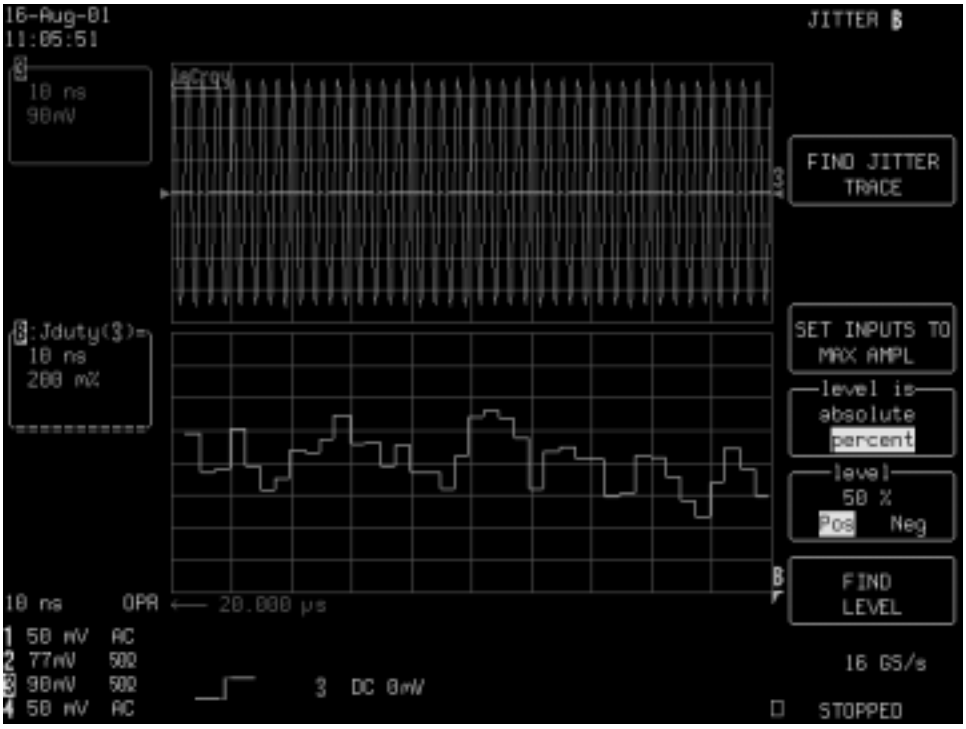
Cycle-Cycle JitterTrack on a clock signal

Cycle-Cycle: Data



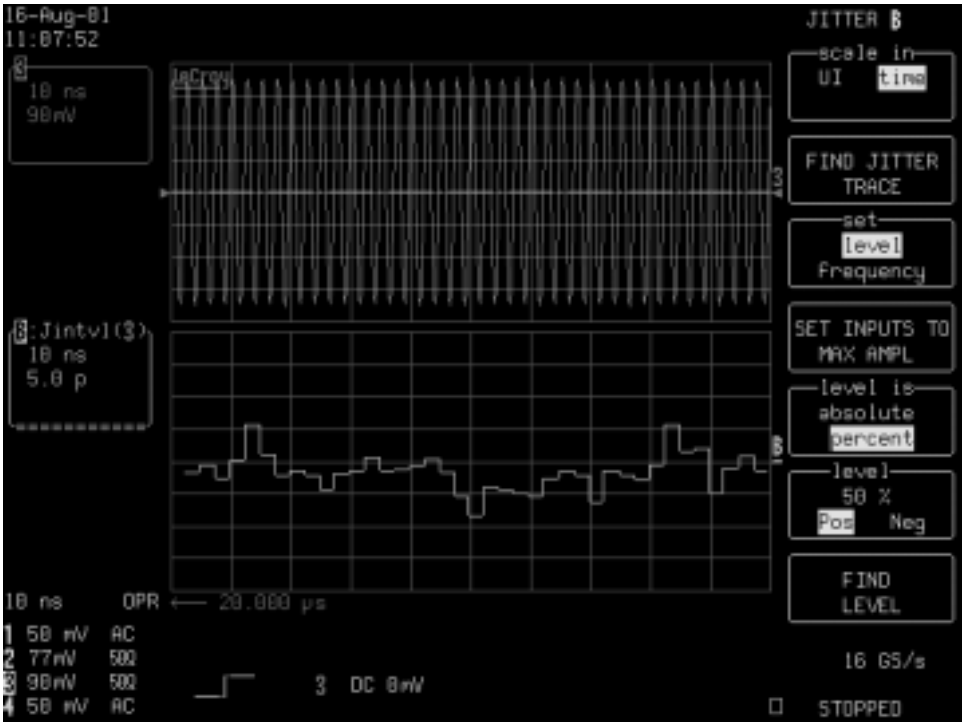
Cycle-to-Cycle JitterTrack on a data signal: Charts the differences in consecutive cycles across the waveform. When in Data Mode, JitterTrack normalizes cycle-cycle values to the clock frequency, which can be either automatically extracted from the data signal using Find Frequency or entered manually

Duty Cycle



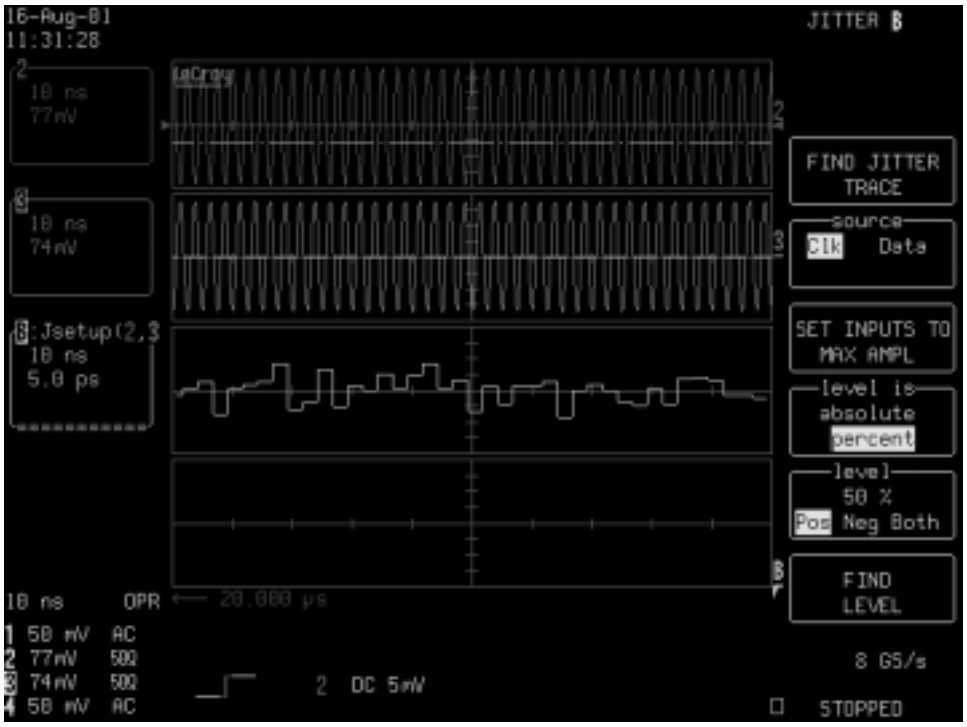
Duty Cycle JitterTrack*:* Charts consecutive duty cycles across the waveform. When the corresponding menu button is pressed, Find Jitter Trace automatically scales the JitterTrack to display the highest and lowest values that mark the limits of the range.

Time Interval Error: Clock



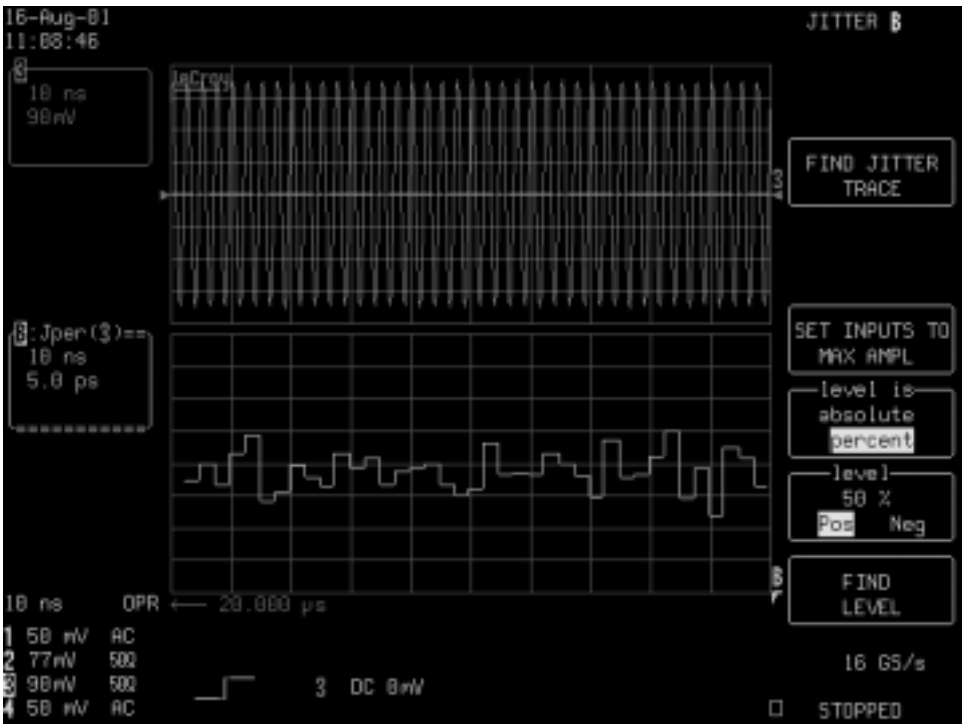
Time Interval Error JitterTrack on a clock signal*:* Charts the timing errors across the waveform by comparing the signal with a user-selected reference, in this case an ideal clock frequency of 400 MHz. The level can be set automatically using Find Level or entered manually.

Time Interval Error: Data



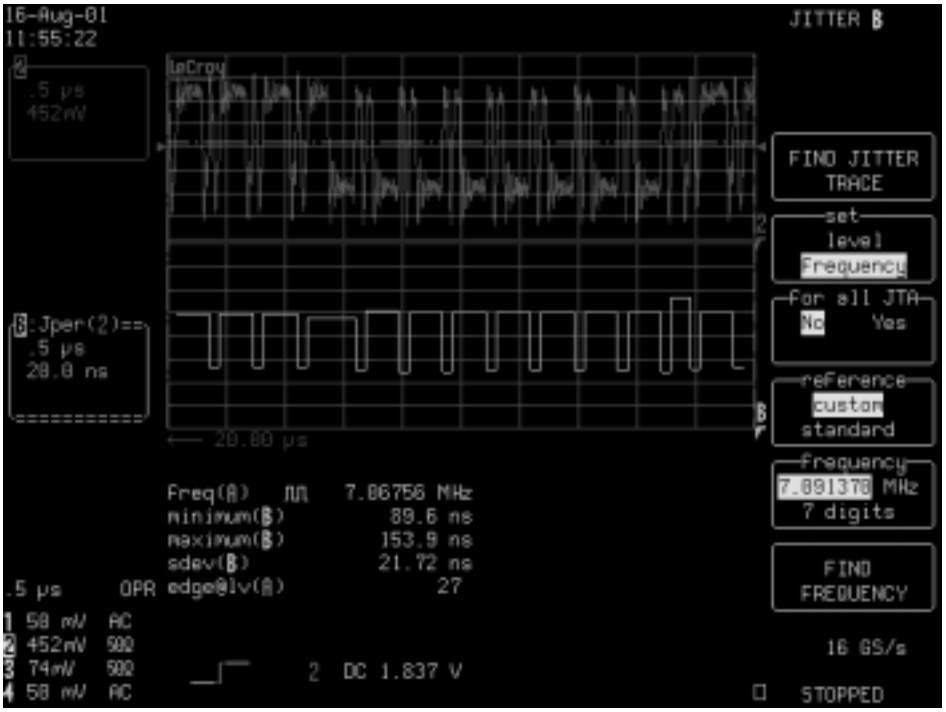
Interval Error JitterTrack on a data signal: Charts the timing errors across the waveform by comparing the signal with a user-selected reference. When in Data mode, Interval Error normalizes the interval error values to the clock frequency to increase timing resolution

Period: Clock



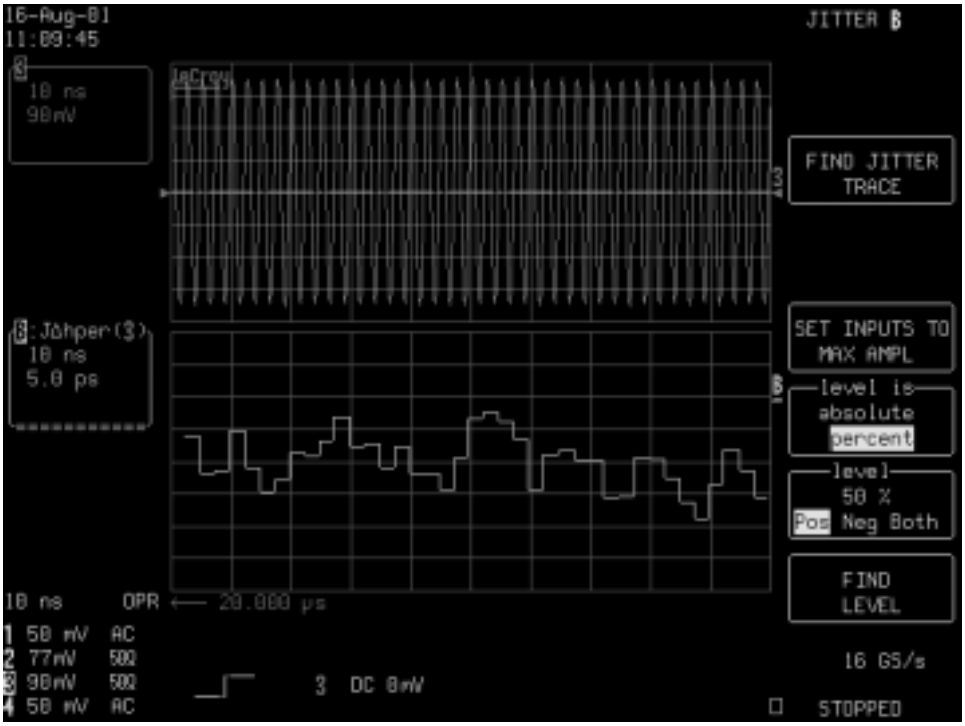
Period JitterTrack on a clock signal: Charts the periods across the waveform. The level can be set automatically using Find Level or entered manually.

Period: Data



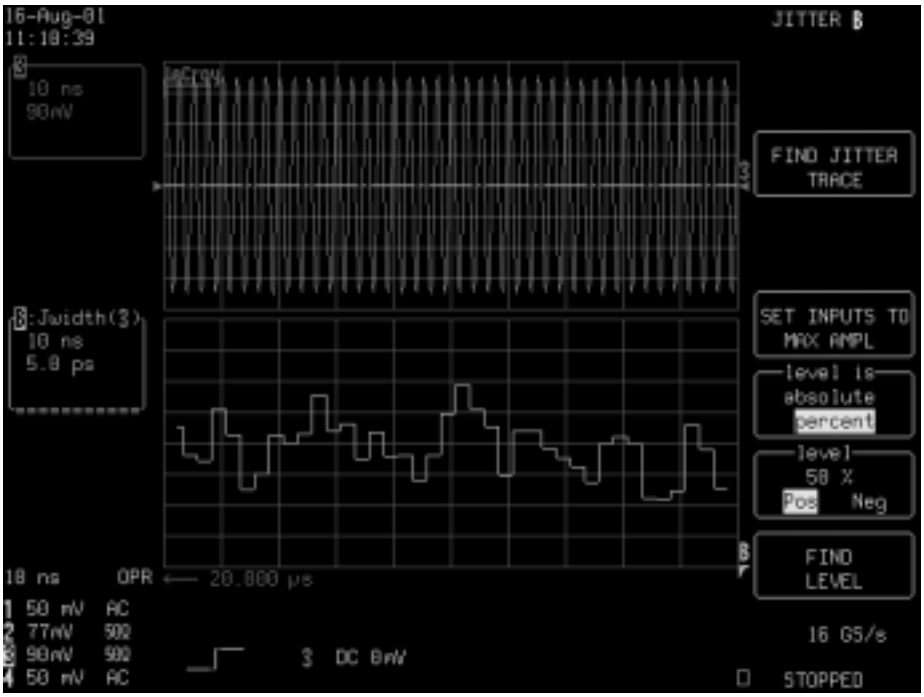
Period JitterTrack on a data signal: Charts the periods across the waveform. When in Data mode, JitterTrack normalizes cycle-cycle values to the clock frequency, which can be either automatically extracted from the data signal using Find Frequency or entered manually.

Half Period



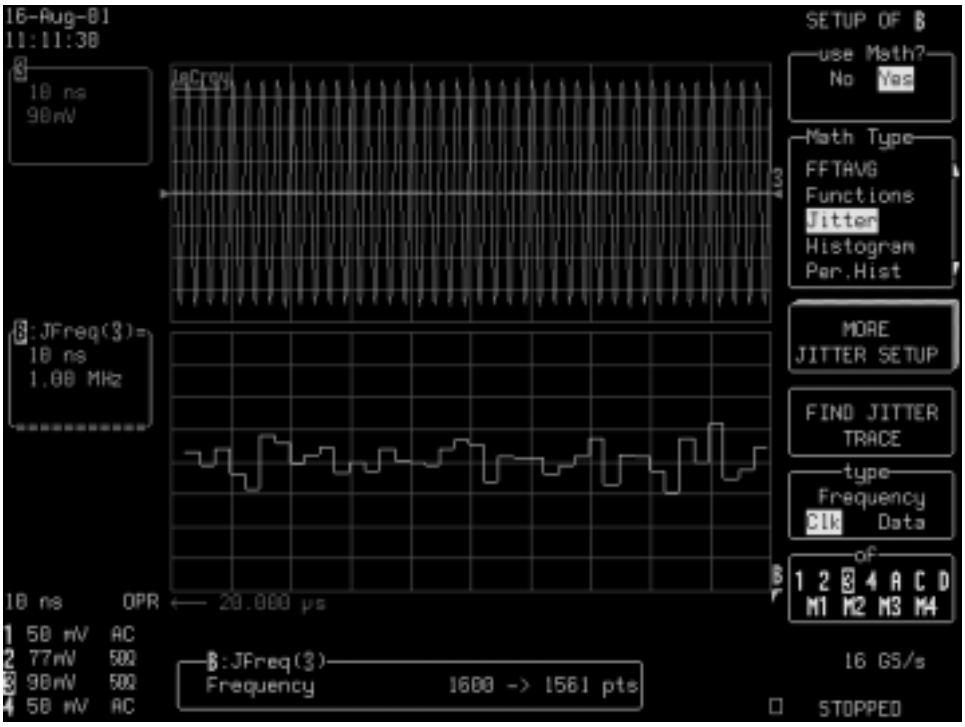
Half Period JitterTrack: Charts the relation of a half period to the full period that it is a part of, always measuring the half period value of the leftmost half period in the full period. If Level is set to Pos, it measures every other half period beginning with the positive slope of the period. If Level is set to Neg, it measures every other half period beginning with the negative slope of the period. If Level is set to Both, it measures every half period.

Width



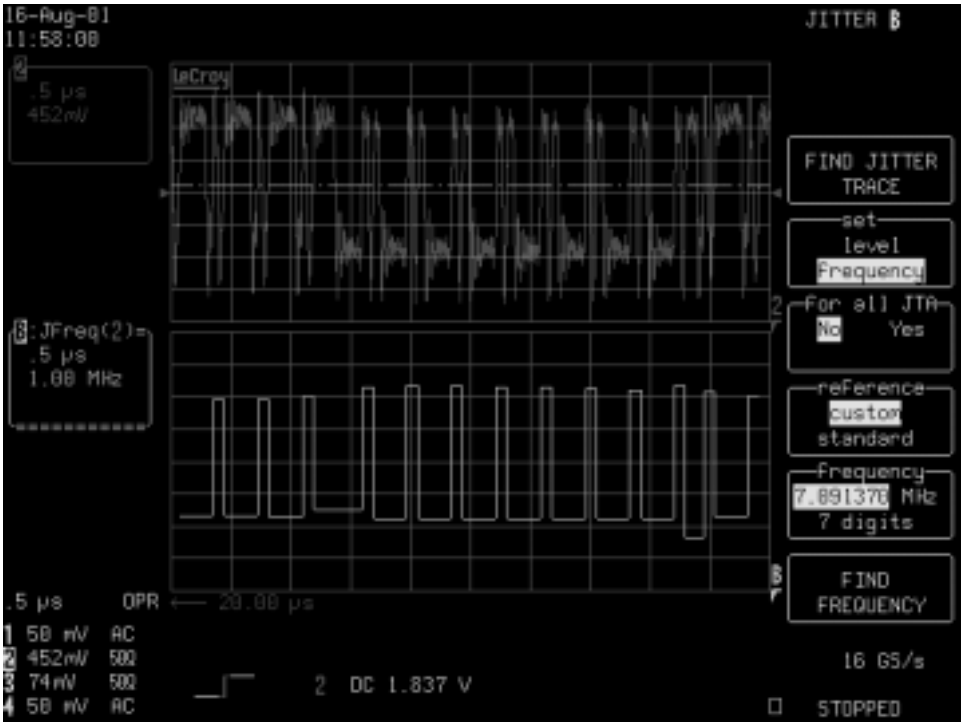
Width JitterTrack: Charts the pulse widths across the waveform. Note the number of sample points used by the measurement indicated in the field beneath the grid. When the corresponding menu button is pressed, Find Jitter Trace automatically scales theJitterTrack to display the highest and lowest values that mark the limits of the range.

Frequency: Clock



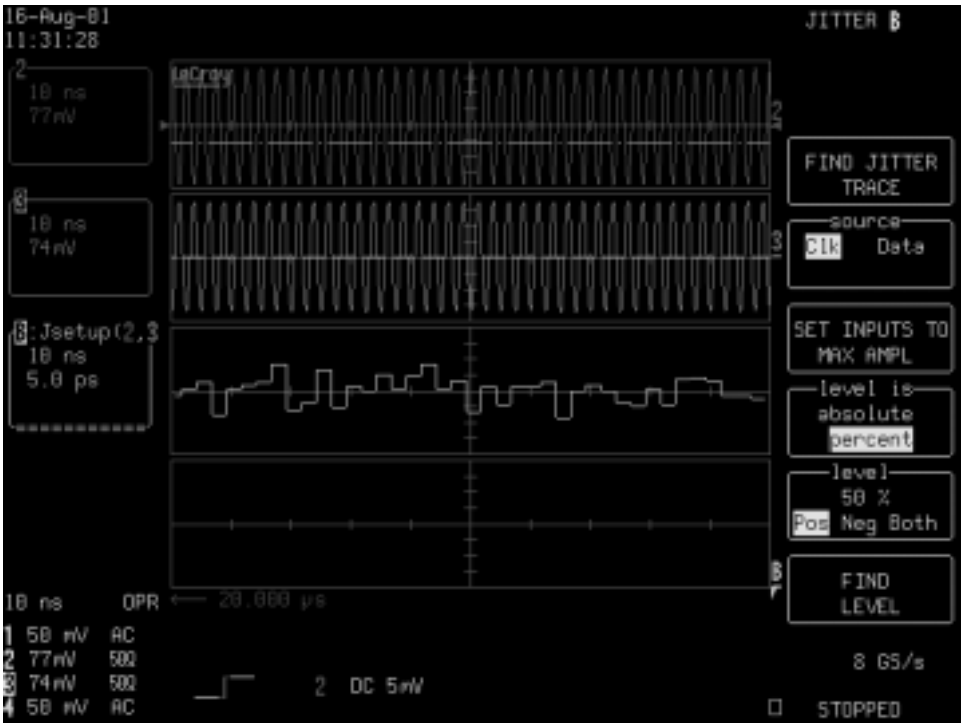
Frequency JitterTrack on a clock signal: Charts frequency across the waveform. The level can be set automatically using Find Level or entered manually.

Frequency: Data



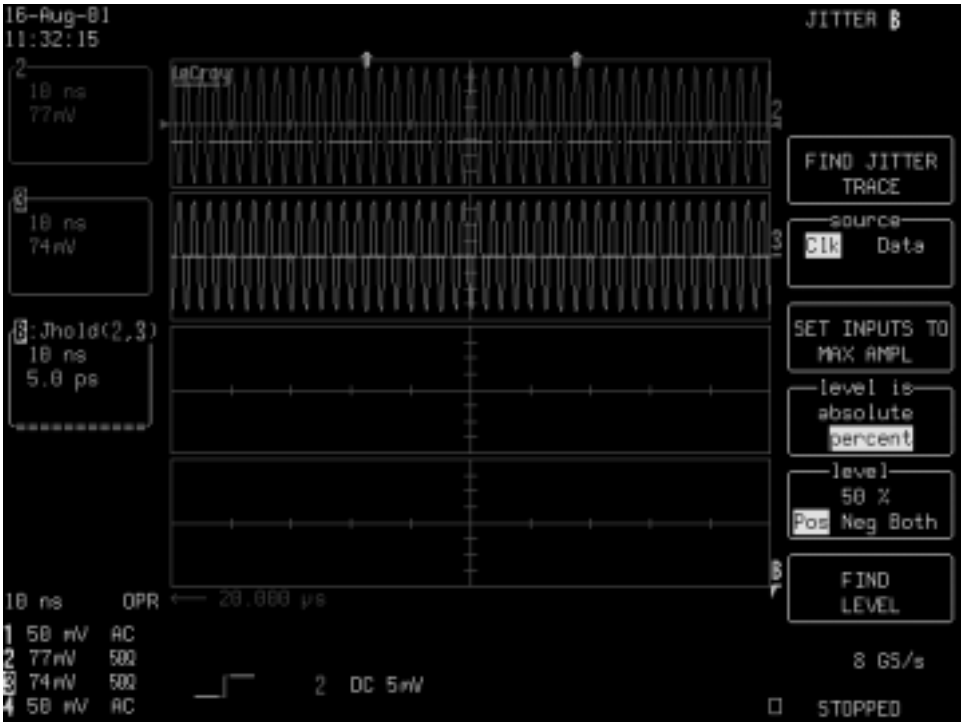
Frequency JitterTrack on a data signal: Charts frequency across the waveform. When in Data mode, JitterTrack normalizes data frequency values to the clock frequency, which can be either automatically extracted from the data signal using Find Frequency or entered manually.

Setup



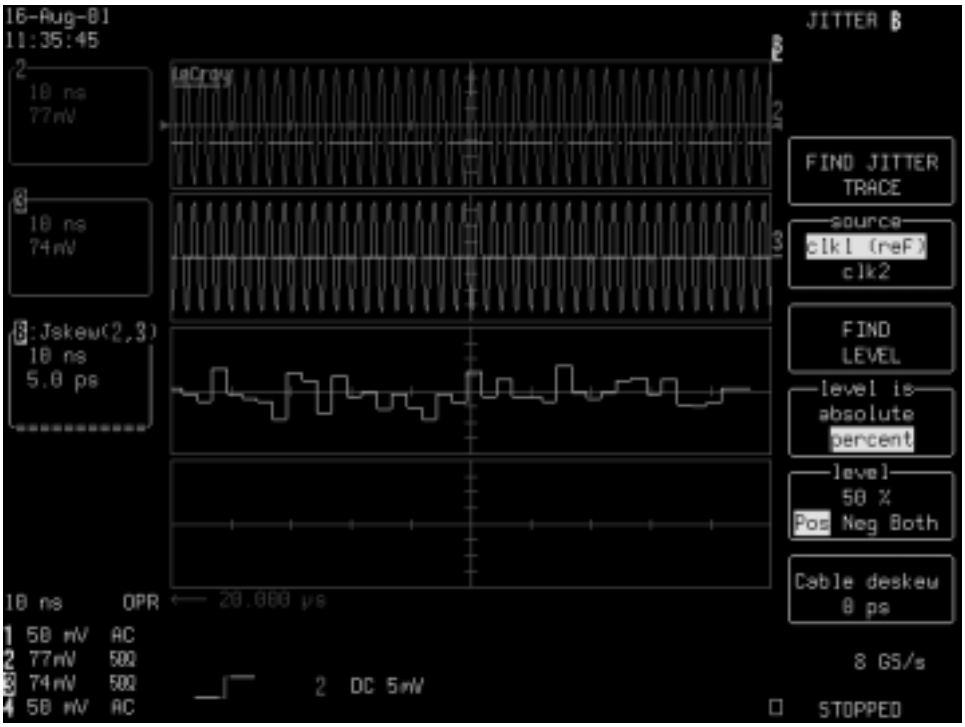
Setup: Charts absolute value of time between data edge nearest next clock edge.

Hold



Hold: Charts absolute value of time between data edge to nearest previous clock edge.

Skew



Skew: Charts skew between two signals.

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