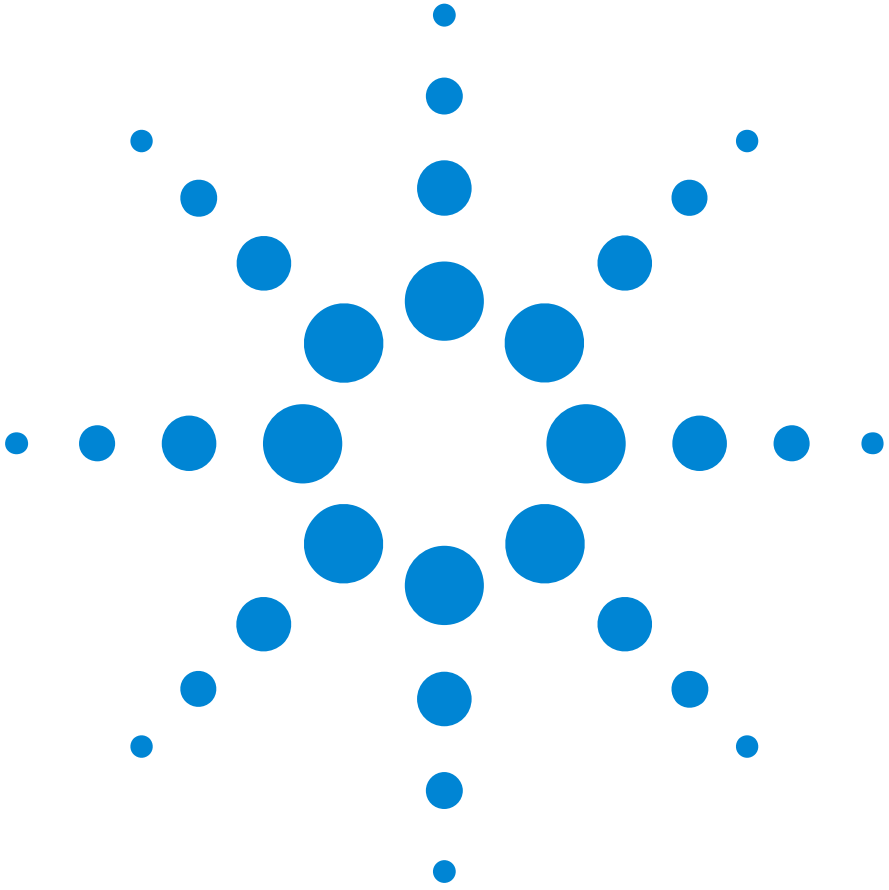

Agilent E8311/12A 165/330 MHz Pulse and Pattern Generators

Quick Start Guide

Agilent Technologies

Notice

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Notice

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Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment. Agilent Technologies further certifies that its calibration measurements are traceable to the United States Institute of Standards and Technology, to the extent allowed by the Institute's calibrating facility, and to the calibration facilities of other International Standards Organization members.

Services and Support

Any adjustment, maintenance, or repair of this product must be performed by qualified personnel. Contact your customer engineer through your local Agilent Technologies Service Center. You can find a list of local service representatives on the Web at:

http://www.agilent.com/Service/English/index.html

Safety Summary

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies Inc. assumes no liability for the customer's failure to comply with these requirements.

General

This product is a Safety Class 1 instrument (provided with a protective earth terminal). The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

All Light Emitting Diodes (LEDs) used in this product are Class 1 LEDs as per IEC 60825-1.

Environmental Conditions

This instrument is intended for indoor use in an installation category II, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 95% and at altitudes of up to 2000 meters. Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

Before Applying Power

Verify that the product is set to match the available line voltage, the correct fuse is installed, and all safety precautions are taken. Note the instrument's external markings described under “Safety Symbols” on page 8.

Ground the Instrument

To minimize shock hazard, the instrument chassis and cover must be connected to an electrical protective earth ground. The instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Fuses

Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified service personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Safety Symbols

Caution (refer to accompanying documents)

Protective earth (ground) terminal

In the manuals:

WARNING

Warnings call attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury or loss of life. Do not proceed beyond a Warning until the indicated conditions are fully understood and met.

CAUTION

Cautions call attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the equipment. Do not proceed beyond a Caution until the indicated conditions are fully understood and met.

About this Book

The quick start helps you to quickly familiarize yourself with the features and the user interface of the Agilent E8311A/12A instruments. The documentation focuses on the Agilent E8311A. Reference is made to the differences between the Agilent E8311A and Agilent E8312A instruments.

"Introducing the Agilent E8311/12A Pulse and Pattern Generators" on page 9 gives a general overview of the Agilent E8311A and Agilent 8312A instruments.

"Getting Started" on page 15 gives the setup information for some real-world signal examples, which can easily be used by varying only some parameter values.

"Using the Agilent E8311/12A" on page 49 provides complete information on the soft panel user interface pages.

In *"Specifications" on page 85* you will find all required information for safety operation and also the definitions for the pulse parameters.

Contents

Introducing the Agilent E8311/12A Pulse and Pattern Generators

The purpose of this introductory chapter is to give a general overview of the Agilent E8311A and Agilent E8312A VXI instruments.

The main features and methods of use are described in *"What You Can Do with the Agilent E8311/12A" on page 10*.

The front panels with their inputs and outputs are depicted and described in *"The Front Panels" on page 11*.

What You Can Do with the Agilent E8311/12A

This section introduces the basic features and methods of use of the Agilent E8311A VXI instrument. Reference is made to the differences between the Agilent E8311A and the Agilent E8312A instruments.

Basic Features

The Pulse and Pattern Generators generate all the standard pulses and digital patterns needed to test all current logic technologies (for example, TTL, CMOS, ECL, PECL, LVDS, GTL) and other digital designs up to 165 MHz with the Agilent E8311A instrument and up to 330 MHz with the Agilent E8312A instrument.

The instruments feature two internal oscillators:

- a synchronously triggerable internal oscillator
- an accurate, stable internal PLL

For even more accuracy, an external frequency reference can be connected.

The instruments provide a reliable and wide range of signals. Any timing parameter can be varied without glitch and drop out. This contributes to more accurate and reliable characterizations of the device under test (DUT).

With the Agilent E8311A the output channels can be used separately or be **added** to form complex signals such as multi-level waveforms (analog channel add).

Automated Testing

Using the VXI*plug&play* driver commands, the new product can be easily integrated into all phases of test-system development such as planning rack integration and test program generation. These benefits combined with the low cost of ownership make the Agilent E8311/12A an invaluable instrument for a wide range of technical applications.

The Front Panels

This section shows the front panels of both Agilent E8311A and E8312A instruments and describes their input and output connectors.

Front Panel Agilent E8311A

The following figure shows the front panel of the Agilent E8311A with its input and output connectors.

Front Panel Agilent E8312A

The following figure shows the front panel of the Agilent E8312A with its input and output connectors.

Inputs and Outputs

The major inputs and outputs of the instruments Agilent E8311A and Agilent E8312A are:

- EXTERNAL IN

  Can be used to connect an external arming source (triggered or gated modes) and to generate leading and trailing edges (external width mode). For details, please refer to *"The Mode/Trigger Page" on page 52*.

- CLOCK/REF IN

  Can be used to connect either an external clock signal or a reference signal for the internal PLL if a higher frequency accuracy than 0.01% is required. See *"The Mode/Trigger Page" on page 52* and *"The Configuration Page" on page 80*.

- STROBE OUT

  Is used only in burst and in pattern mode.

  – In burst mode the strobe output rises at the start of the first pulse period and falls at the start of the last pulse period.

  – In pattern mode the strobe output can be programmed for each bit. See *"The Mode/Trigger Page" on page 52* and *"The Pattern Page" on page 75*. You can set the output levels to TTL or ECL. See *"The Trigger-Level Page" on page 79*.

- TRIGGER OUT

  Marks the start of each pulse period. See *"The Mode/Trigger Page" on page 52*.

  You can set the output levels to TTL or ECL. See *"The Trigger-Level Page" on page 79*.

- OUTPUT

  – **Agilent E8311A**:

  The output connectors provide the normal signal output for channel 1 and channel 2.

  – **Agilent E8312A**:

  The output connectors provide the normal and inverted signal outputs for channel 1 and channel 2.

LEDs on the Front Panel

The LEDs on the front panel are:

- "Failed" LED

  This red LED is lit during module initialization. If it does not turn off after initialization, please contact your local Agilent support center.

- "Access" LED

  This green LED flashes while the module is accessed by the controller.

NOTE If the "Access" LED flashes continuously, for example, flash–flash–flash, pause, flash–flash–flash, pause and so on, please record this error code (number of continuous flashes) and contact your local Agilent support center.

- LEDs at the outputs

  These green LEDs show the current state of the outputs (on or off).

Getting Started

The intention of this chapter is to give the necessary steps to set up generic and advanced signals for first-time users of the Agilent E8311A and Agilent E8312A instruments.

Examples are given for the following types of signals:

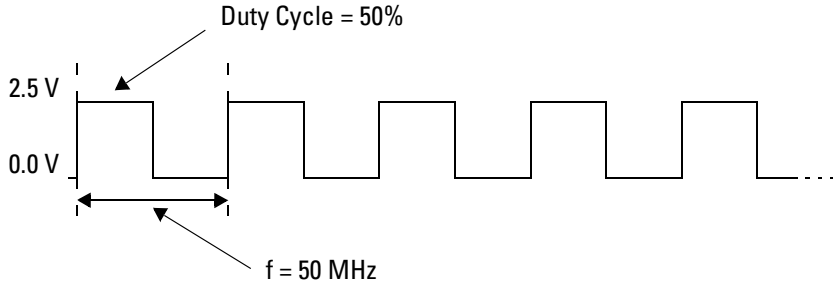
- *"Setting Up a Clock Signal" on page 16*
- *"Setting Up a Pulse Signal" on page 21*
- *"Setting Up a Serial Data Stream Signal" on page 26*
- *"Setting Up an Edge-Displacement Signal" on page 31*
- *"Setting Up a Dual Clock Signal" on page 37*
- *"Setting Up a Burst Signal" on page 43*

To set up all of these signals, you can either use the soft panel interface or the VXI*plug&play* drivers for remote programming. All examples show both ways of signal generation. The remote programming examples have been created using VEE software. Therefore, they cannot be integrated into a C program directly. You can find C programming examples in the online help system of the VXI*plug&play* drivers.

It is intended that you work through the examples in the order in which they appear. The first example therefore provides the most detailed instructions, while the other examples are described in less detail.

Setting Up a Clock Signal

Task Set up a continuous clock signal with a frequency of 50 MHz with PLL accuracy, a duty cycle of 50%, 800 ps transition times, a high level of 2.5 V and a low level of 0 V.



NOTE For this example, an Agilent E8312A instrument is used.

Using the Soft Panel

First Steps To use the soft panel:

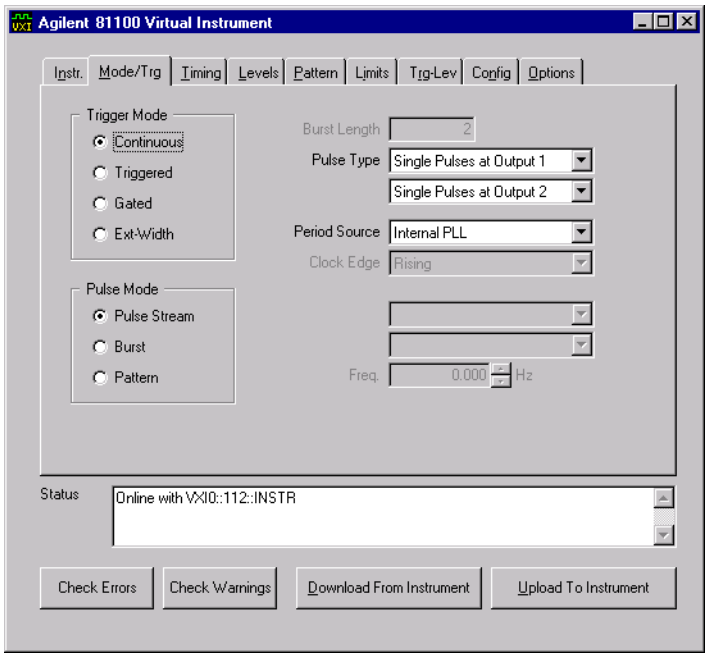
1. Put the instrument into operation.
2. Start the software by selecting *Agilent 81100 Virtual Instrument* from the Windows *Start* menu.

Operating and Trigger Mode To set the **operating and trigger modes** as required:

1. Select the *Config* tab and click the *Reset Instr.* button to reset all parameters and modes.
2. Select the *Mode/Trg* tab.

   The trigger mode *Continuous*, the pulse mode *Pulse Stream* and the pulse type *Single Pulses at Output 1* are selected by default.

3 From the *Period Source* drop down list select *Internal PLL*.



Timing Parameters

To set the **timing parameters** as required:

1 Select the *Timing* tab.

2 Click the *Period* button to select the *Frequency* and enter a value of 50 MHz.

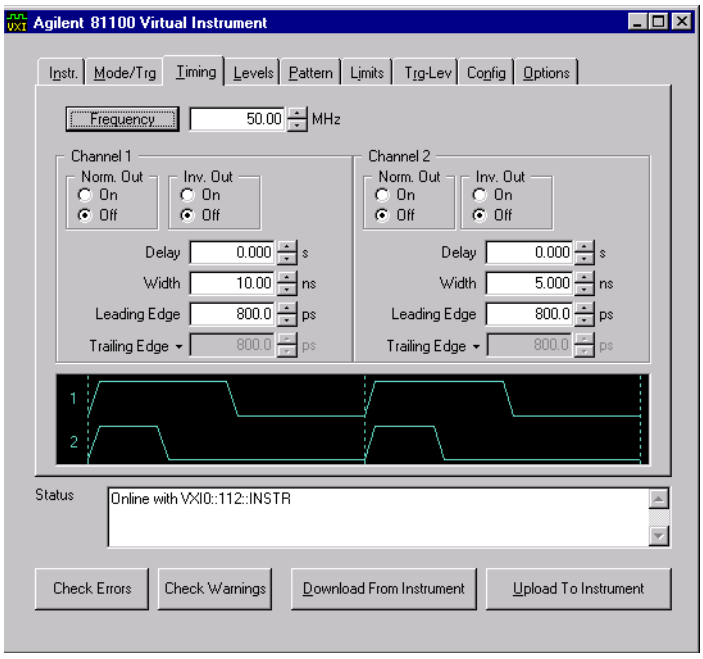
NOTE You can also use the spin buttons to modify the value.

3 Enter a value of 10 ns in the *Width* edit field.

NOTE The duty cycle cannot be entered directly.

4 Enter a value of 800 ps in the *Leading Edge* edit field.

The trailing edge is set to be the same as the leading edge (*Trail Edge* = *Lead Edge*) by default.



Level Parameters

To set the **level parameters** as required:

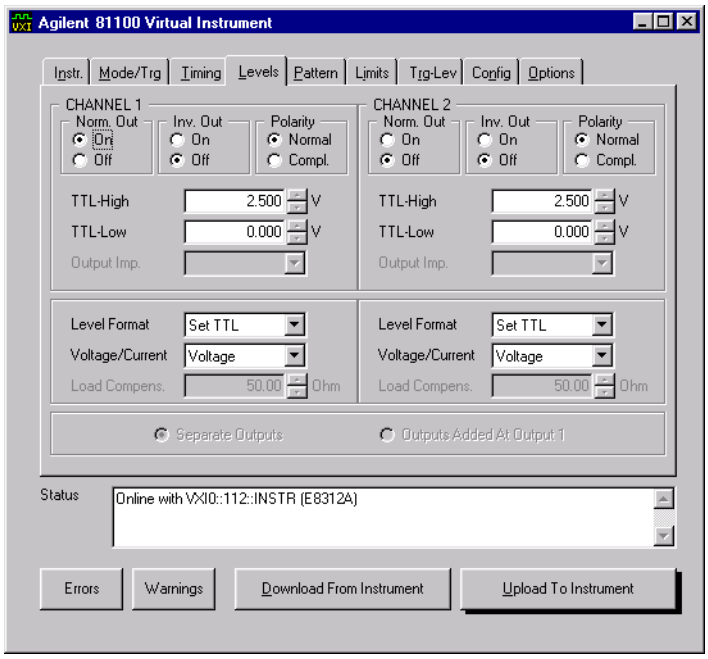
1 Select the *Levels* tab.

2 Select *Set TTL* from the *Level Format* drop down list.

The TTL levels are automatically set—2.5 V and 0.0 V as required.

3 Turn on the normal channel 1 output by selecting the *On* radio button in the *Norm. Out* group.

4 Turn off the inverted channel 1 output by selecting the *Off* radio button in the *Inv. Out* group.

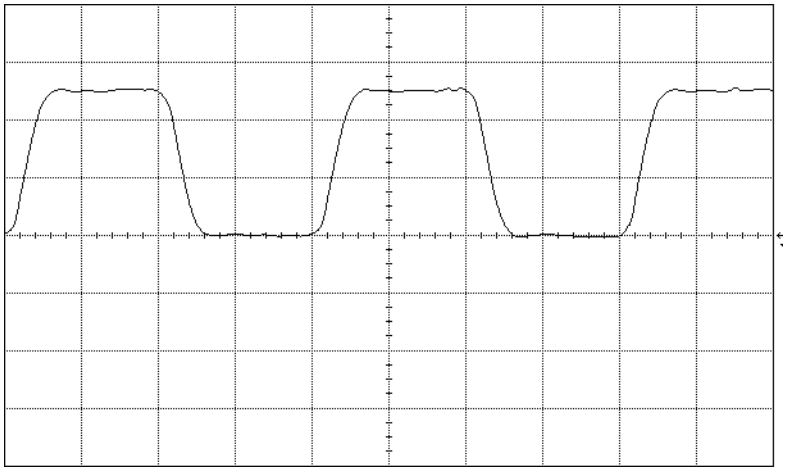


Upload to Instrument

- Click the button *Upload To Instrument* to transfer all parameter settings to the instrument.

Generated Signal

The signal as displayed on a standard oscilloscope is depicted below. Use the generator's TRIGGER OUT to trigger the scope.



Using the VXIplug&play Drivers with VEE

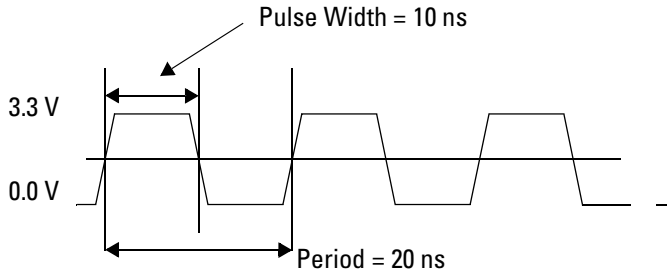
If you want to include this continuous clock signal in a remote program, use the following VXI*plug&play* driver commands.

NOTE For this example, an Agilent E8312A instrument is used. To generate the signal with an Agilent E8311A instrument, replace all hpe8312a instrument identifiers with the hpe8311a (upper case and lower case) and add one function which couples the leading and the trailing edge (see **Note** below).

Function	Comment
`hpe8312a_reset(instrHandle)`	Reset the instrument to start from a defined default state.
`hpe8312a_modeContinuousPulses(instrHandle, HPE8312A_INTERNAL_PLL, HPE8312A_RISING)`	Set the continuous pulse stream mode and the internal PLL as period source.
`hpe8312a_modePulseType(instrHandle, HPE8312A_CHANNEL_1, HPE8312A_SINGLE_PULSES)`	Set the pulse type to single pulses at the channel 1 output.
`hpe8312a_timeWidthDutyCycle(instrHandle, HPE8312A_CHANNEL_1, 50)` `hpe8312a_timeWidthHold(instrHandle, HPE8312A_CHANNEL_1, HPE8312A_DUTY_CYCLE)`	Set the duty cycle to 50%.
`hpe8312a_timeFrequency(instrHandle, 50M)`	Set the frequency to 50 MHz.
`hpe8312a_levelHighLow(instrHandle, HPE8312A_CHANNEL_1, HPE8312A_LEVELS_VOLT, 2.5, 0)`	Set the high and the low signal level to 2.5 V and 0.0 V.
`hpe8312a_timeEdgeLeading(instrHandle, HPE8312A_CHANNEL_1, HPE8312A_UNIT_SEC, 800ps)`	Set the leading edge to 800 ps.
Note: When using the instrument Agilent E8311A, insert the following function in your program because in this case trailing edge and leading edge are not automatically coupled.	
`hpe8311a_timeEdgeTrailingCoupling(instrHandle, HPE8311A_CHANNEL_1, HPE8311A_COUPLING_ON)`	Set the trailing edge to be the same as the leading edge.
`hpe8312a_outputStateNormal(instrHandle, HPE8312A_CHANNEL_1, HPE8312A_OUTPUT_NORMAL_ON)`	Turn on the channel 1 output.

Setting Up a Pulse Signal

Task Set up a continuous pulse signal with 20 ns period, a pulse width of 10 ns, a leading edge of 3 ns, a trailing edge of 5 ns, an amplitude of 3.3 V and an offset of 1.65 V (high level 3.3 V, low level 0.0 V).



NOTE This example can only be executed with Agilent E8311A, because the Agilent E8312A is not able to generate variable slopes.

Using the Soft Panel

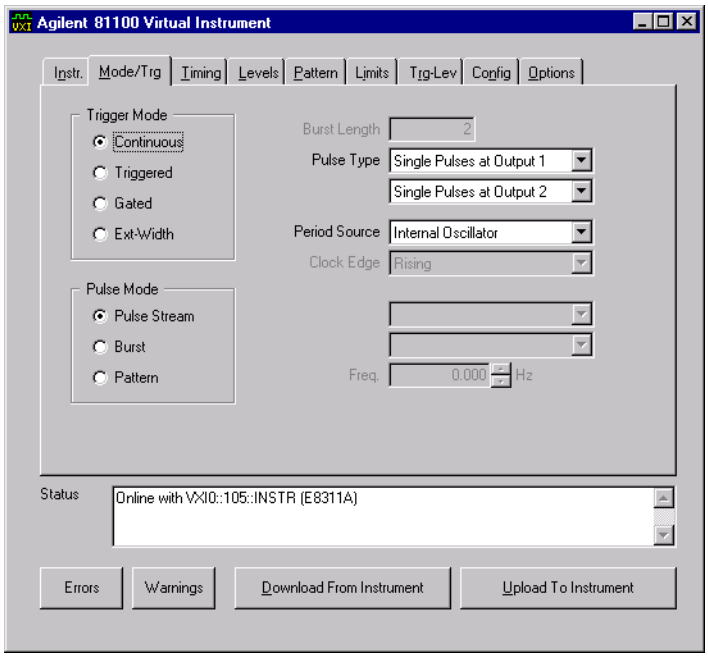
Operating and Trigger Mode

To set the **operating mode and trigger mode** as required:

1 Select the *Config* tab and click the *Reset Instr.* button to reset all parameters and modes.

2 Select the *Mode/Trg* tab.

The default settings can be used for this example.



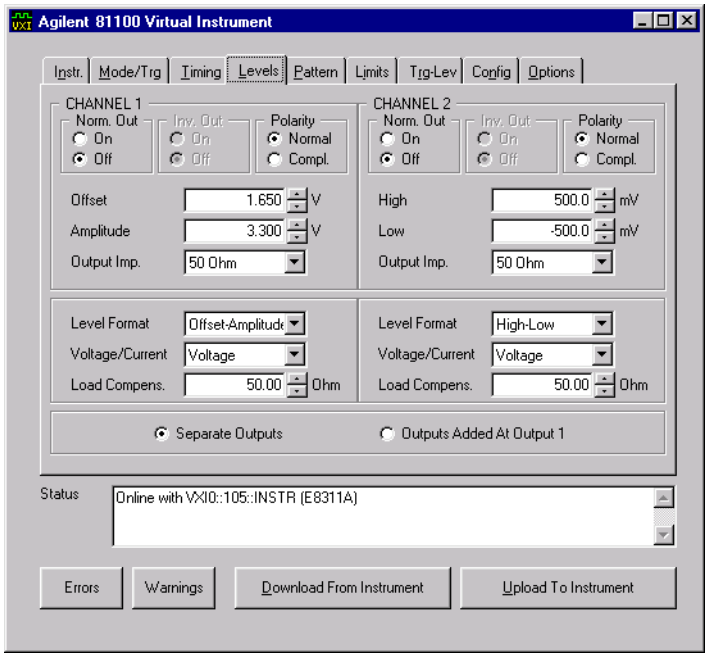
Level Parameters

To set the **level parameters** as required:

1 Select the *Levels* tab.

2 For the channel 1 output select *Offset-Amplitude* from the *Level Format* drop down list.

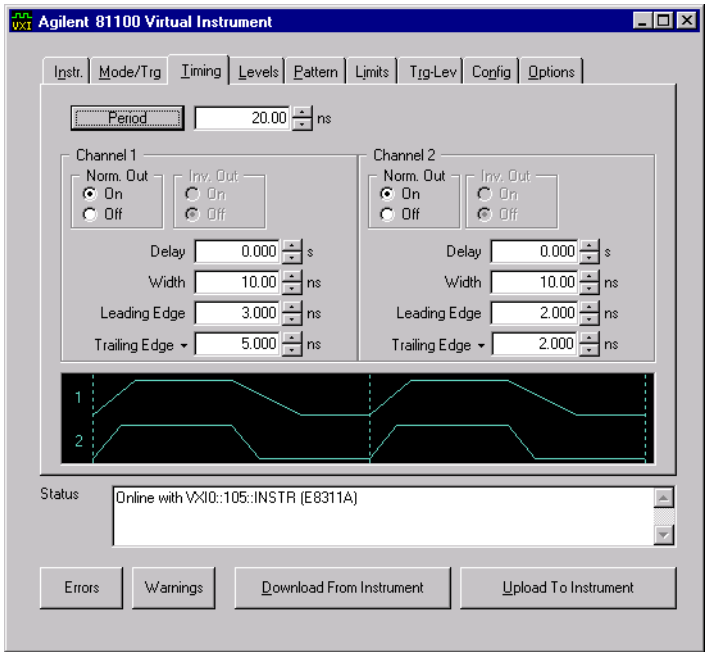
3 Enter an *Offset* of 1.65 V and an *Amplitude* of 3.30 V.



Timing Parameters

To set the **timing parameters** as required:

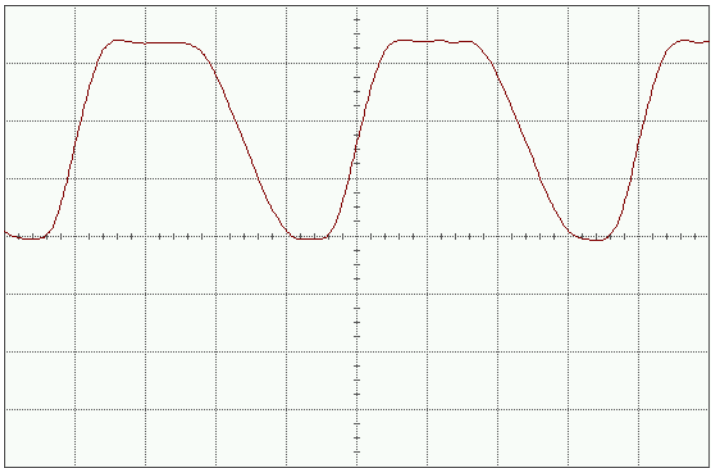
1. Select the *Timing* tab.
2. Enter a period of 20 ns.
3. Enter a value of 10 ns in the *Width* edit field.
4. Enter a value of 3 ns in the *Leading Edge* edit field.
5. Select *Trail Edge Absolute* from the *Trailing Edge* drop down list and a value of 5 ns in the *Trailing Edge* edit field.
6. Turn on the channel 1 output by selecting the *On* radio button in the *Norm. Out* group.



Upload to Instrument

- Click the button *Upload To Instrument* to transfer all parameter settings to the instrument.

Generated Signal The signal as displayed on a standard oscilloscope is depicted below. Use the generator's TRIGGER OUT to trigger the scope.



Using the VXIplug&play Drivers with VEE

If you want to include this pulse signal in a remote program, use the following VXI*plug&play* driver commands.

Function	Comment
`hpe8311a_reset(instrHandle)`	Reset the instrument to start from a defined default state.
`hpe8311a_modeContinuousPulses(instrHandle, HPE8311A_INTERNAL_OSCILLATOR, HPE8311A_RISING)`	Set the continuous pulse stream mode and the internal oscillator as period source.
`hpe8311a_modePulseType(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_SINGLE_PULSES)`	Set the pulse type to single pulses at the channel 1 output.
`hpe8311a_timeWidth(instrHandle, HPE8311A_CHANNEL_1, 0.00000001)`	Set the width to 10 ns.
`hpe8311a_timePeriod(instrHandle, 20n)`	Set the period to 20 ns.
`hpe8311a_levelOffsetAmplitude(instrHandle, HPE8311A_CHANNEL_1, HPE8311A_LEVELS_VOLT, 1.65, 3.3)`	Set the offset to 1.65 V and the amplitude to 3.3 V.
`hpe8311a_timeEdgeTrailingCoupling(instrHandle, HPE8311A_CHANNEL_1, HPE8311A_COUPLING_OFF)`	Decouple the trailing edge from the leading edge.
`hpe8311a_timeEdgeLeading(instrHandle, HPE8311A_CHANNEL_1, HPE8311A_UNIT_SEC, 3n)`	Set the leading edge to 3 ns.
`hpe8311a_timeEdgeTrailing(instrHandle, HPE8311A_CHANNEL_1, HPE8311A_UNIT_SEC, 5n)`	Set the trailing edge to 5 ns.
`hpe8311a_outputStateNormal(instrHandle, HPE8311A_CHANNEL_1, HPE8311A_OUTPUT_NORMAL_ON)`	Turn on the channel 1 output.

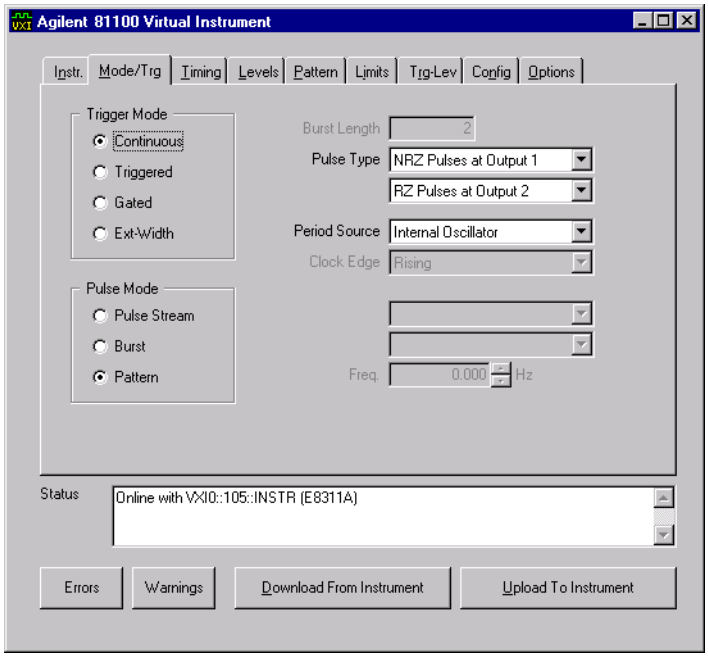
Setting Up a Serial Data Stream Signal

Task Set up a continuous 24-bit long pattern signal with NRZ data output format at 80 MBit/s and ECL output level.
The pattern is '111100111001100101001010010'.

Using the Soft Panel

Operating and Trigger Mode To set the **operating and trigger mode** as required:

1. Select the *Config* tab and click the *Reset Instr.* button to reset all parameters and modes.
2. Select the *Mode/Trg* tab.
3. Select the pulse mode *Pattern*.
4. From the *Pulse Type* drop down list select *NRZ Pulses at Output 1*.



Timing Parameters

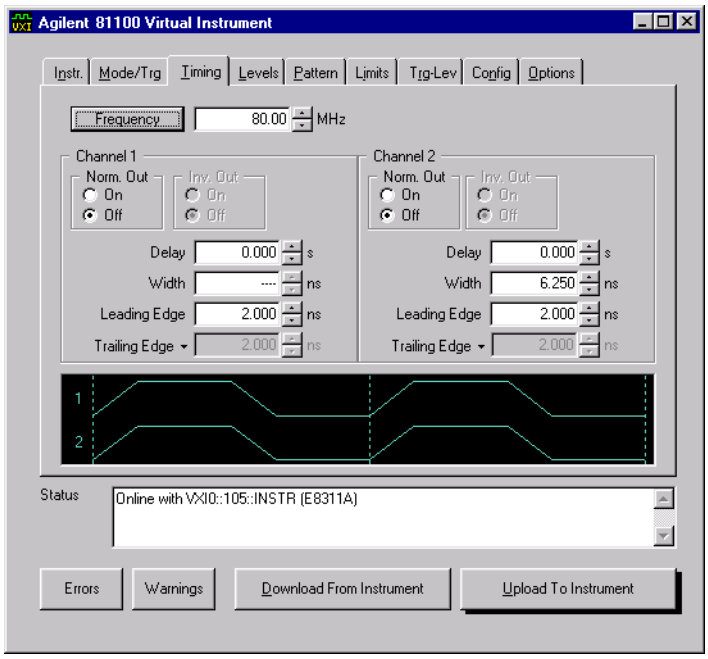
To set the **timing parameters** as required:

1 Select the *Timing* tab.

2 Click the *Period* button to select *Frequency* and enter a value of 80 MHz.

NOTE You cannot enter a pulse width because of the NRZ settings. This is indicated by a dotted line.

The timing diagram always shows the signals in RZ format, regardless of the current parameter settings.



Level Parameters

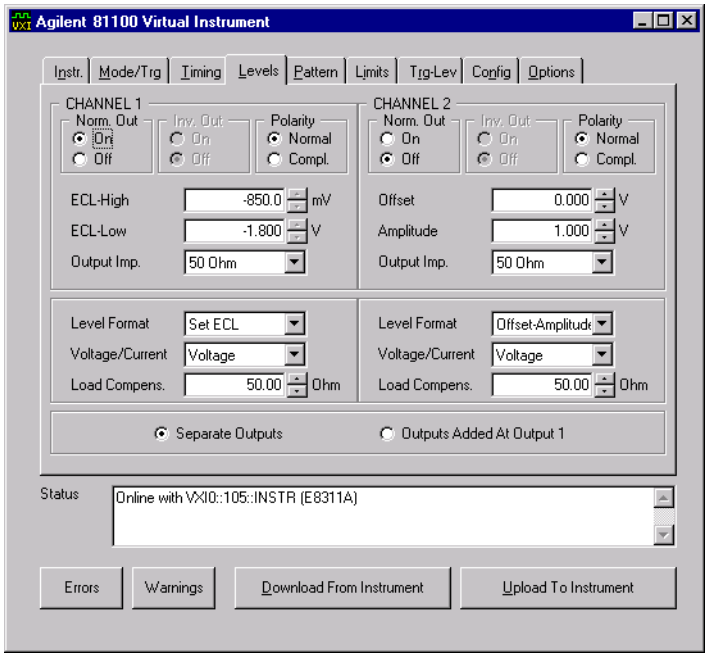
To set the **level parameters** as required:

1 Select the *Levels* tab.

2 Select *Set ECL* from the *Level Format* drop down list.

The *ECL-High* and *ECL-Low* levels are set automatically to –850.0 mV and –1.800 V as required.

3 Turn on the channel 1 output by selecting the *On* radio button in the *Norm. Out* group.



Pattern Parameters

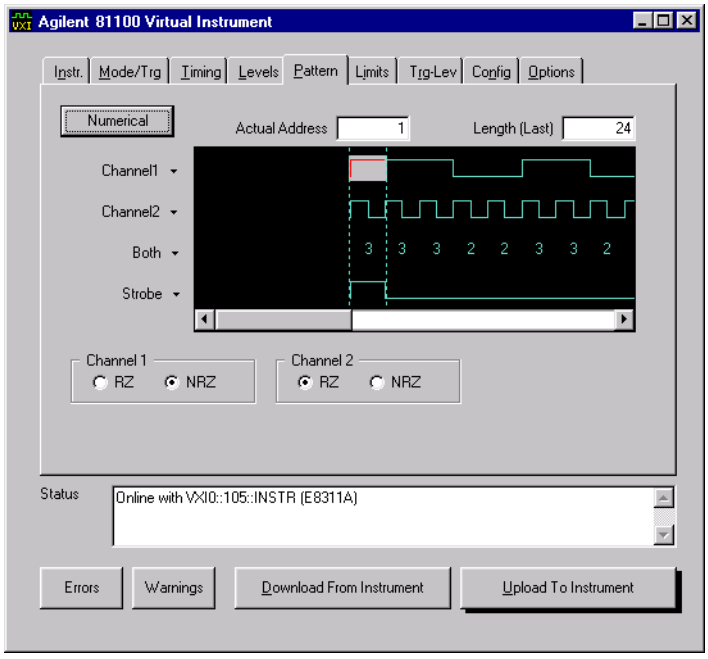
To set the **pattern parameters** as required:

1 Select the *Pattern* tab.

2 Enter **24** in the *Length (Last)* field to define the signal length of 24 bits.

3 To start editing the pattern data, click on the first address of the channel 1 pattern in the timing diagram window.

4 Enter the pattern **111100111001100100101001O**.

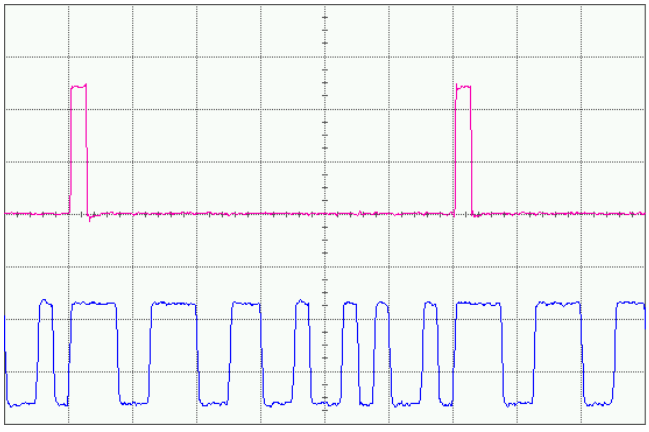


Upload to Instrument

- Click the button *Upload To Instrument* to transfer all parameter settings to the instrument.

Generated Signal

The Strobe output signal and the 24-bit long pattern signal as displayed on a standard oscilloscope are depicted below. Use the generator's STROBE OUT to trigger the scope.



Using the VXIplug&play Drivers with VEE

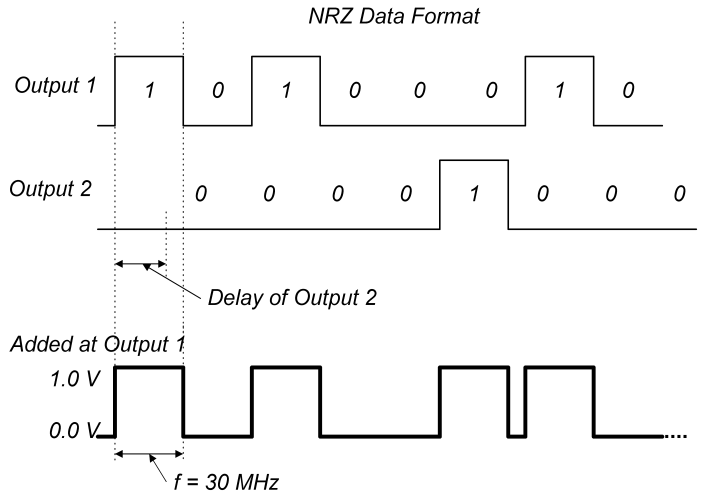
If you want to include this serial data stream signal in a remote program, use the following VXI*plug&play* driver commands.

NOTE For this example, an Agilent E8311A instrument is used. To generate the signal with an Agilent E8312A instrument, simply replace all hpe8311a instrument identifiers with the hpe8312a (upper case and lower case).

Function	Comment
`hpe8311a_reset(instrHandle)`	Reset the instrument to start from a defined default state.
`hpe8311a_modeContinuousPattern(instrHandle, HPE8311A_INTERNAL_OSCILLATOR, HPE8311A_RISING)`	Set the continuous pattern mode and the internal oscillator as period source.
`hpe8311a_modePatternDataFormat(instrHandle, HPE8311A_DATA_CHANNEL_1, HPE8311A_NRZ)`	Set the pulse type to NRZ at output channel 1.
`hpe8311a_patternDataDownloadBuffer(instrHandle, HPE8311A_DATA_CHANNEL_1, Data_Buffer, 24)`	Before you use the next function, the pattern data must be written to the Data_Buffer variable.
`hpe8311a_timeFrequency(instrHandle, 80M)`	Set the frequency to 80 MHz.
`hpe8311a_levelHighLow(instrHandle, HPE8311A_CHANNEL_1, HPE8311A_LEVELS_VOLT, -0.85, -1.8)`	Set the high and the low signal level to −0.85 V and −1.8 V.
`hpe8311a_outputStateNormal(instrHandle, HPE8311A_CHANNEL_1, HPE8311A_OUTPUT_NORMAL_ON)`	Turn on the channel 1 output.

Setting Up an Edge-Displacement Signal

Task Set up a continuous signal with one distorted pulse. The two channels are added with NRZ at both outputs. The high level is 1 V, the low level is 0 V. The delay of output 2 is 10 ns. The bit frequency is 30 MHz.



NOTE This example can only be executed with Agilent E8311A, because the Agilent E8312A is not able to add the outputs.

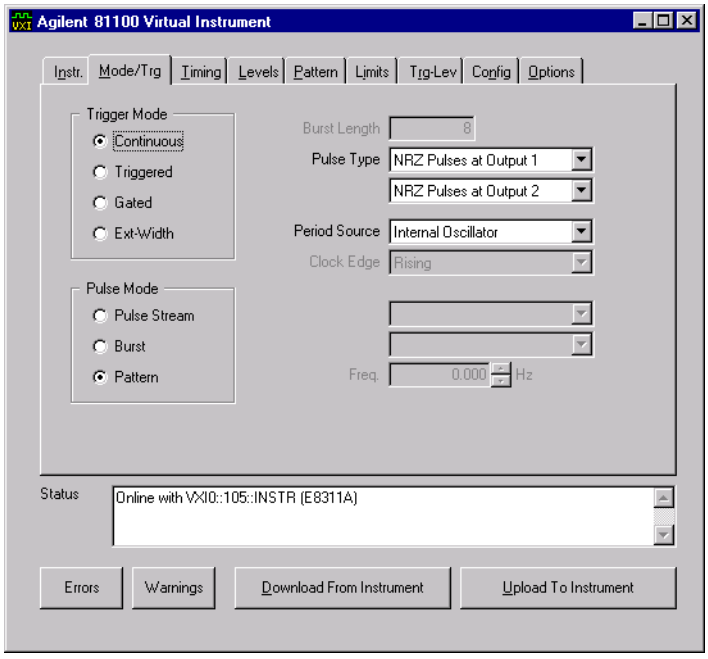
Using the Soft Panel

Operating and Trigger Mode

To set the **operating mode and trigger mode** as required:

1. Select the *Config* tab and click the *Reset Instr.* button to reset all parameters and modes.
2. Select the *Mode/Trg* tab.
3. Select the pulse mode *Pattern*.

4 From the *Pulse Type* drop down list select *NRZ Pulses at Output 1* and *NRZ Pulses at Output 2*.



Pattern Parameters

To set the **pattern parameters** as required:

1 Select the *Pattern* tab.

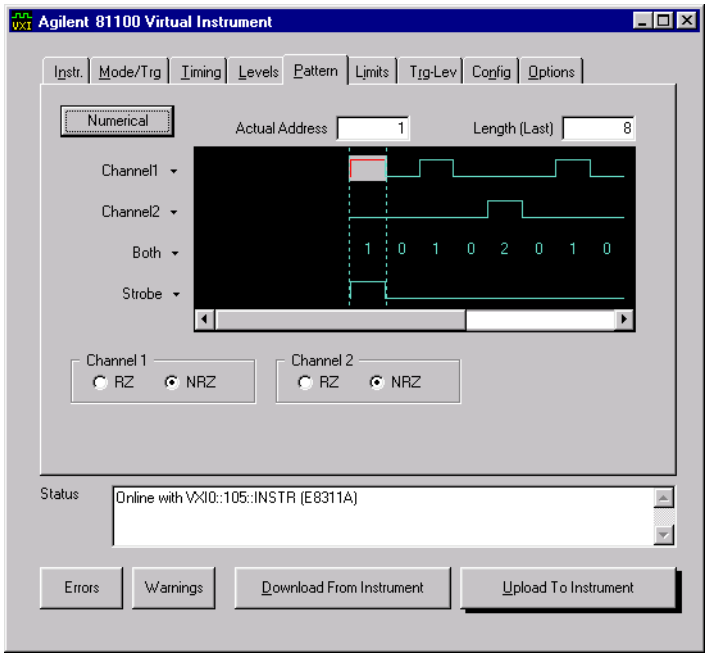
2 To define the signal length of 8 bits, edit **8** in the *Length (Last)* field.

3 To start editing the data for the **channel 1** pattern, click on the first address of this pattern in the timing diagram window.

4 Enter the pattern **10100010.**

5 To start editing the data for the pattern of **channel 2**, click on the first address of this pattern in the timing diagram window.

6 Enter the pattern **00001000.**



Level Parameters

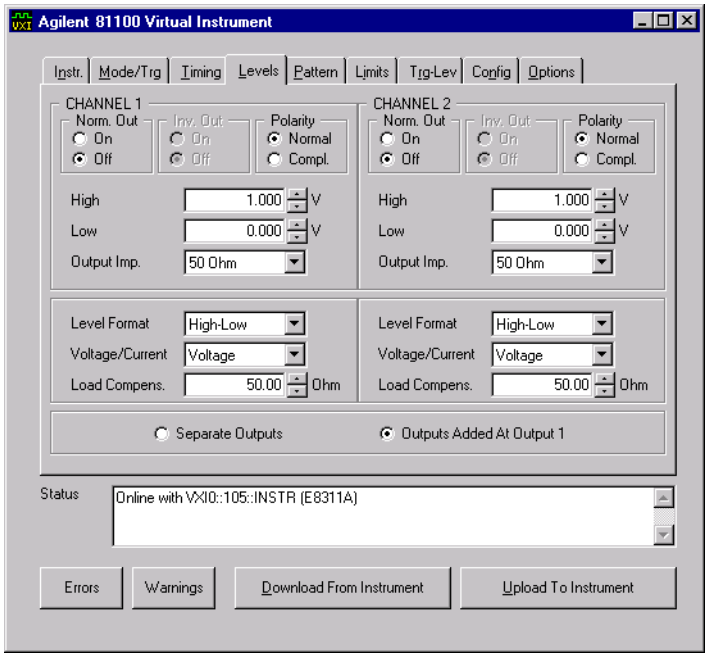
To set the **level parameters** as required:

1 Select the *Levels* tab.

2 From the *Level Format* drop down lists select *High-Low* for both channel 1 and channel 2.

3 For each channel enter a *High* level of 1.0 V and a *Low* level of 0.0 V.

4 Select the radio button *Outputs Added At Output 1*.



Timing Parameters

To set the **timing parameters** as required:

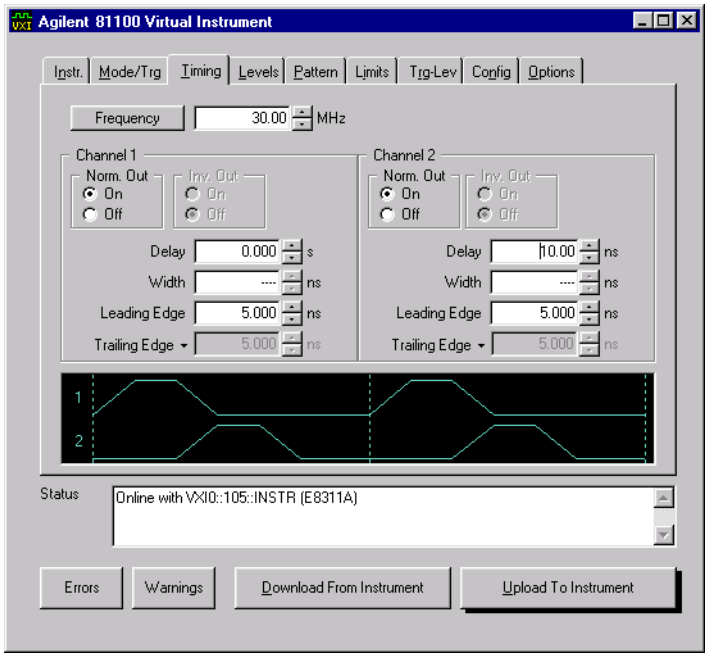
1 Select the *Timing* tab.

2 Click the *Period* button to select the *Frequency* and enter a value of 30 MHz.

3 For the channel 2 output enter a *Delay* of 10 ns.

4 Turn on the channel 1 output and the channel 2 output by selecting the *On* radio buttons of the *Norm. Out* groups.

NOTE The timing diagram always shows the signals in RZ format, regardless of the current parameter settings.

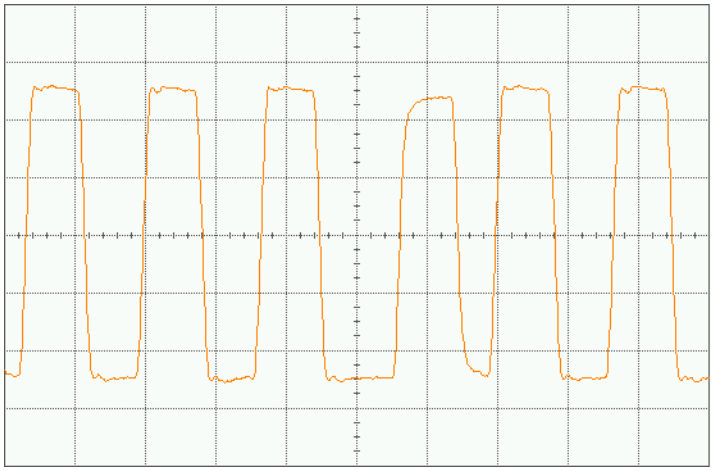


Upload to Instrument

Click the button *Upload To Instrument* to transfer all parameter settings to the instrument.

Generated Signal

The signal as displayed on a standard oscilloscope is depicted below. Use the generator's STROBE OUT to trigger the scope.



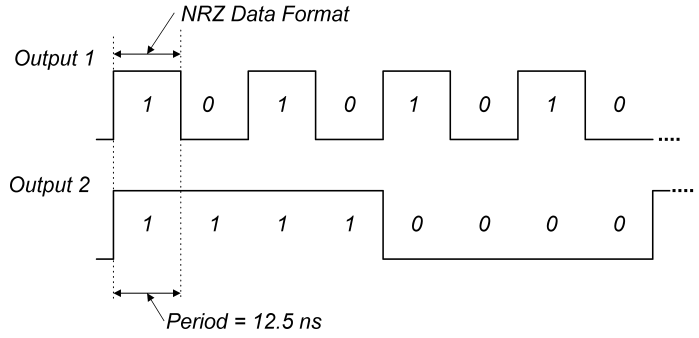
Using the VXIplug&play Drivers with VEE

If you want to include this edge-displacement signal in a remote program, use the following VXI*plug&play* driver commands.

Function	Comment
`hpe8311a_reset(instrHandle)`	Reset the instrument to start from a defined default state.
`hpe8311a_modeContinuousPattern(instrHandle, HPE8311A_INTERNAL_OSCILLATOR, HPE8311A_RISING)`	Set the continuous pattern mode and the internal oscillator as period source.
`hpe8311a_modePatternDataFormat(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_NRZ)`	Set the pulse type at both output channels to NRZ.
Note: Before you use the next both functions the pattern data must be set to the variables Data_Buffer1 and Data_Buffer2.	
`hpe8311a_patternDataDownloadBuffer(instrHandle, HPE8311A_DATA_CHANNEL_1, Data_Buffer1, 8)`	Set the pattern defined in Data_buffer1 with 8 bit length for channel 1.
`hpe8311a_patternDataDownloadBuffer(instrHandle, HPE8311A_DATA_CHANNEL_2, Data_Buffer2, 8)`	Set the pattern defined in Data_buffer2 with 8 bit length for channel 2.
`hpe8311a_timeFrequency(instrHandle, 30M)`	Set the frequency to 30 MHz.
`hpe8311a_timeEdgeLeading(instrHandle, HPE8311A_CHANNEL_1, HPE8311A_UNIT_SEC, 5n)`	Set the leading edge at channel 1 output to 5 ns.
`hpe8311a_timeDelay(instrHandle, HPE8311A_CHANNEL_2, HPE8311A_UNIT_SEC, 10n)`	Set the pulse delay at channel 2 to 10 ns.
`hpe8311a_timeEdgeLeading(instrHandle, HPE8311A_CHANNEL_2, HPE8311A_UNIT_SEC, 3n)`	Set the leading edge at channel 2 output to 3 ns.
`hpe8311a_timeEdgeTrailingCoupling(instrHandle, HPE8311A_CHANNEL_2, HPE8311A_COUPLING_ON)`	Set the leading edge to be the same as the trailing edge at channel 2.
`hpe8311a_levelHighLow(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_LEVELS_VOLT, 1, 0)`	Set the high and the low signal levels for all output channels to 1.0 V and 0.0 V.
`hpe8311a_outputStateNormal(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_OUTPUT_NORMAL_ON)`	Turn on all channel outputs.
`hpe8311a_outputMath(instrHandle, HPE8311A_MATH_PLUS)`	Add the output signals from channel 1 and 2.

Setting Up a Dual Clock Signal

Task Set up a dual clock signal in pattern mode with a period of 12.5 ns and NRZ at the outputs. The high level is 2.5 V and the low level is 0.0 V. Output 1 generates a clock signal with half frequency. Output 2 divides the clock by 8.

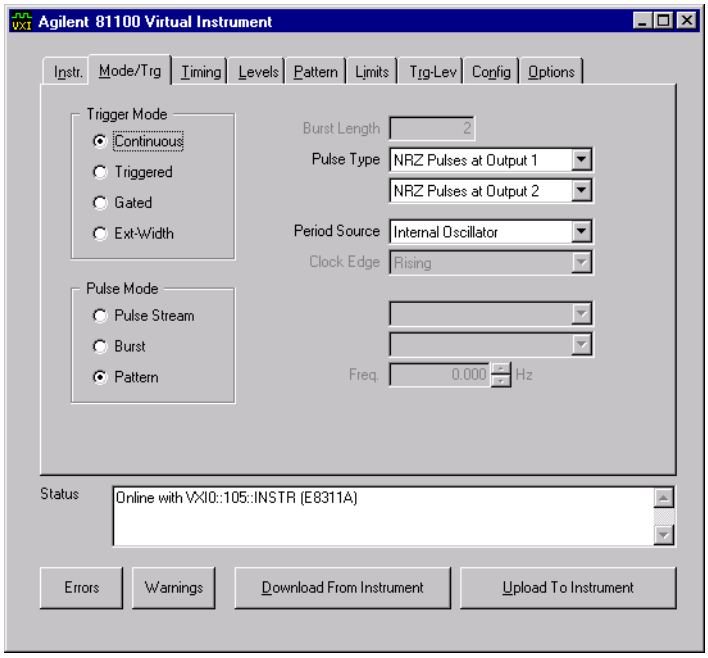


Using the Soft Panel

Operating and Trigger Mode To set the **operating mode and trigger mode** as required:

1. Select the *Config* tab and click the *Reset Instr.* button to reset all parameters and modes.
2. Select the *Mode/Trg* tab.
3. Select the pulse mode *Pattern*.

4 From the *Pulse Type* drop down list select *NRZ Pulses at Output 1* and *NRZ Pulses at Output 2*.



Pattern Parameters

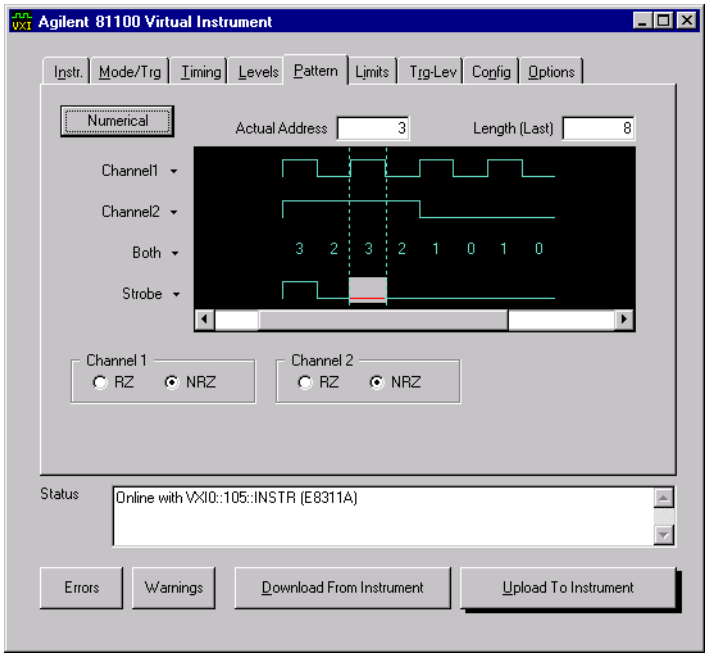
To set the **pattern parameters** as required:

1 Select the *Pattern* tab.

2 To define the signal length of 8 bits, enter **8** in the *Length (Last)* field.

3 Click at the *Channel 1* drop down list and select *Clock / n*. Enter **8** in the Clock/n window displayed.

4 Click at the *Channel 2* drop down list and select *Clock / n*. Enter **2** in the Clock/n window displayed.



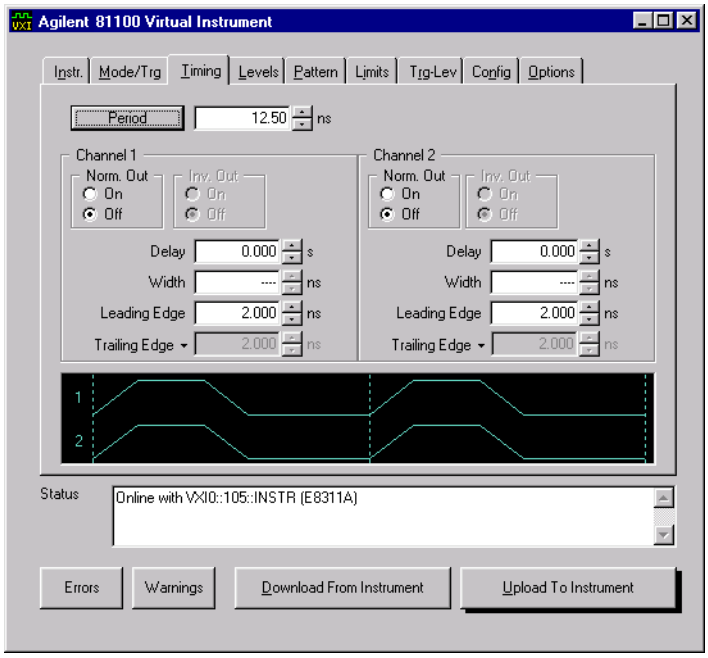
Timing Parameters

To set the **timing parameters** as required:

1 Select the *Timing* tab.

2 Enter a *Period* of 12.5 ns.

NOTE The timing diagram always shows the signals in RZ format, regardless of the current parameter settings.



Level Parameters

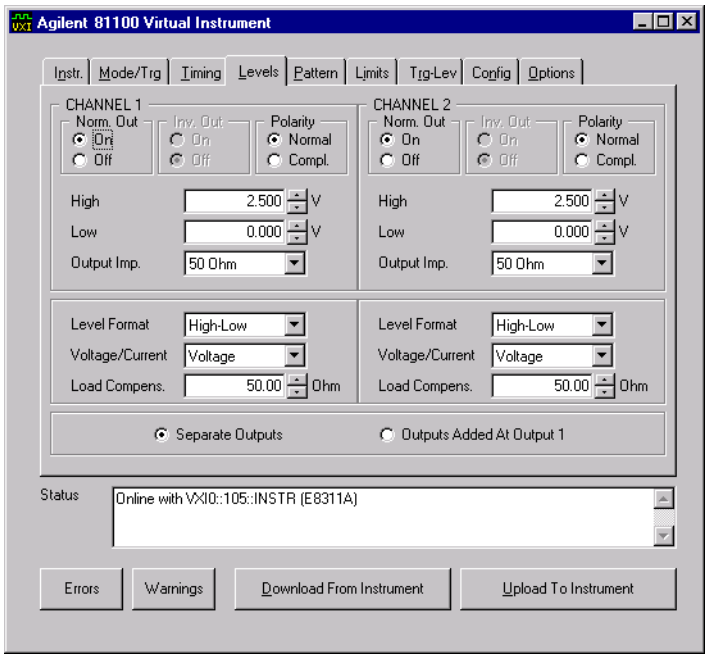
To set the **level parameters** as required:

1 Select the *Levels* tab.

2 From the *Level Format* drop down list select *High-Low* for both channel 1 and channel 2.

3 For each channel enter a *High* level of 2.5 V and a *Low* level of 0.0 V.

4 Turn on the channel 1 output and the channel 2 output by selecting the *On* radio buttons in the *Norm. Out* groups.

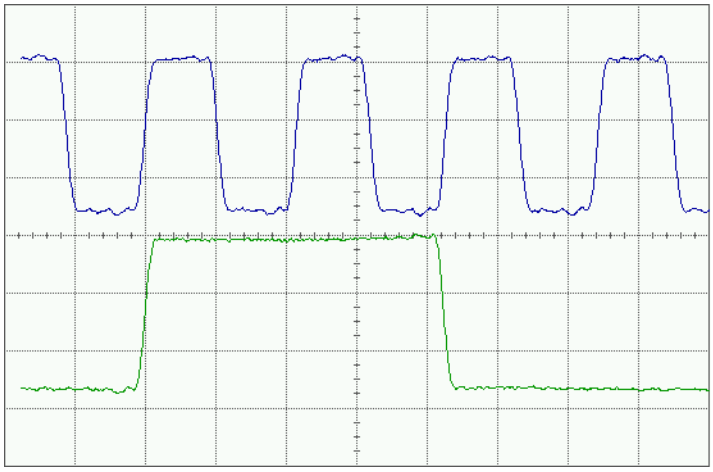


Upload to Instrument

Click the button *Upload To Instrument* to transfer all parameter settings to the instrument.

Generated Signals

The signals as displayed on a standard oscilloscope are depicted. Use the generator's STROBE OUT to trigger the scope.



Using the VXIplug&play Drivers with VEE

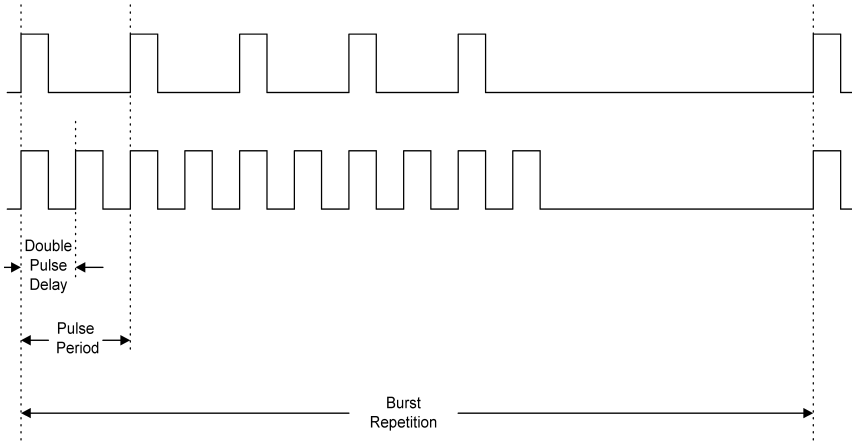
If you want to include this dual clock signal in a remote program, use the following VXI*plug&play* driver commands.

NOTE For this example an Agilent E8311A instrument is used. To generate the signal with an Agilent E8312A instrument, simply replace all hpe8311a instrument identifiers with the hpe8312a (upper case and lower case).

Function	Comment
`hpe8311a_reset(instrHandle)`	Reset the instrument to start from a defined default state.
`hpe8311a_modeContinuousPattern(instrHandle, HPE8311A_INTERNAL_OSCILLATOR, HPE8311A_RISING)`	Set the continuous pattern mode and the internal oscillator as period source.
`hpe8311a_modePatternDataFormat(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_NRZ)`	Set the pulse type at both output channels to NRZ.
`hpe8311a_patternDataPreset(instrHandle, HPE8311A_DATA_CHANNEL_1, 2, 8)`	Define a pattern signal with an 8-bit length which divides the clock frequency by 2.
`hpe8311a_patternDataPreset(instrHandle, HPE8311A_DATA_CHANNEL_2, 8, 8)`	Define a pattern signal with an 8-bit length which divides the clock frequency by 8.
`hpe8311a_timePeriod(instrHandle, 12.5n)`	Set the period to 12.5 ns.
`hpe8311a_levelHighLow(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_LEVELS_VOLT, 2.5, 0)`	Set the high and the low signal levels for all output channels to 2.5 V and 0.0 V.
`hpe8311a_outputStateNormal(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_OUTPUT_NORMAL_ON)`	Turn on all channel outputs.

Setting Up a Burst Signal

Task Set up a burst signal with a burst repetition of 5 µs. Each burst consists of two pulses at a period of 500 ns. The amplitude is 2.0 Vpp and the offset is 0.0 V.



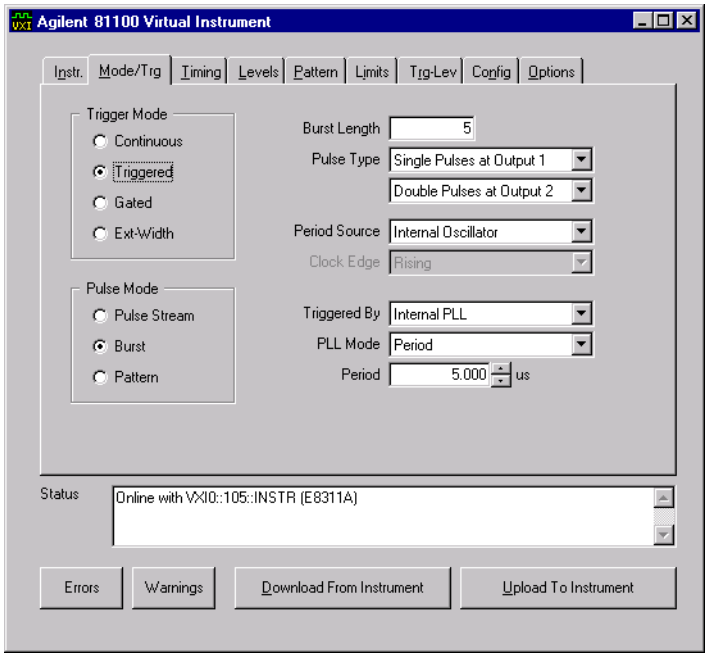
Using the Soft Panel

Operating and Trigger Mode To set the **operating mode and trigger mode** as required:

1. Select the *Config* tab and click the *Reset Instr.* button to reset all parameters and modes.
2. Select the *Mode/Trg* tab.
3. Select the trigger mode *Triggered*.
4. Select the pulse mode *Burst*.
5. Enter a *Burst Length* of 5.
6. From the *Pulse Type* drop down list select *Single Pulses at Output 1* and *Double Pulses at Output 2*.
7. From the *Triggered By* drop down list select *Internal PLL*.

   (The PLL mode *Period* is automatically selected.)

8 Enter a *Period* of 5 µs to define the burst repetition.



Timing Parameters

To set the **timing parameters** as required:

1 Select the *Timing* tab.

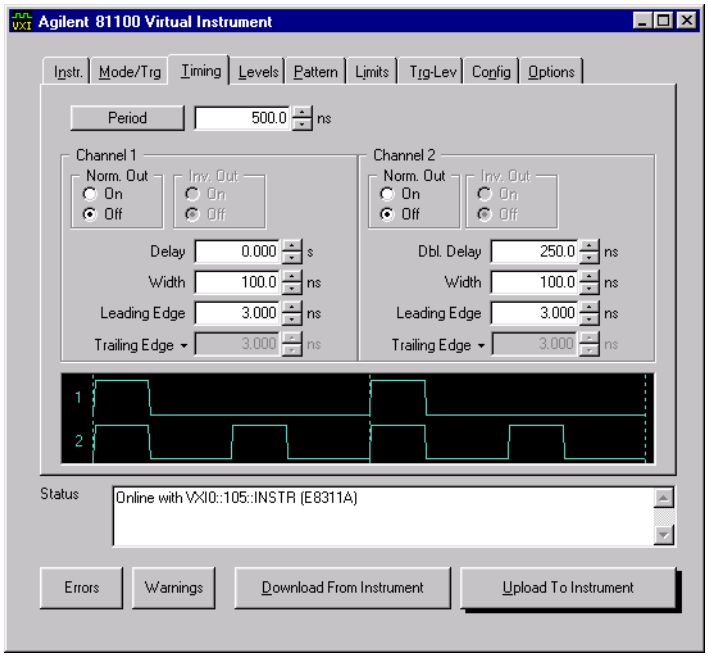
2 Enter a *Period* of 500 ns.

3 For channel 1:

- Enter a *Width* of 100 ns.
- Enter a *Leading Edge* of 3 ns.

4 For channel 2:

- Enter a double pulse *Delay* of 250 ns.
- Enter a *Width* of 100 ns.
- Enter a *Leading Edge* of 3 ns.



Level Parameters

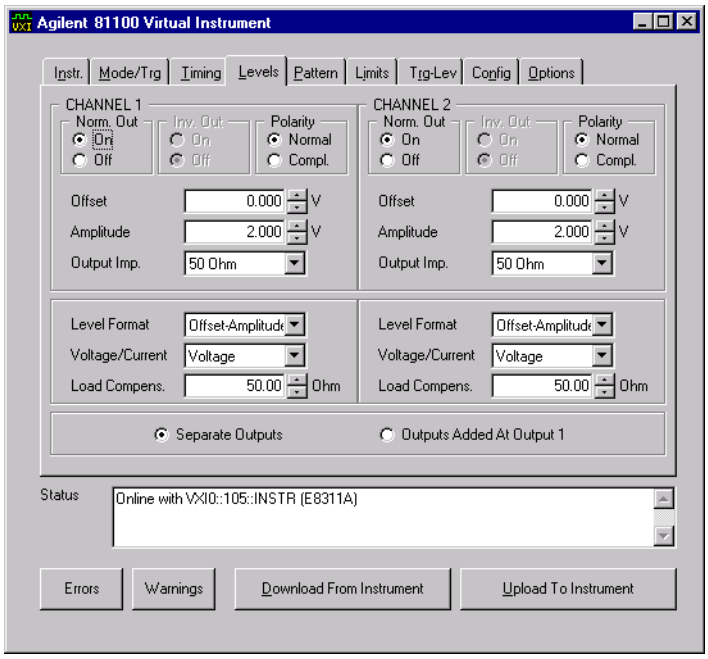
To set the **level parameters** as required:

1 Select the *Levels* tab.

2 From the *Level Format* drop down list select *Offset-Amplitude* for both channel 1 and channel 2.

3 For each channel enter an *Offset* of 0.0 V and an *Amplitude* of 2.0 V.

4 Turn on the channel 1 output and the channel 2 output by selecting the *On* radio buttons in the *Norm. Out* groups.

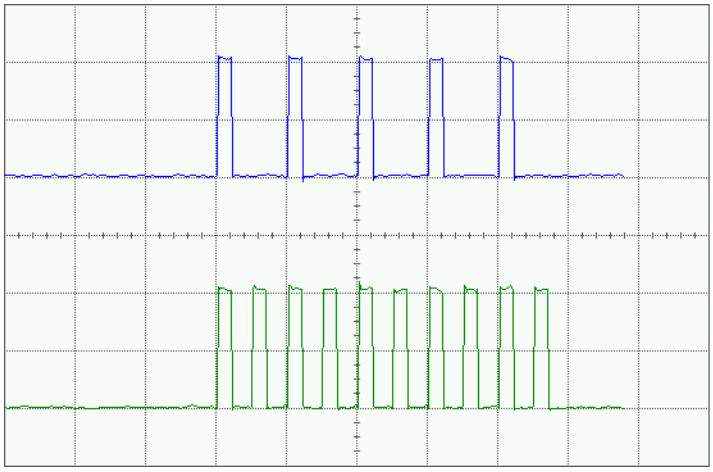


Upload to Instrument

Click the button *Upload To Instrument* to transfer all parameter settings to the instrument.

Generated Signals

The signals as displayed on a standard oscilloscope are depicted below. Use the generator's STROBE OUT to trigger the scope.



Using the VXIplug&play Drivers with VEE

If you want to include this burst signal in a remote program, use the following VXI*plug&play* driver commands.

NOTE For this example an Agilent E8311A instrument is used. To generate the signal with an Agilent E8312A instrument, simply replace all hpe8311a instrument identifiers with the hpe8312a (upper case and lower case).

Function	Comment
`hpe8311a_reset(instrHandle)`	Reset the instrument to start from a defined default state.
`hpe8311a_modePulseType(instrHandle, HPE8311A_CHANNEL_1, HPE8311A_SINGLE_PULSES)`	Set the pulse type to single pulses at the channel 1 output.
`hpe8311a_modePulseType(instrHandle, HPE8311A_CHANNEL_2, HPE8311A_DOUBLE_PULSES)`	Set the pulse type to double pulses at the channel 2 output.
`hpe8311a_modeTriggeredBurst(instrHandle, 5, HPE8311A_INTERNAL_OSCILLATOR, HPE8311A_RISING, HPE8311A_INTERNAL_PLL, HPE8311A_RISING, HPE8311A_VALUE_IS_PERIOD, 5u)`	Set the triggered burst mode and the internal oscillator as period source. Set the internal PLL to trigger the signal with a period (burst repetition) of 5 µs.
`hpe8311a_timePeriod(instrHandle, 0.5u)`	Enter a time period of 0.5 µs.
`hpe8311a_timeDelay(instrHandle, HPE8311A_CHANNEL_2, HPE8311A_UNIT_SEC, 250n)`	Set the pulse delay at channel 2 to 250 ns.
`hpe8311a_timeEdgeLeading(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_UNIT_SEC, 3n)`	Enter a leading edge of 3 ns for all channels.
`hpe8311a_timeEdgeTrailingCoupling(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_COUPLING_ON)`	Set the trailing edge to be the same as the leading edge for all channels.
`hpe8311a_levelOffsetAmplitude(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_LEVELS_VOLT, 0, 2)`	Set the offset to 0.0 V and the amplitude to 2.0 V for all output channels.
`hpe8311a_outputStateNormal(instrHandle, HPE8311A_CHANNEL_ALL, HPE8311A_OUTPUT_NORMAL_ON)`	Turn on all channel outputs.

Using the Agilent E8311/12A

This chapter provides complete reference information on how to use the Agilent E8311/12A via user interface pages.

Each page is described in detail. To access the individual pages, use the tabs above the user interface window.

The following pages are available:

- *"The Instrument Page" on page 50*
- *"The Mode/Trigger Page" on page 52*
- *"The Timing Page" on page 70*
- *"The Levels Page" on page 72*
- *"The Pattern Page" on page 75*
- *"The Limits Page" on page 78*
- *"The Trigger-Level Page" on page 79*
- *"The Configuration Page" on page 80*
- *"The Options Page" on page 82*

Each page contains the following buttons:

- *Errors* and *Warnings* buttons

  At the end of this chapter, *"Warnings and Errors" on page 84* provides details on the instrument's warning and error messaging system.

- *Download From Instrument*

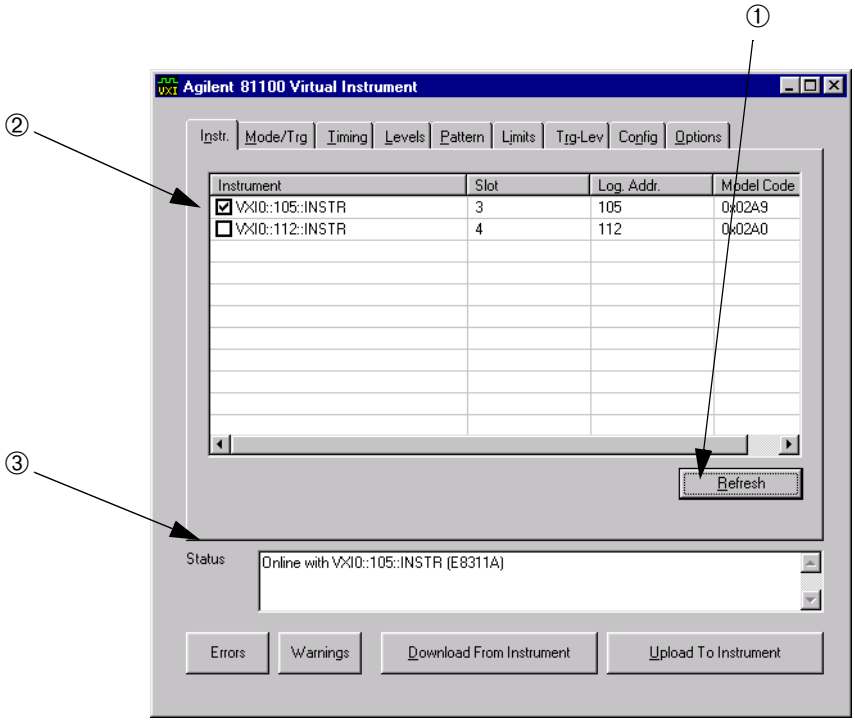
  Loads the current parameter settings from the instrument into the soft panel user interface.

- *Upload To Instrument*

  Loads the current parameter settings from the soft panel user interface to the instrument.

The Instrument Page

To select the Instrument page, click the *Instr.* tab. Use this page to select one of the instruments plugged into the VXI mainframe and to bring this instrument into the online mode.



① Refresh Button

Click the *Refresh* button to switch into the Offline mode (see ③ Status).

NOTE Always restart the program after changing the hardware configuration (for example, after inserting another instrument into the mainframe). Only after a restart, new hardware components will be detected.

② Instrument List

Here all instruments plugged into the VXI mainframe, the slots, the logical addresses, and the model codes are displayed.

Select the instrument you want to use.

③ Status

The status field displays the following modes:

- Offline

  No instrument is in operation.

- Online

  The instrument in operation is displayed.

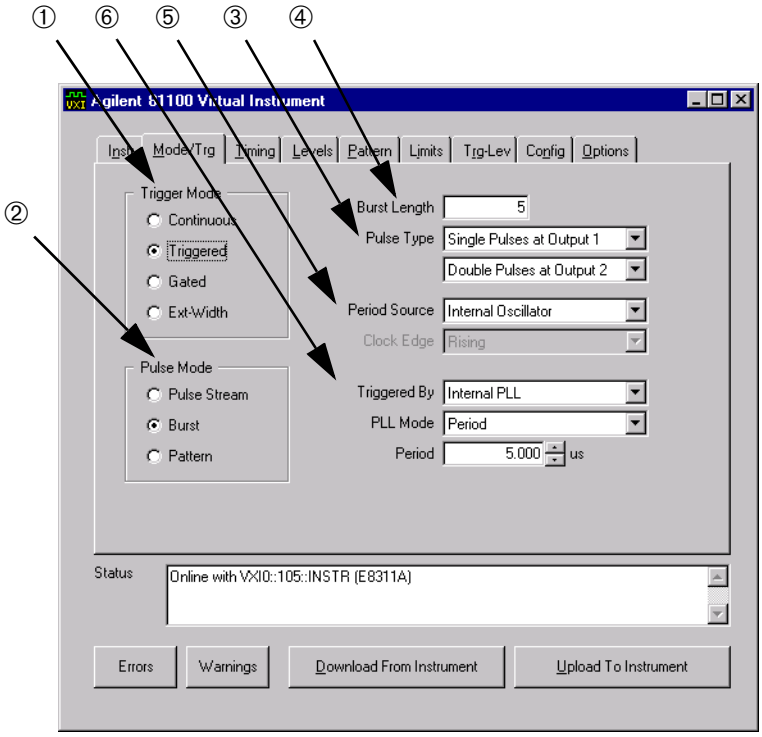
The Mode/Trigger Page

This section describes the Mode/Trigger page, starting with an overview of the available parameter combinations, followed by detailed descriptions of each combination.

Overview

To select the Mode/Trigger page, click the *Mode/Trg* tab. Use this page to set up the basic operating modes of the instrument.

The following figure shows a typical Mode/Trigger page, where the individual parameters are indicated.



In this page, you can set up the signal to be continuous, started or gated, and to be a pulse stream, a burst (several pulses followed by a pause) or a pattern.

Furthermore, you can specify the pulse and trigger sources.

Summary of Mode/Trg Modes

The combinations of the individual mode/trigger parameters are listed in the following table.

① **Trigger Mode**	**Continuous**			**Triggered**			**Gated**			**EXT-Width**
② **Pulse Mode**	**Pulse Stream**	**Burst**	**Pattern**	**Pulse Stream**	**Burst**	**Pattern**	**Pulse Stream**	**Burst**	**Pattern**	
③ **Pulse Type**	Single/Double		RZ/NRZ	Single/Double		RZ/NRZ	Single/Double		RZ/NRZ	
④ **Burst Length**		2 … 65536			2 … 65536			2 … 65536		
⑤ **Period Source**	Internal Oscillator Internal PLL CLK-IN				Internal Oscillator Internal PLL[a] CLK-IN		Internal Oscillator Internal PLL CLK-IN			
⑥ **Triggered by/ Gated by/ Width**				External Input VXI ECLT0 VXI ECLT1 VXI TTLT0 … VXI TTLT7	External Input Internal PLL[a] VXI ECLT0 VXI ECLT1 VXI TTLT0 … VXI TTLT7		External Input VXI ECLT0 VXI ECLT1 VXI TTLT0 … VXI TTLT7			External Input VXI ECLT0 VXI ECLT1 VXI TTLT0 … VXI TTLT7
TRIGGER OUT	Marks each pulse period generated.									
STROBE OUT	Not Used	↑on 1st ↓on last	Programmable	Not Used	↑on 1st ↓on last	Programmable	Not Used	↑on 1st ↓on last	Programmable	Not Used

[a] PLL cannot be used as period and trigger source at the same time.

Pulse Types

Single and Double Pulses

In pulse stream and burst mode, the pulses can be selected from single pulses and double pulses at the output.

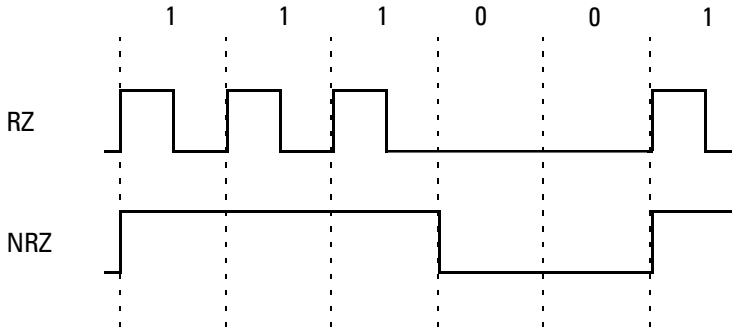
- Single Pulses

  Single pulse per period—delay parameter sets delay to leading edge from start of period.

- Double Pulses

  Double pulse per period—double delay parameter sets delay between leading edges of pulses.

RZ and NRZ In pattern mode, the pulse output format can be selected from RZ and NRZ. The timing of the different formats is shown in the following diagram:



- RZ

  A single pulse is generated in each pulse period with data value 1, no pulse is generated for data value 0.

- NRZ

  A leading edge is generated for a 0 → 1 data transition, a trailing edge is generated for a 1 → 0 data transition.

NOTE To generate DNRZ (Delayed NRZ) signals, program NRZ pulses with a delay.

Period Sources

The pulse *Period Source* can be selected from:

- Internal Oscillator (VFO)

  If you have to trigger after an external event, use the startable oscillator.

- Internal PLL (Higher accuracy than 0.01%)

  If you do not have to trigger but need a high accuracy frequency, then use the internal PLL clock generation circuitry.

- CLK-IN (External signal)

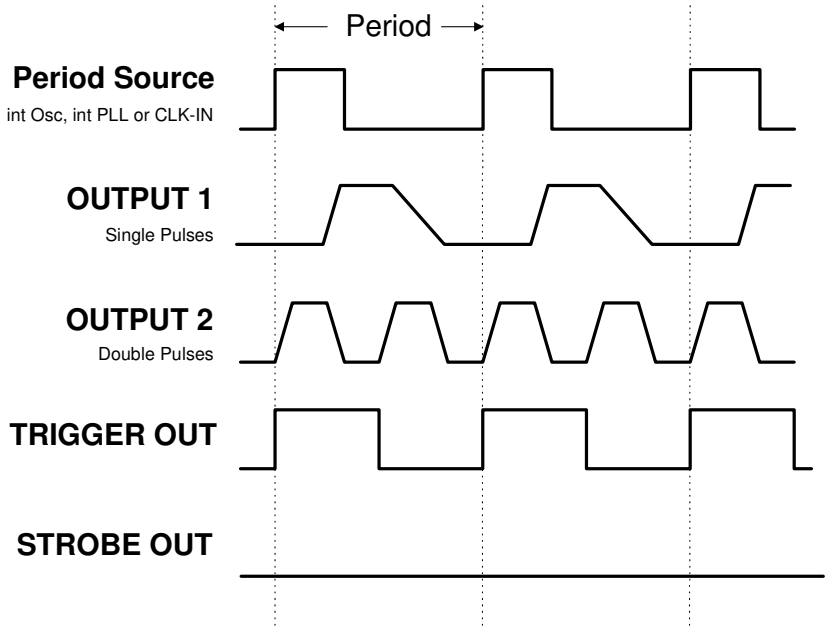
  If you need even more accuracy, use the external signal. Synchronize to rising or falling edge.

The following sections explain the mode combinations in more detail. For each combination of trigger mode and pulse mode, typical timing diagrams are provided.

NOTE Signals with variable slopes as shown in the following timing diagrams can only be generated with the Agilent E8311A instrument.

Continuous Pulse Stream Mode

The following figure shows typical timings for the *Continuous* trigger mode and the *Pulse Stream* pulse mode.



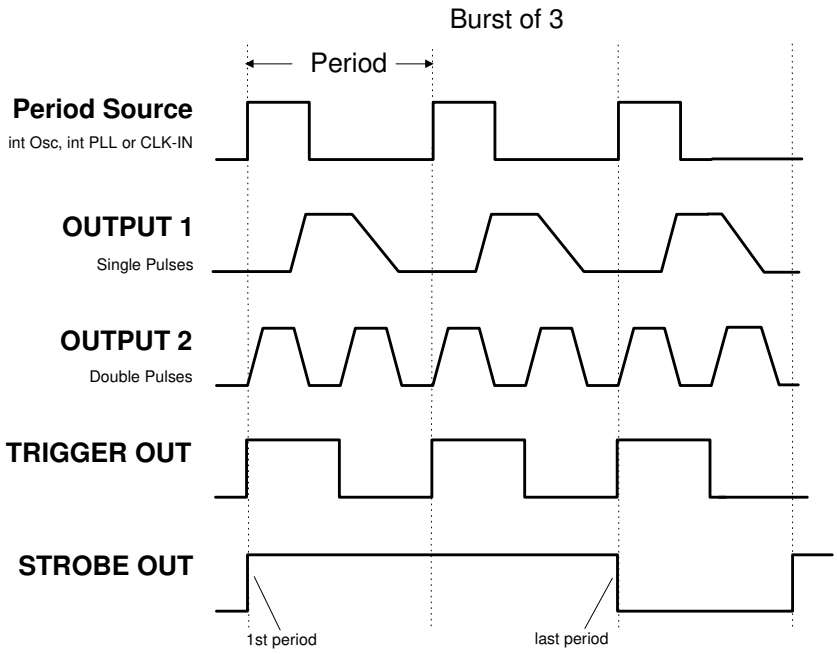
Characteristics

- Pulse periods are generated continuously.
- For the *Period Source*, you can select from:
  - Internal Oscillator (VFO)
  - Internal PLL (Higher accuracy)
  - CLK-IN (External signal)

    Synchronize to rising or falling edge.
- You can select between single and double pulses per pulse period for each output.
- TRIGGER OUT marks each pulse period.
- STROBE OUT is not used in continuous pulse mode.

Continuous Burst Mode

The following figure shows typical timings for the *Continuous* trigger mode and the *Burst* pulse mode.



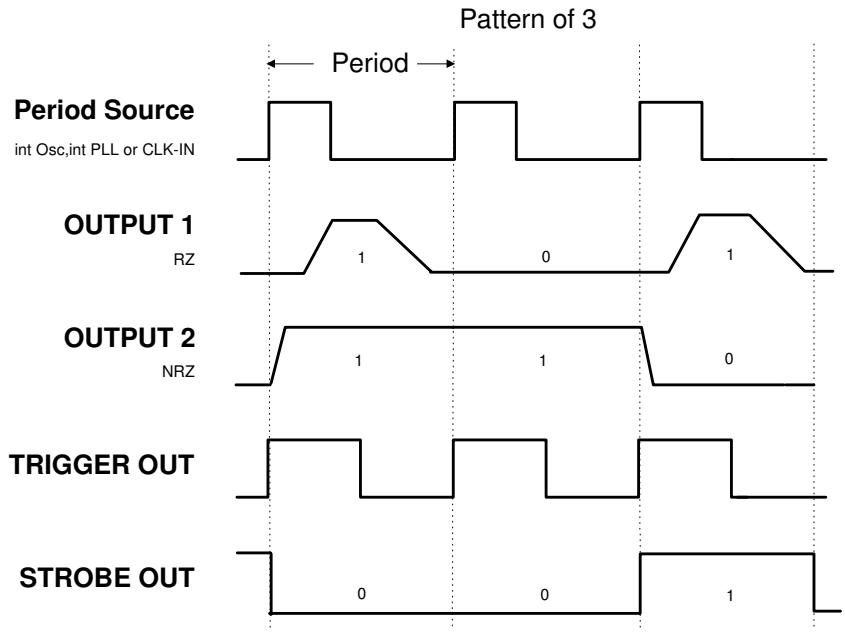
Characteristics

- A burst of pulse periods is repeated continuously.
- For the pulse *Period Source*, you can select from:
  - Internal Oscillator (VFO)
  - Internal PLL (Higher accuracy)
  - CLK-IN (External signal)

    Synchronize to rising or falling edge.
- You can select the number of pulse periods per burst in the range 2 … 65536.
- You can select between single and double pulses per pulse period for each output.
- TRIGGER OUT marks each pulse period.
- STROBE OUT rises at the start of the first pulse period in a burst, and falls at the start of the last pulse period.

Continuous Pattern Mode

The following figure shows typical timings for the *Continuous* trigger mode and the *Pattern* pulse mode.



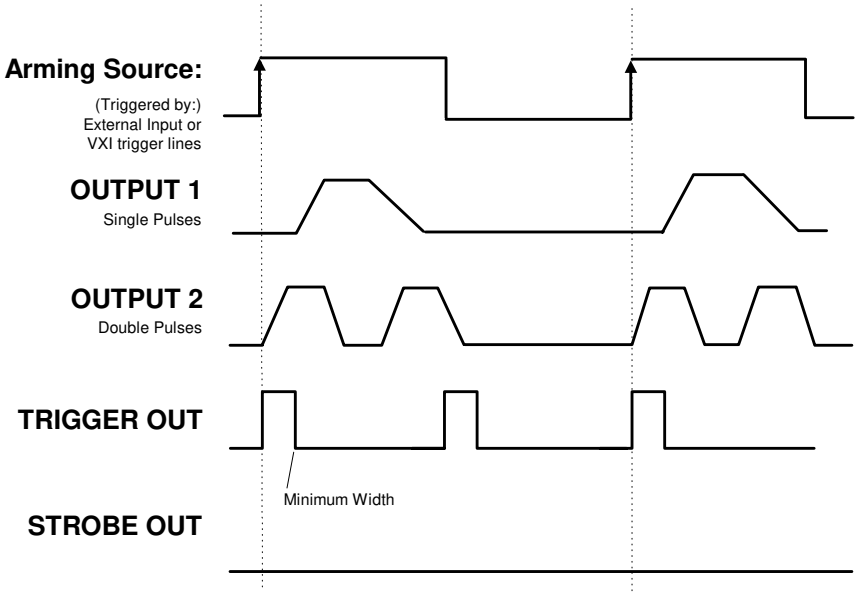
Characteristics

- A pattern of pulses is repeated continuously.
- For the pulse *Period Source*, you can select from:
  - Internal Oscillator (VFO)
  - Internal PLL (Higher accuracy)
  - CLK-IN (External signal)

    Synchronize to rising or falling edge.
- You can select between RZ and NRZ data pulses for each output.
- On pattern page (see *"The Pattern Page" on page 75*) you can
  - select the pattern length in the range 2 … 16384.
  - select the data values for each output.
- TRIGGER OUT marks each pulse period.
- STROBE OUT can be programmed for each bit on the Pattern page. The pulse width is not programmable; only NRZ pulses are generated.

Triggered Pulse Stream Mode

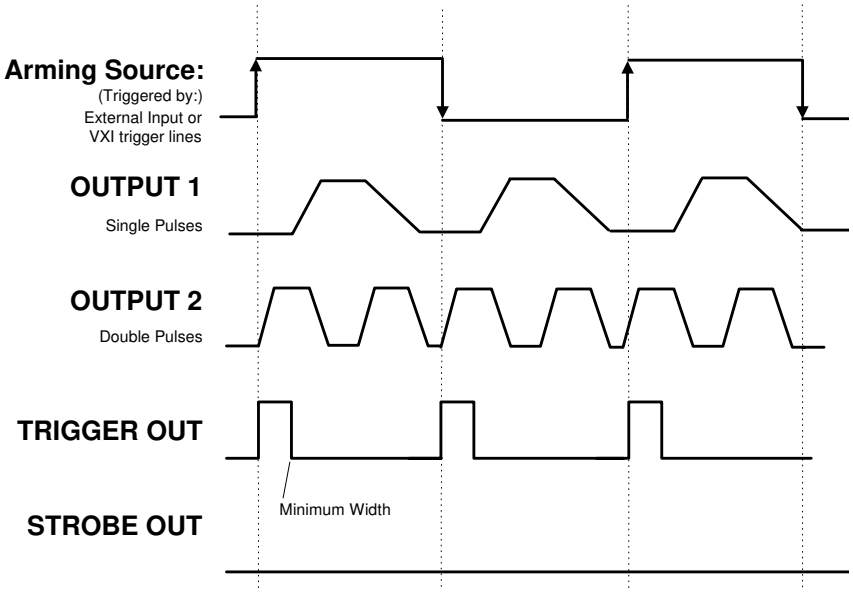
The following figures show typical timings for *Triggered* trigger mode and *Pulse Stream* pulse mode. The bursts are triggered by the rising edge of the arming source.



Characteristics

- Single pulse periods are triggered by rising or falling edges or both at the selected arming source:
  - External Input
  - 2 VXI ECL trigger lines (VXI ECLT 0 … VXI ECLT 1)
  - 8 VXI TTL trigger lines (VXI TTLT 0 … VXI TTLT 7)
- You can select single pulses or double pulses per pulse period.
- TRIGGER OUT marks each pulse period.
- STROBE OUT is not used in triggered pulse mode.

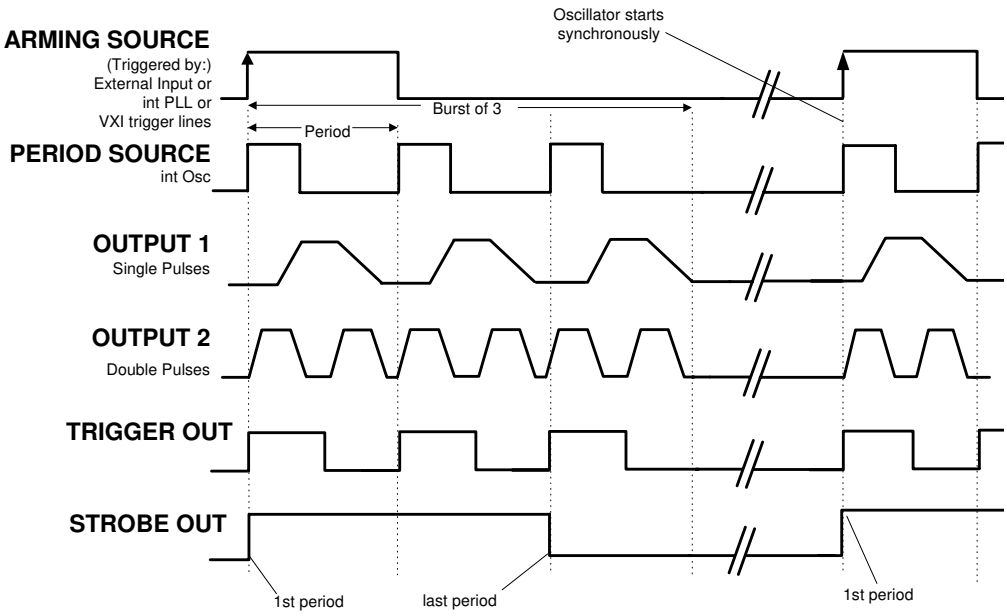
In contrast to the previous figure, this figure shows a timing diagram where the pulses are triggered by both rising and falling edges of the arming source.



Triggered Burst Mode

The following figures show typical timings for the *Triggered* trigger mode and the *Burst* pulse mode. The bursts are triggered by the rising edge of the arming source.

In the first example, the synchronously triggerable **internal Oscillator** is used to source the period.



Characteristics

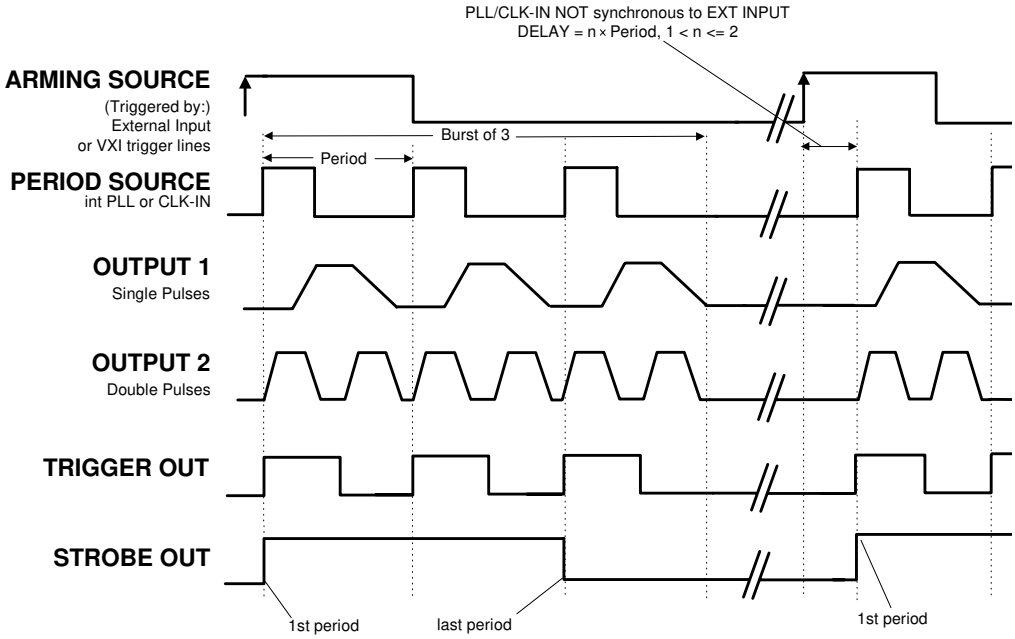
- A burst of pulse periods is triggered by rising or falling edges or both at the selected arming source:
  - External Input
  - 2 ECL VXI trigger lines
  - 8 TTL VXI trigger lines
  - Internal PLL (internally triggered bursts)

NOTE When using the internal PLL as the arming source, you must specify the triggering *Period* or *Frequency*.

- You can select the number of pulse periods per burst in the range 2 … 65536.
- You can select single pulses or double pulses per pulse period.
- TRIGGER OUT marks each pulse period.

- STROBE OUT rises at the start of the first pulse period in a burst and falls at the start of the last pulse period.

In the second example, either the **internal PLL** or an external **CLK-IN** are used to source the period—both cannot be triggered synchronously.

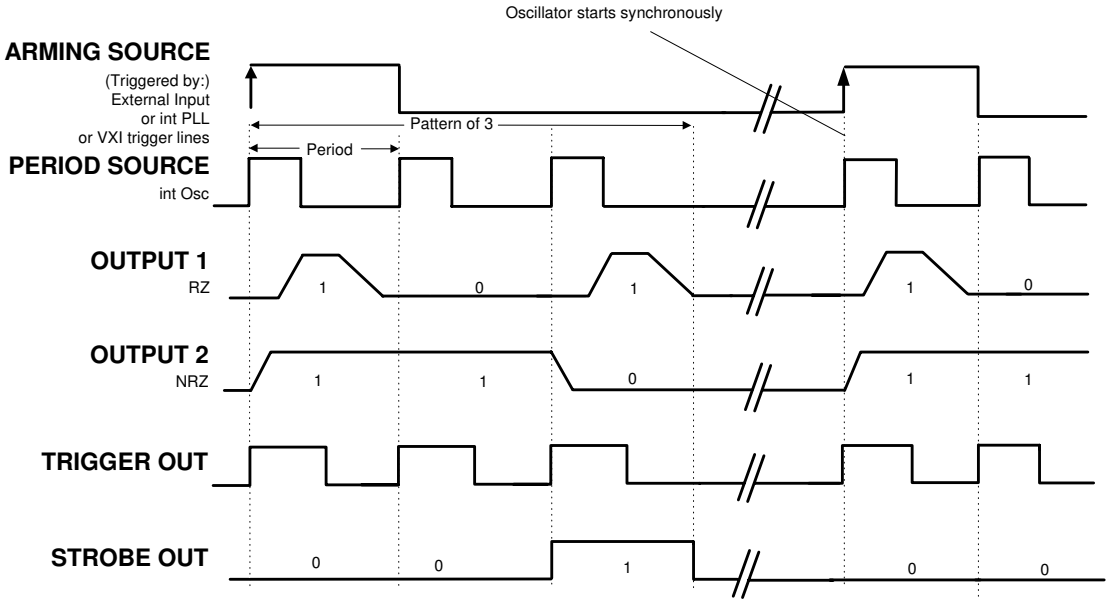


NOTE You cannot use the PLL as both pulse period source and arming source at the same time.

Triggered Pattern Mode

The following figure shows typical timings for the *Triggered* trigger mode and the *Pattern* pulse mode. The patterns are triggered by the rising edge of the arming source.

In the first example, the synchronously triggerable **internal Oscillator** is used to source the period.



Characteristics

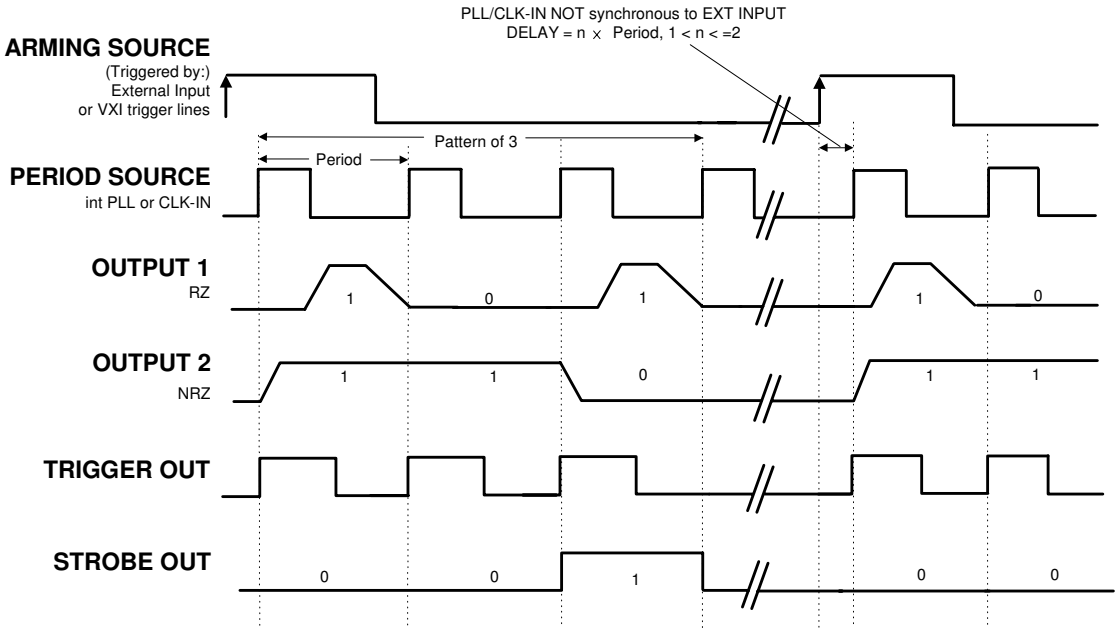
- A pattern of pulses is triggered by rising or falling edges or both at the selected arming source:
  - External Input
  - 2 VXI ECL trigger lines
  - 8 VXI TTL trigger lines
  - Internal PLL (internally triggered patterns)

NOTE When using the internal PLL as the arming source, you must specify the triggering *Period* or *Frequency*.

- You can select between RZ and NRZ data pulses for each output.
- On the Pattern page (see *"The Pattern Page" on page 75*) you can
  - select the pattern length in the range 2 … 16384.
  - select the data values for each output.
- TRIGGER OUT marks each pulse period.

- STROBE OUT can be programmed for each bit on the Pattern page. The pulse width is not programmable; only NRZ pulses are generated.

In the second example, either the **internal PLL** or an external **CLK-IN** are used to source the period—both cannot be triggered synchronously.

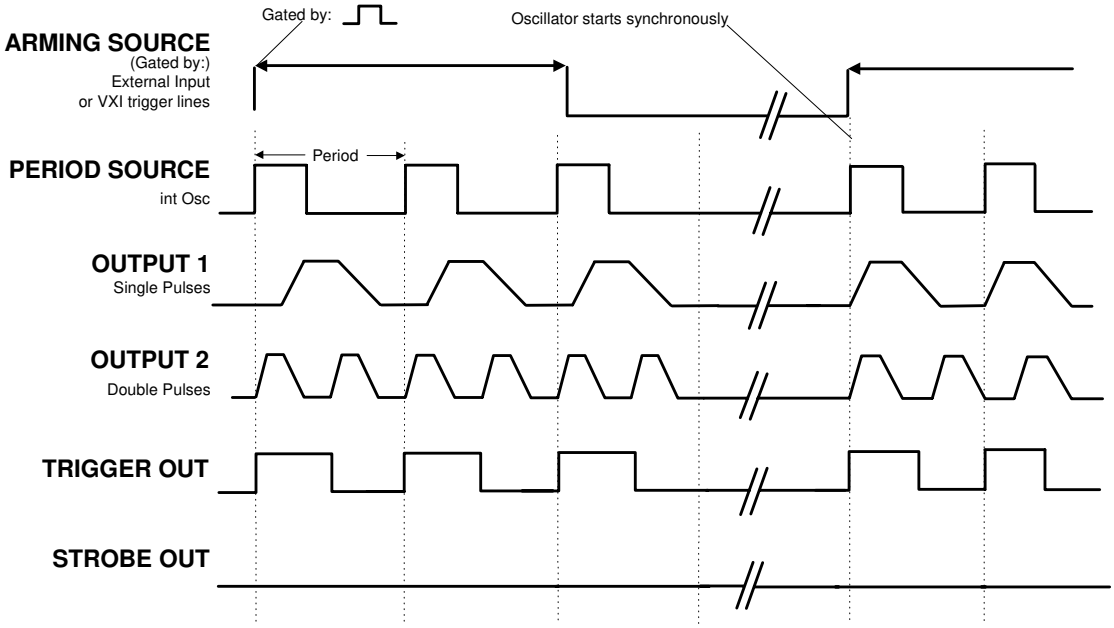


NOTE You cannot use the PLL as both pulse period source and arming source at the same time.

Gated Pulse Stream Mode

The following figures show typical timings for the *Gated* trigger mode and the *Pulse Stream* pulse mode.

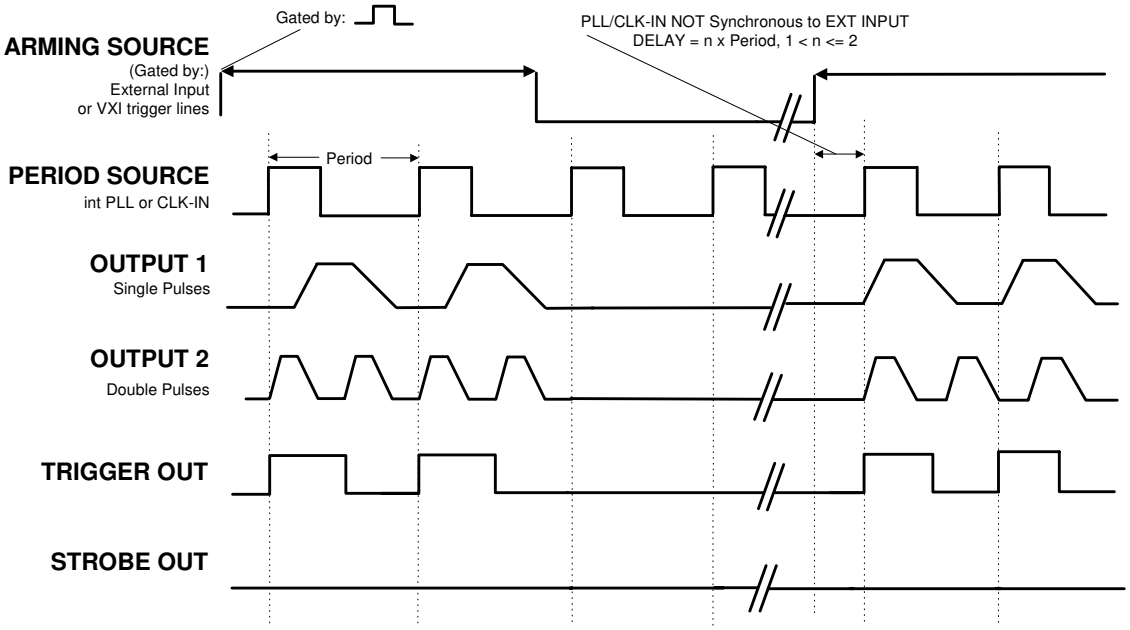
In the first example, the synchronously triggerable **internal Oscillator** is used to source the period.



Characteristics

- Pulse periods are gated by (enabled by) high level or low level or always at the selected arming source:
  - External Input
  - 2 VXI ECL trigger lines
  - 8 VXI TTL trigger lines
- You can select single pulses or double pulses per pulse period.
- TRIGGER OUT marks each pulse period.
- STROBE OUT is not used in gated pulse mode.

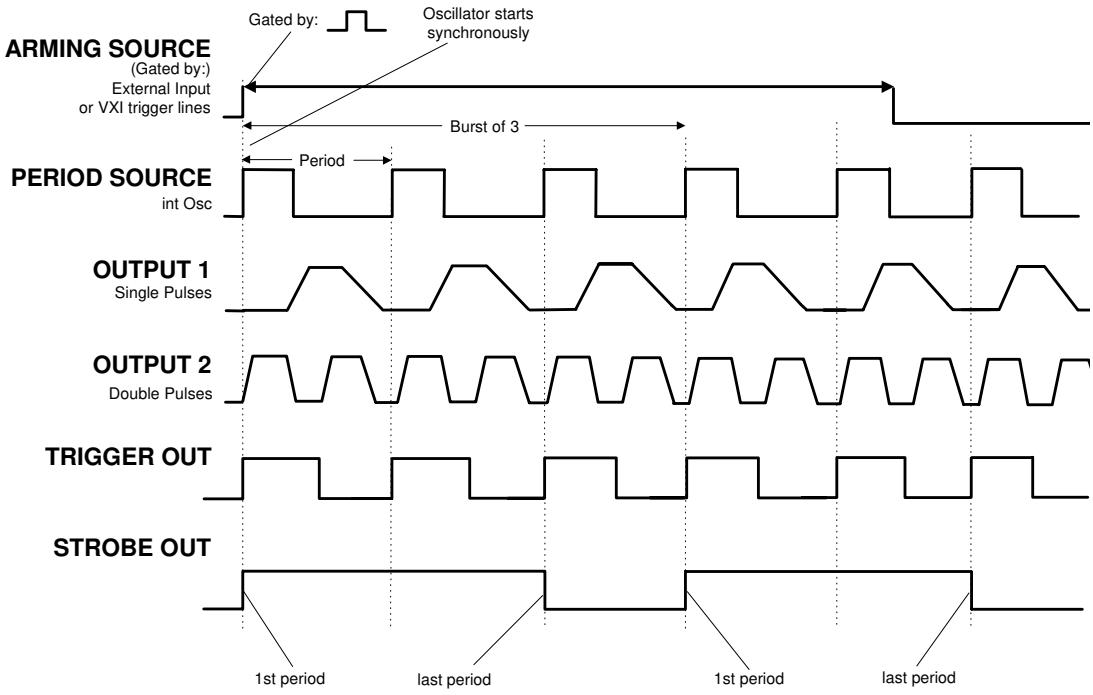
In the second example, either the **internal PLL** or an external **CLK-IN** are used to source the period—both cannot be triggered synchronously.



Gated Burst Mode

The following figures show typical timings for the *Gated* trigger mode and the *Burst* pulse mode.

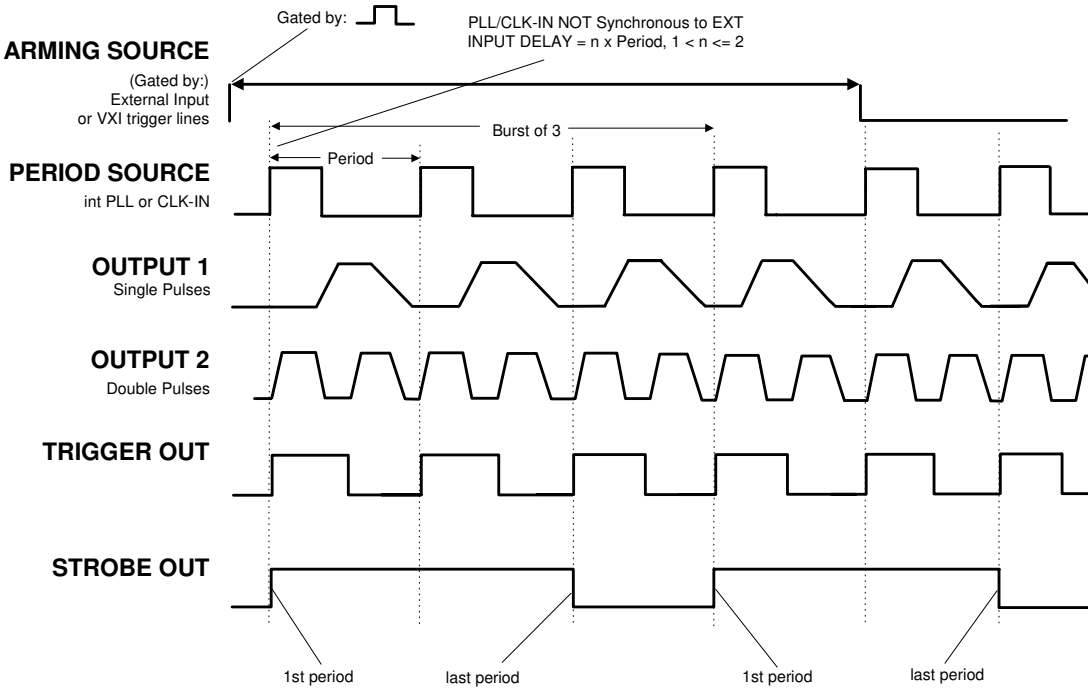
In the first example, the synchronously triggerable **internal Oscillator** is used to source the period.



Characteristics

- Bursts of pulse periods are gated by (enabled by) high level or low level or always at the selected arming source:
  - External Input
  - 2 VXI ECL trigger lines
  - 8 VXI TTL trigger lines
- You can select the number of pulse periods per burst in the range 2 … 65536.
- You can select single pulses or double pulses per pulse period.
- TRIGGER OUT marks each pulse period.
- STROBE OUT rises at the start of the first pulse period in a burst and falls at the start of the last pulse period.

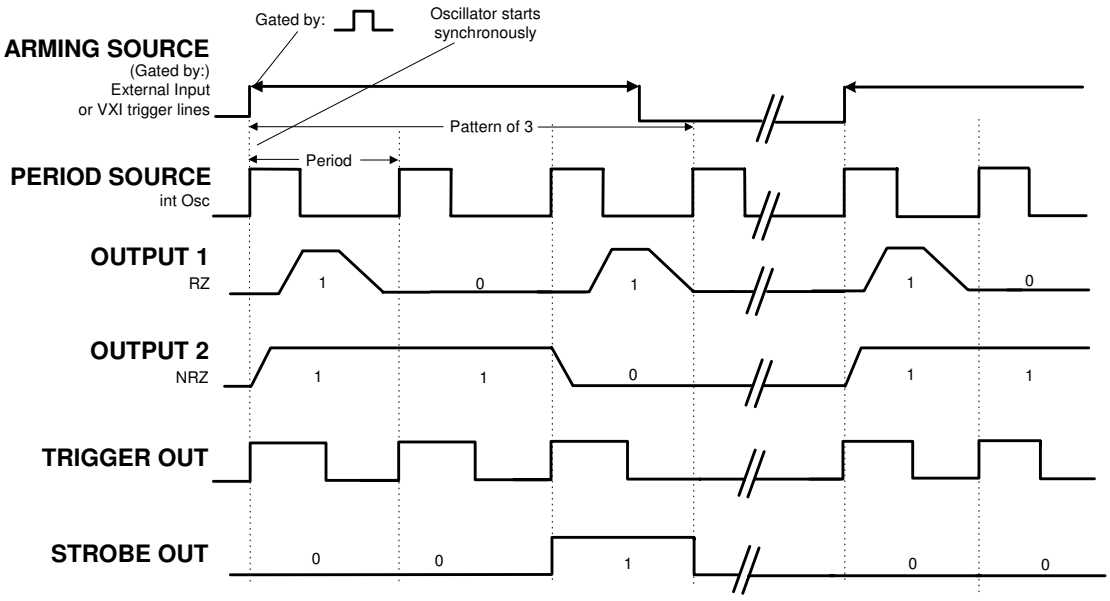
In the second example, either the **internal PLL** or an external **CLK-IN** are used to source the period—both cannot be triggered synchronously.



Gated Pattern Mode

The following figures show typical timings for the *Gated* trigger mode and the *Pattern* pulse mode.

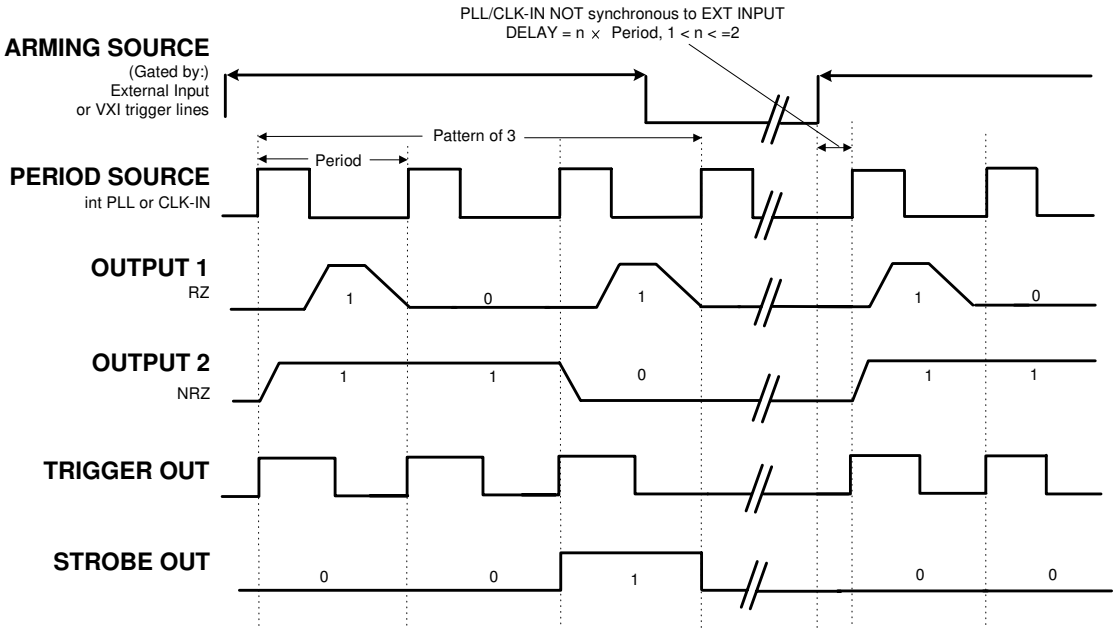
In the first example, the synchronously triggerable **internal Oscillator** is used to source the period.



Characteristics

- A pattern of pulses is gated by high level or low level or always at the selected arming source:
  - External Input
  - 2 VXI ECL trigger lines
  - 8 VXI TTL trigger lines
- You can select between RZ and NRZ data pulses for each output.
- On the Pattern page (see *"The Pattern Page" on page 75*) you can
  - select the pattern length in the range 2 … 16384,
  - select the data values for each output.
- TRIGGER OUT marks each pulse period.
- STROBE OUT can be programmed for each bit on the Pattern page. The pulse width is not programmable; only NRZ pulses are generated.

In the second example, either the **internal PLL** or an external **CLK-IN** are used to source the period—both cannot be triggered synchronously.



Ext-Width Mode

In external width mode, the pulse width is determined by an external signal. You can choose between:

- External Input

  A rising edge at the external input generates a leading edge, a falling edge generates a trailing edge.

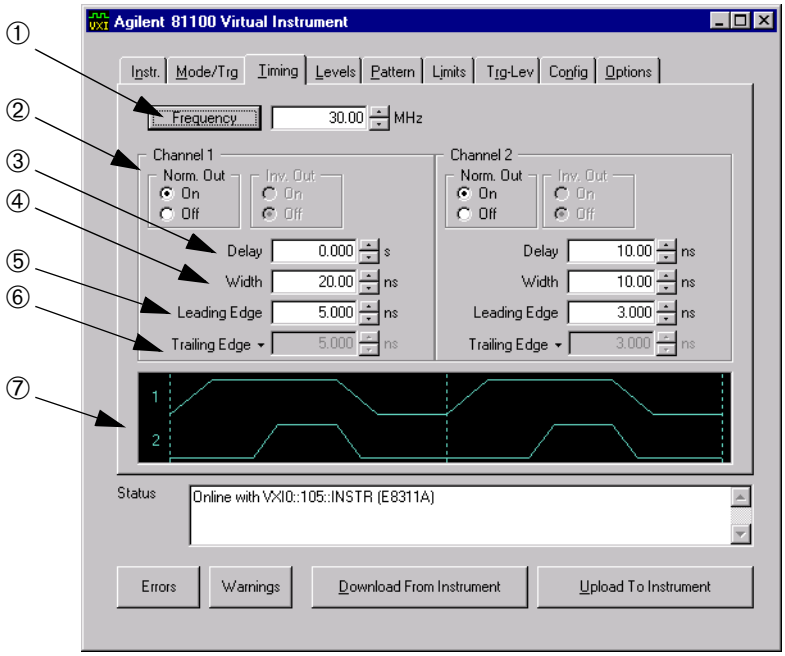
  The threshold and impedance of the external input (EXT-IN) can be set on the Trigger Level (*Trg-Lev*) page.

- 2 VXI ECL trigger lines
- 8 VXI TTL trigger lines

The Timing Page

To select the Timing page, click the *Timing* tab. Use this page to set up the timing parameters of the instrument.

You can use the left part of the Timing page to view and control pulse timing parameters of channel 1, the right part for those of channel 2.



① Pulse Period Parameter

Set the pulse period as either *Period* or *Frequency*.

NOTE For each channel output which is switched on, the pulse period is limited to the value of the width and vice versa.

② Output ON/OFF Parameter

Switch the normal and inverted outputs of each channel on or off.

This automatically switches the Output ON/OFF Parameters on the *"The Levels Page" on page 72* to the same settings.

NOTE The inverted output is only available for the **Agilent E8312A** instrument.

③ Pulse Delay Parameter

Set the *Delay* of the leading edge within the pulse period (see *"Pulse Delay" on page 103*).

④ Pulse Width Parameter

Set the *Width* of the output pulse. The pulse width is independent of changes in pulse period and delay. For the definition, see *"Pulse Width" on page 102*.

For each channel output that is switched on, the width is limited to the value of the pulse period and vice versa.

⑤ Leading Edge Parameter

Set the leading edge transition time of the pulse.

The leading edge of the **Agilent E8312A** instrument can be selected from 800 ps or 1.6 ns.

The leading edge of the **Agilent E8311A** instrument can be adjusted freely.

⑥ Trailing Edge Parameter

Only the leading and trailing edges of the **Agilent E8311A** instrument are independently programmable. This must be done within certain ranges. See *"Ranges of Leading and Trailing Edges" on page 91*.

For the **Agilent E8312A** instrument**,** the trailing edge is always the same as the leading edge.

For the **Agilent E8311A** instrument, two formats are available from the trailing edge drop down list:

- *Trail Edge = Lead Edge*

  The trailing edge transition time is coupled directly to the leading edge to maintain a symmetrical pulse.

- *Trail Edge Absolute*

  Set the trailing edge transition time of the pulse individually.

⑦ Timing Diagram

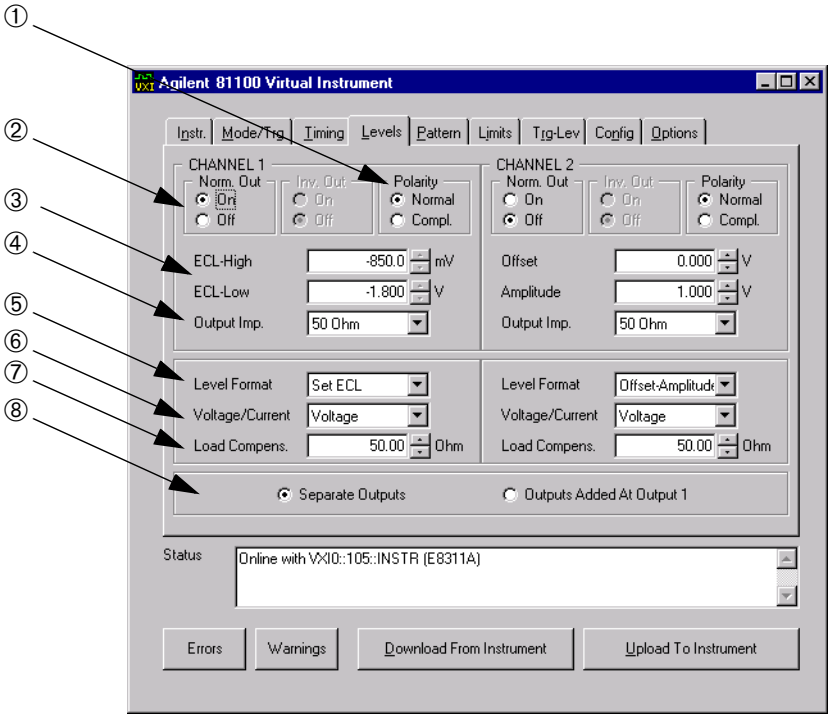
Here you can see a graphical representation of the timing parameters of both channels.

NOTE The timing diagram always shows the signals in RZ format, regardless of the current parameter settings.

The Levels Page

To select the Levels page, click the *Levels* tab. Use this page to set up the level parameters of the instrument.

You can use the left part of the Levels page to view and control the level parameters of channel 1 and the right part for those of channel 2. With the Agilent E8311A instrument a choice can be made between separate and added outputs.



① Normal/Complement Parameters

Switch the OUTPUT between normal and complement modes:

- *Normal*

  Pulse leading edge rises from low to high level, trailing edge falls from high to low level.

- *Compl.*

  Pulse leading edge falls from high to low level, trailing edge rises from low to high level.

② Output ON/OFF Parameter

Switch the normal and inverted outputs of each channel on or off.

NOTE The inverted output is only available for the **Agilent E8312A** instrument.

③ Offset/Amplitude, High/Low Level Parameters

Set and display the pulse levels in terms of either offset and amplitude, or high and low level. You can quickly set TTL or ECL output levels using the *Set TTL* and *Set ECL* level formats (see ⑤ Level Formats).

④ Output Source Impedance Parameter

An impedance of 50 Ω or 1 kΩ is selectable.

NOTE There is no selection for the **Agilent E8312A** instrument.

⑤ Level Formats

You can select the following formats from the *Level Format* drop down list:

- *Set TTL*

  Automatically set the levels to the default TTL levels:

  – TTL-HI: +2.50 V

  – TTL-LOW: +0.0 mV

- *High-Low*

  Select high and low level format for the pulse levels.

- *Offset-Amplitude*

  Select offset and amplitude format for the pulse levels. Offset is measured from 0 V to the middle of the pulse amplitude. Pulse amplitude is the difference between the high and low levels of the pulse.

- *Set ECL*

  Automatically set the levels to the default ECL levels:

  – ECL-HI: –850 mV

  – ECL-LOW: –1.80 V

  These default levels are set once and can be adjusted afterwards by moving the entry focus to the value as normal.

⑥ Voltage/Current Mode (mV/V/mA/A)

You can either set the pulse levels in Volts or in Amperes.

⑦ Load Impedance Parameter

NOTE The load impedance can only be varied with the **Agilent E8311A** instrument.

Adjust the load impedance value expected at the OUTPUT to compensate for non-50 Ω loads. The displayed level parameters are then calculated using this value and therefore represent the levels at a non-50 Ω static load.

⑧ Separate/Added Outputs

Select the outputs of channels 1 and 2 to be separate or digitally added:

- *Separate Outputs*

  Outputs 1 and 2 operate as entirely separate outputs.

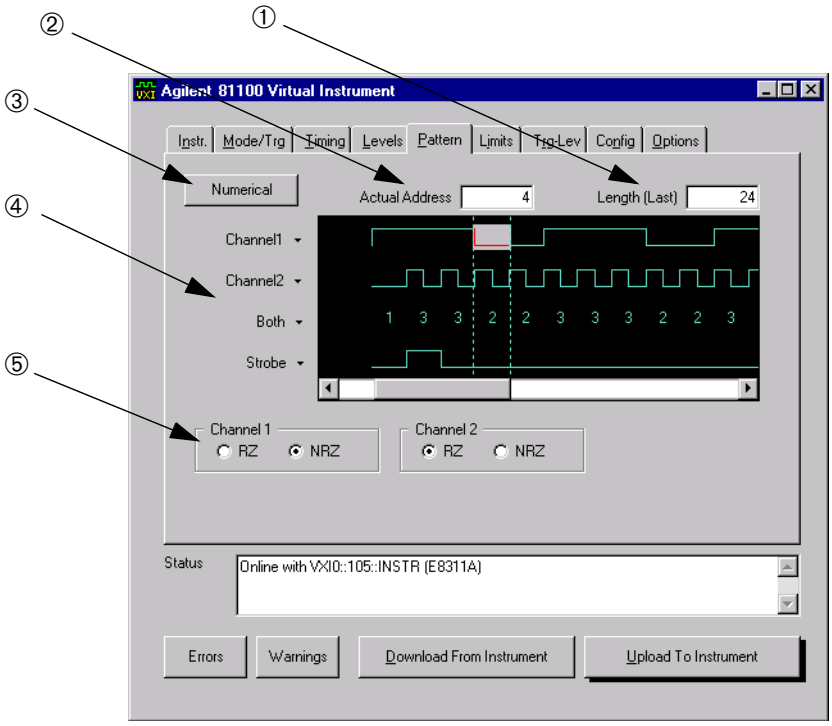
- *Outputs Added At Output 1*

NOTE The channel add option is only available with the **Agilent E8311A** instrument.

Channels 1 and 2 are added (analog channel add). The resulting signal is available at the output 1 connector. Use this to build complex pulse waveforms. Channel 2 is no longer used.

The Pattern Page

To select the Pattern page, click the *Pattern* tab. Use the Pattern page to set up a pattern sequence to be generated by the instrument.



① Length (Last)

Enter the last bit number to set the length of the pattern in the range 2 to 16384.

② Actual Address

Set and display the current bit position.

③ Numerical/Graphical Mode

Switch the bit editing window between numerical and graphical modes.

④ Channel 1, Channel 2, Both, and Strobe

Click in the bit editing window to edit individual data bits—in the *Both* pattern you can edit both output channels together.

The bit editing window automatically moves one location to the right for each pattern entered. To display specific data, you can either scroll through the window or enter the required *Actual Address*.

Block Editing Functions

To enter the bit pattern, the **block editing functions** can be used.

You can select the following block editing functions from the drop down lists of *Channel1*, *Channel2*, *Both*, or *Strobe* on the left-hand side of the page:

- *Fill 0*, *Fill 1*

  Set all bits from the current position to the end of the sequence to 0 or 1.

- *Invert*

  Invert all bits from the current position to the end of the sequence.

- *Set First Bit Only*

  Set the first bit to 1, and all following bits to 0.

- *Set Last Bit Only*

  Set the last bit to 1, and all preceding bits to 0.

- *Insert Bit*

  Insert a bit at the current position. The bit value is copied from the current bit, and all subsequent bits are shifted right. The last bit is lost.

- *Delete Bit*

  Delete the bit at the current position. All subsequent bits are shifted left. The new last bit of the sequence is copied from the old last bit.

- *Clock / n*

  Fill the bits from the actual address to the last with a divided clock pattern. After clicking onto the function, you can enter the dividing factor n from 2 to 16384.

  The bit sequence will be set up as follows:

n	Sequence	n	Sequence
2	101010101010101...	6	111000111000111...
3	100100100100100...	7	111000011100001...
4	110011001100110...	8	111100001111000...
5	110001100011000...	9	1111000001111000...

- *PRBS 2^n - 1*

  To generate a random pattern, PRBS (Pseudo Random Binary Sequence) can be selected. This function fills bits from the actual address to the last. After clicking onto the function, you can enter a value for parameter n of the PRBS polynomial 2^n –1. The value range is 7 to 14.

⑤ RZ/NRZ Data Format

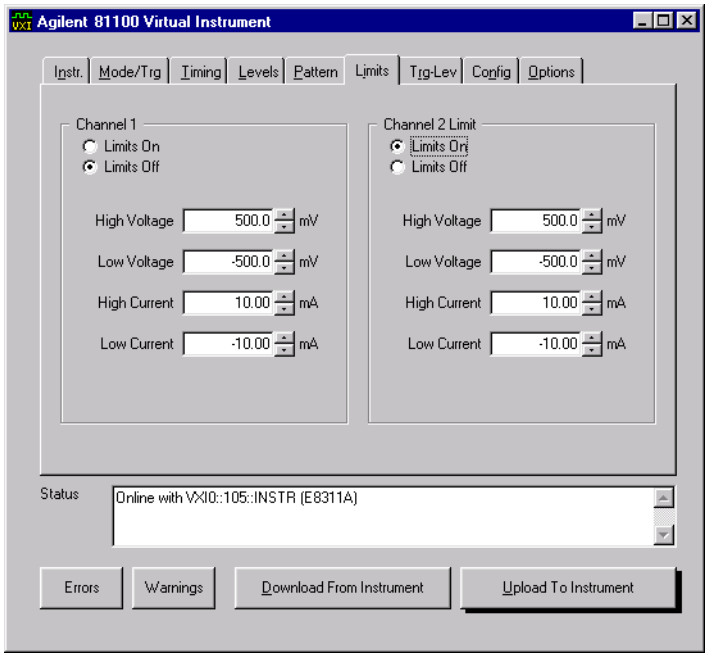
The data output format RZ or NRZ can be selected for the channels if this is not already been done in the Mode/Trigger page.

The Limits Page

To select the Limits page, click the *Limits* tab.

Use the Limits screen to set up voltage and current limits for the pulse level parameters to prevent accidental damage of the device under test.

You can use the left part of the Limits page to view and control the limits of channel 1, the right part for those of channel 2.



After you switch on the limits, the pulse level parameters on the Levels page cannot be adjusted outside the ranges specified on the Limits page if the output is switched on.

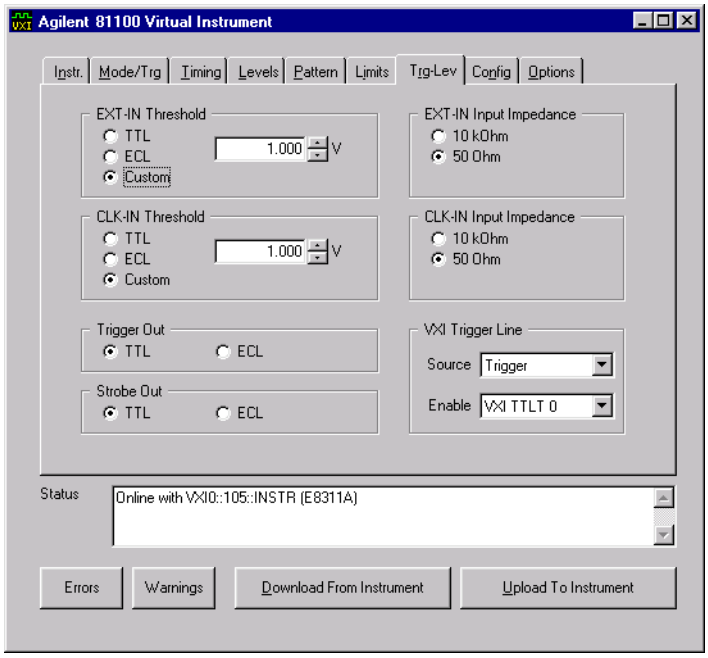
NOTE As current and voltage limits apply, the available ranges of the impedance parameters are also affected.

The Trigger-Level Page

To select the Trigger-Level page, click the *Trg-Lev* tab.

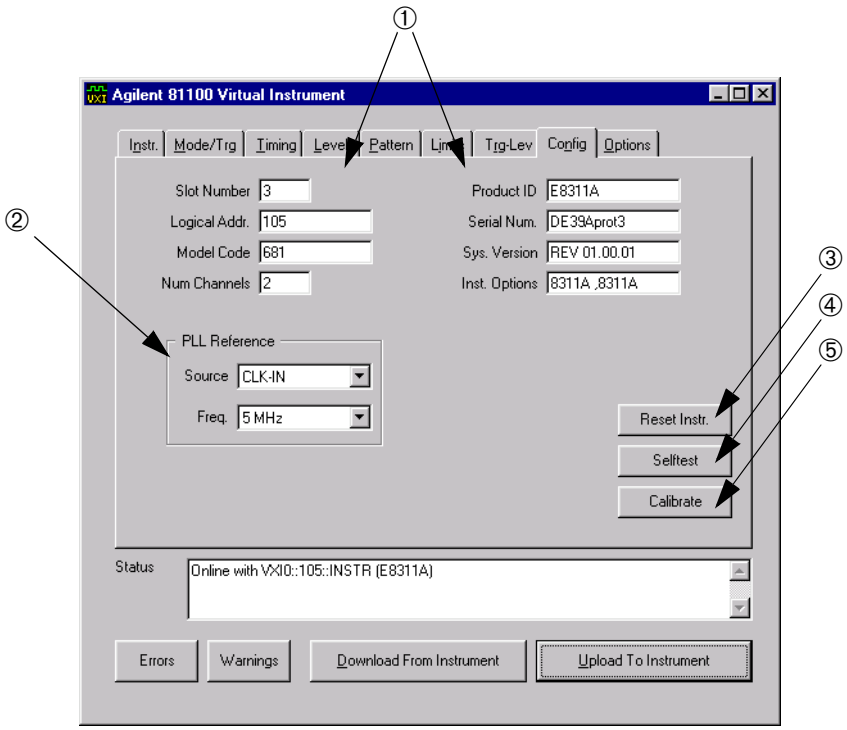
Use the Trigger-Level page to:

- Set the triggering threshold and input impedance for the EXTERNAL IN connector.
- Set the triggering threshold and input impedance for the CLOCK/REF IN connector.
- Set the output levels for the STROBE OUT and TRIGGER OUT connectors.
- Enable VXI Trigger Lines (TTL or ECL) as Trigger or Strobe output.



The Configuration Page

To select the Configuration page, click the *Config* tab. Use this page to reset the instrument parameters, to execute a selftest and for calibration, and to select the PLL Reference.



① Product and Installation Identifiers

These entries cannot be changed. They arise from the current instrument and from its installation.

② PLL Reference

Set the frequency reference source for the PLL:

- *Internal*

  The internal 5 MHz reference.

- *CLK-IN*

  An external reference signal at the CLOCK/REF IN connector is used. The frequency must be 5 or 10 MHz.

③ Reset Instrument

Click this button to reset all parameter settings from the instrument to a defined error-free state. The soft panel user interface will also be updated.

④ Selftest

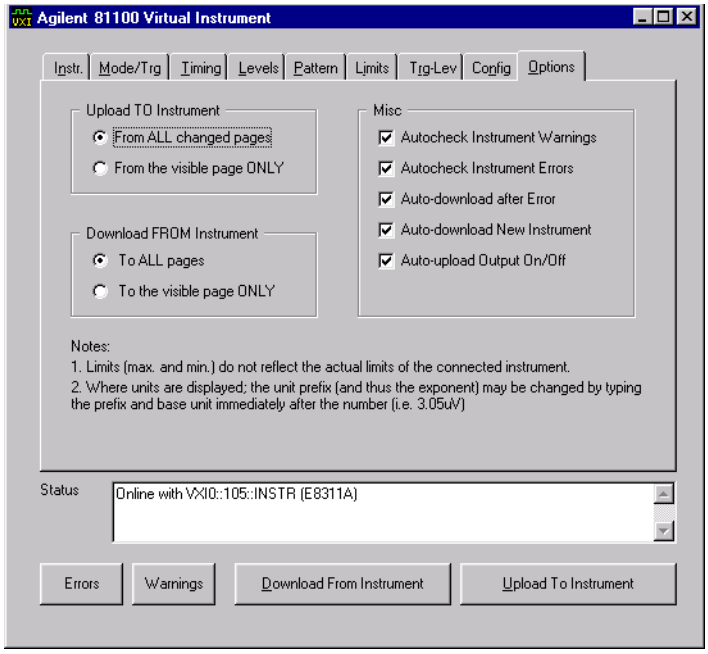
Click this button to perform an instrument selftest. The instrument returns an error message in case of any defect.

⑤ Calibrate

Click this button to perform a timing calibration for the VFO period, delay and width circuitries. If the calibration fails, the list of error messages will be displayed.

The Options Page

To select the Options page, click the *Options* tab. Use this page to set upload and download properties and to switch the autocheck for errors and warnings on or off.



Upload To Instrument

Select between **Upload To Instrument:**

- *From all changed pages*

  This is recommended.

- *From the visible page ONLY*

Download From Instrument

Select between **Download From Instrument:**

- *To ALL pages*
- *To the visible page ONLY*

Misc

In the **Misc** group you can activate more than one item:

- *Autocheck Instrument Warnings*

  If you switch off this item, warnings are no longer immediately displayed (as a result, operation will be faster). To retrieve warning messages, you must click on the *Warnings* button.

- *Autocheck Instrument Errors*

  If you switch off this item, errors are no longer immediately displayed. To retrieve error messages, you must click on the *Errors* button.

- *Auto-download after Error*

  If you activate this item, error-free parameters from the instrument will be downloaded to the soft panel after an error has occurred.

- *Auto-download New Instrument*

  If you activate this item, the next time you select a new instrument in Instrument page, the parameter settings of this instrument will be immediately downloaded to the soft panel.

- *Auto-upload Output On/Off*

  If you activate this item, the parameter settings are immediately uploaded from the output to the instrument as soon as you switch on this output.

Warnings and Errors

The Agilent E8311/12A has two levels of error reporting called "warnings" and "errors". Checking for errors and warnings is always enabled, unless you switch off the output(s).

Warning

A **warning** is generated when the output signal *could* be invalid due to a combination of worst case uncertainties at the current settings of all relevant parameters.

For example, when adjusting the pulse width, all other timing parameters and their uncertainties have to be considered in order to check if the width setting will fit within the pulse period.

Note that the warning limits are therefore not fixed for a particular parameter, but vary with the settings of the related parameters. It is also possible that the error and warning limits are the same, that is, a warning does not occur before the error limit is reached.

If a warning occurs, the settings are still implemented in the hardware because the worst-case conditions used to evaluate the warning limits are very unlikely to occur in practice.

Error

An **error** is generated when an invalid mode is chosen, or the required parameter settings cannot be implemented in the output hardware. Multiple errors can occur, but only the first error detected is displayed.

NOTE If the output(s) is/are switched off and you set parameters, it is usually not possible to generate warnings or errors. All parameters are automatically limited to settings that guarantee specified operation.

If you click the *Reset* button on the Configuration page, the instrument resets all parameters to remove all warning and error conditions.

Specifications

In this chapter you will find the specifications of the Agilent E8311/12A Pulse and Pattern Generators and the pulse parameter definitions.

NOTE **Warranted Performance**

Specifications describe the instrument's warranted performance. Non-warranted values are described as typical. All specifications apply after a 30 minute warm-up phase with a 50 Ω source and a 50 Ω load resistance. They are valid from 5 °C to 40 °C ambient temperature.

Declaration of Conformity

Manufacturer

Agilent Technologies Deutschland GmbH
Boeblingen Verification Solutions
Herrenberger Str.130

D-71034 Boeblingen, Germany

We declare that the system:

Agilent E8311A 165MHz Pulse/Pattern Generator (VXI-Plugin)

Agilent E8312A 330MHz Pulse/Pattern Generator (VXI-Plugin)

conforms to the following standards:

Safety

IEC 1010-1:1990 +A1:1992 +A2:1995 EN61010-1:1993+A2:1995

EMC

EN 55011:1991 / CISPR 11:1990mod Group 1, Class A

EN 50082-1:1997

EN 61000-4-2:1995 ESD: 4kVcd; 8 kVad; 4kV c.p.

EN 61000-4-3:1995 Radiated Immunity: 3V/m 80%AM

ENV 50204:1995 Radiated Immunity: 3V/m; 50%Dty

Supplementary Information

The product herewith complies with the requirements of the

- Low Voltage Directive (73/23/EEC) and the
- EMC Directive (89/336/EEC).

During the measurements against EN55011, the I/O ports were terminated with their nominal impedance, the GPIB connection was terminated with the cable Agilent 10833B.

When the product is connected to other devices, the user must ensure that the connecting cables and the other devices are adequately shielded to prevent radiation.

A Technical Construction File (TCF) got a certificate (#B801356L-6/99) from a Competent Body. For installations in an EU country, the site attenuation requirements must be attended to.

Boeblingen, July 23th 1999

Wolfgang Fenske
Regulation Consultant

General Specifications

In the following, the general specifications are listed.

Environmental Conditions

Condition	Value Range
Operating Temperature Range	5 °C to +40 °C
Storage Temperature	–40 °C to +70 °C
Humidity	95% r.h. up to 40 °C ambient temperature
Altitude Range	up to 2000 m
Installation	Category II
Pollution	Degree 2

Power Requirements

DC Volts	Agilent E8311A		Agilent E8312A	
	DC Current	Dynamic Current	DC Current	Dynamic Currents
+24 V	1.1 A	0.6 A	0.07 A	0.01 A
+12 V	1.1 A	0.25 A	0.9 A	0.05 A
+5 V	1.8 A	0.05 A	1.6 A	0.05 A
–2.0 V	0.6 A	0.05 A	0.35 A	0.02 A
–5.2 V	5.0 A	0.1 A	5.0 A	0.1 A
–12 V	0.9 A	0.05 A	0.8 A	0.05 A
–24 V	1.1 A	0.6 A	0.02 A	0.01 A

	Agilent E8311A	Agilent E8312A
Power Consumption	87 VA max.	50 VA max.

Size

VXI One-Slot C-size.

Weight

	Agilent E8311A	Agilent E8312A
Net	1.8 kg	1.6 kg
Shipping	2.7 kg	2.5 kg

Recalibration Period

1 year recommended.

Warranty

3 years standard.

Cooling Requirements

	Agilent E8311A	Agilent E8312A
For 15 °C rise	5.1 liters/second 0.55 mm H_2O	2.8 liters/second 0.35 mm H_2O

Timing

The timing characteristics are measured at 50% amplitude at fastest transitions in continuous mode with 50 Ω source and load impedance.

Period

Period can also be entered as frequency.

Period	Agilent E8311A	Agilent E8312A
Range	6.060 ns to 999.5 s	3.030 ns to 999.5 s
Resolution	3.5 digits, 5 ps best case for VFO 4 digits, 1 ps best case for PLL	
Accuracy	PLL: 0.01% VFO: 0.5% after selfcal, typical 3% w/o selfcal	
RMS Jitter	PLL: 0.001% + 15 ps VFO: 0.01% + 15 ps	
Frequency Range	1.00 mHz to 165 MHz	1.00 mHz to 330 MHz

There are two period generation sources available:

- startable variable frequency oscillator (VFO)
- high-accuracy frequency generator (PLL)

Repeatability is typically four times better than accuracy.

Width

Width	Agilent E8311A	Agilent E8312A
Range	3.030 ns to 999.5 s (max value: Period – 3.03 ns)	1.515 ns to 999.5 s (max value: Period – 1.5 ns)
Resolution	3.5 digits, best case 5 ps	
Accuracy	± 0.5% ± 250 ps after selfcal, typical ± 3.0% ± 250 ps w/o selfcal	
RMS Jitter	0.01% + 15 ps	
Duty Cycle	0.1% to 95% (depends on period and width; overprogrammable to 99%)	

Delay

Measured between trigger output at front panel and main output.

Delay	Agilent E8311/12A
Fixed Delay	14.0 ns typical
Additional Variable Range	0.00 ns to 999.5 s (max value: Period – 3.03 ns)
Resolution	3.5 digits, best case 5 ps
Accuracy	± 0.5% ± 0.5 ns after selfcal, typical ± 3.0% ± 0.5 ns w/o selfcal
RMS Jitter	0.01% + 15 ps

Double Pulse Delay

Double pulse delay and delay are mutually exclusive. Double pulse delay is the delay between the two pulses in Double Pulse mode.

Double Pulse Delay	Agilent E8311A	Agilent E8312A
Double Pulse Delay Range	6.060 ns to 999.5 s (Width + 3.03 ns) to (Period – Width – 3.03 ns)	3.030 ns to 999.5 s (Width + 1.5 ns) to (Period – Width – 1.5 ns)
Accuracy	± 0.5% ± 150 ps after selfcal, typical ± 3.0% ± 150 ps w/o selfcal	
Resolution	3.5 digits, best case 5 ps	
RMS Jitter	0.01% + 15 ps	
Minimum Period	12.2 ns (82 MHz)	6.06 ns (165 MHz)

Transition Times

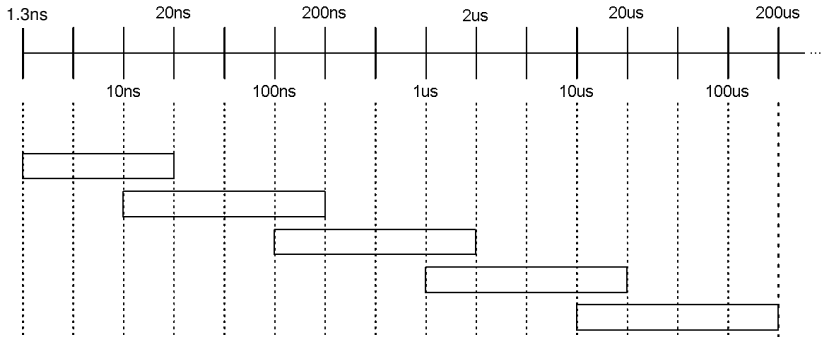
If not otherwise noted, all parameters are measured in Continuous mode with 50 Ω source and load impedance.

The transition times are measured between 10% and 90% amplitude and can be entered as leading/trailing edge.

Transition Times	Agilent E8311A	Agilent E8312A
Range	2.0 ns to 200 ms	800 ps to 1.6 ns, fixed
Minimum Transition	≤ 2.0 ns	≤ 600 ps for Vpp < 1 V ≤ 900 ps for Vpp >1 V
	1.4 ns typical for ECL levels (20% to 80% of amplitude)	450 ps typical for Vpp < 1 V levels (20% to 80% of amplitude)
	5 ns typical for 1 kΩ source impedance	n/a
Accuracy	±10% ± 200 ps	n/a
Linearity	3% typical for transitions > 100 ns	n/a
Resolution	3.5 digits, best case 5 ps	

Ranges of Leading and Trailing Edges

Leading and trailing edges can be programmed independently within the following ranges (maximum ratio 1:20):



Specifications for Output Channels

If not otherwise noted, all parameters are measured in Continuous mode with 50 Ω source and load impedance.

Level parameters can be entered as high/low level or offset/amplitude in terms of voltage or current.

Level Parameters

Level Parameters	Agilent E8311A	Agilent E8312A
Source Impedance	Selectable 50 Ω ± 1% or 1 k Ω typical	50 Ω
Maximum External Voltage	±24 V	–2.2 V to +5.5 V
Short Circuit Current	±400 mA (double for channel addition)	–84 mA to 152 mA
Normal/Complement	Selectable	
ON/OFF	Relays connect/disconnect output (HiZ)	
Limits	High and low levels can be limited to protect the DUT.	

For loads ≠ 50 Ω, the actual load impedance can be entered to correct the output values into a static load.

Level Specifications

Level Specifications	Agilent E8311A		Agilent E8312A
	50 Ω into 50 Ω	1 kΩ into 50 Ω	50 Ω into 50 Ω
Amplitude	100 mVpp to 10.0 Vpp	200 mVpp to 20.0 Vpp	100 mV to 3.8 Vpp
Level Window	–10.0 V to +10.0 V	–20.0 V to +20.0 V	–2.0 V to +3.8 V
Level Accuracy	± (1% of Amplitude + 50 mV)	± (1% of Amplitude + 100 mV)	± (3% of Amplitude + 50 mV)
Resolution	10 mV	20 mV	10 mV

Channel Addition Specifications

NOTE The channel add feature is only available with the **Agilent E8311A** instrument.

2-, 3- and 4-level complex signals can be generated by adding channel 2 to channel 1 at the OUTPUT 1 connector. OUTPUT 2 is disabled.

Channel Addition	Agilent E8311A only	
	50 Ω into 50 Ω	1 kΩ into 50 Ω
Amplitude	100 mVpp to 20.0 Vpp	200 mVpp to 20.0 Vpp
Level Window	–20.0 V to +20.0 V	
Maximum Frequency	60 MHz typical	15 MHz typical
Minimum Transitions	2 ns typical on first channel 5 ns typical on second channel	20 ns typical on both channels
Add Fixed Delay of Second Channel	2.5 ns	

Pulse Performance

Pulse Performance	Agilent E8311A	Agilent E8312A
Overshoot	± 5% of amplitude ± 20 mV	± 5% of amplitude ± 50 mV
Ringing	± 5% of amplitude ± 20 mV	± 5% of amplitude ± 50 mV
Preshoot	± 5% of amplitude ± 20 mV	± 5% of amplitude ± 50 mV
Settling Time	30 ns typical	5 ns typical
Baseline Noise	10 mV RMS typical	4 mV RMS typical
Dynamic Crosstalk	< 0.1% typical	

PLL Ref In/CLK In

It is possible to select between three clock sources: the internal oscillator (VFO), the internal PLL, or CLK-IN (external signal). In triggered mode, the PLL can be used as the trigger source for the VFO, without needing an additional source.

Clock Input/PLL Reference Input

Clock Input/ PLL Reference Inputs	Agilent E8311A	Agilent E8312A
Input Impedance (selectable)	50 Ω or 10 kΩ selectable	
Threshold	–10 V to + 10 V	
Maximum Input Voltage	± 15 Vpp; 10 Vrms	
Input Transitions	< 100 ns	
Input Frequency	dc to 165 MHz	dc to 330 MHz
Minimum Pulse Width	1.5 ns	
Input Sensitivity	≤ 300 mVpp typical	

Phase Locked Loop (PLL)

- Locks either to an external frequency reference at the PLL Ref Input Clk In (5 MHz or 10 MHz selectable) or to its internal reference.
- High accuracy period (frequency) source.
  - When locked to the internal reference, period accuracy, range, resolution, and jitter are improved.
  - When locked to an external frequency reference, the external frequency affects these accuracies.
- Internal triggering of bursts and patterns: the internal PLL can replace an external trigger source, while the output period is determined by the normal internal oscillator.

External Clock

- The output period is determined by the signal at clock input. Frequency accuracy can be increased by using a precise external clock.
- The input frequency can be measured.
- Trigger synchronously to external clock: the output period is synchronous to the signal at clock input. The signal at the external input is used for arming.

Output Modes

These are pulse, burst, and pattern modes.

Pulse Stream Mode

The output signal consists of single or double pulses, controlled by the Trigger mode.

Burst Mode

The output signal consists of bursts of single or double pulses, controlled by the Trigger mode.

Burst Mode	Agilent E8311/12A
Burst Count	2, 3, 4 to 65536
Format	single or double pulses

Pattern Mode

The output signal consists of patterns of RZ or NRZ pulses, controlled by the Trigger mode.

Pattern Mode	Agilent E8311/12A
Pattern Length	2, 3, 4 to 16384 bits/channel and STROBE OUT
Format	RZ (return-to-zero) NRZ (non-return-to-zero) DNRZ (delayed non-return-to-zero)
Random Pattern	PRBS 2^n –1, n = 7 to 14

Trigger Modes

These are continuous, triggered, gated, and external width modes.

Continuous

Generate continuous pulses, double pulses, bursts or patterns.

Externally Triggered

Each active input transition (rising, falling or both) triggers a single or double pulse, a burst or a pattern.

The trigger source can be selected from:

- External Input
- Internal PLL
- 8 VXI backplane trigger lines TTL
- 2 VXI backplane trigger lines ECL

Externally Gated

The active input level (high or low) enables pulses, double pulses, bursts or patterns. The last pulse, double pulse, burst or pattern is always completed.

The gate source can be selected from:

- External Input
- 8 VXI backplane trigger lines TTL
- 2 VXI backplane trigger lines ECL

External Width

To recover a pulse shape of an external signal applied to the External Input or to the VXI trigger lines, the period and width are maintained. The levels and transitions can be set.

External Input

External Input	Agilent E8311A	Agilent E8312A
Input Impedance (selectable)	50 Ω or 10 kΩ	
Threshold	–10 V to +10 V	
Maximum Input Voltage	±15 Vpp; 10 Vrms	
Input Transitions	< 100 ns	
Input Frequency	dc to 165 MHz	dc to 330 MHz
Minimum Pulse Width	1.5 ns	
Input Sensitivity	≤ 300 mVpp typical	

Strobe Output

The strobe output signal can be sent to:

- Strobe out front panel
- 8 VXI backplane trigger lines TTL
- 2 VXI backplane trigger lines ECL

NOTE Only one of the VXI trigger lines can be active at a time. Only strobe ***or*** trigger output can be sent to the VXI trigger lines at a time.

The TTL trigger lines on the VXI backplane are low-active.

Strobe Output	Agilent E8311/12A
Level	TTL or ECL selectable
Output Impedance	50 Ω typical
Maximum External Voltage	–2 V / +7 V
Transition Times	1 ns typical for TTL, 600 ps typical for ECL
Pattern	16384 bits NRZ in pattern mode. Marks burst pulses in burst mode.

Trigger Output

The trigger output signal can be sent to:

- Trigger out front panel
- 8 VXI backplane trigger lines TTL
- 2 VXI backplane trigger lines ECL

NOTE Only one of the VXI trigger lines can be active at a time. Only strobe ***or*** trigger output can be sent to the VXI trigger lines at a time.

The TTL trigger lines on the VXI backplane are low-active.

Trigger Output	Agilent E8311/12A
Level	TTL or ECL selectable
Output Impedance	50 Ω typical
Trigger Pulse Width	50% of period typical; in Triggered Pulses mode: 1.5 ns typical
Maximum External Voltage	–2 V / +7 V
Transition Times	1 ns typical for TTL, 600 ps typical for ECL

Typical Delays

Mode	From	To	Typical Value	
			Agilent E8311A	Agilent E8312A
External Width	Ext Input	Strobe/Trigger Out OUT 1/OUT 2	9.0 ns 18.0 ns	9.0 ns 14.0 ns
Trigger Gated	Ext Input	Strobe/Trigger Out OUT 1/OUT 2	12.0 ns 24.0 ns	12.0 ns 20.0 ns
Continuous	Strobe/Trigger Out	OUT 1/OUT 2	12.0 ns	8.0 ns
External Clock Signal as Pulse Period	CLK IN	Strobe/Trigger Out OUT 1/OUT 2	12.0 ns 24.0 ns	12.0 ns 20.0 ns
any	Trigger Out Front Panel	Next Slot via Backplane ECL	1 ns typical[a]	
any	Trigger Out Front Panel	Next Slot via Backplane TTL	11 ns typical[a]	

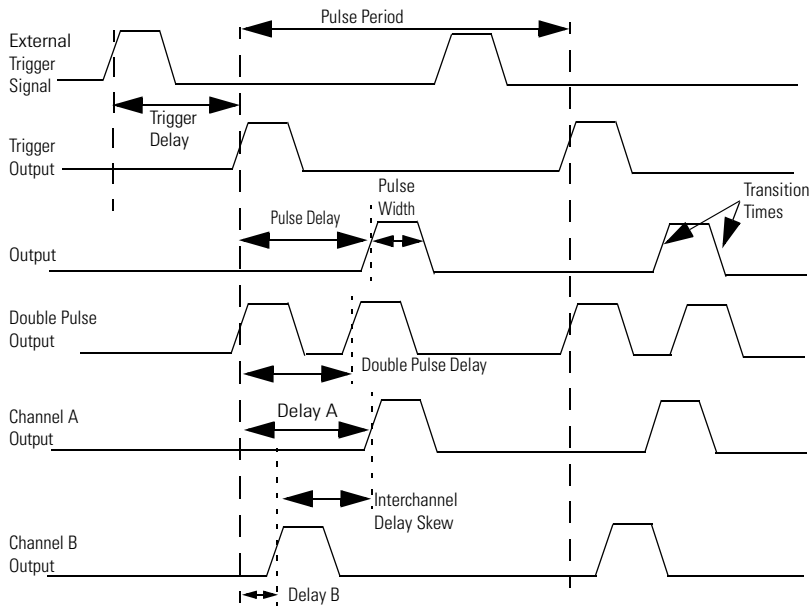
[a] Delay will vary with the load of the connected modules at the backplane.

Remote Control

Register-based VXI interface. Access only by message-based driver library.

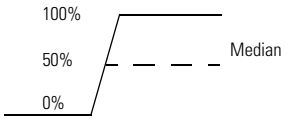
Pulse Parameter Definitions

The pulse parameter terms used in the instrument specifications are defined here. The following figure shows a graphical overview of the pulse parameters.



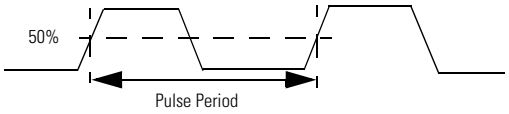
Time Reference Point

The time reference point is at the median of the amplitude (50% amplitude point on pulse edge):



Pulse Period

The time interval between the leading edge medians of consecutive output pulses:

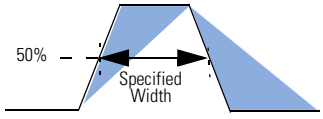


Trigger Delay

Interval between trigger point of the external trigger input signal and the trigger output pulse's leading edge median.

Pulse Width

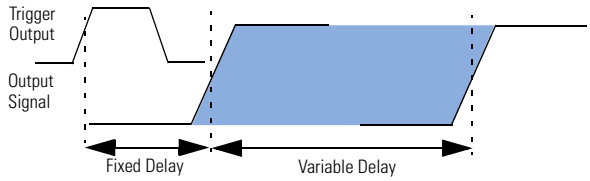
Interval between leading and trailing edge medians:



The specified and displayed value is that obtained with the fastest edges, essentially equal to the interval from the start of the leading edge to the start of the trailing edge. By designing so that the pulse edges turn about their start points, the interval from leading edge start remains unchanged (in practice, start points may shift with changes in transition time) when transition times are varied. This is more convenient for programming and the width display is easy to interpret.

Pulse Delay

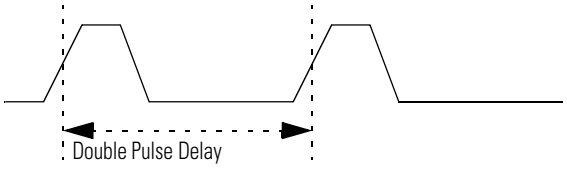
Interval between leading edge medians of trigger output pulse and output pulse:



The specified and displayed value is that obtained with the fastest leading edge. Pulse delay has two components, a fixed delay from trigger output to output signal and a variable delay with respect to the trigger output.

Double Pulse Delay

Interval between leading edge medians of the double pulses.

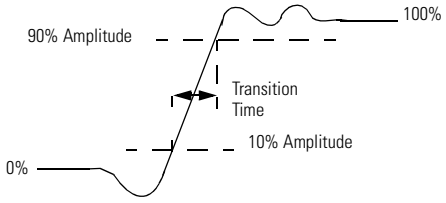


Interchannel Delay (Skew)

Interval between corresponding leading edge medians of the output signals.

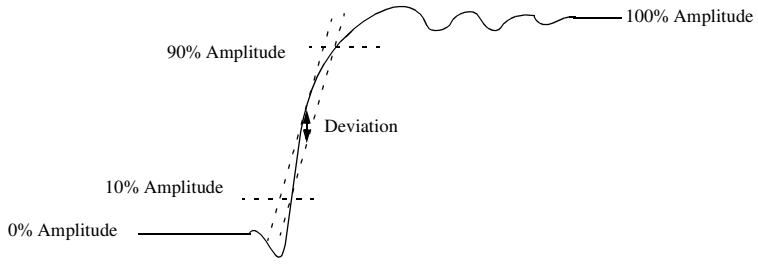
Transition Time

Interval between the 10% and 90% amplitude points on the leading/trailing edge:



Linearity

Peak deviation of an edge from a straight line through the 10% and 90% amplitude points, expressed as percentage of pulse amplitude:



Jitter

Short-term instability of one edge relative to a reference edge. Usually specified as rms value, which is one standard deviation or “sigma”. If distribution is assumed Gaussian, six sigma represents 99.74% of the peak-peak jitter.

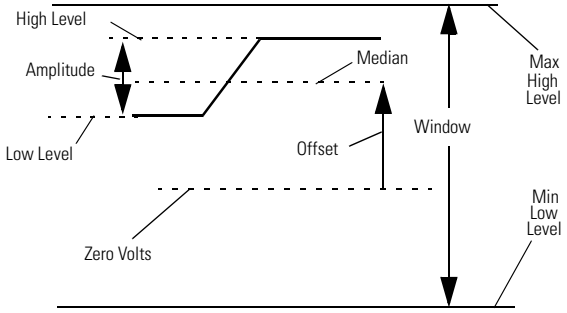
The reference edge for period jitter is the previous leading edge. That for delay jitter is the leading edge of the trigger output. Width jitter is the stability of the trailing edge with regard to the leading edge.

Stability

Long-term average instability over a specific time, for example, hour, year. Jitter is excluded.

Pulse Levels

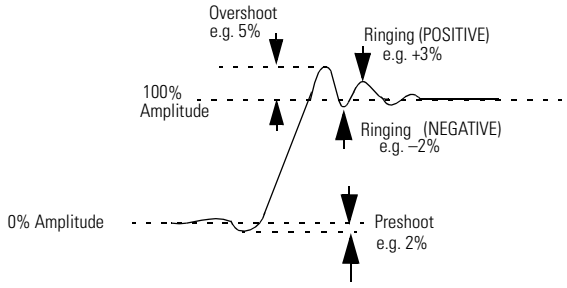
Pulse output is specified as pulse top and pulse base (usually referred to as high level and low level), or as peak to peak amplitude and median offset. A “window” specification shows the limits within which the pulse can be positioned.



Preshoot, Overshoot, Ringing

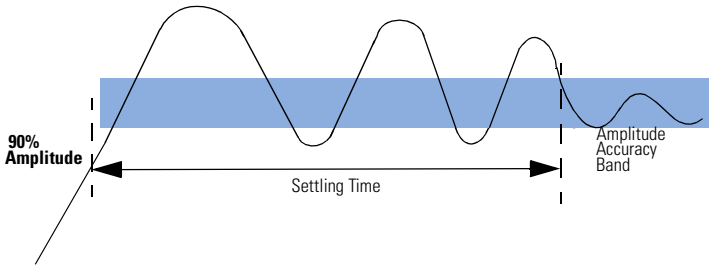
Preshoot and overshoot are peak distortions preceding/following an edge. Ringing is the positive-peak and negative-peak distortion, excluding overshoot, on pulse top or base. For example, a combined preshoot, overshoot, and ringing specification of 5% implies:

- Overshoot/undershoot < 5%
- Largest pulse-top oscillation
  < ±5%, of pulse amplitude.



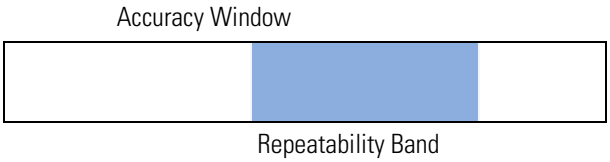
Settling Time

Time taken for pulse levels to settle within level specifications, measured from 90% point on leading edge.



Repeatability

When an instrument operates under the same environmental conditions and with the same settings, the value of a parameter will lie within a band inside the accuracy window. Repeatability defines the width of this band.



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