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pico® Technology

PicoScope® 9000 Series

PC sampling oscilloscopes

Quick Start Guide

Distribution in the UK & Ireland

Lambda

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1. Introduction

Thank you for purchasing a PicoScope 9000 Series PC Sampling Oscilloscope, a high-bandwidth, high-effective-sampling-rate measuring instrument specifically designed for capturing and analyzing cyclical waveforms or clocked data streams.

For further setup information following basic installation, see the **User's Guide** by either clicking the **Help** button within the oscilloscope software or opening the PDF directly from the software disk.

2. Safety information

To prevent possible electrical shock, fire, personal injury, or damage to the product, carefully read this safety information before attempting to install or use the product. In addition, follow all generally accepted safety practices and procedures for working with and near electricity.

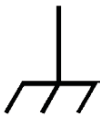
The product has been designed and tested in accordance with the European standard publication EN 61010-1:2010, and left the factory in a safe condition. The following safety descriptions are found throughout this guide:

A **WARNING** identifies conditions or practices that could result in injury or death.

A **CAUTION** identifies conditions or practices that could result in damage to the product or the equipment to which it is connected.

2.1 Symbols

These safety and electrical symbols may appear on the product or in this guide.

Symbols	Description
	Direct current.
	Alternating current.
	Chassis ground terminal.
	Equipment protected throughout by double insulation or reinforced insulation.
	Possibility of electric shock.
	Caution.
	Static awareness. Static discharge can damage parts.
CAT	EN61010 overvoltage category.
	Do not dispose of this product as unsorted municipal waste.

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WARNING
To prevent injury or death use the product only as instructed and use only accessories supplied or recommended. Protection provided by the product may be impaired if used in a manner not specified by the manufacturer.

2.2 Maximum input ranges

Observe all terminal ratings and warnings marked on the product.

The table below indicates the full-scale measurement range and overvoltage protection range for each oscilloscope model. The full-scale measurement range is the maximum voltage that can be accurately measured by the instrument. The overvoltage protection range is the maximum voltage that can be applied without damaging the instrument.

WARNING
To prevent electric shock, do not attempt to measure voltages outside the specified full-scale measurement range below.

Model	Full scale measurement range	Overvoltage protection (without damage or hazard)
All PicoScope 9000 Series oscilloscopes	± 1 V 1 V pk-pk	± 2 V

WARNING
Signals exceeding the voltage limits in the table below are defined as "hazardous live" by EN 61010. To prevent electric shock, take all necessary safety precautions when working on equipment where hazardous live voltages may be present.

Signal voltage limits of EN 61010-1:2010		
± 70 V DC	33 V AC RMS	± 46.7 V pk max.

PicoScope 9000 Series PC oscilloscopes are not designed to measure hazardous live signals as defined by EN 61010. To prevent electric shock, do not attempt to measure voltages outside of the limits shown in the table above or the specified full scale measurement range, whichever is lower.

CAUTION
To prevent permanent damage, do not directly connect the high-voltage differential step generator of the PicoScope 9311 to channel inputs or other equipment. Do not remove the 20 dB pads fitted to the generator outputs, as they ensure the signal is reduced to safe levels. Do not replace the pads with smaller values unless safety is ensured by other test circuit losses and peak ratings.

CAUTION
Exceeding the overload protection range on any connector can cause permanent damage to the oscilloscope and other connected equipment.

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2.3 Grounding

WARNING
The oscilloscope's ground connection through the USB cable is for measurement purposes only. The oscilloscope does not have a protective safety ground.

WARNING
Never connect the ground input (chassis) to any electrical power source. To prevent personal injury or death, use a voltmeter to check that there is no significant AC or DC voltage between the oscilloscope ground and the point to which you intend to connect it.

CAUTION
Applying a voltage to the ground input is likely to cause permanent damage to the oscilloscope, the attached computer, and other equipment.

CAUTION
To prevent measurement errors caused by poor grounding, always use the high-quality USB cable supplied with the oscilloscope.

2.4 External connections

WARNING
To prevent injury or death, only use the power cord and adaptor supplied with the product. These are approved for the voltage and plug configuration in your country.

PicoScope model	USB connection	EXT power supply		
		Voltage (V)	Current (A pk)	Total power (W)
All 9200 models	USB 2.0. Compatible with USB 3.0.	6 V	2.9 A pk	18 W
All 9300 models		12 V	1.7 A pk	21 W

WARNING
To prevent injury, ensure that light or laser light sources are extinguished during connection or disconnection to optical fiber inputs. Never direct an optical source towards a naked eye.

CAUTION
Take care to avoid mechanical stress or tight bend radii for all connected leads, including all coaxial leads and optical fiber and connectors. Mishandling will cause deformation of sidewalls, and will degrade performance and measurement accuracy.

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2.5 Environment

WARNING
To prevent injury or death, do not use in wet or damp conditions, or near explosive gas or vapor.

CAUTION
To prevent damage, always use and store your oscilloscope in appropriate environments, as specified below.

	Storage	Operating
Temperature	–20 °C to +50 °C	+5 °C to +35 °C
Humidity (non-condensing)	≤ 95% RH	≤ 85% RH at 35 °C
Altitude	2000 m	
Pollution degree	2	

2.6 Care of the product

The product contains no user-serviceable parts. Repair, servicing, and calibration require specialized test equipment and must only be performed by Pico Technology or an approved service provider. There may be a charge for these services unless covered by the Pico warranty.

WARNING
To prevent injury or death, do not use the product if it appears to be damaged in any way, and stop use immediately if you are concerned by any abnormal operations.

CAUTION
Do not tamper with or disassemble the oscilloscope, connectors or accessories. Internal damage will affect performance.

CAUTION
When cleaning the product, use a soft cloth and a solution of mild soap or detergent in water. Do not allow water to enter the oscilloscope casing, as this will cause damage to the electronics inside.

CAUTION
Do not block the air vents at the back or front of the instrument as overheating will damage the oscilloscope.

CAUTION
Do not insert any objects through the air vents as internal interference will cause damage to the oscilloscope.

CAUTION
To prevent dirt ingress, fit dust caps to all unmated connectors, and remove them only during connection.

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3. Conformance

3.1 FCC notice

This equipment has been tested and found to comply with the limits for a **Class A digital device**, pursuant to **Part 15 of the FCC Rules**. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference which the user will be required to correct at their own expense.

3.2 CE notice

The PicoScope 9300 Series PC Sampling Oscilloscopes meet the intent of the EMC directive **89/336/EEC** and are designed, tested, and certified to the **EN61326-1 (1997) Class B Emissions and Basic Immunity** standard.

The oscilloscopes also meet the intent of the **Low Voltage Directive** and are designed to the **BS EN 61010-1:2010 / IEC 61010-1:2010** (safety requirements for electrical equipment for measurement, control, and laboratory use) standard.

4. Minimum PC requirements

Processor	Pentium-class processor or equivalent
Memory	1 GB
Disk space	50 MB
Operating system	Microsoft Windows XP (SP2), Windows Vista, Windows 7, Windows 8 or Windows 10. 32-bit or 64-bit.
Ports	USB 2.0, LAN (not PicoScope 9201A).

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5. Included with your PicoScope

Each oscilloscope is supplied with the items and accessories shown below.

	Order code	PicoScope model								
		9201A	9211A	9231A	9301	9302	9311	9312	9321	9341
PicoScope 9000 Series oscilloscope	-	•	•	•	•	•	•	•	•	•
PicoScope 9000 software CD	-	•	•	•						
PicoSample 3 software CD	-				•	•	•	•	•	•
Quick Start Guide	-	•	•	•	•	•	•	•	•	•
6 V power supply, universal input	-	•	•	•						
12 V power supply, universal input	-				•	•	•	•	•	•
Localized mains lead (line cord)	-	•	•	•	•	•	•	•	•	•
USB cable, 1.8 m		•	•	•	•	•	•	•	•	•
SMA / PC3.5 / 2.92 wrench	-	•	•	•	•	•	•	•	•	•
Storage and carry case	-	•	•	•	•	•	•	•	•	•
LAN cable, 1 m	-		•	•	•	•	•	•	•	•
18 GHz 50 Ω SMA(m-f) connector saver adaptor (fitted to each input)	TA170	•	•	•	•	•	•	•	•	•
30 cm precision sleeved coaxial cable	TA265						2	2		
3 dB 10 GHz SMA(m-f) attenuator	TA181		•	•						
10 dB 10 GHz SMA(m-f) attenuator	TA262					•			•	
20 dB 10 GHz SMA(m-f) attenuator	TA173						2			
40 ps tunnel diode head, rising edge	-							•		
40 ps tunnel diode head, falling edge	-							•		
60 cm 50 Ω coaxial SMA(m-m) pulse drive cable	-							2		
18 GHz 50 Ω N(f) - SMA(m) inter-series adaptor (fitted to tunnel diode heads)	TA172							2		
4 GHz power divider kit	TA239		•	•						
14 GHz 25 ps TDR/TDT kit	TA237		•	•			2	2		
14 GHz power divider kit	TA238					•	2	2	•	

Some product packs may contain additional items.

The **4 GHz power divider kit** (TA239) contains:
4 GHz 50 Ω SMA(f-f-f) 3-resistor 6 dB power divider
30 cm precision coaxial SMA(m-m) cable
80 cm precision coaxial SMA(m-m) cable

The **14 GHz 25 ps TDR/TDT kit** (TA237) contains:
18 GHz 50 Ω SMA(m-m) within-series adaptor
18 GHz SMA(f) reference short
18 GHz SMA(f) reference load

The **14 GHz power divider kit** (TA238) contains:
18 GHz 50 Ω SMA(f-f-f) 3-resistor 6 dB power divider
2x 10 cm precision coaxial SMA(m-m) cable

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6. Installing the PicoScope 9000 and PicoSample 3 software

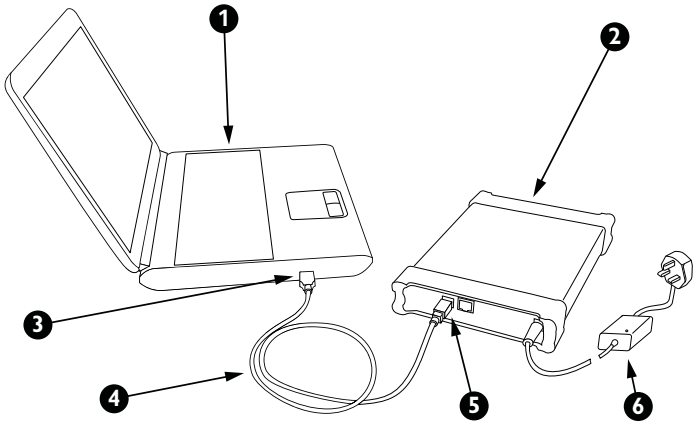
1a. (Recommended: install from web) Go to **www.picotech.com**, click **Downloads**, select the **PicoScope 9000 Series** and your oscilloscope model, then select the latest version of the software. Download and double-click the installer to run it.

1b. (Alternative: install from CD) Insert the Pico software disk into your CD drive. Windows 7 will run the disk automatically. Later versions of Windows will ask you what to do with the CD: select **Run Pico.exe**.

For PicoScope 9200 Series scopes, the **PicoScope 9000** software will be installed.

For PicoScope 9300 Series scopes, the **PicoSample 3** software will be installed.

2. Follow the on-screen instructions to install the appropriate software. Do not connect the oscilloscope until the installation is complete.
3. Connect the mains lead (line cord) to the mains adaptor, and plug it into a mains power socket. Then connect the DC power lead to the back of the oscilloscope, and switch on the mains power.
4. Connect the oscilloscope to the PC using the USB cable supplied. Alternatively, for information on using a LAN connection see the **User's Guide** or separate **LAN setup leaflet**.
5. Wait for Windows to install the oscilloscope. While doing so it will display a message in the taskbar either saying "new device" or telling you that the PicoScope oscilloscope has been installed.
6. Run the **PicoScope 9000** or **PicoSample 3** software by clicking the new icon on your Windows desktop.
7. Once you have finished the basic installation, refer to Section 7 for further information about setting up and using your oscilloscope.



1. PC
2. PicoScope PC oscilloscope
3. USB port
4. USB cable
5. USB port
6. AC adaptor

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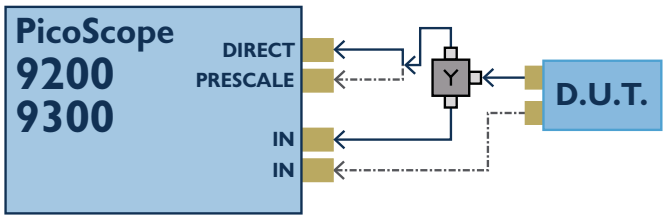
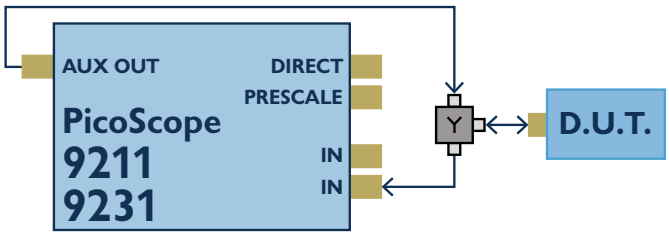
7. Using your oscilloscope

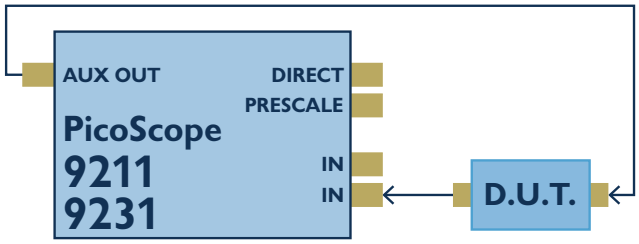
7.1 Connection diagrams



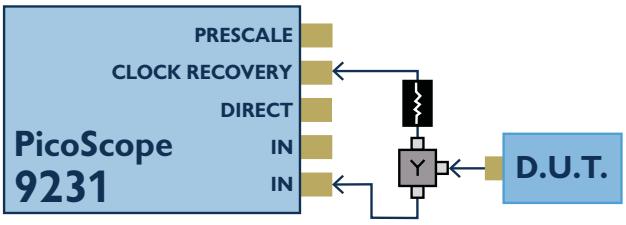
Basic setup for all PicoScope 9000 Series oscilloscopes



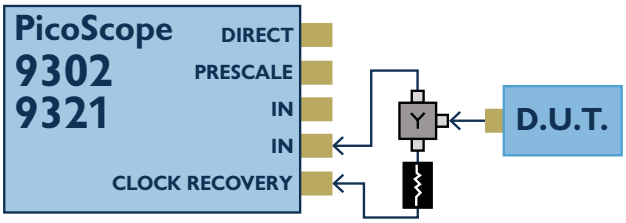
Single-ended TDR setup



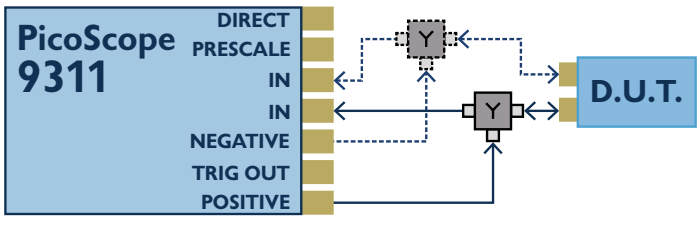
Single-ended TDT setup



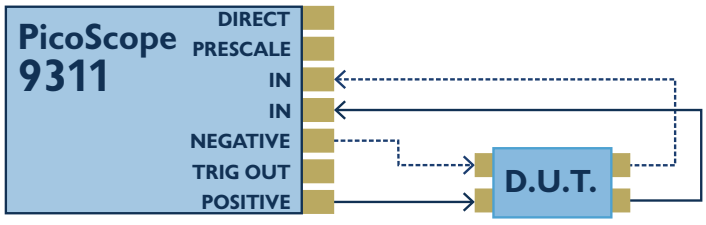
Clock recovery setup for PicoScope 9200 Series



Clock recovery setup for PicoScope 9300 Series



Single-ended and differential TDR setups with the PicoScope 9311



Single-ended and differential TDT setups with the PicoScope 9311

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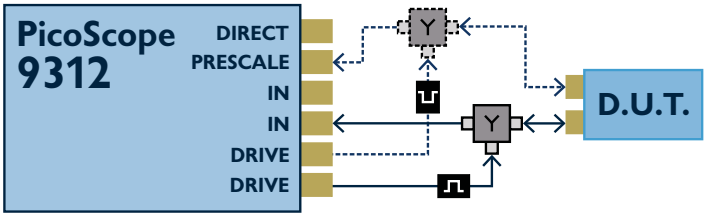
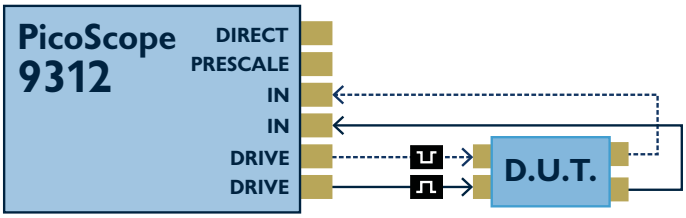
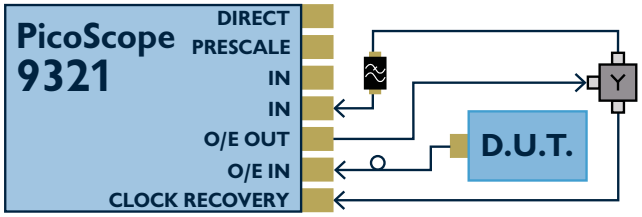


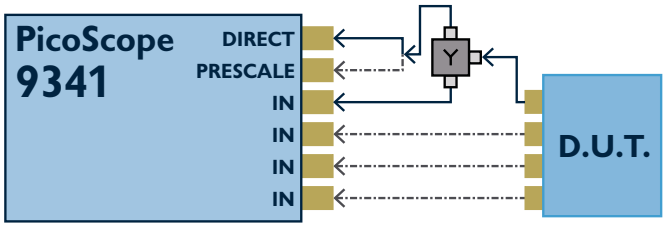
Single-ended and differential TDR setups with the PicoScope 9312



Single-ended and differential TDT setups with the PicoScope 9312



Optical input setup for PicoScope 9321



Four-channel setup for PicoScope 9341

NOTE
The arrangement of the front panel connectors varies between models. Always check the labeling on the front panel of your scope before connecting any equipment.

CAUTION
Refer to the advice regarding PicoScope 9311 outputs in **2.2 Maximum input ranges**.

CAUTION
Refer to the advice regarding cable bend radii in **2.4 External connections**.

Key:

---------	Differential connection		Positive pulse head
-·-·-·-·-	Alternative connection		Negative pulse head
	Optical connection		Low-pass filter (optional)
Y	Power divider		Attenuator (optional)*
D.U.T.	Device under test		

* 3 dB (PicoScope 9200 Series) or 10 dB (PicoScope 9300 Series) attenuator fitted for optimum flatness. Remove only for applications requiring higher clock recovery sensitivity.

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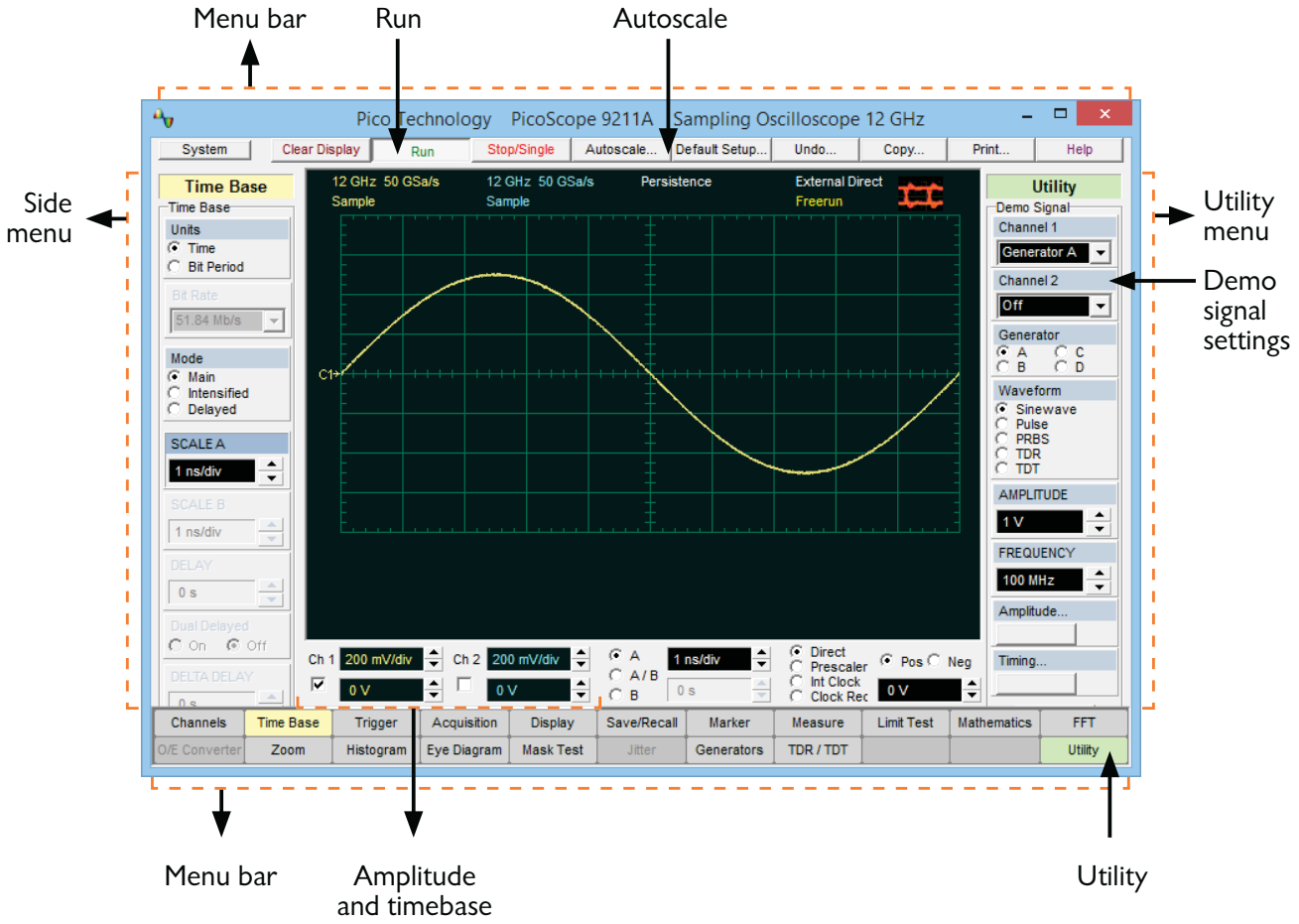
7.2 Getting started with the PicoScope 9000 software

Follow these setup instructions if you are using a PicoScope 9200 Series oscilloscope and the PicoScope 9000 software. For PicoScope 9300 Series oscilloscopes using the PicoSample 3 software, continue to the next section.



1. Select **PicoScope 9000** from the Windows **Start** menu to run the software.
2. You may be asked to calibrate the timebase and channels of your scope. If it's appropriate to do so, click **OK**.
3. Connect an external signal source, if available, to Channel 1 on the oscilloscope.
4. If you do not have a suitable test signal, use the Demo Signal generator to generate a virtual test signal:

   a. Click the **Utility** button on the bottom menu bar. The **Utility** control panel will open.

   > **TIP** When opening a side menu, right-click the appropriate button to open the menu to the right of the waveform display, or left-click to open it on the left.

   b. Select **Demo Signal** from the **Utility** control panel.

   c. Assign a test signal generator to one or both of the input channels.
5. You should now see a signal waveform in the oscilloscope window. If it is not shown, make sure the **Run** button is selected in the top menu bar. The waveform may be unstable or incorrectly scaled at this stage.
6. Click **Autoscale...** on the top menu bar.
7. Adjust the basic amplitude and timebase controls.

You have now captured your first waveform with a PicoScope 9200 Series scope!

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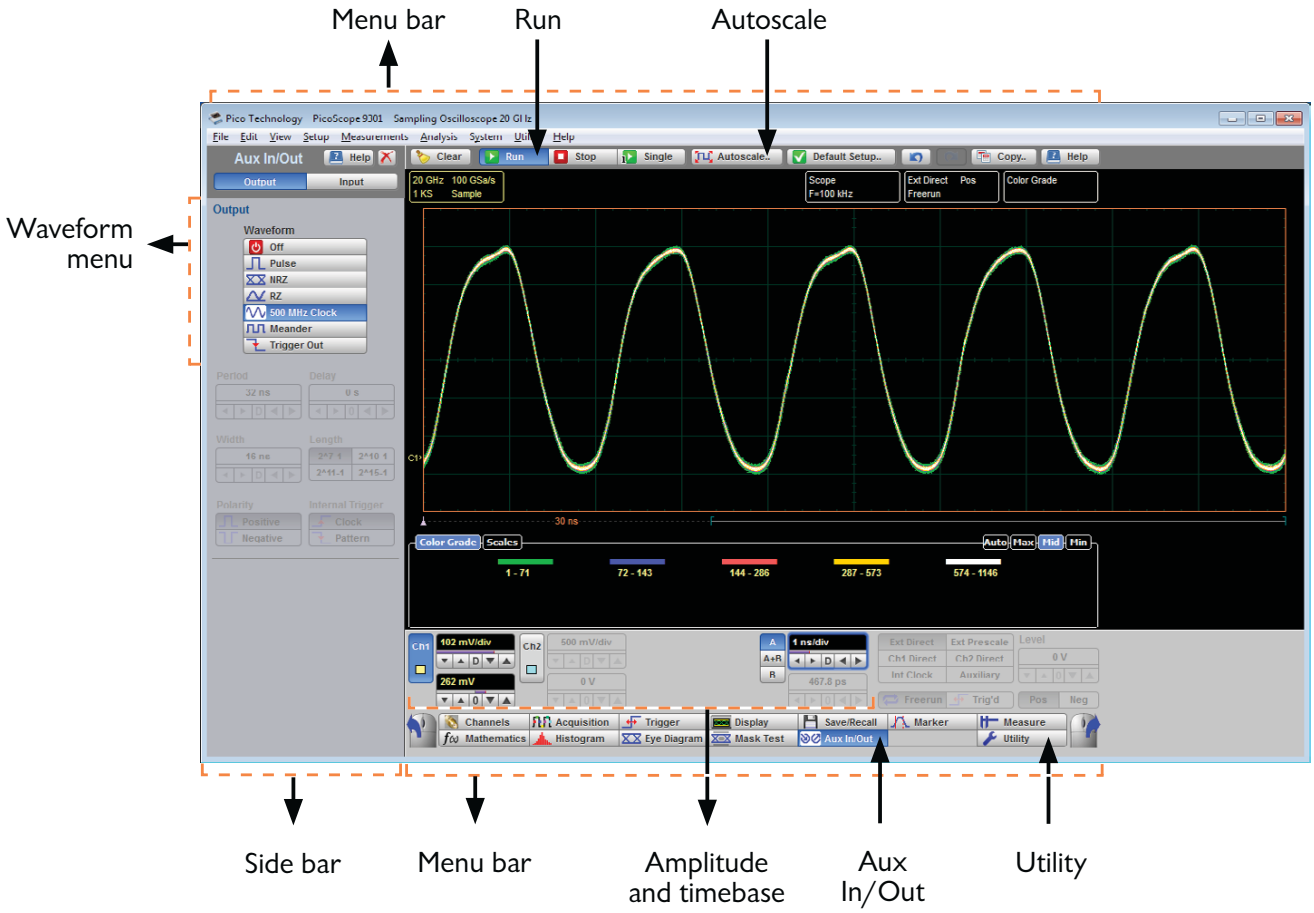
7.3 Getting started with the PicoSample 3 software

Follow these setup instructions if you are using a PicoScope 9300 Series oscilloscope and the PicoSample 3 software. In this example we will use the oscilloscope's built-in pulse generator (labeled **Aux Out** on the rear panel) as the signal source.



1. Select **PicoSample 3** from the Windows **Start** menu.
2. You may be asked to calibrate the timebase and channels of your scope. If it's appropriate to do so, click **OK**.
3. Connect the Aux Out to Channel 1.
4. If you are using a PicoScope model without a built-in pulse generator, select **Demo** when starting the software to use the demonstration signal generator, and continue to step 7.
5. Click **Aux In/Out** on the bottom menu bar. A new side menu will appear.

> **TIP** When opening a side menu, right-click the appropriate button to open the menu to the right of the waveform display, or left-click to open it on the left.

6. Select **Pulse**, **NRZ**, **RZ**, or **500 MHz Clock** from the **Waveform** menu.
7. You should now see a signal waveform in the oscilloscope window. If it is not shown, make sure the **Run** button is active. The waveform may be unstable or incorrectly scaled at this stage.
8. Click **Autoscale** on the top menu bar.
9. Adjust the basic amplitude and timebase controls.

You have now captured your first waveform with a PicoScope 9300 Series scope!

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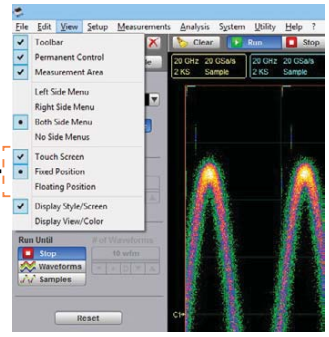
7.4 Touchscreen support in PicoSample 3

PicoSample 3 also works on touchscreen devices. Tap for a left-click and hold for a right-click. To zoom in, drag across the screen to draw a box, then tap inside it. You can also use the touch screen to move traces and cursors, to position trace markers and to set and adjust the data capture area for histograms.

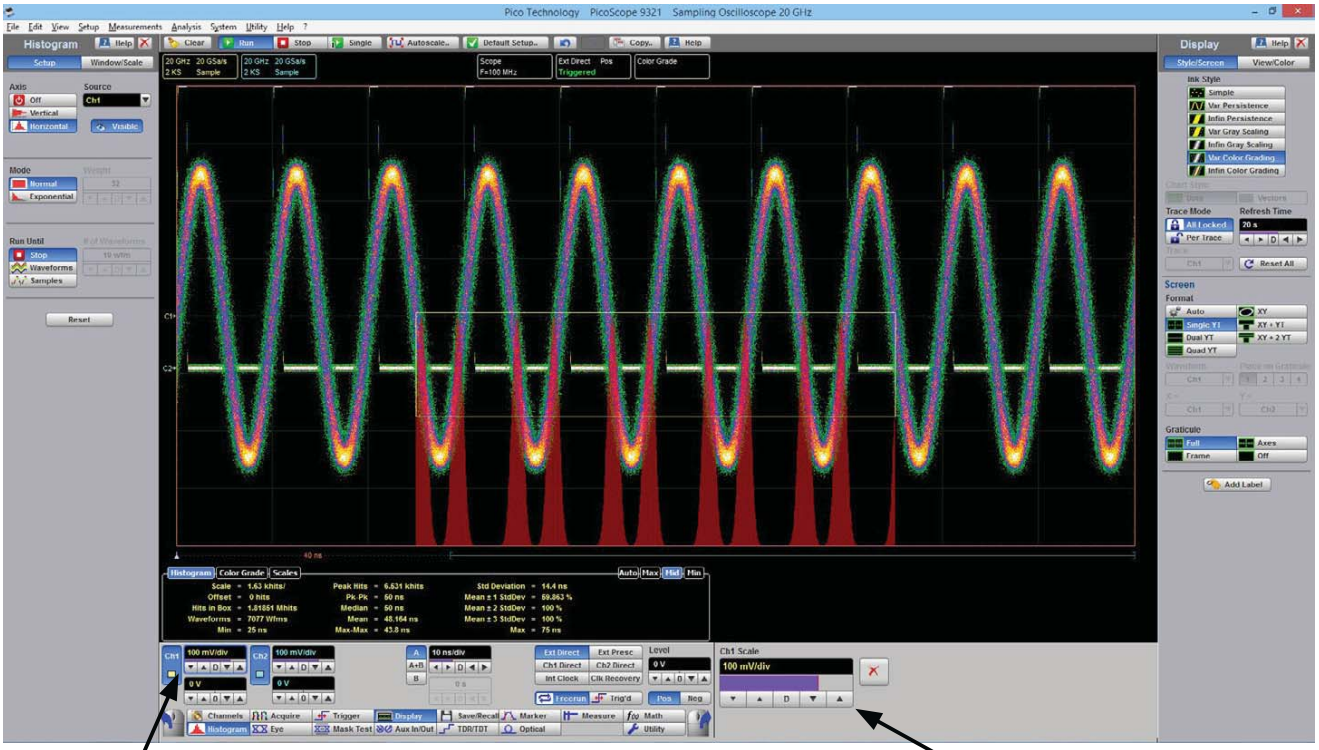
On the menu bar, tap **View > Touch Screen** to open the touch-friendly enlarged parameter control to the right of the main control panel. This lets you make fine adjustments to whichever parameter control is currently highlighted, either by pressing the increment buttons or by dragging the purple bar.

If you prefer, you can set the enlarged controls to float in a separate window.

Settings for enlarged parameter controls

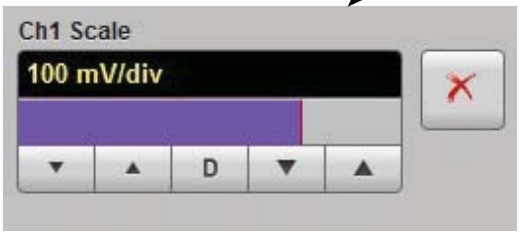


The image below shows PicoSample 3's touchscreen support in action: the box defining the histogram was drawn by hand, and the enlarged parameter control is being used to control the Channel 1 voltage scale.



The Channel 1 voltage scale control is active (and highlighted in blue), but the buttons and the parameter overview bar are too small for easy use with the touch screen.

The enlarged parameter control has larger buttons and a much broader parameter overview bar.



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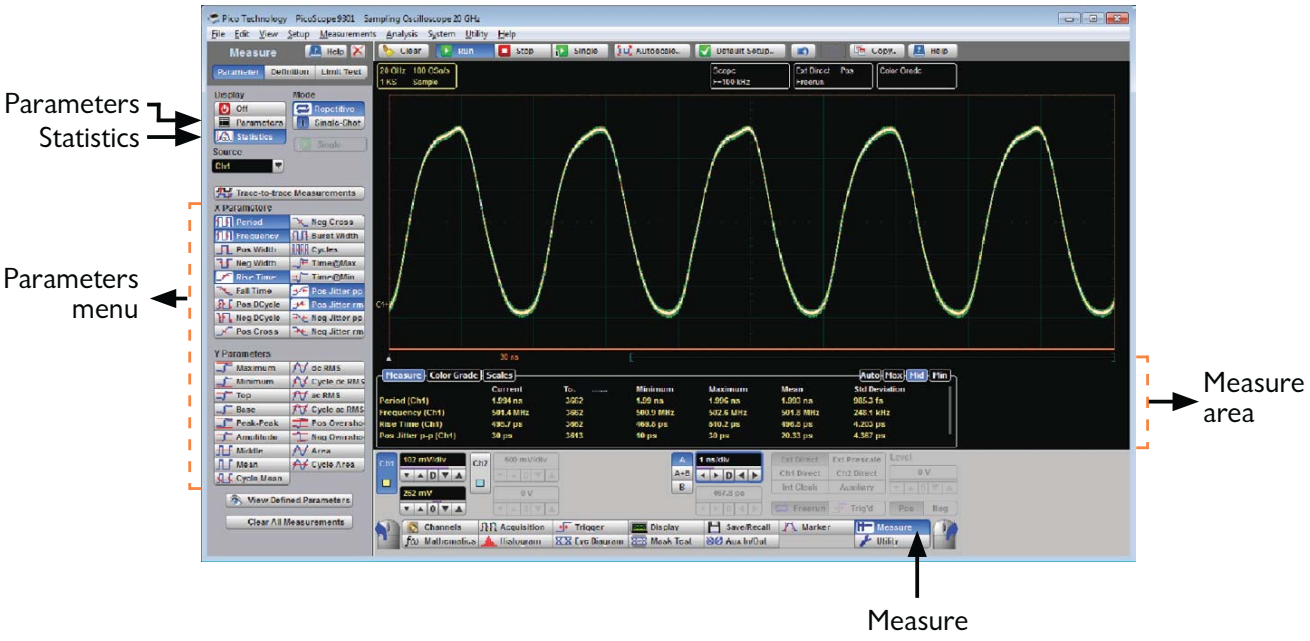
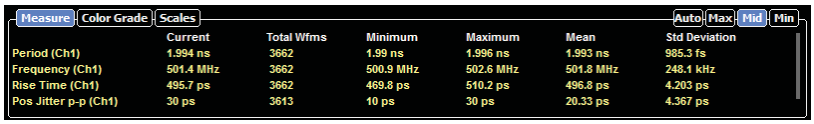
7.5 Adding measurements

The setup below uses the PicoSample 3 software as an example. The same steps can be followed for the PicoScope 9000 software, but the layout may be different.





1. With the **500 MHz Clock** waveform chosen, select **Measure** from the bottom menu bar.
2. Select **Parameters** from the side menu.
3. Select up to 10 defined parameters.
   Note: The control layout is slightly different in the PicoScope 9000 software. Click one of the category buttons such as **X Parameters** to reveal the list of measurements.
4. View the results in the **Measure** area beneath the waveform.
5. Select **Statistics** from the side menu for a wider numeric perspective.
6. Resize the **Measure** area by selecting the **min**, **mid**, **max**, and **auto** tabs, which each display different data sets.

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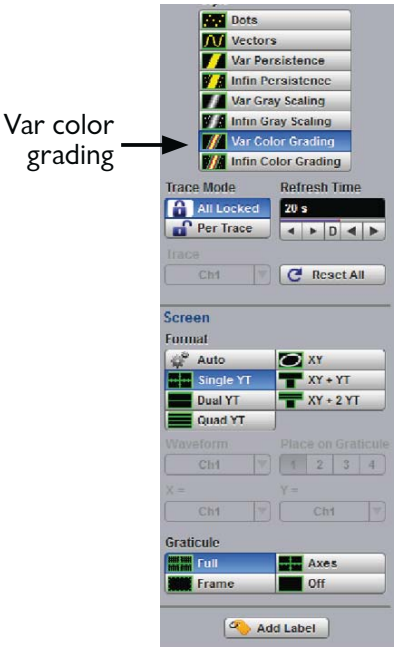
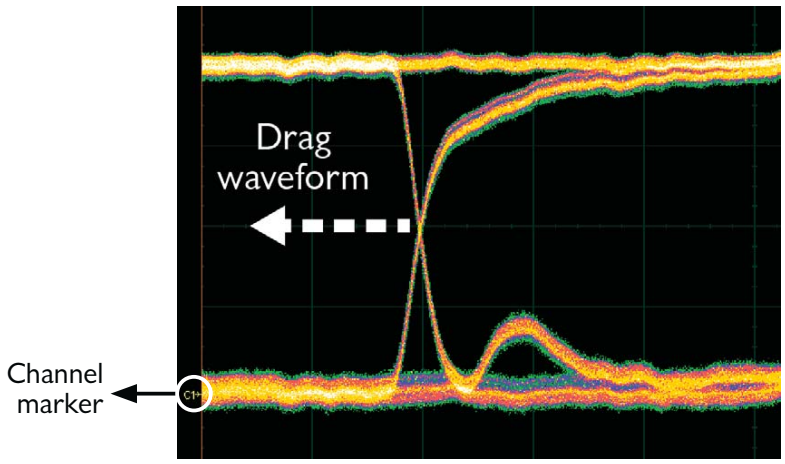
7.6 Configuring the display

The setup below uses the PicoSample 3 software as an example. The same steps can be followed for the PicoScope 9000 software, but the layout of the controls may be different.

1. With the **NRZ** waveform chosen, select **Display** from the bottom menu bar.
2. Select **Var Color Grading** from the side menu to adjust the view of the waveform.
3. Click on the waveform and drag it to the left, as shown below.

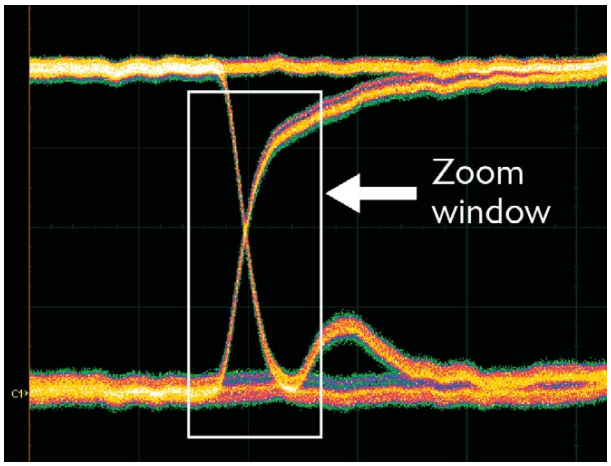


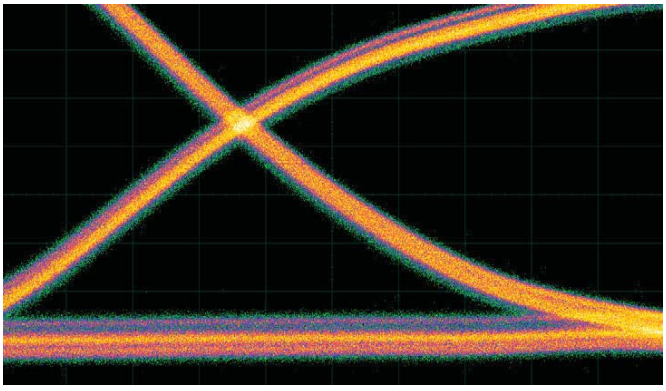


4. Set a faster timebase using the basic controls:

   OR

5. Click outside the waveform to drag out a zoom window.
6. Click within the zoom window to zoom. A second "B" timebase starts and is displayed.





7. To adjust its vertical position, click on the waveform and drag it up or down. To adjust the vertical offset voltage, click on the channel marker (as shown above) and drag it up or down.

You have now covered the basic working principles of the scope software. For further detailed information, see the **User's Guide** and the help files within the software.

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8. Free newsletter

Pico Technology sends out a free monthly newsletter by email. This gives news of product launches, software upgrades and application notes, as well as hints and advice. We treat your e-mail address and other details as confidential and will not pass them to any third party. To subscribe, visit:

www.picotech.com/newsletter/

9. Software updates and replacement

The latest versions of all Pico software and manuals can be downloaded free of charge at:

www.picotech.com

If you require a new software disk, please contact Pico Technology or your distributor. There may be a small charge for this service.

10. Specifications

The **User's Guide** and **Data Sheet** contain the latest specifications for your PicoScope PC Sampling Oscilloscope. We recommend that you print a copy of the specification table for easy reference.

11. Technical support

Regularly updated technical support information can be found at the Pico Technology technical support website and users' forum here:

www.picotech.com/support/

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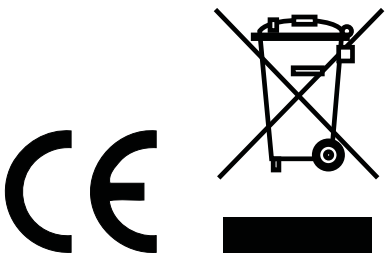
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