



GPS-1104XU

Digital Storage Oscilloscope

100 MHz · 4 channels · 1 GSa/s · 14 Mpts

Quick Start Guide

Issue 1

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1 Safety

Read this section before connecting anything to the instrument.

This oscilloscope is not rated for installation measurement. It must not be used for measurements in categories CAT II, CAT III or CAT IV, and must not be used on mains circuits.

- Use the supplied mains lead and make sure the instrument is earthed. It earths through the protective conductor of that lead, and the earth must be connected before anything is connected to the inputs or outputs.
- The outer shells of the channel BNCs are connected to the chassis and so to earth, and so is the probe ground lead. Never connect the ground lead to anything that is not at earth potential.
- Do not exceed 400 V peak on any input.
- Do not touch the metal of the probe tip while it is connected to a source, and check that the probe lead's insulation is sound before use.
- Leave at least 10 cm clear beside, above and behind the instrument for the cooling fan, and keep the intake and exhaust unobstructed.
- Use it indoors, in a clean and dry place. Do not operate it in damp conditions, in an explosive atmosphere, or with a cover removed.
- There are no user-serviceable parts inside. If you suspect damage, have the instrument inspected before using it again.

If the instrument is used in a way that is not specified here, the protection it provides may be impaired.

2 In the box

- GPS-1104XU oscilloscope
- Four passive probes, 100 MHz, switchable 1X and 10X
- Mains lead
- USB cable
- Quick start guide and calibration certificate

Check the contents before you begin, and keep the packaging until you are satisfied the instrument works.

3 First power-on

Fold the feet under the front out if you want the instrument tilted back for easier viewing. Connect the mains lead to the socket on the rear panel; the instrument accepts 100 to 240 V at 50 or 60 Hz, or 100 to 120 V at 400 Hz, and needs no voltage setting.

Press the power key at the bottom left of the front panel. The instrument runs a series of self-tests, during which you will hear relays switching, and then shows its main screen.

Checking it works

Press Default. Set the switch on one probe to 10X, connect it to channel 1, and clip the probe tip to the compensation output and its ground lead to the ground terminal beside it. Press Auto Setup. A steady square wave should appear.

Repeat with each of the other channels. If the square wave is not flat-topped, compensate the probe as described next.

4 The probe

More wrong measurements come from the probe than from the instrument, and both of the common reasons are avoidable.

The switch on the probe and the setting in the menu must agree

Press the channel key, then Probe, and select the factor that matches the switch on the probe. If the two disagree, every voltage the instrument shows is wrong by that factor, and the display will look perfectly reasonable.

Use the probes at 10X for general work. At 1X a passive probe's bandwidth is far below the instrument's 100 MHz, and fast signals will appear smaller and slower than they are.

Compensating the probe

A new probe, or a probe moved to a different channel, should be compensated before it is trusted. With the probe at 10X on the compensation output and Auto Setup pressed, look at the top of the square wave: it should be flat. If it rises at the start of each half-cycle the probe is over-compensated, and if it is rounded the probe is under-compensated. Adjust the trimmer in the probe with a non-metallic tool until the top is flat.

5 The front panel

Control	What it does
Display	7 inch colour TFT, 800 × 480
Universal knob	Selects menu items and changes values; press to confirm
Function keys	Cursors, Acquire, Save/Recall, Measure, Display/Persist and Utility
Clear Sweeps	Clears persistence, and restarts measurement statistics
Run/Stop	Starts and stops acquisition
Decode	Serial bus decoding: I2C, SPI, UART/RS232, CAN and LIN
Auto Setup	Sets scale, timebase and trigger for a stable display
Navigate	Steps through the record by time, search event or history frame
History	Replays up to 80,000 earlier acquisitions
Default	Returns to the default setup, which can be your own
Vertical	Channel keys 1 to 4, scale and position knobs, Math and Ref
Horizontal	Timebase and position knobs, Roll and Search
Trigger	Setup, Auto, Normal, Single and the level knob
Menu on/off and softkeys	Show or hide the on-screen menu; the keys under the screen select its items
Print	One-press save of the screen, or of the setting you choose
Inputs	Four channel BNCs, 1 MΩ in parallel with 11 pF, 400 V peak maximum
USB host	Front socket for a USB flash drive
Probe compensation	Square-wave output and ground terminal for checking and adjusting probes

6 The rear panel

Connection	What it is for
Handle	Pull up to carry; press down when not needed
LAN	Network connection for remote control
USB device	Connection to a PC for remote control by SCPI commands
Pass/Fail or Trigger Out	BNC giving a pulse at each trigger, or a pass/fail result at 3.3 V TTL
Security lock hole	For a cable lock, bought separately
Mains socket	100 to 240 V at 50/60 Hz, or 100 to 120 V at 400 Hz

7 The controls you need first

Auto Setup and Default

Auto Setup sets the vertical scale, timebase and trigger for a stable display of whatever is connected, and is the first thing to press when nothing sensible is showing. Default returns the instrument to its default setup. That default can be your own, saved through the Save/Recall menu, so a shared bench always starts from the same place.

Run/Stop and Single

Run/Stop starts and stops acquisition; the key is lit while the instrument is acquiring and red when it is stopped. Single arms the trigger, captures one acquisition and stops, which is what you want for an event that happens once.

The knobs, and what pressing them does

- Vertical scale changes volts per division; press it to switch between coarse 1-2-5 steps and fine steps between them.
- Vertical position moves the trace up and down; press it to return to zero.
- Horizontal scale changes the timebase; press it to open Zoom, which shows the whole record above and an expanded section below.
- Horizontal position moves the trigger point left and right; press it to return to zero.
- Trigger level moves the trigger threshold; press it to set the level halfway up the signal, which stabilises most displays at once.
- The Universal knob selects menu items and changes values; press it to confirm.

Trigger mode

Auto keeps the display updating even without a trigger, which is the right choice while you find a signal. Normal updates only when the trigger condition is met. Single captures once and stops.

Help on any key

Hold any key down for about two seconds and the instrument explains what it does. The submenus carry help as well.

8 Channels share the sample rate and memory

The headline 1 GSa/s and 14 Mpts are available on one channel only. Both are shared between the channels that are switched on, and this is the constraint most likely to surprise you.

Channels switched on	Highest sample rate	Longest record
One channel on	1 GSa/s	14 Mpts
Two channels on	500 MSa/s	7 Mpts
Three or four channels on	250 MSa/s	3.5 Mpts

Switch off any channel you are not using: a channel left on halves or quarters the rate available to the ones that matter. Press a channel key twice to turn that channel off. The record length is set from the Acquire menu.

9 Making a first measurement

- Press Measure, choose the source channel and the parameter, and the reading appears at the foot of the screen. Four can be shown at once, from 38 parameters.
- Turn on Statistics to see the current value with its mean, minimum, maximum, standard deviation and count. Clear Sweeps restarts the count.
- All Measure shows every parameter for one channel together, and Gate limits the measurement to a region of the record you choose.
- For a measurement you place yourself, press Cursors and choose manual cursors, or tracking cursors that follow the waveform.

Automatic measurements use the whole record, up to 14 Mpts, rather than the screen, so they are more accurate than reading the graticule.

10 Serial decode, history and search

Decoding a serial bus

Press Decode, choose bus 1 or bus 2 and the protocol (I2C, SPI, UART/RS232, CAN or LIN), and set the source channels and thresholds in its signal menu. The decoded data appears beneath the waveform, and can be shown as a list of events. Two buses can be decoded at once.

To trigger on bus data, open the trigger menu, set the type to serial and choose the same bus. Set the bus up in the Decode menu first: the trigger takes its source channels from there.

Looking back

History keeps up to 80,000 earlier acquisitions, each time-stamped, so an event you missed on screen can be found afterwards. Sequence mode, in the Acquire menu, divides the record into as many as 80,000 segments with almost no dead time between them, for capturing a burst of events.

Search marks every event of a type you choose (edge, slope, pulse, interval or runt) in the record, and Navigate steps from one to the next.

11 Saving, and connecting to a PC

The Save/Recall menu stores setups, waveforms, screen images and CSV data, internally or to a USB flash drive in the front socket. The Print key saves the screen, or the setting you choose, in one press.

For remote control, connect the USB device socket on the rear to a PC; the instrument appears as a USBTMC device and accepts SCPI commands. The LAN port takes the same commands over VXI-11, Telnet on port 5024, or a raw socket on port 5025.

The Pass/Fail or Trigger Out BNC on the rear gives a 3.3 V TTL signal: a pulse at each trigger, or the result of a pass/fail mask test set up in the Utility menu, for driving a go/no-go indicator or a production fixture.

12 Self calibration

Self calibration optimises the signal path for accuracy. Run it once the instrument has warmed up, and again if the room temperature has changed noticeably since it was last run.

Disconnect every probe and lead from the inputs first, then press Utility, select Do Self Cal, and follow the prompts on screen.

13 If something is not right

The screen stays dark

Check the mains lead and the socket, then switch on again. If the screen still stays dark, the fuse may have failed: contact GPS rather than replacing it yourself.

A signal is connected but no waveform appears

Check that the probe is firmly on its BNC and on the circuit, that the channel is switched on, and that the circuit is producing a signal. Then press Auto Setup.

Voltages read too high or too low

The probe's switch and the channel's Probe setting almost certainly disagree. See section 4.

The waveform will not hold still

Check that the trigger source is the channel carrying the signal, that the trigger type suits it (edge for most signals, video for video), and that the level is within the signal; pressing the level knob sets it halfway. Increasing the trigger holdoff steadies signals that repeat irregularly.

Nothing appears in Normal or Single mode

The trigger level is probably outside the signal. Press the level knob, or switch the trigger mode to Auto.

The waveform looks stepped

The timebase may be too slow to resolve the signal; choose a faster one. In vector display, lines drawn between widely spaced samples can also look stepped, and dot display shows the samples themselves.

A USB drive is not recognised

Use a USB flash drive, check it works in another device, and try removing and reinserting it after restarting the instrument.

14 Specification

Item	Specification
Channels	4 analogue channels
Bandwidth	100 MHz (–3 dB) • rise time 3.5 ns typical • 20 MHz bandwidth limit

Item	Specification
Sampling	1 GSa/s on one channel, 500 MSa/s on two, 250 MSa/s on three or four
Memory	14 Mpts on one channel, 7 Mpts on two, 3.5 Mpts on three or four
Vertical	8-bit • 1 mV/div to 10 V/div in a 1-2-5 sequence at probe 1X • offset ± 2 V to 200 mV/div and ± 100 V above
Input	1 M Ω in parallel with 11 pF • 400 V peak maximum • DC, AC and GND coupling
Timebase	2 ns/div to 100 s/div • roll mode 50 ms/div to 100 s/div • accuracy ± 25 ppm
Capture rate	Up to 100,000 waveforms a second, 400,000 in sequence mode • 256-level intensity grading
Trigger	Edge, slope, pulse width, window, runt, interval, dropout, pattern and video, including HDTV • holdoff 80 ns to 1.5 s
Serial	Trigger and decode for I2C, SPI, UART/RS232, CAN and LIN, two decoders, standard
Acquisition	Normal, peak detect, average of 4 to 1024, and enhanced resolution • sequence mode to 80,000 segments • history to 80,000 frames
Measurement	38 automatic parameters, 4 on screen at once, with statistics • manual and tracking cursors • 6-digit hardware counter
Maths	Add, subtract, multiply, divide, differentiate, integrate, square root, and a 128k point FFT with five windows
Display	7 inch TFT, 800 $\times$ 480, 24-bit colour • 8 by 14 divisions
Interfaces	USB host, USB device (USBTMC), LAN (VXI-11, Telnet and socket), pass/fail and trigger out • SCPI
Power	100 to 240 V at 50/60 Hz, or 100 to 120 V at 400 Hz • 50 W maximum
Environment	Operating 0 $^{\circ}$ C to 40 $^{\circ}$ C • storage -20 $^{\circ}$ C to 60 $^{\circ}$ C • 85% RH at 40 $^{\circ}$ C • to 3000 m • indoor use, IP20
Size and mass	312 $\times$ 132.6 $\times$ 151 mm (l $\times$ w $\times$ h) • 2.6 kg

15 Where to go next

Every trigger type, the decode menus in full, maths and FFT, reference waveforms, pass/fail testing and remote control are covered in the full documentation, available from GPS on request, as is the SCPI command reference for programming.

16 Care and warranty

- Unplug the instrument before cleaning it with a soft cloth, dry or barely damp, and let it dry fully before switching on. Do not use solvents, and take care not to scratch the display.
- Do not leave the instrument or its probes in direct sunlight, fog or liquid for long periods.

One year warranty from the date of purchase, subject to product registration with GPS. For service, calibration or technical support contact GPS at sales@gpslimited.com or +44 (0) 203 093 0914.