

# Instek GOS-622G Oscilloscope

## Basic Operation

Before applying power to the oscilloscope, ensure the instrument switch settings and controls are set to the default settings according to the table below.

Control	No.	Setting
POWER	(33)	OFF
INTEN	(1)	Mid-position
FOCUS	(2)	Mid-position
VERT MODE	(15)	CH 1
CHOP	(16)	Released
CH 2 INV	(17)	Released
VERT POSITION	(9), (14)	Mid-position
VOLTS/DIV	(7), (12)	0.5 V/DIV
VARIABLE	(8), (13)	CAL (clockwise)
AC-DC-GND	(6), (11)	GND
SOURCE	(25)	Set to CH 1

Control	No.	Setting
COUPLING	(27)	AC
SLOPE	(28)	+
TRIG ALT	(26)	Released
LEVEL LOCK	(30)	Pushed in
HOLDOFF	(31)	MIN (c-clockwise)
TRIGGER MODE	(32)	AUTO
TIME/DIV	(18)	0.5 mS/DIV
SWP. UNCAL	(19)	Released
HORIZ. POSITION	(21)	Mid-position
X10 MAG	(22)	Released
X-Y	(23)	Released

After the switches and controls are set to the default settings, connect the power cord to the AC line outlet and continue as follows.

- Engage the POWER switch (33) and make sure the power LED (34) is turned on. A trace should appear on the CRT screen (4) in about 20 seconds. If no trace appears after one minute, double check the switch and control settings.
- Adjust the trace with the appropriate brightness and sharpness with the INTEN (1) and FOCUS (2) controls.  
**NOTE: Set the intensity only bright enough to legibly see a trace. Setting the trace intensity too high for a long period of time could cause permanent damage to the CRT screen.**
- Align the trace with the horizontal center line of the grid by adjusting the CH 1 POSITION (9) control and TRACE ROTATION (10) control (adjustable by screwdriver).
- Align the beginning of the trace with the left-most vertical grid line on the CRT screen by adjusting the HORIZ. POSITION (21) control.
- Connect a probe to the CH 1 INPUT terminal (5). Make sure the slide switch on the probe is set to the "X1" position.
- Connect the probe tip to the CAL (36) terminal.
- Set the CH 1 AC-DC-GND (6) switch to AC and release the GND. A square waveform similar to the one shown in Figure 1 should now be displayed on the CRT screen (The vertical lines of a square wave may be invisible on your screen but you should still be able to view the peaks and valleys of the waveform).

Since the CH 1 VOLTS/DIV (7) is set to 0.5 V/DIV, we can determine the peak to peak voltage of the waveform. Each vertical grid square or division represents 0.5 V. Since the peak to peak waveform is approximately 4 divisions from top to bottom our peak to peak voltage is 2 volts ( $0.5\text{-V} \times 4 \text{ divisions} = 2\text{-V}_{\text{P-P}}$ ).

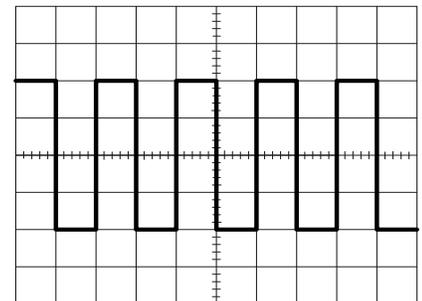


Figure 1

- Now change the CH 1 VOLTS/DIV (7) setting to 0.1 V/DIV, and set the switch on the Channel 1 probe to X10. You should now be viewing a square wave that is approximately 2 vertical grid squares (divisions) high. By turning on the probe's X10 switch, a multiplier of 10 is introduced into the waveform's vertical calculation. The peak to peak voltage of the waveform can then be

found by taking the CH 1 VOLTS/DIV setting times a multiplier of 10, times the number of divisions of the waveform ( $0.1 \times 10 \times 2 = 2-V_{P-P}$ ).

The X10 setting on the probe is mainly used for increasing the number of voltage ranges the oscilloscope is capable of measuring, therefore making it a more versatile instrument. It also allows for viewing waveforms with higher voltage and amplitude that may otherwise be very difficult to observe.

9. The next step will be to determine the frequency of the waveform. Frequency is equal to the reciprocal of the period, or the length of time needed to complete one waveform cycle. With the TIME/DIV (18) set to 0.5-mS/DIV, the waveform cycle is approximately 2 horizontal divisions in length. The period can then be found by taking the TIME/DIV setting times the number of divisions for one cycle ( $0.5\text{-mS} \times 2 = 1\text{-mS}$ ). The reciprocal of the 1-mS period will then be the frequency of the waveform ( $1/0.001\text{-S} = 1000\text{-Hz}$ ).

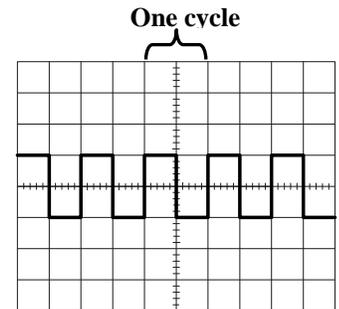


Figure 2

10. Now change the TIME/DIV (18) setting from 0.5-mS/DIV to 0.1-mS/DIV. By changing the time base to a shorter length of time for each division, the waveform, in a sense will appear "stretched out". This allows for a more accurate frequency measurement.

Each division is separated by 5 smaller divisions indicated as graticule marks on the middle vertical and horizontal grid lines. Each of these marks represents 0.2 of a whole division. For example, if one complete cycle of the waveform being measured is just short of 10 divisions by an amount of one graticule mark, then you would use the value of 9.8  $\{(9.8 \text{ divisions}) \times (0.1\text{-ms/DIV}) = 0.98\text{-mS (period)}\}$ . The reciprocal of the 0.98-mS period would then be 1020-Hz. A more accurate reading of the same input waveform from step 9.

**NOTE:** For precision and ease of measuring it is a common practice to move and align the waveform with the vertical and horizontal graticule marks on the CRT screen. This is done by turning the VERT POSITION (9), (14) and the HORIZ POSITION (21) controls.

Just as the vertical scale has an X10 setting directly on the probes, the horizontal scale has the X10 MAG (22) switch that can be used the same way to magnify the amount of time per division by 10 times. Although usually not used as often as the vertical magnifier, the X10 MAG can be used to examine waveforms with extremely low frequencies.

11. Set the TIME/DIV (18) back to 0.5-mS/DIV.
12. Set the VERT MODE (15) switch to CH2 and align the trace with the horizontal center line of the grid by adjusting the CH2 POSITION (14) control.
13. Connect a second probe to the CH2 INPUT terminal (10).
14. Connect the probe tip to the CAL (36) terminal so both CH1 and CH2 probes are connected.
15. Set the CH2 VOLTS/DIV (12) control to 0.1 V/DIV and select X10 on the CH 2 probe.
16. Set the CH2 AC-DC-GND (11) switch to AC and release the GND. You should now see the same square wave signal as before, the only difference being the input is now on CH2 instead of CH1.
17. Set the VERT MODE (15) switch to DUAL. You should now be able to see the waveforms of both CH1 and CH2 as shown in Figure 3. You are able to move the waveform of each channel by using the corresponding CH1 or CH2 VERT POSITION (9), (14) controls.

The DUAL channel mode is very useful for comparing two different waveforms and to observe such characteristics as phase, voltage, and frequency relationships between the two waveforms. Obviously in order for an accurate voltage or amplitude reading, both CH1 and CH2 must be set to the same VOLTS/DIV.

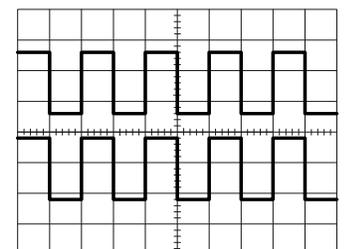


Figure 3

18. Set the VERT MODE (15) switch to ADD. The ADD mode displays the sum of CH1 and CH2 input signals. As you can see the sum of the two  $2\text{-}V_{P-P}$  signals is now displayed as a  $4\text{-}V_{P-P}$  square wave. When using the ADD mode, it is important that both CH1 and CH2 be set to the same VOLTS/DIV.

The ADD mode is mostly used in conjunction with the CH2 INV (17) switch. The CH2 INV switch inverts the polarity of the CH2 input only. This allows subtractions to be used (CH1 minus CH2) and ungrounded voltage drops in a circuit to be determined. For example, in most cases the oscilloscope's ground is connected to the signal generator's ground through the wiring of the power cables and the building's receptacle plugs. This restricts the oscilloscope to test only across grounded components.

If we look at Figure 4, typically the oscilloscope ground would be connected to the circuit ground at point C so all of the voltage measurements will be taken with respect to that point. The measurements can then be taken across  $R_2$  by placing the probe at point B or for total circuit voltage at point A. The oscilloscope cannot, however measure from point A with respect to point B since the oscilloscope ground and the circuit ground are essentially the same point. Doing so could result in shorting  $R_2$  thereby giving inaccurate voltage readings. To then find the voltage drop at  $R_1$ , the oscilloscope would essentially subtract the voltage drop (B to C) from the voltage (A to C).

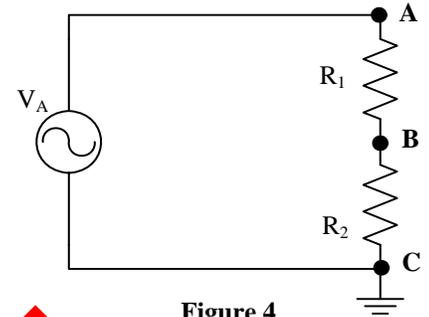


Figure 4

**EXAMPLE**