

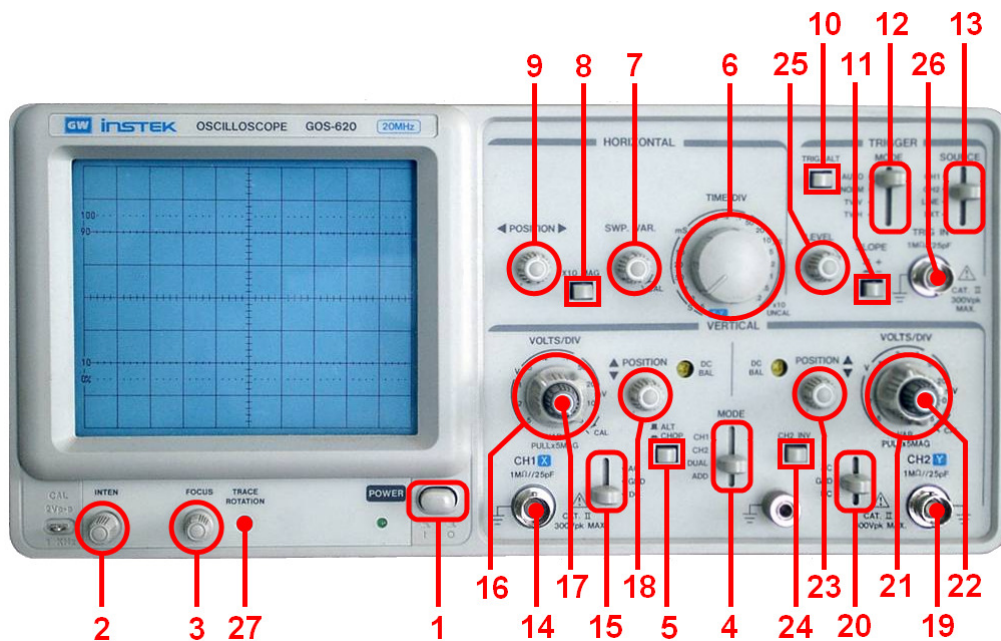
## Using an analog oscilloscope with 201710

2015.11.23 / HS

AE201710-X

This is an example of how to use a slow, analog oscilloscope (400040) for measuring the speed of light *with our "Speed of Light" No. 291710*.

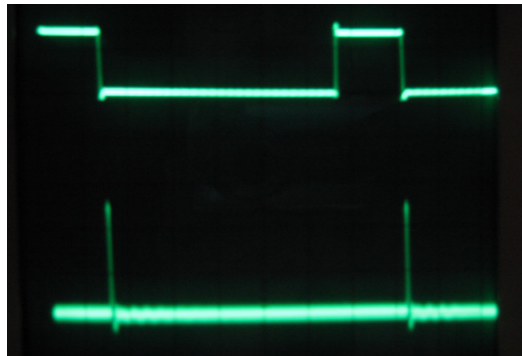
Even though the buttons may be placed differently on other models, the majority of the functions can be found on other oscilloscopes.



Turn on the 201710 by connecting the power adaptor. Place the reflector close to the lens.

- |                          |  |
|--------------------------|--|
| 1 <b>Power</b>           | Start by turning on the oscilloscope   |
| 2 <b>Intensity</b>       | Turn 3/4 up. When everything else is set, adjust this again – eventually to max            |
| 3 <b>Focus</b>           | Probably OK from last time? If in an extreme position: Set it midway                       |
| 4 <b>Mode</b>            | Select <i>Dual</i>   |
| 5 <b>Alt / Chop</b>      | Select <i>Alt</i> (button out)   |
| 6 <b>Time/Div</b>        | Set at 0.5 $\mu$ s/div   |
| 7 <b>Sweep Var.</b>      | Turn to the position marked <i>Cal</i> – completely clockwise (click). Let it remain there |
| 8 <b>x 10 Mag</b>        | Start by de-activating the time axis zoom (button out)                                     |
| 9 <b>Horiz. Pos.</b>     | Start in the middle – when needed, shift the image horizontally                            |
| 10 <b>Trigger Alt</b>    | De-activated (button out). Let it remain there   |
| 11 <b>Trigger slope</b>  | Set at + (button out)  |
| 12 <b>Trigger Mode</b>   | Select <i>Auto</i>   |
| 13 <b>Trigger Source</b> | Select <i>Ch1</i>  |

- |                          |   |
|--------------------------|---|
| 14 <b>Input, Ch1</b>     | Connect to the <i>Sync. Out</i> socket on the 201710 back panel   |
| 15 <b>Coupling, Ch1</b>  | Select either <i>AC</i> or <i>DC</i>  |
| 16 <b>Volts/Div, Ch1</b> | Set at 5 V/div  |
| 17 <b>Do. Variable</b>   | Turn to the position marked <i>Cal</i> – completely clockwise. Pulling the button out results in a x 5 boost – must be kept pushed in                       |
| 18 <b>Position, Ch1</b>  | Shifts the trace up and down. Start in the middle, adjust when needed   |
| 19 <b>Input, Ch2</b>     | Connect to the <i>Receiver out</i> socket on the 201710 back panel  |
| 20 <b>Coupling, Ch2</b>  | Select either <i>AC</i> or <i>DC</i>  |
| 21 <b>Volts/Div, Ch2</b> | Set at 2 V/div  |
| 22 <b>Do. Variable</b>   | Turn to the position marked <i>Cal</i> – completely clockwise. Pulling the button out results in a x 5 boost – must be kept pushed in                       |
| 23 <b>Position, Ch2</b>  | Shifts the trace up and down. Start in the middle, adjust when needed   |
| 24 <b>Ch2 Invert</b>     | De-activated (button out). Let it remain there  |
| 25 <b>Trigger Level</b>  | Start in the middle and turn a little up and down until a stable image is formed (see example). Centre the button in the interval where the image is stable |



- |                          |   |
|--------------------------|---|
| 26 <b>Trigger In</b>     | Not used (trigger on Ch1)   |
| 27 <b>Trace Rotation</b> | if the zero level of the traces is rising or falling, this can be remedied by adjusting this setting. Use a screwdriver |

Now the oscilloscope is almost ready. The time axis is set at 0.2 or 0.1  $\mu\text{s}/\text{div}$  with **6 (Time/Div)**. In order to zoom in on the reflected signal, push **8 (x 10 Mag)** and shift the relevant part of the time axis on to the screen with **9 (Horiz. Pos.)**.

The trace for the reflected signal is made stronger by setting **4 (Mode)** at *Ch2*.

In order to facilitate reading the precise time for the pulses, it may help to shift the traces vertically (**18** and **23**), change amplification (**16** and **21**) and eventually fine tune the amplitude (**17** and **22**). Do not touch the buttons for the time axis or the trigger during the measurements.

In x10 mode, the time axis is typically un-calibrated – or even nonlinear. Use a square wave from a function generator at a frequency of 10 MHz or more as a reference. This must still be done without changing the time axis or the trigger.