SFPI General Instruction and Operating information, Oct. 2024

From Videos made Sept 27 with John Wagner

Table of Contents:

List of Figures:

Go to TOC

Equipment List:

- Melles Griot Scanning Fabry-Perot Interferometer (**SFPI)** head/Sensor: 13 SAB 055, SN: 7028 (full RGB capable: FSR: 2GHz, 450-680nm).
    - ***Thin High voltage cable from Head side to "Scan HV Output" on far left of amplifier.***
        - 4:23:48 to 4:36:20 in video.
        - https://youtu.be/UAMtfjV7bCQ?si=jOn9fQBouJ7JB_tK&t=263
    - ***Coax cable from SFPI Head back end to "Amplifier Input" on far right of amplifier.***
        - 5:29:30 to 5:50:10 in video.
        - https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=329

- Melles Griot Optical Spectrum Analyzer (**OSA**) amplifier: 13 SAD 001, SN: 8104.
    - ***Coax cable from "Amplifier Output" on far right of amplifier to Channel 1 of Rigol.***
        - 5:17:00 to 5:29:30 in video.
        - https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=317
    - ***Coax cable from "Scan Monitor" on far left of amplifier to Channel 2 of Rigol.***
        - 4:37:16 to 4:56:12 in video (going to Ch 3 NOT Ch 2 in video).
        - https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=277
    - Optional: Coax cable from "Oscilloscope Blanking" on middle of amplifier to Channel 3 of Rigol, 4:56:12 to 5:13:59 in video (going to Ch 2 in video NOT Ch 3).
        - https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=296

- Rigol DS1104Z-S Plus Oscilloscope, SN: DS1ZD234901861.
    - Each Channel has a different color on screen corresponding to 4 coax channel inputs.
        - Ch 1 is yellow.
        - Ch 2 is light blue.
        - Ch 3 is purple.
        - Ch 4 is dark blue.

Go to TOC

Basic Setup of Equipment:

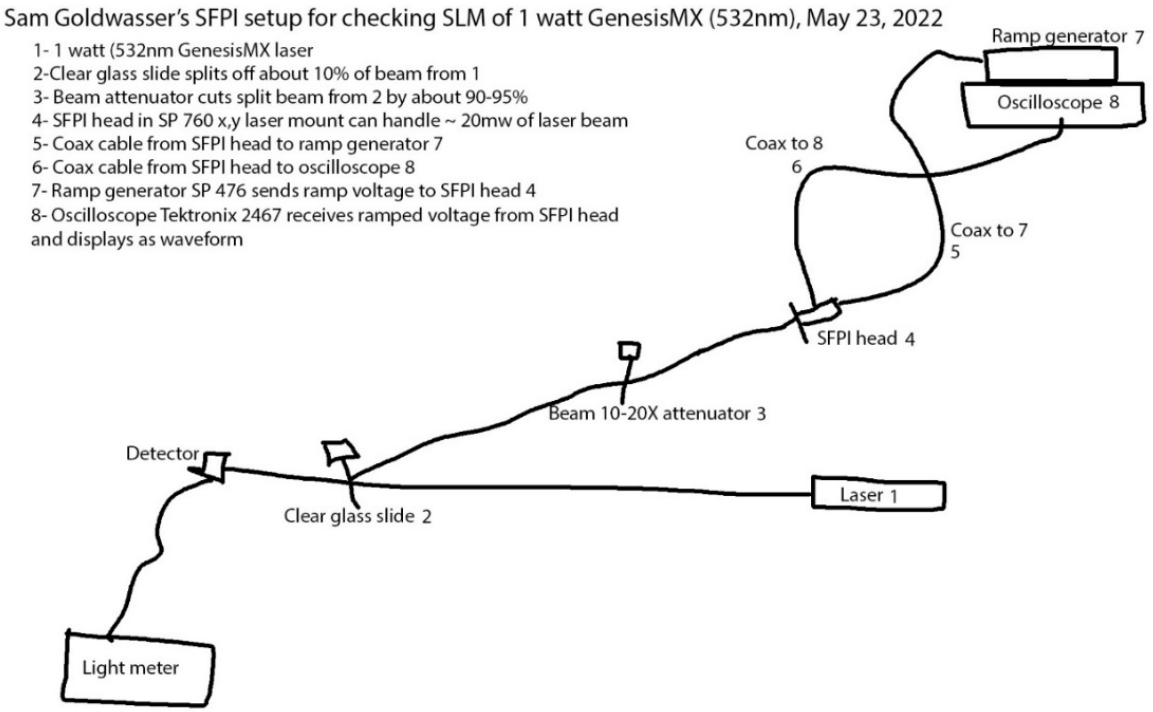


Figure 2 SFPI setup diagram.

Clarification of above diagram (Fig. 1):

1- Can be any laser. Beam should be collimated to =< ~ 4mm diameter.
2- Use thick VBS disk instead of microscope slide to more easily separate its front and back surface reflected dots to eliminate interference between two dots. Additionally, the VBS disk has a higher quality optical surface than the standard microscope slide.
3- The SFPI head will be damaged if more than 10mw of laser energy hits it. That means higher power beams from the laser must be attenuated before the beam enters the SFPI head. Since the purpose of using the SFPI at all is to test for stable SLM operation of the laser at all the different power levels at which it may be used, a reusable attenuation system is necessary optical equipment. For green laser light, we use a dark neutral density filter which attenuates the beam by about 90%+ as well as the adjustable dichroic NRC VBS disk. It may be necessary to use one or more filters and to make sure that the coatings of the filters won't be damaged by higher laser powers being tested. It's important to test the final laser power with a light meter to make sure it's =< 10mw before using the SFPI head.
4- The SFPI head in diagrammed example is different from the MG head I'm using.
5- & 7 - The ramp generator we're using is the MG OSA 13 SAD 001, not Sam's SP476.
8- The oscilloscope is the Rigol DS1104Z-S Plus, not Sam's Tektronix 2467.

Go to TOC

Understanding the Amplifier and Oscilloscope Controls:

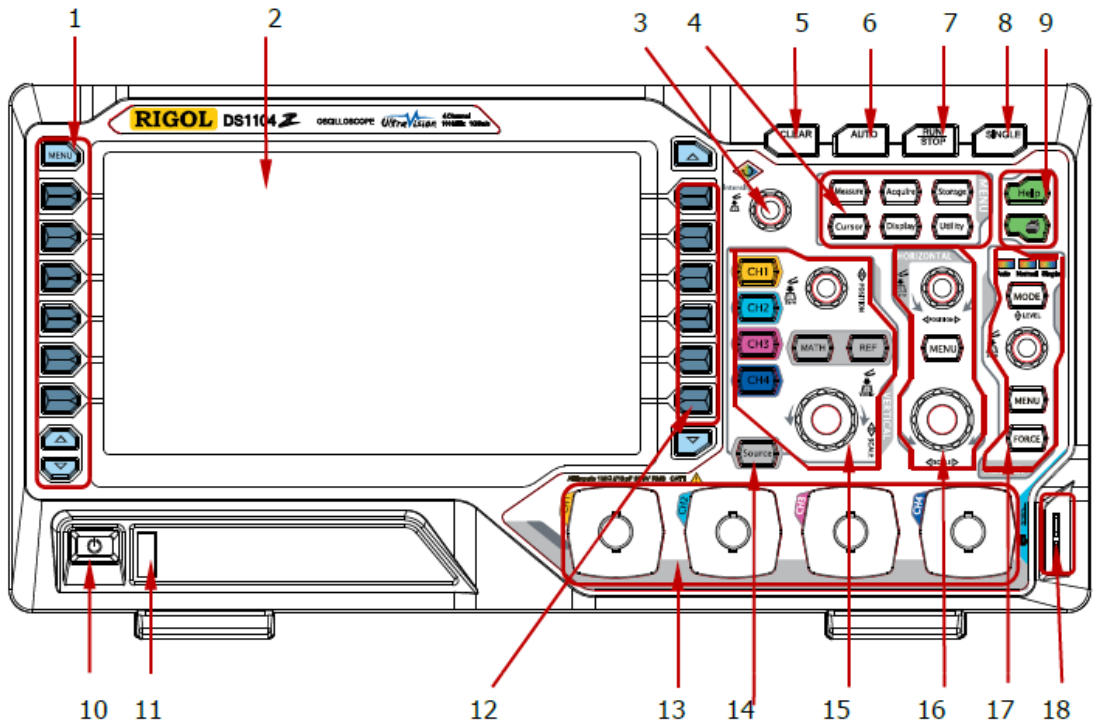


Figure 1-10 Front Panel Overview

Table 1-1 Front Panel Description

No.	Description	No.	Description
1	Measurement Menu Softkeys	10	Power Key
2	LCD	11	USB HOST
3	Multi-function Knob	12	Function Menu Softkeys
4	Function Menu Keys	13	Analog Channel Input Area
5	CLEAR	14	Source[1]
6	AUTO	15	VERTICAL
7	RUN/STOP	16	HORIZONTAL
8	SINGLE	17	TRIGGER
9	Help&Print	18	Probe Compensation Signal Output Terminal/Ground Terminal

Note[1]: Only applicable to DS1104Z-S and DS1074Z-S.

Figure 2 Rigol front panel diagram.

Go to TOC

Figure 3 MG OSA front panel. (see MG OSA settings)

Figure 4 SFPI head, front with cap off, front with cap on, rear view.

These instructions follow along with the transcript of the following 20-minute video (made by John Wagner and Joseph Burns) available on YouTube:
https://youtu.be/UAMtfjV7bCQ?si=FbOyiuawmbLIa32_&t=1
AND Part 2: Sapphire SFPI video (not part of this document): https://youtu.be/tZ-gx8S4LEY

Purpose of the video and these instructions:

The purpose of the video effort was for me to learn, ***as a complete novice to using an oscilloscope***, how to use the Rigol oscilloscope to monitor the waveform output from the SFPI head in order to know whether or not my laser is operating in "single longitudinal mode" (SLM). John Wagner generously spent several days showing me how to do this and the video is a distillation of that teaching effort. It is NOT intended as general oscilloscope or SFPI training but was simply created to help me learn.

SLM is not the same as TEM_{00} mode which describes the "transverse spatial profile" of the laser beam.

SLM describes the laser's frequency spectrum, indicating it emits light at only one specific wavelength.

TEM_{00} describes the spatial distribution of the laser beam, with "TEM_{00}" representing a perfectly smooth, gaussian beam profile with minimum divergence. Both are important laser beam qualities for making good optical display holograms.

Go to TOC

"**The TEM modes determine the spatial distribution of the laser's intensity, while the longitudinal modes determine the spectral properties of the laser, including the frequency content and linewidth.** A laser is considered single-mode if it has only one mode along ***either*** the TEM or longitudinal axis or both." For more information: https://www.rpmclasers.com/blog/what-is-single-longitudinal-mode/

"Typically, the lowest-order transverse mode (TEM_{00}) is selected for emission since it propagates with the least beam divergence and can be focused to the tightest spot." https://www.newport.com/n/laser-light-characteristics.

TEM_{00} mode is easy for anyone to see by eye simply by expanding the laser beam, using a simple lens, onto a white card. SLM is more difficult to ascertain without this SFPI equipment. However, there ARE some simple SLM indicators, such as viewing the wavelength dispersion of the laser beam through a diffraction grating onto a white card, or by using a simple microscope slide held at an angle in the diverged beam to create a reflected interference pattern onto a white card.

The SFPI is considered by laser physicists to be the most precise method of determining SLM and other longitudinal modes of a laser.

The Rigol oscilloscope model was used because it's the one that John Wagner uses in his holography studio in New Zealand. The MG SFPI head was bought from Sam Goldwasser and tested by him for proper operation before purchase.

Summary description of what's seen on oscilloscope and basic SFPI functionality:

Figure 5 Rigol showing clean SLM output & ramp signals from channels 1, 2 & 3.

In Fig. 5 above (from 4:42:13 in video), the yellow spiky signal is Channel 1 and is the signal from the SFPI head. It shows the same SLM good function, repeated three times.
https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=282

Go to TOC

The light blue flat topped square wave is from Channel 2 and is a “Blanking” trigger function generated by the MG OSA amplifier. The image in the screenshot is triggering from the Blanking input, 4:56:12 to 5:13:59 in video. https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=296

The saw tooth purple line is from Channel 3 and is a “Monitor” trigger function generated by the MG OSA amplifier, 4:37:16 to 4:56:12 in video. https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=277
The image appears to be still on the Rigol because of the triggering function. If there were no triggering function, the spiky signal would be streaming across the Rigol screen instead of appearing to stand still on the screen (9:51:00 to 10:18:30 in video).
https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=591

A “Trigger” is needed in order to “lock on” in Time. It is a voltage pulse sent by the MG OSA amplifier. (12:57:40 to 13:23:46 in video).
https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=777

Having two triggers is completely unnecessary. Only one trigger is required. This simply demonstrates that both the “Monitor” and “Blanking” outputs will function effectively as “triggers” (12:00:36 to 12:20:28 in video). https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=720
Also shows that you can “hot” pull coax cable from Rigol and MG OSA (also 18:03:38 to 18:31:39 in video). https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=1083

Turning OFF any of the three illuminated Channel buttons (ch 1, 2, 3), in Fig. 5 above, only HIDES the channel screen output, it doesn’t actually turn off the signals (from 6:00:00 to 7:02:40 in video AND 11:53:45 to 12:00:35). https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=360 AND
https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=713

Pressing the Channel buttons firmly turns them ON/OFF. A simple light press of the same buttons ACTIVATES the specific channel (as indicated along the bottom of the Rigol screen) brightening its channel notification. This allows the various horizontal and vertical knob controls to only affect the selected channel (from 7:31:20 to 8:01:50 in video).
https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=451

Go to TOC

Horizontal (time) axis: (also see MG OSA "Scan, Range knob")

(7:01:55 to 7:15:35 in video), with Channel 3 (purple saw toothed trigger – MG OSA "Scan, Monitor") selected, the horizontal (time axis) large bottom knob expands and contracts the image horizontally allowing more or fewer sweeps to be seen on the screen simultaneously. See Fig. 6 below, knob highlighted in purple for Channel 3. https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=421

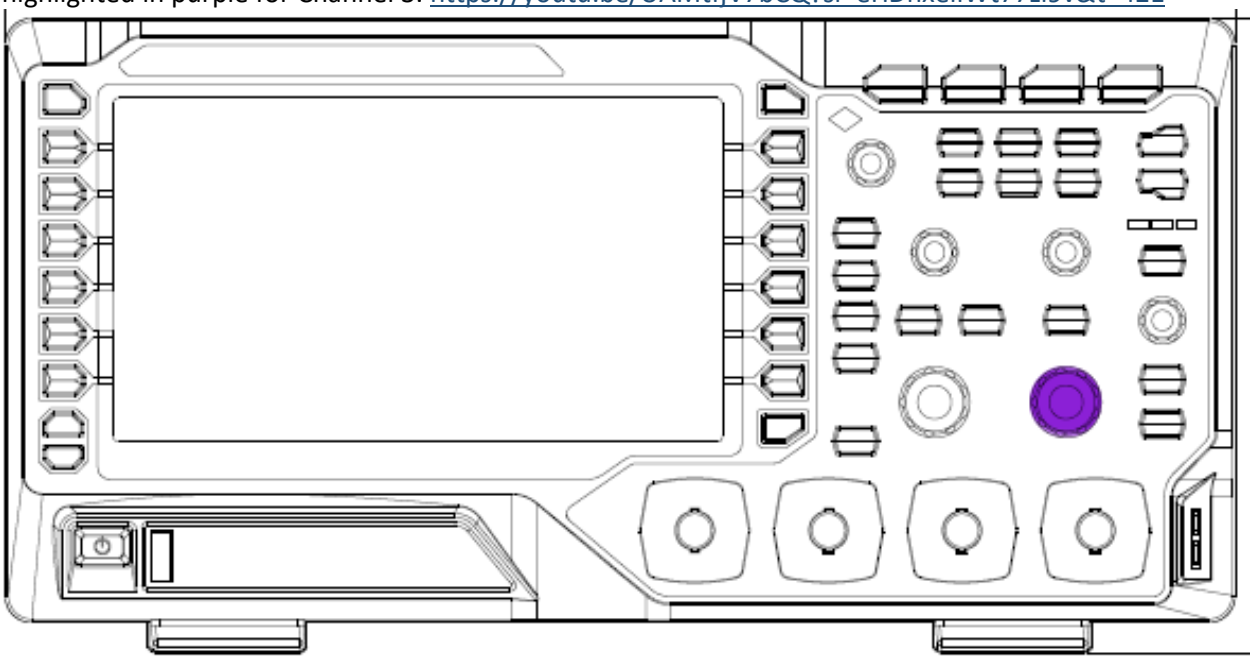


Figure 6 Large horizontal time axis expand/contract knob (7:01:55 to 7:15:35 in video).

(7:15:36 to 7:22:30 in video), with Channel 3 (purple saw toothed trigger) selected, the horizontal small button translates the static image horizontally across the screen. See Fig. 7 below, the small knob highlighted in purple for Channel 3. https://youtu.be/UAMtfjV7bCQ?si=eHDhxeiIWt77zi9v&t=435

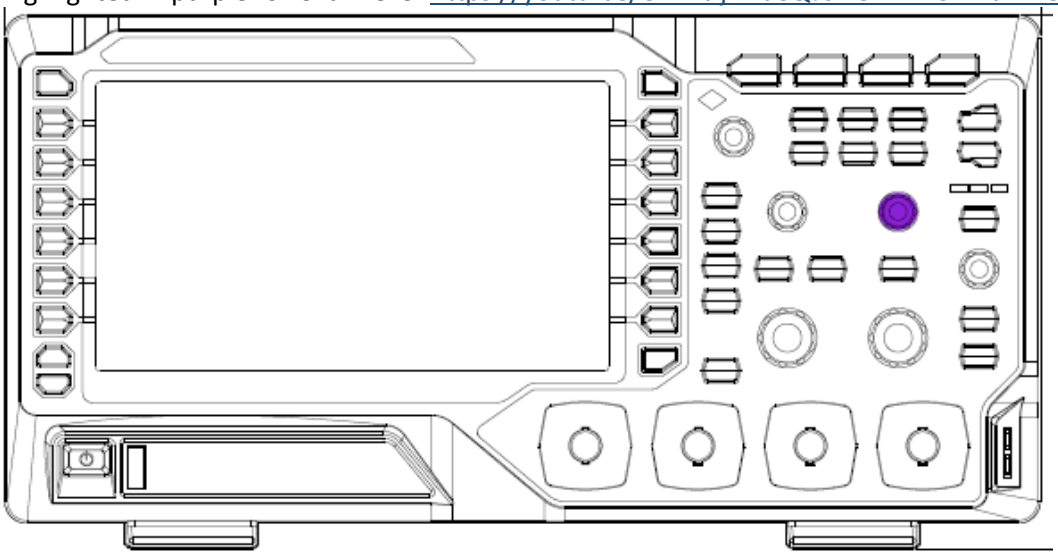


Figure 7 Small knob for horizontal translation of static screen image, (7:15:36 to 7:22:30 in video).
https://youtu.be/UAMtfjV7bC Q?si=eHDhxeiIWt77zi9v&t=435

Go to TOC

The saw tooth purple ramp indicates a steady increase (and faster decrease on the downside - the right side - of the saw tooth) of voltage applied to the SPFI head, (4:37:16 to 4:56:12 in video). The voltage varies the distance between the fixed mirror and the piezo-electrically driven variable mirror in the SFPI head varying the distance between them, which creates the yellow spiky signal seen on Channel 1. (00:08:14 to 00:27:28 in video and 4:08:00 to 4:21:45).
https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=8 AND
https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=248

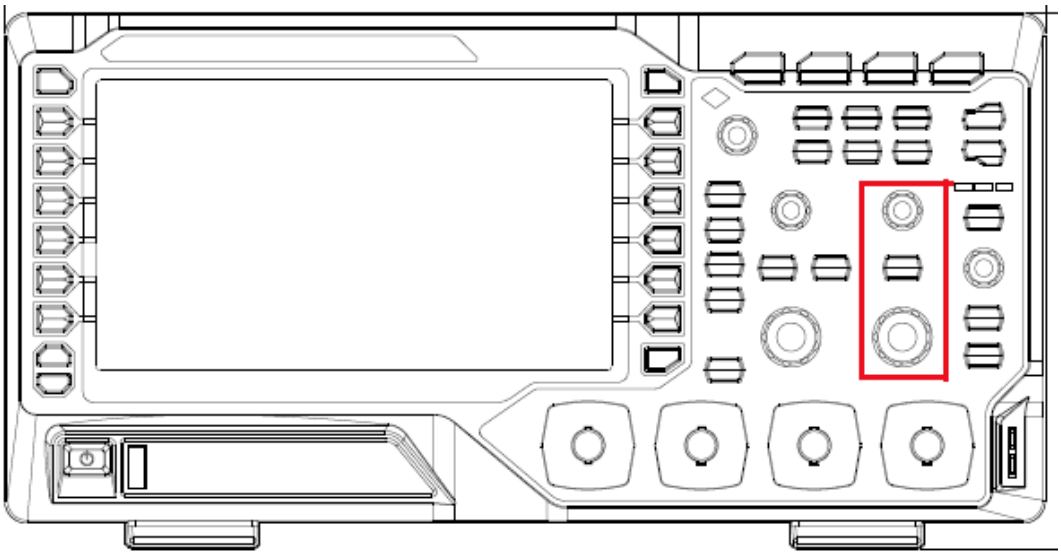


Figure 8 Time axis horizontal controls outlined in red.

Go to TOC

HORIZONTAL

HORIZONTAL **POSITION**: modify the horizontal position. The trigger point would move left or right relative to the center of the screen when you turn the knob. During the modification, waveforms of all the channels would move left or right and the horizontal position message (e.g. D -200.000000ns) at the upper-right corner of the screen would change accordingly. Press down this knob to quickly reset the horizontal position (or the delayed sweep position).

MENU: press this key to open the horizontal control menu under which to turn on or off the delayed sweep function, switch between different time base modes.

HORIZONTAL **SCALE**: modify the horizontal time base. Turn clockwise to reduce the time base and turn counterclockwise to increase the time base. During the modification, waveforms of all the channels will be displayed in expanded or compressed mode and the time base message (e.g. H 500ns) at the upper side of the screen would change accordingly. Press down this knob to quickly switch to delayed sweep state.

Figure 9 Time axis Horizontal from Rigol User Guide.

Go to TOC

Vertical (voltage) axis:

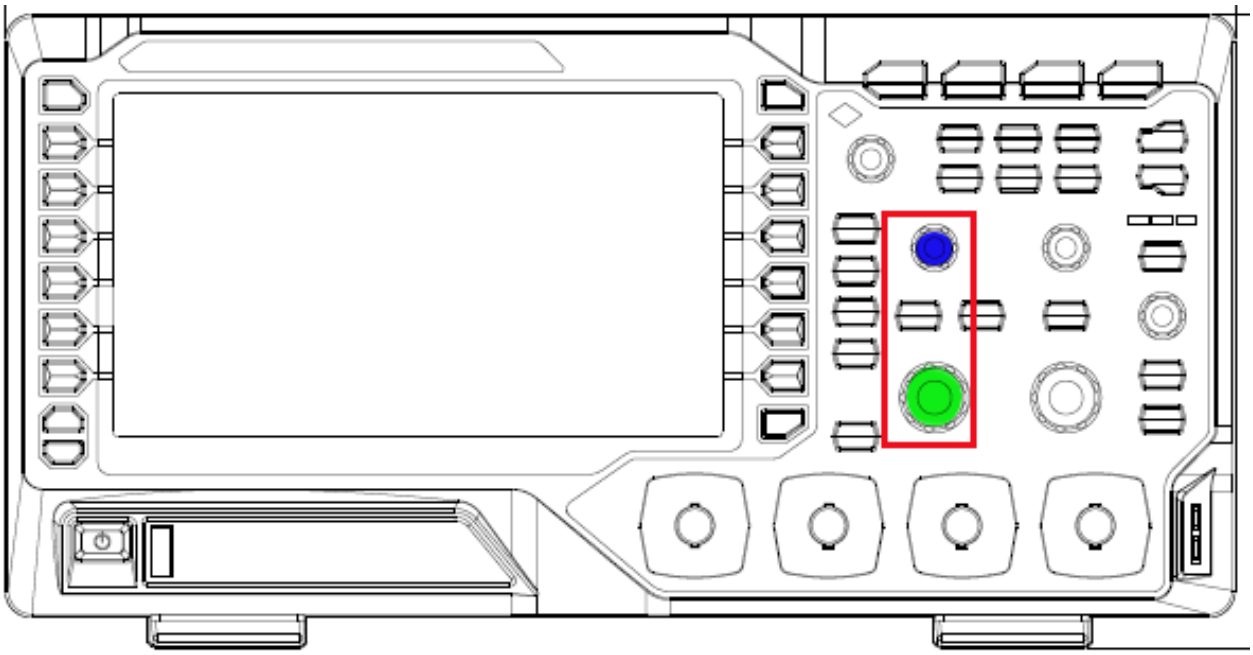


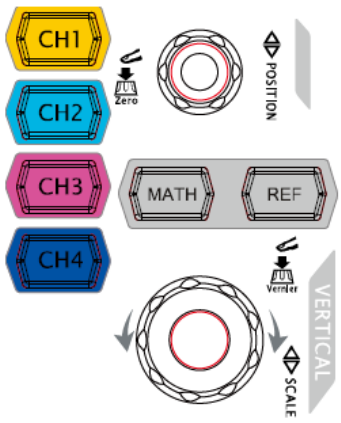
Figure 10 Voltage axis vertical outlined in red with blue voltage offset small knob and green voltage scaling large knob.

The voltage axis controls the imagery on the vertical axis. The large knob, shown in green in Fig. 10, at the bottom, adjusts the scale of voltage viewed on the screen by changing the vertical scale between the white squares outlining the screen (like graph paper) (2:15:35 to 2:48:00 in video) (also see MG OSA "Amplifier, Gain knob"). https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=135

The small knob, shown in blue above, changes the offset, that is vertical position on the screen, relative to the other signals shown. In the case shown in the video, Channel 1 is selected, and the yellow spiky signal is being changed. John is calling it the voltage section – it doesn't actually change the voltage but simply changes the relative view of the voltage on the Rigol screen.

Go to TOC

VERTICAL



CH1, **CH2**, **CH3**, **CH4**: analog input channels. The 4 channels are marked by different colors which are also used to mark both the corresponding waveforms on the screen and the channel input connectors. Press any key to open the corresponding channel menu and press again to turn off the channel.

MATH: press this key to open the math operation menu under which add, subtract, multiply, divide, FFT, A&&B, A||B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp and Abs are provided.

REF: press this key to enable the reference waveform function to compare the waveform actually tested with the reference waveform.

Vertical **POSITION**: modify the vertical position of the current channel waveform. Turn clockwise to increase the position and turn counterclockwise to decrease. During the modification, the waveform would move up and down and the position message (e.g. POS: 216.0mV) at the lower-left corner of the screen would change accordingly. Press down this knob to quickly reset the vertical position to zero.

VERTICAL **SCALE**: modify the vertical scale of the current channel. Turn clockwise to decrease the scale and turn counterclockwise to increase. During the modification, the amplitude of the waveform would enlarge or reduce and the scale information (e.g. 1 200mV) at the lower side of the screen would change accordingly. Press down this knob to quickly switch the vertical scale adjustment modes between "Coarse" and "Fine".

Figure 11 Same info as Fig. 10 as explained by Rigol User Guide.

Tip

How to set the vertical scale and vertical position of each channel?

The four channels of the DS1000Z series digital oscilloscope use the same set of **VERTICAL** **POSITION** and **VERTICAL** **SCALE** knobs. To set the vertical scale and vertical position of a channel, press **CH1**, **CH2**, **CH3** or **CH4** to select the desired channel and then rotate the **VERTICAL** **POSITION** and **VERTICAL** **SCALE** knobs.

Go to TOC

Trigger Menu and how to tell which channel is the trigger channel:

(8:23:35 to 13:23:46 in video) https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=502

Push the trigger menu button (button highlighted in red in Fig. 12 & outlined in red in Fig. 13) to select the "trigger menu" on the Rigol screen (see "trigger menu" outlined in red in Rigol screen photo Fig. 13). Then push the "source" selector button (Rigol screen photo outlined in red and pointing to "source" menu item in Fig. 13 below) to activate "source menu "channel selection" sub menu" (outlined in red in Rigol photo Fig. 14 below). Rotate the "multi-function knob" (highlighted in red in Rigol photo Fig. 14) to select a desired trigger channel in the "source menu channel selection sub menu" (outlined in red in Rigol photo Fig. 14 below. When the desired channel is selected, press the "multi-function" knob to activate the selected channel.

To get out of trigger menu, push any of the channel selection buttons lightly (top left Fig. 11, & video 9:11:55 to 9:20:02) and you will see info about the channel you just pressed.
https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=551

When the trigger channel is desired to be changed, and a new trigger source is selected (9:51:00 to 10:18:30 in video), https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=591
the Ch 1 spiky yellow SFPI head signal will begin moving quickly horizontally. The new trigger screen can be stabilized by rotating the large "trigger level" knob (see Figs. 12 & 13, knob highlighted in green and described in Fig. 15) until the Ch 1 spiky yellow signal stands still again.

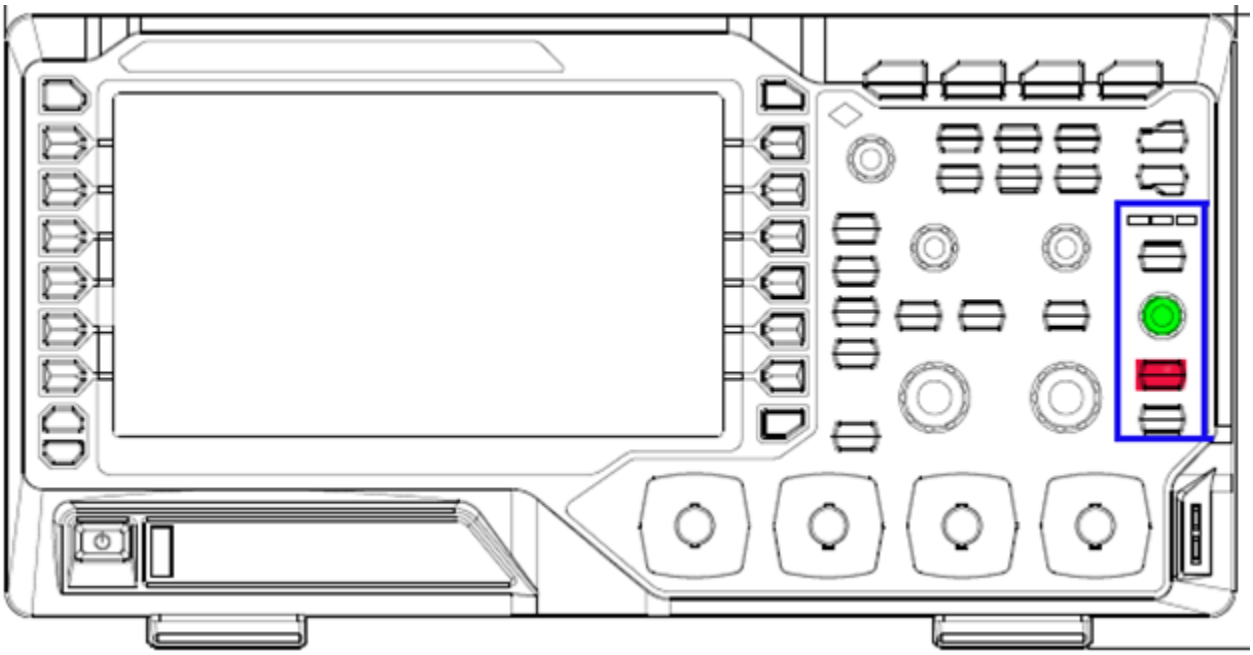


Figure 12 Trigger axis outlined in blue and menu button in red and trigger level knob in green.

Go to TOC

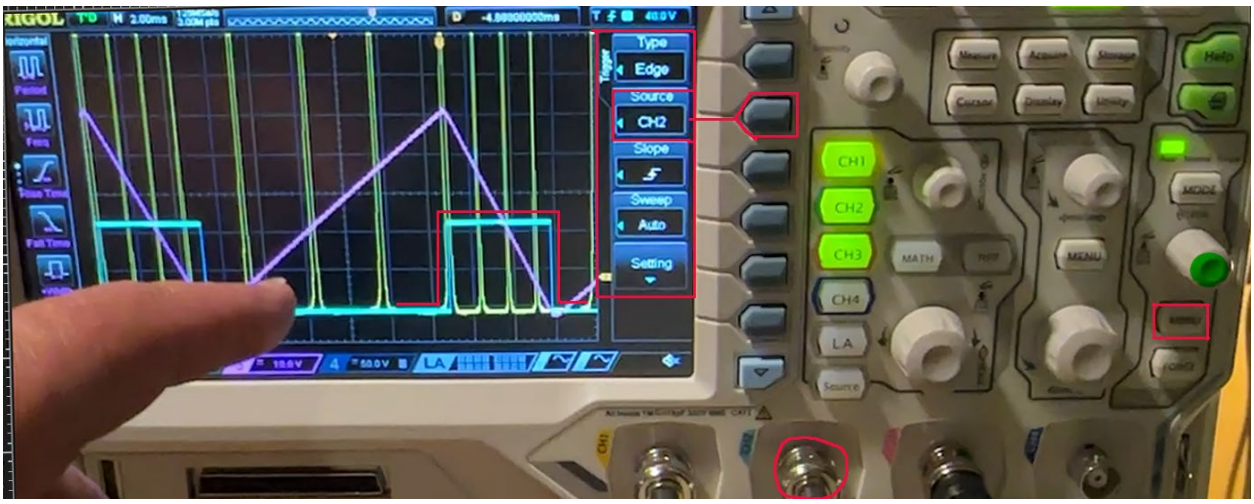


Figure 13 Rigol Trigger Channel 2 (light blue) "blanking" ramp signal, trigger menu, Trigger menu 'source" dialog, Channel "source" selector button, Ch 2 coax input, and trigger menu button, all outlined in red and "trigger level" knob highlighted in green.

Figure 14 Rigol Trigger "channel selection menu" outlined in red and "multi-function knob" highlighted in red.

Go to TOC

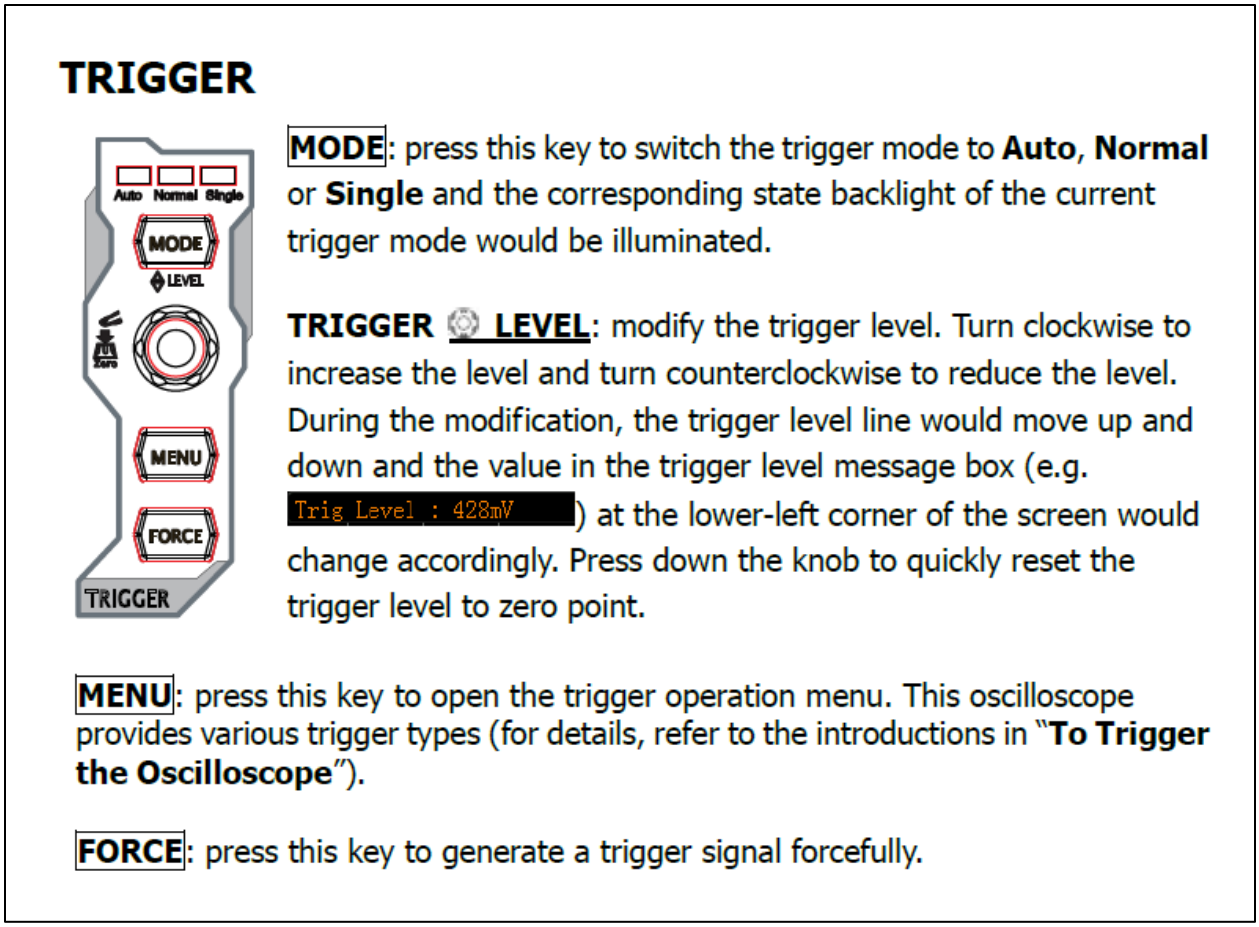


Figure 15 Trigger axis Rigol User Guide info.

Melles Griot OSA knob uses and settings: (see Fig. 3)

13:44:16 to 17:44:53 in video.

There is one row of five control knobs and, under it, one row of six cable inputs.

The top row of five knobs in three categories:

There are three knobs under the SCAN category:

- **Shift (0 to max)**
  - 15:21:37 to 15:29:01 in video, seems to just translate scans across the screen.
    - "It just moves it in time"
    - https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=921

- **Range (0 to max)** (also see Rigol "Horizontal time axis")
  - Rotating the Range knob CCW reduces the "scan voltage" and the number of sweeps per Ramp sequence (13:44:16 to 15:11:26 in video & Figs. 16 & 17). (also 18:31:40 to 19:01:12 in video)
    - https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=824
    - https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=1111

Go to TOC

- What Range is technically doing is impacting the physical distance through which the mirrors are moved inside the SFPI head.
  - The cavity inside the SFPI head is between two mirrors and one of the mirrors is moving, oscillating, and the Range knob changes the movement distance between the two mirrors, one fixed and the other mounted to a moveable piezo-electric crystal. A larger range (**"free spectral range"**, FSR), more voltage, causes the sweep to see the same mode more times during the sweep, that is, find the same line multiple times (Fig. 16).
- **More detailed explanation of purple saw tooth trigger pattern and scan range:**
  - 15:48:25 to 17:44:53 in video.
    https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=948
  - The spike (peak) seen on the longer upside of the saw tooth and the shorter side of the sawtooth are the same mode. Because the voltage is on the vertical axis, each point on the spike corresponds to a particular voltage. Each voltage represents a particular distance between the two mirrors. Oscillating slower apart than it comes back together, which is why the spike has a visually wider angle than when it comes faster back together and is steeper – which is why the saw tooth purple trigger pattern is not a symmetrical waveform.
  - By increasing the scan range, all you're doing is, each cycle is going to scan through a broader range and you'll capture the same peak again more times during each scan cycle.
    - More scan cycles and thus more peaks (spikes) for each leg of the sawtooth trigger pattern as the Scan Range knob is rotated clockwise. Seems to give a maximum of four peaks at maximum range rotated fully clockwise.
    - What you're looking for is the spacing between the lines and you want it to be the same.
  - ***Adjustment of sawtooth ramp after hot swapping from Ch 3 to Ch 2:***
    - Using Rigol large & small voltage axis knobs and MG OSA Detector Offset knob and the large time axis knob.
    - 19:02:55 to 19:54:28 of video.
    - *https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=1142*

- **Rate (min to max)**
  - Rate is the "frequency" and is "not a big deal". We always leave it all the way to the right. (15:13:43 to 15:21:37 in video).
    - https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=913

There is one knob under the Detector category:

- **Offset (- to +)**
  - 15:29:02 to 15:40:49 in video.
    - https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=929

Go to TOC

- For the photodiode (**the sensor in the SFPI head that sends the voltage signal response to the Oscilloscope**), the voltage offset which causes the Ch 1 spiky yellow signal to move around a little bit.

There is one knob under the Amplifier category:

- **Gain (0 to max)** (also see Vertical axis, large knob)
  - 15:40:50 to 15:48:24 in video.
    - https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=940
  - Makes the Ch 1 spiky yellow signal taller or shorter, stays set on maximum.

For the bottom row of MG OSA six cable connector usage, see the Equipment list. There are three connector categories, SCAN, OSCILLOSCOPE, & AMPLIFIER.

- **SCAN**
  - HV input – thin cable from side of SFPI head (don't plug/unplug OSA on).
  - Monitor – coax cable to CH 2 of oscilloscope (used as trigger).
- **OSCILLOSCOPE**
  - Blanking – not necessary to use.
  - Trigger – not necessary to use (**WHY NOT USE THIS?**)
- **AMPLIFIER**
  - Input – coax cable from rear of SFPI head.
  - Output – coax cable to CH 1 of oscilloscope.

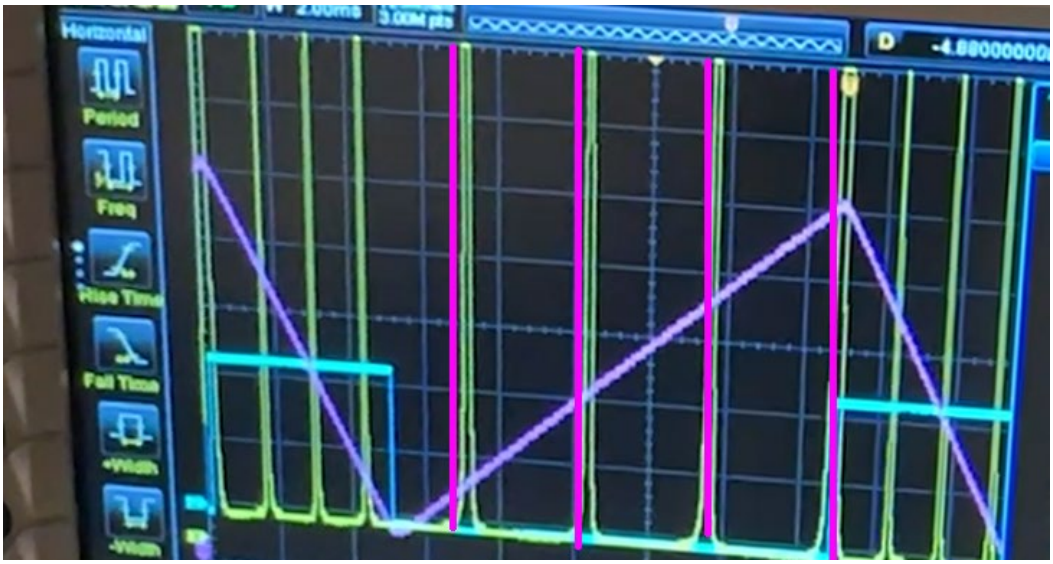


Figure 16 MG OSA SCAN Range knob full right clockwise (max), multiple SFPI head sweeps outlined in fuchsia.

Go to TOC

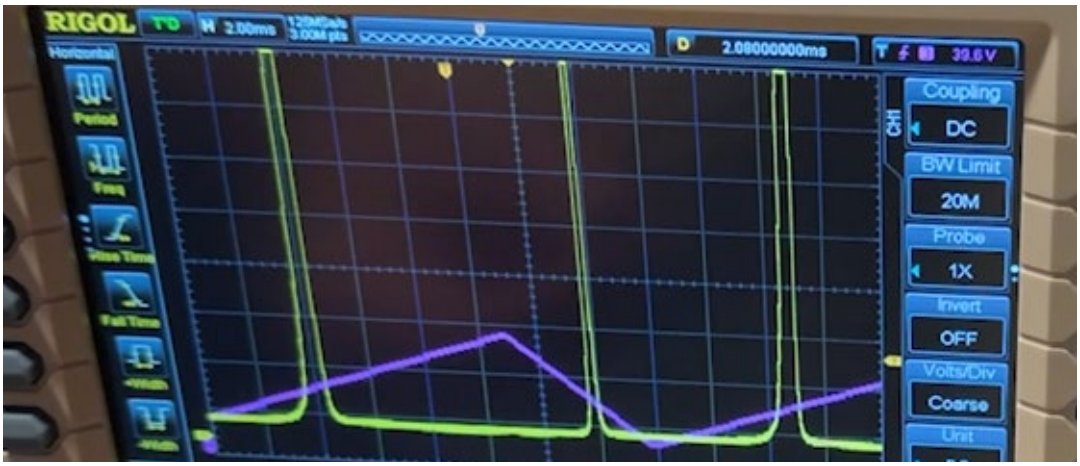


Figure 17 MG OSA SCAN Range knob after being rotated CCW for a single SFPI head sweep.

The other buttons and knobs on oscilloscope:

17:44:54 to 17:54:33 in video. https://youtu.be/UAMtfjV7bCQ?si=PyWHtZoop5zBcObs&t=1064

No need to touch them for this SFPI application.

Part of email: Thu 10/31/2024 11:16 AM

I DO have a couple of questions about stuff in the video. I interrupted your patient explanations a lot and as a result didn't allow you to get to a couple of possibly useful details that you wanted to explain😑.

At 11:44 in the video, you're trying to tell me something about the "little tiny yellow" … I interrupted and we never got back to it. I think it was about what the Rigol manual calls the "trigger level label" pointer (pointer is my word) along the right border of the screen. I also noticed at 10:05:40 that a thin horizontal yellow line comes across the screen at the same point as that "trigger level label" (while adjusting something on the Rigol) - obviously related and indicating something about the "trigger" I'm guessing.

EMAIL THREAD (PARTIAL):

Email: Sat 11/2/2024 12:54 PM

I've been going over the video and instructions I put together and I noticed what may be a relationship between the Rigol and MG OSA controls regarding the size of the vertical peaks, on the Rigol screen, of the SFPI output.

If I understood you correctly, on MG OSA, the "Amplifier, Gain" knob changes the scale and visually changes the height of the SFPI signal peaks (spikes) - in the video, 15:40:50 to 15:48:24. I notice that the voltage in the lower left yellow notification window doesn't change when the Gain is changed.

On the Rigol, the Voltage axis large knob changes the grid scale and visually changes the height of the peaks - in the video, 2:15:35 to 2:48:00.

Is there any actual relationship between these?

Go to TOC

REPLY: Mon 11/4/2024 1:52 AM
Hi Jody
I think you have understood it. :-)
You can think of the Amplifier Gain knob on the MG OSA like the volume on a radio or stereo system.

There is a very very weak signal coming from the SFPI head itself which is generated when the laser light hits the photodiode. This very very small voltage can not be read directly by the Rigol just because it is too small (I am guessing mico-Volts). So the signal is amplified by the MG OSA control box before being sent to the Rigol just like the signal from a record (LP) is amplified before being sent to a speaker.

The Rigol has a fairly wide range of Voltages it can read... from a few millivolts up to about 50 Volts. But you must adjust the scale (turn the Rigol Voltage axis knob) to match the input signal.

So in the video at 15:40 the Rigol has been configured to take voltages up to 16 Volts. This is because the Voltage DIVISION is set to 2.00V and there are 8 divisions (count the grid). The MG OSA is able to amplify the signal from the SFPI head to well over 10 Volts so the Rigol can read it. If you turn the Gain Knob on the MG OSH it is like adjusting the volume and you will see the yellow peaks rise and fall. Now if you cranked up the MG OSA gain knob too high so the voltage output reached 16 volts then the yellow line would saturate and go off the top of the screen. To fix this problem you would adjust the Rigol so each grid was equal to... say... 4 Volts instead of 2 Volts then you would see the yellow line drop to fill half the Rigol screen because 4 Volts x 8 divisions is now 32 Volts.

So yes there is a relationship between the two.
Hope this helps
Regards, John

Email: Mon 11/4/2024 1:51 PM
Hi again John,
Looking at your answer again and comparing it to the video from about 18:35 to about 19:45, I see that yellow Ch 1 is 2.00V which, if I understand what you told me, means that the onscreen graph squares are each represent 2V variation - is that vertical only? Is the yellow Ch 1 signal value reflect the voltage value of the signal from the SFPI sensor?

The blue Ch 2 seems to range from about 5-50V. I also see that when the small (upper) Voltage axis knob is turned, a changing notification comes on the screen “POS” and a changing voltage as the saw tooth ramp comes down. Is the larger blue voltage variation have anything to do with the on screen graph squares like the yellow signal? Is it much stronger because it’s coming from the amplifier MG OSA?
Thanks,
Jody

Email: Mon 11/4/2024 2:12 PM
Hi one more time😮😊.
After I sent this last, I re-read your last email and see that you mostly answered my questions from this last email - sorry. I didn’t really understand it when I first read it but think I do now😊.

Go to TOC

Both the yellow and blue signals are amplified by MG OSA. However, the much weaker signal from SFPI head (yellow) is much less, whereas the ramp is much stronger to begin with since it's generated by MG OSA.

The fog is beginning to dissipate a little about the triggering function, generated by MG OSA, and the MG OSA amplifying the SFPI signal and passing them both to Rigol, and the ability of Rigol to manipulate the two signals and synchronize them.

Your lesson, and my subsequent studying of the video clips and my writeup, have allowed me to understand, a little, other parts of the Rigol.
Thanks,
Jody
PS still trying to understand this though:

At 11:44 in the video, you're trying to tell me something about the "little tiny yellow"… I interrupted and we never got back to it. I think it was about what the Rigol manual calls the "trigger level label" pointer (pointer is my word) along the right border of the screen. I also noticed at 10:05:40 that a thin horizontal yellow line comes across the screen at the same point as that "trigger level label" (while adjusting something on the Rigol) - obviously related and indicating something about the "trigger" I'm guessing.

Reply: Mon 11/4/2024 11:53 PM
Hi Jody
At around 11:44 we were discussing which channel to trigger from. We had two options: Channel two was the blanking output from the MG OSA and channel three was the ramp output from the MG OSA. Either of these is fine, and I expressed my preference for the ramp as it is easier to understand it in my opinion.

This exercise of finding something to trigger from is important so that the yellow peaks (which is actually what is important) are "locked" on the screen. The yellow peaks are synchronized to the ramp (and the blanking signal) and the ramp is really the only consistent reliable signal because the yellow peaks can drift so we trigger on something reliable rather than something that can drift.

So firstly we choose which channel to trigger from, then set the trigger Voltage level and this is what the "little tiny yellow" marker indicates and you can change this using the trigger Voltage knob.

At 11:44 the voltage division was set to 500mV and trigger level was set to the first division (ie the first grid horizontal line) so this says:

"when channel three reaches 500mV then measure all channels and display on the screen" doing this makes everything stable.
Hope this helps, John

YouTube timestamped hyperlinks:
Example YouTube hyperlink with timestamp – timestamps are limited to the second – doesn't seem to want to do tenths of a second. The example below takes you to 10m5s as in email above. While these can be generated manually, the automatic version only works from desktop youtube.

https://youtu.be/UAMtfjV7bCQ?si=sZuZvhRY6CadoaFp&t=605

Go to TOC

Notes of Interest re Computer connection (Ultra Sigma & Ultrascope) to Rigol:
https://supportint.rigol.com/SUPPORTS/faqs_2.html

https://rigol.my.site.com/support/s/article/How-to-use-Ultrasigma-and-Ultrascope-to-take-screenshot-of-scopes

https://rigol.my.site.com/support/s/article/ultrasigma-users-guide1

https://rigol.my.site.com/support/s/article/Taking-FFT-Measurements-with-Ultra-Scope

Go to TOC

User Interface

DS1000Z provides 7.0 inches, WVGA (800*480) 160,000 color TFT LCD.

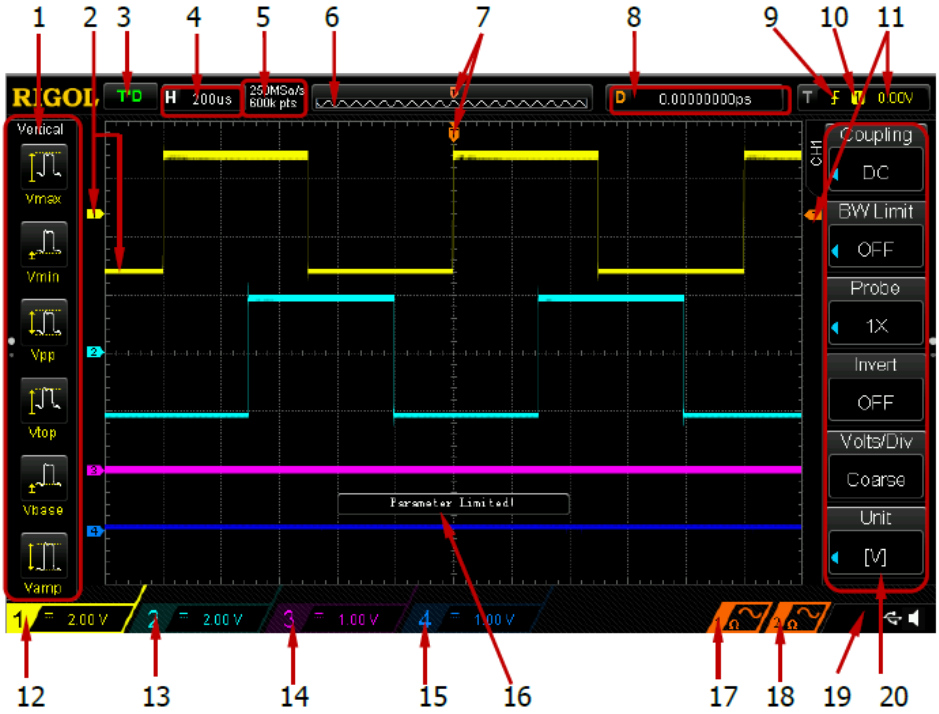


Figure 1-12 User Interface

1. **Auto Measurement Items**
   Provide 16 horizontal (HORIZONTAL) and 16 vertical (VERTICAL) measurement parameters. Press the softkey at the left of the screen to activate the corresponding measurement item. Press **MENU** continuously to switch between the horizontal and vertical parameters.

2. **Channel Label/Waveform**
   Different channels are marked by different colors and the color of the waveform complies with the color of the channel.

3. **Status**
   Available states include RUN, STOP, T'D (triggered), WAIT and AUTO.

4. **Horizontal Time Base**
   - Represent the time per grid on the horizontal axis on the screen.

Figure 18 Rigol Screen Interface explained.

Go to TOC

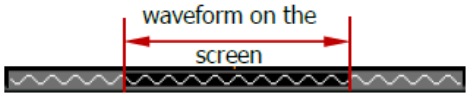
- Use **HORIZONTAL** **SCALE** to modify this parameter. The range available is from 5 ns to 50 s.

5. Sample Rate/Memory Depth

- Display the current sample rate and memory depth of the oscilloscope.
- Use **HORIZONTAL** **SCALE** to modify this parameter.

6. Waveform Memory

Provide the schematic diagram of the memory position of the waveform currently on the screen.



7. Trigger Position

Display the trigger position of the waveform in the waveform memory and on the screen.

8. Horizontal Position

Use **HORIZONTAL** **POSITION** to modify this parameter. Press down the knob to automatically set the parameter to zero.

9. Trigger Type

Display the currently selected trigger type and trigger condition setting.

Different labels are displayed when different trigger types are selected. For example: represents triggering on the rising edge in "Edge" trigger.

10. Trigger Source

Display the trigger source currently selected (CH1-CH4 or AC Line). Different labels are displayed when different trigger sources are selected and the color of the trigger parameter area will change accordingly.
For example: 1 denotes that CH1 is selected as the trigger source.

11. Trigger Level

- T at the right of the screen is the trigger level label and the trigger level value is displayed at the upper-right corner of the screen.
- When using **TRIGGER** **LEVEL** to modify the trigger level, the trigger level value will change with the up and down of T.

Note: In slope trigger, runt trigger and windows trigger, there are two trigger level labels (T1 and T2).

12. CH1 Vertical Scale

- Display the voltage value per grid of CH1 waveform vertically.
- Press **CH1** to select CH1 and use **VIRTICAL** **SCALE** to modify this parameter.
- The following labels will be displayed according to the current channel setting: channel coupling (e.g. ⎓) and bandwidth limit (e.g. B).

Go to TOC

13. CH2 Vertical Scale

- Display the voltage value per grid of CH2 waveform vertically.
- Press **CH2** to select CH2 and use **VIRTICAL** **SCALE** to modify this parameter.
- The following labels will be displayed according to the current channel setting: channel coupling (e.g.) and bandwidth limit (e.g.).

14. CH3 Vertical Scale

- Display the voltage value per grid of CH3 waveform vertically.
- Press **CH3** to select CH3 and use **VIRTICAL** **SCALE** to modify this parameter.
- The following labels will be displayed according to the current channel setting: channel coupling (e.g.) and bandwidth limit (e.g.).

15. CH4 Vertical Scale

- Display the voltage value per grid of CH4 waveform vertically.
- Press **CH4** to select CH4 and use **VIRTICAL** **SCALE** to modify this parameter.
- The following labels will be displayed according to the current channel setting: channel coupling (e.g.) and bandwidth limit (e.g.).

16. Message Box

Display prompt messages.

17. Source1 Waveform

- Display the type of waveform currently set for Source1.
- When the modulation of Source1 is enabled, will be displayed at the bottom of the Source1 waveform.
- When the impedance of Source1 is set to 50 Ω, will be displayed at the bottom of the Source1 waveform.
- Only available to DS1104Z-S and DS1074Z-S.

18. Source2 Waveform

- Display the type of waveform currently set for Source1.
- When the modulation of Source2 is enabled, will be displayed at the bottom of the Source2 waveform.
- When the impedance of Source2 is set to 50 Ω, will be displayed at the bottom of the Source2 waveform.
- Only available to DS1104Z-S and DS1074Z-S.

19. Notification Area

Display system time, sound icon and USB disk icon.

- Sound Icon: when sound is enabled, will be displayed. Press **Utility** → **Sound** to enable or disable the sound.
- USB Disk Icon: when a USB disk is detected, will be displayed.

20. Operation MENU

Press any softkey to activate the corresponding menu.

Go to TOC

The following symbols might be displayed in the menu:


Denote that the multifunction knob at the front panel can be used to select parameter items. The backlight of the multifunction knob turns on when parameter selection is valid.


Denote that you can use the multifunction knob to adjust the parameter and then press down the multifunction knob to select the parameter. In this state, the backlight of the multifunction knob is constant on.


Denote that press to input desired paramrter values directly using the pop-up numeric keyboard. The backlight of turns on when parameter input is valid.


Denote that the current menu has several options.


Denote that the current menu has a lower level menu.


Press this key to return to the previous menu.


The number of the dots denotes that the number of the pages the current menu has.

Go to TOC