

Notes for Using the Tropel (now Coherent) 251 Spectrum Analyzer Controller With the Model 240 Spectrum Analyzer

NOTE: THE VARIABLE CONTROLS (Amplitude, Offset, Rise-time) HAVE SLIP CLUTCHES. This permits you to turn the knob continuously even though you have reached the mechanical (and ohmic) end.

THE MANUFACTURER RECOMMENDS THAT THE SA (SPECTRUM ANALYZER) BE AT LEAST 1 METER FROM THE LASER APERTURE.

Alignment Procedure:

With a meter stick, measure the height of the laser beam above the optical rail. Check that it is level and centered with respect to the rail. If it is not, carefully adjust the laser mount to make it so. Adjust the SA and any other instruments to be placed in the beam to the same height as the beam. Set the SA so that it is centered on the laser beam, and so that the retroreflection of the beam strikes the front face of the laser, just beside the exit aperture.

DIAL CALIBRATION AND INITIAL SETTINGS

1. Turn the RISE-TIME knob CCW (counterclockwise) until you hear (and feel) the mechanical end (clunk). Continue rotating the knob until the line on the knob coincides with the panel marking on the RIGHT-HAND side of the range.
2. Now slowly rotate the knob CW (clockwise). When you get to the mechanical end (clunk), the line should now coincide with the LEFT-HAND side marking. You may have to repeat the process. The control is mechanically capable of approximately 270 degrees of rotation.
3. Repeat this process for the OFFSET and AMPLITUDE knobs.

The knobs are now calibrated, and the following initial settings will make sense:

SWEEP EXPANSION: X1

AMPLITUDE: 250V

OFFSET: MID-RANGE

RISE-TIME: FULLY CCW (10 mS)

TEK SCOPE TDS 220 INITIAL SETTINGS

CH 1:

Coupling	AC	
BW Limit	OFF	
Volts/Div	COARSE	
Probe	1X	
Volts/Div	1 V	Adjust via control in CH 1 panel.

Monitoring the ramp voltage on CH 2 is optional. If you decide to observe this signal, set the controls as described below, then turn off CH 2 when you are done.

CH 2:

Coupling	AC	
BW Limit	OFF	
Volts/Div	COARSE	
Probe	<u>10X</u>	
Volts/Div	50.0 V	Adjust via control in CH 2 panel.

TRIGGER:

Type	Edge
Slope	FALLING
Source	<u>EXT</u>
Mode	NORMAL
Coupling	AC

HORIZONTAL:

Sweep	2.50 mS/div
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After aligning the laser and SA, you should see two (or more) peaks. Adjust the AMPLITUDE control until you see two repeating (clusters of) peaks. If you see many lines jumping about within these peaks, the reflection from the SA is going directly back into the laser. Adjust the SA slightly off axis so that this no longer happens. This will stabilize the pattern. Make fine adjustments to the position of the SA to obtain two or more peaks at each cluster location. These are the (longitudinal) laser modes. The distance between the two repeating clusters is the FSR (free spectral range) of the SA. For this instrument, the FSR is 7.5 GHz (7.5×10^9 Hz). This characteristic is determined by the internal mirror geometry of the SA. The amount by which you must change the distance between the mirrors in the SA to observe multiple interference maxima for the He-Ne laser light is so small that doing so changes the FSR by a negligible amount. For a more detailed explanation, please see the note titled "[Free Spectral Range \(FSR\) of a Scanning Fabry-Perot Interferometer.](#)"

Change the scope from 2.50 mS/div. to 1 mS/div. The clusters should be spread further apart. Now, with the AMPLITUDE and OFFSET controls, set the two clusters to be 8 divisions apart on the scope (so that you can accurately judge the positions of the peaks). Use points that are in phase. You now have 0.125 FSR/div. on the scope. You can use the horizontal position knob on the oscilloscope to adjust the positions of the peaks on the screen.

Use the sweep expansion to magnify the signal. With the scope set as above, switching to X2 gives 0.0625 FSR/division. For example, say that in the X2 position, you measure a displacement of 1.4 divisions between modes. This translates to $1.4 \text{ div.} \times 0.0625 \text{ FSR/div.} \times 7.5 \times 10^9 \text{ Hz} = 660 \text{ MHz}$ separation.