# Scanning Fabry-Perot Interferometers (High-Resolution Spectrometers)


The SA200 family includes 13 Fabry-Perot interferometers that cover six spectral regions with either a 1.5 GHz or 10 GHz Free Spectral Range (FSR). The design of the Fabry-Perot interferometer cavity is comprised of an Invar cavity with internal piezo stacks. This design utilizes the negative thermal coefficient of the piezo stacks to create the nearly athermal cavity that is necessary for the stability of these high-resolution spectrometers.

The tutorial on pages 810-811 covers the basic theory of operation, including an explanation of the effect of the input beam diameter on the resolution of the instrument. In order for the instrument to achieve the specified resolution, the input beam diameter must not exceed the maximum diameter specification, even though the input aperture for the instrument is significantly larger than the specification.

The SA200 can be mounted via a Ø2" ring near the input end of the interferometer. The KS2 is the recommended mount for the SA200 since it will hold the SA200 tightly and provide the kinematic control necessary for proper alignment in the optical cavity. In contrast, the SA210 has a Ø1" mounting ring near the input end of the interferometer, and as a result, the recommended mount is the KS1.

## Features

- Ultra-Stable Invar Cavity
- Confocal Cavity Design
- Mounted Input and Output Alignment Irises

## Specifications

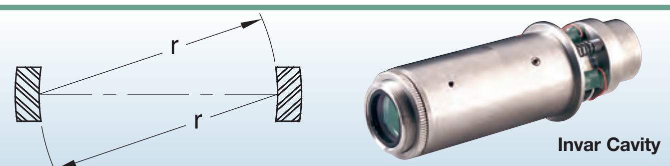
- 1.5 GHz or 10 GHz Free Spectral Range
- Low Scan Voltage, 5 V per FSR @ 633 nm
- 13 Models for the 370 - 1625 nm Range

**SA200**
Mounted in a KS2

See Page 224

| MODEL | SA200 | SA210 |
|---|---|---|
| FSR[a] | 1.5 GHz | 10 GHz |
| Finesse[b] | 200 (250 Typ) | 150 (180 Typ) |
| Resolution | 7.5 MHz | 67 MHz |
| Max. Beam Diameter[c] | 600 µm | 150 µm |
| Cavity Length | 50 mm | 7.5 mm |

[a] Free spectral range for a confocal cavity and defined by FSR = c/4r where c is the speed of light.
[b] Effective finesse defined by $F_t$ = FSR/Δ, where FSR is defined by FSR = c/4r and Δ=FWHM impulse response.
[c] Maximum beam diameter along the length of the cavity to obtain the typical measured finesse specified.




$F_t$ = FSR/Δ
Where Δ = FWHM of Impulse Response

### 1.5 GHz Free Spectral Range, 50 mm Cavity Length, Finesse $F_t \geq 200$ (Typical $F_t = 250$)

| ITEM# | $ | £ | € | RMB | DESCRIPTION | RECOMMENDED MOUNT |
|---|---|---|---|---|---|---|
| NEW SA200-2A | $ 2,727.00 | £ 1,890.50 | € 2.421,00 | ¥ 23,027.00 | Scanning Fabry-Perot, 370-410 nm, 1.5 GHz FSR | KS2 (See Page 224) |
| SA200-5A | $ 2,535.10 | £ 1,757.50 | € 2.250,50 | ¥ 21,407.00 | Scanning Fabry-Perot, 525-650 nm, 1.5 GHz FSR | |
| SA200-6A | $ 2,828.00 | £ 1,960.50 | € 2.510,50 | ¥ 23,880.00 | Scanning Fabry-Perot, 650-800 nm, 1.5 GHz FSR | |
| SA200-7A | $ 2,747.20 | £ 1,904.50 | € 2.439,00 | ¥ 23,198.00 | Scanning Fabry-Perot, 780-930 nm, 1.5 GHz FSR | |
| SA200-9A | $ 2,939.10 | £ 2,037.50 | € 2.609,50 | ¥ 24,818.00 | Scanning Fabry-Perot, 900-1100 nm, 1.5 GHz FSR | |
| SA200-12A | $ 2,979.50 | £ 2,065.50 | € 2.645,00 | ¥ 25,159.00 | Scanning Fabry-Perot, 1250-1400 nm, 1.5 GHz FSR | |
| SA200-14A | $ 2,646.20 | £ 1,834.50 | € 2.349,50 | ¥ 22,345.00 | Scanning Fabry-Perot, 1450-1625 nm, 1.5 GHz FSR | |

### 10 GHz Free Spectral Range, 7.5 mm Cavity Length, Finesse $F_t \geq 150$ (Typical $F_t = 180$)

| ITEM# | $ | £ | € | RMB | DESCRIPTION | RECOMMENDED MOUNT |
|---|---|---|---|---|---|---|
| SA210-5A | $ 2,656.30 | £ 1,841.50 | € 2.358,50 | ¥ 22,430.00 | Scanning Fabry-Perot, 525-650 nm, 10 GHz FSR | KS1 (See Page 224) |
| SA210-6A | $ 2,838.10 | £ 1,967.50 | € 2.519,50 | ¥ 23,965.00 | Scanning Fabry-Perot, 650-800 nm, 10 GHz FSR | |
| SA210-7A | $ 2,716.90 | £ 1,883.50 | € 2.412,00 | ¥ 22,942.00 | Scanning Fabry-Perot, 780-930 nm, 10 GHz FSR | |
| SA210-9A | $ 2,706.80 | £ 1,876.50 | € 2.403,00 | ¥ 22,857.00 | Scanning Fabry-Perot, 900-1100 nm, 10 GHz FSR | |
| SA210-12A | $ 2,979.50 | £ 2,065.50 | € 2.645,00 | ¥ 25,159.00 | Scanning Fabry-Perot, 1250-1400 nm, 10 GHz FSR | |
| SA210-14A | $ 2,747.20 | £ 1,904.50 | € 2.439,00 | ¥ 23,198.00 | Scanning Fabry-Perot, 1450-1625 nm, 10 GHz FSR | |

# Scanning Fabry-Perot Controller Box

### Photo Amplifier Specifications

- **Gain Steps:** 0, 10, and 20 dB
- **Transimpedence Gain (Hi-Z):** 10 kV/A, 100 kV/A, and 1 MV/A
- **Transimpedence Gain (50 Ω):** 5 kV/A, 50 kV/A, and 500 kV/A
- **Output Voltage:** 0 - 10 V (Min)
- **Bandwidth:** 250 kHz
- **Noise (RMS):**
  - <0.1 mV @ 10 kV/A Gain
  - 0.2 mV @ 100 kV/A Gain
  - 1.5 mV @ 1 MV/A Gain

### Ramp Specifications

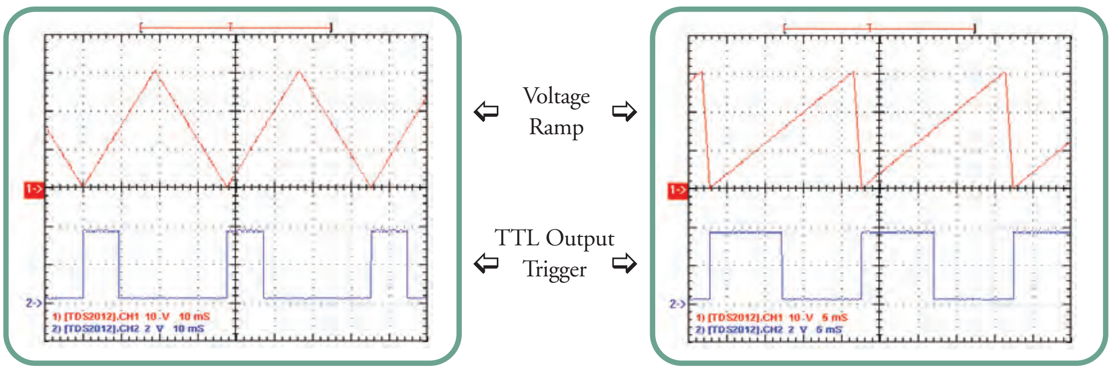
- **Waveform:** Sawtooth or Triangle
- **Output Voltage Range:** 1 - 45 V (Offset + Amplitude)
- **Offset Range:** 0 - 15 VDC
- **Amplitude Range:** 1-30 V
- **Risetime Range:** 0.01 - 0.1 s (1X Sweep Expansion) 1 - 10 s (100X Sweep Expansion)
- **Sweep Expansion:** 1X, 2X, 5X, 10X, 20X, 50X, or 100X
- **Sweep Scale Error:** ±0.5%
- **Output Noise:** 1 $mV_{RMS}$ (~6.6 $mV_{PP}$)
- **Trigger:** Ramp Start or Midpoint

SA201

The SA201 is specifically designed to control Thorlabs' Fabry-Perot Interferometers by generating a high-stability, low-noise voltage ramp. This ramp signal is used to scan the separation between the two cavity mirrors. The controller adjusts the ramp voltage and scan time, allowing the user to choose the scan range and speed, while an offset control allows the spectrum displayed on an oscilloscope to be shifted right or left.

A TTL output allows the user to externally trigger an oscilloscope on either the beginning or midpoint of the ramp waveform. The ability to trigger the oscilloscope from the mid-point makes zooming in on a lineshape more convenient. Simply place the spectral component of interest on the center of the screen, and increase the timebase of the oscilloscope. There is no need to use the offset to re-center the signal since the scope expands the time scale about the point of interest. The controller also has a calibrated zoom capability that provides a 1X, 2X, 5X, 10X, 20X, 50X, or 100X increase in the period of the ramp signal, which allows for an extremely wide range of scan times.

The SA201 also includes a high-precision photodetector amplifier circuit used to monitor the transmission of the cavity. The amplifier provides an adjustable transimpedence gain of 10 kV/A, 100 kV/A, or 1 MV/A when driving a high impedance load, such as an oscilloscope. Using the output sync signal from the controller, an oscilloscope can be used to display the spectrum of the input laser. The detector circuitry incorporates a blanking circuit that disables the photodiode response during the falling edge of the sawtooth waveform. The blanking circuit can be disabled by switching a circuit board jumper as described in the manual.




| ITEM# | $ | £ | € | RMB | DESCRIPTION |
|---|---|---|---|---|---|
| SA201 | $ 841.50 | £ 583.40 | € 747,10 | ¥ 7,105.70 | Control Box for the SA200 Family of Interferometers |