



**FEMTOCHROME®
RESEARCH, Inc.**

2123 4th St., Berkeley, CA 94710 Ph#: 510-644-1869, Fx#: 510-644-0118
e-mail: sales@femtochrome.com; http: www.femtochrome.com

FR-103HP AUTO/CROSSCORRELATOR



Specifications:

- * Resolution: ~ 1fs
- * Minimum Pulsewidth: < 5fs
- * Maximum Pulsewidth: ~ 30ps
- * Scan Range: > 70ps
- * Sensitivity: $[P_{av}P_{pk}]_{min} = 10^{-5}W^2_{(w/PMT)}$
 $10^{-2}W^2_{(w/PD)}$
- * Wavelength Range: 410-5000nm
- * Background-free (Non-collinear SHG)
- * Crosscorrelation
- * Fiber Coupled/ Free Space
- * Any rep rate > 4Hz (w/CDA)
- * Computer Data Acquisition Option

The **FR-103HP** is a dispersion-free, 'real-time' NL crystal auto/crosscorrelator for the measurement of temporal width of ultrashort laser pulses. It is a cost-effective, compact model suitable for medium/high power modelocked lasers with subpicosecond durations.

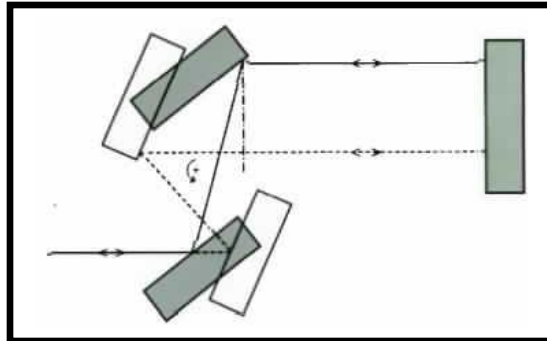
DISPERSION-FREE, HIGH RESOLUTION

Dispersion is negligible in the **FR-103HP** for pulsewidths down to <5fs. Using high reflective metallic-coated optics [the only transmissive element is an ultrathin (<1um) pellicle beamsplitter], an unprecedented resolution approaching 1fs (limited only by the NL crystal thickness) is attained.

ROTATING PARALLEL (//) MIRROR ASSEMBLY

Rapid scan, periodic optical delay is introduced by means of a parallel (//) mirror assembly.* This unique mechanism results in uniform and error-free delay generation. Large delays are easily generated, with dispersion-free interferometric resolution.

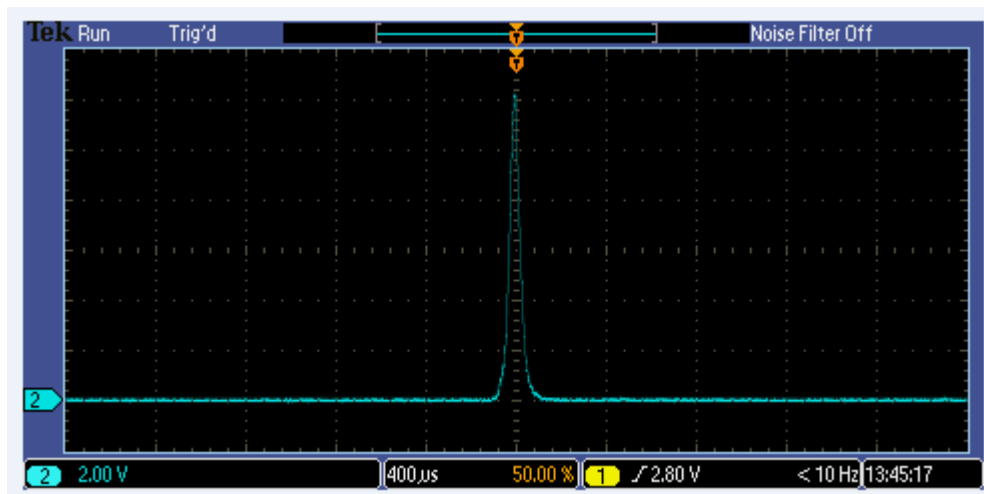
The delay generated by the // mirror assembly is an exact sinusoidal function of time. Since the entire scan range occurs within small angles, linear approximation is excellent.



* Z.A.Yasa and N.M.Amer, Optics Commun., V36, 406 (1981)

HIGH RESOLUTION

With an optimally thin NL crystal, the **FR-103HP** is capable of measuring a sub 10fs pulse :



Commercial fiber laser pulse of 500fs duration

WAVELENGTH RANGES (/BBO/KDP/IR)

Three optimal **NL crystals** provide operation to ~ 5000nm. The standard unit comes with one NL crystal, customer specified:

- /BBO → 410-600nm
- /KDP → 510-1100nm
- /IR → 850-5000nm.

These BBAR coated NL crystals accept **vertically** polarized input beams and fundamental blocking filters are provided for their operational range. For long term reliability, a desiccators is provided to protect the crystal when not in use. The standard NL crystal thickness is customer specified (0.1mm/0.3mm/1mm), with attention to the trade-off between resolution (thinner NL crystal) and sensitivity (thicker NL crystal).

Generally, a 0.3mm crystal thickness can be considered sufficient for pulsewidths down to ~30fs. With shorter pulses, a thinner crystal is necessary. For sub 10fs pulsewidths, a custom (<25μm) NL crystal thickness will need to be specified.

Two types of ultrathin pellicle **beamsplitters** are used with the **FR-103HP**, one (VS) which covers the entire wavelength range, and the second (IR) optimized for >800nm operation. When working with wavelengths < 800nm, the (VS) beamsplitter needs to be used. For wavelengths > 700nm, (IR) beamsplitter is preferable.

DETECTOR (PD) MODULES (/xxxx)

The **FR-103HP** comes with easily exchangeable plug-in photodiode (PD) detector modules (/xxxx) covering a wide range of wavelengths. The selections are:

/400 → 410 -1100nm
/1100 → 1100-2200nm
/2200 → 2200-3400nm
/3000 → 3000-5000nm

In addition, a compact PMT module (**/PMT**) is available covering the wavelength range of 410-1800nm, providing high sensitivity in this wavelength range.

Sensitivity of PD modules is orders of magnitude lower as compared to PMT detection (such as in FR-103XL Autocorrelator), since they do not have the gain as provided by a PMT. Typically, a minimum of ~ 5mW avg. power is needed with a subpicosecond mode-locked pulse.

SLOW SCAN OPERATION

There are two modes of operation for the // mirrors in the **FR-103HP**:

1. Uniform rotation (with refresh rate typically ~2Hz)
2. Controlled movement such that the // mirrors slow down greatly (4 selectable speeds) over a period when the pulses on the two arms of the Michelson Interferometer set-up are overlapping. The // mirrors speed up outside this range, to return quickly for a repetition of the cycle. This mode renders the **FR-103HP** suitable for 'real-time' autocorrelation of lasers with any rep rate > 500Hz. This is particularly useful for kHz amplified lasers.

OPTIONS:

CROSSCORRELATION (/CC)

The **FR-103HP** has a built-in auxiliary port for crosscorrelation of two spatially separate synchronized beams. No additional optics is necessary for this mode of operation.

FIBER ADAPTER OPTION (/FA)

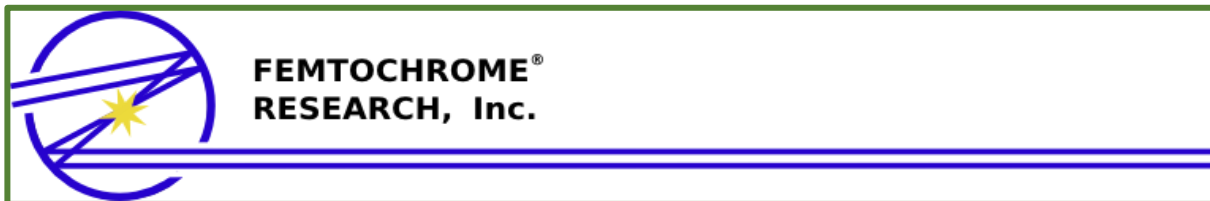
An optional gimbal mount with a collimator is installed over the variable input aperture of the **FR-103HP**, for easy connection of fiber-coupled beams. Factory aligned, repeated connections without a need for realignment is facilitated. The /FA is easily removable for a free-space input beam. Its standard adapter is FC [FC/PC or FC/APC]. For operation at 1550nm, a PM-DSF patchcord can be attached to the /FA. The collimator of the /FA is focus adjustable to obtain good collimation if it needs to be used at greatly different wavelengths. A $\lambda/2$ plate holder is also provided within the /FA assembly, for users to install one for their wavelength of operation, if needed for polarization control. The /FA option can also be applied to the CC port [/FA(CC)].

COMPUTER DATA ACQUISITION OPTION (CDA)

A data acquisition board is installed in the **FR-103HP/CDA**, providing an interface (USB) with any PC w/ Windows OS. Its associated software allows traces to be displayed, analyzed (averaged and/or fit with Gaussian and Sech2) and saved.

SPECIFICATIONS:

- * Resolution: $\sim 1\text{fs}$
- * Minimum Pulsewidth: $< 5\text{fs}$
- * Scan Range: $> 70\text{ps}$
- * Sensitivity: $[P_{\text{av}}P_{\text{pk}}]_{\text{min}}=10^{-2}\text{W}^2$
- * Wavelength Range: 410-5000nm
- * Background-free (Noncollinear SHG)
- * Fiber Coupled/ Free Space
- * Crosscorrelation
- * 'real-time' autocorrelation for $>500\text{Hz}$ input rep rates
- * Computer Data Acquisition Option



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