



**FEMTOCHROME®  
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## **FR-103HP AUTO/CROSSCORRELATOR**



### **Specifications:**

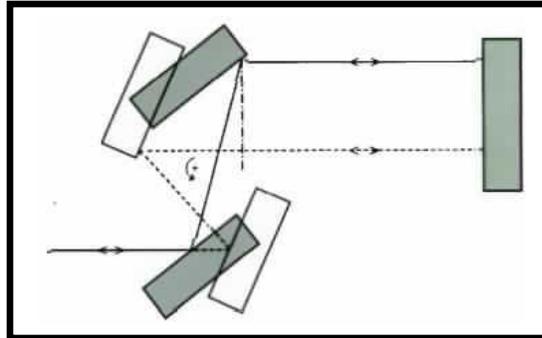
- \* Resolution: ~ 1fs
- \* Minimum Pulsewidth: < 5fs
- \* Maximum Pulsewidth: ~ 30ps
- \* Scan Range: > 75ps
- \* Sensitivity:  $[P_{av}P_{pk}]_{min}=10^{-2}W^2$
- \* Wavelength Range: 700-5000nm
- \* Background-free (Non-collinear SHG)
- \* Fiber Coupled/ Free Space
- \* Any rep rate > 4Hz (w/CDA)
- \* 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.

## 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.



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

## **DISPERSION-FREE, HIGH RESOLUTION**

Dispersion is negligible in the **FR-103HP** for pulsewidths down to  $<5\text{fs}$ . Using high reflective metallic-coated optics [the only transmissive element is an ultrathin ( $\ll 1\mu\text{m}$ ) pellicle beamsplitter], an unprecedented resolution approaching  $1\text{fs}$  (limited only by the NL crystal thickness) is attained, rendering the **FR-103HP** capable to measure a  $\sim 5\text{fs}$  pulsewidth.

## **WAVELENGTH RANGES (/BBO/KDP/IR)**

Three optimal **NL crystals** provide operation to  $\sim 5000\text{nm}$ . The standard unit comes with one NL crystal, customer specified:

/KDP → 700-1100nm  
/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 desiccator 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).

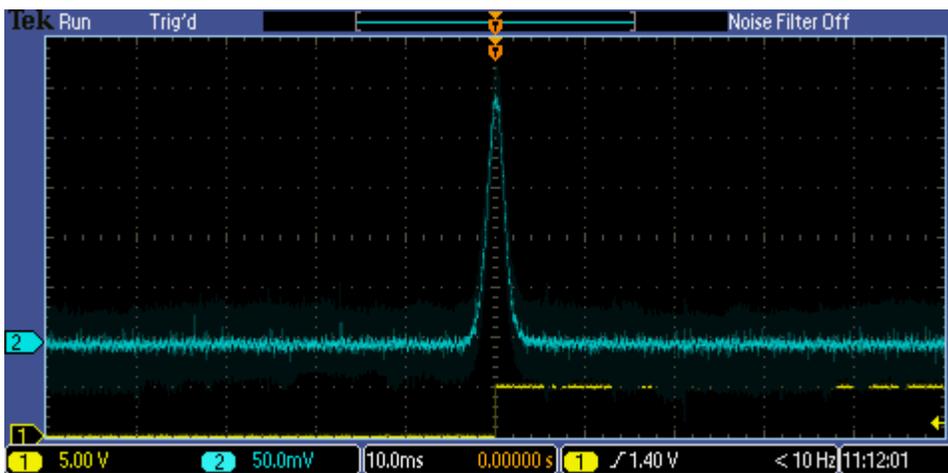
Generally, a 0.3mm crystal thickness can be considered sufficient for pulsewidths down to  $\sim 30\text{fs}$ . With shorter pulses, a thinner crystal is necessary. For  $<10\text{fs}$  pulsewidths, a custom ( $<25\mu\text{m}$ ) NL crystal thickness will need to be specified.

## 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:

- /700 → 700 -1100nm
- /1100 → 1100-2200nm
- /2200 → 2200-3400nm
- /3000 → 3000-5000nm

Sensitivity of PD modules is orders of magnitude lower as compared to PMT detection (such as w/ 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.



Commercial fiber laser (4mW/50MHz/1550nm) pulse of 500fs width measured by the **FR-103HP**

## 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:

### 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 Sech<sup>2</sup>) and saved.

## SPECIFICATIONS:

- \* Resolution: ~ 1fs
- \* Minimum Pulsewidth: < 5fs
- \* Scan Range: > 75ps
- \* Sensitivity:  $[P_{av}P_{pk}]_{min}=10^{-2}W^2$
- \* Wavelength Range: 700-5000nm
- \* Background-free (Noncollinear SHG)
- \* Fiber Coupled/ Free Space
- \* Any rep rate > 500Hz (>4Hz w/CDA)
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