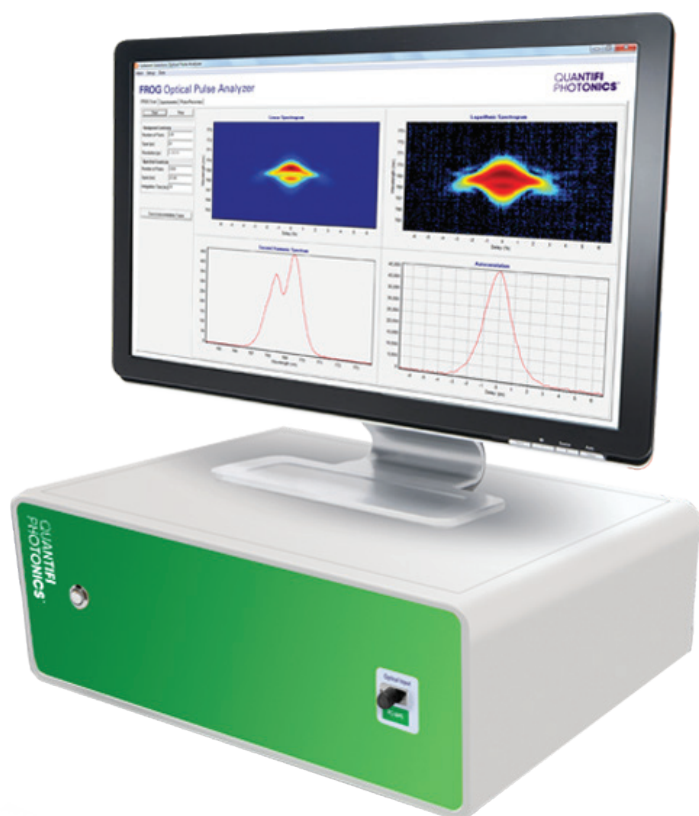


# IQFROG

## FREQUENCY-RESOLVED OPTICAL GATING PULSE ANALYZER

### SPECIFICATION SHEET



The IQFROG measures pulse intensity and phase in both spectral and temporal domains, yielding a complete pulse characterization.

With its long delay arm and high resolution spectrometer, the IQFROG measures chirped pulses up to 50 ps wide, or, if transform limited, up to 7.5 ps wide (1.0 $\mu$ m) or 10 ps wide (1.5 $\mu$ m).



**Autocorrelator function**

The IQFROG can scan and save autocorrelation traces, even if the pulse is too broad (with a very narrow spectral width) or is unsuitable for FROG recovery. The IQFROG can be used as an autocorrelator and measure pulses up to 50 ps.

**Long temporal scan range**

The IQFROG uses a long mechanical translation stage to provide up to 200 ps of scan range to allow autocorrelation measurement of up to 50 ps long pulses. It is one of the few pulse analyzers on the market which can measure such

broad picosecond pulses, as well as short pulses down to 300 fs width. In comparison the competitive SPIDER technique is limited in the ability to measure pulses broader than 1 ps.



**Connectorized input**

The connectorized input makes coupling of the beam easy and fast by eliminating the need to align the beam into the unit manually. IQFROG is by far the most easy-to-use optical pulse analyzer on the market.

**Full software control**

The mechanical control, alignment and tuning is controlled by the software, no more need to align manually.

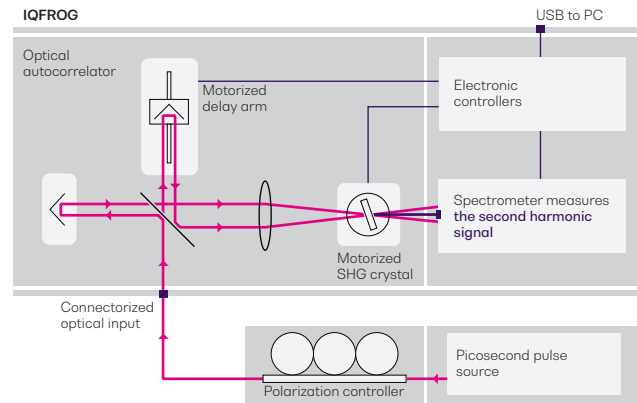
**Ease of Use**

The IQFROG with its connectorized input, user-friendly full software control and USB connection to PC, makes it the smarter plug and play pulse analyzer.

## The IQFROG is a spectrally resolved Second Harmonic Generation (SHG) autocorrelator.

It can resolve sub-picosecond pulses since it is not limited by the response time of the detector. At each delay position on the autocorrelation, a complete SHG spectrum is measured, recording both the spectral and temporal characteristics of the pulse simultaneously.

The two dimensional plot of SHG spectrum as a function of delay is referred to as a 'spectrogram'. Once a spectrogram has been measured, a fast mathematical recovery algorithm is used to completely recover all the characteristics of the pulse, including pulse shape, spectrum, chirp and group delay.



FROG schematic diagram

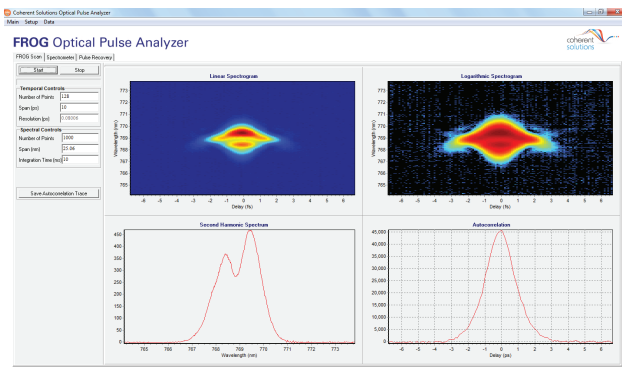
## The FROG measurement technique requires the measurement of second harmonic spectrum of the pulse.

The resolution of the spectral measurement often limits the broadest pulse width that a pulse analyzer can measure, most other competitive products can only measure pulses less than 1ps. Coherent Solutions' IQFROG has a built-in high-resolution spectrometer to enable measurement of transform limited pulses.

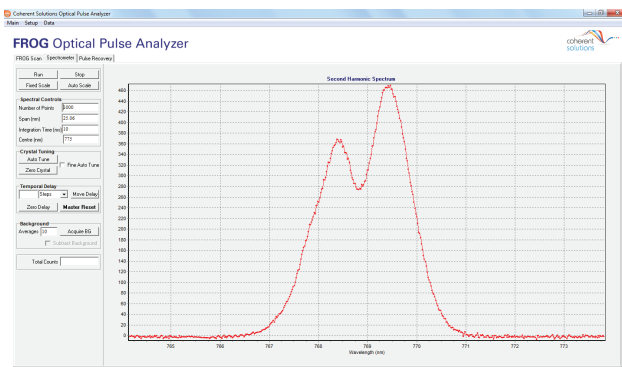
The IQFROG 1.0  $\mu\text{m}$  enables measurement of transform limited pulses of up to 7.5 ps width, or broader if the pulse has a frequency chirp. It has a 1000 - 1100 nm input pulse wavelength range, making it a perfect fit for seed laser pulses for chirped pulse amplification (CPA).

The IQFROG 1.5  $\mu\text{m}$  enables measurement of transform limited pulses of up to 10 ps width, or broader if the pulse has a frequency chirp. It has a 1520 - 1610 nm input pulse wavelength range, making it a perfect fit for C-band femtosecond and picosecond pulsed fiber lasers.

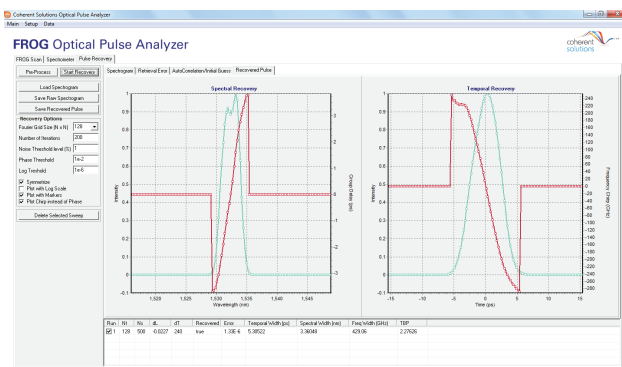
The IQFROG comes with dedicated all-in-one software, ‘Optical Pulse Analyzer’ (OPA) which controls the mechanicals and measures and recovers optical pulses using an intuitive graphical user interface.



FROG Scan functionality measuring the spectrogram and displaying its autocorrelation trace.



Spectrometer functionality displaying the second harmonic spectrum.



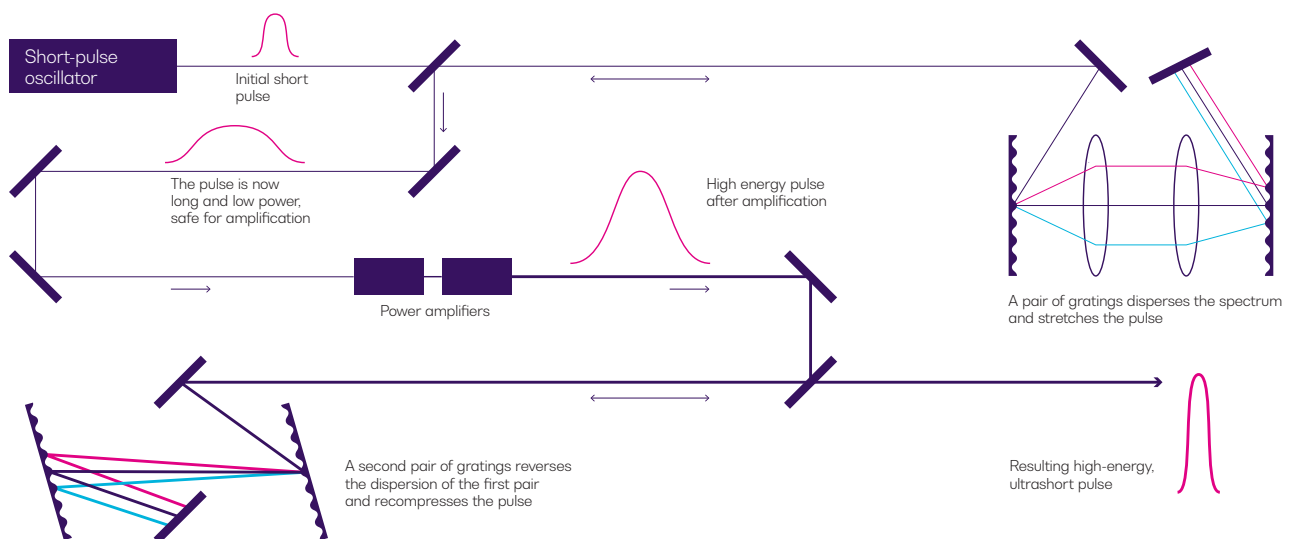
FROG pulse recovery functionality showing the pulse shape and chirp in both temporal and spectral domains.

- Use the IQFROG to obtain the complete expression of electric field of your optical pulse, so that it can be used in numerical simulations
- Characterize and optimize the optical pulses generated from lasers such as, Erbium Doped Fiber Laser, Gain switched laser, Saturable Absorber mode-locked laser and externally modulated pulse source
- Generate transform-limited pulses by compensating for the chirp measured using IQFROG
- Generate optical pulses with desired intensity and chirp profiles using an arbitrary optical filter and check the results with an IQFROG
- Device characterization using comparative measurements of input and output pulses

High power femtosecond and picosecond optical pulses are used for micromachining applications such as; ablating, etching and cutting of a wide range of materials as they minimize the thermal damage on the substrate.

A common technique employed to amplify the power of ultra-short pulses is Chirped Pulse Amplification (CPA).

CPA broadens, amplifies and then compresses the pulse and it is necessary to know the chirp and pulse characteristics at each stages of the CPA. IQFROG measures all the pulse characteristics necessary to optimize the CPA setup.



Chirped pulse amplification diagram

## MODELNAME TECHNICAL SPECIFICATIONS

Crystal type	IQFROG 1.0 $\mu$ M		IQFROG 1.5 $\mu$ M
	BBO CRYSTAL	KDP CRYSTAL	LiNbO3
Input pulse temporal FWHM <sup>a</sup>	0.3 - 7.5 ps (transform limited pulses)		0.3 - 10 ps (transform limited pulses)
Temporal scan range	200 ps		200 ps
Temporal resolution	15 fs		15 fs
Input centre wavelength <sup>b</sup>	1000 - 1100 nm		1520 - 1610 nm
Input pulse spectral FWHM	0.2 - 15 nm	0.2 - 25 nm	0.2 - 10 nm
Spectral resolution	150 pm		120 pm
Pulse repetition rate	Independent		Independent
Input RF clock required	No		No
Input peak power (saturation)	0.5 W <sup>2</sup>	10 W <sup>2</sup>	7 W <sup>2</sup>
Input peak power (sensitivity) <sup>c</sup>	0.002 W <sup>2</sup>	0.01 W <sup>2</sup>	0.005 W <sup>2</sup>
Input connector type	FC/APC or FC/PC		FC/APC or FC/PC

General Specification	IQFROG 1.0 $\mu$ M	IQFROG 1.5 $\mu$ M
Dimensions W x D x H	440 x 450 x 128 mm 17.32 x 17.72 x 5.04 inch	440 x 450 x 128 mm 17.32 x 17.72 x 5.04 inch
Weight	14 kg   30.9 lbs	14 kg   30.9 lbs
PC interface method	USB 2.0	USB 2.0
Operating system requirement	Windows 7, 8 or 10 (32 or 64 bit)	Windows 7, 8 or 10 (32 or 64 bit)
Power supply	~100 - 240 V; 50 / 60 Hz; 500 W	~100 - 240 V; 50 / 60 Hz; 500 W
Operating temperature range	5 °C to 45 °C 41 °F to 113 °F	5 °C to 45 °C 41 °F to 113 °F
Storage temperature range	-40 °C to 70 °C -40 °F to 158 °F	-40 °C to 70 °C -40 °F to 158 °F

### Notes

- a. Broader pulses of up to 50 ps are measurable if the spectral FWHM is within the specified range.
- b. Other centre wavelengths are also available. Please enquire for details.
- c. Minimum value needed for a good recovery; product of average and peak power.

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## ORDERING INFORMATION

**IQFROG** - 1.0 MICRON - XXX - XX

**Crystal type**

**BBO** = BBO - Barium Borate

**KDP** = KDP - Potassium Dideuterium Phosphate

**Connector Type**

**FC** = FC/PC

**FA** = FC/APC

**SC** = SC/PC

**SA** = SC/APC

**IQFROG** - 1.5 MICRON - LINBO<sub>3</sub> - XX

**Connector Type**

**FC** = FC/PC

**FA** = FC/APC

**SC** = SC/PC

**SA** = SC/APC

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## WARRANTY INFORMATION

This product comes with a standard 1 year warranty.

## EXTENDED WARRANTIES AND CALIBRATION PLANS

With an **extended warranty and calibration plan** you'll spend more time focused on your priorities and less time worrying about maintenance.

Your choice: add a **3 or 5 year extended warranty** when you buy.



### Guarantee performance

Ensure your equipment is operating at the best it can be for reliable and accurate results.

### Lower cost of ownership

Lock in savings and maximise your testing budget with a lower base cost of ownership.

### Peace of mind

Spend less time worrying about maintenance and more on generating results.

## CALIBRATION PLANS FOR ADDITIONAL DISCOUNTS

Order a **calibration plan** when purchasing your Quantifi Photonics instruments and get additional discounts.

### 10% Discount

On calibrations ordered at the time of purchase.

### 25% Discount

Add on an extended warranty and receive a 25% discount on calibrations.

Over time and with regular use, all optical parts and connectors require re-calibration and maintenance to guarantee accurate and reliable performance. We recommend Quantifi Photonics optical instruments are re-calibrated every 12 months. With an instrument calibration performed by Quantifi Photonics technicians you receive:

- Comprehensive calibration to factory specifications
- End-to-end inspection to ensure all instrument functions are working and connectors are clean
- Firmware, software and documentation updates
- Certificate of calibration which includes detailed test results

## How to do I secure my extended warranty or calibration plan?

Contact your Quantifi Photonics sales representative or email [sales@quantifiphotonics.com](mailto:sales@quantifiphotonics.com)

Extended warranties and calibration plans must be ordered at the time of purchase and are available only for Quantifi Photonics' products. The 25% calibration discount only applies to calibrations while the product is covered by the extended warranty period.



# Test. Measure. Solve.<sup>TM</sup>

Quantifi Photonics is transforming the world of photonics test and measurement. Our portfolio of optical and electrical test instruments is rapidly expanding to meet the needs of engineers and scientists around the globe. From enabling ground-breaking experiments to driving highly efficient production testing, you'll find us working with customers to solve complex problems with experience and innovation.

**To find out more, get in touch with us today.**

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