Pulse Measurement Perfection with the Multitalent from APE

- It is good to have plenty of options at hand. Suitable for the characterization of virtually any ultrafast pulsed laser, the pulseCheck autocorrelator from APE covers the broadest possible range of wavelengths and pulse widths. This flexibility is achieved by using exchangeable Optics Sets, typically consisting of a nonlinear crystal and a dedicated detector module.

- Exchangeable Optics Sets for broadest spectrum coverage from 200 nm to 12 µm
- Pulse widths from as low as <10 fs all the way up to 400 ps
- Ultra-precise delay resolution
- Toggle between interferometric and intensity autocorrelation
- Wide range of sensitivity levels covered with PMT, PD, and TPA
- Automatic phase matching
- Gaussian, Sech², and Lorentzian fitting routines
- Ready to use software and USB interface
- TCP/IP remote control with standardized command set for easy programming
- NIST traceable calibration
- Option: FROG for complete pulse characterization (page 5)
**pulseCheck  Flexibility for your Experiments**

**Maximum Functionality through Modular Design**

- APE fulfills a growing need for maximum functionality and flexibility with the modular concept on which its pulseCheck autocorrelator series is based.

1. *From Ultrashort to Longer Pulses*

- The various pulseCheck configurations can be optimized accordingly to suit your individual pulse width measurement needs. Extra-long pulse durations are accessible with pulseCheck SM, which utilizes fast and highly precise stepping motor technology to measure long pulses across a larger scan range.

<table>
<thead>
<tr>
<th>Base Unit</th>
<th>Pulse Width Measurement Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t</td>
</tr>
<tr>
<td>pulseCheck 15</td>
<td></td>
</tr>
<tr>
<td>pulseCheck 50</td>
<td></td>
</tr>
<tr>
<td>pulseCheck 150</td>
<td></td>
</tr>
<tr>
<td>pulseCheck SM 320</td>
<td></td>
</tr>
<tr>
<td>pulseCheck SM 600</td>
<td></td>
</tr>
<tr>
<td>pulseCheck SM 1600</td>
<td></td>
</tr>
<tr>
<td>pulseCheck SM 3200</td>
<td></td>
</tr>
</tbody>
</table>

- < 10 fs ... 3.5 ps
- < 10 fs ... 12 ps
- < 50 fs ... 35 ps
- < 120 fs ... 60 ps
- < 120 fs ... 150 ps
- < 120 fs ... 300 ps
- < 120 fs ... 400 ps

2. *High Sensitivity and Low Noise with Three Types of Detectors*

- The three detector types address the need for low noise and enhanced sensitivity in different applications. For pulse measurement with extreme sensitivity and low pulse energy, we recommend our photomultiplier (PMT) detector. Spectrally enhanced photodiodes (PD, TPA), on the other hand, are the ideal choice for measurements requiring sensitivities of a few mW².

- **Photodiode Detector (PD)**  Standard sensitivity up to 1 W²
- **Photomultiplier (PMT)**  Highest sensitivity up to $10^4$ W²
- **Two Photon Absorption (TPA)**  High sensitivity up to $10^2$ W²
3. Ultimate Wavelength Range

- The detectors and Optics Sets available from APE cover a wide range of wavelengths, from UV at 200 nm to Mid-IR at 12 µm.

### Photodiode (PD)
- **Typ. Sensitivity:** 1 W²
- **Rep. Rate:** > 10 Hz
- **Measurement Mode:** Collinear and Non-collinear

### Photomultiplier (PMT)
- **Typ. Sensitivity:** up to 10⁻⁶ W²
- **Rep. Rate:** > 250 kHz
- **Measurement Mode:** Collinear and Non-collinear

### Two Photon Absorption (TPA)
- **Typ. Sensitivity:** < 0.1 W² (NIR/IR) < 500 W² (UV) < 50 W² (VIS)
- **Rep. Rate:** > 10 Hz
- **Measurement Mode:** Collinear Intensity

* For cross-correlation, wavelength range depends on pump wavelength
## pulseCheck Specifications

### Specifications

<table>
<thead>
<tr>
<th>Measurable Pulse Width Range</th>
<th>depending on Base Unit: (&lt; 10) fs (\ldots 3.5) ps &lt; 120) fs (\ldots 60) ps &lt; 120) fs (\ldots 150) ps &lt; 120) fs (\ldots 300) ps &lt; 120) fs (\ldots 400) ps &lt; 50) fs (\ldots 35) ps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength Range</td>
<td>200 nm - 12 µm, depends on Optics Set</td>
</tr>
<tr>
<td>Optics Sets</td>
<td>Exchangeable</td>
</tr>
<tr>
<td>Detector (Optics Sets)</td>
<td>PMT, PD, or TPA</td>
</tr>
<tr>
<td>Delay Resolution</td>
<td>(&lt; 0.001) % of scan range</td>
</tr>
<tr>
<td>Delay Linearity</td>
<td>(&lt; 1) %</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Typically (1 \ldots 10^6) (\text{W}^2) depending on Optics Set*</td>
</tr>
<tr>
<td>Recommended Repetition Rate</td>
<td>PD, TPA: 10 Hz and above; PMT: 250 kHz and above</td>
</tr>
<tr>
<td>Type of Measurement Mode</td>
<td>PMT, PD: non-collinear intensity, collinear interferometric; TPA: hybrid collinear intensity</td>
</tr>
<tr>
<td>Mode Switching</td>
<td>Available for PMT, PD</td>
</tr>
<tr>
<td>SHG Tuning for Phase Matching</td>
<td>PMT/PD: automatic; TPA: not applicable</td>
</tr>
<tr>
<td>Trigger Mode</td>
<td>TTL, (f &lt; 50) kHz; pulseCheck SM &lt; 1 kHz</td>
</tr>
<tr>
<td>Input Polarization</td>
<td>Linear horizontal, vertical available as option</td>
</tr>
<tr>
<td>Input Beam Coupling</td>
<td>Free-space; Option: fiber coupling FC/PC, FC/APC, SMA</td>
</tr>
<tr>
<td>Max Input Power</td>
<td>1 W (e.g. oscillator with a rep. rate of approx. 70 MHz) or 10 (\mu)J (e.g. amplified system with rep. rates in the kHz range), whichever results in lower value</td>
</tr>
<tr>
<td>Input Aperture</td>
<td>6 mm (free-space)</td>
</tr>
<tr>
<td>Software</td>
<td>Included; Real-time display of pulse width and central wavelength, different fitting routines</td>
</tr>
<tr>
<td>Fitting Routine</td>
<td>Gaussian, (\text{Sech}^2), Lorentz</td>
</tr>
<tr>
<td>Connection</td>
<td>USB</td>
</tr>
<tr>
<td>Remote Control</td>
<td>Possible via TCP/IP (SCPI command set)</td>
</tr>
<tr>
<td>Calibration</td>
<td>NIST traceable calibration certificate included</td>
</tr>
</tbody>
</table>

### Options

- Various Optics Sets incl. detector
- Fiber coupling
- Polarization rotator
- FROG

### Dimensions and Power

**Dimensions**

250 \(\times\) 190 \(\times\) 315 mm (pulseCheck 15 / 50)

Different dimensions for pulseCheck 150 and SM series (See appendix for details)

**Power**

95 \(\ldots\) 240 V, 50 \(\ldots\) 60 Hz, 60 W

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* Measured sensitivity including Optics Set, defined as average power times peak power of the incident pulses \(P_{AV} \times P_{peak}\)
Second Harmonic Generation FROG

Complete Pulse Characterization with pulseCheck and FROG Option

- Second Harmonic Generation FROG is the most popular spectrometer-less Frequency Resolved Optical Gating method. The pulseCheck autocorrelators by APE optionally integrate FROG, giving access to complete pulse characterization. The addition of a special nonlinear crystal module and dedicated software opens the door to complete spectral and temporal pulse characterization.

Crystal Module

FROG Setup:
1. Crystal Module within pulseCheck
2. Replacement Focus Mirror
3. FROG Software Upgrade

Different crystal modules for various wavelength ranges*:

- VIS I: 420-550 nm
- VIS II: 550-700 nm
- NIR: 700-900 nm
- IR I: 900-1200 nm
- IR II: 1200-1600 nm

- Complete pulse characterization with Second Harmonic Generation FROG
- Different crystal modules available to cover wavelengths from 420 - 1600 nm
- FROG trace data processing and visualization with included software
- Pulse width ranges from as low as 20 fs up to 6 ps
- High spectral resolution up to 0.1 nm
- Available for the pulseCheck autocorrelator series**

* See appendix for configuration details
** Except for pulseCheck SM models; Required laser rep. rate >10 kHz
FROG Pulse Characterization Software

FROG Trace

- The software provides the laser pulse intensity as a function of time and frequency (wavelength). This is visualized in form of the common FROG trace diagram.
- With the implemented phase matching routine from pulseCheck, it only is a matter of seconds to automatically find the required phase matching tuning angle.

Wavelength and Pulse Coverage

- The various crystals available guarantee coverage of wavelengths from 420 nm right up to 1600 nm, of pulse widths from 20 fs to 6 ps, and a spectral resolution starting as high as 0.1 nm.
- The FROG option is designed for laser repetition rates above 10 kHz and is available for the pulseCheck autocorrelator series (except for SM models).

Software interface FROG for pulseCheck
# Appendix FROG Crystals

<table>
<thead>
<tr>
<th>FROG Crystal</th>
<th>Wavelength Range</th>
<th>Pulse Width Range</th>
<th>Spectral Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS-I-200</td>
<td>420 ... 550 nm</td>
<td>200 ... 6000 fs</td>
<td>0.1 nm</td>
</tr>
<tr>
<td>VIS-I-50</td>
<td>420 ... 550 nm</td>
<td>50 ... 200 fs</td>
<td>0.3 nm</td>
</tr>
<tr>
<td>VIS-I-20</td>
<td>420 ... 550 nm</td>
<td>20 ... 70 fs</td>
<td>1 nm</td>
</tr>
<tr>
<td>VIS-II-150</td>
<td>550 ... 700 nm</td>
<td>150 ... 2000 fs</td>
<td>0.1 nm</td>
</tr>
<tr>
<td>VIS-II-50</td>
<td>550 ... 700 nm</td>
<td>50 ... 200 fs</td>
<td>0.3 nm</td>
</tr>
<tr>
<td>VIS-II-20</td>
<td>550 ... 700 nm</td>
<td>20 ... 60 fs</td>
<td>2 nm</td>
</tr>
<tr>
<td>NIR-200</td>
<td>700 ... 900 nm</td>
<td>200 ... 5000 fs</td>
<td>0.1 nm</td>
</tr>
<tr>
<td>NIR-50</td>
<td>700 ... 900 nm</td>
<td>50 ... 500 fs</td>
<td>0.2 nm</td>
</tr>
<tr>
<td>NIR-20</td>
<td>700 ... 900 nm</td>
<td>20 ... 50 fs</td>
<td>3 nm</td>
</tr>
<tr>
<td>IR-I-150</td>
<td>900 ... 1200 nm</td>
<td>150 ... 900 fs</td>
<td>0.2 nm</td>
</tr>
<tr>
<td>IR-I-60</td>
<td>900 ... 1200 nm</td>
<td>60 ... 200 fs</td>
<td>1 nm</td>
</tr>
<tr>
<td>IR-I-30</td>
<td>900 ... 1200 nm</td>
<td>30 ... 60 fs</td>
<td>5 nm</td>
</tr>
<tr>
<td>IR-II-100</td>
<td>1200 ... 1600 nm</td>
<td>100 ... 700 fs</td>
<td>0.5 nm</td>
</tr>
<tr>
<td>IR-II-50</td>
<td>1200 ... 1600 nm</td>
<td>50 ... 100 fs</td>
<td>2 nm</td>
</tr>
<tr>
<td>IR-II-30</td>
<td>1200 ... 1600 nm</td>
<td>30 ... 50 fs</td>
<td>9 nm</td>
</tr>
</tbody>
</table>
**pulseCheck** Technical Drawings

**Multitalent for any task**

!![Diagram](image)

**Input mirror**

**Beam height**

Manual delay (15 / 50 ps version only)

**Beam distance**

**Beam input**

Focus alignment

315 (for 15/50 ps version)
350 (for 150 ps version)
440 (for SM 250 ps version)

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**Similar Products**

- **Mini TPA** - Compact and tuning-free
- **Mini PD** - Routine tasks with a fixed wavelength range
- **Carpe** - First choice for multiphoton microscopy
- **Spider** - Complete pulse characterization
- **peakDetect** - Pulse quality monitoring

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**Contact**

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**APE follows a policy of continued product improvement. Therefore, specifications are subject to change without notice.**

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