MACH SERIES

130 & 200 kHz Energy Meters

MONITORS

ENERGY DETECTORS

POWER DETECTORS

HIGH POWER DETECTORS

PHOTO DETECTORS

THZ DETECTORS

OEM DETECTORS

SPECIAL PRODUCTS

BEAM DIAGNOSTICS

200 kHz

Mach 6 Module

KEY FEATURES

1. **UP TO 200 kHz PULSE-TO-PULSE**
   - 130kHz with Mach 5 Module and M5 Detectors
   - 200 kHz with Mach 6 Module and M6 Detectors

2. **CAPTURE AND STORE UP TO 4 MILLION PULSES**
   Store 40 seconds of data at 100 kHz

3. **TRACK MISSING PULSES AND PULSES BELOW THRESHOLD**
   Know how many pulses were missed or that didn't make the energy threshold with this unique pulse feature

4. **SEVERAL HEADS TO CHOOSE FROM**
   Silicon, InGaAs and Pyroelectric heads for a broad wavelength and energy range

5. **ANALOG MODULE AVAILABLE**
   Use our fast M5/M6 Detectors with the APM and an oscilloscope for fast analog energy measurements

6. **FULL-SPEED USB 2.0 CONNECTION**
   Ensures high data rate transfer and fast operation

7. **USER-FRIENDLY SOFTWARE WITH MANY DIAGNOSTIC FEATURES**
   - Live Mode, Strip Chart, Histogram and Statistics displays
   - FFT display of pulse energy data for temporal diagnostics
   - Life Test Mode to automate laser testing

AVAILABLE MODELS

- **M5/M6-6-Si**   6 mm Ø, Silicon Sensor (0.35–1.1 µm)
- **M5/M6-6-Si-L**   6 mm Ø, Silicon Sensor (0.35–1.1 µm), Low Noise Level
- **M5/M6-6-In**   6 mm Ø, InGaAs Sensor (1.0–1.6 µm)
- **M5/M6-6-In-L**   6 mm Ø, InGaAs Sensor (1.0–1.6 µm), Low Noise Level
- **M5/M6-6-PY**   6 mm Ø, Pyroelectric Sensor with Metallic Coating (0.35–2.5 µm)
- **M5/M6-12.5-PY**   12.5 mm Ø, Pyroelectric Sensor with Metallic Coating (0.35–2.5 µm)

All M5/M6 heads need to be used with the Mach 5/Mach 6 Energy Meters (respectively)

ACCESSORIES

Stand with Delrin Post
(Model Number: 200428)

Additional 9V Power Supply
(Model Number: 200960)

USB Cable
(Model Number: 202373

APM Analog Power Supply
(Model Number: 201848)

M5-UC-QED
Relative Measurements in UV

Pelican Carrying Case

SEE ALSO

APPLICATION NOTES:

WATCH THE DEMONSTRATION VIDEO AVAILABLE ON OUR WEBSITE AT WWW.GENTEC-EO.COM

MACH SERIES
SPECIFICATIONS

CE WEEE/RoHS COMPLIANT

MACH 5/ MACH 6	M5-6-Si/ M6-6-Si	M5-6-Si-L/ M6-6-Si-L	M5-6-In/ M6-6-In	M5-6-In-L/ M6-6-In-L	M5-6-PY/ M6-6-PY	M5-12.5-PY/ M6-12.5-PY
MAX ENERGY	200 µJ	2 µJ	200 µJ	2 µJ	20 mJ	200 mJ
MAX AVERAGE POWER	5 W	5 W	5 W	5 W	5 W	25 W
MAX REP RATE (MACH 5/6)	130 000 Hz/ 200 000 Hz	130 000 Hz/ 200 000 Hz	130 000 Hz/ 200 000 Hz	130 000 Hz/ 200 000 Hz	130 000 Hz/ 200 000 Hz	130 000 Hz/ 200 000 Hz
EFFECTIVE APERTURE	6 mm Ø	6 mm Ø	6 mm Ø	6 mm Ø	6 mm Ø	12.5 mm Ø
MEASUREMENT CAPABILITY	With Mach 5/6	With Mach 5/6	With Mach 5/6	With Mach 5/6	With Mach 5/6	With Mach 5/6
Spectral Range	0.35 - 1.1 µm	0.35 - 1.1 µm	1.0 - 1.6 µm	1.0 - 1.6 µm	0.35 - 2.5 µm	0.35 - 2.5 µm
Max Measurable Energy [a]	200 µJ	2 µJ	200 µJ	2 µJ	20 mJ	200 mJ
Noise Equivalent Energy	2 nJ	20 pJ	2 nJ	20 pJ	0.2 µJ	2 µJ
Rise Time (0-100%)	150 ns	150 ns	150 ns	150 ns	150 ns	150 ns
Max Repetition Rate	130 000 Hz/ 200 000 Hz	130 000 Hz/ 200 000 Hz	130 000 Hz/ 200 000 Hz	130 000 Hz/ 200 000 Hz	130 000 Hz/ 200 000 Hz	130 000 Hz/ 200 000 Hz
Max Pulse Width	100 nsec	100 nsec	100 nsec	100 nsec	100 nsec	100 nsec
Calibration Uncertainty	± 4%	± 4%	± 4%	± 4%	± 4%	± 4%
Repeatability	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%
DAMAGE THRESHOLDS						
Max Avg Power (60 seconds)	5 W	5 W	5 W	5 W	5 W	25 W
Max Probe Energy (@ 1064 nm)	200 µJ	2 µJ	200 µJ	2 µJ	20 mJ	200 mJ
PHYSICAL CHARACTERISTICS						
Effective Aperture	6 mm Ø	6 mm Ø	6 mm Ø	6 mm Ø	6 mm Ø	12.5 mm Ø
Sensor	Silicon	Silicon	InGaAs	InGaAs	Pyroelectric	Pyroelectric
Absorber	WA	WA	WA	WA	WA	WA
Dimensions	38.1 Ø x 58.4D mm	38.1 Ø x 58.4D mm	38.1 Ø x 58.4D mm	38.1 Ø x 58.4D mm	38.1 Ø x 58.4D mm	76H x 111W x 76D
Weight (Head only)	150 g	150 g	150 g	150 g	150 g	N/A

ORDERING INFORMATION						
Product Name (Mach 5)	M5-6-Si	M5-6-Si-L	M5-6-In	M5-6-In-L	M5-6-PY	M5-12.5-PY
Product Number	201551	201553	201545	201546	201547	201549
Product Name (Mach 6)	M6-6-Si	M6-6-Si-L	M6-6-In	M6-6-In-L	M6-6-PY	M6-12.5-PY
Product Number	202115	202116	202117	202118	202119	202120
Modules			Mach 5: 201557 / Mach 6: 202090			

a. Maximum pulse energy reading will vary with wavelength and probe voltage responsivity (Rv). For more details, please read Application Note 121D-201932 and contact us at info@gentec-eo.com

Specifications are subject to change without notice

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▮ MACH 5 / MACH 6 JOULEMETERS

Measure every pulse at up to 130 kHz with MACH 5 and 200 kHz with MACH 6. Measure with 12-bit digital accuracy and capture up to 4 million pulses in real time. Our MACH 5 and MACH 6 Joulemeters are the only instruments in the world that perform at this speed, and with this precision. They are designed to support our full complement of fast energy probes that include Silicon, InGaAs and Pyroelectric Detectors. Measure from pJ to mJ and from 0.35 to 2.5 µm. Using the M5-Si detector and the M5-UC-QED accessory, you can make relative measurements at 266 nm.

MACH 5 / 6 (Front View)

MACH 5 / 6 (Rear View)

SPECIFICATIONS & FEATURES

	MACH 5	MACH 6
Compatible Detector Heads	M5	M6
Maximum Repetition Rate	130,000 Hz	200,000 Hz
Analog Output	0-3 V	0-3 V
External Trigger (TTL)	Optically Coupled	Optically Coupled
Internal Trigger	2-20 %	2-20 %
Trigger Delay (User-Selectable)	38-3825 ns	38-3825 ns
Energy Resolution	1/2000	1/2000
Computer Input Connector	USB2.0	USB2.0
Product Number	201557	202090

▮ INSTRUMENT CONTROL SCREEN

Our powerful LabView Application Software includes many unique control and diagnostic features. The Instrument Control Screen, shown on the left, is used to set up the operation of the MACH 5/6, including range, trigger, wavelength, and more. In addition, it is used to set a pulse batch size and to ARM the instrument, which starts the data collection. It also gives you access to features like "Autoset", "Call Live Mode", "Run Life Test", "Save Instrument Setup" and the like. These features can be accessed by clicking directly on the feature or pushing the associated function key.

▮ LIVE MODE DISPLAY
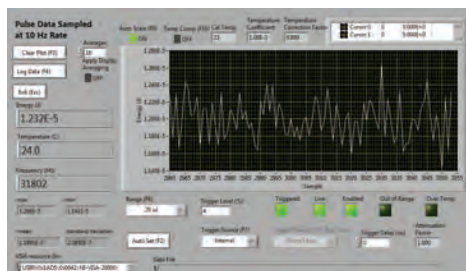
The Live mode can be accessed from the Instrument Control Screen, or by simply pressing the "F4" function key on your PC. This mode of operation is intended to act like your typical slower Digital Joulemeter, as it samples the laser pulses at a 10 Hz rate. It provides you with an energy strip chart, live energy reading, statistics and repetition rate. It is a very useful mode when setting up the Mach 5/6 with your laser. You can select "Auto Set", where the instrument runs through the ranges and trigger levels until it finds the correct range, or set them manually. When setup is complete, you will exit this screen and return to the "Control" screen where you will select a Batch Size, Arm the instrument and start taking pulse energy data.

MACH SERIES

STRIP CHART
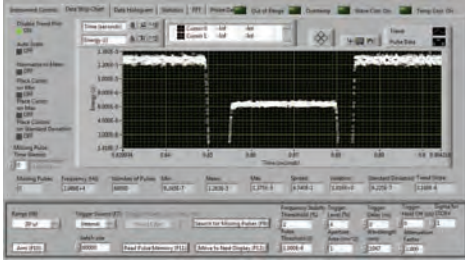
The Strip Chart Display provides a quick graphical look at the pulse data batch just collected. The data can be displayed in full scale or in auto scale mode. You can also zoom-in on a portion of the data, like shown in the screen on the right. An ND0.3 filter has been dropped through the beam and you can see the effects on the pulse data collected. You can fit trend and min/max lines to the data. Just below the chart, you will find a complete set of statistics for the batch. At the top of this screen you will see tabs that will take you to the Histogram, Statistics, and FFT (Fast Fourier Transform) displays.

HISTOGRAM
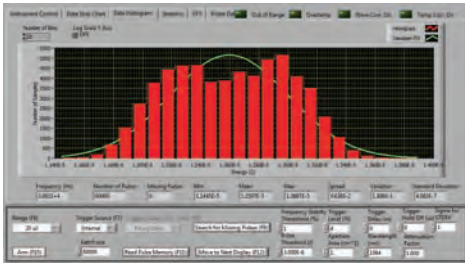
Interested in viewing the statistical distribution of the pulse energy data set? The Histogram screen does this for you and fits a "best Gaussian curve" to the data. It displays complete statistical calculations along the bottom of the graph, along with pulse frequency. Just below the statistics, you will find instrument controls, like range and trigger. You are also given the ability to adjust trigger delay and hold off as needed.

STATISTICS

The Statistics Display offers a very complete set of useful energy readings and calculated statistics. These include: minimum, maximum, average (mean), standard deviation, spread and variation. Some other very handy features include: windows displaying, Average Frequency, Pulse Jitter, Pulses Below Trigger and Pulses Below Threshold (a level set by you). In the screen on the right, you can see that there were 12 pulses below an energy threshold of 3 µW, and 147 missing pulses (or pulses below trigger).

LIFE TEST MODE

Would you like to run a life test on your high repetition rate pulsed laser? How about a periodic test vs. an environmental change like temperature? We have included a great feature to accomplish this. In the Life Test screen, we give you the ability to select the statistics you want, a start time and date, a stop time and date, the number of pulses and a test interval. You simply identify a file, a place to put the data, and then click on start and walk away! When you come back, you have a data set that tracked the performance of your laser over time, temperature, shock, vibration or anything you chose.

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