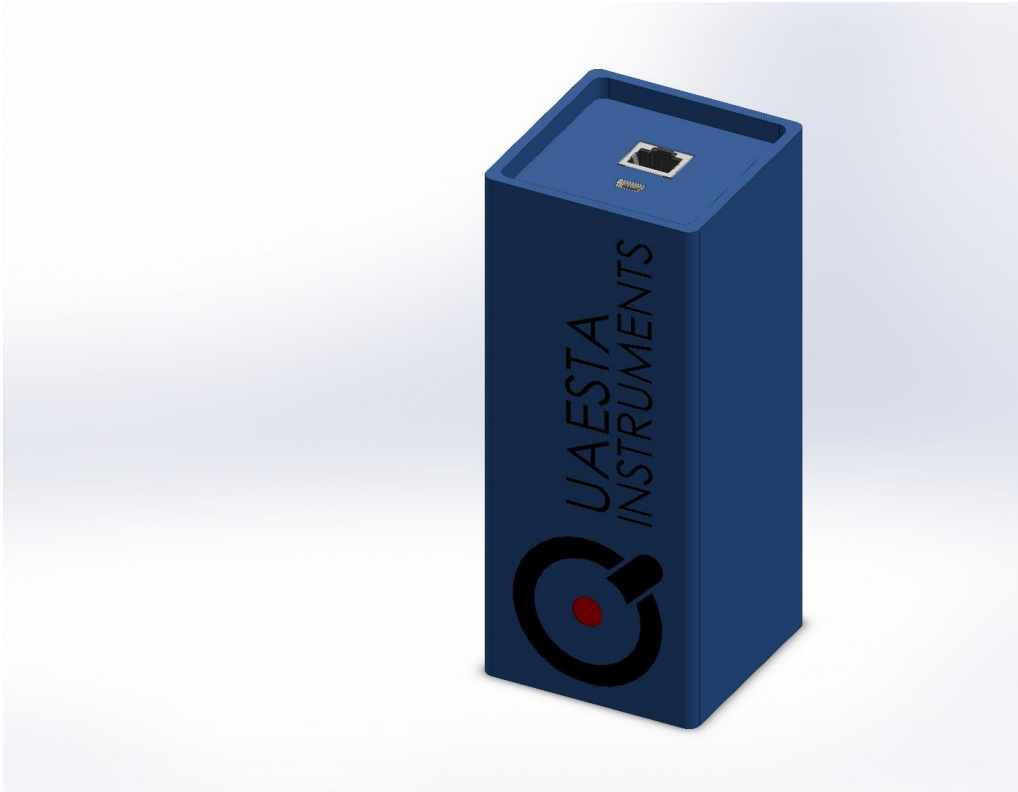# Quaesta Instruments

## Product Information Sheet
## MODEL:  **GSD-2000E/U NEW PRODUCT**



The GSD-2000 is an integrated gamma spectrometer with scintillator, PMT, low noise amplifier, multichannel analyzer (MCA), microcontroller, data logger and both Ethernet and USB communications interfaces.  This device has multiple output options and data types including List Mode (time-stamped) data.  The GSD-2000 can be controlled via a simple command set or with a GUI operating in a browser environment.

# Quaesta Instruments

| Components & Features | Description |
|---|---|
| | |
| GSD-2000 | Gamma Spectrometer with integrated scintillator (2" OD x 2"L, right cylinder, NaI(Tl) crystal standard, or user specified type), low noise amplifier and digital interface including MCA. List Mode Data output type included. |
| | |
| **Mechanical** | |
| | |
| Dimensions | 2.25" OD x 9.5" length (typical, actual dimensions depend upon selection of scintillator tye and size. |
| Enclosure Finish | Aluminum body, metal plating finish (corrosion resistant) |
| Communication & Power Connector | Power over Ethernet jack, USB (Type-B) jack |
| LED | Indicator LED (red) on rear panel. |
| TTL output jack | Optional. SMA connector (standard) or custom. |
| Scintillator (internal) | 2" OD x 2" L, right cylinder, NaI(Tl) crystal (standard), or user specified type |
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| | |
| **Electrical** | |
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| **Analog Components** | |
| High Voltage (HV) | 0 to 2,700V. RMS noise 0.010V. HV level user adjustable. |
| Charge Sensitive Amplifier (CSA) | Integrates input charge pulse and converts to voltage. Sensitivity: 1V / pC or custom. |
| Pulse Shaping Electronics | Pulse shaping time constant 1 to 10□s (typical). Pulse shaping decay time 10 to 100□s (typical). |
| Deadtime | Minimum time between successive counts, 30 to 100□s (typical). |
| Gamma Counting Rate | 33kHz (higher count rate options are available). |
| Amplifier Electronics | Gain range 1 to 20, user selectable. |
| Detector Type | PMT (gain ~ $10^6$, typical) |
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| **Digital Components** | |
| Microcontroller & Timer | ARM Processor, 160MHz. |
| Nonvolatile memory | Up to 128Gb. |
| Analog-to-Digital Converter (ADC) | 12 bit, 8Msps (mega-samples per second). |

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| Temperature & Humidity Sensor | Temperature: range -40C to 124C; resolution 0.01C; accuracy +/- 0.1C Humidity: range 0 to 100% RH; resolution 0.03% RH; accuracy +/- 3%. |
|---|---|

| Components & Features | Description |
|---|---|
| **Features** | |
| Shaped Pulse Waveform Capture | Shaped gamma pulse waveform digitized and stored.  Up to 256 points per waveform, 100ns timing resolution. |
| Pulse Height Measurement | Firmware algorithms measure pulse height.   Noise rejection algorithms can also be applied. |
| Discriminators (Digital) | Standard upper and lower digital discriminator levels are user selectable.  Multiple discriminator values that allow for multiple regions of interest (ROIs) are possible through firmware customization. |
| Digital Timer | 100nsec resolution, timing up to 7.6hours. |
| Digital Counter | Counts gamma events within user specified Region of Interest (ROI).  Capacity 4 billion counts. |
| Multichannel Analyzer (MCA) | Signal pulse height spectrum (histogram) is generated and stored. Histogram resolution 64 to 4096 bins, 4 billion counts per bin. |
| Differential Pulse Arrival Time Spectrum | Differential arrival time (Delta-t) histogram is generated and stored.  Records time between successive gamma counts within a single NPM.   Variable resolution from 100ns to 1ms.  (Optional). |
| | |
| **List Mode Data** | |
| Time Stamping | Time stamps each gamma count.  120ns resolution. 33kHz rate.  Run duration 7.6hours before clock wrap around.  40-bit counter. |
| Pulse Height | Stores pulse height for each gamma count.  12-bit resolution. |
| Source Tagging | Time stamped data is tagged with device identifier.  For use in arrays of up to 256 detectors. |
| External Master Clock Operation (Optional) | Operate up to 256 devices synchronously with a Quaesta-supplied master clock/synchronizer.  Master clock signal inserted through existing Ethernet interface. |
| External Synchronizer Operation (Optional) | Synchronize the time stamp clock of up to 256 devices with a Quaesta-supplied master clock/synchronizer.  Synchronizing pulse inserted through existing Ethernet interface. |
| | |
| **Diagnostics (Optional)** | |
| Internal Pulse Simulator | Diagnostic mode.  NPM internally produces known simulated pulses to test pulse shaper, amplifier, ADC, pulse height measurement algorithms and time stamping. |
| Power Monitoring | Monitors NPM power consumption. |
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| **Data Logging** | |
| Real-Time Clock | Accurate time to 1s per day. |

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|---|---|
| Internal SD Card | Micro SD card, up to 128Gb. |
| Data Stored | User configurable.  Stores list mode data.  Also stores gamma counts and elapsed time, pulse height spectrum histogram, coincidence (Delta-t) histogram, device operating parameters, temperature/humidity (optional).  Data stored in FAT 32 file format. |
| Battery | 48mA-hours.  Estimated 6-year life. |

| Components & Features | Description |
|---|---|
| **Interface** | |
| Communication Typed | Power Over Ethernet, IEEE 802.3af. and USB |
| TCP/IP Terminal Interface | Command line interface.  Configure device and download data. |
| GUI (web browser) | HTTP web browser, 100Mbaud.  Configure device, display and download numerical and graphical data.  Communicate with device from multiple computers simultaneously. |
| | |
| **Quick Specifications** | |
| Power | Power Over Ethernet, IEEE 802.3af. |
| High Voltage (internal) | 0 to 2,700VDC |
| Amplifier Gain | 1 to 20 |
| Deadtime | 30 to 100□s (typical) |
| Gamma Counting Rate | 33kHz maximum |
| Timing resolution | 120ns |