MIRION TECHNOLOGIES

iPA™

Intelligent Preamplifier for HPGe Detectors

iPA for Slimline™ Cryostats

iPA for Flanged™ Cryostats

FEATURES

- Low Noise
- Diode Protected FET input
- Independently terminated Energy and Timing outputs
- Supports Capacitive LN2 Level Probe
- Internal Test Pulser
- USB 2.0 Serial Communication
- Integrated Flash Memory for Parameter and Status Logging
- Software Application for Setup of Preamplifier and Log File Transfer

DESCRIPTION

The Mirion Intelligent Preamplifier (iPA) for High-Purity Germanium (HPGe) Detectors is a low-noise, high-speed resistive feedback preamplifier designed for high resolution gamma spectroscopy and timing measurements. When energy is deposited in the detector, the iPA detector converts the charge to a step-function output pulse of which the amplitude is proportional to the total charge accumulated in the event.

The preamplifier includes a low-noise FET input circuit optimized for the ultra-high source impedance of germanium detectors. A protection network prevents damage to the preamplifier input from high voltage transients. The charge amplifier and buffer stages have been designed for both the low noise and high speed performance needed for precise energy and timing spectroscopy. In addition, special circuits monitor both the temperature and activity of the detector, and warn when improper operating conditions exist.

The iPA detector is equipped with a high-speed USB 2.0 serial data interface. This interface facilitates extensive control and monitoring of many critical preamplifier and detector functions. The included iPA Control Panel software application provides the user with real-time monitoring of the detector current and temperature, along with pertinent internal preamplifier operating voltages. The integrated data logging feature continuously records several of these key operating parameters on a periodic basis, and stores them within the iPA mass storage memory. The stored data log files can be readily downloaded and viewed. This allows the user to take preventative measures if a key parameter starts to shift and ultimately improves equipment availability and productivity. A standard test input and internal test pulser are provided to assist system setup and as a diagnostic aid. The internal test pulser is digitally-controlled through the iPA Control Panel software.

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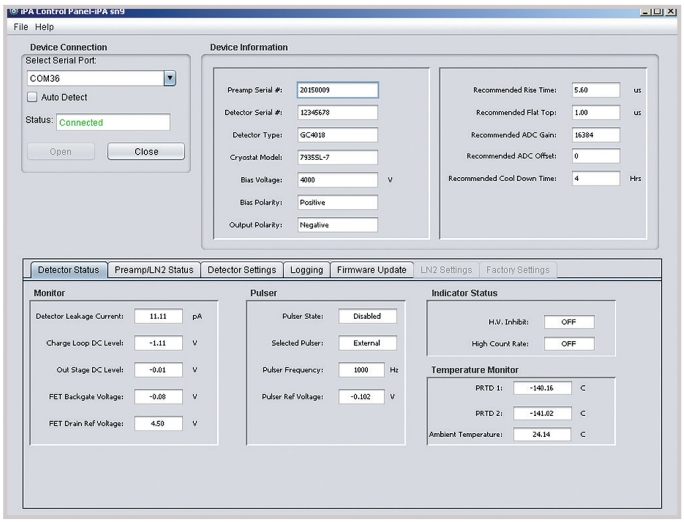
The iPA detector also includes an integrated LN_2 level monitoring circuit, for use with an optional Mirion capacitive LN_2 level-sensing probe. The iPA and probe work together to continuously measure the LN_2 level within the Dewar. The measurement is displayed on the *iPA Control Panel* status screen, and warns the user when the LN_2 level becomes low and the Dewar requires refilling.



ERGONOMIC

Inputs:

- **TEST INPUT –** Charge coupled to preamplifier input at 0.5 pC/V nominal; voltage gain to outputs 0.5X, 1X, 2.5X, or 5X (as selected), ±30%. Input impedance is 93 Ω.
- **HV INPUT –** Detector bias voltage, 0 to ±5 kV dc; no limit to the rate at which bias may be applied; series resistance to detector bias point is 2000 MΩ nominal. High voltage ground is isolated from signal ground by 470 Ω**.**
- **LN2 INPUT –** Low-capacitance SMA coaxial connection for optional Mirion LN2 Dewar capacitive level-sensing probe. Input impedance is 100 kΩ.
- **USB –** High-speed USB2.0 mini-B serial data interface; supports data transfer rates up to 480 Mbps.
- **POWER –** Accepts ±12 V dc and ±24 V dc from main shaping amplifier or MCA.

Outputs and Indicators:

- **ENERGY OUTPUT –** Provides unipolar pulses with peak amplitude linearly proportional to the charge input, non-inverting. Decay time constant is 50 µs (±10%).
- Output swing range is ±10 V open circuit. Output impedance is 93 Ω, series connected, dc coupled. Output dc offset is 0 ±75 mV dc (at gain of 100 mV/MeV), or 0 ±100 mV dc (at gain of 500 mV/MeV).
- **HV INHIBIT OUTPUT** (Requires cryostat with temperature sensor) – Provides a logic signal to turn off High Voltage Power Supply when detector temperature exceeds level which causes detector leakage. Output is +5 V when temperature is correct and <+0.5 V under fault condition; capable of sinking 10 mA. High voltage inhibit ground is isolated from signal ground by 47 Ω to prevent introduction of ground loop noise.
- **HV INHIBIT INDICATOR** (Requires cryostat with temperature sensor) – Green LED glows when detector is at normal operating temperature. Red LED glows if temperature exceeds level, which causes detector leakage.
- **HIGH RATE INDICATOR –** Provides a visual indication of count rate overload. LED glows Red when max rate is reached. LED glows Green when the count rate is below max count rate.
- **INTERNAL PULSER INDICATOR –** Provides a visual indication of the internal pulser status. The LED glows Red when the internal pulser is active, and turns off when the internal pulser is not active.
- **TIMING OUTPUT –** Unipolar pulse for each input event; signal parameters same as above, except 50 Ω output.

PERFORMANCE

- **INTEGRAL NONLINEARITY** – <±0.05% for an output swing of ±8 V (unterminated).
- **GAIN STABILITY** – ≤±0.005%/°C (±50 ppm/°C) over a range of 0 to +50 °C; ≤±0.01% over 24 hours at constant temperature after 1 hour stabilization.
- **CHARGE SENSITIVITY** – 1, 2, 5, or 10 V/pC, corresponding to 50, 100, 250, or 500 mV/MeV (Ge) equivalent, as selected digitally. Shipped in the 500 mV/MeV position. Gain tolerance is ±25%.
- **COUNT RATE** – Count rate performance has been demonstrated up to 200 000 counts per second for 60Co source (1.33 MeV).

Connectors types:

- **HV INPUT** – SHV.
- **TEST INPUT** – BNC UG-1094/U.
- **ENERGY OUTPUT** – BNC UG-1094/U.
- **TIMING OUTPUT** – BNC UG-1094/U.
- **HV INHIBIT OUTPUT** – BNC UG-1094/U (iPA-SL), Amphenol 31-10 (iPA).
- **LN2 INPUT –** SMA (Emerson 142-0701-501).
- **USB –** USB 2.0-Mini-B (Tyco 1734035-2).
- **POWER –** Molex 83611-9006 (iPA); Amphenol 17-20090 (iPA-SL).

Accessories:

- **CABLE ADAPTER –** One 0.9 m (3 ft) power cable adapter is supplied with iPA unit.
- **USB CABLE –** USB-A to right angle Mini-B – 1.8 m (6 ft).

Power Requirements:

- +24 V dc – 12 mA –24 V dc – 10 mA
- +12 V dc – 70 mA –12 V dc – 18 mA

Physical:

- **SIZE – iPA unit (on Flanged Cryostats):** 7.6 x 10.2 x 4.4 cm (3 x 4 x 1.75 in.);
- **iPA-SL (on Slimline Cryostats):** cylindrical, 12.7 x 7.9 cm (5 x 3.1 in.) (L x D).
- **NET WEIGHT** – 0.40 kg (0.88 lb).
- **SHIPPING WEIGHT** – 0.86 kg (1.9 lb).

Software:

The “iPA Control Panel” application requires the following to be installed on the PC:

- USB drivers for the iPA unit. The software distribution disk contains drivers for both 32-bit and 64-bit operating systems.
- Java 6 or higher.

The iPA detector comes pre-configured from the factory and does not necessarily require the software application to be run. But to access the intelligent features, USB connection and software application are required.

Environmental:

- **OPERATING TEMPERATURE** – 0 °C to 50 °C.
- **OPERATING HUMIDITY** – 0-80% relative, non-condensing.
- Tested to the environmental conditions specified by EN 61010, Installation Category I, Pollution Degree 2.

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