

## ORDELA MODEL 2320N

### POSITION-SENSITIVE PROPORTIONAL COUNTER

#### DESCRIPTION

The ORDELA Model 2320N is a high count-rate, two-dimensional, position-sensitive proportional counter (PSPC) and data acquisition system (DAS) designed and manufactured by ORDELA, Inc. for applications in small-angle neutron scattering research. The Model 2320N system is based on the amplifier-per-wire design, developed by ORDELA, Inc. This technology has been applied to greatly extend the life-time and increase the count-rate capability of the PSPC and DAS. This system consists of the neutron PSPC, its position decoder electronics and data acquisition system, and all power and bias supplies.

The PSPC pressure vessel and electronics enclosure are constructed of Aluminum 6061-T6. Their design pressure is five times their operational pressure, and they are tested to 50% over-pressure for increased operational and shipping safety. Only metal and ceramic components are used inside the counting volume for improved gas purity over extended time periods. The amplifier-per-wire method is used for position encoding and counting of thermal neutrons because it offers good spatial resolution, high count-rate capability, and extended life-time. The spatial resolution is 10 mm x 10 mm (fwhm). The count-rate capability is  $10^5$  neutrons per second ( $10^4$  neutrons per second per cathode wire) with <10% coincidence losses. The active counting volume has a square area 32 cm x 32 cm (32 x 32 pixels). It is only 2.5 cm deep to limit parallax distortion to <1 pixel over the entire active area for a PSPC-to-sample distance >1 m. The counting gas is  $^3\text{He-CF}_4$  at 300 kPa for high neutron detection efficiency, good spatial resolution, and low gamma radiation cross-section.<sup>1</sup> The small encoder capacitance and low-noise electronics enable PSPC operation at low gas multiplication (<25) for extended lifetime.

The position decoder consists of 64 low-noise preamplifiers/pulse shaping filters, each connected to a cathode wire. A preamplifier/discriminator processes outputs from the anode wire plane for pulse height and coincidence analysis. All discriminators are programmed and remotely adjusted from the data acquisition system. A programmable pulse generator is included to allow simulating neutron pulses at any pixel location. The logic circuit decodes the position coordinate for all pairs of valid neutron events from the cathode circuits. Multiple events, background, and other invalid signals are rejected by this unit. A programmable high-voltage bias supply and low-voltage power supplies are included for biasing the PSPC electrodes and operating all electronic circuits. All PSPC electronic circuits are contained in a sealed enclosure located on the PSPC back plane.

The data acquisition system is controlled by a type P5 micro-processor. Aside from programming and remotely controlling the bias voltage, discriminator levels, and pulse generator outputs, the processor also programs and manages all essential counter operations such as acquire, stop, clear, time slicing, data storage, and display. The display functions include region-of-interest (circular or rectangular) analysis and integration, slicing, and projections. For more sophisticated data analyses and operations, ORDELA, Inc. will develop and manufacture, upon request, customized software programs (not included in the price of the standard Model 2320N PSPC system). Also, the data acquisition system of the Model 2320N may be networked (via Ethernet or similar) to a remote computer system for data transfer and analysis.

<sup>1</sup> M. K. Kopp et al., Nucl. Instrum. Methods 201, 395 (1982).

## SPECIFICATIONS

ACTIVE AREA:	32 cm x 32 cm
SPATIAL RESOLUTION:	32 x 32 picture elements (pixels)
PIXEL SIZE:	1 cm x 1 cm
SPATIAL UNCERTAINTY:	0.5 cm (fwhm) for an avalanche charge of 150 fC per neutron (i.e., GMF = 50)
COUNTING GAS:	70% <sup>3</sup> He + 30% CF <sub>4</sub> at 300 kPa absolute pressure (total)
CENTROID SPHERE DIAMETER:	0.4 cm
DETECTION EFFICIENCY:	85% for 5 Å neutrons, 65% for 3 Å, 50% for 2 Å
COUNT-RATE CAPABILITY:	10 <sup>5</sup> neutrons per second (10 <sup>-4</sup> neutrons per pixel per second) for 10% coincidence losses
SPATIAL UNIFORMITY:	±2% integral, ±10% differential
BIAS VOLTAGE:	<3000 V (exact bias voltage preset at factory)
ELECTRONICS POWER:	±5 V and ±12 V (from internal power supply)
EXTERNAL POWER:	110 V, 50/60 Hz Clean Power

## COUNTER CONSTRUCTION

BODY AND WINDOW:	Aluminum 6061-T6
DESIGN PRESSURE:	The design pressure for the counter chamber assembly is 1.5 MPa absolute pressure
TEST PRESSURE:	The pressure chamber assembly is tested to 500 kPa absolute pressure in air
WINDOW THICKNESS:	1 cm
OVERALL DIMENSIONS:	64 cm diameter, 23 cm high
SHIPPING WEIGHT:	<100 kg

## ACCESSORIES

Optional accessories available from ORDELA, Inc. but not included in the Model 2320N system are:

- 1.- An insulating transition flange designed to adapt the Model 2320N to its support structure in the flight path and reduce electrical noise interference.
- 2.- Software for customized data analysis and display functions of the Model 2320N system.
- 3.- Customized window configurations and thickness.

Upon request, ORDELA, Inc. will design and manufacture these accessories to customer specifications for delivery with the Model 2320N system as a factory integrated and tested system.

**ORDELA Model 2320N System architecture and  
outline/dimensions drawing available upon request**

## WARRANTY

ORDELA, Inc. warrants its products to be free from defects in materials and workmanship for 12 months after shipment. No other warranty is included. Specifically, no warranty of merchantability or fitness for a particular purpose is implied. ORDELA's liability under this warranty is limited to repairing or replacing the product at ORDELA's option. This warranty is void if the product is operated improperly, disassembled, or modified other than in the ORDELA laboratory.

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