



## ORDELA MODEL 2321N POSITION-SENSITIVE PROPORTIONAL COUNTER

### DESCRIPTION

The ORDELA Model 2321N is a position-sensitive proportional counter (PSPC) and position-encoding electronics (DAS) designed and manufactured by ORDELA, Inc. for applications in neutron scattering and diffraction research. It applies the multi-anode/multi-cathode and preamplifier-per-cathode design for excellent angular resolution and count-rate capability. The counting volume has an active area of 32 cm x 32 cm and is 2.5 cm deep. The counting gas is  $^3\text{He}$  plus additives at <300 kPa absolute pressure for increased neutron detection efficiency and reduced gamma-radiation cross-section. The anode/cathode wire pitch (and thus the spatial resolution) is  $\approx 5$  mm. The PSPC operates at low gas multiplication (<40); that is, the anode avalanche generates 160 fC charge per detected neutron. This is <5% of the charge required for operating a typical 2-dimensional RC Encoded PSPC. This reduction in charge requirement by itself should increase the life time of the anode by a factor of twenty.

The PSPC pressure vessel and electronics enclosure are constructed of Aluminum 6061-T6. They are designed for operation inside a vacuum flight path. Their design pressure is five times their operational pressure, and they are tested to 50% over-pressure for increased operational and shipping safety. Mostly metal and ceramic components are used inside the counting volume for improved gas purity over extended time periods.

The Model 2321N position encoding electronics consists of one low-noise, wide-band preamplifier/discriminator per cathode wire for independent amplification and discrimination of each of the 128 outputs (64 each for the x- and y-coordinates). All cathode wire signals are grouped into sixteen sets of modular preamplifier card, discriminator card, and front-end-processing card, sixteen wires per set. Multiple Event Discrimination (MED) between adjacent wires is implemented with Programmable Gate Array (PGA) circuits by over-sampling discriminator outputs of each wire. This technique also eliminates spurious noise pulses from being processed. All 128 cathode outputs are connected to the on-board processor for coincidence analysis between the x- and y- coordinates. A Fast Digital Interface (FDI) latches valid X-Y coincident events. A handshake signal with the host computer or data logger will update the one-event latch with a new event. Coincident X-Y events from the detector cathode wires can be processed and latched on the FDI for readout at a sustained cycle rate of 100ns. Standard features of the Model 2321N electronics include an anode preamplifier to process outputs from the anode wire plane for pulse-height analysis. An on-board processor allows for remote control of the amplification and discriminator settings for each wire and the high voltage power supply setting via an RS-485 differential serial bus. Software is provided so the user can easily control these functions from the data acquisition PC.

The position encoding electronics are modular for simple maintenance and replacement. A minimum number of processing devices is used to maximize encoding speed and reliability of the detector. All the PSPC position encoding electronics are contained in a sealed enclosure located on the PSPC back plane. This enclosure is vented to atmosphere to allow operation of the electronics at atmospheric pressure when the PSPC is located in a vacuum flight path. The enclosure is easily accessible for maintenance purposes.

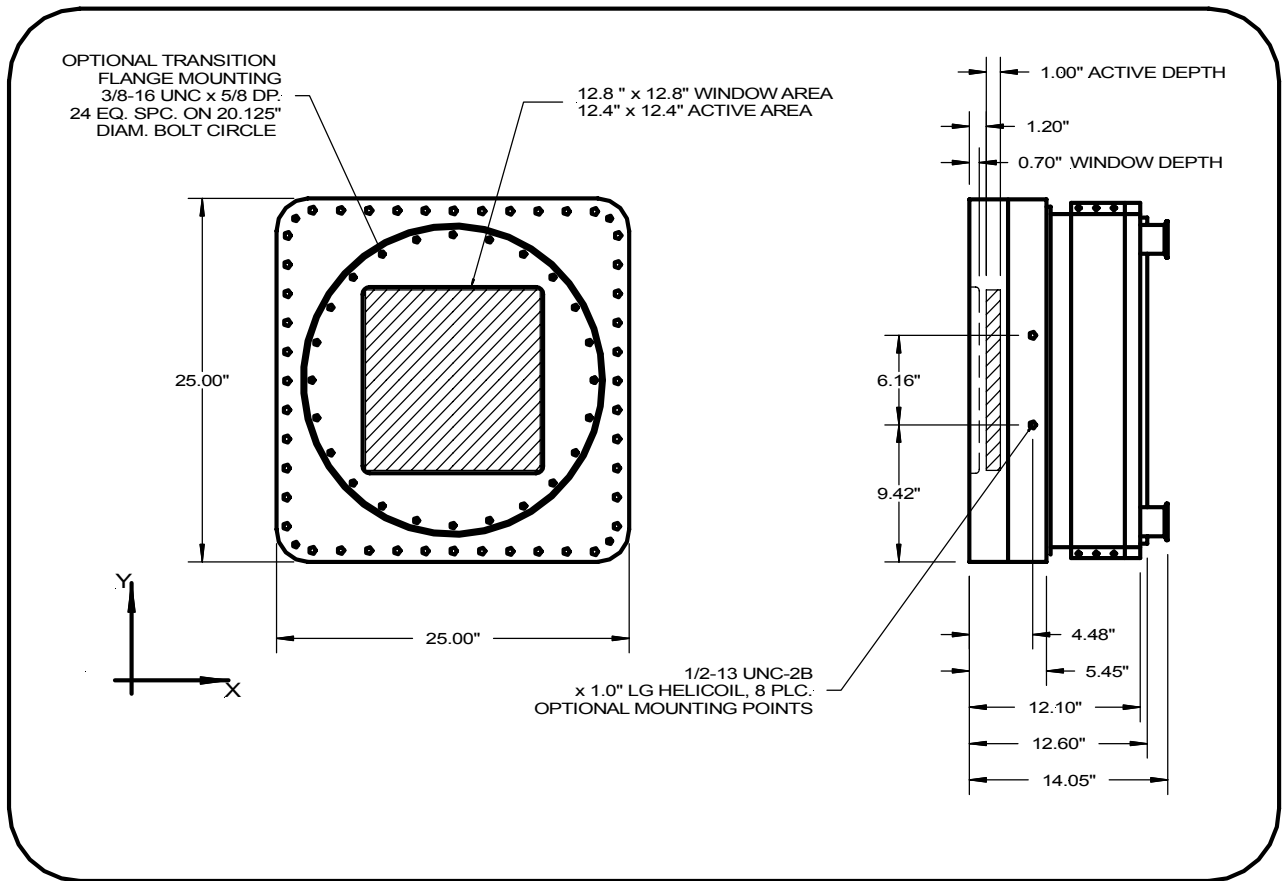
### PSPC SPECIFICATIONS

ACTIVE AREA:	32 cm x 32 cm
SPATIAL RESOLUTION:	64 x 64 picture elements (pixels)
PIXEL SIZE:	0.5 cm x 0.5 cm
SPATIAL UNCERTAINTY:	0.5 cm (fwhm) for an avalanche charge of 160 fC per neutron (i.e., GMF = 40)
COUNTING GAS:	77% $^3\text{He}$ + 23% $\text{CF}_4$ at 260 kPa absolute pressure (total)
DETECTION EFFICIENCY:	80% for 5 Å neutrons, 65% for 3 Å, 50% for 2 Å
COUNT-RATE CAPABILITY:	$10^4$ neutrons per second per anode ( $10^6$ neutrons per second overall) using digital data processing.
SPATIAL UNIFORMITY:	$\pm 2\%$ integral, $\pm 10\%$ differential

BIAS VOLTAGE: <3000 V (exact bias voltage preset at factory)  
 ELECTRONICS POWER:  $\pm 5$  V and  $\pm 12$  V (from internal power supply)  
 EXTERNAL POWER: 110/220 V, 50/60 Hz Clean Power (factory set to customer specification)

**COUNTER CONSTRUCTION**

BODY AND WINDOW: Aluminum 6061-T6  
 DESIGN PRESSURE: The design pressure for the counter/buffer chamber assembly is 1.5 MPa absolute pressure  
 TEST PRESSURE: The pressure vessel/buffer chamber assembly is tested to 500 kPa absolute pressure in air (i.e., 50% over-pressure for operation of the counter system in vacuum)  
 WINDOW THICKNESS: 1 cm  
 OVERALL DIMENSIONS: 64 cm diameter, 23 cm high  
 SHIPPING WEIGHT: <100 kg



ORDELA Model 2321N System Outline and Dimensions

**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.