

# 142A, B, and C Preamplifiers



- Optimum performance for (A) low-, (B) medium-, and (C) high-capacitance charged-particle or heavy-ion detectors
- Extremely low noise
- Accepts 0 to  $\pm 1$  kV bias
- Separate fast-timing output signal with rise time from  $< 5$  ns
- Operates in vacuum
- Small size

The ORTEC Models 142A, 142B, and 142C Preamplifiers are low-noise, fast-rise-time, charge-sensitive preamplifiers designed for optimum performance with charged-particle or heavy-ion detectors.

The Model 142A is optimized for extremely low noise and fast timing for detectors with capacitance up to 100 pF. This makes it the ideal selection for high-resolution alpha- and beta-particle spectroscopy applications.

Model 142B is optimized for extremely low noise and fast timing for detectors with capacitance greater than 100 pF but less than 400 pF.

Model 142C is optimized for extremely low noise and fast timing for detectors with capacitance greater than 400 pF.

These preamplifiers have a separate fast-timing output with pulse widths of  $\sim 50$  ns and rise times ranging from less than 5 ns for 0 pF detectors to less than 20 ns for 1000 pF detectors. This timing output, when used in conjunction with ORTEC's standard electronics, provides excellent time resolution ([Fig. 1](#)); also, its fast-differentiated shape often permits direct coupling to the timing discriminator.

The performance of many spectroscopy systems can be enhanced by these preamplifiers being able to operate in vacuum enclosures. This allows the input cable length to be minimized. The small size of the preamplifier is of significant importance when operating in such enclosures due to the limited space available.

## PERFORMANCE

Performance specifications apply to E output unless stated otherwise.

## INPUTS

**INPUTS** Accepts positive or negative charge input (normally from a semiconductor detector) from any type detector; BNC connector.

**BIAS** Accepts detector bias from supply and applies it to detector through the INPUT connector; maximum  $\pm 1000$  V; SHV connector of ORTEC type C-38.

**TEST** Input for pulse generator to test and calibrate the system; BNC connector.



**NOISE** (see [Fig. 2](#))

Model	Detector Capacitance (pF)	Maximum Noise (keV)(Si)
142A	0	1.60
142A	100	3.40
142B	100	3.20
142B	1000	19.00
142C	400	7.20
142C	1000	14.50
142C	2000	27.00

**INTEGRAL NONLINEARITY**

≤0.03%, 0 to ±7 V open circuit or ±3.5 V terminated in 93 Ω.

**TEMPERATURE INSTABILITY**

**142A** <±50 ppm/°C from 0 to 50°C.  
**142B** <±100 ppm/°C from 0 to 50°C.  
**142C** <±100 ppm/°C from 0 to 50°C.

**OPEN LOOP GAIN**

**142A** >40,000.  
**142B** >80,000.  
**142C** >80,000.

**CHARGE SENSITIVITY (Si equivalent)**

**142A** Nominally 45 mV/MeV.  
**142B** Nominally 20 mV/MeV.  
**142C** Nominally 20 mV/MeV.

**ENERGY RANGE**

**142A** 0 - 200 MeV.  
**142B** 0 - 400 MeV.  
**142C** 0 - 400 MeV.

**E<sup>2</sup>CRP** Maximum energy-squared count-rate product:

**142A**  $1.5 \times 10^7$  MeV<sup>2</sup>/s.  
**142B**  $3 \times 10^7$  MeV<sup>2</sup>/s.  
**142C**  $3 \times 10^7$  MeV<sup>2</sup>/s.

**RISE TIME (0 to 0.5 V pulse at E output on 93-W load)**

**142A** <5 ns at 0 pF; <12 ns at 100 pF.  
**142B** <5 ns at 100 pF; <25 ns at 1000 pF.  
**142C** <11 ns at 400 pF; <20 ns at 1000 pF.

**DECAY TIME**

**142A** Nominally 500 μs.  
**142B** Nominally 1000 μs.  
**142C** Nominally 1000 μs.

**POWER** Input power through 10-ft captive power cable from ORTEC main amplifier or ORTEC Model 4002P Portable Power Supply.

**OUTPUTS**

**E** Positive or negative linear tail pulse for energy measurement. BNC connector.

**T** Negative or positive linear fast-clipped pulse for timing. This output is generated using an inverting transformer that differentiates the energy output. Its rise time ranges from <5 ns to <25 ns. BNC connector.

**ELECTRICAL AND MECHANICAL****POWER REQUIRED**

**142A** +24 V, 20 mA; -24 V, 10 mA; +12 V, 15 mA; -12 V, 15 mA.  
**142B** +24 V, 40 mA; -24 V, 10 mA; +12 V, 15 mA; -12 V, 15 mA.  
**142C** +24 V, 40 mA; -24 V, 10 mA; +12 V, 15 mA; -12 V, 15 mA.

**WEIGHT**

**Net** 0.32 kg (0.75 oz)  
**Shipping** 1.25 kg (2.75 lb)

**DIMENSIONS** 3.81 x 6.10 x 13.3 cm (1.5 x 2.4 x 5.25 in.).

**SELECTION GUIDE TO 142A, 142B, or 142C**

To choose among Models 142A, 142B, or 142C:

1. Find the depletion depth of your detector. If it is an ORTEC detector, the last group of 2 to 4 digits is the depth in μm.
2. Find the depletion depth on the graph in [Fig. 4](#) and read the capacitance in pF/mm<sup>2</sup> on the top part of the chart.

### RECOMMENDED RANGE OF INPUT CAPACITANCE

**142A** 0 to 100 pF.

**142B** 100 to 400 pF.

**142C** 400 to 2000 pF.

### DETECTOR BIAS VOLTAGE

±1000 V maximum.

3. Multiply the area of your detector in  $\text{mm}^2$ . This is the middle three-digit number for an ORTEC detector. Choose a Model 142A if the capacitance is less than 100 pF, a Model 142B if the capacitance is more than 100 pF but less than 400 pF, a Model 142C if the capacitance is greater than 400 pF. An ORTEC D-025-100-200 detector will have about  $1 \text{ pF}/\text{mm}^2$  for its  $100\text{-}\mu\text{m}$  depletion depth. This, then, is 200 pF for the  $200 \text{ mm}^2$  area, and a Model 142B Preamplifier is preferred.

### ORDERING INFORMATION

To order, specify:

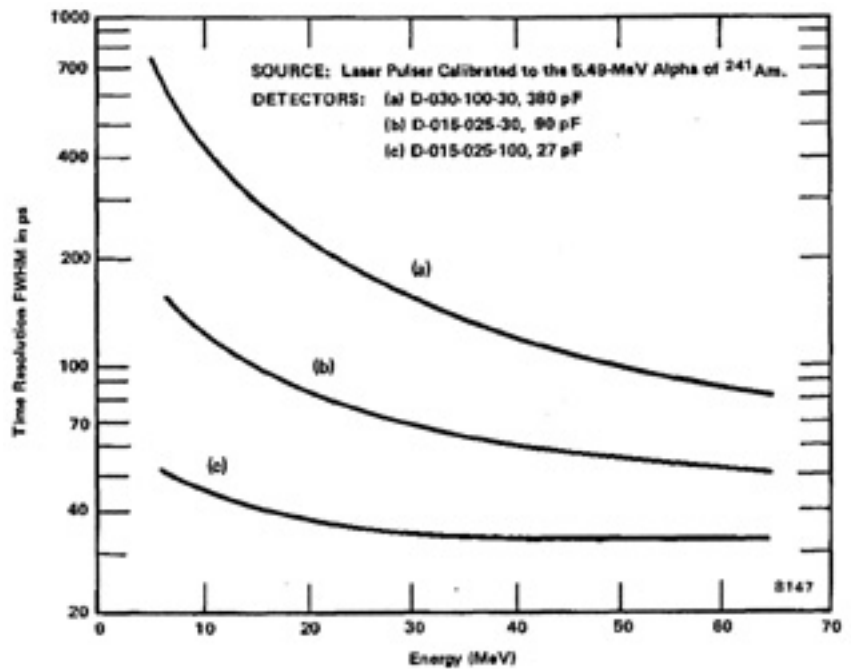
#### Model Description

**142A** Preamplifier (for 0 to 100 pF)

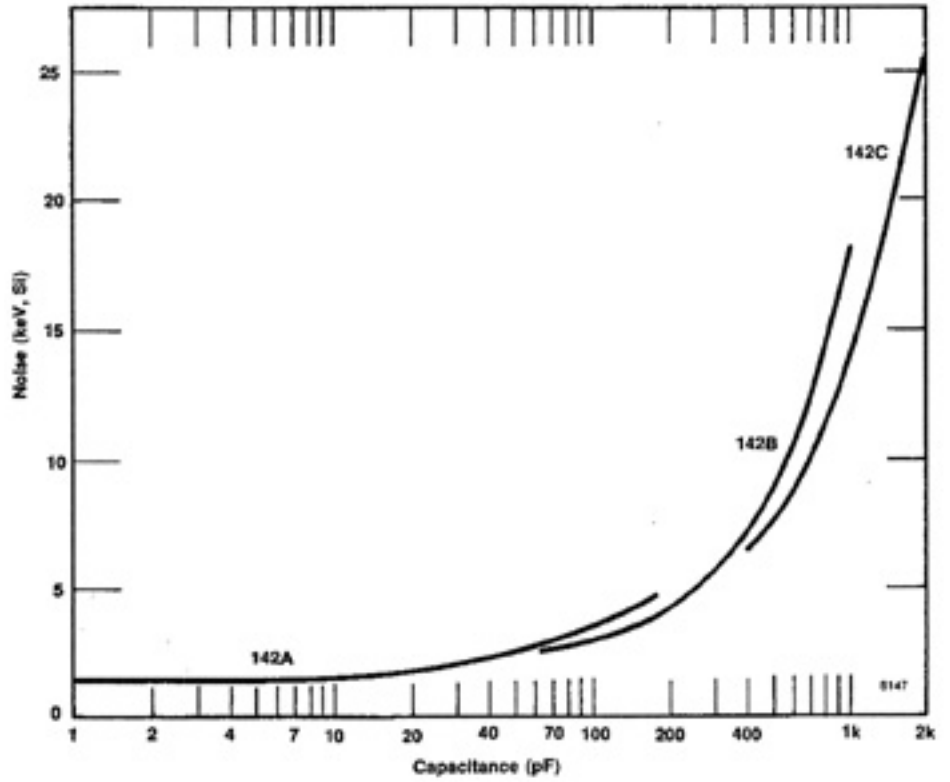
**142B** Preamplifier (for 100 to 400 pF)

**142C** Preamplifier (for 400 to 2000 pF)

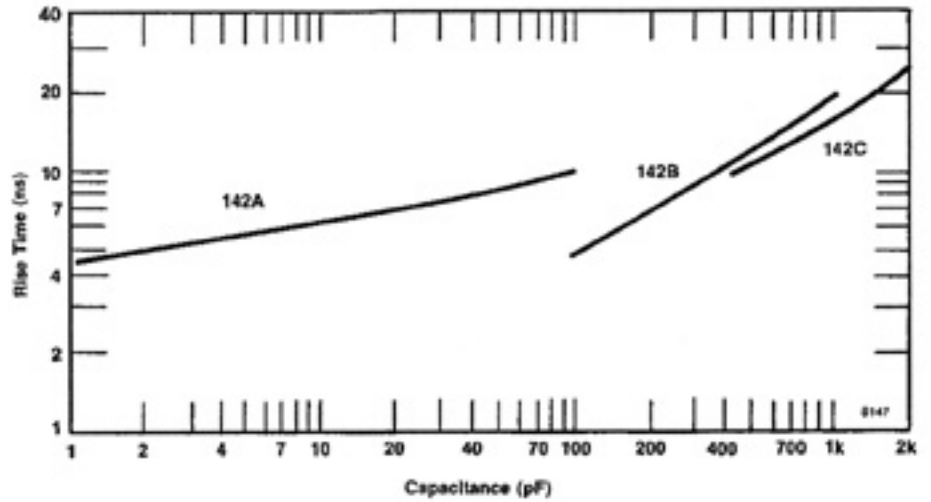
**Fig. 1.** Typical Time Resolution vs. Energy for different capacitance detectors using ORTEC standard electronics.



**Fig. 2.** Typical noise as a function of input capacitance measured with an ORTEC Model 572 Amplifier and 2- $\mu$ s time constant.



**Fig. 3.** Typical rise time as a function of input capacitance with rise time compensation optimized at each data point. (Values given are for a +0.5 V signal into 93  $\Omega$  from the E channel.)



**Fig. 4.** Silicon Detector: specific capacitance in pF/mm<sup>2</sup>

