

## Pen-type scintillation detector

### Features:

- Built-in spectroscopy amplifier
- Built-in single channel analyzer
- Built-in high voltage generator
- Small in size

By using 10 mm diameter Pen-type photomultiplier tubes, small scintillation crystals (with or without an internal or external collimator) can provide information on activity, for example in node sentinel studies.

These instruments can be supplied complete with a sealed electronic unit which contains a high voltage generator (DC controlled), spectroscopic amplifier and a single channel analyzer.

Pen-type instruments provide as well an analog output for spectroscopic information (pulse height spectra), and a TTL (SCA) output signal selecting pulses in the region of interest. Lower Level Discriminator (LLD) and Upper Level Discriminator (ULD) are provided with test points and the analog output can be monitored with any commercial ADC.

### The detector assembly

The probe consists of a NaI(Tl) scintillation crystal 9.5 x 20 mm, optically coupled to a Pen-type photomultiplier tube (Hamamatsu R1635). The assembly is housed in an aluminum housing with a 1.5 m long output cable.



The signal and power supply junction box provides the high voltage to the probe and processes the analog signal from the PMT.

### Electronic working principles

The photomultiplier tube is fed using a resistor chain with a total resistance value of 3.7 MΩ.

The high voltage is positive and the anode is AC coupled to the input of the amplifier via a DC decoupling capacitor. The high voltage is controlled by a DC input voltage which is taken from the positive 12 volt power supply.



The control voltage can be monitored at the test point on the side of the junction box. The reference voltage is internally regulated. The high voltage can be calculated using:

$$\text{HV[kV]} = \text{Control Voltage [V]} \times 2.50 \text{ kV}$$

The maximum high voltage is -1250 V and the unit is protected against short-circuit or overload and polarity reversal.

### **The amplifiers**

The amplifiers require a stable +12 and -12 V power supply voltage which are generated internally.

The signal from the anode of the PMT is amplified with a shaping amplifier.

### **Specifications:**

#### **Type number**

9.5B20/0.4 – E1 – X + Electronics

#### **The probe**

NaI(Tl) crystal: 9.5 mm x 20 mm  
(different shapes/ crystals on request)

FWHM @ 662 keV < 8%

FWHM @ 122 keV < 17%

PMT type Hamamatsu R 1635

Aluminum housing

Output cable: RG174 1.5 m long

Connector: Lemo FFB 0S 403 CLAC32

## **Application Note**

### **Electronics**

#### **Amplifier**

Shaping time: 0.63  $\mu$ s

Output pulse: Bipolar

1  $\mu$ s rise time

1  $\mu$ s fall time

Max. pulse height: +8 V

#### **Single Channel Analyzer**

Output pulse: TTL (+5 V)

Pulse length: 1.5  $\mu$ s

ULL adjustment: 20 turn pot

LLD adjustment: 20 turn pot

Factory Calibration:

ULD: Maximum

LLD: 20 keV

#### **Junction box connections**

Signal in: Lemo ERA 0S 403 CLL

Signal out: :Lemo ERA 00 250 CTL

TTL out: Lemo ERA 00 250 CTL

Mating cabling connectors provided. No cable provided. Cables can be supplied on special request.

#### **Power Requirements**

Voltage: +12 V

Power consumption: < 300 mW

Connector: Lemo connector with 3 m cable with flying leads (Brown = +12 V, White is ground)

#### **Overall Size:**

112 mm x 31 mm x 62 mm