

mesytec **MPR-1** is a charge integrating preamplifier module. It provides two outputs which can be jumpered to different or same polarity. One can be configured as timing filter output. Both can drive terminated BNC cables. The sensitivity can be changed by a factor of 5 via front panel switch. This helps to get larger signals at low charge deposition.

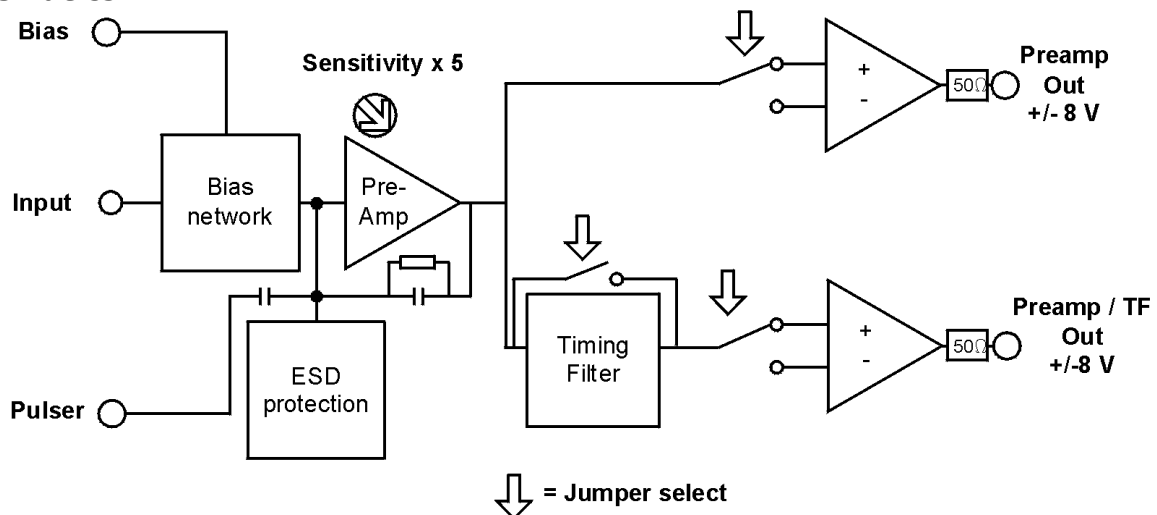
MPR-1 is available with Lemo, BNC and SHV connectors.

## Features:

- Ni-plated, fully shielded case
- ESD input protection
- Positive and negative input charge
- Pulser input
- Bias voltage up to  $\pm 3000$  V with SHV connectors ( $\pm 1500$  V with BNC)
- Two outputs (selectable polarity, one can be configured as timing filter output)
- Strong output driver for  $50 \Omega$
- (optional  $93 \Omega$ ) termination
- Fast risetime ( $t < 12$  ns)
- Two sensitives (switch selectable)
- Low power



## Schematics:



## Technical Data

### Different standard ranges are available

Range in energy deposition in silicon detectors.

Divide by 3.6 to get number of electrons ( $1 \text{ GeV} = 2.8 \cdot 10^8$  electrons)

All values for  $\pm 8 \text{ V}$  output, left number for switch position low sensitivity, right number for high sensitivity.

- **200 MeV type:** 200 MeV / 40 MeV → low noise (for energies up to 200 MeV [Si] = 9 pC)
- **1 GeV type:** 1 GeV / 200 MeV → Si detectors in heavy ion experiments or PMTs (for energies up to 1 GeV = 45 pC)

Other ranges on request.

### Preamplifier

- ESD protected
- Positive and negative charge can be amplified equally.
- Open loop gain typ 60000 @ 1 pF integration capacity
- Temperature drift  $< \pm 50 \text{ ppm}/^\circ\text{C}$
- Nonlinearity  $< 50 \text{ ppm}$
- Energy rate capacity at 200 MeV:  $2 \cdot 10^6 \text{ MeV/s}$ , at switch 40 MeV:  $4 \cdot 10^5 \text{ MeV/s}$ .
- Risetime of energy and timing output.

Detector +cable capacity	Signal risetime
0 pF	12 ns
100 pF	25 ns
330 pF	50 ns

### Pulsar input

- Tail pulse, rise-time  $TR = 0 \dots 100 \text{ ns}$ , decay time typ. 500 us
- Terminated with  $50 \Omega$
- Amplitude: max. 10 V
- For 200 MeV type: 1 V corresponds to a charge injection of  $10^{-12} \text{ }^\circ\text{C}$  or 22 MeV [Si]
- For 1 GeV type: 1 V corresponds to  $4.7 \cdot 10^{-12} \text{ }^\circ\text{C}$  or 100 MeV.

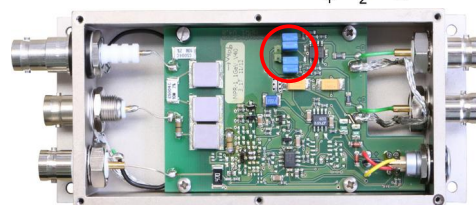
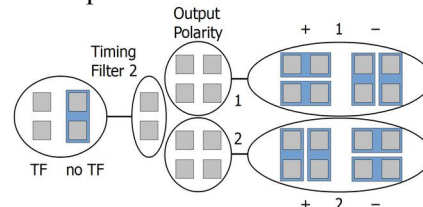
**Example:** for 200 MeV type, switch to 200 MeV: 1 V pulser input will result in 0.8 V output voltage.

### Output stage

- Positive and negative output for single or differential use. Internal switchable: same polarity, or one output with timing filter.
- The timing filter is a single differentiation with time constant  $\tau = 33 \text{ ns}$ .
- Output swing: 0 to  $\pm 8 \text{ V}$  (not terminated)
- Decay time  $TD = 100 \text{ us}$

### Internal Jumper setting

setting for output 1 and 2



### Input capacity

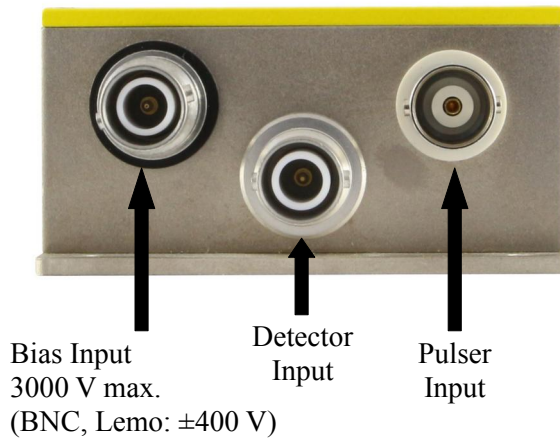
- The preamplifier can handle capacities of more than 1000 pF
- Preamp input capacity typ. 10 nF

### Detector bias (Bias Network):

- Maximum:  $\pm 3000 \text{ V}$
- Bias filter: T-filter (RCR) with  $10 \text{ M}\Omega$  from bias input,  $4.7 \text{ nF}$  filter capacitor to ground,  $50 \text{ M}\Omega$  resistor to detector input.
- (others on request)

**Input side**

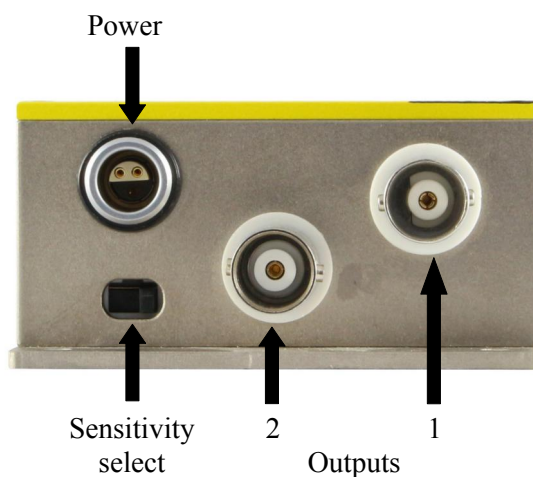
(Lemo, BNC, MHV or SHV connectors)


**• 200 MeV type**

for 1 us shaping time (= 2.3 us FWHM):

$$N = 2.3 \text{ keV} + 0.021 \text{ keV} / \text{pF}$$

Detector + cable capacity	Noise [FWHM] 1 us shaping time	0.35 us shaping time
0 pF	2.3 keV	2.7 keV
50 pF	3.5 keV	4.7 keV
100 pF	4.1 keV	5.9 keV
330 pF	9.1 keV	15 keV

**Output side**

 Output 1: polarity + or –  
 Output 2: polarity + or –, optional Timing filter

**Amplifier noise**

- Noise vs. Input C and shaping time (idealised amplifier and detector):

$$N = (N_0 + C_{Det} * N_S) * \sqrt{1 / \Delta T};$$

 $C_{Det}$  = cable + detector capacity, in pF;

 $\Delta T$  = shaping time, in us;

 $N$  = noise FWHM in keV;

 $N_0$  = noise factor at capacity 0;

 $N_S$  = noise factor slope

**• 1 GeV type**

Detector + cable capacity	Noise [FWHM] 1 us shaping time
0 pF	6 keV
50 pF	8.5 keV
100 pF	11 keV
200 pF	16 keV
400 pF	25 keV

**Power consumption**

- +12 V 40 mA + output current
- 12 V 30 mA + output current

**Power connector**

needed plug:

Lemo: FFA.0S.303.CLAC44ZN

Lemo to SubD-9 cable included at delivery

**Power cable output connector**

SubD-9 connection:

1, 2 = gnd / 4 = +12 V / 9 = –12 V /

others not connected

**Dimensions**

- 60 mm \* 143 mm \* 30 mm including connectors
- Weight: 240 g