Photomultiplier Base with Preamplifier

The ORTEC Model 276 Photomultiplier Tube Base and Preamplifier incorporates an integral low-noise preamplifier, a PMT base with voltage divider network, and a focus control for optimum performance in scintillation detector applications. The unit provides two outputs: the preamplifier output for energy analysis and the anode output for either timing or auxiliary energy analysis. The preamplifier is dc-coupled to simplify pole-zero cancellation in the main amplifier. A Test input accepts the output of a pulse generator to calibrate and test the preamplifier and the following system. The Model 276 has a diode protection network to prevent damage to the internal transistors due to sudden application or removal of high voltage to the unit. The Model 276 is powered from any ORTEC main amplifier or preamplifier power supply.

The Model 276 is directly compatible with 10-stage PMTs that fit standard 14-pin sockets including those listed in Table 1. The Model 276 is also compatible with other 10-stage tubes not listed in Table 1 (see Fig. 1). Compatibility may be determined by comparison with those listed.

Specifications

PERFORMANCE

PREAMPLIFIER

Integral Nonlinearity $\leq 0.02\%$, 0 to $+10$ V.

Temperature Instability $\leq 0.005\%/{^\circ}C$, 0 to $50^\circ C$.

Output Rise Time $\leq 100$ ns for test input or fast scintillator.

Output Fall Time Time constant of 50 $\mu$s.

Output Noise $\leq 50 \mu V$ rms with ORTEC Model 572 Amplifier and time constant of 1 $\mu$s.

Conversion Gain Nominal 5 $\mu V/eV$ with 2- by 2-in. NaI(Tl) crystal and PMT gain of $10^6$; the typical output for a 511-keV x ray with a 10-stage PMT gain of $10^5$ will be $\sim 250$ mV.

Saturation Level $+10$ V into an open circuit; $+5$ V into 93-$\Omega$ load.

VOLTAGE DIVIDER Resistor-divider connected to 10-stage PMT base. Total resistance 1.49 $M\Omega$, resulting in bleeder current of 0.6 mA with typical high voltage of 1 kV. The distribution is linear to all stages with the focus adjustment on the grid.

CONTROL

FOCUS Single-turn locking potentiometer on panel for external adjustment of PMT grid potential.

Table 1. Compatible Photomultiplier Tubes.

<table>
<thead>
<tr>
<th>ADIT</th>
<th>Burle (formerly RCA)</th>
<th>Hamamatsu</th>
<th>Philips</th>
</tr>
</thead>
<tbody>
<tr>
<td>B51B01</td>
<td>B89B01</td>
<td>S83021E</td>
<td>R1513</td>
</tr>
<tr>
<td>L51B01</td>
<td>B89C01</td>
<td>S83022F</td>
<td>R208</td>
</tr>
<tr>
<td>V51B01</td>
<td>B89D01</td>
<td>S83025F</td>
<td>R550</td>
</tr>
<tr>
<td>B51D01</td>
<td>B133D01</td>
<td>S83006E</td>
<td>R594</td>
</tr>
<tr>
<td>B51C01</td>
<td>B133C01</td>
<td>S83013F</td>
<td>R787</td>
</tr>
<tr>
<td>B76B01</td>
<td>V133B01</td>
<td>S83019F</td>
<td>R78</td>
</tr>
<tr>
<td>V76B01</td>
<td>S83020F</td>
<td>R1507</td>
<td>7696</td>
</tr>
<tr>
<td>B76C01</td>
<td>S83021E</td>
<td>R1512</td>
<td>7696</td>
</tr>
</tbody>
</table>

Fig. 1. JEDEC B14-38 PMT Pin Base, with Pin Assignments:

d1 – d10 dynodes 1 to 10
a anode
i.c. internal connection
g grid
k cathode
## INPUTS

**POS HV** SHV connector, AMP 51494-2, for distribution of positive high voltage to PMT base; +2000 V maximum.

**TEST** BNC connector, accepts pulses from an ORTEC pulse generator for testing and calibration.

**SIGNAL** Preamplifier input is connected internally to dynode 10.

**POWER** Captive 3-m (10-ft) power cable terminated in Amphenol 17-20090 connector accepts preamplifier operating power; compatible with all ORTEC main amplifiers and the Model 4002P Portable Power Supply.

**PM SOCKET** TRW 3B14. Fits JEDEC B14-38 PMT pin base (see Fig. 1).

## OUTPUTS

**PREAMP** BNC connector, furnishes preamplifier positive output pulse to an ORTEC main shaping amplifier for linear energy analysis; \( Z_0 = 93 \Omega \), dc-coupled.

**ANODE** BNC connector, furnishes negative anode output pulse for use either in timing or auxiliary energy analysis; \( Z_0 = 1 \mathrm{~k}\Omega \), ac-coupled.

## ELECTRICAL AND MECHANICAL

**POWER REQUIRED** For preamplifier, +24 V, 16 mA; –24 V, 16 mA; for PMT base, +2000 V maximum (use rated voltage for the tube that is installed).

**WEIGHT**
- Net 0.65 kg (1.5 lb).
- Shipping 1.3 kg (3.0 lb).

**DIMENSIONS** 5.6 cm (2.2 in.) diam x 10.2 cm (4 in.) long plus 3 m (10 ft) captive power cable.

## Accessories

A C-36-12 Cable is required for connection to a high-voltage supply. A C-24-12 Cable is recommended for connecting the preamplifier output to the spectroscopy amplifier. For timing signals from the anode, use a C-25-12 Cable.

## Ordering Information

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>276</td>
<td>Photomultiplier Base with Preamplifier C-24-12 RG-62A/U 93-Ω Cable with two BNC male plugs, 12-ft length</td>
</tr>
<tr>
<td>C-25-12</td>
<td>RG-58A/U 50-Ω Cable with two BNC male plugs, 12-ft length</td>
</tr>
<tr>
<td>C-36-12</td>
<td>RG-59A/U 75-Ω Cable with two SHV female plugs, 12-ft length</td>
</tr>
</tbody>
</table>

Specifications subject to change 091517