

**Model VT120  
Fast Timing Preamplifier  
Operating and Service Manual**

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## SAFETY INSTRUCTIONS AND SYMBOLS

This manual contains up to three levels of safety instructions that must be observed in order to avoid personal injury and/or damage to equipment or other property. These are:

- DANGER** Indicates a hazard that could result in death or serious bodily harm if the safety instruction is not observed.
- WARNING** Indicates a hazard that could result in bodily harm if the safety instruction is not observed.
- CAUTION** Indicates a hazard that could result in property damage if the safety instruction is not observed.

Please read all safety instructions carefully and make sure you understand them fully before attempting to use this product.

In addition, the following symbol may appear on the product:



**ATTENTION—Refer to Manual**



**DANGER—High Voltage**

Please read all safety instructions carefully and make sure you understand them fully before attempting to use this product.

## SAFETY WARNINGS AND CLEANING INSTRUCTIONS

**DANGER** Opening the cover of this instrument is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.

**WARNING** Using this instrument in a manner not specified by the manufacturer may impair the protection provided by the instrument.

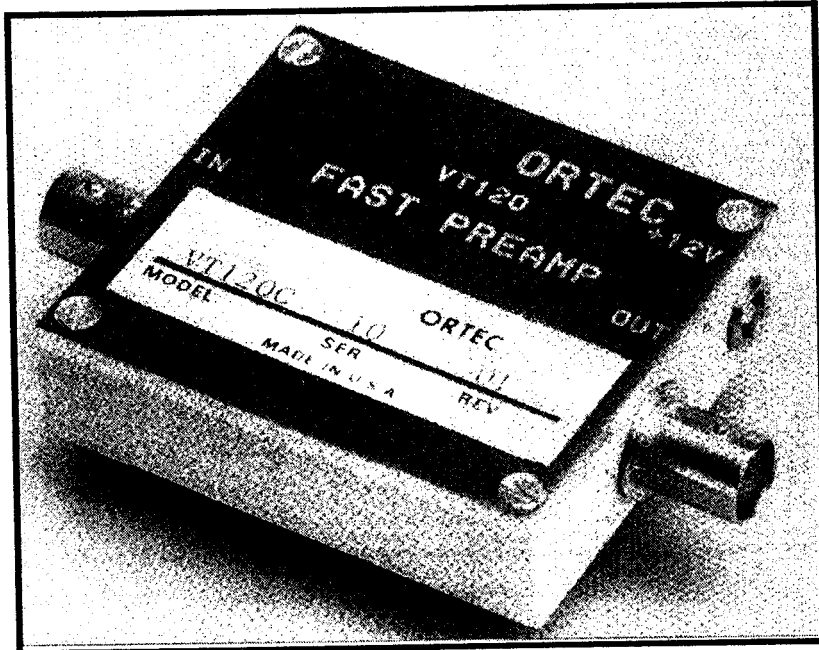
### Cleaning Instructions

To clean the instrument exterior:

- Unplug the instrument from the ac power supply.
- Remove loose dust on the outside of the instrument with a lint-free cloth.
- Remove remaining dirt with a lint-free cloth dampened in a general-purpose detergent and water solution. Do not use abrasive cleaners.

**CAUTION** To prevent moisture inside of the instrument during external cleaning, use only enough liquid to dampen the cloth or applicator.

- Allow the instrument to dry completely before reconnecting it to the power source.



# ORTEC MODEL VT120 FAST TIMING PREAMPLIFIER

## 1. DESCRIPTION

The VT120 preamplifier is a high-performance, wide-bandwidth preamplifier designed for boosting very fast linear signals from photomultipliers, electron multipliers, silicon surface-barrier detectors, and other detectors used in fast timing applications. The rise time on all versions is  $<1$  ns with a 5-V output, enabling excellent timing resolution.

The VT120 is a single-channel unit in a small preamp package. It is available with a gain of 200, noninverting (A version); a gain of 200, inverting (B version); or a gain of 20, noninverting (C version). BNC connectors are used for signal connections on the VT120. A cable is available (Model C-VT120) for connecting power between the Model VT120 and conventional preamplifier power outputs using Amphenol-type 17-80090 connectors.

## 2. SPECIFICATIONS

### 2.1. PERFORMANCE

**GAIN** (10% gain tolerance on all versions):

**A Version** 200, noninverting.

**B Version** 200, inverting.

**C Version** 20, noninverting.

**RISE TIME**  $\leq 1$  ns.

**NOISE**  $\leq 20$   $\mu$ V rms equivalent input noise.

**BANDWIDTH** 10 to 350 MHz.

**OUTPUT RANGE** 0 to -5 V with 50- $\Omega$  load.

**INPUT** BNC connector; input impedance 50  $\Omega$ .

**OUTPUT** BNC connector; 0 to -5 V output with a 50- $\Omega$  load. Output impedance  $\leq 1$  n.

### 2.2. ELECTRICAL AND MECHANICAL

**POWER REQUIRED** +12 V, 50 mA (uses LEMO power connector that is compatible with accessory cable C-VT120).

**DIMENSIONS** Aluminum housing 5.8 X 5.1 X 1.6 cm (2.3 X 2.0 X 0.63 in.).

**WEIGHT** 0.2 kg (0.4 lb).

### 2.3. ACCESSORIES

C-VT120 cable assembly with connections between VT120 power input (LEMO) and Amphenol-type 17-80090 preamplifier power connectors that are compatible with other ORTEC NIM-standard modules.

### 3. INSTALLATION

#### 3.1. GENERAL

The VT120 contains no internal power supply and must obtain power from a NIM-standard bin and power supply, usually by connecting the C-VT120 accessory power cable between the VT120 and a NIM-standard module with a mating Am phenol-type 17-80090-15 preamp power connector. The bin and

power supply should be turned Off when modules are inserted or removed. The power supply voltages should be checked after modules are inserted. Ensure that the VT120 has sufficient cooling air circulating to prevent any localized heating of the solid-state circuitry used throughout the unit. The VT120 should not be subjected to temperatures in excess of 50 °C.

### 4. CIRCUIT DESCRIPTION

The VT120 preamplifier is available in three versions. The "A" version has a noninverting gain of 200, the "B" version has an inverting gain of 200, and the "C" version has a noninverting gain of 20. The schematic diagram for each version is attached at the end of this manual.

The schematic diagram for the VT120A at the end of this manual shows that the "A" version has five gain stages, Q1 through Q4, connected in the Common-Emitter configuration and Q5 connected in the Emitter-Follower configuration. Each stage is ac-coupled to isolate bias voltages and to strongly reject low-frequency components. Input protection is furnished by diode D1.

Consider the first stage formed around Q1. Resistor R2 furnishes base-injection bias for the transistor, the series combination C2 and R3 provides shunt feedback, and resistor R4 is an unbypassed emitter resistor which, along with C3, peaks the high-frequency response of the stage. Each of the other Common-Emitter stages operates in a similar manner with specific component values set for optimum gain distribution and rise time. The final two Common-Emitter stages, Q3 and Q4, have variable peaking capacitors, C20 and C21, which

are set in test to give an overall rise time of <1 ns. Transistor Q5 is connected in the Emitter-Follower configuration and provides excellent output drive capability, 0 to -5 V, and low output impedance, <1 Ω.

The schematic diagram of the VT120B is attached at the end of this manual. The "B" version has one less Common-Emitter amplifier stage than does the "A" version. This causes an overall signal inversion from input to output. The operation of each stage is similar to that of the "A", version except for the distribution of gain and rise time among the various preamplifier stages. Peaking capacitors C16 and C17 are set in test to give an overall rise time <1 ns.

The schematic diagram of the VT120C is also attached at the end of this manual. The "C" version has two less Common-Emitter amplifier stages than does the "A" version. There is no signal inversion from input to output, and the overall gain is nominally 20. The operation of each stage is similar to that of the "A" version except for the distribution of gain and rise time among the various preamplifier stages. Peaking capacitors C3 and C7 are set in test to give an overall rise time <1 ns.

### 5. MAINTENANCE

The VT120 Fast Timing Preamplifier requires very little maintenance other than routine removal of dust and tightening of mechanical connections.