PerkinElmer instruments.
ORTEC Products

474
Timing Filter Amplifier

- Timing with germanium detectors
- Energy spectroscopy at ultra-high count rates
- Selectable filter for pulse shaping
- Signal-to-noise ratio optimization
- Continuously adjustable gain X2 to X250
- Pole-zero cancellation
- DC-coupling

The Model 474 Timing Filter Amplifier is especially designed to shape pulses and permit optimizing the signal-to-noise ratio for timing measurements. The Model 474 is particularly suited for use with an ORTEC Constant-Fraction Timing Discriminator in timing applications with germanium or silicon charged-particle detectors (Fig. 1). It derives its input signal directly from the preamplifier output. The timing spectrum in Fig. 2 illustrates the performance obtainable with the Model 474 shaping the germanium detector pulses before they are furnished to the discriminator. Tables 1 and 2 give typical performance data for various ORTEC germanium detectors.

The fast rise time, high output drive, and high gain capabilities of the Model 474 make it useful for other applications, such as timing with systems utilizing low-gain photomultiplier tubes. In addition, the pole-zero cancellation network, the dc-coupling, and the time-invariant baseline restorer permit energy spectroscopy with scintillation detectors and Si charged-partical detectors at ultra-high count rates.

A wide variety of input pulse shapes can be filtered as required for optimum signal processing. The Model 474 combines continuously adjustable gain (X2 to X250) with separately selectable Integrate (τ_i) and Differentiate (τ_d) time constants for proper pulse shaping, making this unit and important asset for time measurement.

PERFORMANCE

Input Amplitude Range 0 to ±1 V signal, 0 to ±5 V dc offset; maximum input ±5 V total.

Output Amplitude Range 0 to ±5 V with a 50-Ω load.

Noise For maximum gain, rms noise referred to the input is ≤10 µV with $\tau_i = \tau_d$ = 200 ns or ≤50 µV with filter out; measured using a Hewlett-Packard 3400A true rms meter.

Rise Time ≤10 ns with filter out or ~2.2 τ_i for other selections.

Nonlinearity ≤±0.05% at midband frequency over ±5 V range.

Temperature Instability
DC Level ≤±25µV/°C referred to the output.
Gain ≤±0.06%/°C.
Specifications over 0 to 50°C range.

CONTROLS

COARSE GAIN Front-panel 6-position switch for selection of X1, X2, X4, X6, X10, or X20.

FINE GAIN Front-panel single-turn potentiometer, continuous from X2 to X12.5.

PZ ADJ Front-panel screwdriver adjustment to compensate for the preamplifier decay time constant.

Time Constant Two 6-position switched on front panel:
INTEGRATE RC time constants: OUT (equivalent to 4 ns), 20, 50, 100, 200, and 500 ns.
DIFF RC time constants: OUT (equivalent to 0.2 ms), 20, 50, 100, 200, and 500 ns.
NOTE: With Differentiate and Integrate in the OUT position, the passband is 1 kHz to 35 MHz.

ELECTRICAL AND MECHANICAL

Power Required +24 V, 60 mA; -24 V, 40 mA; +12 V, 145 mA; -12 V, 165 mA.

Dimensions NIM-standard single-width module 3.43 x 22.13 cm (1.35 x 8.714 in.) per DOE/ER-0457T.

Weight
Net 1.0 kg (2.4 lb)
Shipping 2.5 kg (5.4 lb)

NON INV/INV Selects inversion or non-inversion of the input signal.

INPUT

Positive or negative polarity selectable by front-panel switch; amplitude 0 to ±1 V; protected to ±6 V dc and to ±100 V at 10% duty factor integrated over 1 s; impedance 100 Ω, dc-coupled; front-panel BNC connector. Accepts a ±5 V dc offset, maximum input (signal plus offset) limited to ±5 V.

OUTPUTS

OUTPUT Front-panel BNC connector. Amplitude 0 to ±5 V; rise time ≤10 ns for filter out (2.2 τ_i for other filter selections). Impedance <1 Ω, dc-coupled.

Preamplifier Power Rear-panel standard ORTEC power connector, Amphenol 17-10090.

Table 1. Timing Resolution for Various Sizes of Germanium Detectors Using ^{22}Na.

Detector	Dynamic Range	Timing Resolution (ns)						
		CF Mode			SRT Mode			
		FWHM	FW.1M	FW.02M	FWHM	FW.1M	FW.02M	FW.01M
8.6% HPGe	1.1:1	4.4	10.1		4.3	10.1		21.6
52.6 cc	10:1	4.2	13.6		4.2	10.5		23.4
	20:1	4.7	13.5		4.7	12.8		30.4
12.5% HPGe	1.1:1	5.0	10.0		5.0	9.5		17.6
62.3 cc	10:1	4.5	13.2		4.4	9.4		17.8
	20:1	5.1	14.3		5.0	12.0		24.8
19.6% HPGe	1.1:1	7.9	16.4		8.1	16.0		27.3
103 cc	10:1	8.4	24.0		7.9	17.0		30.0
	20:1	8.4	26.0		8.4	23.0		40.0
8.6% HPGe	1.1:1	6.4	12.6	29.1	6.5	14.1	29.6	
	5:1	7.6	18.0	59.4	7.3	18.0	45.6	
	10:1	7.6	22.7	63.2	7.6	21.7	50.1	

Table 2. Timing Resolution for Large Germanium Detectors Using 583 CFDD/SCA, 474 TFA, and ^{60}Co.

Detector	Efficiency	FWHM Energy Resolution (keV)	Constant Fraction Delay (ns)	Timing Resolution (ns)			
				E > 100 keV		E = 1332 ±50 keV	
				FWHM	FW.1M	FWHM	FW.1M

N30526A	73%	2.03	34	5.4	19.4	3.7	8.8
P20171	81%	1.97	34	5.5	27.0	4.7	13.8
N20366A	88%	2.34	36	5.8	21.2	5.5	16.4

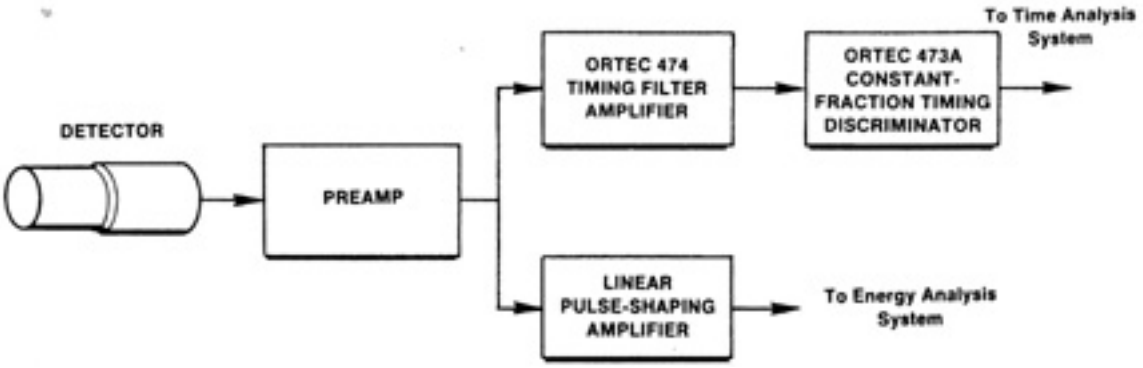

Fig. 1 Simplified Timing System.

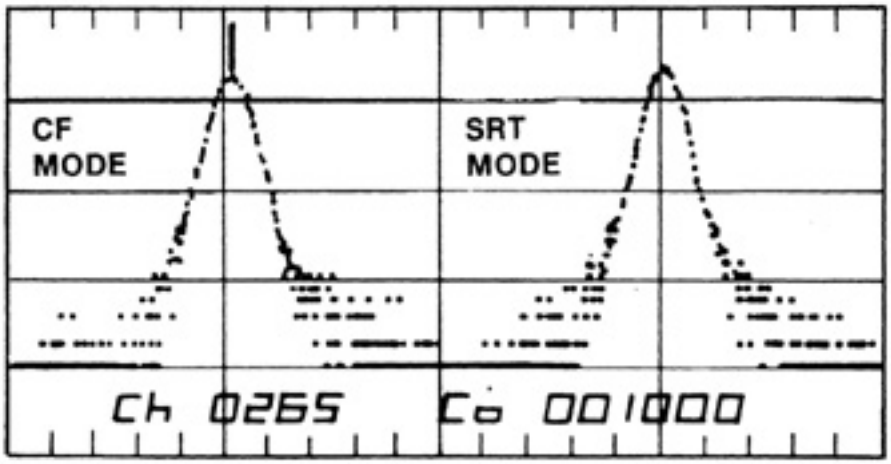

Fig. 2 Timing Spectrum for a Narrow Synamic Range Using a Germanium Detector. (Resolution values are given in Table 1.)

22Na
Start: KL236 (1x1), RCA 8575 Photomultiplier Tube
Stop: Ge Coax, 12.5%, 62.3 cc
1.1:1 Dynamic Range
473A Discriminator

Model 474
Timing Filter Amplifier
Operating and Service Manual

Printed in U.S.A.

ORTEC® Part No. 733370
Manual Revision D

1003

Advanced Measurement Technology, Inc.

a/k/a/ ORTEC®, a subsidiary of AMETEK®, Inc.

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ORTEC's exclusive liability is limited to repairing or replacing at ORTEC's option, items found by ORTEC to be defective in workmanship or materials within one year from the date of delivery. ORTEC's liability on any claim of any kind, including negligence, loss, or damages arising out of, connected with, or from the performance or breach thereof, or from the manufacture, sale, delivery, resale, repair, or use of any item or services covered by this agreement or purchase order, shall in no case exceed the price allocable to the item or service furnished or any part thereof that gives rise to the claim. In the event ORTEC fails to manufacture or deliver items called for in this agreement or purchase order, ORTEC's exclusive liability and buyer's exclusive remedy shall be release of the buyer from the obligation to pay the purchase price. In no event shall ORTEC be liable for special or consequential damages.

Quality Control

Before being approved for shipment, each ORTEC instrument must pass a stringent set of quality control tests designed to expose any flaws in materials or workmanship. Permanent records of these tests are maintained for use in warranty repair and as a source of statistical information for design improvements.

Repair Service

If it becomes necessary to return this instrument for repair, it is essential that Customer Services be contacted in advance of its return so that a Return Authorization Number can be assigned to the unit. Also, ORTEC must be informed, either in writing, by telephone [(865) 482-4411] or by facsimile transmission [(865) 483-2133], of the nature of the fault of the instrument being returned and of the model, serial, and revision ("Rev" on rear panel) numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. The ORTEC standard procedure requires that instruments returned for repair pass the same quality control tests that are used for new-production instruments. Instruments that are returned should be packed so that they will withstand normal transit handling and must be shipped PREPAID via Air Parcel Post or United Parcel Service to the designated ORTEC repair center. The address label and the package should include the Return Authorization Number assigned. Instruments being returned that are damaged in transit due to inadequate packing will be repaired at the sender's expense, and it will be the sender's responsibility to make claim with the shipper. Instruments not in warranty should follow the same procedure and ORTEC will provide a quotation.

Damage in Transit

Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify ORTEC of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment, if necessary.

CONTENTS

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.

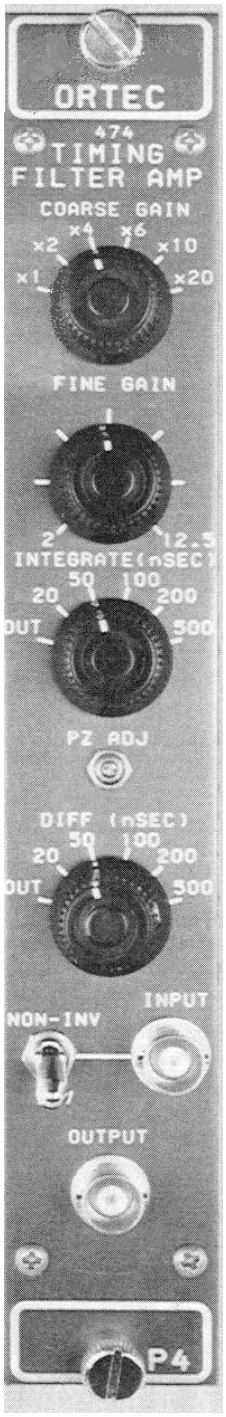
Cleaning Instructions

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
474
TIMING
FILTER AMP
COARSE GAIN
×1
×2
×4
×6
×10
×20
FINE GAIN
2
12.5
INTEGRATE (nSEC)
20
50
100
200
500
PZ ADJ
DIFF (nSEC)
20
50
100
200
500
NON-INV
INPUT
OUTPUT
P4

ORTEC MODEL 474
TIMING FILTER AMPLIFIER

1. DESCRIPTION

1.1. GENERAL

The ORTEC 474 Timing Filter Amplifier is a NIM-standard module for use where a wide-band fast, variable RC filter amplifier with high drive and variable gain is needed. Features of the 474 include a wide gain-control range, separately selectable RC integrate and differentiate time constants in the nanosecond region, pole-zero compensation, and drive capability sufficient for use with 50Ω or 100Ω systems.

The input signals are dc coupled into an impedance of about 100Ω. The acceptable amplitude range for the linear input, to retain its linearity, is 0 to ±l V. The 474 can operate with an input dc offset where the maximum total input signal range, including the offset, does not exceed the limits of ±5 V. Input signals may be either positive or negative unipolar, or they can be bipolar with either a positive or negative lobe leading. The output polarity can be switch-selected to either duplicate or invert the input polarity. Protection is provided for input voltages of up to ±100 V at a 10% duty cycle integrated over 1 second.

The gain for midband frequencies can be set at any value from X2 through X250, using six coarse gain settings and a fine gain control, which is a single-turn potentiometer. The gain factors are selected to provide range overlap and to assure continuously adjustable gain control throughout the full range.

Two 6-position switches permit the separate selection of RC-integrate and RC-differentiate time constants. The integrate time constant can be selected from 10 ns (switch set at Out) through 500 ns. The differentiate time constant can be selected from 20 ns through 500 ns or, when set at Out, at 150 µs. Thus the input pulses can be reshaped to provide a consistent risetime and decay time for compatibility with the application requirements.

The linear output pulses can be either uni polar or bipolar, depending on the type of input pulses that are furnished to the 474. When the front panel toggle switch selects Invert, the output is the opposite polarity to the input or, when the toggle switch selects Non-invert, the polarities are the same. The 474 is capable of driving a 50Ω load up to ±5 V with no degradation of the performance specifications.

The ORTEC 474 Timing Filter Amplifier is a NIM-standard single-width module; the front panel measures 1.35 by 8.714 in., which is in accordance with TID-20893 (Rev). It is intended for installation and operation in a standard enclosure, such as the ORTEC 4001/4002 Series of Bins and Power Supplies. The module accepts all of its required operating power f rom the power supply that is attached to the bin.

2. SPECIFICATIONS

2.1. PERFORMANCE

INPUT AMPLITUDE RANGE 0 to ±1V linear signal, 0 to ±5 V offset, maximum input ±5 V total.

OUTPUT AMPLITUDE RANGE 0 to ±5 V linear onto a 50Ω cable and load.

RISETIME <10 ns with filter Out, or ~2.2 τ_i for other Integrate settings.

NOISE For maximum gain, rms noise referred to the input is ≤10 µV with $\tau_i = \tau_d$ = 200 ns, or ≤50 µV with filter Out; measurements made with an HP 3400A true rms meter.

NONLINEARITY ≤±0.05% at mid-band frequency over ±5 V range.

TEMPERATURE INSTABILITY
DC Level ≤±25 µV/°C referred to the output.
Gain ≤ 0.06%/°C.

OPERATING TEMPERATURE RANGE 0 to 50°C (273 to 323 K).

2.2. CONTROLS

COARSE GAIN Front panel 6-position switch to select X1, X2, X4, X6, X10, or X20 gain factor.

FINE GAIN Front panel single-turn potentiometer, continuously adjustable from X2 to X12.5.

POLE ZERO ADJUST Front panel screwdriver adjustment to cancel the pole associated with the input signal such as that derived from the preamplifier clipping network.

DIFFERENTIATE Front panel 6-position switch selects a differentiation time constant to control the decay time of the pulse; settings select Out (equivalent to 150 µs), 20, 50, 100, 200, or 500 ns.

INTEGRATE Front panel 6-position switch selects an integration time constant to control the risetime of the pulse; settings select 20, 50, 100, 200, or 500 ns or Out (equivalent to 10 ns).

Note: With Diff and Int switches both at Out, passband is typically 1 kHz to 35 MHZ.

INVERT/NONINVERT Front panel toggle switch selects inversion or noninversion of the input signal polarity for the polarity of the output signal.

2.3. INPUT

INPUT Front panel BNC connect or accepts input pulses of either polarity; amplitude 0 to ±1 V, protected to ±6 V dc and to ±100 V at 10% duty cycle integrated over 1 second; impedance 100Ω dc coupled. Accepts a ±5 V dc offset; maximum input (signal plus offset) limited to ±5 V.

2.4. OUTPUTS

OUTPUT Front panel BNC connector furnishes the shaped and amplified signal through Z_{out} <1Ω, dc coupled. Amplitude 0 to ±5 V; risetime and decay time controlled by Integrate and Differentiate filter settings.

PREAMP POWER Rear panel standard ORTEC power connector, Amphenol type 17-10090.

2.5. ELECTRICAL AND MECHANICAL

POWER REQUIRED +24V, 60 mA; -24V, 40 mA;+12V, 145 mA; -12 V, 165 mA.

DIMENSIONS NIM-standard single-width module (1.35 by 8.714 in.) per TID-28093 (Rev).

3. INSTALLATION

3.1. GENERAL

The 474 operates on power that must be furnished from a nuclear-standard bin and power supply such as the ORTEC 4001/4002 Series. The bin and power supply is designed for relay rack mounting. If the equipment is to be rack mounted, be sure that there is adequate ventilation to prevent any localized heating of the components that are used in the 474. The temperature of the equipment mounted in racks can easily exceed the maximum limit of 50°C (323 K) unless precautions are taken.

3.2. CONNECTION TO POWER

The 474 contains no internal power supply and must obtain the necessary dc operating power from the bin and power supply in which it is installed for operation. Always turn off power for the power supply before inserting or removing any modules. ORTEC modules are designed so that a full complement of modules installed in the bin will not overload the NIM-standard power supply. Since, however, this may not be true when the bin contains modules other than those of ORTEC design, the dc power levels should be checked after all of the modules have been installed. The ORTEC 4001/4002 Series Bins Power Supplies have convenient test points on the power supply control panel to permit monitoring these dc levels.

3.3. INPUT/OUTPUT CONNECTIONS

The input impedance of the 474 is about 100Ω and provides a suitable termination for cable with a

characteristic impedance of 93Ω. It the cable with a characteristic impedance of 50Ω, use a BNC Tee at the 474 Input to accommodate the cable and a 100Ω terminator; the terminator and the input impedance, which are in parallel, will then match the 50Ω cable impedance.

The low output impedance of the 474 requires that the output cable be terminated by the characteristic impedance of the cable at its remote end. This can be accomplished at the input of a high-input impedance instrument or by using an instrument with an input impedance equal to the impedance of the cable. Both driving end and receiving end coaxial line termination is recommended for long cables, although this reduces the driving amplitude by 50%.

4. OPERATING INSTRUCTIONS

Either of two functions, or both, may be furnished by the ORTEC 474 Timing Filter Amplifier, depending on the details of the circuit in which it is installed. It may be used to linearly amplify a small amplitude range into one that is better suited to the requirements of a subsequent instrument in the system: the gain can be set at any level from X2 through X250 for this purpose. The shaping time constants that select integration and differentiation circuits in the 474 can be set to normalize a pulse rise and decay time to optimize timing measurements. In addition to these basic functions, the 474 can also be used to invert the pulse polarity if desired and to correct for the pole-zero effect that is provided from the preamplifier system.

There are no typical control settings that can be suggested for operation, since each application of the 474 will require a different combination of functions. After the system has been installed, use an oscilloscope to observe the waveforms at the input and output of the 474 and adjust its controls to optimize its operation, considering the functions that are required of it.

Generally speaking, the Integrate time constant can be selected so that the rise time of the output pulses is normalized at a rate that is slower than the rise times of the input pulses. This function is of greatest value when the pulses originate in a large detector so that they generate a wide variety of rise times and are difficult to observe for timing measurements. The Differentiate time constant is also selectable and determines the total interval before the pulse returns to the baseline and allows a new pulse to be observed. The combination of integration and differentiation time constants also contributes to the amount of electronic noise that is seen in the system, so the resulting waveforms should be considered from each of these points of view and adjusted for optimum results.

When the shaping time constants impose considerable changes in the input waveform, the nominal gain, which is the product of the Coarse and Fine control settings, may be degraded somewhat. This is not normally a problem, since the gain is constant even though it may be less than the nominal settings indicate.

5. CIRCUIT DESCRIPTION

The front panel toggle switch, S1, selects a resistance network for Invert or a circuit through Ql and Q2 for Non-invert for pulses of either polarity, and the pulses are then furnished into the differentiation network at S2. If S2 is set at Out, the input pulse is coupled through R34 to the input of Al. The pole-zero adjustment, R30, does not provide any effect for the Out setting of S2. If S2 is set at any of its other five positions, the input pulse is coupled through a capacitor that is in parallel with a portion of the signal, furnished through the pole-zero circuit, and provided to the input of A1.

Amplifier A1 is an ORTEC Hybrid circuit, type HBA0106, that includes Coarse Gain control S3. The amplified output at pin 5 of A1 is furnished to the integration network at the input to A2, which is another type HBA0106 ORTEC Hybrid circuit.

Amplifier A2 has a gain that is adjusted by Fine Gain control R64. The output of A2 is furnished to the base of 09, which is the input of the output voltage amplifier. The output voltage amplifier, consisting of transistors Q9 through Q20 and associated resistors and capacitors, has a voltage gain of approximately 5. A complementary Darlington output stage is used to provide good bipolar drive capability. Potentiometer R100 is a factory-adjusted balance control for the two halves of the complementary Darlington output stage.

Integrated circuit IC1 senses the output at CN2 and acts in the dc feedback loop to force the output to zero. IC1 is connected as an integrator, with a time constant of approximately 150 µs (corresponding to about 1 kHz).

The NIM power connector includes circuits that accept ±12 V and ±24 V. These input power levels are filtered and are used internally in the circuits of the 474. The four levels are also furnished through the rear panel Preamplifier Power connector, CN4, and can be used as the power source for an associated ORTEC preamplifier.

6. MAINTENANCE

6.1. CORRECTIVE MAINTENANCE

The ORTEC 474 should require no regular maintenance other than replacement of components that have failed due to age. Always ensure that the replacement components are equivalent to the original parts. No internal trimming or adjustment is necessary for the 474.

To aid in the identification of a malfunctioning component, typical dc voltages are listed in Table 6.1. Note that these are typical values, and may vary from one unit to another without indicating a fault.

6.2. FACTORY SERVICE

This instrument can be returned to the ORTEC factory for service and repair at a nominal cost. The ORTEC standard procedure for repair ensures the same quality control and checkout that are used for a new instrument. Always contact ORTEC Customer Service before sending in an instrument for repair to obtain shipping instructions and so that the required Return Authorization Number can be assigned to the unit. This number should be written on the address label and on the package to ensure prompt attention when it reaches the factory.

6.3. GENERAL

The most important function that is served by the 474 Timing Filter Amplifier is pulse shaping. This is especially important when using the output from a large volume detector, with a wide range of charge-collection times for its output pulses, and attempting to obtain timing information from these nonuniform pulses. By adjusting the pulse rise time with the 474 to an interval that is longer than any of the input rise times, the 474 output pulses will have the advantage of uniformity. The pulse decay time constant is also selectable so that the operator can compromise between pulse-pair resolution time and system noise; as shorter time constants are used, pulse-pair resolution time is shortened at the expense of an increase in noise.

Other functions that are also included in the 474 area linear amplification of small pulses of either polarity, polarity control, and adjustable pole-zero cancellation. These additional features provide useful functions in most of the circuits where pulse shaping is necessary.

Each application for the 474 will require a different combination of the data enhancement parameters that are available. Use each as required in the specific application.

6.4. CONSTANT-FRACTION TIMING WITH GERMANIUM DETECTORS

Figure 6.1 is a block diagram of a gamma-gamma coincidence system that can be used for timing with germanium detectors. In this system, the TPHC start channel uses a fast plastic scintillator and the stop channel uses a coaxial germanium detector. Excellent timing spectra have been obtained by combining the pulse shaping available with the 474 together with the use of the slow-rise-time (SRT) reject circuitry in the constant-fraction discriminator.

Table 1. Typical DC Voltages.
NONINV Mode; DIF and INT switches set to "Out"; fine gain = 2, coarse gain = 1.

Q1B	−2.7 mV	Q18E	−29 mV
Q1E	−0.6 V	Q19B	8.65V
Q1C	12.0 V	Q19C	11.70 V
Q2B	45 mV	Q20B	−8.65 V
Q2C	5.90 V	Q20C	−11.70 V
Q3E	5.35 V	IC1(2)	−2.6 mV
Q4B	−6.76 V	IC1(3)	−2.2 mV
Q4E	−7.40 V	IC1(4)	−12 V
Q5B	−7.40 V	IC1(6)	−70 mV
Q6E	−7.30 V	IC1(7)	12 V
Q7B	14.50 V	A1(1)	100 mV
Q7E	13.95 V	A1(2)	120 mV
Q8E	14.56 V	A1(3)	−0.50 V
Q9B	90mV	A1(4)	17 mV
Q9E	0.73V	A1(5)	0 mV
Q8C	−9.25 V	A1(6)	−11.5 V
Q10B	7.60 V	A1(7)	−5.8 V
Q10E	8.25 V	A1(8)	0 V
Q11B	8.20 V	A1(9)	0.66 V
Q11C	12.0 V	A1(10)	11.7 V
Q12E	8.20 V	A2(1)	−17 mV
Q12C	1.27 V	A2(2)	−1.0 mV
Q13E	1.21 V	A2(3)	−0.8 V
Q13C	−1.25 V	A2(4)	40 mV
Q14E	−9.85 V	A2(5)	−56 mV
Q14C	−1.31 V	A2(6)	−11.5 V
Q15E	0.66 V	A2(7)	−5.8 v
Q15C	8.0 V	A2(8)	0 V
Q16E	25 mV	A2(9)	0.77 V
Q17E	−0.68 V	A2(9)	0.77 V
Q17C	−8.0 V	A2(10)	11.7 V

The SRT circuitry is most effective when used with a wide dynamic range of energies. It can provide dramatic improvement in timing resolution below the FWHM level and makes reliable timing data possible at even the FW(1/100)M level.

The SRT circuitry in the constant-fraction discriminator can provide improved timing resolution by rejecting those logic pulses that result from leading-edge timing in the instrument. Since the input signals that cause leading-edge walk represent valid energy information, use of the SRT circuitry results in a loss in the counting efficiency of the system.

A system for measuring the lifetimes of excited states at extremely low energies is similar to the system shown in Fig. 6.1. In this configuration, the coaxial Ge(Li) detector and preamplifier are replaced with a Ge(Li) low-energy photon spectrometer (LEPS) detector and preamplifier.

6.5. NANOSECOND FLUORESCENCE SPECTROMETRY

The ORTEC 9200 Nanosecond Fluorescence Spectrometer is used in lifetime measurements of excited molecular states. In the specific application where the molecular structure is studied, the experimenter seeks to verify a complex model of a particular molecule or to determine how a particular molecule is altered by its surroundings. This type of experiment requires that the total efficiency, the exact energy, and the complete time function involved in the de-excitation of an electronic state be known so that the experimental results can be fit precisely to a model. Figure 6.2 shows the 9200 System, and Fig. 6.3 shows the detailed lifetime characteristics of a 0.1 N solution of quinine sulfate in sulfuric acid that was excited with impulses of light at approximately 340 nm with the 9200 System. The quantity of information available from such a lifetime measurement is illustrated by this set of data.

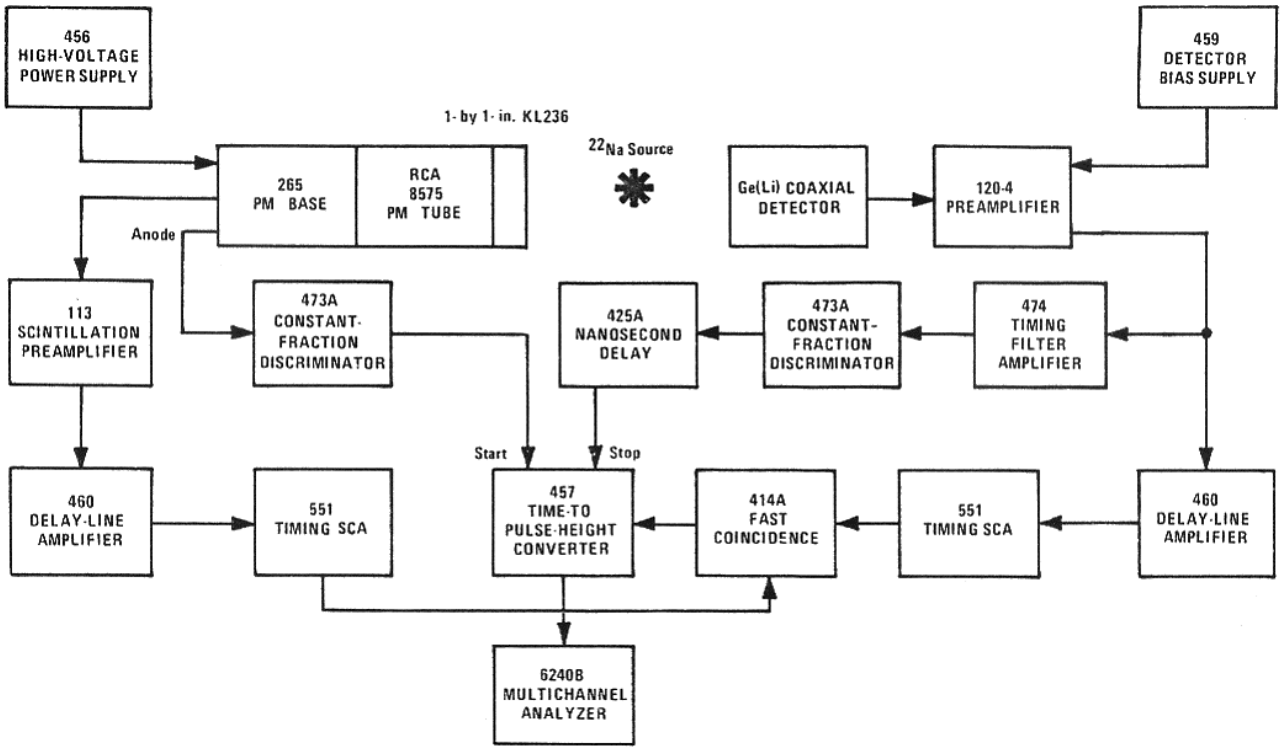


Fig. 6.1. Gamma-Gamma Coincidence System Using a Plastic Scintillator and a Large Ge(Li) Coaxial Detector.

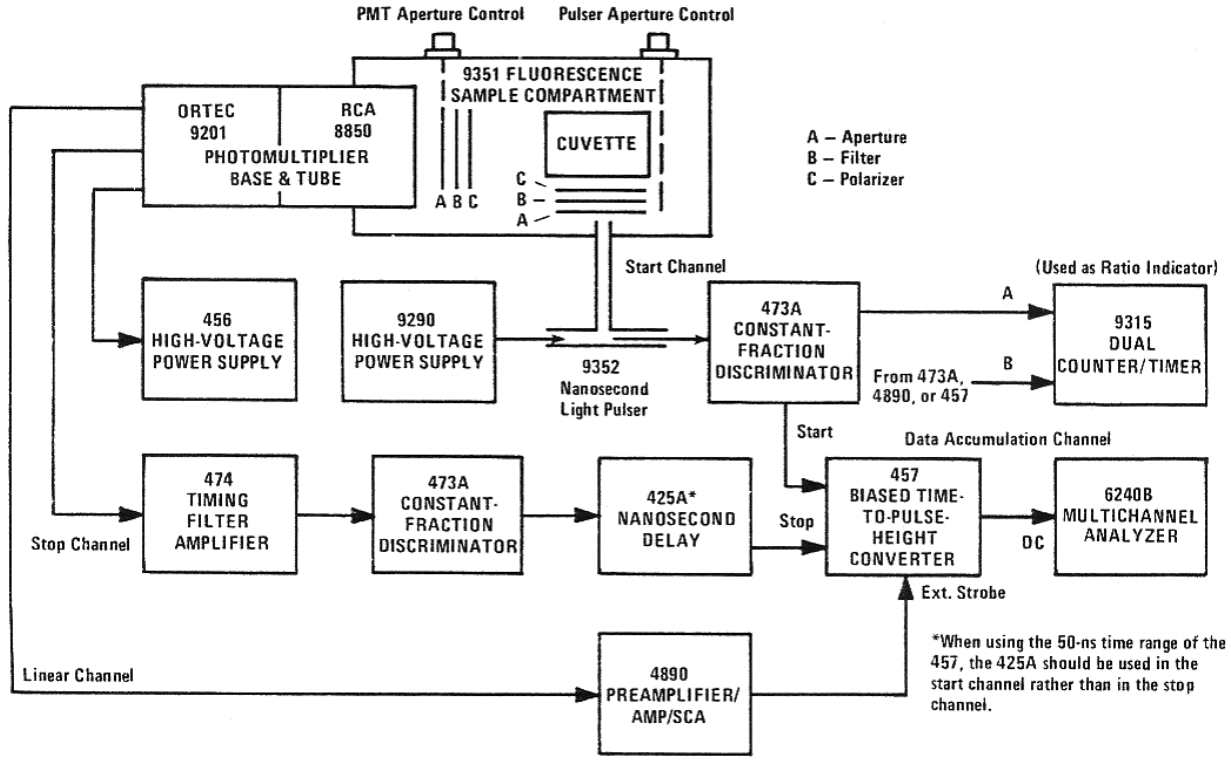


Fig. 6.2. Nanosecond Decay Time Fluorescence Spectrometer System.

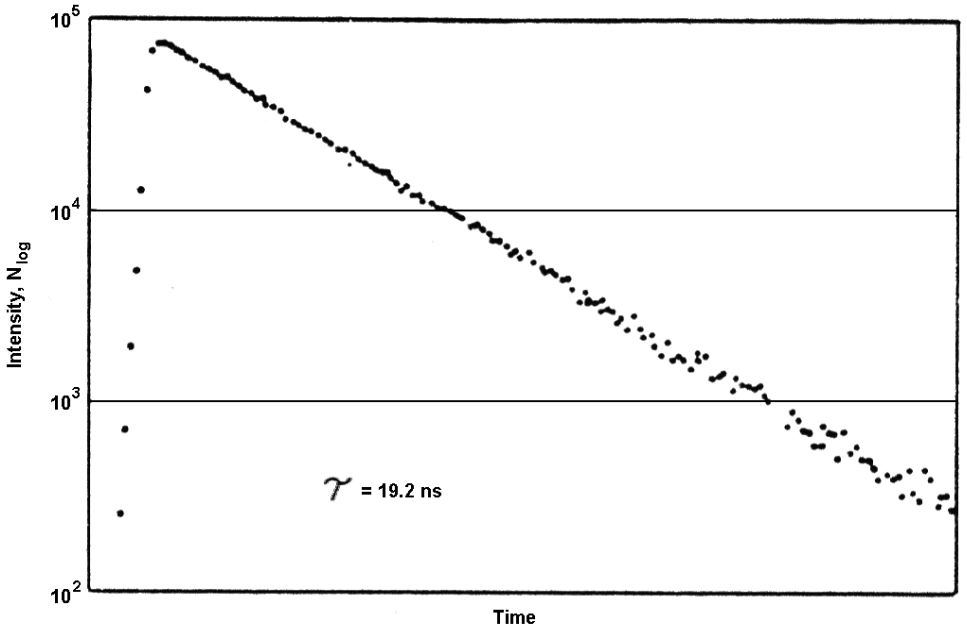


Fig. 6.3. Lifetime Spectrum of Quinine Sulfate in Sulfuric Acid.

Bin/Module Connector Pin Assignments for Standard Nuclear Instrument Modules per DOE/ER-0457T

Pin	Function	Pin	Function
1	+3 V	23	Reserved
2	−3 V	24	Reserved
3	Spare Bus	25	Reserved
4	Reserved Bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	*28	+24 V
7	Coaxial	*29	−24 V
8	200 V dc	30	Spare Bus
9	Spare	31	Spare
*10	+6 V	32	Spare
*11	−6 V	*33	117 V ac (Hot)
12	Reserved Bus	*34	Power Return Ground
13	Spare	35	Reset (Scaler)
14	Spare	36	Gate
15	Reserved	37	Reset (Auxiliary)
*16	+12 V	38	Coaxial
*17	−12 V	39	Coaxial
18	Spare Bus	40	Coaxial
19	Reserved Bus	*41	117 V ac (Neutral)
20	Spare	*42	High-Quality Ground
21	Spare	G	Ground Guide Pin
22	Reserved		

Pins marked (*) are installed and wired in ORTEC's Model 4001A and 4001C Modular System Bins.