

FLUORESCENCE
DETECTORS



FILTER FLUOROMETERS



FARRAND OPTICAL
COMPONENTS
& INSTRUMENTS

DIVISION OF RUHLE COMPANIES, INC.

INTRODUCTION

FARRAND OPTICAL COMPONENTS AND INSTRUMENTS

Offers high performance filter fluorometers, for a wide range of applications. They represent the latest technology for fluorescence detection instruments in a line that has been in development since 1944.

APPLICATIONS

Filter fluorometers are for fluorescence assay procedures with fixed excitation and emission wavelengths. They measure concentration levels of: NADH: NADPH, DNA, RNA, Protein: Peptides Aflatoxin, ATP, Fluorescein based labeling, Rhodamine, Estrogen, Protease activity, Enzyme assays, Kinetic Intercellular measurement, Amino Acids, Vitamins, Drug-metabolites, Steroids, etc., and fluorescence polarization measurements, to name a few.

AVAILABLE FEATURES

Accurate for levels of fluorescein less than 1 pM.

Minimum sample volume of 500, 80, or 25 microliters.

Seven range positions, providing a one million to one dynamic range for Ratio 3 and Standard Curve.

Excitation and emission filter holders externally accessible.

Optical system uses high quality 39mm diameter lenses.

Two 100 watt illumination sources available - mercury or a quartz halogen lamp.

Two, high-gain low-noise photomultiplier tubes available: 200-700nm or 200-900nm.

Standard Curve instrument incorporates a microprocessor.

T-EM. — Allows simultaneous detection of two different emission wavelengths.

SELECTING THE RIGHT FILTER FLUOROMETER

- **A-1**, Filter Fluorometer — For routine procedures. Featuring 100 watt Mercury lamp, precision lenses, high gain low noise photomultiplier tube with a range of 200-700nm and a 6mm cell holder. Options that may be substituted: 100 watt Quartz Halogen lamp, Extended Range photomultiplier tube with a range of 200-900nm, 5mm & 10mm Cell holders.
- **RATIO-3**, Filter Fluorometer — For all procedures. Featuring all of the A-1 features plus automatic correction for illumination energy changes and seven range positions for a Dynamic range of 1,000,000 to 1.
- **STANDARD CURVE**, Filter Fluorometer — For all procedures. From known concentrations develops Standard Curve and calculates concentration levels of unknown samples. Featuring microprocessor control of all functions, auto ranging (Dynamic range of 1,000,000 to 1), RS232, Printer ports, and Automatic correction for illumination energy changes.
- **T-EM**, Dual Emission Filter Fluorometer — For special and routine procedures. Featuring all of the A-1 features plus **Real Time measurement of Two separate Emission Wavelengths** and a ratio signal for Emissions A/B or Emissions B/A. Instrument has the flexibility to be used as a Single Emission wavelength Fluorometer.

APPLICATION INFORMATION

Fluorescence analysis provides a sensitivity several orders of magnitude greater than other techniques. The level of sensitivity made possible by fluorometry is often comparable to that of radioisotope labeling. In addition, fluorescence methods have been attracting more attention since they lack the problems associated with the use of radioisotopes. Although fluorometers are non-

scanning filter instruments, their sensitivity is superior to the more expensive spectrofluorometers. They may be used as research instruments provided that the excitation and emission wavelength of the compounds are known. Applications range from basic neurochemistry, to clinical pharmacology, food technology and environmental monitoring.

ANALYTICAL BIOCHEMISTRY

• NADH:NADPH

Many enzymes assays are based on the formation of NADH. With fluorescence detection, sensitivity is increased several fold and only small sample volumes are required, an important factor in pediatrics. Furthermore, generation of NADH is the basis of the widely used micromethod of enzymatic cycling developed by Lowry *et al* on our fluorometer. Fig. 1 and 2 illustrate the application of this technique in plant physiology for the detection of 10^{-14} M sucrose and in clinical and environmental analysis for the detection of 1nmol. ammonia.

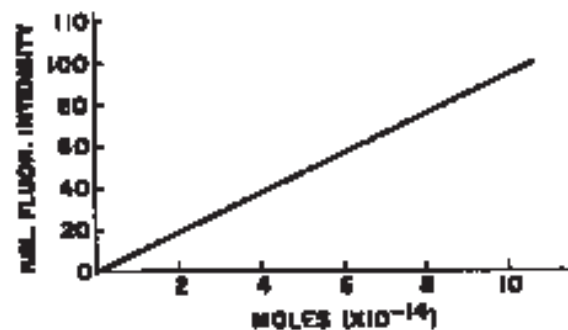


Fig. 1 Standard curve for sucrose in the 10^{-14} mole range.

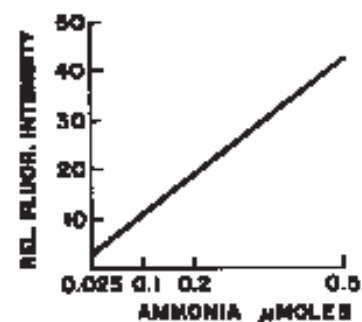


Fig. 2 Calibration curve

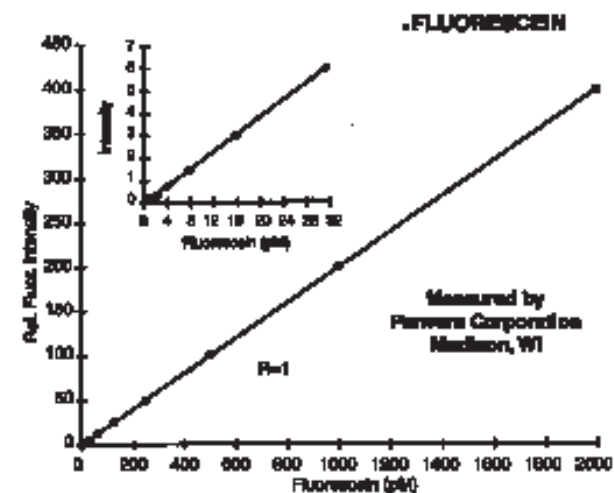


Fig. 3 Fluorescein concentrations vs Fluorescence Intensity

• DNA

Fig. 4 depicts a standard curve using calf thymus DNA with the ethidium bromide procedure. As little as 0.1ng can be detected.

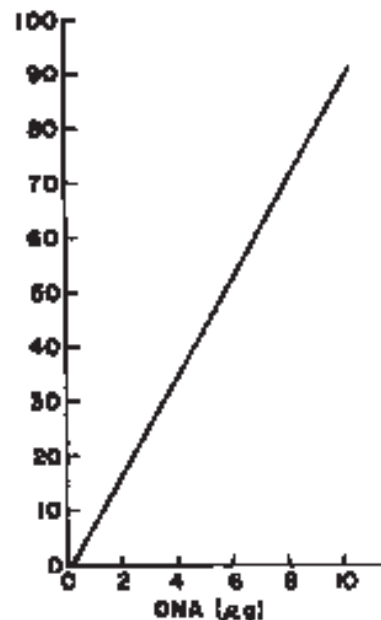


Fig. 4. Standard curve for calf thymus DNA by the ethidium bromide method.

SYSTEM FEATURES

Mercury Lamp: A 100-watt, high intensity, mercury vapor lamp provides excitation energy. Substantial spectral continuum is available from 220 to 650nm, with much higher energy lines at discrete wavelengths. Figure 5 indicates the approximate distribution of the radiated energy from 200 to 650 nm. Major mercury lines are: 254, 265, 313, 365, 405, 436, 546 and 577nm.

Quartz Halogen Lamp: A 100 watt high intensity lamp operating at 3000°K provides excitation over a wide spectrum; refer to Fig. 6 for distribution of radiated energy. This lamp is recommended for use when excitation wavelengths are equal to or greater than 450nm.

Photomultiplier Tubes: The standard response Photomultiplier Tube (PMT) is provided with each fluorometer unless otherwise specified. This tube's spectral response, together with one having extended red sensitivity are shown in Fig. 7. In applications where higher responses are required for different spectral areas, other PMT tubes may be selected.

Optical Filters: Both the primary and secondary filter holders can accommodate a combination of filters up to 10mm in thickness. Over fifty different glass color filters covering a broad spectral range are available. See Figures 8 & 9 (page 6). Combinations of these filters and interference types will satisfy any requirement. Glass filters are applicable when there is a relatively large separation between the peak excitation and emission wavelengths. Interference filters are recommended to obtain maximum fluorescence to solvent signal ratio.

It is recommended that the samples' excitation and emission spectra be obtained to aid in the selection of optical filters. The intensity of the emission spectrum is directly proportional to the excitation energy and the concentration of the fluorophore under test.

The selection of excitation and emission optical filters is based upon the following factors:

- Excitation and emission spectral characteristics of the fluorophore to be measured.
- Radiated spectrum of the illumination source.

- Pass band and rejection characteristics of optical filters with respect to each other.
- Photomultiplier tube spectral response characteristics.
- Required sensitivity.

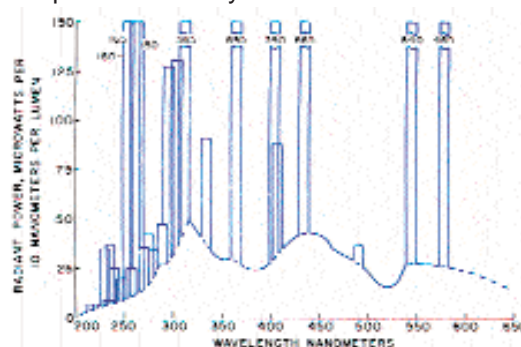


Fig. 5.
Mercury Vapor Lamp spectral Output

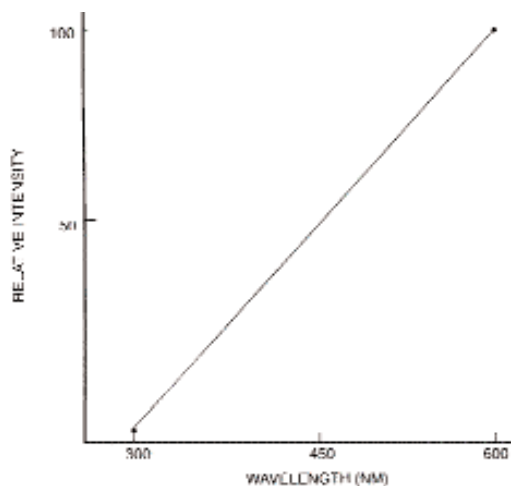


Fig. 6.
Quartz Halogen Lamp Spectral Output

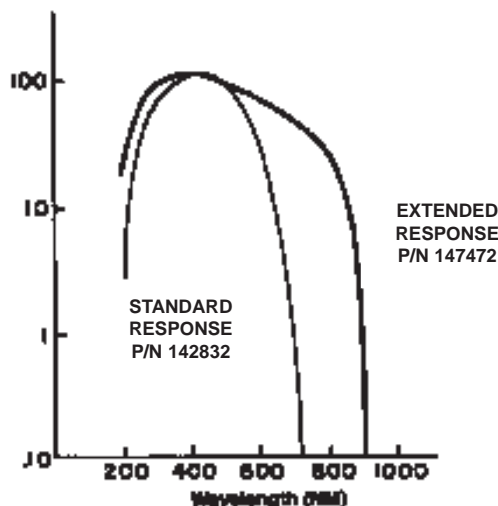


Fig. 7.
Photomultiplier Tube

FILTER FLUOROMETER ORDERING INFORMATION

INSTRUMENTS

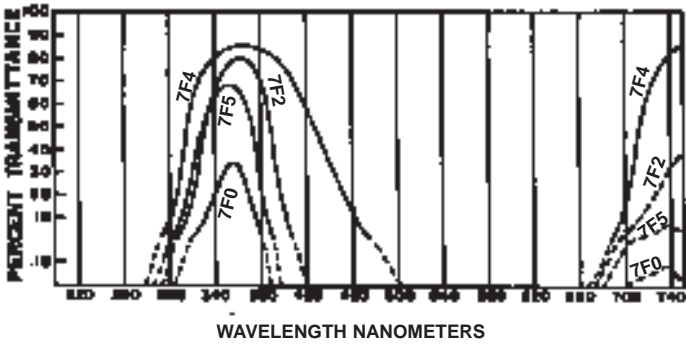
FEATURES	A-1 189840	RATIO-3 189790	STANDARD CURVE 168118	DIAL EMISSION 168208
SENSITIVITY FOR FLUORESCCEIN	<1pM	<1pM	<1pM	<1pM
WAVELENGTH RANGE 200-900nm	YES	YES	YES	YES
SENSITIVITY RANGES	4 (1K:1)	7 (1M:1)	7 (1M:1) WITH AUTO-RANGING	4 (1K:1)
CELL HOLDER for 8X50mm CELL, MIN. VOL. 60µl (PART NO. 168680)	YES	YES	YES	YES (168280) "T"
ILLUMINATION SOURCE: 100 WATT MERCURY LAMP	YES	YES	YES	YES
RATIO COMPENSATION FOR ILLUMINATION CHANGES	NO	YES	YES	NOT REQUIRED
FILTERS, 50mm EXTERNALLY ACCESS.	YES	YES	YES	YES
PHOTOMULTIPLIER TUBE 200-700nm (PART NO. 142832)	YES	YES	YES	YES (2) CHANNELS A, B
ANALOG OUTPUT SIGNAL FOR KINETIC MEASUREMENTS	YES	YES	NO	YES (3) A, B, AB
RS232 AND PRINTER PORTS	NO	NO	YES	NO
MICROPROCESSOR CONTROLLED, WITH USER FRIENDLY PROGRAMS	NO	NO	YES	NO
AUTOMATICALLY CALCULATES CONCENTRATION	NO	NO	YES	NO
PRIMARY POWER 115VAC, @60HZ (Other primary power voltages available)	⊕1.5 AMPS	⊕1.5 AMPS	⊕2.0 AMPS	⊕1.5 AMPS
DIMENSIONS	15.5" WIDTH 20.8" DEPTH 9.5" HEIGHT	15.5" WIDTH 20.8" DEPTH 9.5" HEIGHT	15.5" WIDTH 20.8" DEPTH 9.5" HEIGHT	17.0" WIDTH 16.0" DEPTH 7.0" HEIGHT
OPTIONS				
158808 TEMPERATURE (TEC) CONTROL 8-80°C (AUTO)	NO	NO	YES	NO
168757 TEMPERATURE (TEC) CONTROL 8-80°C (MANUAL)	YES	YES	NO	YES
168885 CELL HOLDER 10 x 76mm MIN. VOL., 500 µl	YES	YES	YES	YES (168245) "T"
180120 CELL HOLDER 5 x 80mm MIN. VOL., 28 µl	YES	YES	YES	NO
160189 ILL. SOURCE 100 WATT QUARTZ HALOGEN LAMP >400nm	YES	YES	YES	YES
147472 EXTENDED RED PMT 200-900nm RANGE	YES	YES	YES	YES (2)
168887 PRINTER	NO	NO	YES	NO
164002 RECORDER - 1 PEN	YES	YES	NO	YES
168222 RECORDER - 2 PEN	YES	YES	NO	YES

FILTER INFORMATION

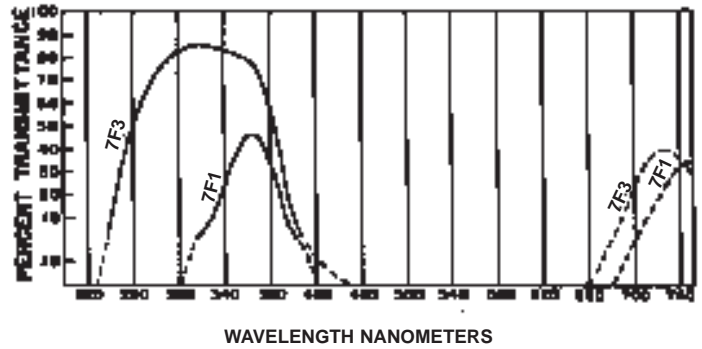
GLASS COLOR FILTERS RESPONSE CHARACTERISTICS

BANDPASS FILTERS Figure 8

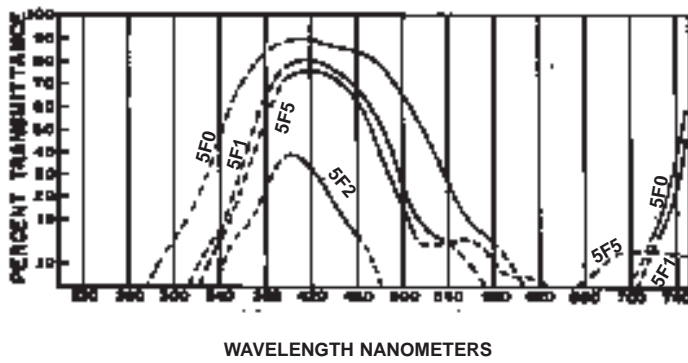
UV TRANSMITTING



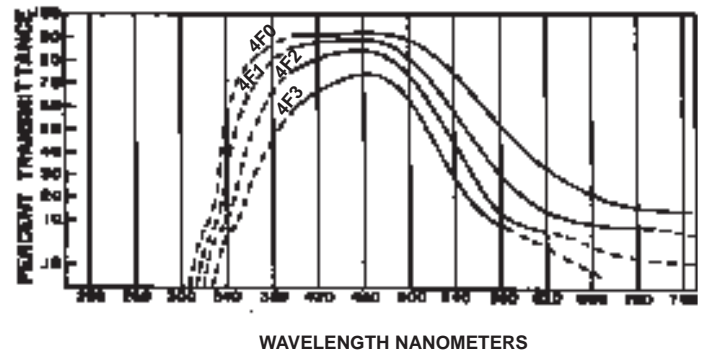
UV TRANSMITTING



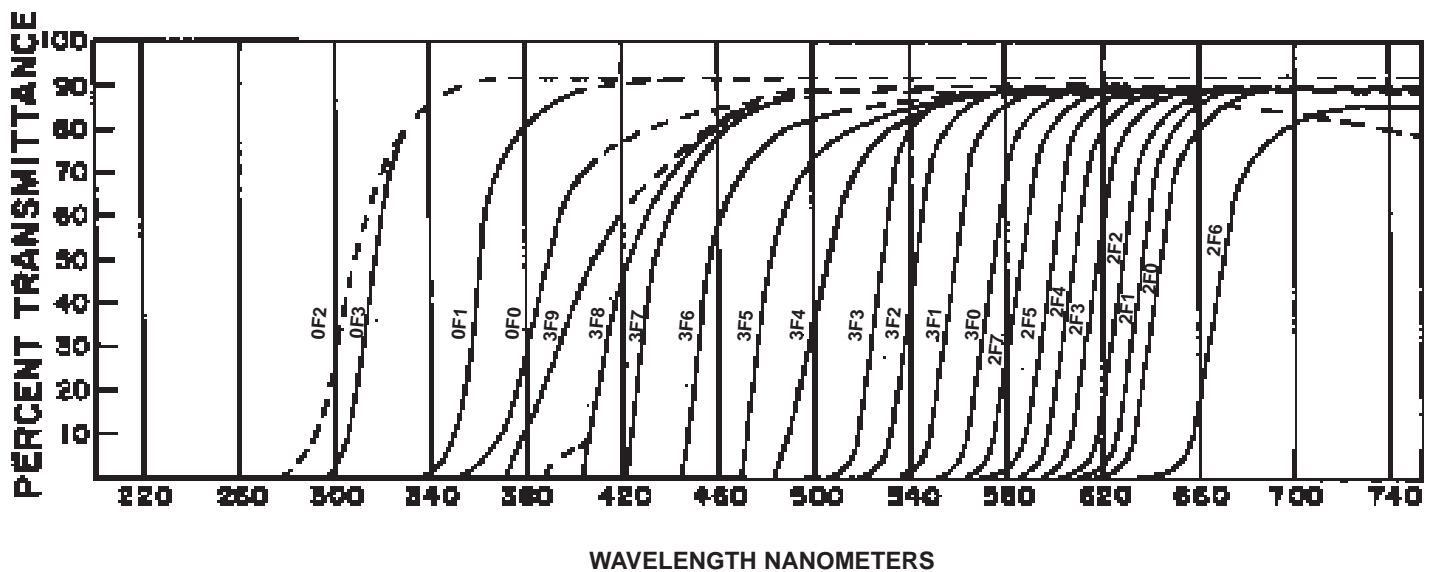
BLUE TRANSMITTING



BLUE-GREEN TRANSMITTING



CUT-OFF FILTERS Figure 9



FILTER ORDERING INFORMATION

GLASS FILTERS

FILTER	CATALOG #	FILTER	CATALOG #
0F0	160351	3F6	160372
0F1	160352	3F7	160373
0F2	160353	3F8	160374
0F3	160354	3F9	160375
2F0	160358	4F0	160379
2F1	160359	4F1	160380
2F2	160360	4F2	160381
2F3	160361	4F3	160382
2F4	160362	5F0	160386
2F5	160363	5F1	160387
2F6	160364	5F2	160388
2F7	160383	5F5	160391
3F0	160366	7F0	160397
3F1	160367	7F1	160399
3F2	160368	7F2	160401
3F3	160369	7F3	160404
3F4	160370	7F4	160389
3F5	160371	7F5	160390

INTERFERENCE FILTERS

CATALOG #	CATALOG #	CATALOG #	CATALOG #	SPECIFICATIONS FOR STANDARD INTERFERENCE FILTERS:
254nm	450nm	600nm	700nm	ONE HALF TRANSMISSION BANDWIDTH: 10nm CENTER WAVELENGTH : ±2nm OTHER BANDWIDTHS ARE AVAILABLE
265nm	470nm	610nm	710nm	
313nm	480nm	620nm	720nm	
366nm	500nm	630nm	730nm	SPECIAL HIGH PERFORMANCE FLUORESCIN INTERFERENCE FILTERS: EXCITATION PART #159373 EMISSION PART #159374
400nm	520nm	640nm	740nm	
405nm	530nm	650nm	750nm	
410nm	546nm	660nm	760nm	STANDARD INTERFERENCE FILTERS: Less Than 400nm: ULTRAVIOLET 400 TO 700nm: VISIBLE Greater Than 700nm: NEAR INFRARED
420nm	550nm	670nm	770nm	
430nm	577nm	680nm	780nm	
436nm	590nm	690nm	800nm	

Other fluorescence detection instruments in our product line include:

**SPECTROFLUOROMETERS
&
FLUORESCENCE
POLARIZATION INSTRUMENTS**

Our optical alignment tool product line includes:

**VERTICAL LEVELING MIRRORS
&
SPECIALIZED OPTICAL
ALIGNMENT TOOLS**

Optical display products include:

**THE PANCAKE WINDOW®
INFINITY DISPLAY FOR VISUAL
SIMULATION SYSTEMS**

We also develop and manufacture specialty electro-optical instruments and optical alignment tools for OEM and other unique applications.



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