

# Model 814FP Pulser

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## User's Manual

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The information in this document describes the product as accurately as possible, but is subject to change without notice.

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# Important Safety Considerations

## Read Carefully



Indicates warning of mains or high voltage present at output labeled HV.  
Risk of electrical shock if covers are removed.



Caution – risk of danger. Refer to documentation for detailed explanation of caution symbol wherever marked.



Earth symbol: indicates the connection point for the primary earth (ground) supply.



Product complies with appropriate current EU directives (Low Voltage & EMC).



Product complies with appropriate current FCC /UL / CSA 61010-1 directives (Low Voltage & EMC).

### Manufacturer's Address

Mirion Technologies (Canberra), Inc.  
800 Research Parkway  
Meriden, CT 06450 USA

# 1. Introduction

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The Canberra 814FP Pulser is a single-width NIM module designed to simulate the output from a solid-state or scintillation detector/preamplifier combination, thereby providing a means of testing and calibrating the electronics in a nuclear counting system.

The 814FP offers a fast rise time (typically 10 ns) signal and variable repetition rates of up to 2 kHz. Either square wave or tail pulse outputs are selectable. The 814FP is unique in that the square wave output will not degrade the resolution of a gamma spectroscopy system even if it is run simultaneously with a germanium detector. Other tail pulsers introduce an additional pole into the preamplifier/amplifier combination, preventing the amplifier from properly pole/zeroing the system. This results in spectrum broadening, especially on the low energy side.

The 814FP can be calibrated to read directly in terms of energy with the ten-turn precision PULSE HEIGHT potentiometer, NORMalize control and ATTENUATOR switches. The PULSE HEIGHT control has a maximum nonlinearity of +0.25% and the ATTENUATORS use 1% resistors.

Calibration of nuclear spectroscopy systems and multichannel analyzers, evaluation of system stability, measuring the integral nonlinearity and noise of amplifiers, and selecting delays in coincidence timing systems are typical of the wide range of applications for the Canberra 814FP Pulser. The variable repetition rate is also useful in determining the system's count rate performance.

The 814FP offers either a direct output or an attenuated output. When all the attenuator switches are in the "out" position the output is direct. Attenuation factors of up to 1000:1 are selectable via two-position switches with gold-plated contacts. These contacts greatly improve both the reliability and the long-term stability of the attenuator section.

A DISABLE input is featured on the 814FP for gated operation and is selectable as active High or active Low for interfacing with a wide variety of devices. It is also synchronized with the internal pulse generator to prevent erroneous outputs. The disable feature enables the 814FP to be turned on or off by remote or computer control.

A SYNC output is provided on the front panel for convenient oscilloscope triggering while monitoring either the system output or waveforms from the 814FP.

## 2. Controls and Connectors

### Front and Rear Panels

This is a brief description of the 814FP's front panel controls and connectors. For more detailed information, refer to Appendix A, *Specifications*

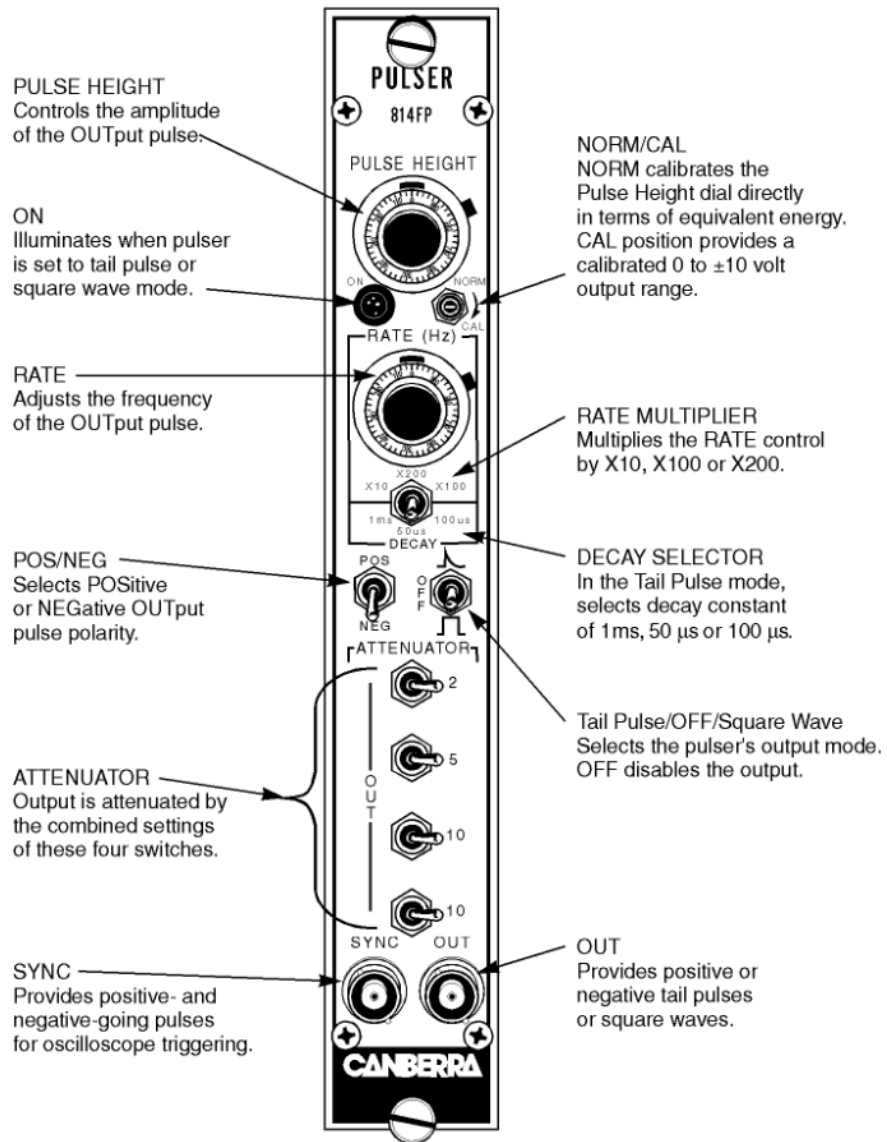


Figure 1 Front Panel Controls and Connectors

## 3. Pulser Operation

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The Canberra Model 2000 Bin and Power Supply, or other bin and power supply systems conforming to the mechanical and electrical standard set by DOE/ER-0457T will accommodate the Model 814FP.

Before installing the Model 814FP in the NIM Bin, the internal controls, accessible through cutouts in the side cover, should be set to their desired positions.

The right side cover of the NIM module acts as a guide for insertion of the instrument. The module is secured in place by turning the two front panel captive screws clockwise until finger tight. It is recommended that the NIM bin power switch be off whenever the module is installed or removed.

The Model 814FP can be operated where the ambient air temperature is between 0 °C and +50 °C (+120 °F maximum). Perforations in the top and bottom sides permit cooling air to circulate through the module. When relay rack mounted along with other

heat generating equipment, adequate clearance should be provided to allow for sufficient air flow through both the perforated top and bottom covers of the NIM bin.

### Setting the Amplitude

The Pulse Height potentiometer controls the amplitude of the output pulse, with a range of 0 to  $\pm 10$  volts open circuit (0 to  $\pm 5$  volts, terminated into 50 ohms).

### Normalizing the Output

The Norm control allows a 2.5:1 variation of the output amplitude for normalization of the Pulse Height dial, enabling the user to calibrate the Pulse Height dial directly in terms of equivalent energy.

#### **CAL**

Setting the Norm control fully clockwise to the CAL position provides a calibrated 0 to  $\pm 10$  volt output range.

### The Rate Control

The Rate control adjusts the frequency of the Output signal.

## Rate Multiplier and Decay Selector

In the Tail Pulse mode, the Decay switch selects one of three decay constants: 1 ms, 50  $\mu$ s or 100  $\mu$ s.

This switch also selects the multiplier for the RATE control: X10, X100 or X200. Square waves may be selected on any range.

## Selecting the Output Mode

To select the output mode, set this switch to either the Tail Pulse position or the Square Wave position.

## Attenuating the Output

The Attenuator switches reduce the full scale pulse height by factors of 2, 5, or 10, or any combination of these values.



# A. Specifications

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## Input

DISABLE – Accepts a dc control signal which enables or disables the pulser output signal. Internally selectable as active HI (>2 V to disable; <1.5 V to enable) or active LO (<1.5 V to disable; >2 V to enable). The DISABLE signal is synchronized to the internal pulse generator to terminate the current pulse at the correct time to prevent erroneous outputs; rear panel BNC.

## Outputs

OUT – Provides attenuated positive or negative tail pulses or square waves; pulse height 0 to  $\pm 10$  V open circuit (0 to  $\pm 5$  V when terminated into  $50 \Omega$ ); rise time <30 ns; fall time constants are independent of output terminations. Attenuation factors of up to 1000 may be selected;  $Z_{out} = 50 \Omega$ ; front panel BNC.

SYNC – Provides positive- and negative-going pulses for oscilloscope triggering. Positive oscilloscope triggering syncs on the leading edge of the output waveform, while negative oscilloscope triggering syncs on the trailing edge of the output waveform. Sync pulses are approximately  $\pm 3.5$  V,  $0.1 \mu\text{s}$  wide;  $Z_{out} = 50 \Omega$ ; front panel BNC.

## Controls

PULSE HEIGHT – Front panel ten-turn potentiometer controls output pulse amplitude from 0 to  $\pm 10$  V, open circuit (0 to  $\pm 5$  V when terminated into  $50 \Omega$ .)

NORM/CAL – Front panel multi-turn potentiometer allows a >2:1 variation of the output amplitude for normalization of the PULSE HEIGHT dial, enabling the user to calibrate the PULSE HEIGHT dial directly in units of energy. Setting the NORM control fully clockwise to the CAL position provides a calibrated 0 to  $\pm 10$  V output range.

RATE – Front panel ten-turn potentiometer and dial provides control of output frequency with a 100:1 range.

DECAY – Front panel three-position toggle switch selects one of three decay constants in Tail Pulse mode and multiplier for the RATE control. Maximum frequency is 2 kHz for the  $50 \mu\text{s}$  decay constant, 1 kHz for the  $100 \mu\text{s}$  decay constant, and 100 Hz for the 1 ms decay constant. The Square Wave output may be selected on any range.

POLARITY – Front panel two-position toggle switch selects POSitive or NEGative output pulse polarity.

Tail Pulse/OFF/Square Wave – Front panel three-position toggle switch selects the pulser's operating mode: OFF disables the output (overrides the rear-panel DISABLE input) and sets the output to 0 V; the Tail Pulse position outputs a tail pulse; the Square Wave position outputs a square wave.

ATTENUATOR – Four front panel two-position toggle switches select attenuation factors of 2, 5, 10 and 10. Total attenuation is the product of the selected attenuators.

DISABLE – Internal jumper selects DISABLE HI (>2 V) or DISABLE LO (<1.5 V) mode for rear panel DISABLE input.

## Indicators

ON – Front panel LED illuminates when the Tail Pulse/OFF/Square Wave switch is in either the Tail Pulse or Square Wave position and the pulser is not disabled through the rear panel DISABLE input.

## Performance

TEMPERATURE STABILITY –  $\leq \pm 0.01\%/^{\circ}\text{C}$ .

SUPPLY VOLTAGE STABILITY –  $\leq +0.01\%$  for a  $\pm 1\%$  change in the  $\pm 24$  volt supply voltages.

NORMALIZE RANGE –  $> 2:1$ .

SWITCHING TRANSIENTS –  $\leq 0.1$  V peak-to-peak,  $\leq 20$  ns duration. INTEGRAL NONLINEARITY –  $\leq \pm 0.25\%$  of full scale.

DUTY CYCLE – 50% with square wave output selected.

RISE TIME –  $< 30$  ns.

FALL TIME – Tail Pulse output: 50  $\mu\text{s}$ , 100  $\mu\text{s}$  or 1 ms, ( $\pm 10\%$ ) selected by front panel switch and independent of output termination; Square Wave output:  $< 30$  ns.

PULSE REPETITION RATE – Range depends on the selected DECAY time: 50  $\mu\text{s}$ : 20 Hz to 2 kHz; 100  $\mu\text{s}$ : 10 Hz to 1 kHz; 1  $\mu\text{s}$ : 1 Hz to 100 Hz; the Square Wave output can be chosen at any range.

## Power Requirements

+24 Vdc – 130 mA +12 V dc – 60 mA

-24 V dc – 130 mA -12 V dc – 80 mA

## Physical

SIZE – Standard single-width NIM module 3.43 x 22.13 cm (1.35 x 8.71 in.) per DOE/ER-0457T.

NET WEIGHT – 1.36 kg (3.0 lb).

SHIPPING WEIGHT – 2.27 kg (5.0 lb).

## Environmental

OPERATING TEMPERATURE RANGE – 0 to 50 °C (32 to 122 °F). OPERATING HUMIDITY RANGE – 0 to 80% relative, non-condensing.

Tested to the environmental conditions specified by EN 61010, Installation Category I, Pollution Degree 2.

# Notes

## B. Installation Considerations

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This unit complies with all applicable requirements. Compliance testing was performed with application configurations commonly used for this device.

During design and assembly of the device, precautions were taken by the manufacturer to minimize the effects of RFI and EMC on the system. However, care should be taken to maintain full compliance. These considerations include:

- A rack or tabletop enclosure fully closed on all sides with rear door access.
- Single point external cable access.
- Blank panels to cover open front panel Bin area.
- Compliant grounding and safety precautions for any internal power distribution.
- The use of NRTL/CE compliant accessories such as fans, UPS, etc.

### Preventive Maintenance

This unit does not require any periodic cleaning maintenance.

Any maintenance should be performed by a qualified Mirion Technologies (Canberra) service representative.

### Operating Protection Impairment

Mirion Technologies (Canberra) is not liable for any operational malfunctions or personal injuries due to mishandling or unauthorized repair and maintenance not detailed in this manual.

### Cleaning/Decontamination



When needed, the front panel of the unit may be cleaned. Remove power from the unit before cleaning. Use only a soft cloth dampened with warm water and make sure the unit is fully dry before restoring power. Do not use any liquids directly on the preamp housing, front, or rear panels.

## C. FCC Notice

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The following paragraphs are notices required by Federal Communications Commission (FCC) rules, Part 15, Subpart A.

“The user is cautioned that any changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.”

This equipment has been tested and found to comply with the limits for a class A digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

# Request for Circuit Information

The Schematics, Block Diagrams, and/or Circuit Description may be available for this unit directly from CANBERRA. Request can be made by calling, faxing, or emailing:

Training and Technical Services Department  
Canberra Industries  
800 Research Parkway, Meriden, CT 06450  
Telephone: (800) 255-6370 FAX: (203) 639-2067  
Email: [techsupport@canberra.com](mailto:techsupport@canberra.com)

If you would like schematics and/or a circuit description, if available, for this unit, please provide us with the following information.

Your Name \_\_\_\_\_

Your Address \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Unit's model number \_\_\_\_\_

Unit's serial number \_\_\_\_\_

Note: Schematics, block diagrams, and circuit descriptions are provided for information only; if you service or repair or try to service or repair this unit without Canberra's written permission you may void your warranty.

# Notes



## Warranty

Mirion Technologies (Canberra) Inc. (we, us, our) warrants to the customer (you, your) that for a period of ninety (90) days from the date of shipment, software provided by us in connection with equipment manufactured by us shall operate in accordance with applicable specifications when used with equipment manufactured by us and that the media on which the software is provided shall be free from defects. We also warrant that (A) equipment manufactured by us shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment of such equipment, and (B) services performed by us in connection with such equipment, such as site supervision and installation services relating to the equipment, shall be free from defects for a period of one (1) year from the date of performance of such services.

If defects in materials or workmanship are discovered within the applicable warranty period as set forth above, we shall, at our option and cost (A) in the case of defective software or equipment, either repair on a return to factory basis or replace the software or equipment, or (B) in the case of defective services, reperform such services.

### LIMITATIONS

EXCEPT AS SET FORTH HEREIN, NO OTHER WARRANTIES OR REMEDIES, WHETHER STATUTORY, WRITTEN, ORAL, EXPRESSED, IMPLIED (INCLUDING WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE) OR OTHERWISE, SHALL APPLY. IN NO EVENT SHALL WE HAVE ANY LIABILITY FOR ANY SPECIAL, EXEMPLARY, PUNITIVE, INDIRECT OR CONSEQUENTIAL LOSSES OR DAMAGES OF ANY NATURE WHATSOEVER, WHETHER AS A RESULT OF BREACH OF CONTRACT, TORT LIABILITY (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE. REPAIR OR REPLACEMENT OF THE SOFTWARE OR EQUIPMENT DURING THE APPLICABLE WARRANTY PERIOD AT OUR COST, OR, IN THE CASE OF DEFECTIVE SERVICES, REPERFORMANCE AT OUR COST, IS YOUR SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY.

### EXCLUSIONS

Our warranty does not cover damage to equipment which has been altered or modified without our written permission or damage which has been caused by abuse, misuse, accident, neglect or unusual physical or electrical stress, as determined by our Service Personnel.

We are under no obligation to provide warranty service if adjustment or repair is required because of damage caused by other than ordinary use or if the equipment is serviced or repaired, or if an attempt is made to service or repair the equipment, by other than our Service Personnel without our prior approval.

Our warranty does not cover detector damage due to neutrons or heavy charged particles. Failure of beryllium, carbon composite, or polymer windows or of windowless detectors caused by physical or chemical damage from the environment is not covered by warranty.

We are not responsible for damage sustained in transit. You should examine shipments upon receipt for evidence of damage caused in transit. If damage is found, notify us and the carrier immediately. Keep all packages, materials and documents, including the freight bill, invoice and packing list.