



# Model JSR-12 Neutron Coincidence Analyzer

## Features

- Low power for sealed case
- Wide input power supplies for 110/220 V operation
- Standard RS-232C serial port for total computer control
- LCD alphanumeric display for menu-driven operator setup
- Internal clock for date/time tagging of all data
- Automatic non-volatile storage for 3000 data runs
- 4 MHz internal clock
- Internal burst pulser provides complete self test capabilities
- Count gate output for control of external data acquisition electronics
- Buffer status command to insure no loss of data on long runs
- Authorized for routine inspection use by the International Atomic Energy Agency (IAEA)
- Meets European Union EMC and safety requirements

## Description

The JSR-12 Neutron Coincidence Analyzer separates coincidence neutron events from random neutron events, and thus provides a method of counting neutron signatures from spontaneously fissioning isotopes or induced fission from fissile isotopes. At the

conclusion of each counting interval (operator selected), the unit provides information on total counts, reals plus accidentals and accidentals as displayed on the front panel. Most significantly, it does this without substantial downtime by a unique technique in which a new coincidence gate is started for each neutron event presented at the input.

The JSR-12 has an internal, battery-backed time-of-day and day-of-year realtime clock and data RAM which permits time and date marking of all stored data for power-down storage of up to 3000 data runs. The firmware resides in EPROM.

### DATA ACQUISITION

The JSR-12 internal clock speed is 4 MHz which, with front-end burst buffer, permits pulse pair resolution of 20 ns and count rates of 4 MHz.

Internal diagnostics continuously monitor the state of the data acquisition, flagging internal under- and over-flows whenever they occur, thus guaranteeing data integrity during counting intervals. Errors are immediately indicated on the front-panel LCD display.

A second totals counter is provided for an additional channel input which can be operated in synchronization with the regular input or as a totally separate counter. This counter is also equipped with a burst buffer to permit high instantaneous count rates.

### PHYSICAL

The JSR-12 comes in two standard configurations: the standalone unit or a triple-width module, which uses the NIM standard physical configuration.

### POWER REQUIREMENTS

Wide-input power supplies are used in the JSR-12, which accommodate both 110 and 220 V ac standard power. This eliminates the need for a power switch to select the input power voltage, and incidentally also eliminates the danger of attempting to operate on the wrong supply voltage.

The NIM version of the JSR-12 derives ac power from the NIM Bin and generates all necessary voltages from internal regulators, including the high voltage.

The low power requirement ( $\approx 3$  W) eliminates the need for cooling fans or special mounting for thermal stability. In addition, the unit can be sealed (it has no vents) and thus protected from dust and humidity.



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## OPERATOR CONTROLS AND SETUP

A parameter/data switch toggles the display between the setup parameters and the display of data. This switch is automatically overridden when a data run is in progress.

Within the parameter setup mode, a rotary switch selects the parameter to be adjusted. Each setup parameter has its own menu on the 4-line x 16 LCD display, which guides the operator in setting the value for the given parameter.

The pre-delay value is manually or remotely adjustable (from terminal or computer) from 0.5 to 7.5  $\mu\text{s}$  in 0.5  $\mu\text{s}$  intervals to allow for electronic deadtime in the front-end amplifier.

The gate width is manually or remotely adjustable from 1 to 250  $\mu\text{s}$  in 1  $\mu\text{s}$  increments (optionally from 2 to 500  $\mu\text{s}$ ).

Counting times are adjustable manually or remotely between 0.1 seconds and  $9.9 \times 10^9$  seconds, with the unit and exponent values individually adjustable for simplicity in setup.

High voltage power supply voltage is manually or remotely adjustable between 500 and 2500 V in 1 V increments, with the display showing both the desired value and the actual value measured digitally at the output of the unit. This dual display allows adjustment with the HV switched off, and the actual voltage display provides diagnostic assistance in the event of an output overload or supply failure.

The number of consecutive runs selected for a data acquisition campaign is manually and remotely selectable between 1 and 99. Continuous operation (infinity) can also be selected.

All selected parameters are retained in a non-volatile memory and restored for operation when the unit is powered up. In the case of scrambled or lost parameters, as determined by automatic internal diagnostics on power up, default values (most often used values) are automatically selected to avoid irrational results. In any event, selected parameters are displayed on the front panel.

The front-panel display is a 4-line by 16 LCD module with backlighting. The backlighting is toggled on or off from the front panel, except when battery operation is selected, in which case the backlighting switch causes backlighting for 15 seconds with automatic turnoff to avoid unduly burdening the battery.

The front-panel display is used to display any error condition which might result from internal diagnostics.

## COMMUNICATION

The JSR-12 comes with a RS-232C serial communications port which can be connected to a printer or terminal, or to a computer. The communications protocol is a superset of the JSR-11 protocol and includes new commands for setting each of the assay parameters as described above.

The data transfer rate of the unit is retained until changed manually, with the value displayed on the LCD front-panel display. Available transfer rates are 300, 1200, 2400, 9600, and 19200 bits/second.

## DATA STORAGE

The JSR-12 is supplied with battery-backed RAM for storage of all setup parameters and automatic data storage.

As a data run is taken it is automatically stored in a circulating buffer which is capable of retaining 3000 individual data runs. Each data run is stored with the date and time and all setup parameters, as well as the gate width, total counts, reals and reals plus accidentals. Data are retrieved from memory upon command from terminal or computer, which fetches data by day and month.

Retrieved data can be printed upon command or downloaded directly to the computer.

All setup parameters can be downloaded to printer or computer upon command.

## Specifications

### INPUTS

- SIGNAL – Accepts TTL pulses from Neutron Counter for standard shift register counting (R+A and A); minimum pulse width 20 ns; rear panel BNC.
- AUX SCALER – Totals scaler for an additional counter input; rear panel BNC.
- RS-232 – Provides connection to an RS-232C EIA device. Computer control is through this interface. Baud rates of 300, 1200, 2400, 9600 and 19.2k are supported; rear panel 25-pin D connector.

### OUTPUTS

- RS-232 – Provides connection to an RS-232C EIA device. Provides status Feedback to the computer as well as data transfer. Baud rates of 300, 1200, 2400, 9600 and 19.2k are supported; rear panel 25-pin D connector.
- +5V – +5 V dc  $\pm 1\%$ ; 1.5 A max (this is enough supply current for up to 18 JAB-01 Preamp/Disc boards); short circuit protected; rear panel BNC.
- HV OUTPUT – 500 to 2500 V  $\pm 1\%$ ; 100  $\mu\text{A}$  max; adjustable in 1 V increments; rear panel SHV.
- COUNT GATE – TTL logic low when counting and logic high when stopped. Sinks up to 20 mA in the low state and supplies 1 mA when high; rear panel BNC.

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## MANUAL CONTROLS

- POWER – Turns unit on or off; front panel toggle switch.
- PARAMETER DISPLAY/OPERATE – Selects LCD display for operating parameters or data display; front panel toggle switch.
- ADJUST KNOB – Sets operating parameters; front panel continuous turn pot.
- SELECTION SWITCH – Off position displays setup parameters; other positions select parameter to display or change: count time, gate width, predelay, high voltage, multiple runs or baud rate; front panel rotary switch.
- HIGH VOLTAGE – Turns HV on or off; front panel toggle switch.
- BACKLIGHT – Toggles LCD backlight on and off; front panel pushbutton.
- START – Starts data acquisition; front panel pushbutton.
- STOP – Halts data acquisition; front panel pushbutton.
- RESET – Clears all counters and count time; front panel pushbutton.
- READOUT – Sends data from last cycle to RS-232 port; front panel pushbutton.
- SINGLE/RECYCLE – Selects single count cycle or number of runs set by the multiple run parameter; front panel toggle switch.

## PROGRAMMABLE CONTROLS

- GATE WIDTH – 1-250  $\mu$ s in 1  $\mu$ s increments.
- HV – 500-2500 in 1 V increments.
- PREDELAY – 0.5-7.5  $\mu$ s in 0.5  $\mu$ s increments.
- COUNTING TIMES – The elapsed counting time for each input can be set from 0.1 - 9.9  $\times 10^9$  s.
- MULTIPLE RUNS – 0 for continuous counting cycles or preset of 1-99.

## CONNECTORS

- SIGNAL – Rear panel BNC.
- AUX SCALER – Rear panel BNC.
- COUNT GATE – Rear panel BNC.
- +5V – Rear panel BNC.
- RS-232 – Rear panel 25-pin D-type connector.
- HV OUTPUT – Rear panel SHV.
- 85-250 V ac – Rear panel ac receptacle plug (stand alone unit only).

## PERFORMANCE

- COUNTING REGISTERS – Internally clocked at 4 MHz; R+A, A: 32 bits deep each; Totals: 32 bits deep; Aux: 32 bits deep each.
- DERANDOMIZING BUFFER – 16 bits deep buffer on the signal input; random input capture rate; synchronized output rate at 4 MHz.
- PULSE PAIR RESOLUTION – Ability to recognize a new pulse on any input 20 ns after the falling edge of the preceding pulse.
- DATA STORAGE – Battery-backed RAM in a circular buffer that holds up to 3000 individual runs.

## FRONT PANEL INDICATORS

- POWER – LED indicates main power switch is on.
- HV – LED indicates HV is on.
- EXT MODE – LED indicates external control mode by either computer or terminal.
- LCD – Displays parameters and data.

## POWER REQUIREMENTS

### Model JSR-12 (Standalone System)

- 110-120 V ac  $\pm$ 10, 50/60 Hz, single phase.
- 220-240 V ac  $\pm$ 10, 50/60 Hz, single phase.

### Model JSR-12N (NIM Module System)

- 100-120 V ac  $\pm$ 10, 50/60 Hz, single phase.
- POWER CONSUMPTION – 45 V, maximum  
Overvoltage Category: II; Pollution Degree: 2; Class: 1.

## FUSE REQUIREMENTS

### Model JSR-12 (Standalone System)

- 100-120 V ac, (5 x 20 mm cartridge), 1.0 A SB.
- 220-240 V ac, (5 x 20 mm cartridge), 0.5 A T.

### Model JSR-12N (NIM Module System)

- 100-120 V ac, (3AG), 1.0 A SB.

## BATTERY REQUIREMENTS

- Two 3.5 V 1600 mAh lithium batteries with the following dimensions: 47.24 x 16.76 x 16.76 mm (L x W x H).  
Battery life: at least 10 years.

## PHYSICAL DIMENSIONS

- SIZE – JSR-12: 300 mm wide x 102 mm tall x 508 mm deep (11.8 x 4.0 x 20 in.); JSR-12N: Triple wide NIM, 102 mm wide x 193 mm tall x 267 mm deep (4.0 x 7.6 x 10.5 in.).
- NET WEIGHT – JSR-12: 5.4 kg (11.8 lb); JSR-12N: 2.6 kg (5.6 lb).

## ENVIRONMENTAL

- OPERATING TEMPERATURE – 15 to 35 °C.
- OPERATING HUMIDITY – Up to 85%, relative, non-condensing.
- Meets the environmental conditions specified by EN 61010, Installation Category I, Pollution Degree 2.
- USE – Systems are for indoor use only.

