

428F QUAD LINEAR FAN-IN/FAN-OUT

429A QUAD LOGIC FAN-IN/FAN-OUT

- 4 Inputs, and at Least 4 Outputs Per Channel
- Positive or Negative Inputs
- NIM Packaging
- High Speed

FOR COMBINING INPUTS OR DISTRIBUTING MULTIPLE OUTPUTS

Fan-in/fan-out units are accessory modules used to simplify the configuration of an experimental set up. The fan-in function adds or combines multiple analog signals and ORs logic signals for later processing. The fan-out function makes multiple outputs from one or more analog or logic inputs. Fan-outs are commonly used to distribute gate or veto signals over a number of data acquisition units.

LeCroy's fan-in/fan-out units are available for use with either analog (linear) or logic signals. They are NIM standard modules for maximum flexibility.

FEATURES

Multiple Independent Units - Each module contains four sections of fan-in/fan-out.

Multiple Inputs - 4 inputs per channel.

Multiple Outputs - Each channel has 4 outputs and the Model 429A also has 2 complementary outputs.

Flexible Accessory - Fan-in/fan-outs are useful utility modules which should be part of every lab.

FUNCTIONAL DESCRIPTION

Both fan-in/fan-out modules have the same basic function of combining the inputs and distributing multiple outputs. The Model 428F is used with linear (analog) inputs while the Model 429A is used with logic (NIM or TTL) signals. In either case, they are high performance versatile accessory modules which can be used in CAMAC crates if desired with the Model 4501A NIM-to-CAMAC adaptor.

Model 428F

Each channel of the Model 428F Quad Linear Fan-In/Fan-Out contains 4 direct-coupled linear outputs. The bipolar inputs, together with the polarity switch, allow convenient summing of either anode or dynode pulses. An output swing of +100 mV to -2 V is compatible with all normal analog inputs (e.g., discriminators, ADCs, etc.) and also accommodates standard logic levels. Each of the 428F's inputs is provided with input protection circuitry which gives immunity to transient signals up to ± 5 A for 0.5 microseconds.

The incorporation of the polarity switch is particularly significant in that it enables convenient, direct use of the fanned-out dynode signals for multiple fast logic decisions, while the anode signal can be directly applied to a current-integrating ADC.

All outputs are reverse-terminated and mutually isolated. The 428F utilizes a direct-coupled feedback-stabilized circuit design that provides excellent linearity, long-term stability, and uniformity of gain and pulse shape. The speed of the unit is suitable for all common photomultiplier and logic signals, and there are no duty cycle limita

tions or rate effects in the Normal Mode.

In the Inverting Mode, the 428F operates as a capacitively-coupled unit with a 400 μ sec time constant, recovering to the average non-inverted DC input level. In addition, the 428F exhibits duty-factor related base-line shifts equal to twice that of a normal AC-coupled circuit. Thus, although the Inverting Mode provides great versatility and convenience in application, some care must be exercised when using this mode with wide inputs or at high rates.

Model 429A

The Model 429A is a multi-functional fast logic module designed to fulfill a wide variety of signal handling needs. It combines the operations of TTL-to-NIM level translation, logic fan-in, logic fan-out, and polarity inversion in one low-cost module. Each of the 4 channels of the 429A has four inputs which accept both NIM and TTL levels. This is particularly useful for test setups and experiments where digital triggers and/or control logic may use both signal standards.

Each channel of the 429A includes four independent logic inputs, four normal logic outputs, and two complementary logic outputs. Channels may be paralleled to provide up to 16 inputs and 24 outputs by means of a front-panel switch. An efficient circuit design holds power dissipation of the entire module to within the NIM standard.

The 429A eliminates the extra cabling and time delay involved when conventional fan-ins and fan-outs must be cascaded. In addition, it eliminates the common use of expensive logic units to perform logical ORing with adequate fan-out. The ability to conveniently parallel channels permits the 429A a degree of flexibility and efficiency heretofore unavailable.

Inputs are 50 ohm impedance for NIM or TTL signals. Unused inputs need not be terminated. Inputs may be driven with single or double amplitude NIM signals or TTL signals without affecting output amplitude. The three pairs of bridged outputs are direct-coupled current sources which deliver -32 mA into two 50 ohm loads. Output duration is equal to the logical OR of the input durations.

The circuitry of the 429A is completely direct-coupled and compatible with either normal or complementary logic signals in any duty ratio. Channel paralleling is accomplished by means of a single front-panel locking switch that is not in the signal path and hence permits switching with minimal effect on signal fidelity. Front-panel LEDs located between channels light to indicate channels that are combined, providing a clear, easily-interpreted display of the unit's status.

SPECIFICATIONS

Model 428F

Number of Sections: 4 independent sections with 4 inputs per section. A front-panel switch on each section which selects normal or inverting mode.

INPUT

No. of Inputs: 4 per channel; 50 ohm ± 5 %; direct-coupled in non-inverting mode. In inverting mode operates as a capacitively-coupled unit with a 400 μ sec time constant. Inputs protected against 0.5 μ sec transient overloads, up to ± 5 A.

Signal Level Requirements: Positive or Negative analog signals.

Reflection Coefficient: Less than 7% for inputs of 2 nsec rise time.

OUTPUT

No. of Outputs: 4 per channel; reverse-terminated; direct-coupled; for optimum output shape, three outputs must be terminated into 50 ohm. For proper operation, at least 2 outputs must be terminated on each channel used.

Output Levels: Linear range in normal mode is limited to: +100 mV to > -2 V, with maximum amplitude of > -2 V into 50 ohm and gain of $1.0 \pm 2\%$ up to -2 V. Linear range in inverting mode: +100 mV to > -1.5 V, with maximum amplitude of > -1.5 V into 50 ohm and gain of approximately 0.98 up to -1.5 V.

Rise Times: 2.5 nsec, 10% to 90%, with outputs terminated in 50 ohm.

Fall Times: 4 nsec 10% to 90%, with outputs terminated in 50 ohm. Integral non-linearity: $\pm 1\%$ up to -1 V.

MISCELLANEOUS

DC Offset: Adjustable with front-panel potentiometer. Care should be taken to readjust DC level whenever the Normal/Inverting switch is used. Stability: $< 60 \mu\text{V}/^\circ\text{C}$ in normal and inverting modes.

Output DC Level Voltage Coefficient: $< 25 \mu\text{V}/1\%$ variation of any supply voltage in normal and inverting modes.

Interchannel Isolation: 40 dB.

Noise: $< 750 \mu\text{V}$ R.M.S.

Overload Recovery: Approximately 2 nsec with four simultaneous NIM level (-800 mV) inputs.

GENERAL

Rate: DC to 100 MHz typically.

Input/Output: < 6 nsec.

Duty Cycle Limitations: None for direct-coupled outputs.

Packaging: RF-shielded AEC/NIM #1 module. Lemo-type connectors.

Power Requirements: 80 mA at +24 V, 80 mA at -24 V, 160 mA at +12 V, 160 mA at -12 V.

Model 429A

Number of Sections: 4; may be cascaded by means of front-panel switch to form dual 8-fold fan-in/12-fold fan-out or single 16-fold fan-in/24-fold fan-out, with LED indication.

INPUT

Number of Inputs: 4 per section; 50 ohm $\pm 5\%$; direct-coupled. Quiescent level is 0 V DC.

Signal Level Requirements: Standard NIM logical 1 input levels, -12 mA to -36 mA; Standard TTL logical 1 input levels, +2 V to +5 V; signal width must be 4 nsec minimum, FWHM.

Reflection Coefficient: $< 10\%$ for input rise times 2 nsec.

OUTPUT

Number of Outputs: 4 normal (2 bridged pairs); 2 complementary (1 bridged pair).

Output Levels: Normal NIM (quiescently 0 mA, -32 mA into two 50 ohm loads during output). Complementary NIM (quiescently 32 mA into two 50 ohm loads, 0 mA during output). Duration is equal to the logical sum of the input durations.

Rise Times: 2.3 nsec typical, 2.8 nsec maximum.

Fall Times: 2.3 nsec typical, 2.8 nsec maximum.

MISCELLANEOUS

Time Variation of Output with Input Amplitude: < 1 nsec worst case between inputs of -600 mV and -1.6 V; typically < 0.5 nsec.

Time Variation Between Outputs: 4 channels, 4 x 6 operation: < 0.2 nsec; 2 channels, 8 x 12 operation: < 0.4 nsec; 1 channel, 16 x 24 operation: < 0.9 nsec.

GENERAL

Rate: DC to 100 MHz.

Input/Output: < 6.5 nsec.

Duty Cycle Limitations: None.

Packaging: RF-shielded AEC/NIM #1 module. Lemo-type connectors.

Power Requirements: 35 mA at +12 V, 50 mA at -12 V, 295 mA at +6 V, 460 mA at -6 V.

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