

NSCL-ELECTRONIC

MODEL 429A

LOGIC FAN-IN/FAN-OUT

August, 1983

WARRANTY

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IF ANY FAILURE OCCURS, notify LeCroy Research Systems Corp., or the nearest service facility, giving full details of the difficulty, and include the Model number, serial number, and FAN (Final Assembly Number) or ECO (Engineering Change Order) number. On receipt of this information, service data or shipping instructions will be forwarded to you. On receipt of the shipping instructions, forward the instrument, transportation prepaid. A Return Authorization number will be given as part of shipping instructions. Marking this RA number on the outside of the package will insure that it goes directly to the proper department within LeCroy. Repairs will be made at the service facility and the instrument returned, transportation prepaid.

ALL SHIPMENTS OF LeCROY INSTRUMENTS FOR REPAIR OR ADJUSTMENT should be made via Air Freight or "Best Way" prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

IN EVENT OF DAMAGE IN SHIPMENT to original purchaser the instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the LeCroy factory or the nearest service facility).

DOCUMENTATION DISCREPANCIES OR OMISSIONS. LeCroy Research Systems is committed to providing unique, reliable, state-of-the-art instrumentation in the field of high-speed data acquisition and processing. Because of this commitment, the Engineering Department at LeCroy is continually refining and improving the performance of products. While the actual physical modifications or changes necessary to improve a model's operation can be implemented quite rapidly, the corrected documentation associated with the unit usually requires more time to produce. Consequently, this manual may not agree in every detail with the accompanying unit. There may be small discrepancies that were brought about by customer-prompted engineering changes or by changes determined during calibration in our Test Department. These differences usually are changes in the values of components for the purposes of pulse shape, timing, offset, etc., and only rarely include minor logic changes. Where any such inconsistencies exist, please be assured that the unit is correct and incorporates the most up-to-date circuitry. Whenever original discrepancies exist, fully updated documentation should be available upon your request within a month after your receipt of the unit.

ANY APPLICATION OR USE QUESTIONS, which will enhance your use of this instrument will be happily answered by a member of our Engineering Services Department, telephone 914-425-2000 or your local distributor. You may address any correspondence to:

LeCroy Research Systems Corp., 700 S. Main Street,
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LeCroy Research Systems Corp., 14800 Central S.E.,
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A T T E N T I O N

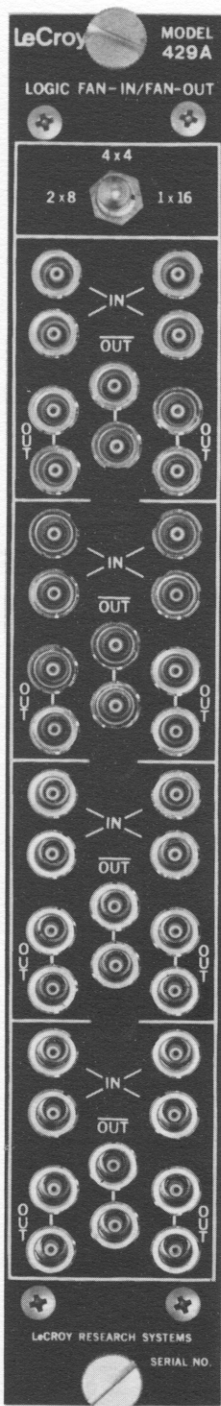
CRATE POWER SHOULD BE TURNED OFF DURING INSERTION AND REMOVAL OF UNIT TO AVOID POSSIBLE DAMAGE CAUSED BY MOMENTARY MISALIGNMENT OF CONTACTS.

SEE BACK POCKET OF MANUAL FOR SCHEMATICS, PARTS LISTS, AND ADDITIONAL ADDENDA WITH ANY CHANGES TO MANUAL.

A T T E N T I O N

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NIM Model 429A

Quad Mixed Logic Fan-In/Fan-Out

The LeCroy Model 429A is a *multifunctional* 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 four channels of the Model 429A has four inputs which accept both NIM and TTL levels. This is particularly important for present generation experiments involving MWPC systems and elaborate digital triggers.

Each channel of the Model 429A contains 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 the power dissipation of the entire module to within the NIM standard.

The Model 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 OR-ing with adequate fan-out. The ability to conveniently parallel channels permits the 429A a degree of flexibility and efficiency heretofore unavailable.

Inputs are 50 Ω 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 Ω loads. Output duration is equal to the logical sum of the input durations.

The circuitry of the Model 429A is complete 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 lamps located between channels light to indicate channels that are combined, providing a clear, easily-interpreted display of the unit's status.

September 1977

Innovators in Instrumentation

SPECIFICATIONS

NIM Model 429A

QUAD MIXED LOGIC FAN-IN/FAN-OUT

Number of Sections: Four; 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 CHARACTERISTICS

Number of Inputs: Four per section.

Impedance: $50 \Omega \pm 5\%$.

Reflections: $< 10\%$ for input risetimes ≥ 2 nsec.

Quiescent Level: 0 volts 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 Requirements: 4 nsec minimum, FWHM.

Coupling: Direct.

OUTPUT CHARACTERISTICS

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

Output Levels: Normal: quiescently 0 mA, > 28 mA into two 50Ω during outputs. Complementary: quiescently, > 28 mA into two 50Ω loads, 0 mA during output.

Risetimes and Falltimes: 2.3 nsec typical, 2.8 nsec maximum.

Duration: Equal to the logical sum of the input durations.

Time Variation of Output with Input Amplitude: < 1 nsec worst case between inputs of -600 mV and -1.6 volts; 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: > 100 MHz.

Stage Delay: < 6.5 nsec.

Duty Cycle Limitations: None.

Packaging: Single-width AEC/NIM module; in conformance with AEC standard for nuclear modules (AEC Report TID-20893); Lemo-type connectors.

Current Requirements: $+12$ V at 35 mA $+6$ V at 295 mA
 -12 V at 50 mA -6 V at 460 mA

SECTION 2

FUNCTIONAL DESCRIPTION

2.1 General

Each channel of the four-channel Model 429A Logic Fan-In/Fan-Out can be divided into two basic sections, the 4-fold Fan-In and the four normal-two complement Fan-Out. Also, there is a cross-coupling network to allow merging of channels. These sections are easily identified on the schematic at the end of this manual.

The following is a general description of these sections.

2.2 Four-Fold Fan-In

Each Fan-In is composed of a 25 mA differential stage, having four parallel transistors with independent input bases in place of the normal single "off" transistor. Any time that one or more of the inputs (transistor bases) are brought below the reference level, the normally "on" transistor base will switch the 25 mA of emitter current to the common collector, driving the terminated 90 Ω strip line with a 1.1 V pulse. This signal is then buffered by an emitter follower. In addition to driving its own output stage, the follower allows emitter-ORing of adjacent Fan-In stages, and is therefore able to drive adjacent output stages.

2.3 Fan-Out

Each Fan-Out stage is composed of an emitter follower driving a terminated 90 Ω strip line which in turn drives two differential stages. Each differential stage provides 32 mA of output current during the pulse which can be used to drive two 50 Ω loads per stage. The output of one of the complementary transistors (normally "on") is also brought to the front panel and can drive two 50 Ω loads. All outputs are coupled to ground with three Schottky diodes to voltage-clamp the outputs at approximately -1.5 Volts if no output terminations are used.

2.4 Cross-Coupling Section

Four FET switches are used to couple the channels into two groups of two or one group of four. A front panel switch is used to turn the proper FET's on or off, (along with associated front panel LED's), by connecting the appropriate FET's and LED's (through resistors) from the -12 Volt level they are at in the individual channel (4 x 4) mode to +12 Volts for cross connecting of channels. When cross connected, the output emitter followers of the input stage are emitter-ORed, so any one can drive the common "cross bus", and the input emitter followers of the output stages provide high impedance pickoffs for each of the output stages tied to the common "cross bus".

LRS	PART NO	DESCRIPTION	QTY
102	245 103	CAP CERA DISC 25V .01 UF PT-FDCL-1/32 LEADS 3/8 AWG 22	47
102	944 *75	CAP CERA DISC 1KV 7.5 PF 10% S2L	8
142	124 476	CAP TANT DIP CASE 47 UF 6.3V 20% .335 X .394	8
142	824 685	CAP TANT DIP CASE 6.8 UF 35V 20% .256 X .374	9
161	*30 **0	RES COMP ZERO OHMS	16
161	225 102	RES COMP 1/8W 5% 1 K	11
161	225 104	RES COMP 1/8W 5% 100 K	2
161	225 122	RES COMP 1/8W 5% 1.2 K	5
161	225 151	RES COMP 1/8W 5% 150 OHMS	4
161	225 153	RES COMP 1/8W 5% 15 K	4
161	225 431	RES COMP 1/8W 5% 430 OHMS	4
161	225 510	RES COMP 1/8W 5% 51 OHMS	4
161	225 512	RES COMP 1/8W 5% 5.1 K	4
161	225 560	RES COMP 1/8W 5% 56 OHMS	16
161	225 680	RES COMP 1/8W 5% 68 OHMS	4
161	225 910	RES COMP 1/8W 5% 91 OHMS	8
161	335 152	RES COMP 1/4W 5% 1.5 K	1
161	335 200	RES COMP 1/4W 5% 20 OHMS	2
161	335 301	RES COMP 1/4W 5% 300 OHMS	4
161	335 302	RES COMP 1/4W 5% 3 K	2
161	335 471	RES COMP 1/4W 5% 470 OHMS	4
161	335 472	RES COMP 1/4W 5% 4.7 K	1
161	335 820	RES COMP 1/4W 5% 82 OHMS	8
161	335 911	RES COMP 1/4W 5% 910 OHMS	3
161	445 *27	RES COMP 1/2W 5% 2.7 OHMS	1
161	555 151	RES COMP 1W 5% 150 OHMS	1
208	*11 **3	IC SINGLE OP AMP LM301AN DIP-8	2
230	110 **5	DIODE SWITCHING 1N4448	26
253	*10 835	DIODE HOT CARRIER HP2835 H-P CASE 15	12
256	*10 102	DIODE LED (RED) DIFF LENS WIREWRAP LEADS	3
270	130 **2	TRANSISTOR NPN A 430 TO-72	24
270	150 **1	TRANSISTOR NPN 2N3053 TO-5	1
275	170 **2	TRANSISTOR PNP 2N5771 TO-92	4
275	170 **3	TRANSISTOR PNP A441 TO-72/FORMERLY SAB4113 (TI)	26
275	190 **1	TRANSISTOR PNP PWR 2N3740 TO-66	1
280	180 **1	TRANSISTOR FET 'N' U1897 TO-106	4
300	*10 **1	BEAD SHIELDING FERRITE	44
300	*20 **1	BEAD SHIELDING "1/2" SIZE	8
300	*50 **1	CHOKE FERRITE SINGLE LEAD	4
400	*10 **8	SOCKET IC ST DIP-8 .300 SEP/TIN CONT/COPP-NICKEL PINS	2
402	*30 **0	CONNECTOR CO-AXIAL LEMO	40
402	*30 **2	SPANNER NUT SMALL OD LEMO	40
402	*30 **3	GROUND LUG NONLOCK LEMO	6
405	112 **1	CONNECTOR BLOCK (FIN) 42 *MIXED*	1
405	212 **2	GUIDE FIN (MALE) CADMIUM PLATED BRASS	1
405	213 **1	GUIDE FIN (MALE) BRASS	1
405	312 **1	GUIDE FIN (FEMALE) CADMIUM PLATED BRASS	2
405	410 *16	CONNECTOR PIN (MALE)	A/R
405	613 **1	CONNECTOR HOOD CADMIUM PLATED STEEL/INT CLOSED END	1
410	112 203	SWITCH TOGGLE SPDT ON-OFF-ON/3-POS LOCKING	1

MODEL NO 429A
ECON 1007

LOGIC FAN-IN/FAN-OUT

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LRS PART NO	DESCRIPTION	QTY
471 112 **1	BUS BAR 2-LAYER/5 GROUPS ON 1.00 CENTERS	2
500 120 **2	TRANSIPAD "LARGE"	1
519 110 **2	BUSHING LED BLK MP 52	3
540 103 102	SIDE COVER NIM LEFT	1
540 103 103	SIDE COVER NIM RIGHT	1
540 104 101	WRAPAROUND NIM SIZE #1 WITH BIN GATE	1
540 105 **1	BRACKET NIM WRAP SIZE #1	2
540 109 100	SWITCH HOLE PATTERN COVER	1
555 611 **1	CAPTIVE SCREW 6-32	2
555 621 **2	CAPTIVE SCREW RETAINER NICKEL PLATED BRASS	2
567 256 **4	SCREW FLAT PHIL 2-56X1/4	4
585 141 237	RIVET "POP" ALU 1/8X.237 BUTTONHEAD 1/8 DIA .237 LONG	2
710 429 *13	PC BD PREASS'Y 429A	1
720 429 *13	FRONT PNL PREASS'Y 429A 540102001(1)555621002(2)	1

NOTE: 1
NOTE: 2
NOTE: 3
NOTE: 4
NOTE: 5
NOTE: 6
NOTE: 7
NOTE: 8
NOTE: 9
NOTE: 10
NOTE: 11
NOTE: 12
NOTE: 13
NOTE: 14
NOTE: 15

MODEL NO P429A
LAST REVISION NO 1006
TRIGGER NO 2005

429A PLUG-INS
REVISION DATE 12-Aug-80
TRIGGER DATE 15-Aug-80

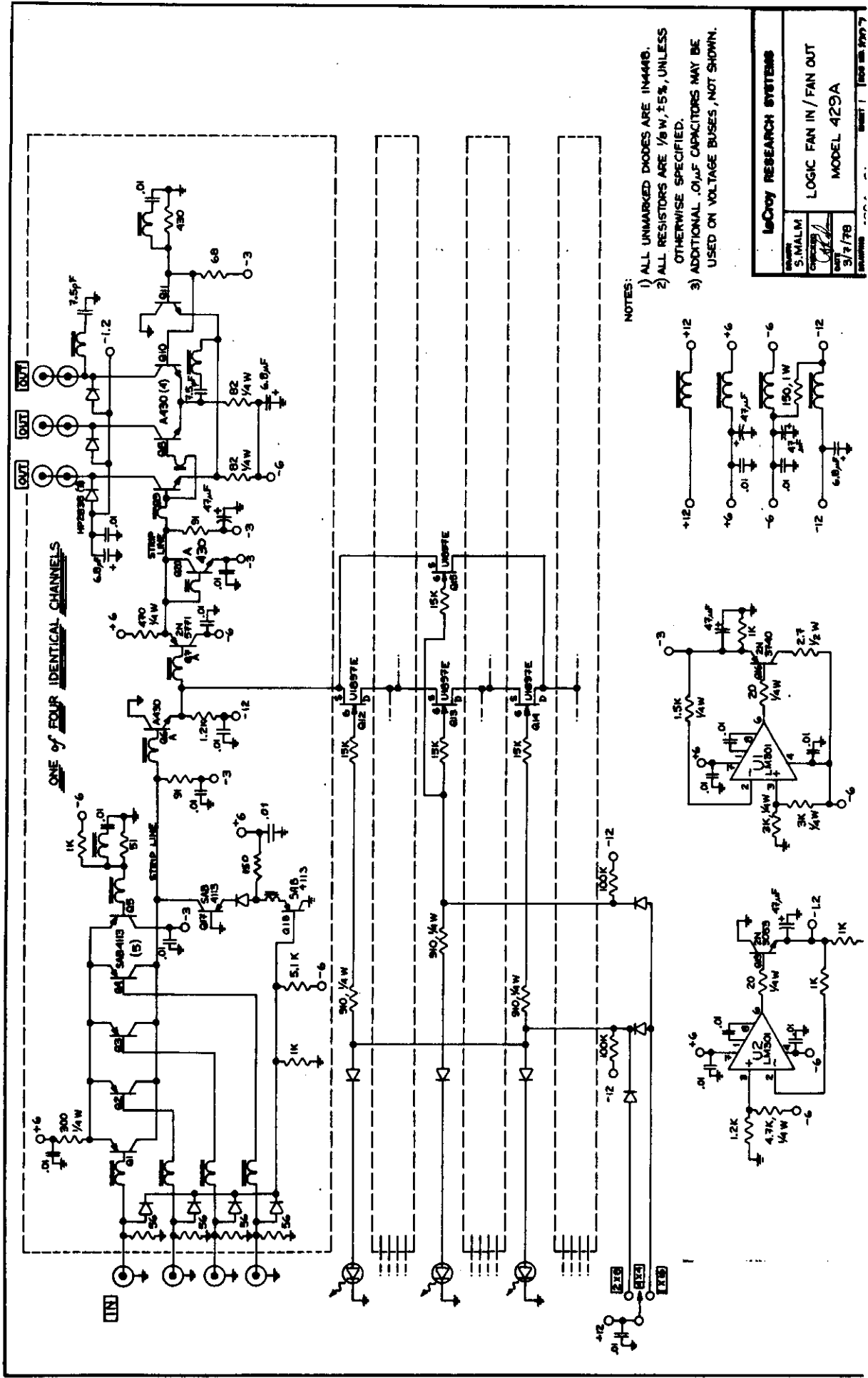
PRINTED 15-Aug-80

208 *11 **3 IC SINGLE OP AMP LM301AN DIP-8

2

- NOTES 1
- NOTES 2
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- NOTES 7
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- NOTES 15

Bye



ONE OF FOUR IDENTICAL CHANNELS

- NOTES:
- 1) ALL UNMARKED DIODES ARE 1N4448.
 - 2) ALL RESISTORS ARE 1/8 W, ±5%, UNLESS OTHERWISE SPECIFIED.
 - 3) ADDITIONAL .01 μF CAPACITORS MAY BE USED ON VOLTAGE BUSES, NOT SHOWN.

McGraw Hill	
S. MALLM	3/7/78
LOGIC FAN IN / FAN OUT MODEL 429A	