MODEL 825
QUINT TIMING DISCRIMINATOR

Institut de
PHYSIQUE NUCLÉAIRE
Université de Lausanne
Bâtiment des Sciences Physiques
Dorigny,
1015 LAUSANNE

Rev: November 23, 1981

WARRANTY

LeCROY RESEARCH SYSTEMS CORP. warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of 1-year from date of purchase. Custom monolithics and hybrids sold separately and all spare or replacement parts are warranted for 90-days. This warranty extends only to the original purchaser. This warranty shall not apply to fuses, disposable batteries or any product or parts which have been subject to misuse, neglect, accident or abnormal conditions of operations.

In the event of failure of a product covered by this warranty, LeCroy will repair and calibrate an instrument returned to the factory or an authorized service facility within 1 year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within one year of the original purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident or abnormal conditions or operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

The foregoing warranty is in lieu of all other warranties, express or implied, including but not limited to any implied warranty of merchantability, fitness or adequacy for any particular purpose or use. LeCroy Research Systems Corp., shall not be liable for any special, incidental or consequential damages, whether in contract, tort or otherwise.

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,
Spring Valley, New York 10977, ATTN: Engineering Services Dept.

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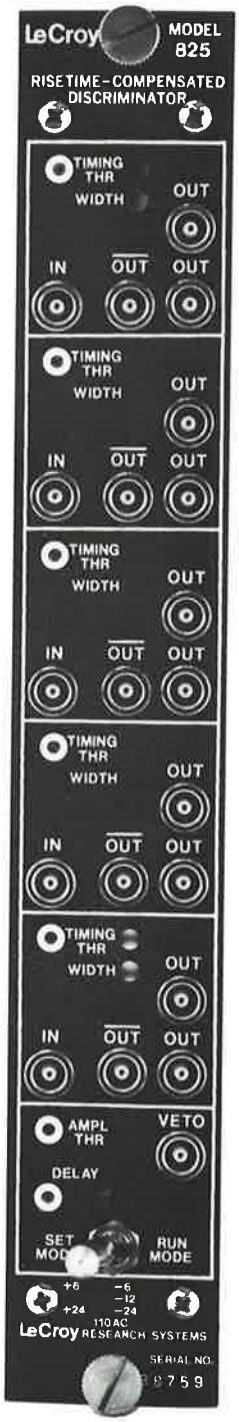
West Germany

A T T E N T I O N

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

A T T E N T I O N

TECHNICAL DATA



NIM Models 825 and 825E

Risetime-Compensated Quint Discriminators

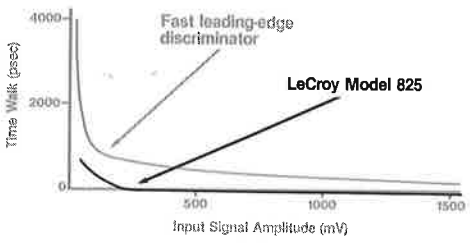
- No clumsy delay cables
- Excellent timing from simple 2-threshold scheme
- Five channels per NIM module
- Ease of set-up
- 100 MHz performance
- Hybrid circuitry
- Common veto

The LeCroy Models 825 and 825E are five-channel discriminators designed for critically-timed coincidence applications and for use with time-of-flight detector arrays. The instruments use the dual-threshold timing method which offers excellent performance, ease of operation, and a simple, reliable design. The Model 825 employs 110 VAC in addition to the ±6 V, ±12 V, and −24 V NIM supplies. The Model 825E differs only in that it does not employ 110 VAC.

The 825 circuit utilizes the LeCroy Model LD701 dual-threshold hybrid. The timing technique employs a lower-level Timing Threshold per channel and an upper-level Amplitude Threshold common to all five channels. Using this method, slewing effects are minimized in direct proportion to the ratio of the two thresholds. Typical slewing in comparison with a leading edge discriminator is shown below.

Each channel of the 825 offers two 16 mA NIM outputs and one NIM complement. The crisp 1.5 nsec risetime and falltime properties help preserve the excellent timing characteristics of the 825. Unused outputs may be unterminated when not in use without any detrimental effects on output pulse shape.

To set up the 825, the delay of the timing discriminator output must be set equal to the pulse risetime. A front-panel ten-turn delay potentiometer allows the delay to be set and read out by the front-panel test point (100 mV/nsec). When the set mode is selected via the Run/Set switch, the amplitude discriminators are removed from the circuits allowing the timing thresholds of all channels to be set. Upon setting the common amplitude threshold, the 825 is adjusted and ready for use.



March 1980

Innovators in Instrumentation

LeCROY RESEARCH SYSTEMS CORPORATION • 700 SOUTH MAIN STREET • SPRING VALLEY, N.Y. 10977
TWX: 710-577-2832 CABLE: LERESCO TELEPHONE: (914) 425-2000

SPECIFICATIONS
NIM Models 825 and 825E
RISETIME-COMPENSATED DISCRIMINATORS

Signal Input: One per channel. Front-panel Lemo connectors. Input impedance 50 Ω ±1%. Protected to ±5 A for 0.5 μsec. Reflections <3% for pulse risetimes of ≥3 nsec. Offset <2 mV.

CONTROLS

Threshold: Timing threshold: one multiturn potentiometer per channel. Front-panel screwdriver-adjustable over the range −5 mV to −50 mV. Front-panel test point supplies DC level 10X threshold (±5%) with a temperature coefficient of 0.4%/°C from 0°C to 70°C.

Amplitude threshold: one multiturn potentiometer common to all five channels. Front-panel screwdriver-adjustable over the range −30 mV to −600 mV. Front-panel test point supplies DC level 10X threshold.

Delay: Analog delay of lower level discriminator output. Should be set approximately equal to input pulse risetime. Common multiturn potentiometer front-panel delay control adjustable over the range 2.0 nsec to 30 nsec. Front-panel test point gives DC level 100 mV/sec ±5%.

Output Width: One multiturn potentiometer per channel. Adjustable over the range 4 nsec to 100 nsec.

Mode Switch: Common switch used for setup. In SET mode, upper level is defeated, making the 825 a conventional leading-edge device. In the RUN mode, the 825 acts as a dual-threshold device.

Bin Gate: Slow gate via rear connector and rear-panel ON-OFF switch; risetimes and falltimes approximately 50 nsec; clamp to ground from +5 V inhibits; direct-coupled.

Veto: Front-panel connector permits simultaneous inhibiting of all channels; 50 Ω required NIM-level signal (> −600 mV); direct-coupled, must overlap the leading edge of input signal plus the delay setting. Minimum width 10 nsec.

OUTPUT CHARACTERISTICS

3 NIM-level voltage outputs, two, quiescently 0 volts, −800 mV during output; one, complementary −16 mA quiescently, 0 mA during output; duration 5 nsec to 100 nsec, continuously variable via front-panel screwdriver control; risetimes and falltimes typically 1.5 nsec (max. 2.0 nsec), 10% to 90%. Width stability better than ±0.25%/°C.

GENERAL

Maximum Rate: >100 MHz, input and output.[1]

Double-Pulse Resolution: Less than 9 nsec at minimum width setting.[1]

Time Slewing: ≤500 psec from half fire; measured with a 1.8 nsec risetime; threshold 30/5 mV.

Walk: < ±125 psec 100:1 dynamic range. (−50 mV to −5 V) with a risetime ≤1 nsec and thresholds of 50/5 mV.

Input-Output Delay: 7.5 nsec + internal delay setting.

Multiple-Pulsing: None; one and only one output pulse of preset duration is produced for each input pulse regardless of input pulse amplitude or duration.

Packaging: In RF-shielded AEC/NIM #1 module (AEC Report #TID-20893); Lemo-type connectors.

Current Requirements:

Model 825		Model 825E	
− 6 V at 500 mA	+ 6 V at 10 mA	− 6 V at 850 mA	+ 6V at 10 mA
−12 V at 160 mA	+24 V at 30 mA	−12 V at 160 mA	+24 V at 30 mA
−24 V at 85 mA	110 VAC at 25 mA	−24 V at 85 mA	

1. For $\frac{\text{threshold amplitude}}{\text{threshold timing}} \leq 3$

SPECIFICATIONS SUBJECT TO CHANGE.

LeCROY MODEL 825
Quint Timing Discriminator

General Description

The Model 825 employs a dual threshold discriminator to minimize the effects of leading edge pulse walk. A block diagram of one channel is shown in Figure 1. Logic signals are generated when the input crosses a low (Timing) threshold and a higher (Amplitude) threshold. The Model 825 produces an output only if the amplitude discrimination level is exceeded. Timing is with respect to the low threshold crossing.

The two discriminator signals, T and A, are used to trigger the output stage of the Model 825. (See Figure 2.) In order to account for the time difference between the two threshold crossings, it is necessary to delay the Timing signal with respect to the Amplitude signal generating a delayed timing signal, D. An RC delay is employed. The Amplitude signal arms the timing stage allowing the delayed timing signal to fire the output pulse, N. If A is not present, receipt of D will not trigger an output.

When the 825 is optimally adjusted, the Timing Threshold, V_T, is set slightly above the noise level of the input signal and the delay adjusted to be equal to the zero to 100% (horizontal tangent) risetime of the input pulse. If the time is set incorrectly, the Time and Amplitude signals will arrive at the timing stage at different times. This will cause an apparent increase in discriminator threshold.

Set Up

Adjust the Timing threshold in the Set Mode, selected by the front panel Mode switch. For this adjustment the Delay control should be set to zero (fully counterclockwise). Adjust the Timing threshold so it is set just above the noise (see Figure 2).

The Model 825 Delay must be adjusted for the risetime of the input signal. The Delay time may be measured via the front panel DC test point. The proportionality constant is 100 mV/nsec. As shown in Figure 2, the Delay should be set equal to the zero to 100% risetime. After both the Timing threshold and Delay adjustments are set, the 825 may be switched into the Run Mode and the Amplitude threshold adjusted as required.

June, 1979

ENGINEERING DEPARTMENT
LeCroy Research Systems Corp.
Spring Valley, New York

ADDENDA TO SPECIFICATIONS

Delay: Analog delay of lower level discriminator output. Should be set approximately equal to input pulse risetime. Common multiturn potentiometer front-panel delay control adjustable over the range 2 nsec to 30 nsec. Front-panel test point gives DC level 100 mV/nsec = ±5%.

ENGINEERING DEPARTMENT
LeCroy Research Systems Corp.
Spring Valley, New York

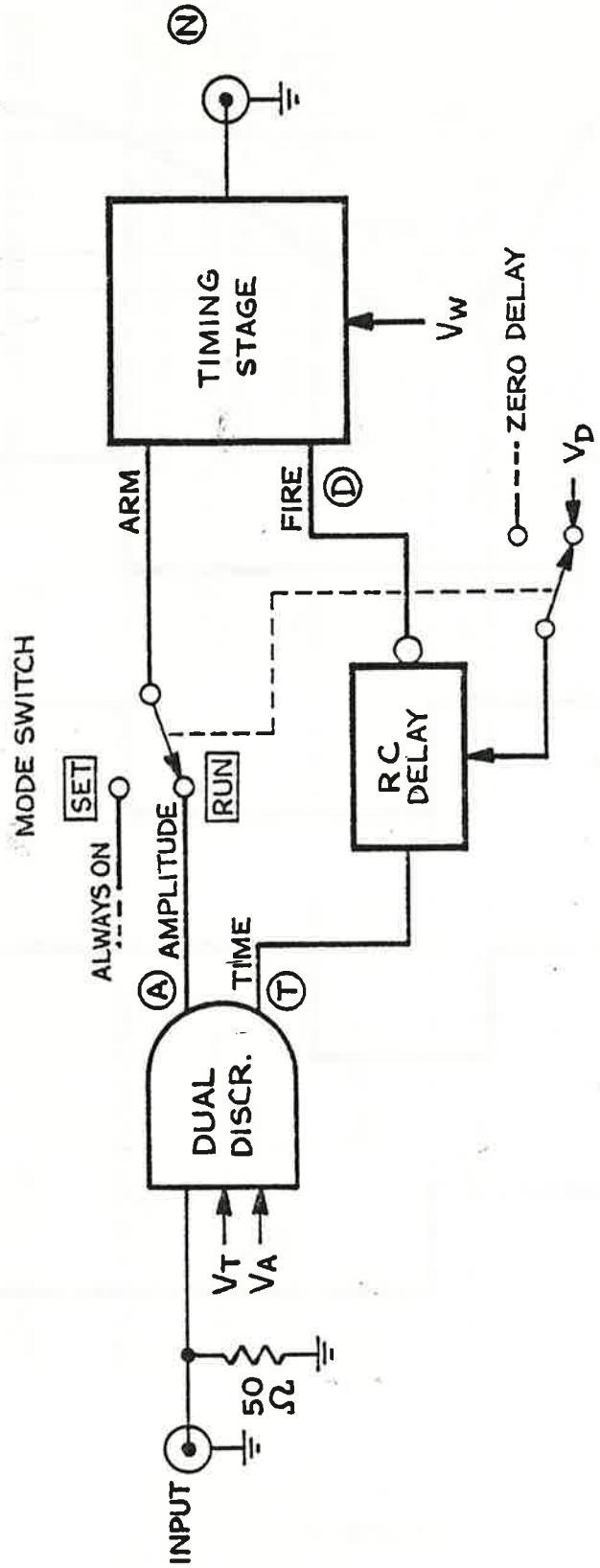


FIGURE 1

ENGINEERING DEPARTMENT
LeCroy Research Systems Corp.
Spring Valley, New York

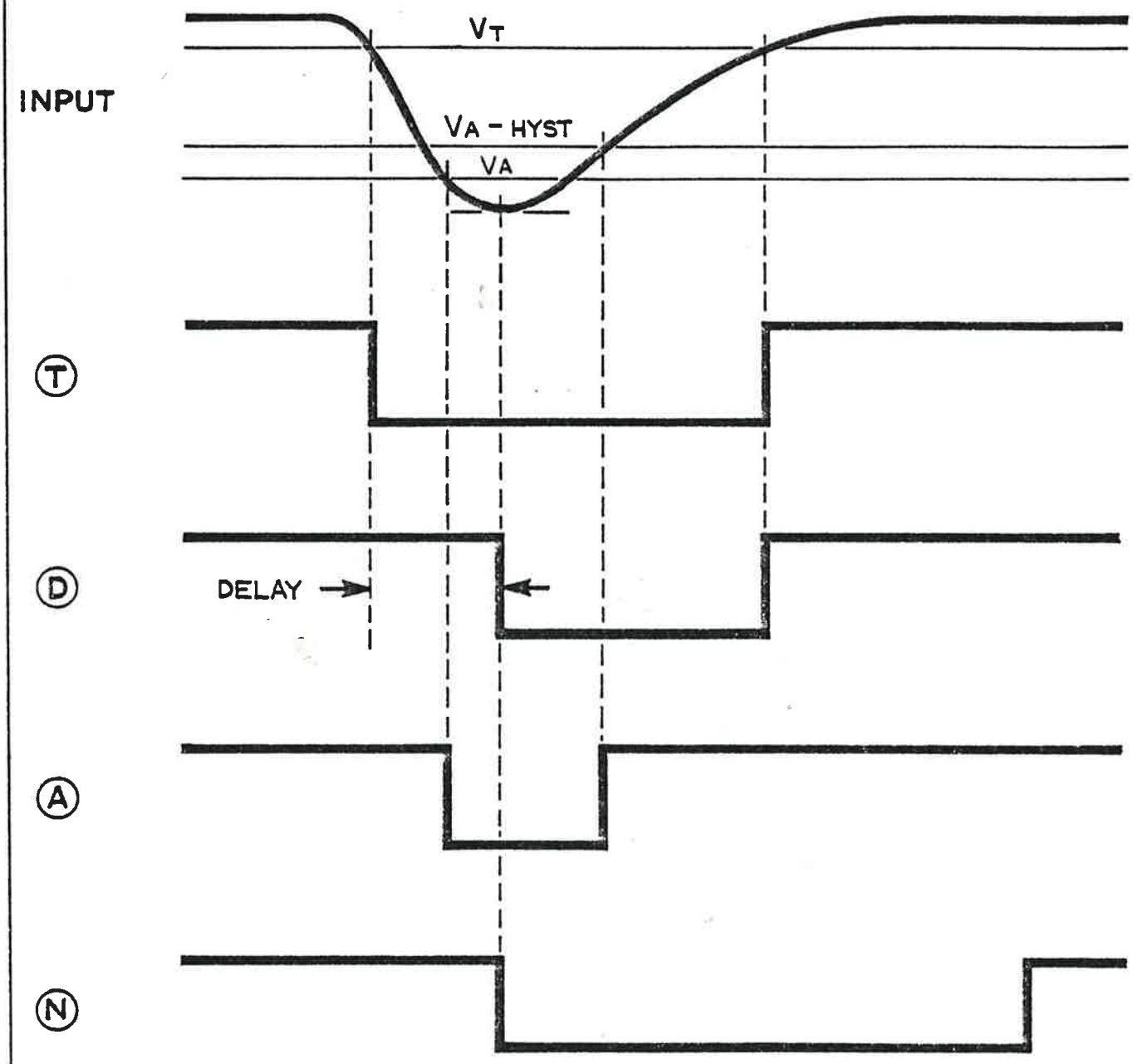
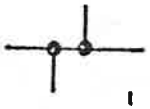


FIGURE 2

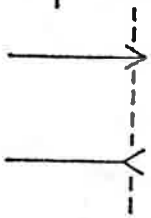
CONNECTION JUMPS TO SPECIFIED PAGE

LINE ENDING AT THE EDGE OF THE SHEET INDICATES CONTINUANCE ON ANOTHER SHEET.

NO CONNECTION

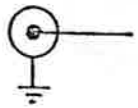


CONNECTION



MALE PIN OR CARD-EDGE CONTACT.

FEMALE PIN, SOCKET, OR CARD-EDGE CONNECTOR.

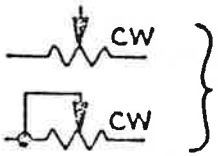


CO-AXIAL CONNECTOR

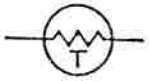
CONNECTION TO ANY GIVEN VOLTAGE.

FUSE

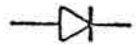
RESISTOR, VALUE IN OHMS



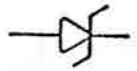
RESISTOR, VARIABLE (ANY TYPE)



RESISTOR, THERMAL (THERMISTOR)

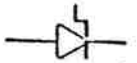


DIODE, SIGNAL OR RECTIFIER

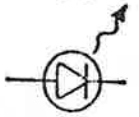


DIODE, ZENER

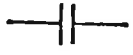
DIODE, TUNNEL



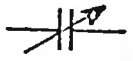
DIODE, SNAP



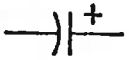
DIODE, LIGHT-EMITTING (LED)



CAPACITOR (CERAMIC, W/VALUE IN μF, UNLESS OTHERWISE SPECIFIED)



CAPACITOR, VARIABLE (VALUE IN pF, UNLESS OTHERWISE SPECIFIED)

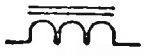


CAPACITOR, POLARIZED (VALUE IN μF/VOLTS, UNLESS OTHERWISE SPECIFIED)

AIR CHOKE

FERRITE BEAD, HALF

FERRITE BEAD, FULL



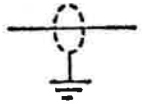
FERRITE CORE CHOKE

LeCroy RESEARCH SYSTEMS		
DRAWN S.MALM	STANDARD DRAFTING SYMBOLS, ELECTRONIC	
CHECKED GALLANT		
DATE 3/13/79		
DRAWING NUMBER:	SHEET 1	ECO NO

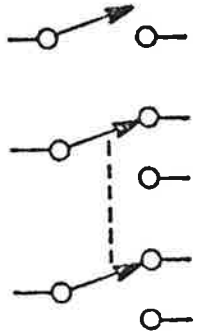
GROUND (ALSO USED AS SIGNAL GND.)

CHASSIS GND.

POWER GND.



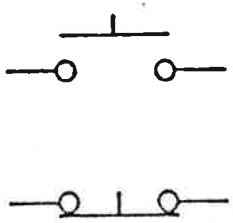
CO-AXIAL CABLE



SPST SWITCH

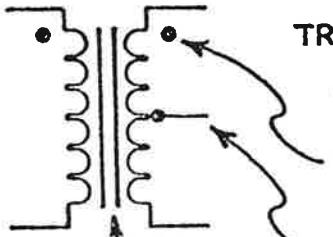
DPDT SWITCH

ROTARY SWITCH



NORMALLY OPEN MOMENTARY SWITCH

NORMALLY CLOSED MOMENTARY SWITCH



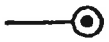
TRANSFORMER

BLACK DOT SHOWS PHASE OF WINDINGS

TAP (CENTER, UNLESS OTHERWISE SPECIFIED)

FERRITE OR IRON CORE

JUMPER



TEST POINT

LeCroy RESEARCH SYSTEMS	
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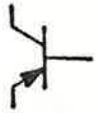
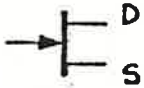
CHECKED GALLANT	
DATE 3/13/79	
DWG 2 NO	

NPN TRANSISTOR

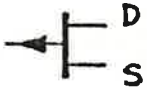


PNP TRANSISTOR

FIELD EFFECT TRANSISTORS (FET)



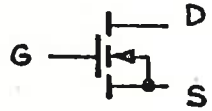
JUNCTION GATE
N CHANNEL
DEPLETION TYPE



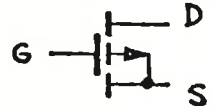
JUNCTION GATE
P CHANNEL
DEPLETION TYPE

INSULATED GATE
N CHANNEL
DEPLETION TYPE

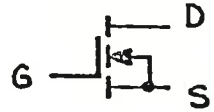
INSULATED GATE
P CHANNEL
DEPLETION TYPE



INSULATED GATE
N CHANNEL
ENHANCEMENT TYPE

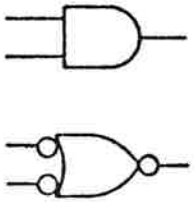


INSULATED GATE
P CHANNEL
ENHANCEMENT TYPE



VMOS (INSULATED V GATE)
N CHANNEL
ENHANCEMENT TYPE

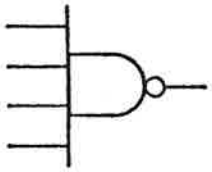
LeCroy RESEARCH SYSTEMS		
DRAWN S.MALM	STANDARD DRAFTING SYMBOLS, ELECTRONIC	
CHECKED GALLANT		
DATE 3/13/79		
DRAWING NUMBER:	SHEET 3	ECO NO



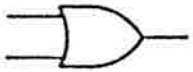
"AND" GATE

(EQUIVALENT)

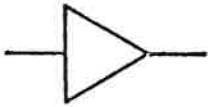
EXCLUSIVE OR GATE



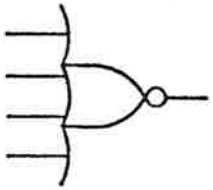
4-INPUT NAND



"OR" GATE

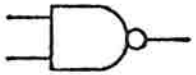


NON-INVERTING BUFFER

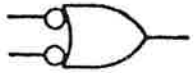


4-INPUT NOR

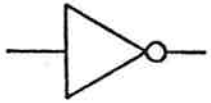
ASTERISK DRAWN INSIDE DEVICE REFERS TO OPEN-COLLECTOR OUTPUT



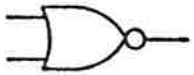
"NAND" GATE



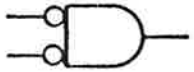
HYSTERESIS SYMBOL INDICATES SCHMITT TRIGGER



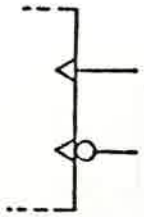
INVERTER OR INVERTING BUFFER



"NOR" GATE

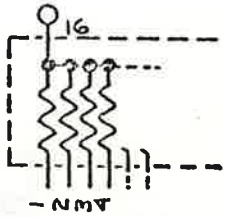


LeCroy RESEARCH SYSTEMS	
DRAWN S.MALM	STANDARD DRAFTING SYMBOLS
CHECKED GALLANT	
DATE 3/13/79	DIGITAL I.C.s -TTL

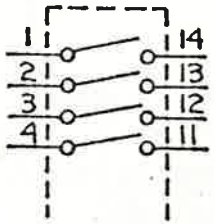


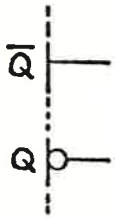
POS. EDGE-TRIGGERED CLK. INPUT

NEG. EDGE-TRIGGERED CLK. INPUT

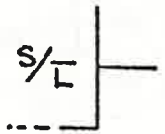


DIP RESISTOR ARRAYS AND SWITCHES ARE SHOWN AS ONE DEVICE.

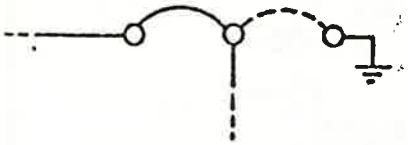




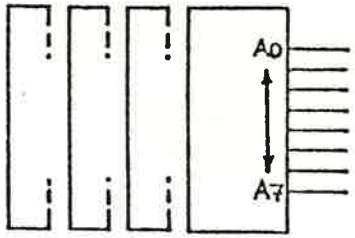
TO INDICATE INVERTED SIGNAL, USE EITHER THE BAR OVER THE SIGNAL NAME, OR THE INVERSION "BUBBLE", BUT NOT BOTH.



THIS LABEL INDICATES THAT A HIGH STATE ENABLES THE SHIFT MODE, AND A LOW STATE ENABLES THE LOAD MODE.

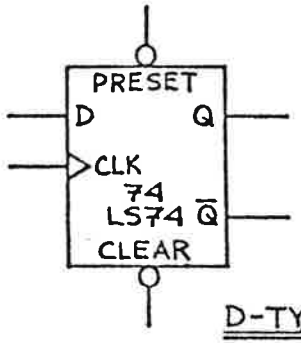


SHOW THE NORMAL (STD.) POSITION OF A JUMPER OPTION AS A SOLID ARC. OTHER POSITIONS ARE SHOWN AS DASHED ARCS.

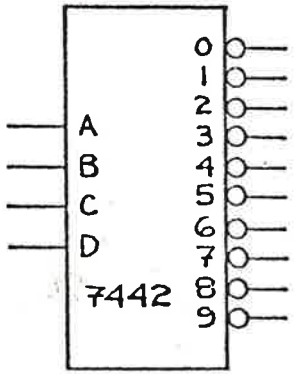


MEMORY ARRAYS (OR OTHER I.C.s) WITH COMMON CONNECTIONS MAY BE SHOWN IN THIS COMPRESSED FASHION.

LeCroy RESEARCH SYSTEMS		
DRAWN S.MALM	STANDARD DRAFTING SYMBOLS, ELECTRONIC	
CHECKED GALLANT		
DATE 3/13/79		
DRAWING NUMBER:	SHEET 5	ECO NO

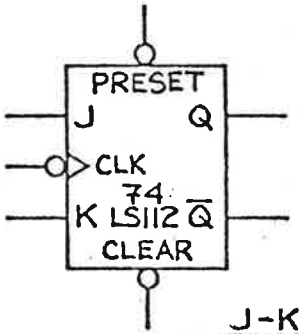


D-TYPE FLIP-FLOP

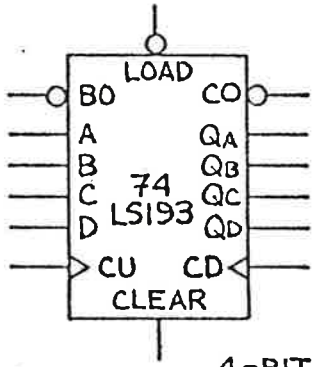


BCD TO DECIMAL DECODER

POSITIVE LOGIC CONVENTION IS OBSERVED.
THE HIGH STATE (LOGICAL "1") IS MORE POSITIVE THAN THE LOW STATE

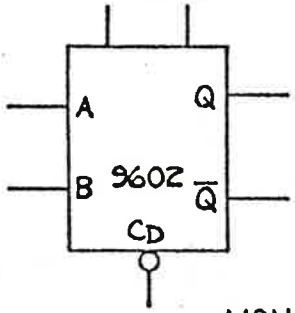


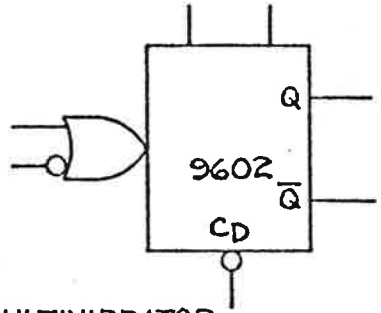
J-K FLIP-FLOP



4-BIT UP/DOWN COUNTER

THESE ARE EXAMPLES OF COMMONLY USED SYMBOLS FOR TTL DEVICES.

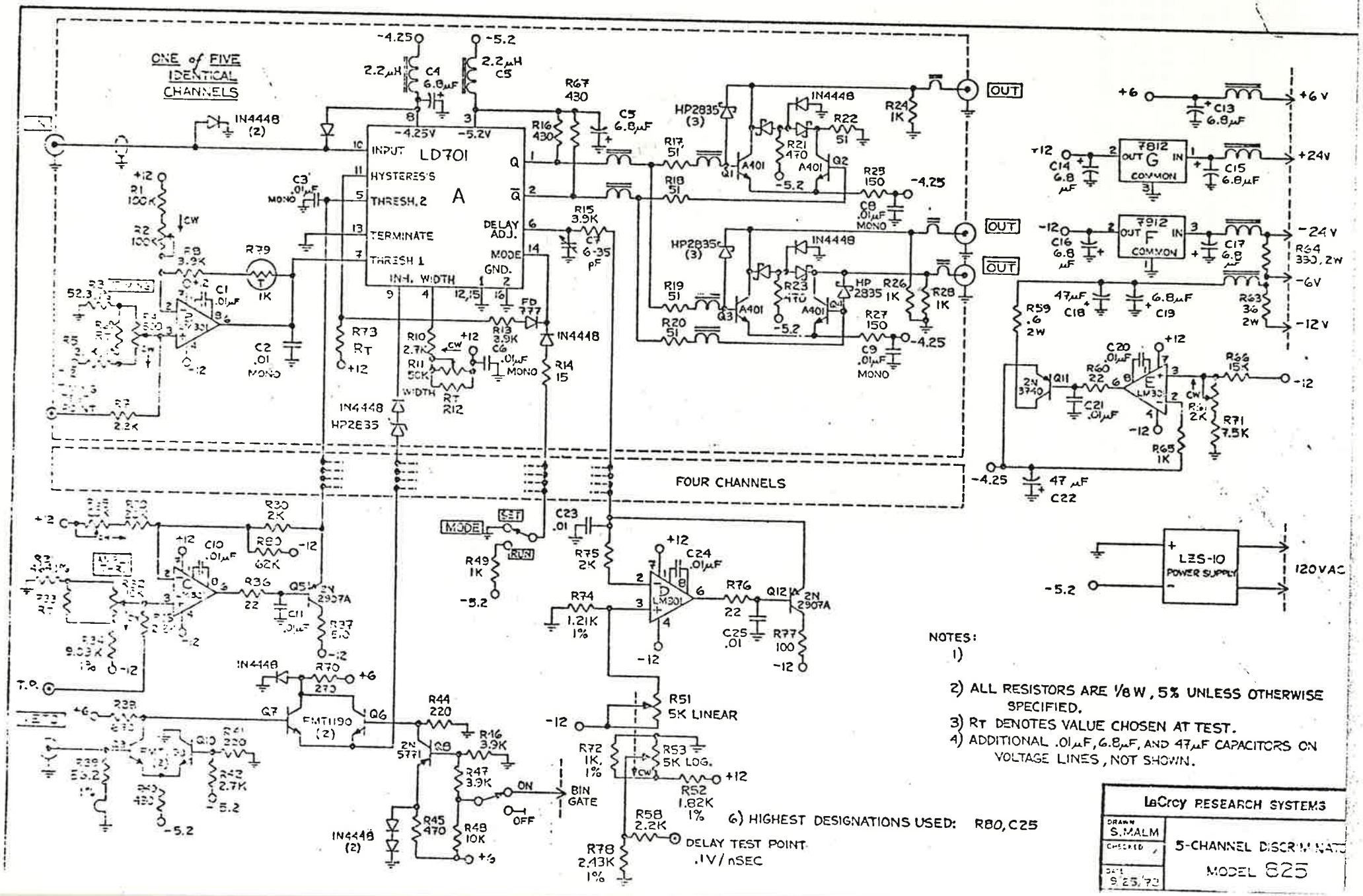




MONOSTABLE MULTIVIBRATOR

LeCroy RESEARCH SYSTEMS

DRAWN S.MALM	STANDARD DRAFTING SYMBOLS, DIGITAL I.C.s -TTL
CHECKED GALLANT	
DATE 3/13/79	


ONE of FIVE IDENTICAL CHANNELS
LD701
INPUT
HYSTERESIS
THRESH. 2
TERMINATE
THRESH 1
DELAY ADJ.
MODE
GND.
INH. WIDTH
OUT
FOUR CHANNELS
MODE
SET
RUN
WIDTH
BIN GATE
ON
OFF
DELAY TEST POINT
.1V/nSEC
LES-10
POWER SUPPLY
120VAC
7812
7912
LM301
2N 3740
2N 2907A
2N 5771
FMT1190
HP2835
IN4448
NOTES:
1)
2) ALL RESISTORS ARE 1/8 W, 5% UNLESS OTHERWISE SPECIFIED.
3) RT DENOTES VALUE CHOSEN AT TEST.
4) ADDITIONAL .01μF, 6.8μF, AND 47μF CAPACITORS ON VOLTAGE LINES, NOT SHOWN.
6) HIGHEST DESIGNATIONS USED: R80, C25
LeCroy RESEARCH SYSTEMS
DRAWN S.MALM
CHECKED
DATE 9/25/72
5-CHANNEL DISCRIMINATOR
MODEL 825