OPERATOR'S MANUAL

MODEL 4415A
16-CHANNEL PROGRAMMABLE
NON-UPDATING DISCRIMINATOR

May 1987

LeCroy

Innovators in Instrumentation

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CAUTION

COOLING

The high power dissipation of the 4415A requires that it be well cooled. Be sure fans move sufficient air to maintain exhaust air temperature at less than 50° C.

6 V POWER REQUIREMENT

The 4415A uses significant power from the -6 and +6 CAMAC power lines. Be sure that your crate can supply enough current to this and other modules, especially if multiple 4415A's are to be used.

OUTPUT DURING TEST MODE

In Test mode, the positive inputs of all 16 channels of the 4415A will be pulsed with a 400 mV signal. Ensure that any modules connected to the inputs on the discriminator and the threshold monitor will not suffer adverse effects because of this signal.

INSTALLATION

Crate power should be turned off during insertion or removal of modules to avoid possible damage caused by momentary misalignment of contacts.

SPECIFICATIONS

The information contained in this manual is subject to change without notice. The reference for product specification is the Technical Data Sheet effective at the time of purchase.

1 GENERAL INFORMATION

PURPOSE

This manual is intended to provide instruction regarding the setup and operation of the covered instruments. In addition, it describes the theory of operation and presents other information regarding its functioning and application.

The Service Documentation, packaged separately, should be consulted for the schematics, parts lists and other materials that apply to the specific version of the instrument as identified by its ECO number.

UNPACKING AND INSPECTION

It is recommended that the shipment be thoroughly inspected immediately upon delivery. All material in the container should be checked against the enclosed Packing List and shortages reported promptly. If the shipment is damaged in any way, please notify the Customer Service Department or the local field service office. If the damage is due to mishandling during shipment, you may be requested to assist in contacting the carrier in filing a damage claim.

WARRANTY

LeCroy warrants its instrument products to operate within specifications under normal use and service for a period of one year from the date of shipment. Component products, replacement parts, and repairs are warranted for 90 days. Software is thoroughly tested, but is supplied "as is" with no warranty of any kind covering detailed performance. Accessory products not manufactured by LeCroy are covered by the original equipment manufacturers warranty only.

In exercising this warranty, LeCroy will repair or, at its option, replace any product returned to the Customer Service Department or an authorized service facility within the warranty period, provided that the warrantor's examination discloses that the product is defective due to workmanship or materials and has not been caused by misuse, neglect, accident or abnormal conditions or operations.

The purchaser is responsible for the transportation and insurance charges arising from the return of products to the servicing facility. LeCroy will return all in-warranty products with transportation prepaid.

This 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 shall not be liable for any special, incidental, or consequential damages, whether in contract, or otherwise

PRODUCT ASSISTANCE

Answers to questions concerning installation, calibration, and use of LeCroy equipment are available from the Customer Services Department, 700 Chestnut Ridge Road, Chestnut Ridge, New York 10977-6499, (914) 578-6059, or your local field service office.

MAINTENANCE AGREEMENTS

LeCroy offers a selection of customer support services. For example, Maintenance agreements provide extended warranty that allows the customer to budget maintenance costs after the initial warranty has expired. Other services such as installation, training, on-site repair, and addition of engineering improvements are available through specific Supplemental Support Agreements. Please contact the Customer Service Department or the local field service office for details.

DOCUMENTATION DISCREPANCIES

LeCroy is committed to providing state-of-the-art instrumentation and is continually refining and improving the performance of its products. While physical modifications can be implemented quite rapidly, the corrected documentation frequently requires more time to produce. Consequently, this manual may not agree in every detail with the accompanying product and the schematics in the Service Documentation. There may be small discrepancies in the values of components for the purposes of pulse shape, timing, offset, etc., and, occasionally, minor logic changes. Where any such inconsistencies exist, please be assured that the unit is correct and incorporates the most up-to-date circuitry.

SOFTWARE LICENSING AGREEMENT

Software products are licensed for a single machine. Under this license you may:

- Copy the software for backup or modification purposes in support of your use of the software on a single machine.
- Modify the software and/or merge it into another program for your use on a single machine.
- Transfer the software and the license to another party if the other party accepts the terms of this agreement and you relinquish all copies, whether in printed or machine readable form, including all modified or merged versions.

2 PRODUCT DESCRIPTION

OVERVIEW

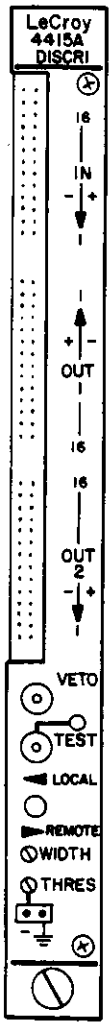

Figure 1
Front Panel Layout

The LeCroy Model 4415A is a 16-input, non-updating discriminator in a single-width CAMAC module. This type of discriminator offers advantages in high input rate counting and timing applications since the counting rate (the rate of output pulse leading edges) is monotonic with input rate. The unit also offers differential ECL outputs which are compatible with LeCroy ECLine Series of data handler and trigger processor modules. For added flexibility, the 4415A accepts single-ended or differential signal inputs and permits DC or AC coupling. Figure 1 shows the layout of the front panel.

The Model 4415A has 16 discriminator channels which operate at a maximum repetition rate of typically 9 MHz. The repetition rate can be increased to approximately 30 MHz or decreased below 9 MHz by a simple user modification to the timing capacitors. The discriminator threshold is adjustable between $\pm$30 mV and $\pm$600 mV, and is common to all channels. A common Veto input signal will disable the unit for the duration of this input. Also, a test input or CAMAC command permits firing all channels simultaneously for system evaluation. A CAMAC programmable mask may be applied to select only a subset of channels which will fire during this test.

A threshold set by the front-panel potentiometer can be read by a voltmeter at a front-panel test point. This same test point can be used to program the threshold with an external input voltage. In either case, for readout or for external programming of the threshold, the test point is a factor of 10 larger than the actual applied threshold voltage.

High density and low price per channel are made possible through the use of the LeCroy HVL100 hybrid integrated circuit. Sixteen of these hybrids, one per channel, are used in the 4415A and provide all the essential function of the discriminator.

SPECIFICATIONS

Input Characteristics

Signal Inputs: 16 inputs via a front-panel 34-pin connector single-ended or differential, DC-coupled (AC-coupled optional). Common mode voltage range ±3 V. Impedance, 110 Ω ±5% differential; 55 Ω ±5% from each pin to ground.

Threshold: Set via a screwdriver adjustable front-panel, potentiometer or via an external voltage applied to the threshold control connector. The threshold is common to all channels.

Threshold Control: Front-panel 2-pin connector; high impedance, (5.6 kΩ). Used as output, it indicates the internal threshold control voltage. Used as input, it controls the threshold.

Threshold Control Ratio: Threshold monitor point on front panel has 10:1 ratio of monitor voltage to actual voltage. Range, -0.3 V to -6 V, corresponding to thresholds of 30 mV to +600 mV for single-ended pulse, and 15 mV to 300 mV for differential inputs due to AC coupling.

Threshold Range: -30 mV to -600 mV (±10 mV or ±10%, whichever is greater) for single-ended negative going pulses. For positive going signals with a risetime less than 300 μsec, the threshold is +30 mV to +600 mV. For differential signals the range is 15 mV to 300 mV (see Figure 2).

Threshold Uncertainty: The threshold will drift with both temperature and supply voltage. The temperature coefficient for the drift is 50 μV/° C and the threshold coefficient for 6 V power supply drift is 10 mV/V.

Hysteresis: 3.6 mV typical.

Input-Output Delay: 22 nsec, typical (2× threshold, see Time Slewing below).

Test Input: One Lemo front-panel connector, 50 Ω ±2% impedance, triggers all channels simultaneously. Requires NIM level signal (-16 mA into 50 Ω = -0.8 V. Tolerance is ±4 mA according to NIM standard). Minimum width: 10 nsec, direct coupled.

Veto Input: One Lemo front-panel connector 50 Ω ±2% input impedance, inhibits all outputs during input of VETO. NIM level signal (-16 mA into 50 Ω = -0.8 V. Tolerance is ±4 mA according to NIM Standard); direct coupled.

Output Characteristics

Signal Output: 2 X 16, two outputs per channel in two front-panel 34-pin connectors; ECL differential level (-0.8, -1.6 V) into 100 Ω twisted pair. Duration: 100 nsec to 1 μsec (factory set; user modification for other values. See Chapter 6). Output duration set by front-panel screwdriver control, common to all channels. Risetimes and fall times typical 2.2 nsec. Width stability: <0.2%°C.

Timing Characteristics:

Double Pulse Resolution: Typical 110% of output width (leading edge to leading edge) or width of pulse plus 12 nsec whichever is greater.

Time Slewing: <2 nsec for input amplitudes from 2 to 20 times threshold.

Tracking Error: The tracking error is given by the ability of the input stage of the 4415A to follow the input signal leading edge. Tests on the 4415A indicate that the tracking error is not in excess of 1 nsec.

REMOTE/LOCAL SWITCH Front panel switch. LOCAL position disables mask register and Test Mode.

GENERAL

Maximum Repetition Rate: 9 MHz when output width set to 100 nsec. For other settings see Table 1 in Chapter 6.

Slewing is the variation in propagation delay from the beginning of the pulse input to the output pulse as a function of input pulse amplitude. The intrinsic slewing is measured as a function of input crossing threshold to output pulse. Also, pulses of varying risetimes give different delays from the beginning of the pulse because the threshold crossing time relative to the pulse beginning depends upon the amplitude of the pulse. Only the intrinsic slewing is specified for the Model 4415A since risetime slewing is application dependent.

Slewing typically is measured as the difference between propagation delay for input pulse amplitudes twice that of threshold and input pulses whose amplitudes are 20 times threshold. Threshold is defined as the input pulse level which results in discriminator firing for 50% of the pulses.

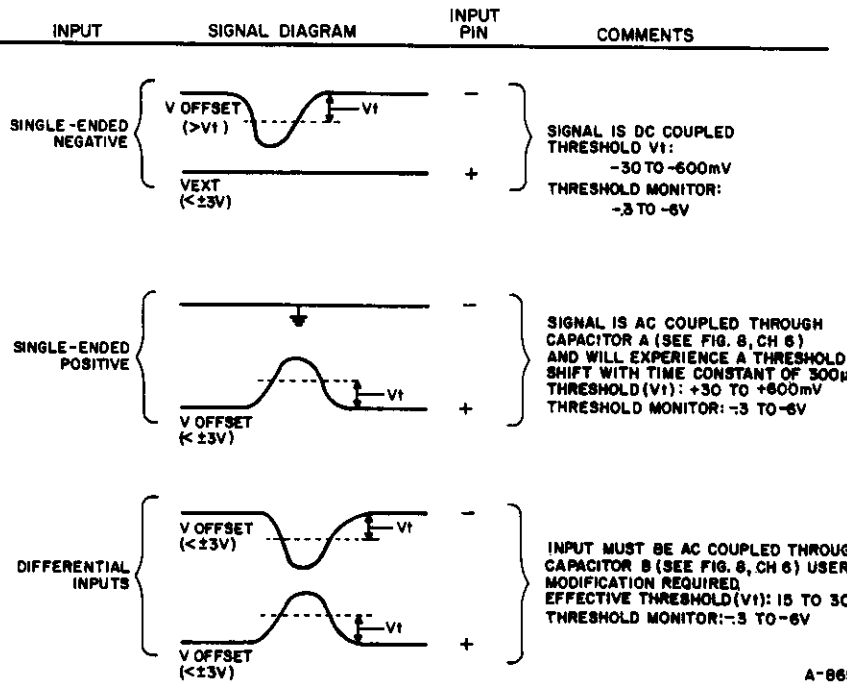

Figure 2

Input Signals to the 4415A

Crosstalk: Crosstalk between adjacent channels is isolated by -60 dB for input pulses with risetimes exceeding 2 nsec.

Test to Output Delay: Typical 40 nsec.

Veto to Output Delay: Typical 10 nsec.

Multiple Pulsing: None; one and only one output pulse is produced regardless of input pulse amplitude and duration.

Power Requirement: 1.3 A at +6 V
4.25 A at -6 V
20 mA at -24 V
33.8 W Total

CONTROLS AND CONNECTORS

Signal Input

Signal input to all 16 channels of the 4415A is made via a common 34-pin front-panel connector. These signals may be either

single-ended or differential such as differential ECL levels. The unit permits DC or AC coupling of the signals.

For single-ended inputs, if the negative input pin is grounded and positive pulses are sent, the 4415A is AC coupled. A DC level shift will occur on pin 13 of the HVL 100 Hybrid as a function of the duty cycle of the input, which is common in AC coupled circuits. This variation will result in an effective threshold level shift with a time constant of 300 μsec. Conversely, if the positive pin is grounded and negative pulses are input, then the discriminator is DC coupled and experiences no threshold level shift.

If both positive and negative going complementary pulses are applied to the input pins, the positive side is AC coupled and the negative side DC coupled. Again, the threshold would vary with input duty cycle as above.

The input signals may be AC coupled at the inputs by cutting the jumpers which bypass capacitors on both positive and negative input pins (see Chapter 6). This AC coupling ability is useful when, for example, differential ECL signals are input. ECL signal levels are −0.8 V and −1.6 V, so AC coupling is required. When this modification is performed, the time constant for threshold drift is lowered to about 12 μsec.

Threshold

The threshold range of the 4415A discriminator is −30 mV to −600 mV for negative going single-ended pulses. For positive going single-ended pulses with a risetime less than 300 μsec, the range is +30 mV to +600 mV. For differential pulses the range is 15 mV to 300 mV. The threshold value is common to all channels, and is set either by a front-panel, 15-turn potentiometer, or by an external voltage applied to the front-panel test point.

A front-panel two-pin connector provides a voltage output that is ten times that applied to the input signal. Since the voltage present at this connector is then sent to the portion of the circuit that actually provides the threshold for the HVL100 hybrids, any external voltage applied here will result in a factor of 10 less threshold voltage applied to the HVL100. Therefore, this connector can be used either as a front-panel test point indicating the threshold setting or as a threshold programming input.

Veto Input

A front-panel Lemo connector accepts NIM level signals to VETO or inhibit all 16 outputs simultaneously during a logical 1 state ($\leq$−600 mV).

If a complementary NIM Level ($\overline{\text{NIM}}$) is input to the VETO connector, then the unit will act as a gated coincidence unit be-

tween the individual inputs and the VETO input. In other words, the discriminators will generate an output only when the input level exceeds the set threshold and while these signals occur during a logical 0 ($\geq$-100 mV) state of the complementary input to the VETO.

Note that an output pulse can occur if the input initiates an output which extends beyond the end of the VETO input. The resulting discriminator output width will equal the set width minus the portion of the pulse which overlaps the VETO signal.

TEST Input

The TEST input is a front-panel Lemo connector which triggers all channels simultaneously with the receipt of a NIM signal. However, initiation of the TEST mode requires the REMOTE/LOCAL switch to be in the REMOTE position. A front-panel LED indicates when TEST is in operation.

Output

The output of the 4415A is differential ECL pulse pairs suitable for driving twisted pair cables. Two outputs per channel are provided from two 34-pin front-panel connectors. These cables may be ordered from LeCroy as Model DC2/34.

The output of selected channels in the TEST mode can be disabled or masked by loading a 16-bit word via CAMAC F(16) command into a storage register.

Width Adjustment

The output width is continuously adjustable by a 15-turn front-panel potentiometer. The width range is from less than 100 nsec to over 1 μsec as supplied from the factory and is common to all channels. To alter the range of the width adjustment, a simple user modification can be made.

REMOTE/LOCAL

The front-panel switch allows all channels to be tested when in the REMOTE position. In the LOCAL position, the TEST mode and mask register are disabled.

CAMAC Commands

The commands for the 4415A conform to the CAMAC Standard-IEEE Std 583-1975. If the user is unfamiliar with the CAMAC standard, a good reference is *CAMAC Instrumentation and Interface Standards*. It is published by: The Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, NY 10017.

Further information is available from LeCroy Corporation in the form of Application Notes. In particular, AN-33, *Introduction to CAMAC*, is very useful.

F(16)•A(0): Writes mask register on CAMAC write line W1 - W16. Q response generated.

F(17)•A(0): Writes a bit, on CAMAC Write line W1 to Enable/Disable Test Mode. To enable Test mode, W1=1. To disable, W1=0. Q response is generated.

F(25)•A(0): Triggers test function. A Q response is generated in Test Mode when Remote/Local switch is in Remote mode only.

F(27)•A(0): Remote/Local switch test. Q=1 response if switch is in Remote, Q=0 otherwise.

Z: Disables mask register and clears test mode.

I: Disables all outputs if in remote mode (User modification disables I, see Chapter 6 for details).

CAMAC Responses

X: An X response is generated for every valid F,N,A.

Q: A Q response is generated if the valid command can be executed.

3 INSTALLATION

The 4415A is a CAMAC module and as such must be installed in a CAMAC crate. Care must be taken to ensure the crate power is off before the module is installed. It can be installed in any slot except in the crate controller position (slots 24 and 25).

The 4415A requires significant power from the ±6 V lines. It should be determined prior to installation whether the crate can support one or more 4415A's with other modules which are to be installed in the crate.

Input signals may be either single-ended or differential. If the signals are to be AC coupled at the inputs, then the jumpers bypassing input capacitors must be cut. See Chapter 6 for more details. AC coupling is required when differential ECL levels are utilized.

Another modification can be made by the user to alter the output width and thus the repetition rate of the discriminator. This modification is also discussed in Chapter 6. As supplied from the factory, the output width is adjustable from 100 nsec to 1 μsec and the repetition rate is 9 MHz to .9 MHz. The required width/repetition rate should be determined and if necessary, the modification made before installation.

Once the unit is installed in the crate, input signals must be applied to the front-panel connector. Then the threshold and output width must be adjusted via the front-panel potentiometers. Alternately, the threshold can be set by applying a voltage which is ten times greater than the actual required threshold to the front-panel 2-pin connector. This connector also could be used as the test point for the threshold level if not used as above.

To complete cable connection of the 4415A a VETO signal should be connected if required. Of course, the output of the 4415A must be connected to associated units. Figure 3 demonstrates possible output cable configurations when using the 4415A in a common counting system.

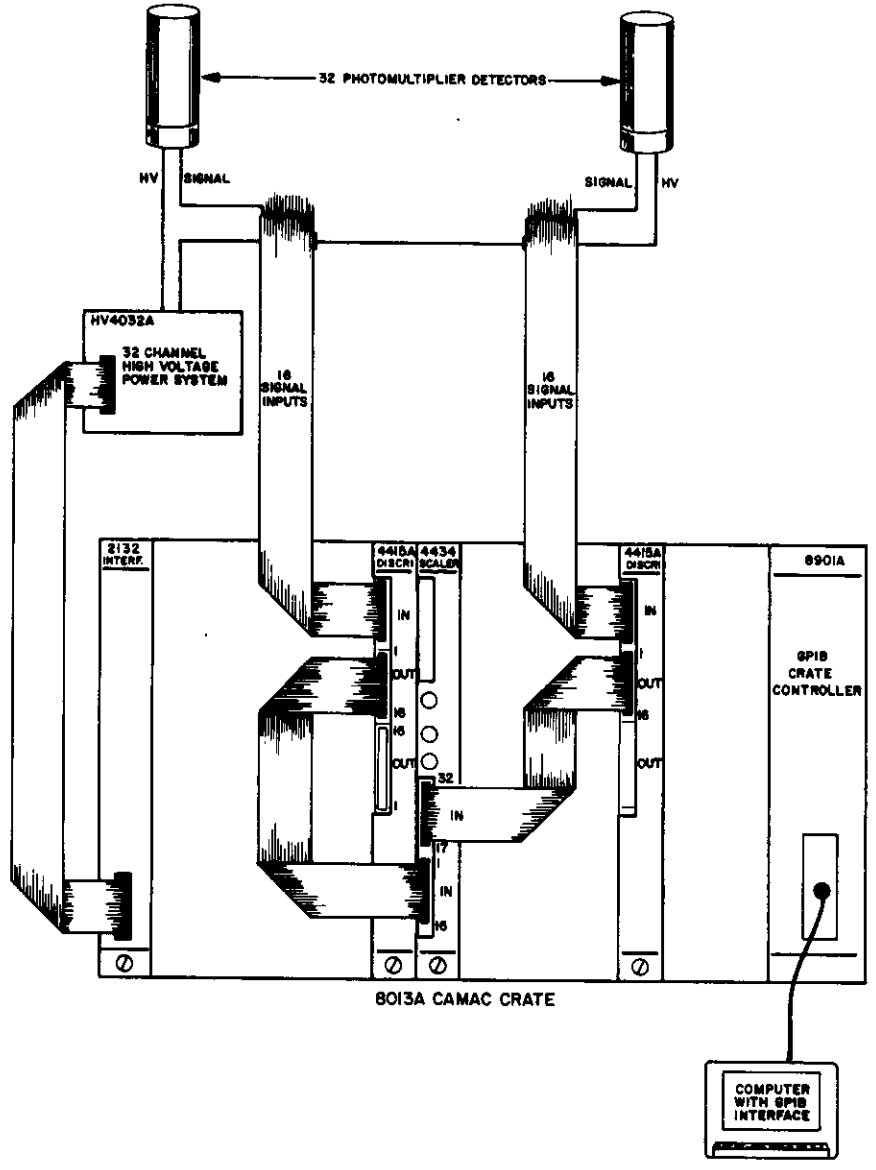
32 PHOTOMULTIPLIER DETECTORS
HV
SIGNAL
SIGNAL
HV
HV4032A
32 CHANNEL HIGH VOLTAGE POWER SYSTEM
16 SIGNAL INPUTS
16 SIGNAL INPUTS
2132 INTERF.
4418A DISCRI
4434 SCALER
4418A DISCRI
8901A
GPIB CRATE CONTROLLER
IN
OUT
16
32
17
8013A CAMAC CRATE
COMPUTER WITH GPIB INTERFACE

Figure 3

4 OPERATING INSTRUCTIONS

GENERAL

Setup of the 4415A can be split into two categories, one being adjustment of the threshold and output width and the other is initiating the test mode.

Threshold

The main function of the discriminator is to generate a logic pulse output when the input exceeds a given threshold. Correct adjustment of the threshold is therefore one of the most important duties to be performed.

The threshold is adjusted via a front-panel potentiometer or via an external reference voltage. It can be set at some level which corresponds to a physical quantity (i.e., 100 mV may equal 100 keV) or it can be set above the noise level depending on the application. In either case, it is necessary to determine the level to which the threshold should be set. This action may be as easy as measuring the maximum noise level input or as complex as calibrating the system by accurately determining the relationship between pulse height (voltage level) and some quantity.

Once the level is determined it is set by adjusting the potentiometer with a screwdriver. The resulting change in threshold level is monitored with a high impedance voltmeter connected to the 2-pin front-panel connector. The voltage displayed on the meter is ten times the actual value for single ended pulses and 20 times the threshold for differential inputs. Alternatively, ten or twenty times the desired threshold voltage may be input to this same connector to externally set the threshold.

There are three important phenomena of which to be aware when setting the threshold other than normal temperature and supply voltage drifts. These are hysteresis, threshold shift and minimum charge input.

Threshold Hysteresis

A 4 mV hysteresis is built into the HVL100 hybrid. This avoids multiple pulsing due to "ringing", noise, or other structure riding on the input pulse. Two examples are shown in the figure below to illustrate this point.

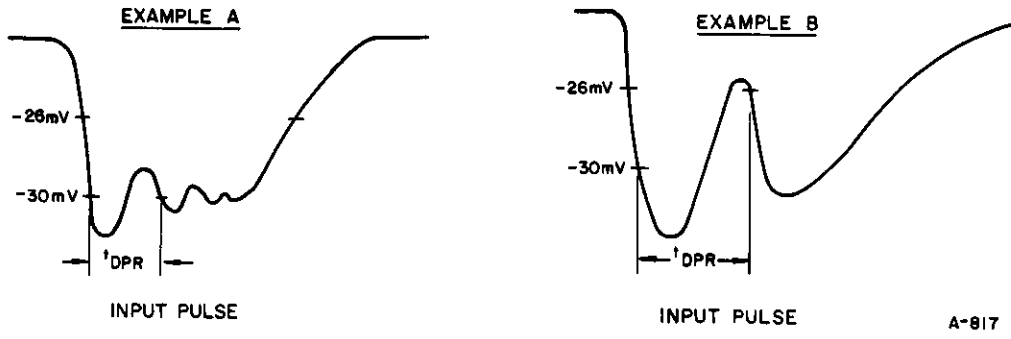

Figure 4
Input pulses with structure which results in only one pulse output (A) or more than one output (B)

In example A of Figure 4 above, the input pulse will not retrigger the discriminator, if set for −30 mV threshold, even though it crosses the threshold level at a time exceeding the Double Pulse Resolution (DPR) of the unit.

In example B, the input signal does go back through the threshold of −30 mV but goes beyond to exceed the threshold plus hysteresis level. Two discriminator output pulses would result.

Threshold Shift

As mentioned in Chapter 2, positive input signals are always AC coupled and experience an apparent threshold shift dependent on the input risetime and duty cycle. The time constant for this apparent level shift is 300 μsec. Likewise, the negative input may be AC coupled by a user modification for use with differential input signals. In this case, the time constant for the apparent threshold shift is 12 μsec. In neither case will this apparent shift be indicated at the threshold monitor. The user must be aware of this shift in making a determination of where the threshold voltage must be set.

When differential inputs are applied to the 4415A, the comparator inputs internal to the HVL100 hybrid are driven towards one another. This occurance is, in effect, equivalent to applying a single-ended pulse of twice the amplitude of either of the differential inputs. In this example, the applied threshold voltage is effectively added as an offset to the pulse at the positive comparator input. This offset, plus the apparent "summing" of the

input amplitiudes, combine to make the apparent differential threshold 1/2 of the actual threshold voltage applied, or 1/20th of the voltage measured at (or applied to) the threshold monitor.

Minimum Input Charge

The Model 4415A requires a minimum charge to trigger. Figure 5 illustrates the input pulse width sensitivity for two values of the threshold setting. The pulse widths were measured at nominal threshold values.

Effective threshold as a function of input pulse width for narrow pulses. Curves for two threshold settings, −30 mV and −300 mV, are shown.

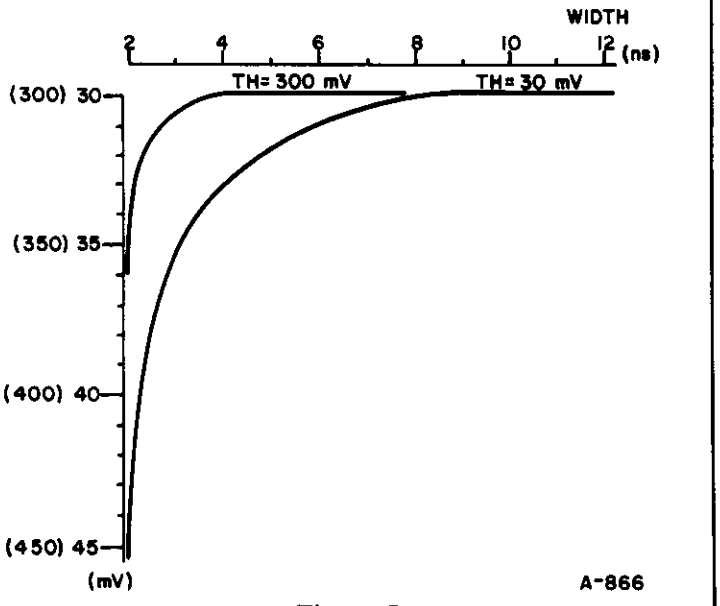

Figure 5

OUTPUT WIDTH

The output of a discriminator is a standard logic pulse which can be used for various functions and purposes in the rest of the system. The output pulse width must be compatible with the equipment following the discriminator. However, the maximum repetition rate of the unit is limited by this width. Therefore, certain tradeoffs may have to be made in determining the required output width.

The output width is adjusted via a front-panel potentiometer.

TEST MODE

To initiate Test, the front-panel switch is set in the REMOTE position. Then an output mask can be loaded via a CAMAC **F(16)** command with a 16-bit data word. Bits 1 to 16 in the data word correspond to discriminator channels 0 to 15 respectively. A "1" in any bit disables the corresponding channel of the discriminator, in the test mode, while a "0" enables the associated channel.

Note that output masks are stored in a register in the 4415A and recalled whenever the test mode is entered. Therefore, entering the mask word is needed only on initialization or when a change is required.

A CAMAC **F(17)** command with any odd data word (i.e., W1=1) will enable the test mode 200 μsec after the test mode is enabled. It may be triggered via a NIM pulse at the front-panel test input or with CAMAC **F(25)** command. A front-panel LED indicates that the unit is in Test.

Exiting from Test is done with a CAMAC **F(17)** command with any even data word (i.e., W1=0). The threshold value is reset to its original value within 200 μsec.

The following is an example of a program written in FORTRAN to initialize and execute a Test. In this example the 4415A is presumed to be loaded in slot 10 of crate 1 on a parallel branch highway 1. It is also presumed that the user has CAMAC subroutines similar to those described by ANSI/IEEE Std. 758-1979 IEEE Standard Subroutines for CAMAC.

```
                - Perform Standard CAMAC Initialization Prior to TEST -
C
C   Define unit
C
        KRATE=1
        ISLOT=10
        NBRANCH=1
        NADR=0
C
C   Declare a CAMAC Register
C
C
    CALL CDREG (IDISC, NBRCH, KRATE, ISLOT, NADR)
C
C   Load Mask to Disable Channel 0-7. Decimal Equivalent of 16-bit
C   word is 255
C
    CALL CSSA (16, IDISC, 255,IQ)
     If (.NOT.IQ) ERROR MESSAGE
C
C
C   Enable Test Mode
C
C
    Call CSSA (17, IDISC, 1, IQ)
C
C   Now Fire Enabled Outputs Using CAMAC F(25) for 100 Times with
C   1 millisecond interval between tests
C
    DO  100 I=1,100
    CALL CSSA (25, 1 DISC, 1 DUM, IQ)
    CALL WAIT (1)
100 CONTINUE
C
C   Disable Test Mode
C
    CALL CSSA (17, 1 DISC, 0, IQ)
```

Note that the positive input of the channels and the threshold monitor will be pulsed with a 400 mV signal. Ensure that any modules connected to the discriminator will not suffer adverse effects because of this signal.

Figure 6 shows a simplified block diagram of one channel of the 4415A and of the HVL100 hybrid discriminator. The hybrid consists of a comparator at its input with a monostable stage at its output. The negative input of the comparator is driven directly by the "–" input to the 4415A (or may, optionally, be AC coupled).

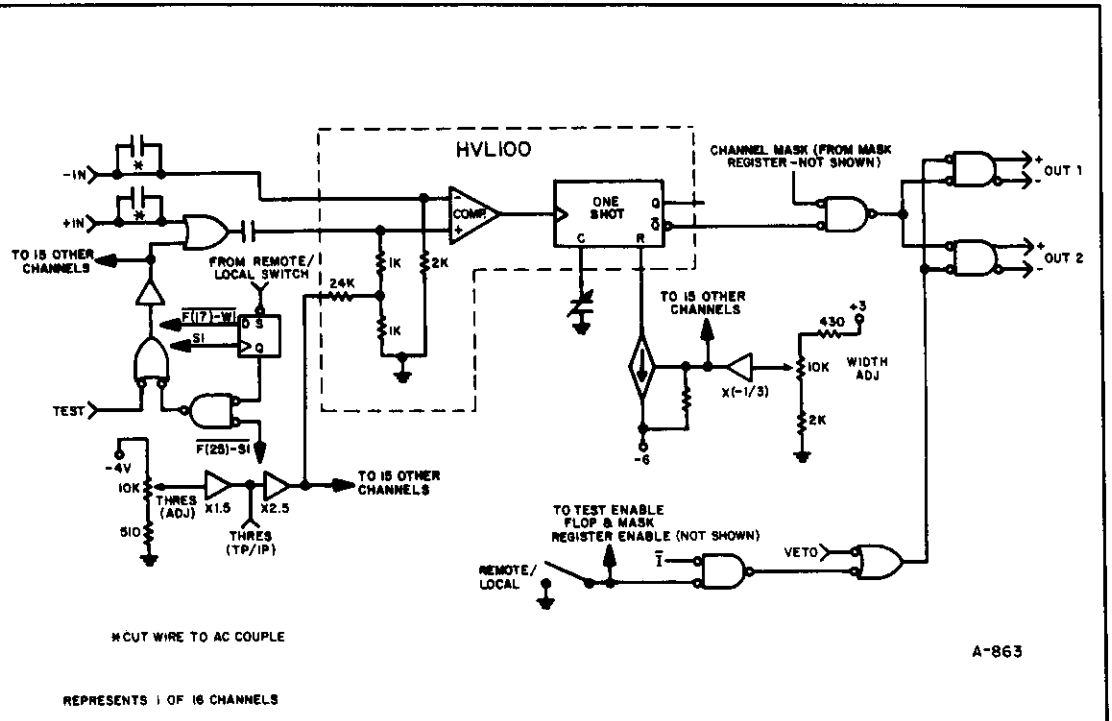

Figure 6

When the 4415A is used as a direct-coupled, negative input discriminator, the threshold voltage for the comparator is derived from a 25:1 voltage divider internal to the HVL100 and delivered to the comparator's positive input. The voltage applied to the HVL's threshold input will therefore range from –750 mV to –15 V. It is common to all channels and may be generated by either of two methods. The front-panel threshold pot may be adjusted to apply a voltage between –195 mV and –4 V to an amplifier with a gain of 1.5. This amplifier's output is available for monitoring at the front-panel THRES test point.

It will be a factor of 10 greater than the actual comparator threshold voltage, since the voltage at this node is amplified by 2.5 before delivery to the hybrid's 25:1 divider. Optionally, the THRES test point can be used as an input, and the comparator's reference will be 1/10 of the voltage applied to this node as described above.

The comparator's positive input is AC coupled, and may be driven either from the 4415A's "+" input or by a test pulse. To enable the test function, the REMOTE/LOCAL switch on the 4415A's front panel must be in the REMOTE position, and an **F(17)** command must be issued with any odd data word on the write lines (i.e., W1=1). The test pulse may then be generated by CAMAC at S1 time if an **F(25)** command is issued, or an external NIM level pulse may be delivered to the front-panel TEST input.

The comparator also may be driven differentially by delivering a negative going pulse to the 4415A's "–" input and a positive going pulse to the "+" input. To use the 4415A in this mode both inputs should be AC coupled (see Chapter 6) and the threshold pot should be set for its minimum value.

In any event, causing the comparator to fire will trigger the HVL's monostable stage. The timing capacitor, external to the hybrid, is adjustable to allow for inter-channel matching. The discharge current for this capacitor (which will determine the one-shot's output width) is a voltage-controlled current source, with the control voltage common to all channels and set by the front-panel WIDTH pot. (NOTE: if output widths wider than specified are desired, fixed capacitors may be added by the user across the adjustable caps installed in the 4415A. If a shorter output width is required, the timing capacitors can be removed altogether. See the discussion in Chapter 6 under Output Width Section).

Individual channel outputs may be disabled via an internal mask register, loaded from the CAMAC Write lines (W1–W16) with an **F(16)** command at S1 time. All outputs may be disabled in remote mode by a CAMAC I. All outputs are likewise disabled whenever a NIM low-level is present on the front-panel VETO Input.

6 ADDITIONAL INFORMATION

USER MODIFCIATIONS

Depending on the application, the user may find it necessary to modify the Model 4415A Discriminator so that it will perform the desired function. There are three simple modifications available which were designed to render the unit more versatile. One modification is to alter the output width of the discriminator, the second enables AC coupling of input signals, and the third disables the response to a CAMAC inhibit (I).

OUTPUT WIDTH/ REPETITION RATE

The output width is continuously adjustable via a front-panel 15-turn potentiometer. The width range is from less than 100 nsec to over 1 μsec as supplied from the factory and is common to all 16 channels.

If a shorter or longer output width is desired, a simple modification to the timing capacitors (C0 to C15) can be made.

To realize a shorter output width, thus increasing the maximum repetition rate, the timing capacitors (C0 through C15) are removed altogether. Then the trim caps, which are in parallel to the timing capacitors, are adjusted to internally match the output width of all the channels. Figure 7 identifies the location of the timing capacitors and the trim caps on the board. In module operation the front-panel trim pot is still used to adjust the pulse width of all the discriminators.

To increase the output pulse width, the timing capacitors can be removed and replaced with non-polarized capacitors of higher capacitance value (see Table 1 below). Adjustments to the trim caps are not usually necessary to match all the channels due to their small (3.5 pF to 18 pF) capacitance range as compared to the larger fixed value capacitors installed by the user.

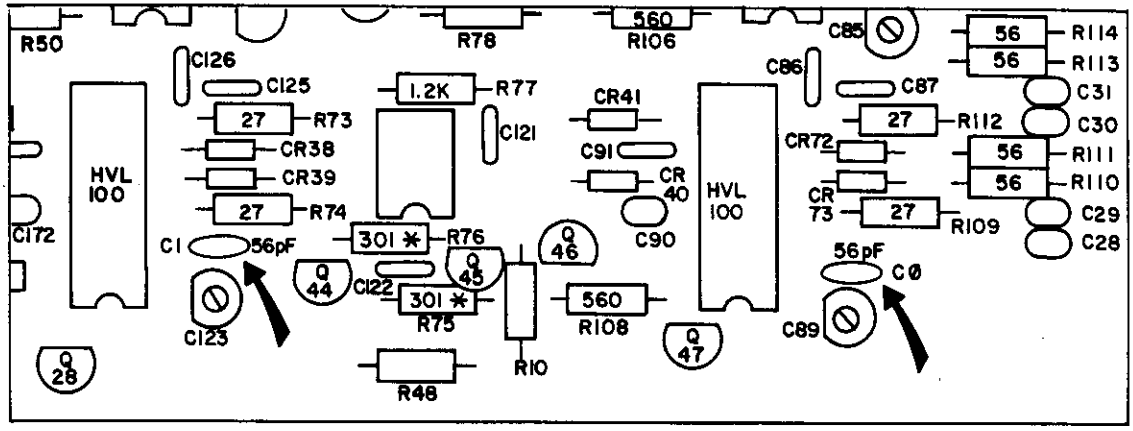

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Figure 7
Location of timing capacitors and trim caps as shown by C0 and C1 in this example.

Table 1
Output Pulse Width/Repetition Rate Versus Timing Capacitor Value

User Installed Value for the Timing Capacitor C0 to C15	Output Pulse Width	Maximum Repitition Rate
		Approximately
(Factory Installed and set) 0*	~20 nsec to 150 nsec	30 MHz to 6 MHz
56pf	100 nsec to 1 μsec	9 MHz to .9 MHz
680 pf	1 μsec to 10 μsec	900 kHz to .90 kHz
6.8 nF	10 μsec to 100 μsec	90 kHz to 9 kHz
68 nF	100 μsec to 1 msec	9 kHz to .9 kHz

* Adjust trim cap parallel to C0 through C15 for proper output pulse width

AC COUPLING

The input signals may be AC coupled at the inputs by cutting the jumpers which bypass capacitors B on both positive and negative input pins (See Figure 8 and 9). This modification is required when, for example, differential ECL signals are input, since ECL signal levels are −0.8 V and −1.6 V. When the modification is performed, the time constant for threshold drift is about 12 µsec.

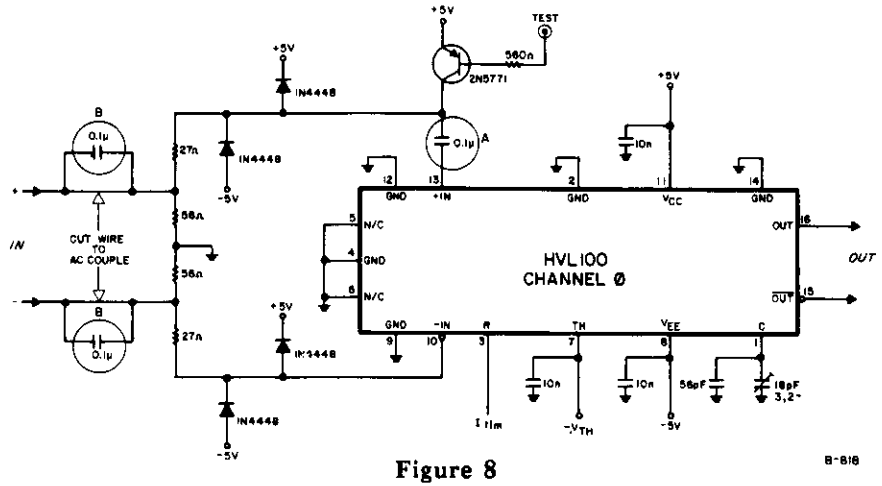

Figure 8
Input State Circuit

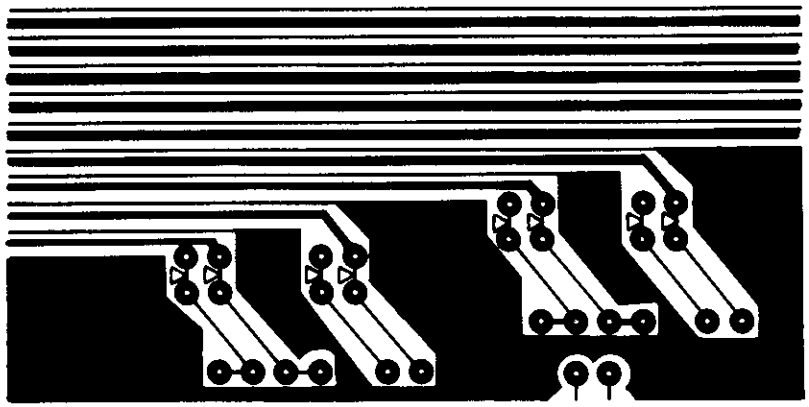

Figure 9
For AC coupled inputs, cut the lines on the solder side of the board, indicated by the arrows above.

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DISABLING THE CAMAC INHIBIT (I)

If the user does not desire the 4415A to respond to a CAMAC I, the Inhibit function may be disarmed with the following modification. First, the Zero Ω "resistor" located near the CAMAC edge connector between IC's W and X must be removed. Then, Pin 9 of IC W should be connected to Vcc at Pin 14 of IC X with a short piece of wire. This modifiction will allow a CAMAC I to be issued to other modules in the crate without any effect on the 4415A.

INDEX

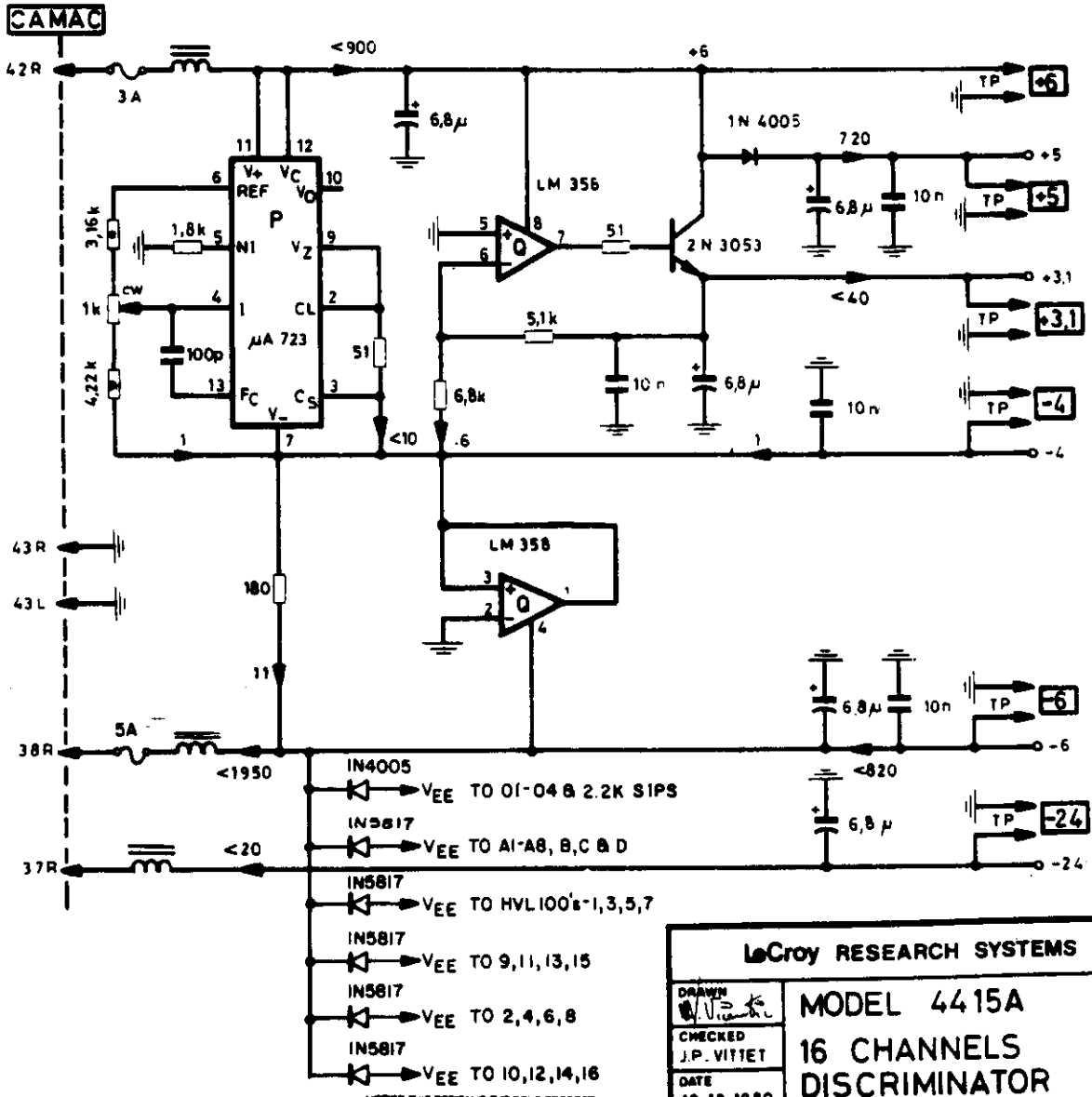
LECROY CORPORATION
4415A PARTS LIST

PART NUMBER	DESCRIPTION	QUANTITY PER
102412101	CAP CERA DISC 100V 100PF	1
102412560	CAP CERA DISC 100V 56 PF	16
103317222	CAP CERA MONO 50V 2200 PF	1
103327103	CAP CERA MONO 50V .01 UF	93
103427104	CAP CERA MONO 100V .1 UF	48
142824685	CAP TANT DIP CASE 6.8 UF	5
158819001	CAP VARI CERA 3.5 - 18 PF	17
161030000	RES COMP ZERO OHMS	1
161335122	RES CARBON FILM 1.2 K	13
161335132	RES CARBON FILM 1.3 K	2
161335155	RES CARBON FILM 1.5 MEG	1
161335181	RES CARBON FILM 180 OHMS	1
161335182	RES COMP 1/4W 5% 1.8 K	1
161335202	RES CARBON FILM 2 K	1
161335270	RES CARBON FILM 27 OHMS	34
161335271	RES CARBON FILM 270 OHMS	3
161335304	RES CARBON FILM 300 K	1
161335332	RES CARBON FILM 3.3 K	2
161335391	RES CARBON FILM 390 OHMS	3
161335392	RES CARBON FILM 3.9 K	1
161335431	RES CARBON FILM 430 OHMS	1
161335471	RES CARBON FILM 470 OHMS	3
161335510	RES CARBON FILM 51 OHMS	4
161335511	RES CARBON FILM 510 OHMS	1
161335512	RES CARBON FILM 5.1 K	2
161335560	RES CARBON FILM 56 OHMS	32
161335561	RES CARBON FILM 560 OHMS	18
161335562	RES CARBON FILM 5.6 K	2
161335682	RES CARBON FILM 6.8 K	1
161335750	RES CARBON FILM 75 OHMS	2
168531343	RES PREC RN55D 301 OHMS	16
168531397	RES PREC RN55D 1.10 K	1
168531405	RES PREC RN55D 1.33 K	1
168531441	RES PREC RN55D 3.16 K	1
168531453	RES PREC RN55D 4.22 K	2
168531473	RES PREC RN55D 6.81 K	1
168531481	RES PREC RN55D 8.25 K	2
168531489	RES PREC RN55D 10.0 K	1
168531513	RES PREC RN55D 17.8 K	1
181457102	RES VARI CERMET 1 K	1
182537103	RES VARI CERMET 10 K	1
182537203	RES VARI CERMET 20 K	1
190042102	RESISTOR NETWORK 1 K	1
190042103	RESISTOR NETWORK 10 K	1
190042222	RESISTOR NETWORK 2.2 K	1
190042561	RESISTOR NETWORK 560 OHMS	4
190042681	RESISTOR NETWORK 680 OHMS	2
190842102	RES NETWORK 1 K	1
190842103	RESISTOR NETWORK 10 K	1
190842222	RESISTOR NETWORK 2.2 K	1
190842561	RESISTOR NETWORK 560 OHMS	4
200031049	IC D-TYP FLOP SN74LS74N	1
200031058	IC 2-INPUT AND 7409P	1
200031073	IC 2-IN POS OR SN74LS32N	2

PART NUMBER	DESCRIPTION	QUANTITY PER
200031086	IC 2-INPUT AND SN74LS08N	1
200041062	IC DEC/DEMULTP SN74LS138N	1
200071003	IC 8-BIT REGIST SN74LS374	2
204042012	IC 2-IN AND GATE MC10104P	1
204042016	IC 2-INPUT OR/NOR F10101P	9
204042103	IC 2-IN OR GATE MC10103P	4
204142014	IC ACTIVE TERMIN F10014P	1
208011007	IC DUAL OP AMP LM358N	11
208031004	IC PREC VOLT REG UA723C	1
230110005	DIODE SWITCHING 1N4448	66
235010005	DIODE RECTIFIER 1N4005	2
253050817	DIODE HOT CARRIER 1N5817	5
256233209	DIODE LED RED MV5075C	1
270150001	TRANSISTOR NPN 2N3053	1
270170001	TRANSISTOR NPN 2N5770	22
275170001	TRANSISTOR PNP 2N5087	1
275170002	TRANSISTOR PNP 2N5771	37
300050001	CHOKE FERRITE SINGLE LEAD	3
400030016	SOCKET IC ST DIP-16	16
402130001	CONN LEMO RT ANGLE PC MTG	2
403119234	HEADER RT ANGLE 34-PIN	3
410162000	SWITCH TOGGLE N/LOCK SPDT	1
433220002	FUSE PICO II 125V 3 AMP	1
433225001	FUSE PICO II 125V 5 AMP	1
454310002	HDR DIP SOLD TO PC BD 2	9
454712002	HDR DIP SOLD TO MALE 2	1
500120002	TRANSIPAD "LARGE"	1
521000004	SPACER HEX 2-56X.417	4
540203001	SIDE COVER CAMAC STD(LIP)	1
540206078	RAIL CAMAC STD TOP W/LIP	1
540206178	RAIL CAMAC STD BOT W/LIP	1
540209001	REAR PANEL CAMAC SIZE #1	1
555430003	CAPTIVE SCREW ASSEMBLY	1
560256005	SCREW PHILIPS 2-56X5/16	4
560440003	SCREW PHILIPS 4-40X3/16	4
560440004	SCREW PHILIPS 4-40X1/4	2
567440006	SCREW FLAT PHIL 4-40X3/8	2
568256002	SCREW FLAT PHIL 2-56X1/8	4
590001018	WIRE TEFLON 19/13 BLK 18	2
714415010	PC BD PREASS'Y 4415A	1
724415103	FRONT PNL PREASS'Y 4415A	1
734415103	SIDE CAMAC LEFT 4415A	1
HVL100	IC AMPL DISC HVL100	16

End of report. 97 Details encountered.

PARTS	IC	DESIGNATION	+6V	+5V	GND	-5V	-6V	-24V
225 040 002	HVL 100	Ø TO 15		11	2,14	8		
200 031 086	74 LS 08 N	U		14	7			
200 031 058	74 09 N	V		14	7			
200 031 073	74 LS 32N	W,X		14	7			
200 031 049	74 LS 74N	Y		14	7			
200 041 062	74 LS 138N	T		16	8			
200 071 374	74 LS 374 N	R,S		20	10			
204 042 016	10101 P	A1, A2, A3, A4, A5, A6, A7, A8, D			1,16	8		
204 042 012	10104 P	C			1,16	8		
204 142 014	10014 P	B			16	8		
208 011 007	LM 358 N	E		8				4
208 011 007	LM 358 N	G, H, I, J, K, L, M, N			8		4	
208 011 007	LM 358 N	F, Q	8				4	
208 031 004	µA 723 C	P	11,12					
204 042 103	10 103 P	01, 02, 03, 04			1,16	8		



LeCroy RESEARCH SYSTEMS

DRAWN

CHECKED J.P. VITTET

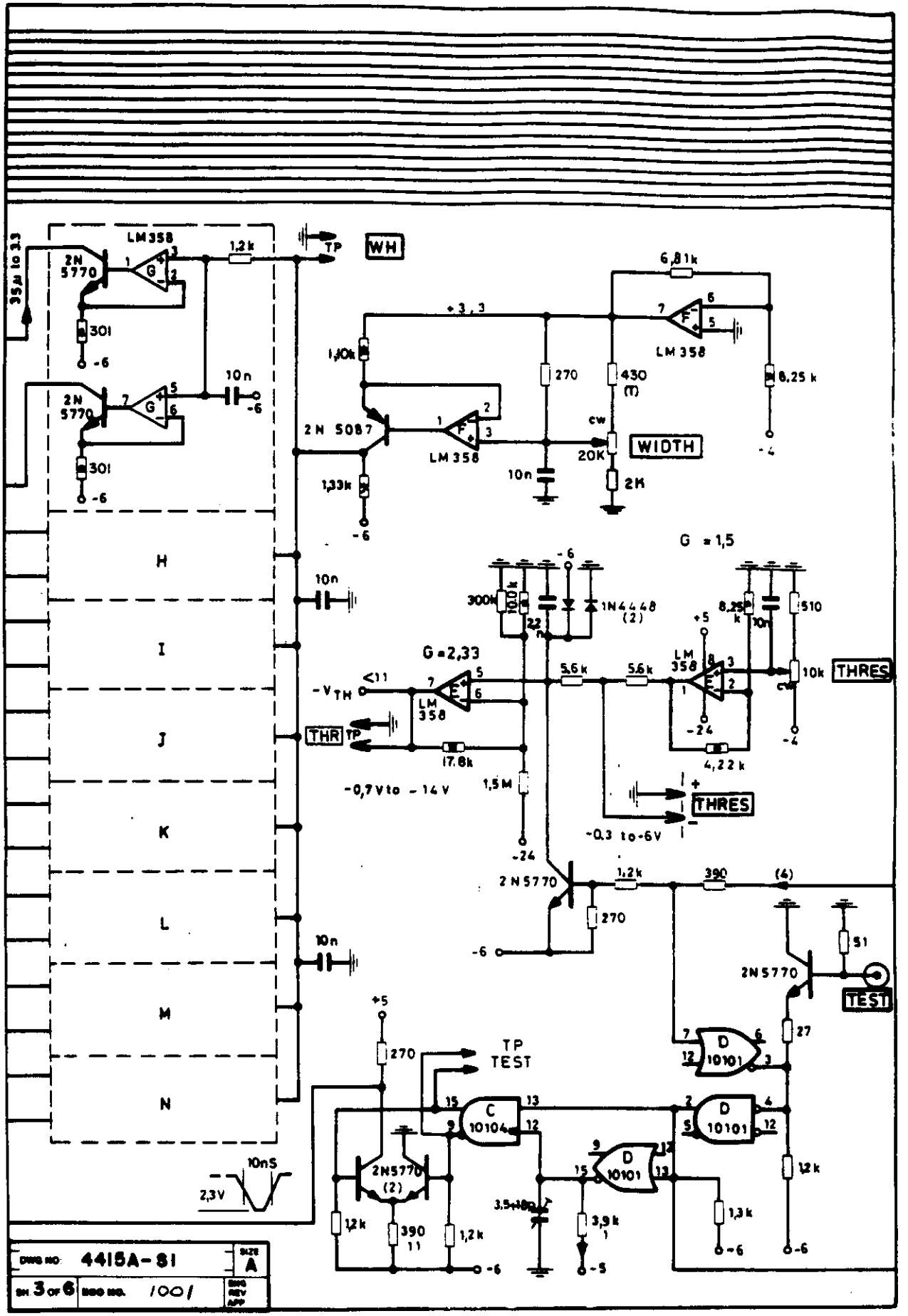
DATE 19-12-1980

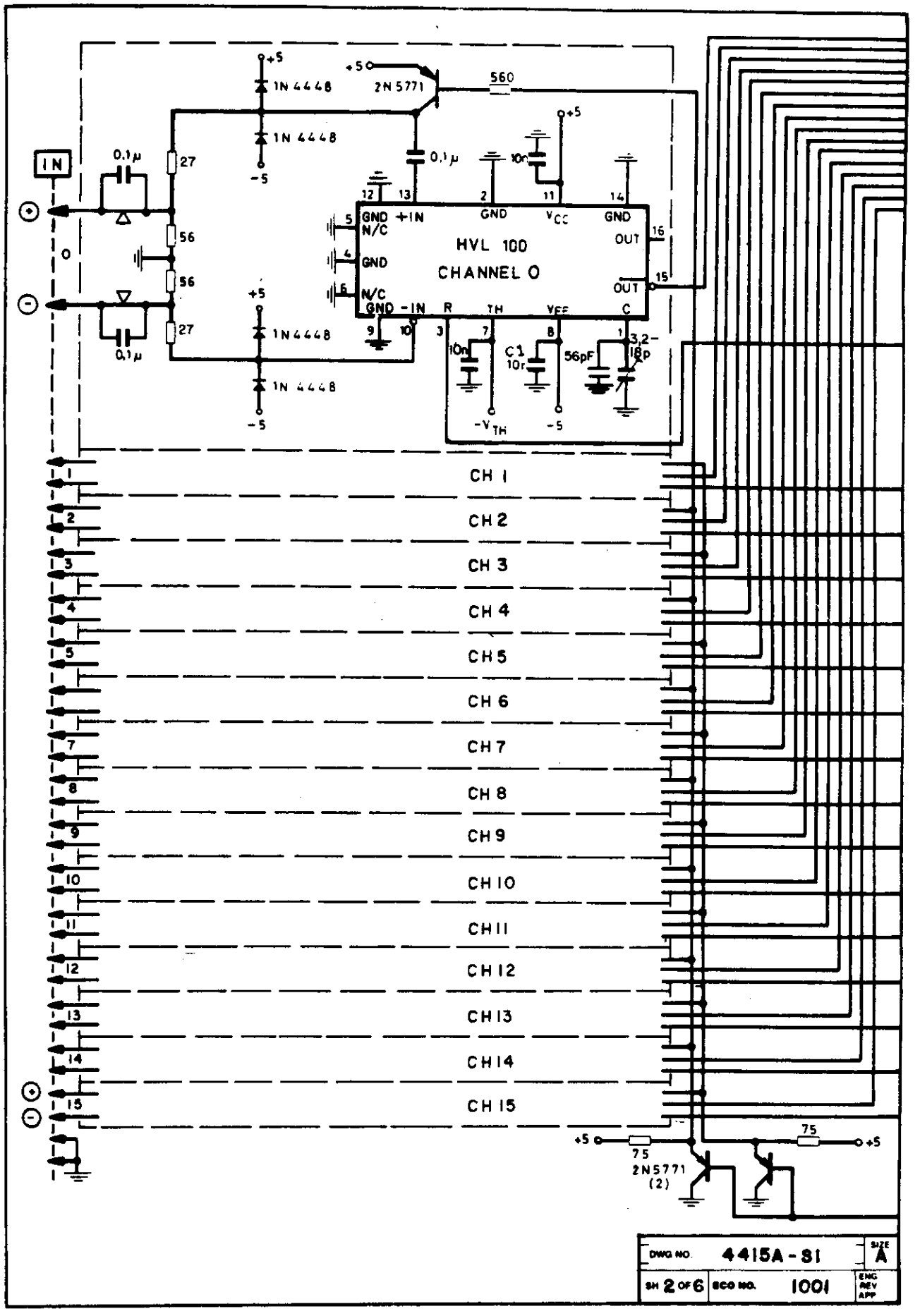
MODEL 4415A

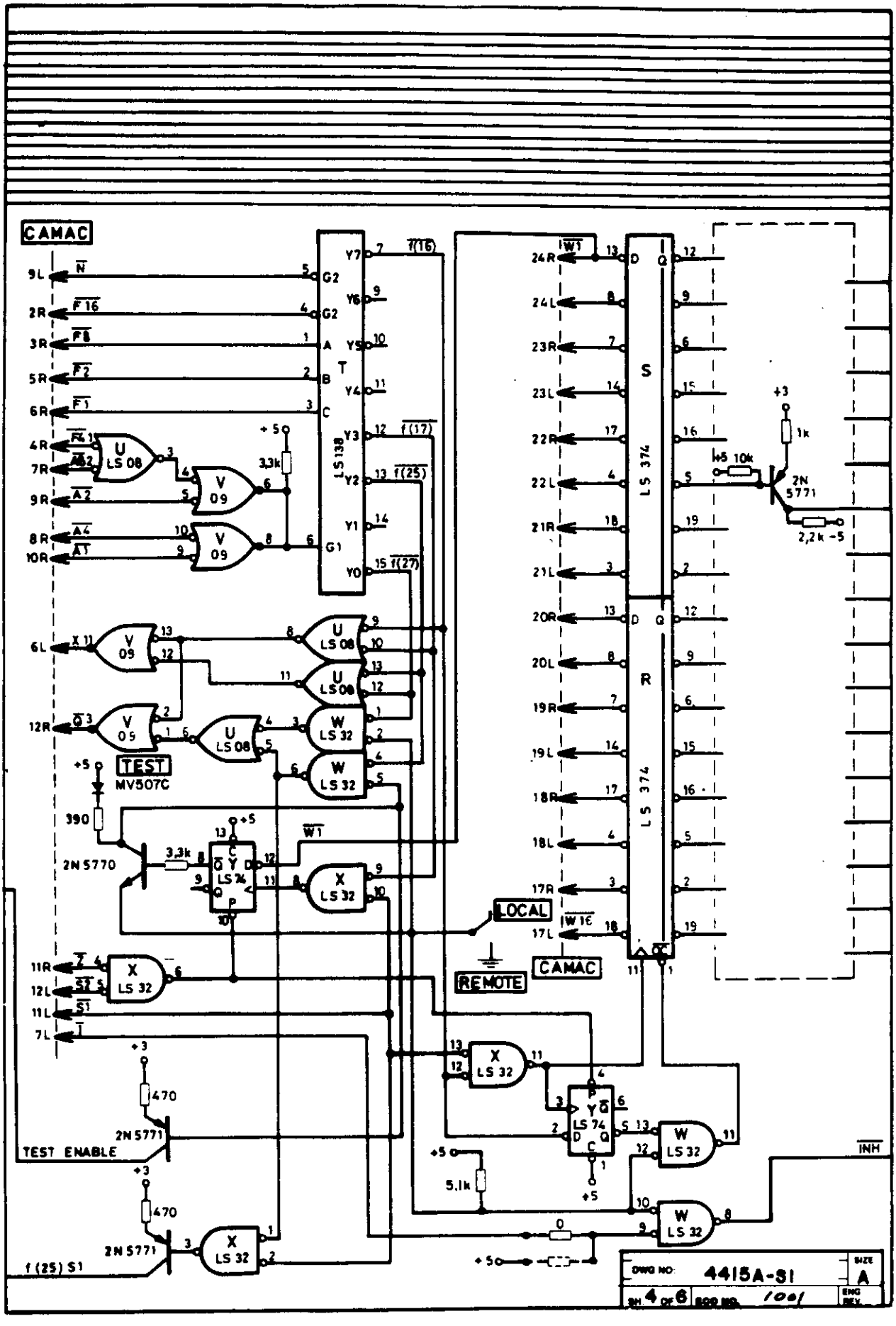
16 CHANNELS DISCRIMINATOR

DRAWING NUMBER: 4415A-SI SHEET 1 OF 6

ECO 1001 DATE 5-22-86


LM358
2N 5770
1,2k
TP
WH
301
-6
10n
2N 5770
301
-6
6,81k
+3,3
LM 358
1,10k
270
430 (1)
8,25 k
2N 5087
LM 358
cw
WIDTH
20K
10n
2K
1,33k
-6
-4
G = 1,5
H
I
J
K
L
M
N
10n
10n
10n
300k
1N4448 (2)
22 n
8,25 k
10n
510
G=2,33
-V TH
LM 358
5,6k
5,6k
LM 358
10k
THRES
cw
THR
TP
17,8k
-24
4,22 k
-0,7V to -14V
1,5M
THRES
-0,3 to -6V
-24
2N 5770
1,2k
390
(4)
270
-6
51
2N 5770
TEST
+5
270
TP TEST
D 10101
27
C 10104
D 10101
D 10101
10nS
2,3V
2N5770 (2)
1,2k
390
1,2k
3,5-18p
3,9k
1,3k
1,2k
-6
-6
-5
-6
DWG NO 4415A-81
SIZE A
SH 3 OF 6
DWG NO 1001
DWG REV APP


IN
0
+5
1N 4448
2N 5771
560
0,1 µ
27
56
-5
HVL 100
CHANNEL 0
GND
N/C
+IN
-IN
OUT
R
TH
VEE
C
10n
56pF
3,2-18p
-V TH
CH 1
CH 2
CH 3
CH 4
CH 5
CH 6
CH 7
CH 8
CH 9
CH 10
CH 11
CH 12
CH 13
CH 14
CH 15
75
2N5771 (2)
DWG NO. 4415A-81
SIZE A
SH 2 OF 6
ECO NO. 1001
ENG REV APP


CAMAC
9L N
2R F16
3R F8
5R F2
6R F1
4R A1
7R A2
9R A2
8R A4
10R A1
U LS 08
V 09
V 09
+5
3,3k
LS 138
T
Y7 f(16)
Y6
Y5
Y4
Y3 f(17)
Y2 f(25)
Y1
Y0 f(27)
G2
G2
A
B
C
G1
6L X 11
12R Q3
V 09
V 09
U LS 08
U LS 08
U LS 08
W LS 32
W LS 32
TEST
MV507C
+5
390
2N 5770
3,3k
LS 74
W1
X LS 32
11R
12L S2
11L S1
7L I
X LS 32
+3
470
2N 5771
TEST ENABLE
+3
470
2N 5771
f(25) S1
X LS 32
24R W1
24L
23R
23L
22R
22L
21R
21L
20R
20L
19R
19L
18R
18L
17R
17L IW16
S
LS 374
R
LS 374
LOCAL
REMOTE
CAMAC
+3
1k
+5 10k
2N 5771
2,2k -5
X LS 32
LS 74
5,1k
+5
W LS 32
W LS 32
INH
0
+5
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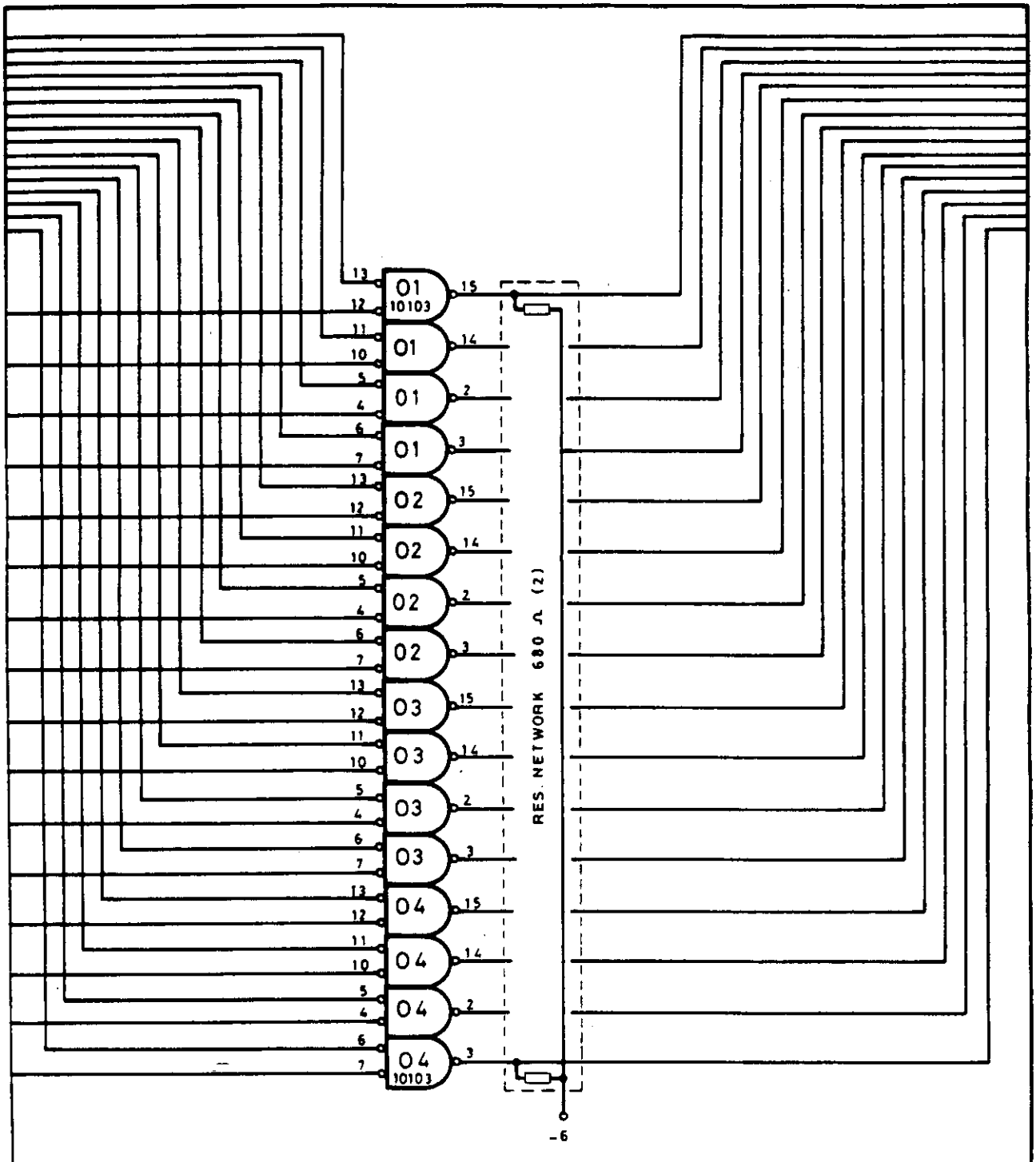
SIZE A
SH 4 OF 6
ENG REV



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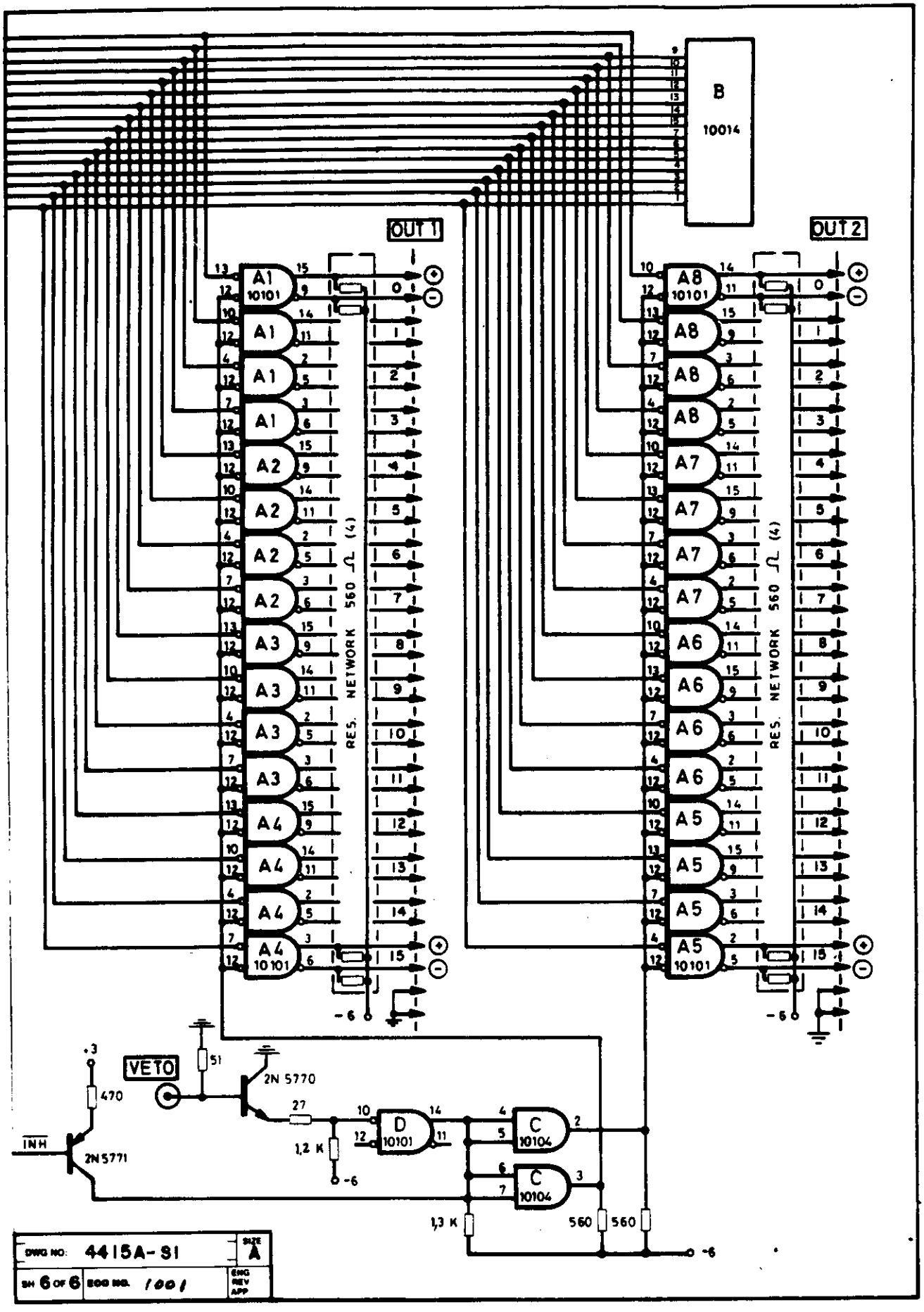
SH 5 OF 6	ECO NO. 1001	ENG REV APP



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SH 6 OF 6	ECO NO. 1001	ENG REV APP