technical information manual

NIM MODEL 4608

OCTAL 200 MHZ
UPDATING DISCRIMINATOR

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1015 LAUSANNE Ø

16 MARS 1981

WARRANTY

All LeCroy instruments are guaranteed to operate within their specifications for one year from the date of purchase. Under this warranty, any unit which fails to perform with in specifications, as a result of defects in workmanship or materials, will be restored to specified operating condition free of charge except for shipping costs involved in the return of the unit to the factory.

All questions concerning repairs or replacement parts should be addressed directly to factory's Quality Control Manager. This procedure will insure the fastest possible service. Please include the Model Type, Serial Number, and ECN (Engineering Change Number) with all requests for parts or service.

LeCroy
RESEARCH SYSTEMS SA

EUROPEAN PRODUCTS DIVISION

AVENUE LOUIS-CASAI 81
1216 COINTRIN-GENÈVE SUISSE

TECHNICAL DATA

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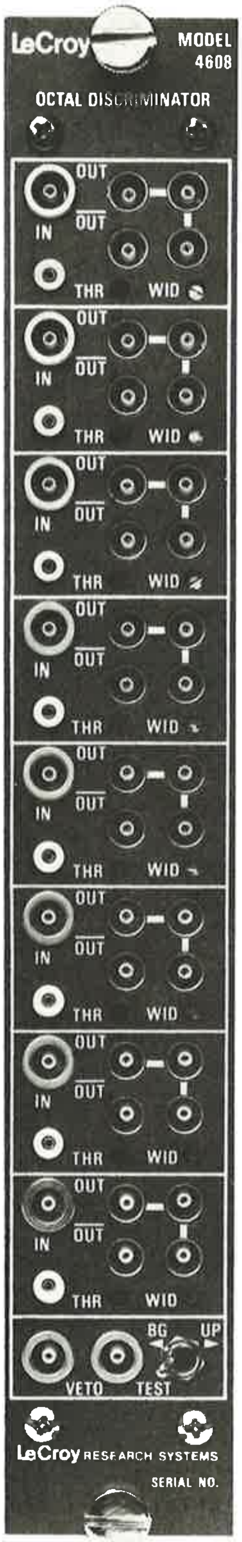

NIM Model 4608

Octal 200 MHz Updating Discriminator

- **High counting rate**
- **High density**
- **High fan-out**
- **Low threshold**
- **Burst Guard mode**
- **Fast veto**
- **Built-in test feature**

The Model 4608 is a high-performance, eight-channel leading edge discriminator featuring high sensitivity, high speed, and updating or Burst Guajd mode. A common inhibit adds to the versatility of the Model 4608, which may be used as an enable for pulsed-mode applications. A built-in test feature simulates an input signal for each channel upon receipt of a NIM-level signal applied to a Lemo-type front-panel test input connector. This permits rapid, simultaneous testing of all discriminator channels.

The minimum threshold of the Model 4608 is −30 mV, variable up to −1 V via front-panel screwdriver adjustment. A monitor point is provided to permit measurement of the threshold level with a voltmeter rather than the more difficult and less precise analog measurement via oscilloscope, assuring accurate results even in varied operating environments. Because of the extremely low reflections from its input (4%), the 4608 is significantly better protected against the multiple-pulsing due to reflections at −30 mV.

The Model 4608 operates at maximum rates of 200 MHz. Its updating design permits retriggering even while an output from a previous input is still present. The 4608 will respond to a second pulse within 4 nsec of the leading edge of the first pulse. Propagation delay through the 4608 is approximately 12 nsec.

In the Burst Guard mode (front-panel switch-selected) the output pulse duration is equal to the input pulse time over threshold or the preset output width, whichever is larger. In case of very high frequency bursts (above 500 MHz) the output will be true from the leading edge of the first pulse to the trailing edge of the last pulse in the burst.

The outputs of the 4608 are high impedance −48 mA current-switching stages, providing output levels of −800 mV into three 50 Ω loads. Unused outputs need not be terminated; the maximum output swing is amplitude limited to −1.2 V for a single output load. The single complementary output provides −16 mA (−800 mV into 50 Ω) in the quiescent state. The output durations may be indpendently set via front-panel screwdriver adjustment from 4 nsec to 40 nsec. Up to 100 nsec output width is possible with the restriction that input and output pulse widths cannot be equal. Output risetimes and falltimes are less than 2 nsec.

February, 1980

INNOVATORS IN INSTRUMENTATION

EUROPEAN PRODUCTS DIVISION

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TÉLÉPHONE: (41 22) 98 97 97

TÉLEX: 28 230

SPECIFICATIONS
NIM Model 4608
OCTAL 200 MHz UPDATING DISCRIMINATOR

CHARACTERISTICS

Inputs:
8, Lemo-type front-panel connectors, 50 Ω ±2% protected to ±5 A for 0.5 μsec clamping at +1 and −6 volts.
Reflections <4% for input pulses of 2 nsec risetime.
Stability better than 0.25%/° C over 20° C to 60° C operating range.
Offset ± 1 mV.
Threshold, −30 mV tp −1 volt ± 5%; front-panel screwdriver adjustable. Threshold monitor point on front panel has 10:1 ratio of monitor voltage to actual voltage ± 5%.
Hysteresis: typical 6 mV.

nput:
One Lemo-type connector on front panel, 50 Ω± 2%, triggers all enabled channels.
Requires NIM-level direct-coupled signal (> −600 mV).
Minimum width: 3 nsec.
Maximum rate: 200 MHz.

Input:
One Lemo-type front-panel connector, 50 Ω ±2%, permits simultaneous fast inhibiting of all channels; requires NIM-level signal (> −600 mV).
Direct-coupled.
Must precede input signal by approximately 3.5 nsec and overlap its leading edge in update mode or overlap complete input signal in Burst Guard mode.
Minimum duration: 4 nsec.

PUT CHARACTERISTICS

ative Outputs:
3; 0 mA quiescently, −50 mA ±6 mA during output; −800 mV into three 50 Ω loads. Amplitude limited to −1.2 V.
Duration, 4 nsec to 40 nsec. 100 nsec output duration possible with the restriction that input and output pulse width cannot be equal.
Risetimes and falltimes less than 2 nsec.
Width stability better than 0.2%/° C max.

nplementary Output:
1, −16 mA ±2 mA quiescently, 0 mA during output. Duration, risetimes, falltimes, and width stability specifications are identical to those of negative outputs.

NERAL

ximum Rate: 200 MHz.

ble-Pulse Resolution: Typical, 4 nsec.

e Slewing: 500 psec for input amplitudes from 2 times to 20 times over threshold.

ut-Output Delay: <12 nsec.

t-Output Delay: <14 nsec.

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

rst Guard: A front-panel switch enables the Burst Guard operation for all channels.

wer Requirements:

+6 V	40 mA
−6 V	1.9 A
−12 V	150 mA
+24 V	40 mA
−24 V	25 mA

INTRODUCTION

The LeCroy NIM Model 4608 is an octal discriminator representing the state of the art in its field.

Its features include indeed all the experience gained in the field up to now. The most important improvements are a higher max. working frequency, a better slewing time, a general veto and a general test input.

The high density is made possible through extensive use of hybrid circuits. Except for few external components, a discriminator channel is contained in a single hybrid, called LD401. The use of hybrid circuits is dictated by the sophisticated technique needed for a 200 MHz discriminator. The test and calibration procedures being quite sophisticated, this manual will not contain a test and calibration section. We recommend the customer to contact the nearest LRS sales agent, any time a problem is encountered in the use of the 4608 discriminator.

INPUT CHARACTERISTICS

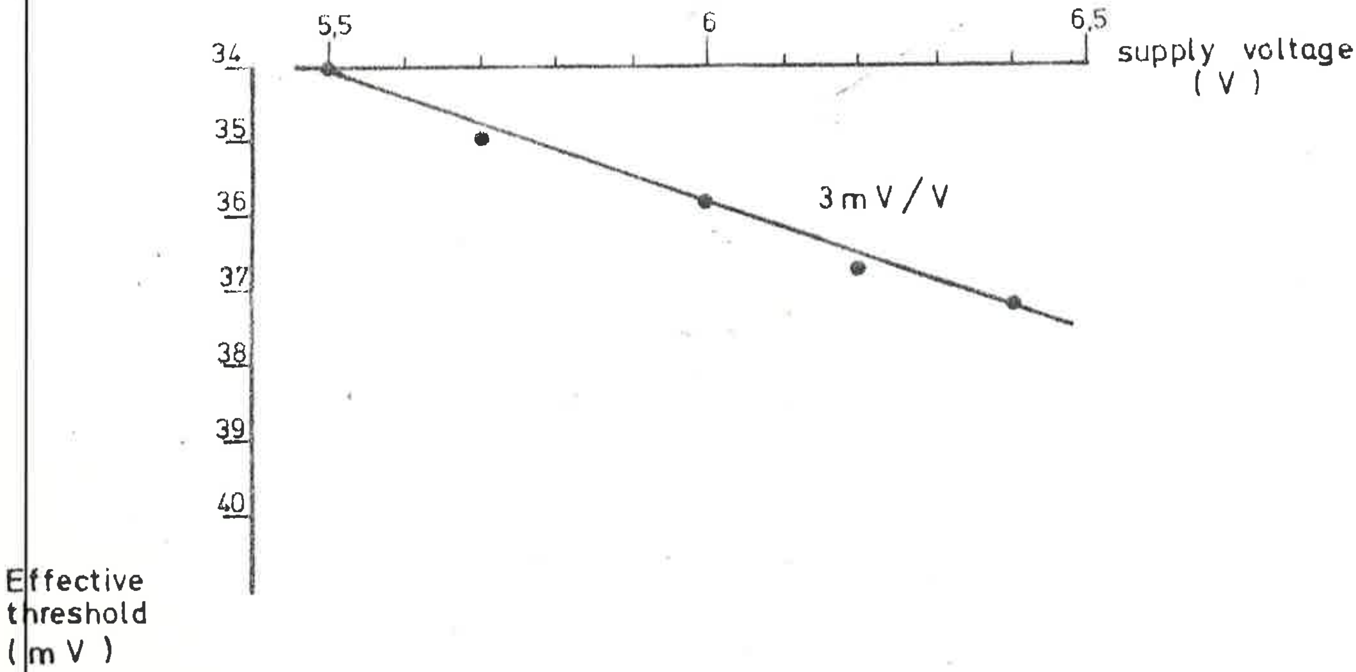
Threshold Range:
The threshold range of the 4608 octal discriminator is -30 mV to -1 V. Each channel is settable by a front-panel, 15 turns potentiometer. In the above range the adjustment is uniform and does not present any discontinuity nor changes in sensibility.

The low minimum threshold of the 4608 makes it possible to use lower gain photo-multipliers, lower high voltage in the phototubes, and to drive PM signals over longer cable lengths than would be possible with higher thresholds. In addition, the low minimum threshold permits back-termination at the photomultiplier to absorb reflections and high amplitude noise. (In this case, the PM drives 25 ohms, the tube current is shared, and the amplitude is half that of the unter-minated system.)

Threshold Uncertainty: While most people consider the threshold of a discrimi-nator to be that value which is written on a data sheet or determined by a front-panel setting, in reality the actual value not only varies from channel to channel, but can be a strong function of other environmental conditions. The external factors with the strongest effect upon the threshold value are the temperature coefficient of threshold and the power supply coefficient of threshold. Combining these, the actual threshold value V_T is given by:

V_T: Threshold according to front-panel control setting ± dc offset ± temperature coefficient X temperature change from calibration temperature ± supply coefficient X voltage change from nominal supply voltage.

In the case of 4608 the measured offset value is 0.6 mV; the supply coefficient comes out to be 3 mV/Volt and the temperature coefficient 0.65 mV/C^{o}.

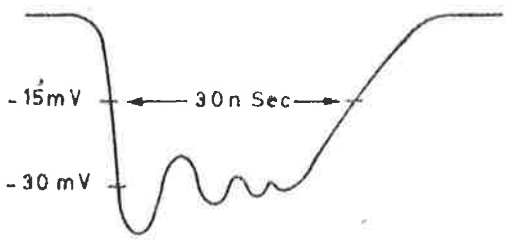


Treshold calibration:

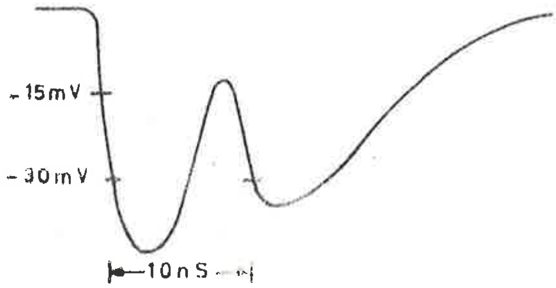
A front panel test point allows a 10:1 monitor of the threshold. That is the dc value,read on the test point, is proportional to the actual threshold value. The proportionality is all over the threshold range, within ±5%. The output impedançé of the test point is 10 KΩ,so a high impedance digital voltmeter should be used.

4608 Threshold Hysteresis:

The 4608 discriminator hysteresis is built into the front end, such that every threshold crossing will not trigger the discriminator unless the previous signal has returned to below approximately -24 mV for a threshold setting of -30 mV. This avoids multiple pulsing due to fine structure, riding on a flat-topped pulse, that may bring the pulse above and below threshold. Note the examples below.



INPUT PULSE
(example A)



INPUT PULSE
(example B)

In Example A, the pulse shape variations of the input pulse will not retrigger the discriminator even though they cross the threshold level at a time exceeding the DPR of the unit. In Example B, since the input signal does go back through -24 mV and then once again rises to exceed the -30 mV threshold level, two discriminator outputs would result. Since LeCroy discriminators are most often used with photomultipliers and plastic scintillators, and since the characteristic pulses,out of this type of detector,are typically smooth for each individual event, multiple outputs should only occur when they represent multiple events.

-15 mV Minimum Threshold Option: By special request and at added cost, LeCroy can provide the 4608 Discriminator with its minimum threshold set at -15 mV instead of -30 mV. Extreme care must be taken in the use of these modified units. The hysteresis level (described above) is only 5 mV for the -15 mV unit, such that any input pulse with variations exceeding 5 mV may cause the discriminator to retrigger. Care should be taken to avoid any small DC offset. It is actually recommended that AC coupling be used if the input rates are low enough to permit it. Special care must be taken regarding ground loops which would result in 50/60 cycles threshold sensitivity modulation.

Input Reflections: Input reflections probably account for the majority of multiple-pulsing problems encountered in an experiment. As discriminator thresholds have become lower, the amount of reflected signal required to retrigger the unit has decreased accordingly. Unless the percentage of input reflections is reduced along with the minimum threshold value, the experimenter finds himself in the situation where multiple-pulsing negates the usefulness of lower threshold. The input reflections of a discriminator effectively determine the allowable dynamic range of event or noise input signals.

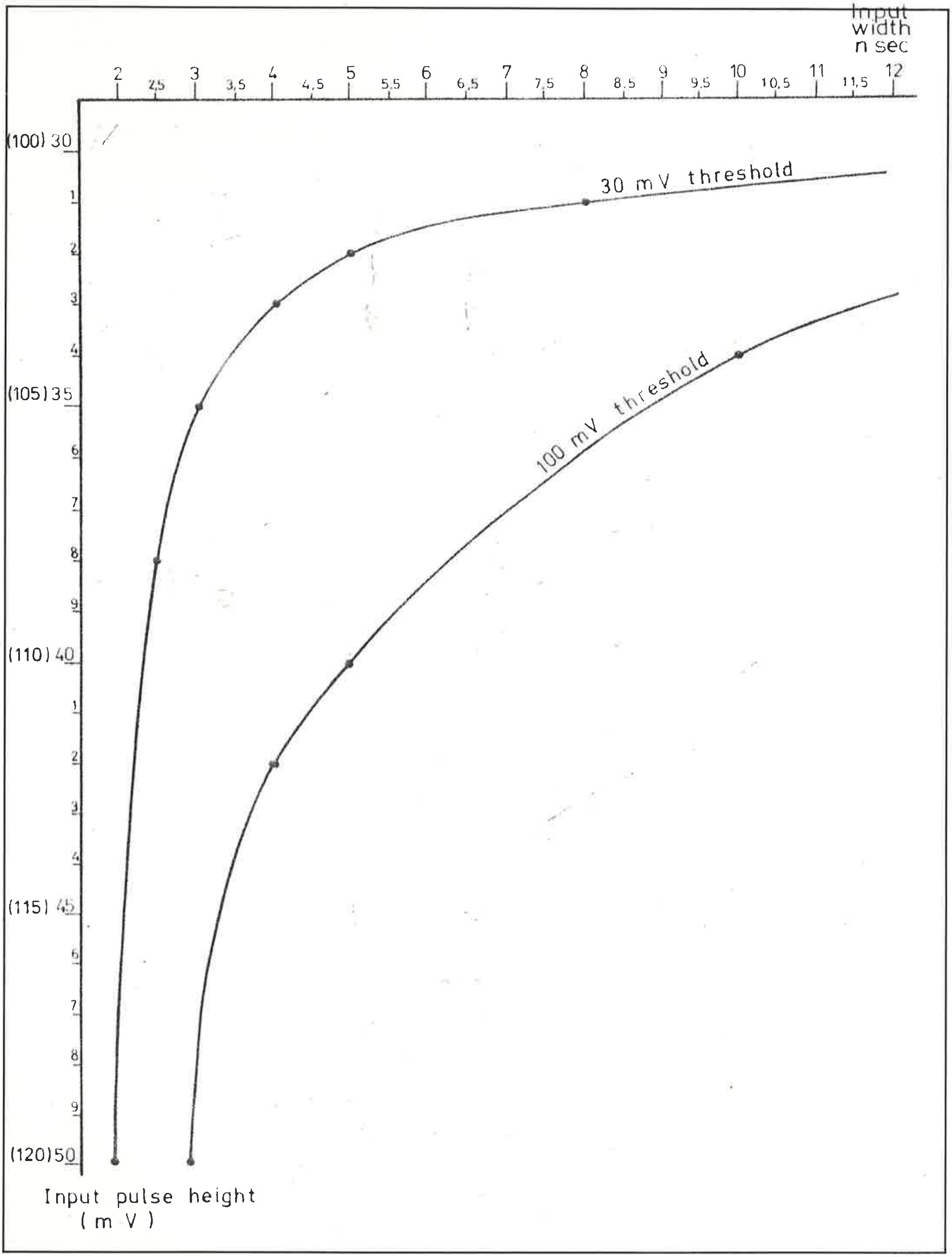
On the experimental floor, a limited dynamic range may mean that minimum threshold values will have to be set higher to prevent multiple-pulsing on noise or large (shower)event signals. In addition, high input reflections also limit the ability of a discriminator to be used to restandardize logic signals which have been degraded by long cables.

The Model 4608 presents <4% reflections for input pulses of 2 nsec. risetime.

Input Protection: The inputs of 4608 Discriminator are protected to 5 A for 0.5 µsec., clamping at +1 and -6 volts.

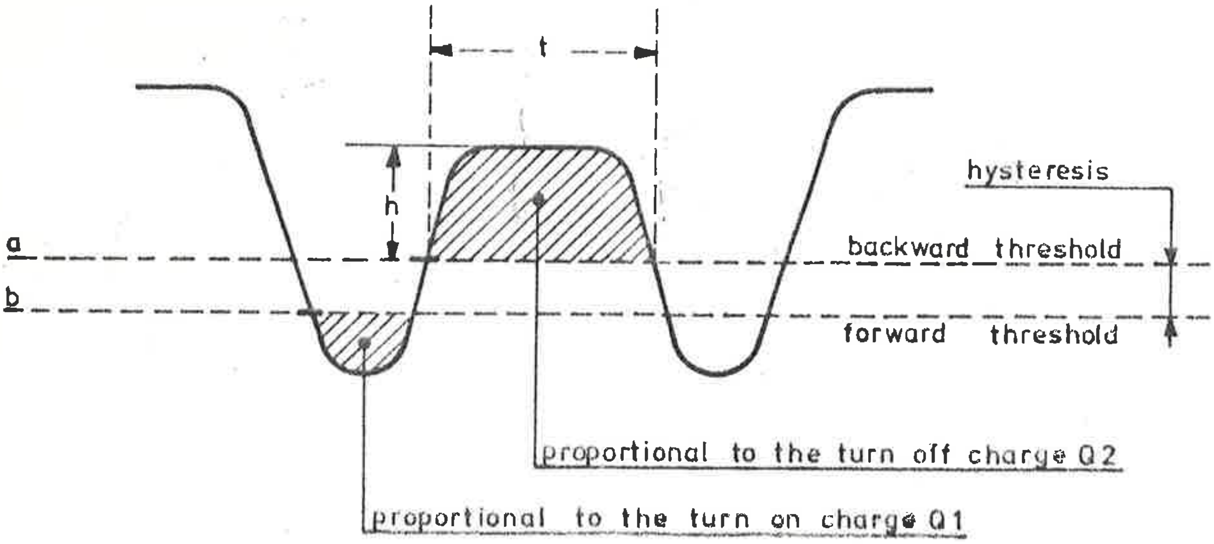
The DC protection is limited by the 0.25 watt dissipation limit of the input resistor, which can be assumed to offer protection against DC signals less than 5 volts.

Input charge over Threshold:
Alike all discriminators, the 4608 needs a minimum input charge above threshold to trigger. As a result, the discriminator threshold is input pulse width dependent, and this effect will be more apparent for smaller input pulse widths. The following figure shows a typical threshold behaviour as function of the input pulse width, for two values of the nominal threshold. The pulse widths given have been measured at the nominal threshold value.


Input
width
n sec
2
2,5
3
3,5
4
4,5
5
5,5
6
6,5
7
7,5
8
8,5
9
9,5
10
10,5
11
11,5
12
(100) 30
(105) 35
(110) 40
(115) 45
(120) 50
30 mV threshold
100 mV threshold
Input pulse height
(m V)

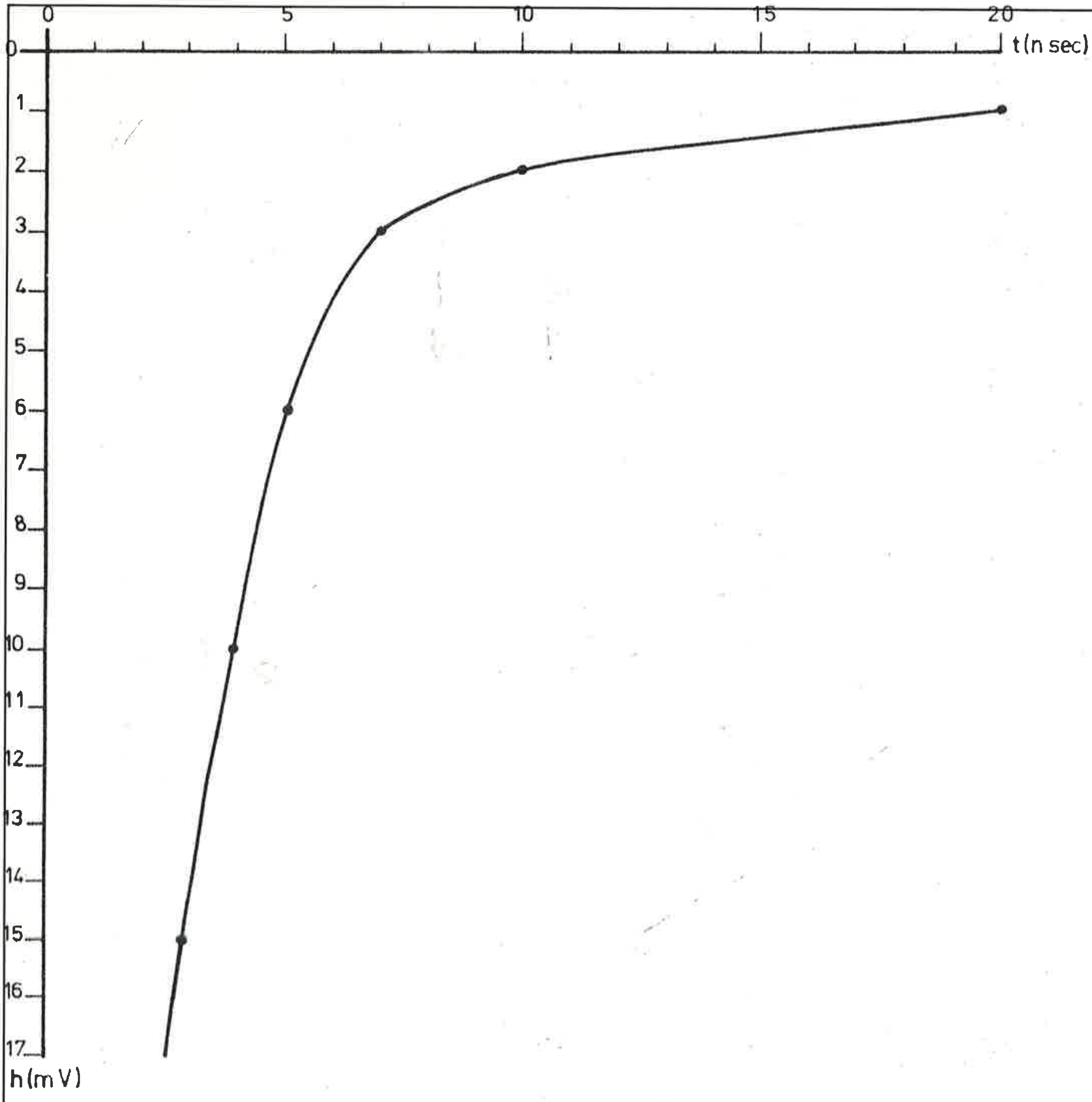
Input charge under Threshold:

Similarly to the minimum charge needed above threshold, a minimum charge has to flow back from the input between two pulses, to make the discriminator retriggerable. The situation is depicted in figure below.



If the turn-off charge is not above the minimum value, the discriminator will see the input pulses as they were a single pulse.

Of course, one should be aware of this effect especially at high frequency and make sure that the voltage, between two pulses, is really going to zero or even to positive values. A pulse clipping with a delay line, should have indeed, in general, an improving effect. The following figure shows how the hole between two pulses, represented by its height h, typically behaves as function of the distance t between the pulses themselves.



Test input:

A front panel test input allows the unique feature to trigger all channels at once, as soon as a NIM pulse is sent. This useful feature allows complete test of the module without removing any input cable, and also permits the use of the 4608 as a 24 fold negative fan-out and 8-fold complementary fan-out.
The test pulse will have on all channels the same effect as a similar pulse on the normal inputs. In particular the output width in burst guard mode, will be proportional to the input width.

Veto input:
A front panel input allows vetoing of all channels simultaneously, when a negative NIM pulse is applied.

The action of the veto input can however be different depending on the operation mode of the unit (updating or burst guard), and on the static level of the veto input.

A complementary NIM signal applied to the veto input, permits the 4608 to be used as an 8-channel strobed coincidence.

The different possibilities to use the veto are in the following:

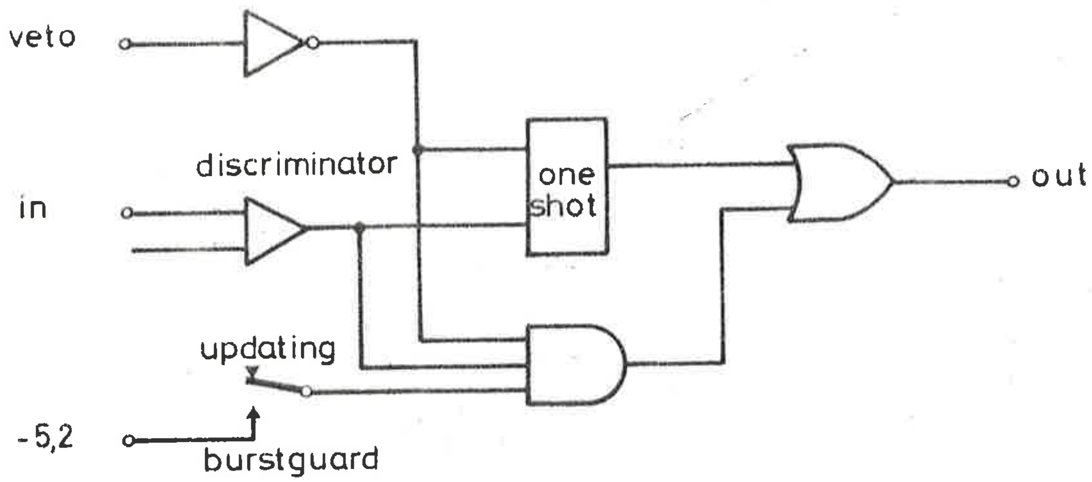
a) Updating mode

In the updating mode, the leading edge of the input pulse triggers the discriminator timing stage, and a veto input is to be coincident and preceed the input pulse leading edge by 3.5 ns to be operative.

b) Burst guard mode (time over threshold)

When the burst guard section is on (see figure), an overlap coincidence between the discriminator output and the veto pulse is activated. A negative veto pulse of width T will veto the output during this time. If a pulse wider than T is applied at the input, an output will result due to the part of the pulse exceeding T. An efficient veto should overlap completely the input pulses.

The same applies when a complementary NIM veto pulse is applied to gate the unit, instead of veto it. The gate pulse should completely overlap the input pulses. In this case the unit is working as a strobed overlap coincidence.



OUTPUT CHARACTERISTICS

The 4608 provides three negative NIM outputs and one complementary NIM output. The negative outputs are bridged and all coming from the same differential type current source, providing 0 mA statically and -48 mA dynamically, into three 50 Ω loads. The output pulse height, event within NIM specifications, can vary then, depending from the number of outputs used, from -0.7 V to -1.2 V.

The outputs present normally an overshoot which does not exceed the 15% of the pulse amplitude. The risetime and falltime are typically ⩽ 2 nsec.

The single complementary output is actually the output from the collector of the other half of the differential pair supplying current to the fast negative timing output. It is a 50 Ω output with quiescent level at -16 mA, and logical 1 at 0 mA. Risetime and other characteristics are similar to that of the negative outputs.

Output width

The output width, in standard updating mode, is continuously adjustable, independently for each channel, via front panel potentiometers in range 4 nsec. to 40 nsec.

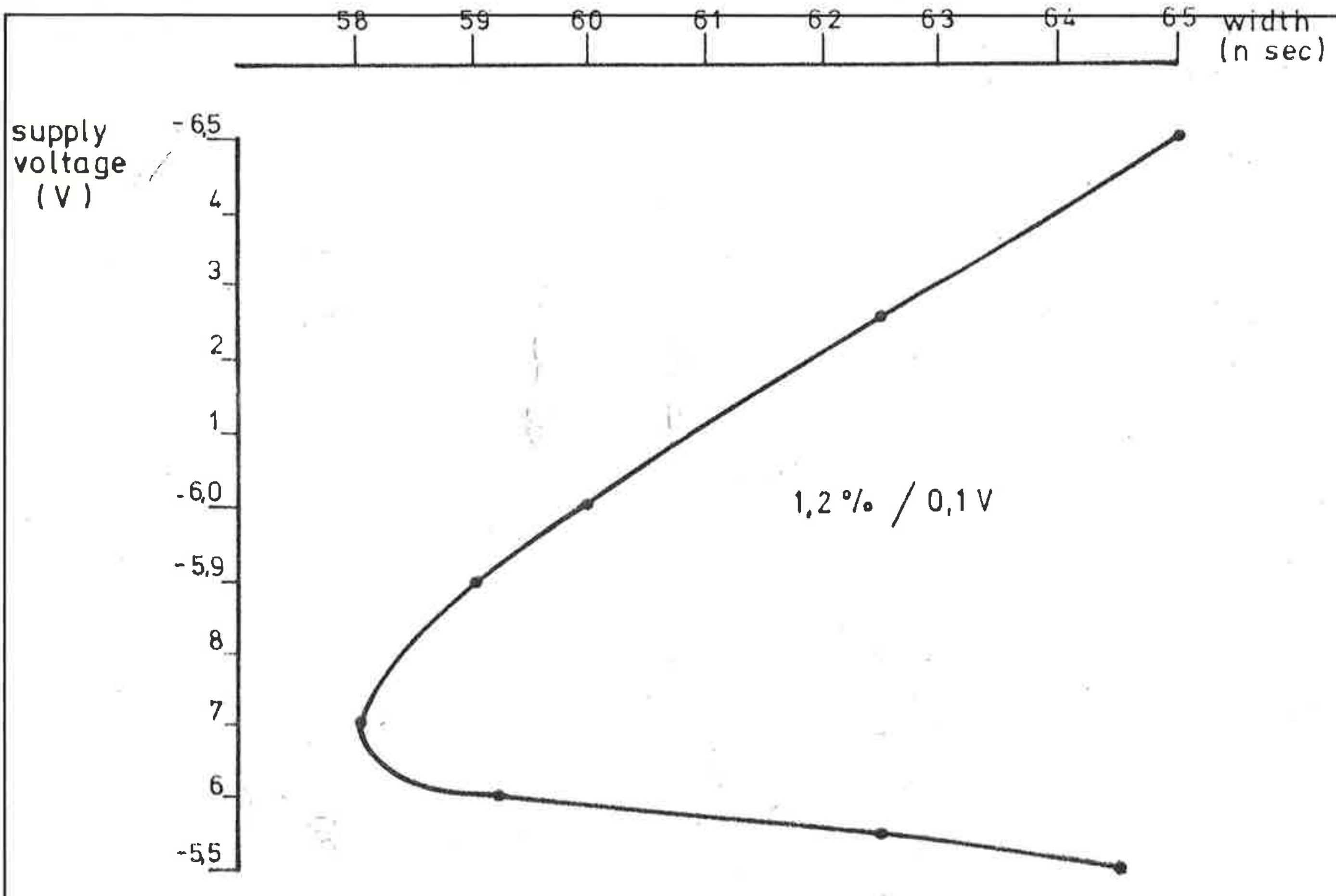
Larger widths, up to 100 nsec, can be obtained with a different trimming of the circuit, which can be made on customer request. It must be stressed however that in the range 40 to 100 nsec. a modulation of the output width may occur if the input and output widths will be equal. This modulation affects mainly the trailing edge of the output which can be deteriorated or it can move in time. The amount of the width modulation is ⩽ 10%.

Output width stability

The main contributions to output width uncertainty are a function of the external conditions in a manner similar to threshold uncertainty. Variations in both temperature and supply voltage can cause significant changes in output width.

Width temperature coefficient has been measured to be ⩽0.25%/°C, while the voltage coefficient is 1.2%/0.1 V.

The last one has in fact a funny behaviour, better understood on the graph below.



UPDATING AND BURST GUARD OPERATION MODES

The module has a front panel switch which allows to chose between two possible operation modes.

Updating:
In updating mode the output is extended if a second pulse comes in before the first output returns to zero, as long as the second pulse arrives at a time later than the double-pulse resolution of the unit. Thus, the second pulse will be seen by the front end even though an output pulse is still present from the first signal, and that second pulse will cause a new output to be generated and added (in time) to the portion of the original output already occured.

Burst Guard:
In Burst Guard mode, the output of the front end is ORed with the conventional mode output. Thus, for input pulses arriving at a rate which exceeds the double-pulse resolution of the unit, the discriminator output duration will be equal to the time interval between the first leading edge threshold crossing and the last trailing edge threshold recrossing, or the preset output width, whichever is greater. This feature is expecially important in veto applications, where it is desired to keep the discriminator output on when the detector is being hit by unwanted and unmeasurable high rates. A discriminator without Burst Guard would

see the first pulse and generate the preset output width, but would be paralyzed at quiescent level or would trigger only randomly for subsequent pulses separated by less time than the DPR of the unit. Burst Guard assures a logical 1 output level during these high rate bursts.
Burst guard mode is also useful in any application where the output width has to be proportional to the input width. Figure at page 7 could help for a better understanding.

TIMING CHARACTERISTICS

Maximum rate: Maximum rate capability of 4608 is guaranteed at 200 MHz. but in fact a discriminator frequency behaviour is more complicated than that. Depending on the operation mode, burst guard or updating, one can define indeed a certain number of typical frequencies defining ranges of frequencies where different behaviours occur.

In updating mode one can define three typical frequencies:
a ≃ 205 MHz, b ≃ 220 MHz, c > 500 MHz

For ν < a the output will follow identically the input; so that the same frequency structure present at the input will be reproduced at the output.

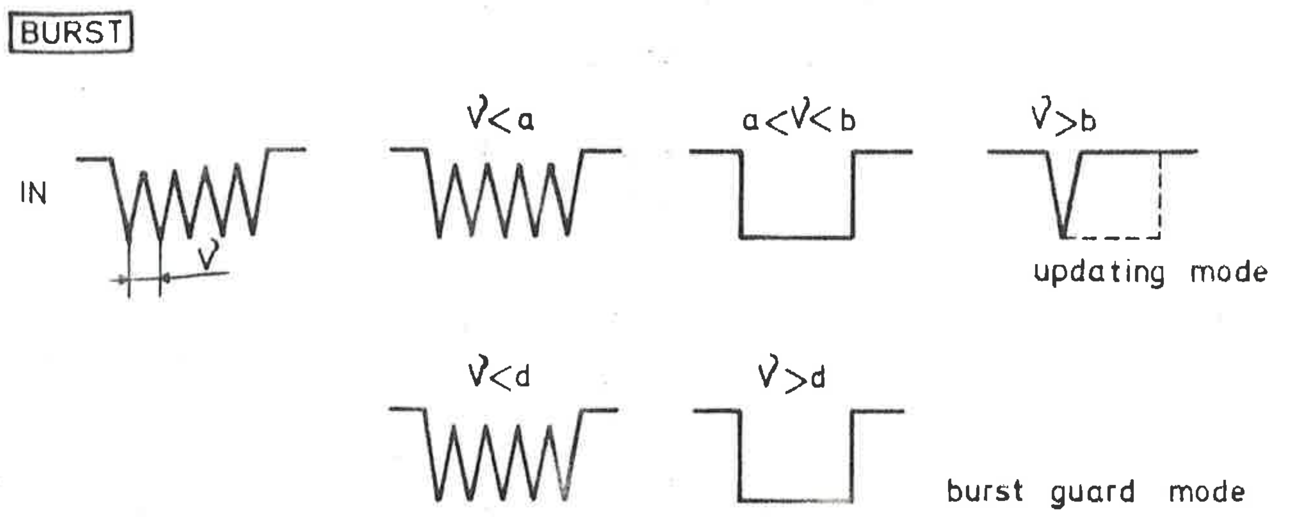
For a < ν < b, the input stage is still capable of distinguish the input pulse, while the output stage does not. The output will be then a long pulse of width as long as the input burst duration.

For ν > b and at least up to 500 MHz even the input stage is no more able to separate the input pulses and the input burst will be taken as a single pulse. The output will be then a single pulse triggered by the first pulse in the burst.

In burst guard mode only one frequency, d ≃ 180 MHz, is the most critical.

For ν < d the discriminator will reproduce the input frequency structure at the output.

For ν > d and at least up to 500 MHz, the output will be a single pulse of width as long as the input burst duration.



Double-Pulse Resolution: The speed of a discriminator is practically defined by its double-pulse resolution or the time between the leading edges of the most closely spaced pulse pair for which the discriminator produces two distinct output pulses. Although simple in concept, this specification can be misleading unless the input conditions are precisely defined and ambiguities in performance are disclosed. One should indeed investigate the double pulse resolution as function of the input amplitude over threshold and of the input width. Tests on 4608 gave a double pulse resolution which is never worse than 4 nsec.

Tracking Error: The ability of a discriminator to be used for precise timing (coincidence or TOF) in an environment which encounters narrow pulse pair separations is demonstrated by considering the time shift (or tracking error) introduced as the time interval between successive inputs is reduced. In a experiment, tracking error is equivalent to time dispersion as a function of input rate. For many experiments, this can be critical, since it is often in high rate situations that the best timing resolution is required.

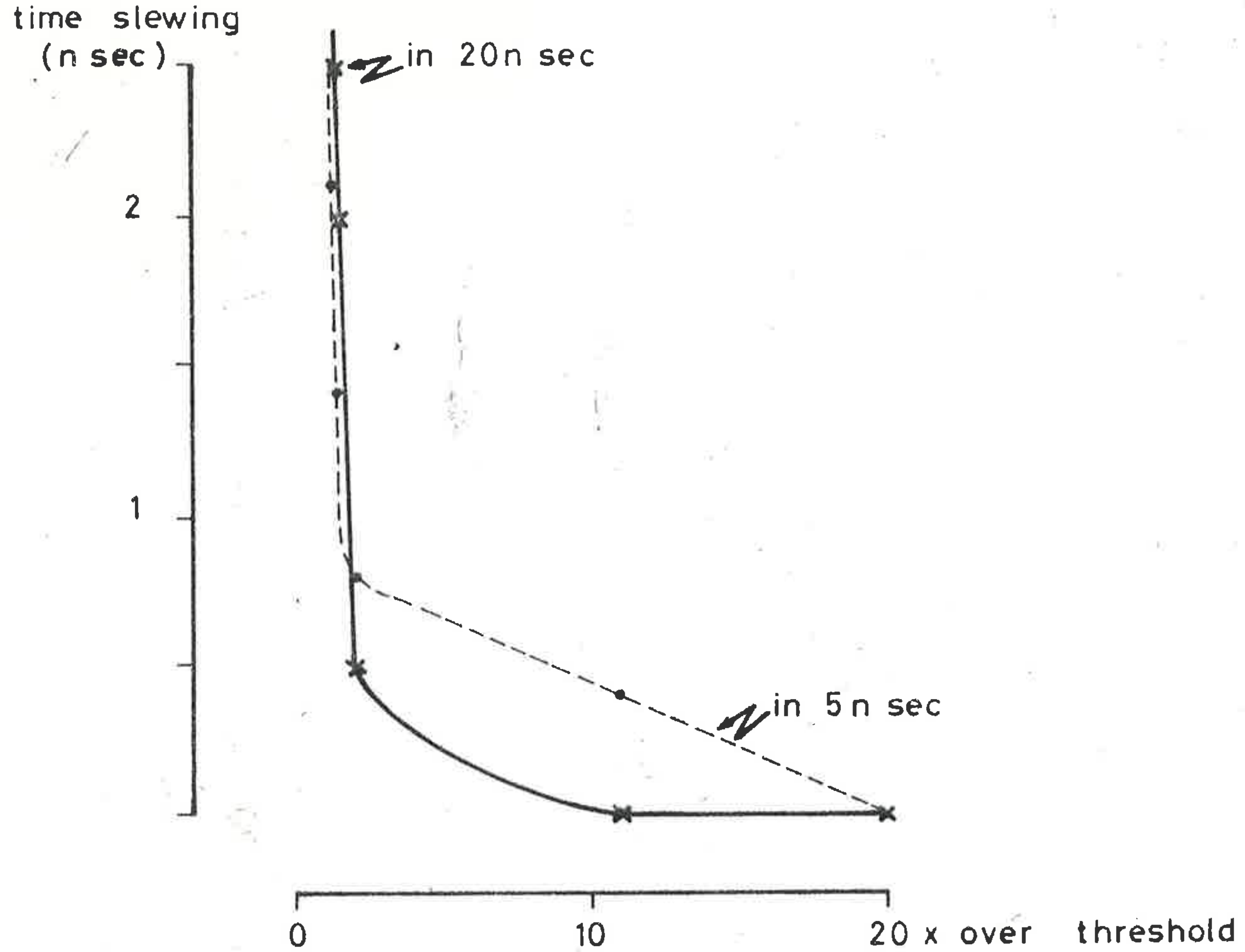
Tests on 4608 gave a tracking error typically not in excess of 200 psec.

Slewing

At less than maximum input rates which do not tax the double-pulse resolution of the discriminator, a class of characteristics comes into play which defines the fidelity of the discriminator output to the time information in the input signal. The most important of these, and the most difficult to strictly define and to measure, is time slewing or walk. This is variation in the input-to-output time delay of a discriminator with input amplitude. The net measured slewing yielded by a discriminator has two components, one contributed by the discriminator itself (intrinsic slewing) and the other dependent upon the input risetime.

Intrinsic slewing might be defined as the slewing measured with a delta function input. Risetime-dependent slewing arises from the fact that the discriminator fires earlier on the leading edge of a large pulse of finite risetime than on one of smaller amplitude. For an extreme range of pulse heights, the maximum contribution is equal to the 0 to 100% risetime of the pulse.

With most discriminators, by far the largest portion of the slewing occurs in the amplitude region just above threshold, threshold being defined as the input amplitude that produces 50% triggering. Slewing specifications are frequently given over an input amplitude range from threshold to a specified overload factor (such as 10 X threshold).



The picture shows how the time slewing behaves, for two different input widths, taking as reference in time the output corresponding to the input 20 X over threshold.

PACKAGING

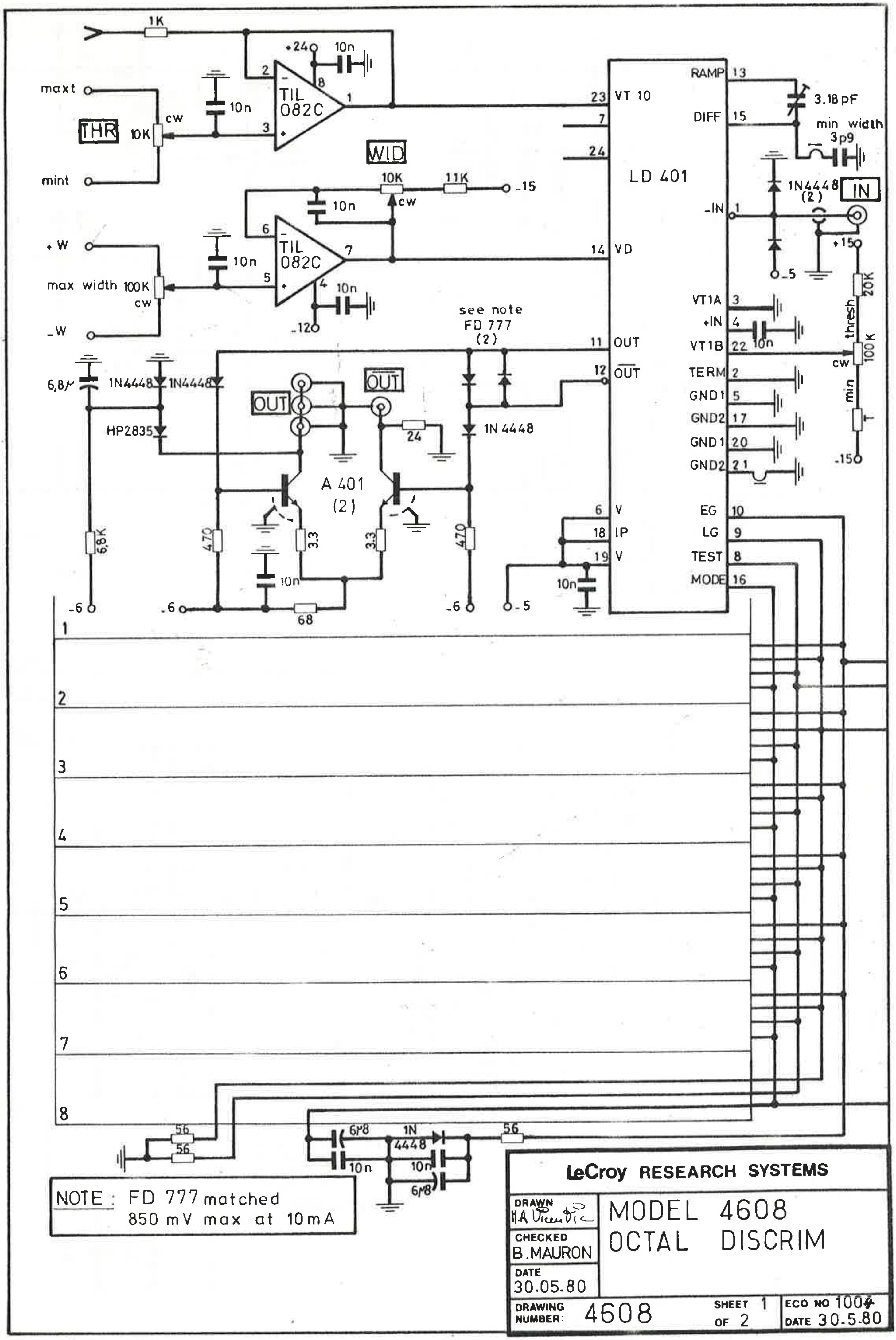
The 4608 discriminator is packaged in a No. 1 NIM module with Lemo type connectors.

POWER CONSUMPTION

The model 4608 requires considerably more current than does any other LRS discriminator, and that because of the very high working frequency. The current drain upon the - 6 V supply is 1.9 A, the total power dissipation of the module is 15 W, so it is highly recommended to use a NIM bin with higher dissipation limits, or to take care to carefully choose low power modules for the remaining slots in the bin, or to perhaps leave some NIM slots blank.

Recommended Use of the NIM Power Bins:

It is highly recommended to keep any NIM bin at as constant a temperature as possible, using air conditioning in the trailer or experimental station and definitely using fans to assure an air flow through all modules in every bin. Elimination of large temperature variations removes the worry of temperature drift effects upon modules of any manufacturer, and the forced air flow is good insurance against the potential failure of components in the modules due to excessive heating for extended periods of time. Despite the fact that all components are pre-aged and burned-in before insertion into LRS modules, and the modules themselves are temperature cycled for days under power between initial test and final test, it is recommended to avoid subjecting any modules to adverse operating conditions if it could be avoided.


1K
+24
10n
TIL 082C
maxt
THR
10K
cw
mint
WID
10K
11K
-15
+W
max width 100K
-W
-12
see note FD 777 (2)
LD 401
RAMP 13
VT 10 23
DIFF 15
3.18 pF
min width 3p9
1N4448 (2)
IN
-IN 1
VD 14
VT1A 3
+IN 4
VT1B 22
TERM 2
GND1 5
GND2 17
GND1 20
GND2 21
OUT 11
OUT 12
6,8μ
1N4448
HP2835
1N 4448
OUT
24
A 401 (2)
470
3.3
6,8K
68
V 6
IP 18
V 19
EG 10
LG 9
TEST 8
MODE 16
+15
20K
thresh
100 K
min
-15
-6
-5
1
2
3
4
5
6
7
8
56
6μ8
1N 4448
10n
NOTE : FD 777 matched 850 mV max at 10 mA
LeCroy RESEARCH SYSTEMS
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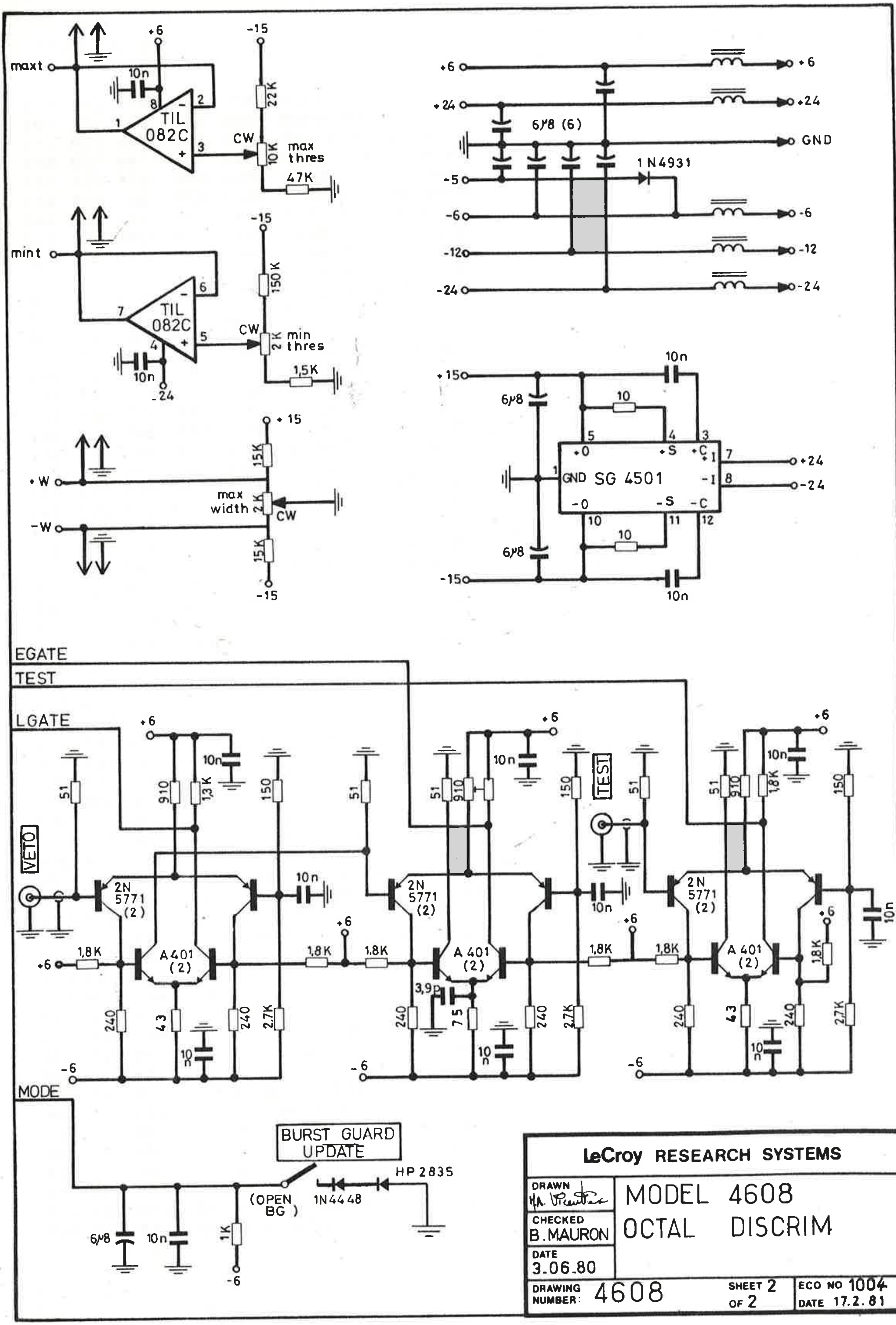
CHECKED B.MAURON
DATE 30.05.80
MODEL 4608 OCTAL DISCRIM
DRAWING NUMBER: 4608
SHEET 1 OF 2
ECO NO 1004
DATE 30.5.80



LeCroy RESEARCH SYSTEMS

DRAWN [signature]	MODEL 4608
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DATE 3.06.80	
DRAWING NUMBER: 4608	SHEET 2 OF 2
ECO NO 1004	DATE 17.2.81

MODEL NO 4608 OCTAL DISCRIMINATOR PRINTED 20-Feb-81
LAST REVISION NO 1004 REVISION DATE 17-Feb-81

102 412 *39	CAP CERA DISC 100V	3.9 PF	9
103 327 103	CAP CERA MONO 50V	.01 UF	80
142 824 685	CAP TANT DIP CASE	6.8 UF	19
158 819 **1	CAP VARI CERA	3.2-18 PF	8
161 335 *33	RES COMP 1/4W 5%	3.3 OHMS	16
161 335 100	RES COMP 1/4W 5%	10 OHMS	2
161 335 101	RES COMP 1/4W 5%	100 OHMS	2
161 335 102	RES COMP 1/4W 5%	1 K	9
161 335 113	RES COMP 1/4W 5%	11 K	8
161 335 132	RES COMP 1/4W 5%	1.3 K	1
161 335 151	RES COMP 1/4W 5%	150 OHMS	3
161 335 152	RES COMP 1/4W 5%	1.5 K	2
161 335 153	RES COMP 1/4W 5%	15 K	2
161 335 154	RES COMP 1/4W 5%	150 K	1
161 335 182	RES COMP 1/4W 5%	1.8 K	7
161 335 203	RES COMP 1/4W 5%	20 K	8
161 335 223	RES COMP 1/4W 5%	22 K	1
161 335 240	RES COMP 1/4W 5%	24 OHMS	8
161 335 241	RES COMP 1/4W 5%	240 OHMS	6
161 335 272	RES COMP 1/4W 5%	2.7 K	3
161 335 430	RES COMP 1/4W 5%	43 OHMS	2
161 335 471	RES COMP 1/4W 5%	470 OHMS	16
161 335 473	RES COMP 1/4W 5%	47 K	1
161 335 510	RES COMP 1/4W 5%	51 OHMS	5
161 335 560	RES COMP 1/4W 5%	56 OHMS	3
161 335 622	RES COMP 1/4W 5%	6.2 K	3
161 335 680	RES COMP 1/4W 5%	68 OHMS	8
161 335 682	RES COMP 1/4W 5%	6.8 K	8
161 335 750	RES COMP 1/4W 5%	75 OHMS	1
161 335 911	RES COMP 1/4W 5%	910 OHMS	3
181 457 103	RES VARI CERMET	10 K	1
181 457 104	RES VARI CERMET	100 K	16
181 457 202	RES VARI CERMET	2 K	2
182 537 103	RES VARI CERMET	10 K	16
208 *11 *11	IC JFET OP AMP	TL082CP	9
208 *21 501	IC VOLT REG DUAL	SG4501J	1
210 *80 401	IC DISCRIMINATOR	LD401A	8
230 110 **3	DIODE SWITCHING	FD 777	16
230 110 **5	DIODE SWITCHING	1N4448	42
235 *50 **1	DIODE RECTIFIER	1N4139	1
253 *10 835	DIODE HOT CARRIER	HP2835	9
270 130 401	TRANSISTOR NPN	A401	22
275 170 **2	TRANSISTOR PNP	2N5771	6
300 *20 **1	BEAD SHIELDING '1/2' SIZE		16
300 *50 **1	CHOKE FERRITE SINGLE LEAD		5
400 *10 **8	SOCKET IC ST	DIP-8	9
400 *20 *14	SOCKET IC ST	DIP-14	1
400 *40 *24	SOCKET IC ST	DIP-24	8
402 *30 **0	CONNECTOR CO-AXIAL	LEMO	10
402 *30 **1	HOOD FOR BULKHD LEMO CONN		10
402 *30 **2	SPANNER NUT SMALL OD LEMO		10
402 112 **1	CONN PC MTG LEMO	NICKEL	32
405 112 **1	CONNECTOR BLOCK	(PIN)	1
405 212 **2	GUIDE PIN	(MALE)	1
405 213 **1	GUIDE PIN	(MALE)	1
405 312 **1	GUIDE PIN	(FEMALE)	2
405 613 **1	CONNECTOR HOOD		1
410 162 **0	SWITCH TOGGLE N/LOCK SPDT		1
454 310 **2	HDR DIP SOLD TO PC BD	2	10

MODEL NO 4608 OCTAL DISCRIMINATOR PRINTED 20-Feb-81
LAST REVISION NO 1004 REVISION DATE 17-Feb-81

468 911 **1	TEST POINT (JACK) WHT	8
521 440 *22	SPACER HEX 4-40X11/16	2
523 400 *24	ROLL PIN SIZE #4 3/4 LG	8
540 103 102	SIDE COVER NIM LEFT	1
540 103 103	SIDE COVER NIM RIGHT	1
540 104 101	WRAPAROUND NIM SIZE #1	1
540 105 *11	BRACKET NIM WRAP SIZE #1	2
555 611 **1	CAPTIVE SCREW 6-32	2
555 621 **2	CAPTIVE SCREW RETAINER	2
560 440 **5	SCREW PHILIPS 4-40X5/16	8
567 256 **4	SCREW FLAT PHIL 2-56X1/4	4
567 440 **4	SCREW FLAT PHIL 4-40X1/4	10
593 910 **1	CABLE CO-AX RG196 OR 178	4
714 608 **3	PC BD PREASS'Y 4608	1
724 608 **3	FRONT PNL PREASS'Y 4608	1
750 **0 101	WIRE 11" BLK W/PIN AWG 22	1
750 **0 111	WIRE 11" BRN W/PIN AWG 22	1
750 **0 131	WIRE 11" ORA W/PIN AWG 22	1
750 **0 161	WIRE 11" BLU W/PIN AWG 22	1
750 **0 181	WIRE 11"GRAY W/PIN AWG 22	1

NOTE 1	FOR 4608/Z ADD FOLLOWING
NOTE 2	402 030 000 X 8
NOTE 3	402 030 001 X 8
NOTE 4	402 030 002 X 8
NOTE 5	724 608 013 X 1
NOTE 6	593 910 001 X 3
NOTE 7	SUPPRESS 724 608 003 X 1
NOTE 8	
NOTE 9	
NOTE 10	
NOTE 11	
NOTE 12	
NOTE 13	
NOTE 14	
NOTE 15	

Bye