KEK-EXP. FACILITIES-77-2
June 1977

NIM STANDARD MODULES FOR COUNTER EXPERIMENTS AT THE KEK

by

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Abstract

The data acquisition system of the high energy experiment demands various kinds of electronics. The standardized units of the modular configuration are designed and built under the specifications of NIM and CAMAC standards. The specifications of the NIM modules preferentially used at KEK are described, including the commercial modules for the facilitation of use by experimentalists.

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§ 1. Introduction

In the last May (1977), started the high energy experiment at the KEK using the internal target beam. The electronics system is an important part of the experimental apparatus to take numerous data with the computer on-line. It consists of modular units which have various functions and are arranged in accordance with specific experimental requirements. These modular units are designed according to the world-wide specifications for the nuclear electronics: NIM and CAMAC standards.

At the KEK, the electronics modules for the experiments are distributed to users and maintained by the Electronics Group of the Physics Department. Although the similar modules are almost available in the commercial market, the Electronics Group has developed many modules for use at the KEK including special demands of experiments because of the convenience of users and also the easy maintainance. Up to now, the number of modules amounts to about 2,000 including both NIM and CAMAC modules. The book-keeping of these modules is facilitated with a computer program which updates periodically the stock-list file. For this purpose, all of the modules are numbered as shown in the appendix. A part of these modules has been developed in cooperation with the electronics group of the High Energy Division in the INS.

This paper describes the specifications and schematics of the NIM modules which include the specific modules designed in the KEK and the commercial ones. This paper is expected to be not only a useful manuals for experimentalist but also the basic data sheets for ourself. A similar paper for the CAMAC modules will be published soon. These papers show the present results of our work in electronics. The functions of modules will be improved corresponding to the extended needs from experiments and the day-by-day progress of the electronical techniques.

Acknowledgement

The authors wish to express their sincere thanks to Prof. Y. Nagashima of the KEK, Prof.'s M. Mishina and K. Husimi of the INS for their valuable advices and encouragement through this work. They are indepted to Mr. K. Shiino and Mr. S. Watanabe for their useful contribution to developments of several modules. Thanks are also due to Dr. K. Ukai, Mr. A. Imanishi of the INS for their helpful discussion about problems of the high speed pulse technique. They are also indepted to Mr. M. Kaneko of Kaizu Seisakusho Inc. for his kind assistance.

REFERENCES

The NIM standard modules are designed by next reference.

1. AEC Committee: Standard Nuclear Instrument Modules, TID-20893 (Rev. 3), December 1969.

For more detailed descriptions of the NIM standard modules are seen following references.

2. A. Yoshimura: Pulse Stretcher, INS-TL-102 (1968).

3. T. Yamagata, T. Yoshizaki and T. Kiyoshima: Single Count Monitor, INS-TH-59 (1968).

4. S. Iwata: Fast Timing Circuits for Time-of-Flight Measurement, INS-TH-65 (1970).

5. K. Takikawa, T. Nozaki, F. Takasaki and S. Inaba: Control and Readout System of Scaler, INS-TH-67 (1970).

6. S. Inaba and K. Husimi: 120 MHz High Speed IC Decade Counter with a Centesimal Top Counting Stage, INS-TH-73 (1972).

7. S. Inaba and M. Mishina: Nimfan, Cooling Fan for AEC NIM BIN, INS-TH-74 (1972).

8. S. Watanabe: Variable Attenuator, INS-TH-79 (1972).

9. S. Inaba and K. Husimi: High Speed Decimal Scaler with a Centesimal Top Counting Stage, Nuclear Instrum. and Methods, 106 (1973) p563-567.

10. K. Shiino, A. Imanishi and M. Mishina: Multiscan Digital Voltage Monitor, INS-TH-83 (1973).

11. S. Watanabe and M. Mishina: Triple DC Linear Amplifier Module, INS-TH-85 (1973).

12. S. Watanabe and M. Mishina: Fast Linear Gate and Stretcher, INS-TH-91 (1974).

13. K. Shiino and M. Mishina: Fast Discriminator and Fast Coincidence Circuit, INS-TH-92 (1974).

14. S. Inaba, M. Ikeda and K. Shiino: Dual Fanout Module, KEK-Exp. Facilities - 3 (1974).

15. S. Inaba, E. Inoue, K. Nakagome and K. Ninomiya: Dual Nanosecond Variable Delay Module, KEK-Exp. Facilities - 5 (1974).

16. K. Ukai and K. Gomi: Current Integrator using the Voltage to Frequency Converter, INS-TH-97 (1975).

17. S. Inaba and M. Ikeda: Quad NIM → ILl Level Shifter Module, KEK-Exp. Facilities - 1 (1975).

18. S. Watanabe and K. Shiino: Specifications of fast electronics components (I), INS-TS-11 (1975).

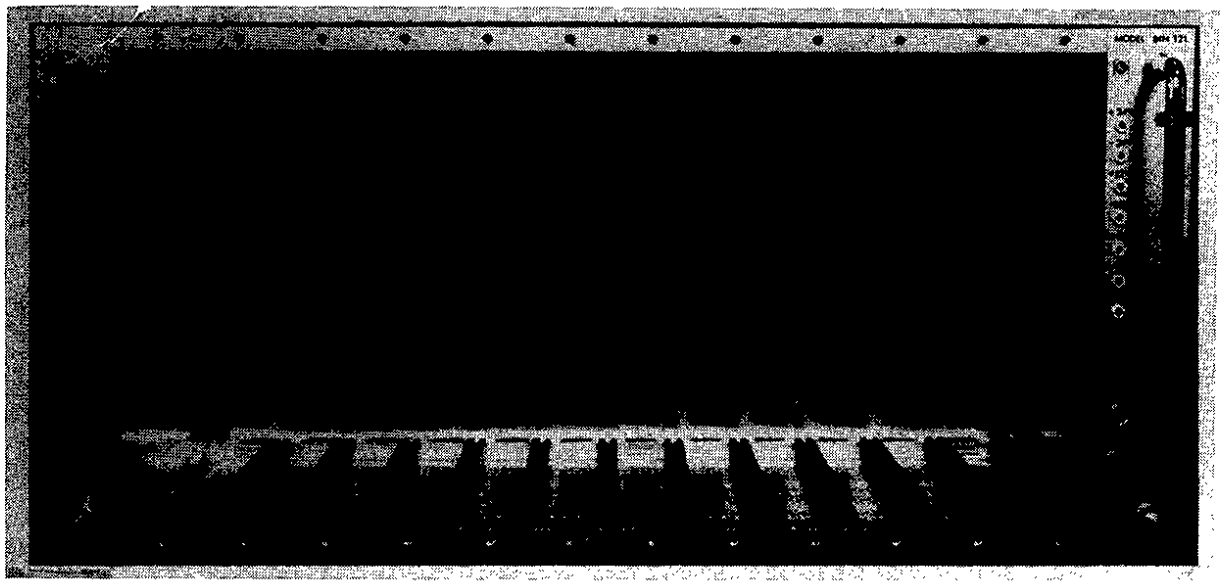
19. S. Inaba, E. Inoue, K. Nakagome, K. Ninomiya and S. Watanabe: Dual Nanosecond Variable Attenuator Module, KEK-Exp. Facilities - 1 (1976).

20. T. Ookubo and K. Shiino: Fast NIM Standard Module with ECL IC, INS-TH-105 (1976).

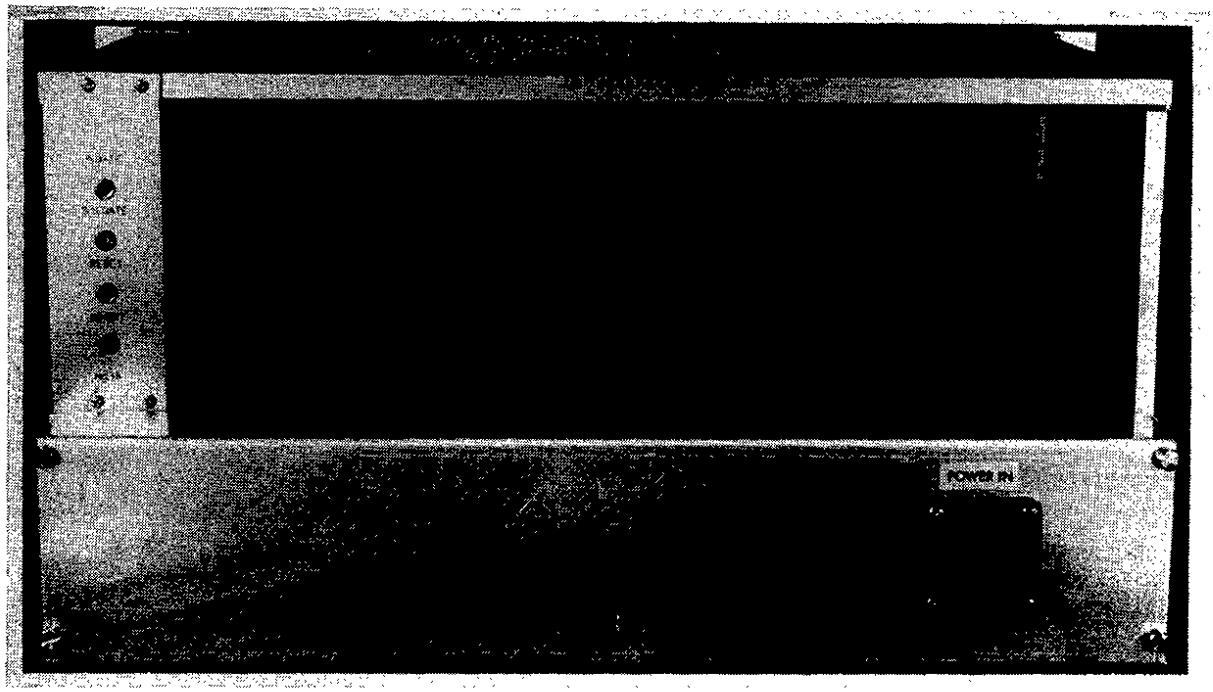
21. S. Inaba, M. Ikeno and M. Mishina: NIM Fast Visual Scaler with On-Line Control Function, KEK-Exp. Facilities -77 - 1 (1977).

22. K. Shiino, M. Yoshioka and S. Asaoka: Control Circuits for the 1.3 GeV Electron Synchrotron (I), INS-TH-112 (1977).

NO1-11 NIM BIN (KEK TYPE-1)



NIM BIN Front View



NIM BIN Rear View

KEK NIM STANDARD (01-11)
NIM BIN KEK TYPE-1

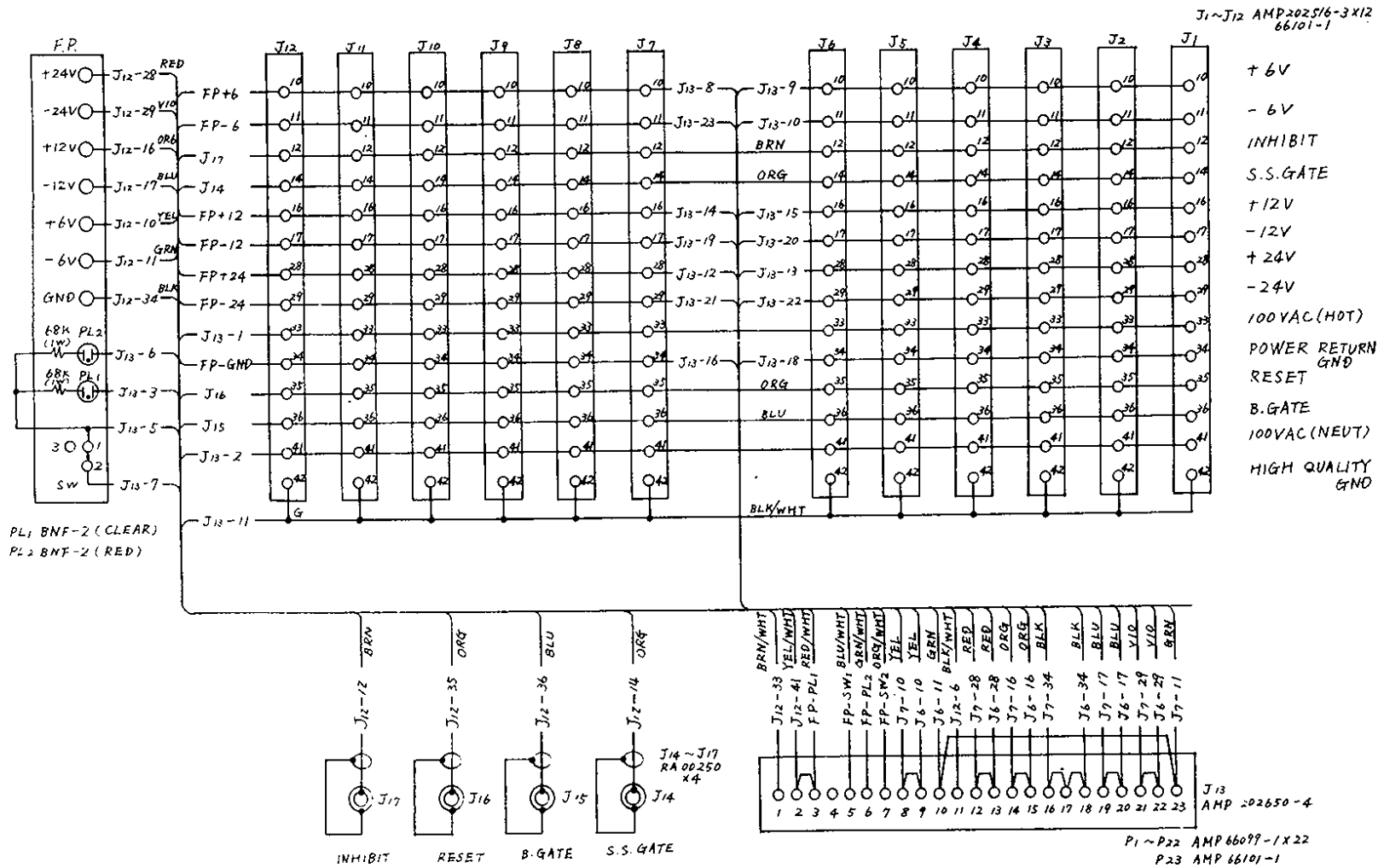
KEK NIM STANDARD (NO1-11)
NIM BIN KEK TYPE-1

SPECIFICATIONS

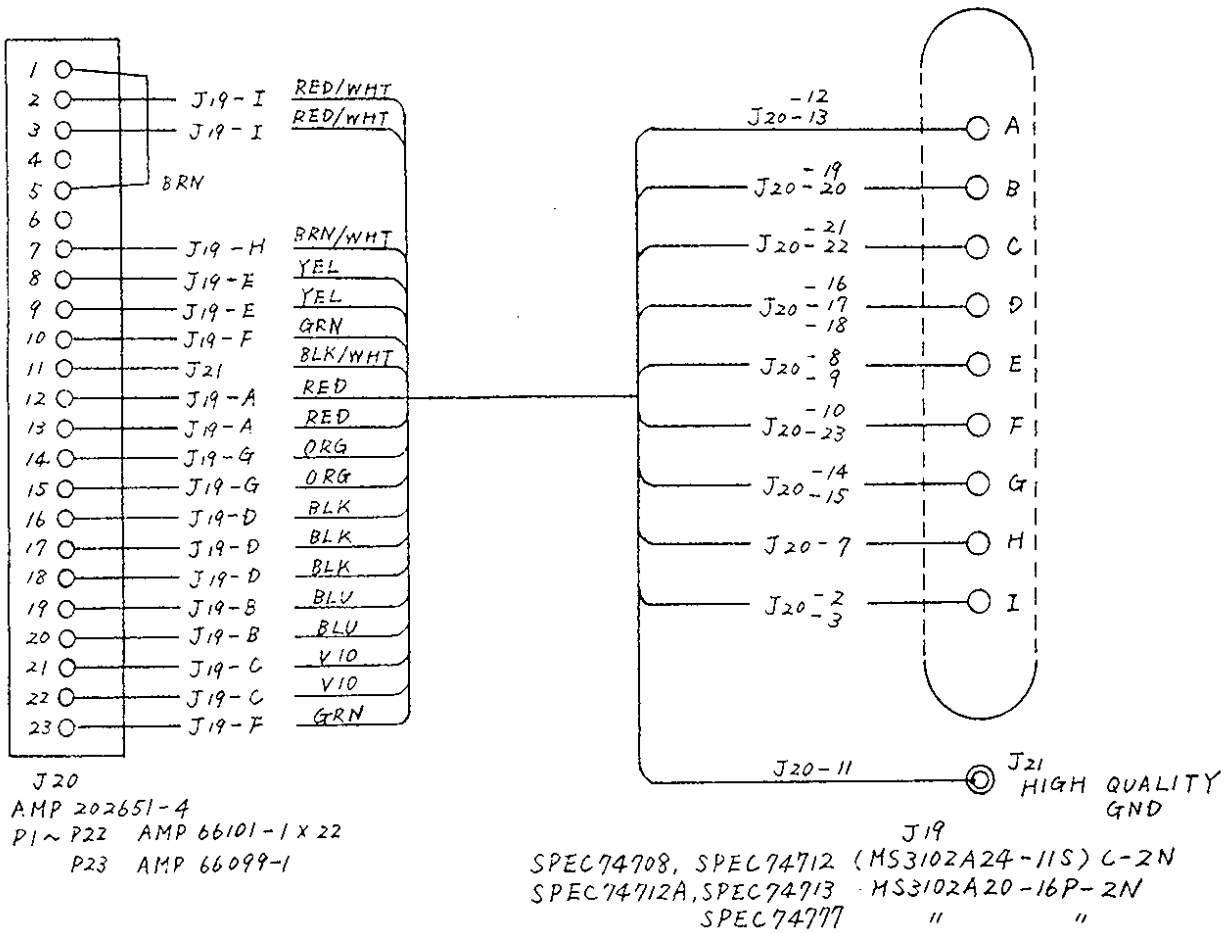
(1) MECHANICAL TOLERANCES : In accordance with TID-20893 (Rev.3), providing for interchangeability of all standard modules.

(2) MODULE CONNECTORS : 12 each as specified by TID-20893 (Rev.3). (AMP-202516-3 connectors)

(3) INSTALLED WIRING : All connectors wired in parallel for +6V, -6V, +12V, -12V, +24V, -24V, high-quality ground, power-return ground and AC100V, in accordance with TID-20893 (Rev.3). And in addition to inhibit, start-stop gate, reset and beam gate through rear control panel.



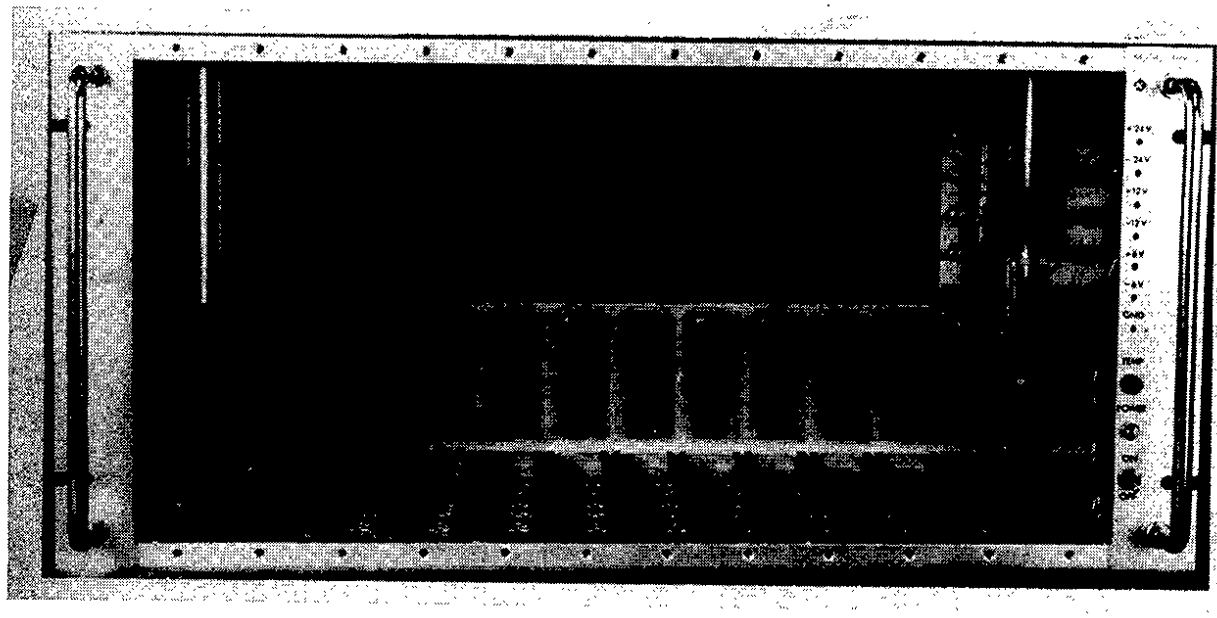
NIM BIN KEK TYPE-1 (NO1-11)



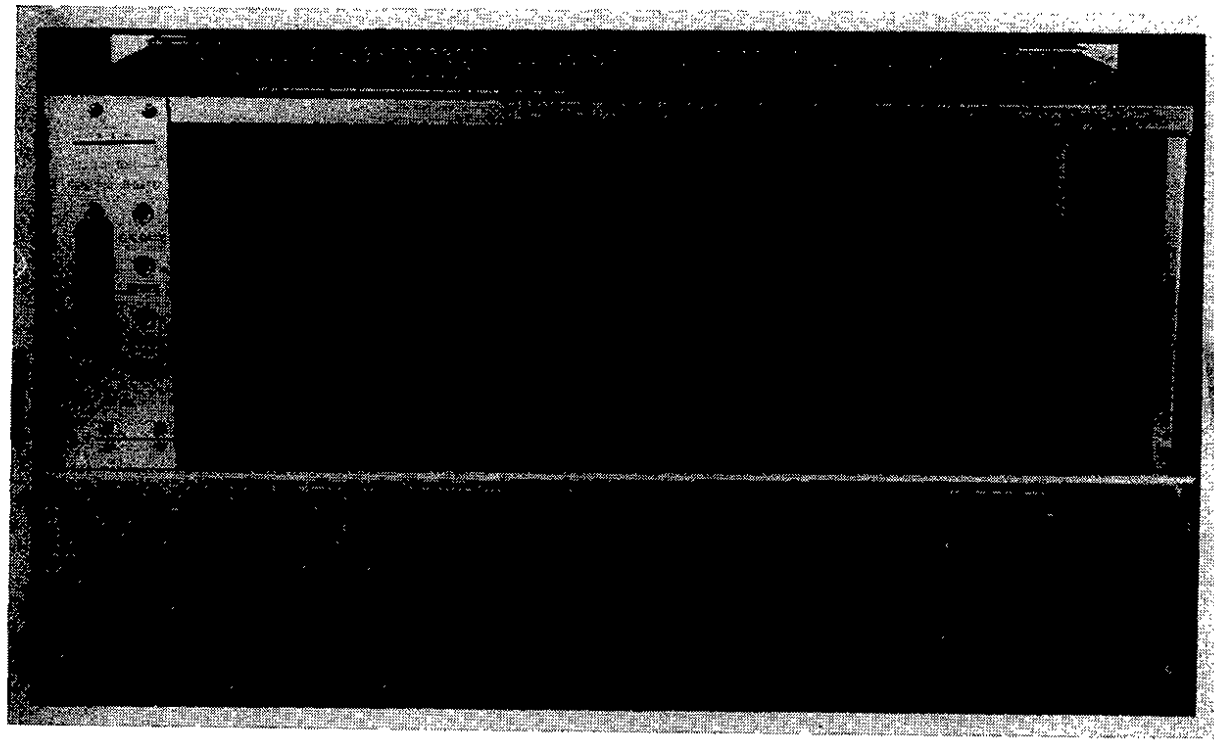
NIM BIN KEK TYPE-1

NIM BIN KEK TYPE-2 CONNECTOR BOX

NO1-21 NIM BIN WITH DATA WAY (KEK TYPE-2)



NIM BIN Front View



NIM BIN Rear View

KEK NIM STANDARD (01-21)
NIM BIN KEK TYPE-2 with DATAWAY

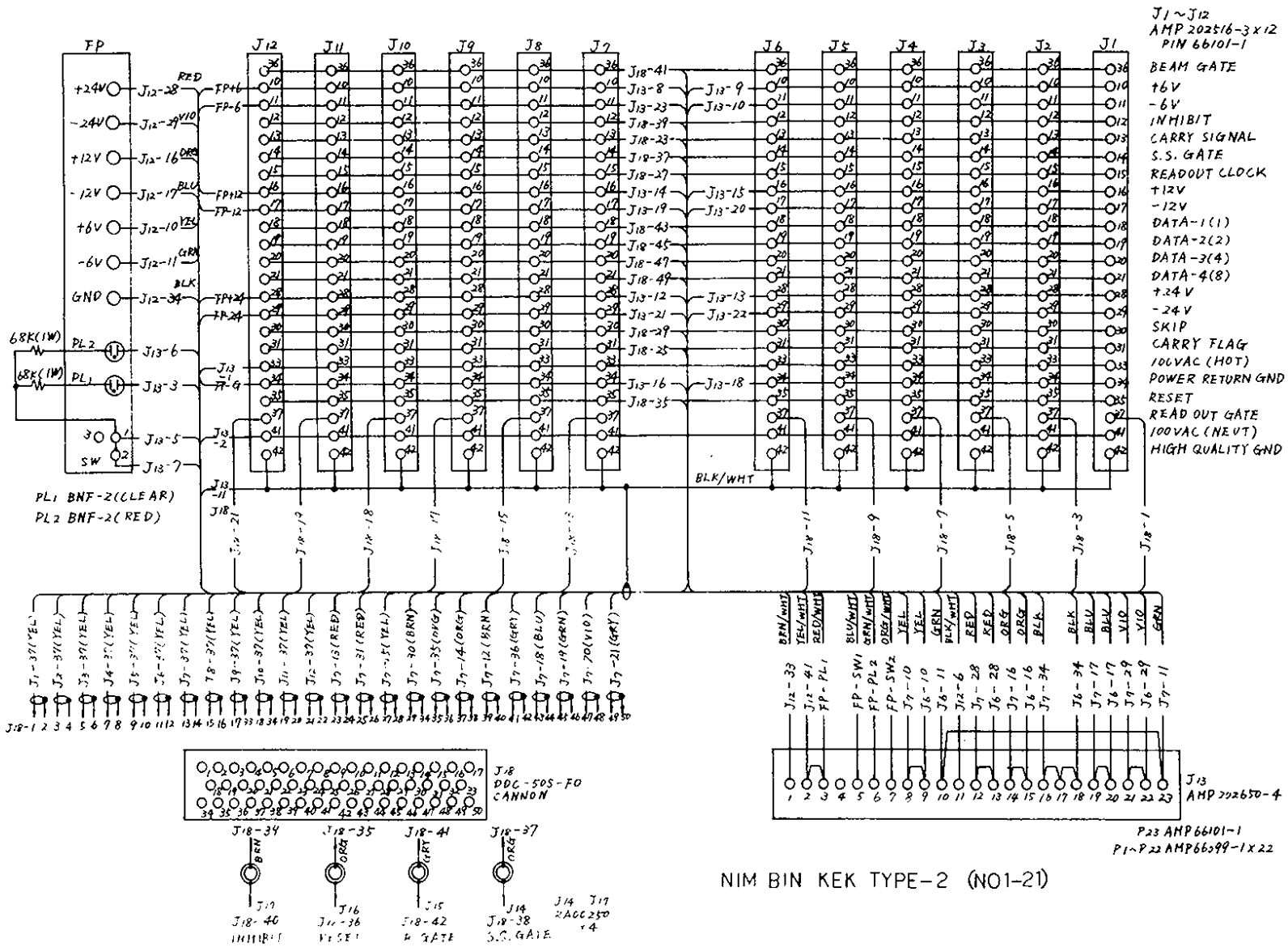
KEK NIM STANDARD (NO1-21)
NIM BIN KEK TYPE-2 WITH DATAWAY

SPECIFICATIONS

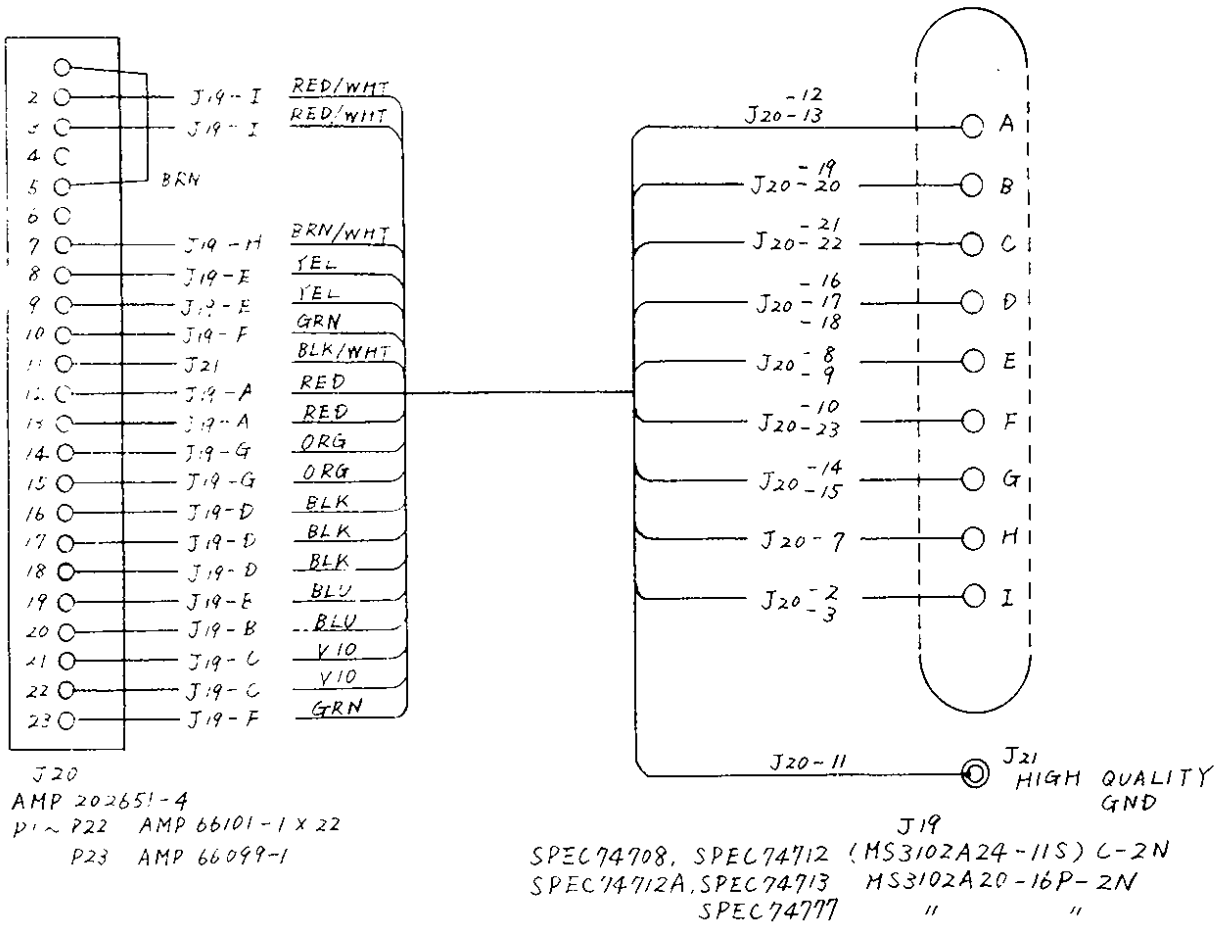
(1) MECHANICAL TOLERANCES : In accordance with TID-20893 (Rev.3), providing for interchangeability of all standard modules.

(2) MODULE CONNECTORS : 12 each as specified by TID-20893 (Rev.3), (AMP-202516-3 connectors)

(3) INSTALLED WIRING : All connectors wired in parallel for +6V, -6V, +12V, -12V, +24V, -24V, high-quality ground, power-return ground and AC100V, in accordance with TID-20893 (Rev.3). And in addition to inhibit, start-stop gate, reset, beam gate, carry signal, read-out clock, data(4 lines), skip, carry flag and read-out gate through rear control panel.



NIM BIN KEK TYPE-2 (NO1-21)



NIM BIN KEK TYPE-1

NIM BIN KEK TYPE-2 CONNECTOR BOX

PIN	NIM FUNCTION	KEK FUNCTION
1	+3 VOLTS	
2	-3 VOLTS	
5	COAXIAL	
6	COAXIAL	
7	COAXIAL	
8	+200 VOLTS	
10	+6 VOLTS	+6 VOLTS
11	-6 VOLTS	-6 VOLTS
12		INHIBIT
13	CARRY No.1	CARRY SIGNAL
14		START-STOP GATE
15		READ-OUT CLOCK
16	+12 VOLTS	+12 VOLTS
17	-12 VOLTS	-12 VOLTS
18		DATA-1 (1)
19		DATA-2 (2)
20		DATA-3 (4)
21		DATA-4 (8)
28	+24 VOLTS	+24 VOLTS
29	-24 VOLTS	-24 VOLTS
30		SKIP
31	CARRY No.2	CARRY FLAG
33	117 VOLTS AC (HOT)	100 VOLTS AC (HOT)
34	POWER RETURN GND	POWER RETURN GND
35	RESET	RESET
36	GATE	BEAM GATE
37		READ-OUT GATE
38	COAXIAL	
39	COAXIAL	
40	COAXIAL	
41	117 VOLTS AC (NEUTRAL)	100 VOLTS AC (NEUTRAL)
42	HIGH QUALITY GND	HIGH QUALITY GND
G	GROUND GUIDE PIN	GROUND GUIDE PIN

NIM BIN KEK TYPE-1, TYPE-2
CONNECTOR (J1-J12)
PIN ASSIGNMENTS

USED CONNECTOR: AMP-202516-3
(AMP)

PIN	FUNCTION
1	READ-OUT GATE 1
2	PIN 1 PAIR RETURN
3	READ-OUT GATE 2
4	PIN 3 PAIR RETURN
5	READ-OUT GATE 3
6	PIN 5 PAIR RETURN
7	READ-OUT GATE 4
8	PIN 7 PAIR RETURN
9	READ-OUT GATE 5
10	PIN 9 PAIR RETURN
11	READ-OUT GATE 6
12	PIN 11 PAIR RETURN
13	READ-OUT GATE 7
14	PIN 13 PAIR RETURN
15	READ-OUT GATE 8
16	PIN 15 PAIR RETURN
17	READ-OUT GATE 9
18	READ-OUT GATE 10
19	READ-OUT GATE 11
20	PIN 19 PAIR RETURN
21	READ-OUT GATE 12
22	PIN 21 PAIR RETURN
23	CARRY SIGNAL
24	PIN 23 PAIR RETURN
25	CARRY FLAG
26	PIN 25 PAIR RETURN
27	READ-OUT CLOCK
28	PIN 27 PAIR RETURN
29	SKIP
30	PIN 29 PAIR RETURN

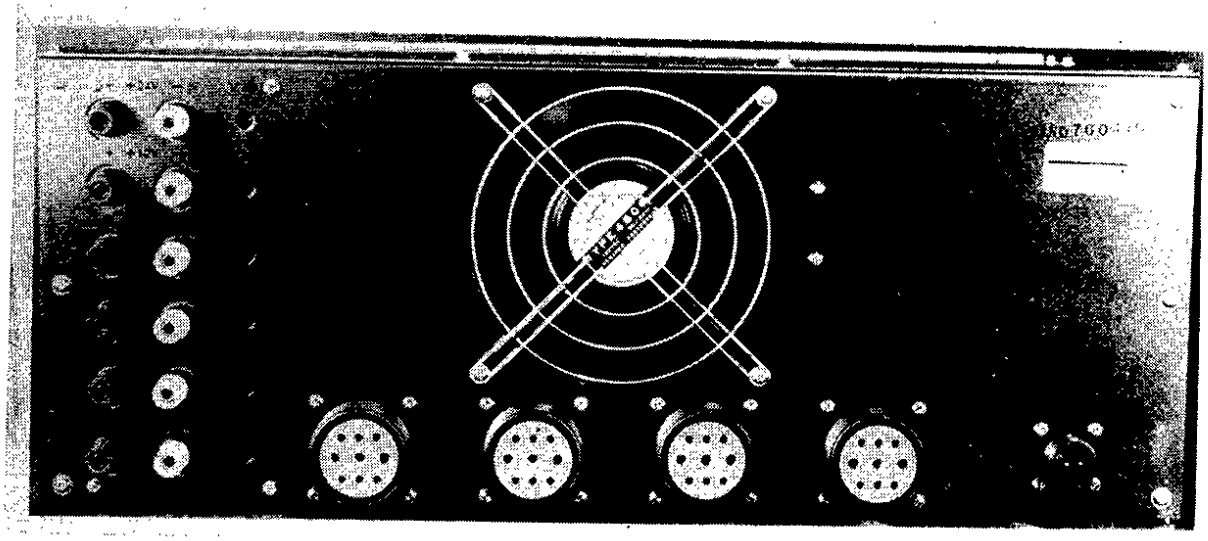
PIN	FUNCTION
31	
32	
33	PIN 17 PAIR RETURN
34	PIN 18 PAIR RETURN
35	RESET
36	PIN 35 PAIR RETURN
37	START STOP GATE
38	PIN 37 PAIR RETURN
39	INHIBIT
40	PIN 39 PAIR RETURN
41	BEAM GATE
42	PIN 41 PAIR RETURN
43	DATA (1)
44	PIN 43 PAIR RETURN
45	DATA (2)
46	PIN 45 PAIR RETURN
47	DATA (4)
48	PIN 47 PAIR RETURN
49	DATA (8)
50	PIN 49 PAIR RETURN

NIM BIN KEK TYPE-2
CONTROL (Dataway) CONNECTOR
PIN ASSIGNMENTS

USED CONNECTOR: DDC-50S-F0
(Cannon)

N02-11 NIM POWER SUPPLY (KEK TYPE-2)

NIM POWER SUPPLY FRONT VIEW



NIM POWER SUPPLY REAR VIEW

KEK NIM STANDARD (N02-11)
NIM POWER SUPPLY KEK TYPE-2

KEK NIM STANDARD (NO2-11)
NIM POWER SUPPLY KEK TYPE-1

(1) INPUT VOLTAGE : AC100V±10%, 48-63HZ.
Input power at AC100V is 650VA.

(2) DC OUTPUT VOLTAGE : +6V at 25A, -6V at 25A,
+12V at 5A, -12V at 5A,
+24V at 3A, -24V at 3A, max
output power, 0 to 50°C ambient.

(3) AC OUTPUT VOLTAGE : AC100V at 2A

(4) REGULATION : 0.1%+Ripple and Noise
Over the combined range of zero to full load.

(5) RIPPLE and NOISE : <3mV peak to peak for ±12V and ±24V.
<15mV peak to peak for ±6V.
As observed on 50MHZ bandwidth oscilloscope.

(6) VOLTAGE ADJUSTMENTS : ±0.5V

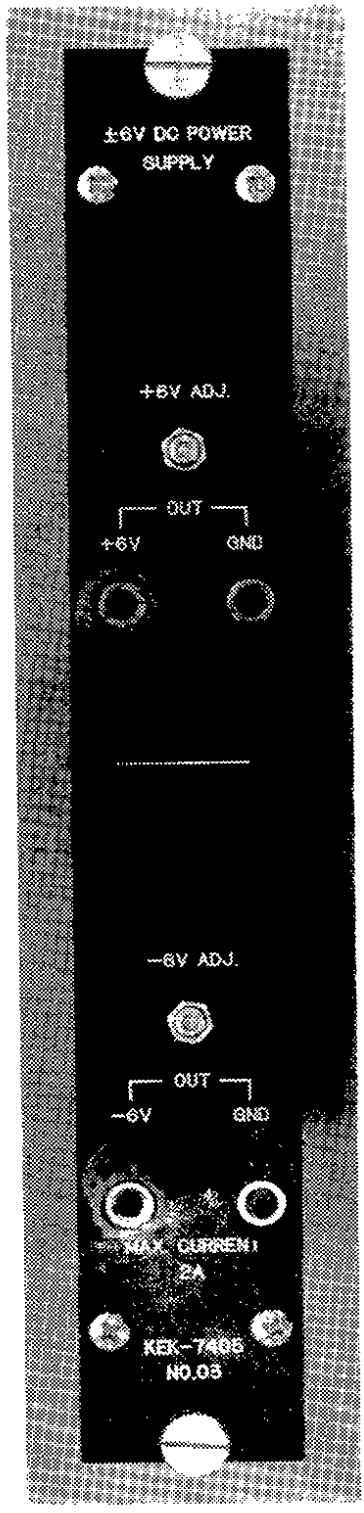
(7) TEMPERATURE COEFFICIENT : <±0.02% 1°C,
0 to 40°C

(8) CIRCUIT PROTECTION : Both input power lines fused, and
automatically cut off by an internal
power relay if the output current
exceeds a maximum limit.

(9) DIMENSION : 484W×177H×4900mm

(10) WEIGHT : 30Kg

N02-21 ±6V POWER SUPPLY MODULE (KEK TYPE-1)



KEK NIM STANDARD MODULE (N02-21)
±6V POWER SUPPLY (±6V 2A)

KEK NIM STANDARD MODULE (NO2-21)
±6V POWER SUPPLY (±6V→2A) KEK TYPE-1

SPECIFICATIONS

(1) INPUT VOLTAGE: +12V, -12V (DC Voltage)
(Rear connector pin number, +12V→16
-12V→17)

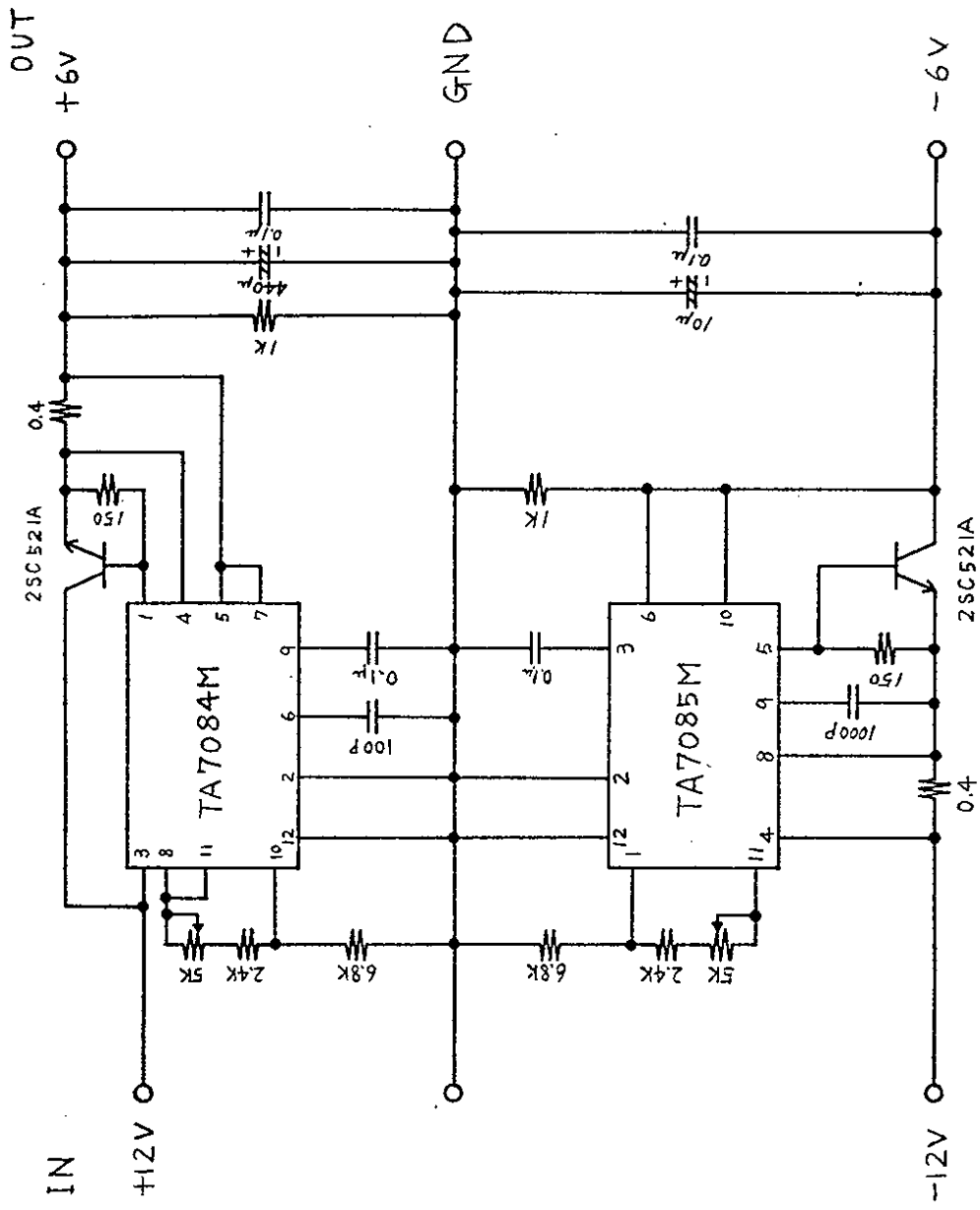
(2) OUTPUT VOLTAGE: +6V at 2A, -6V at 2A
Front panel terminal and rear connector
Combined maximum output power
48W at 30°C

(3) NOISE and RIPPLE: < 1mV peak to peak
As observed on 100 MHZ oscilloscope

(4) VOLTAGE ADJUSTMENT: ±1 V

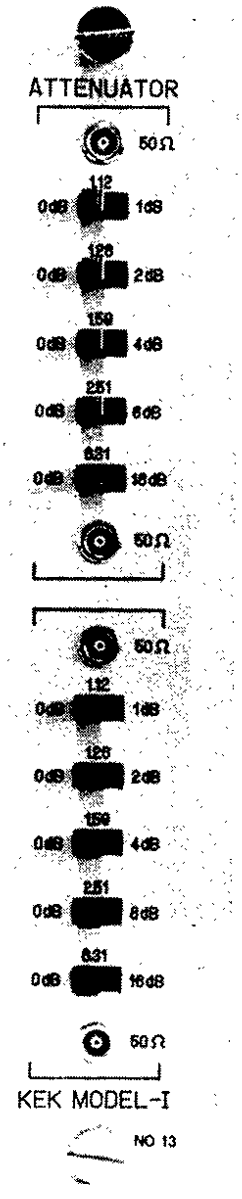
(5) CRCUIT PROTECTION: Automatically cut off by an internal electronic switching if the output current exceeds a maximum limit

(6) DIMENSION: NIM standard single width module,
1.35" wide x 8.75" high in accordance with
TID-20893(Rev.3)



±6V POWER SUPPLY CIRCUIT DIAGRAM
(NO2-21 KEK TYPE-1)

NO3-11 NIM COOLING FAN (KEK TYPE-1)



KEK NIM STANDARD (NO3-11)
NIM COOLING FAN KEK TYPE-1

KEK NIM STANDARD MODULE (N03-11)

NIM COOLING FAN KEK TYPE-1

SPECIFICATIONS

A simple cooling fan, NIM COOLING FAN KEK TYPE-1, was devised for the ventilation of the US AEC NIM standard BINs.

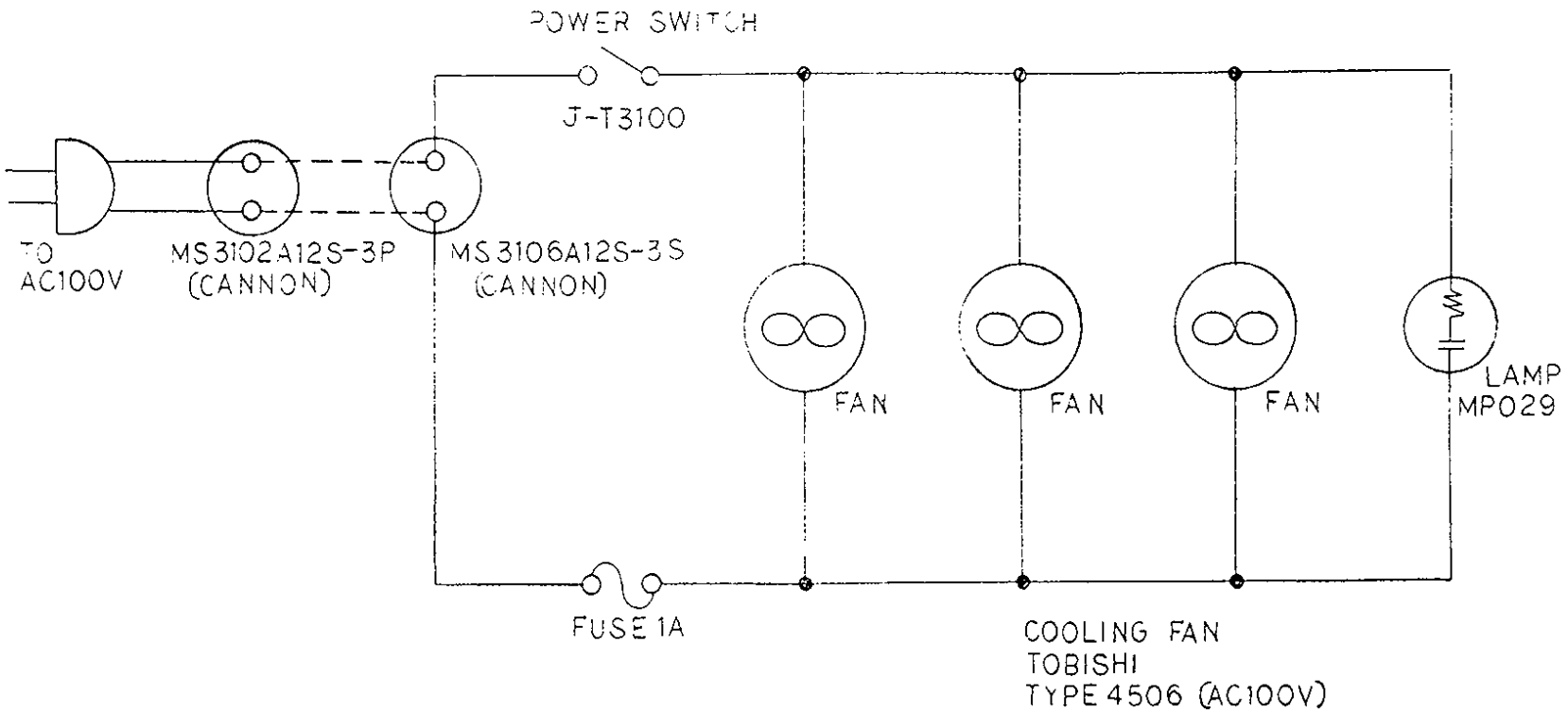
Then a cooling fan is devised which can be mounted in a standard 19-inch rack occupying little space.

The dimensions of the chassis are
43 mm (1-3/4 inch) in height,
410 mm (16-1/8 inch) in width,
213 mm (8-3/8 inch) in depth.

The total weight is 3.2 kg.

Three 4-3/4 inch fans are attached to the chassis and can be provide an air flow of about 90 litre/sec.

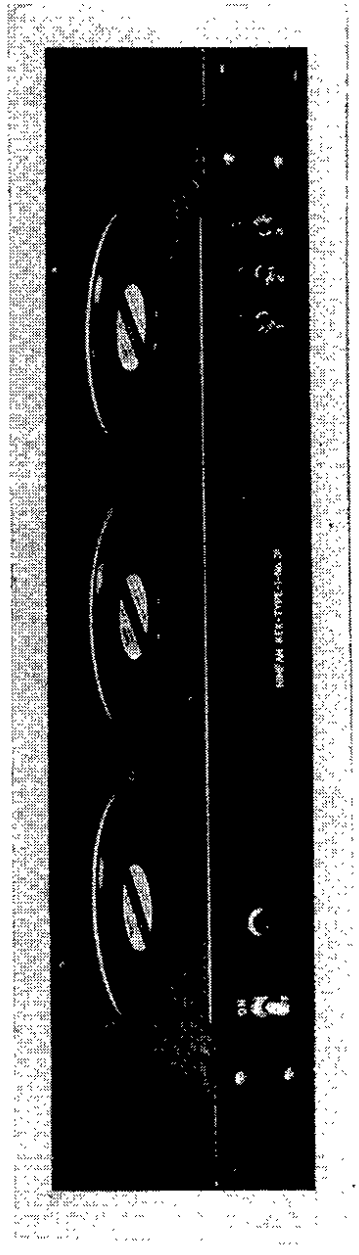
The front panel has a Power On-Off switch, AC power light and 1A fuse.



NIM COOLING FAN CIRCUIT DIAGRAM

(NO3-11 KEK TYPE-1)

N04-11 DUAL VARIABLE ATTENUATOR (0-31 DB)
(KEK TYPE-1)



KEK NIM STANDARD MODULE (N04-11)
DUAL VARIABLE ATTENUATOR KEK TYPE-1

KEK NIM STANDARD MODULE (N04-11)
DUAL VARIABLE ATTENUATOR KEK TYPE-1

SPECIFICATIONS

(1) CHANNEL NUMBER: dual channels

(2) INPUT: 50 ohms impedance
either polarity
type LEMO (RA-00250) connector

(3) MAXIMUM INPUT POWER: 100 mW (70°C max.)

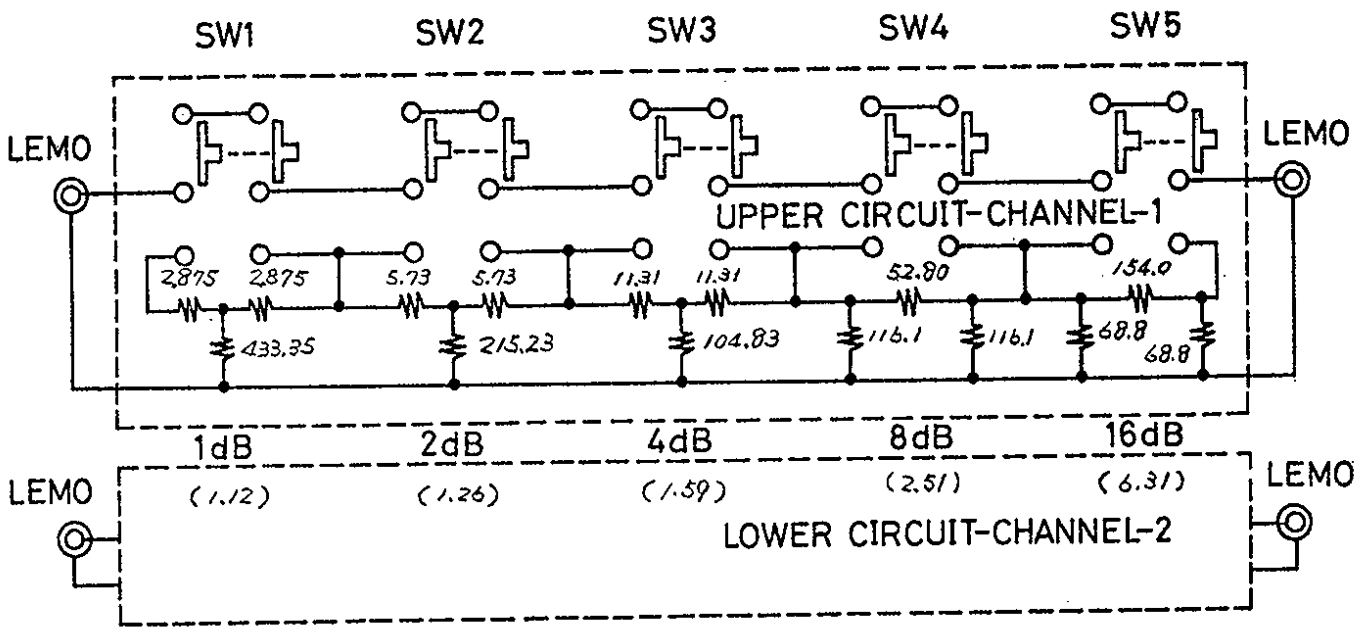
(4) OUTPUT: 50 ohms impedance
furnishes the input signals with a attenuation
as selected by the switches
type LEMO (RA-00250) connector

(5) ATTENUATION: switches select 1, 2, 4, 8 and 16 db
five slide switches selection
1 db steps from 0 db to 31 db

(6) ATTENUATOR PAD: RNA-0808 (TEITSU)
T and π type fixed attenuator

(7) POWER REQUIRED: no power required

(8) DIMENTION: NIM standard single width module

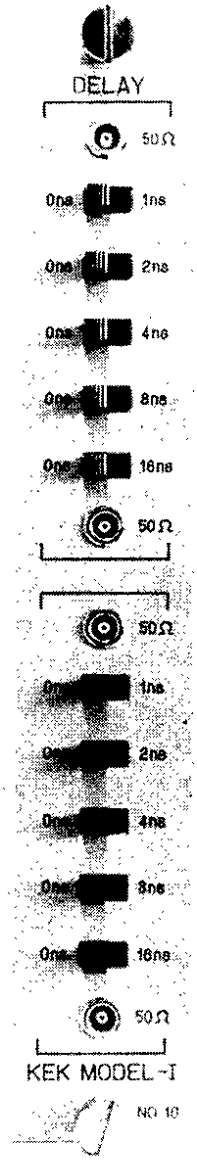


SWITCH : SL-7(TEITSU)

ATTENUATOR PAD: RNA-0808(TEITSU)

CIRCUIT DIAGRAM OF DUAL NANOSECOND VARIABLE ATTENUATOR MODULE

N05-11 DUAL VARIABLE DELAY (0-31 NSEC)
(KEK TYPE-1)



KEK NIM STANDARD MODULE (N05-11)
DUAL VARIABLE DELAY KEK TYPE-1

KEK NIM STANDARD MODULE (N05-11)
DUAL VARIABLE DELAY KEK TYPE-1

SPECIFICATIONS

(1) CHANNEL NUMBER: dual channels

(2) INPUT: 50 ohms impedance
either polarity
type LEMO (RA-00250) connector

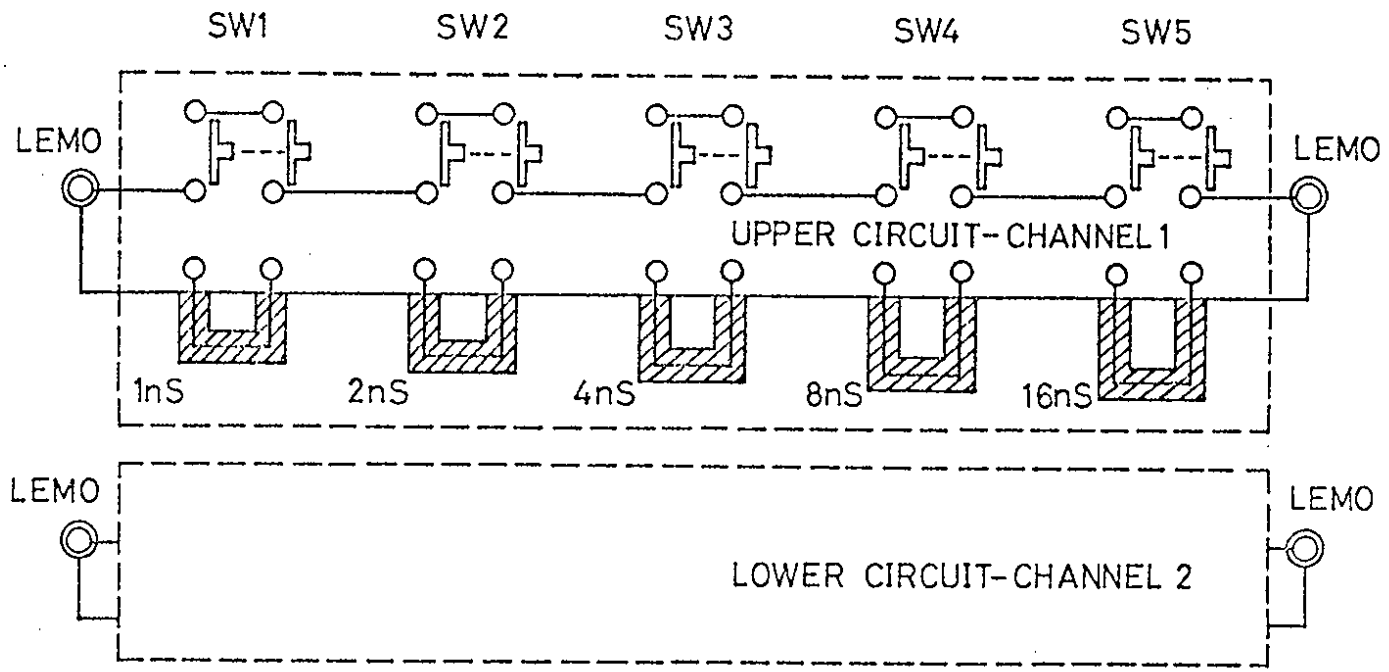
(3) OUTPUT: 50 ohms impedance
furnishes the input signals with a delay
as selected by the switches
type LEMO (RA-00250) connector

(4) DELAY TIME: switches select 1, 2, 4, 8 and 16 ns
five slide switches selection
1 ns steps from 0 ns to 31 ns

(5) CABLE: coaxial cable
used RG-58 C/u (RG-58 A/u)

(6) POWER REQUIRED: no power required

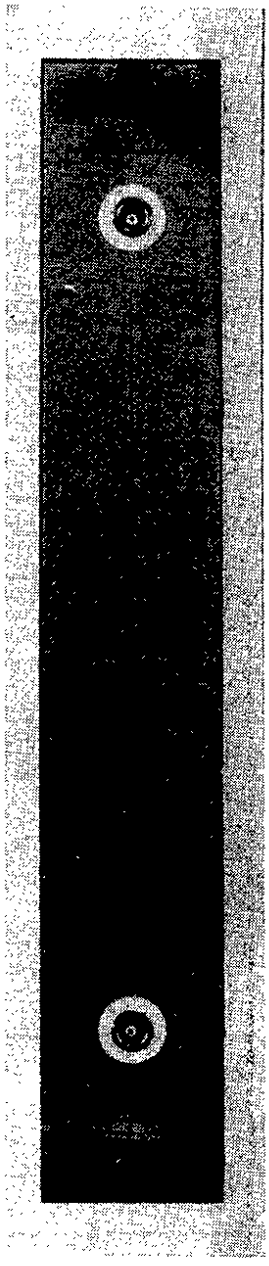
(7) DIMENSION: NIM standard single width module



SWITCH: SL-7(TEITSU)
CABLE : RG-58C/U(FUJIKURA)

CIRCUIT DIAGRAM OF DUAL NANOSECOND VARIABLE DELAY MODULE

N05-21 FIXED DALAY (100 NSEC) (KEK TYPE-1)



KEK NIM STANDARD MODULE (N05-21)
FIXED DELAY (100nsec) KEK TYPE-1

KEK NIM STANDARD MODULE (N05-21)
FIXED DELAY (100nS) KEK TYPE-1

SPECIFICATIONS

(1) CHANNEL NUMBER: single channel

(2) INPUT: 50 ohms impedance
either polarity
type LEMO (RA-00250) connector

(3) OUTPUT: 50 ohms impedance
either polarity
type LEMO (RA-00250) connector

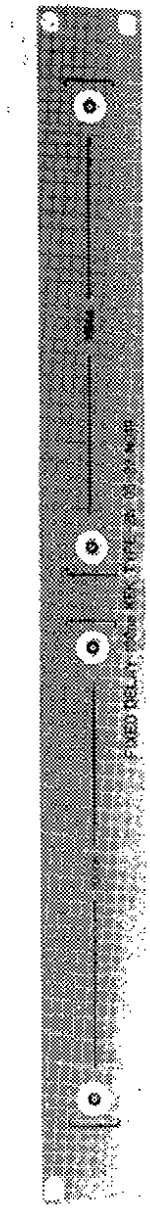
(4) DELAY TIME: 100nS

(5) CABLE: coaxial cable
uses MX50-3.6 (DAINICHI-NIPPON-DENSEN)

(6) POWER REQUIRED: no power required

(7) DIMENSION: NIM standard single width module

N05-22 DUAL FIXED DALAY (100 NSEC)
(KEK TYPE-1)



KEK NIM STANDARD MODULE (N05-22)
DUAL FIXED DELAY (100nS)
KEK TYPE-1

KEK NIM STANDARD MODULE (N05-22)
DUAL FIXED DELAY (100nS) KEK TYPE-1

SPECIFICATIONS

(1) CHANNEL NUMBER: dual channels

(2) INPUT: 50 ohms impedance
either polarity
type LEMO (RA-00250) connector

(3) OUTPUT: 50 ohms impedance
either polarity
type LEMO (RA-00250) connector

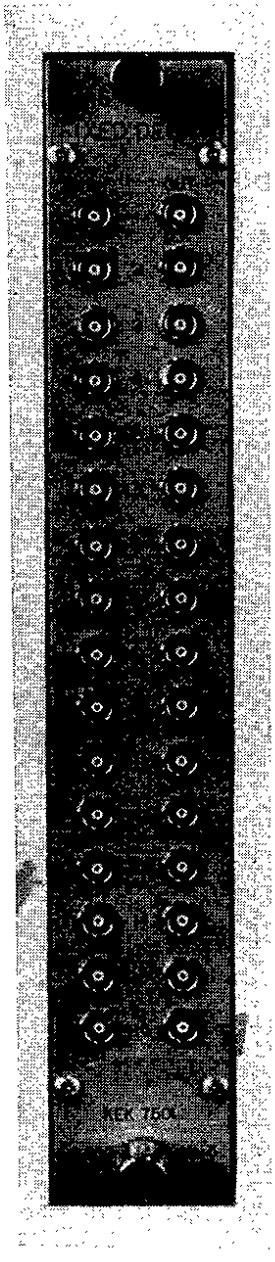
(4) DELAY TIME: each channel, 100nS

(5) CABLE: coaxial cable
uses PTFE (JUNKOSHA)

(6) POWER REQUIRED: no power required

(7) DIMENSION: 43 mm (1-3/4 inch) in height
410 mm (16-1/8 inch) in width
352 mm (13-7/8 inch) in depth

N05-31 16-CH FIXED LOGIC DELAY (105 NSEC)
(KEK TYPE-1)



KEK NIM STANDARD MODULE (N05-31)
16-CH TIMING PULSE FIXED DELAY (105ns)
KEK TYPE-1

KEK NIM STANDARD MODULE (NO5-31) NO5-31-01
16-CH FIXED LOGIC DELAY (105 nS) KEK TYPE-1

SPECIFICATIONS

(1) NUMBER OF CHANNELS: 16 channels.

(2) INPUT

Impedance: 50 ohms (direct-coupled).

Voltage: Standard negative "NIM" logic signal, threshold level -450 mV.

Width: Shortest pulse to produce full output <9 ns (at input pulse height -600 mV).

Reflections: $<10\%$ for input of 1 ns rise time.

Maximum Rate: Maximum repetition rate to produce full output >51 MHz (at input pulse width 10 ns).

(3) OUTPUT

Output: One output (independent each output).
Quiescently 0 mA, current source switches to -16 mA (-800 mV into 50 ohms load) during output.

Width: Equal to the input pulse duration. Non-updating.

Rise and Fall Time: Rise time <1.6 ns.
Fall time <2.2 ns.

Over Shoot: $<5\%$

Under Shoot: $<4\%$

(4) DELAY TIME

Delay Time: 98 ns $\pm$ 4 ns.

Delay Component: Z35-100, dual in line delay line (Zo = 350 ohms, Td = 100 ns). Temperature coefficient is $\pm$ 200 ppm/°C. (Showa Electric Wire and Cable Co., Ltd.)

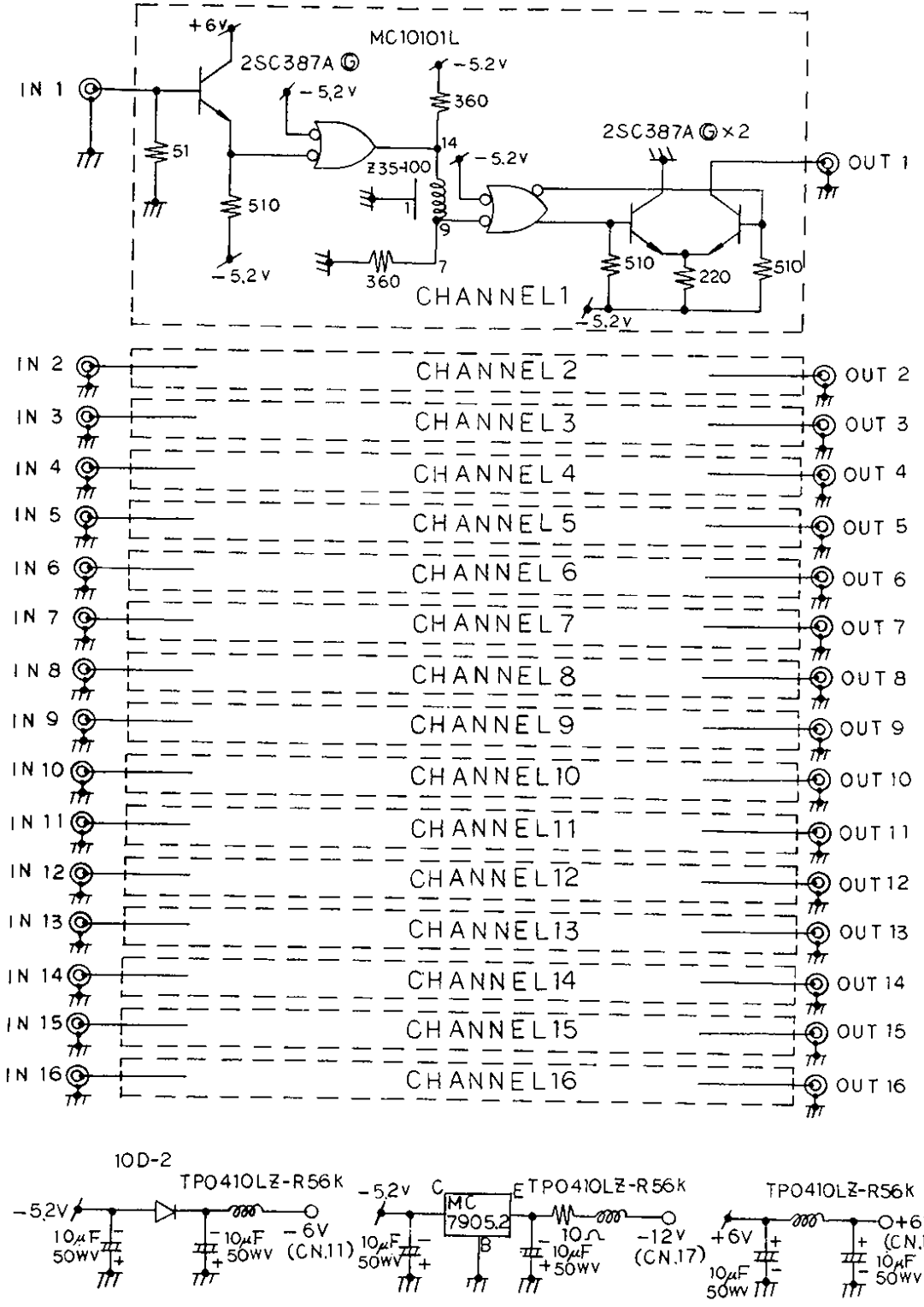
(5) POWER REQUIREMENTS

+6 Volts: 132 mA. -6 Volts: 685 mA. -12 Volts: 260 mA.

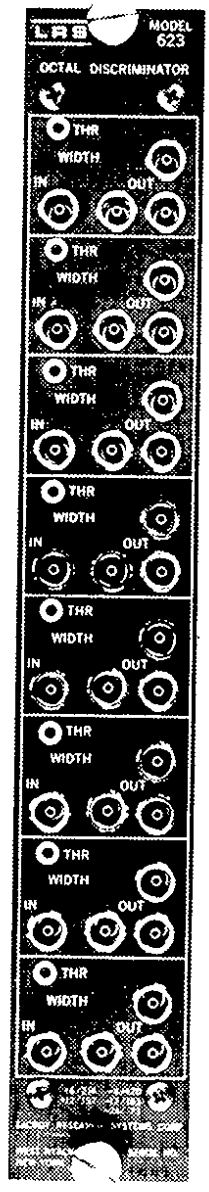
(6) DIMENSION: Single width AEC-NIM module, 1.35" wide x 8.75" high in accordance with TID-20893 (Rev. 2).
Lemo-type connectors.

16-CH FIXED DELAY

(NQ5-31 KEK TYPE I)



N06-20 OCTAL UPDATING DISCRIMINATOR (LeCroy 623)



KEK NIM MODULE (N06-20)
OCTAL UPDATING DISCRIMINATOR
(LeCROY 623)

KEK NIM STANDARD MODULE (N06-20) N06-20-01
OCTAL UPDATING DISCRIMINATOR (LeCROY 623)

SPECIFICATIONS

(1) SIGNAL INPUT CHARACTERISTICS

Threshold: -30 mV to approximately -1.0 volt, (continuously variable up to -600 mV); front-panel screwdriver adjust (screwdriver included).

Impedance: 50 Ω ± 1%, protected to ± 5 A for 0.5 μs clamping at +1 and -7 volts.

Reflections: < 2% for input pulses of 2 ns risetime.

Stability: < 0.2%/°C, 20°C to 60°C operating range.

Offset: 0 ± 1 mV.

Threshold Monitor: 10:1 ratio of monitor voltage to actual voltage.

(2) OUTPUT CHARACTERISTICS

Amplitude: 3 NIM-level voltage outputs, quiescently 0 volts, -800 mV during output.

Duration: ≤6 ns to >150 ns, continuously variable via front-panel screwdriver control.

Risetime: ≤2 ns.

Falltime: Approx. 4 ns at minimum width, increasing with width setting up to 6 ns max.

Width Stability: Maximum ± (50 ps + 0.3%)/°C for temperature variation and ±0.1%/% for variation of any supply voltage.

Amplitude Stability: Better than ±0.1%/°C.

(3) GENERAL

Maximum Rate: >100 MHz, input and output.

Double-Pulse Resolution: Less than 9 ns.

Time Slewing: 1 ns for input amplitudes 110% of threshold and above.

Input-Output Delay: 13 ns.

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.

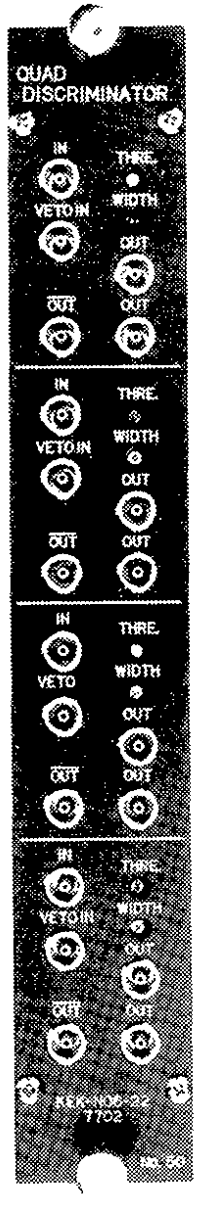
Bin Gate: Slow gate via rear connector and rear panel ON-OFF switch; risetimes and falltimes approximately 50 ns; clamp to ground from +5 volts inhibits; direct-coupled.

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

Current Requirements: +12 volts at 160 mA
+ 6 volts at 214 mA
- 6 volts at 420 mA
-12 volts at 163 mA
-24 volts at 73 mA

Optional: Bridged high impedance inputs available at extra cost at the expense of one output.

N06-22 QUAD NON-UPDATING DISCRIMINATOR (KEK TYPE-2)



KEK NIM STANDARD MODULE (N06-22)
QUAD NON-UPDATING DISCRIMINATOR
KEK TYPE-2

KEK NIM STANDARD MODULE (NO6-22)
QUAD NON-UPDATING DISCRIMINATOR KEK TYPE-2

NO6-22-01

SPECIFICATIONS

(1) NUMBER OF CHANNELS: Four channels.

(2) INPUT

Impedance: 50 ohms (direct-coupled).

Threshold: -40 mV to approximately -800 mV.
Continuously adjustable by means of front panel threshold level control.

Width: Shortest pulse to produce full output < 2 ns for signal input (at input signal height -100 mV).

Protection: Protected to clamping at +0.7 V and -6 V.

Reflections: < 5% for input of 1 ns rise time.

Maximum Rate: Maximum repetition rate to produce full output > 57 MHz (at input signal height -100 mV, width 3 ns).

(3) VETO INPUT

Impedance: 50 ohms (direct-coupled).

Voltage: Standard negative "NIM" logic signal, threshold level -450 mV.
This input permits simultaneous inhibiting of all outputs.

Reflections: < 10% for input of 1 ns rise time.

Precede Time: 0.5 ns, veto input should precede signal input by 0.5 ns to compensate for internal propagation delay.

(4) BIN GATE INPUT

Input: Via rear connector, with rear panel On-Off switch.
Common to all channels.

Impedance: 1.6 K ohms, 2 standard TTL loads (direct-coupled).

Voltage: Quiescently above +3 volts, clamping to ground inhibits.

(5) OUTPUT

Normal Outputs: Two outputs (independent each output). Quiescently 0 mA, current source switches to - 16 mA (-800 mV into 50 ohms load) during output.

Complementary Output: One output. Quiescently -16 mA (-800 mV into 50 ohms load), switching to zero volts during output.

Width: 7 ns to approximately 100 ns. Continuously adjustable by means of front panel width control.

Multiple Pulsing: None, one and only one output pulse of preset duration is produced each input pulse.

Rise and Fall Time: Normal output, rise time < 1.2 ns, fall time 1.5 ns. Complementary output, rise time < 2.2 ns, fall time 1.6 ns.

Over Shoot: < 5%.

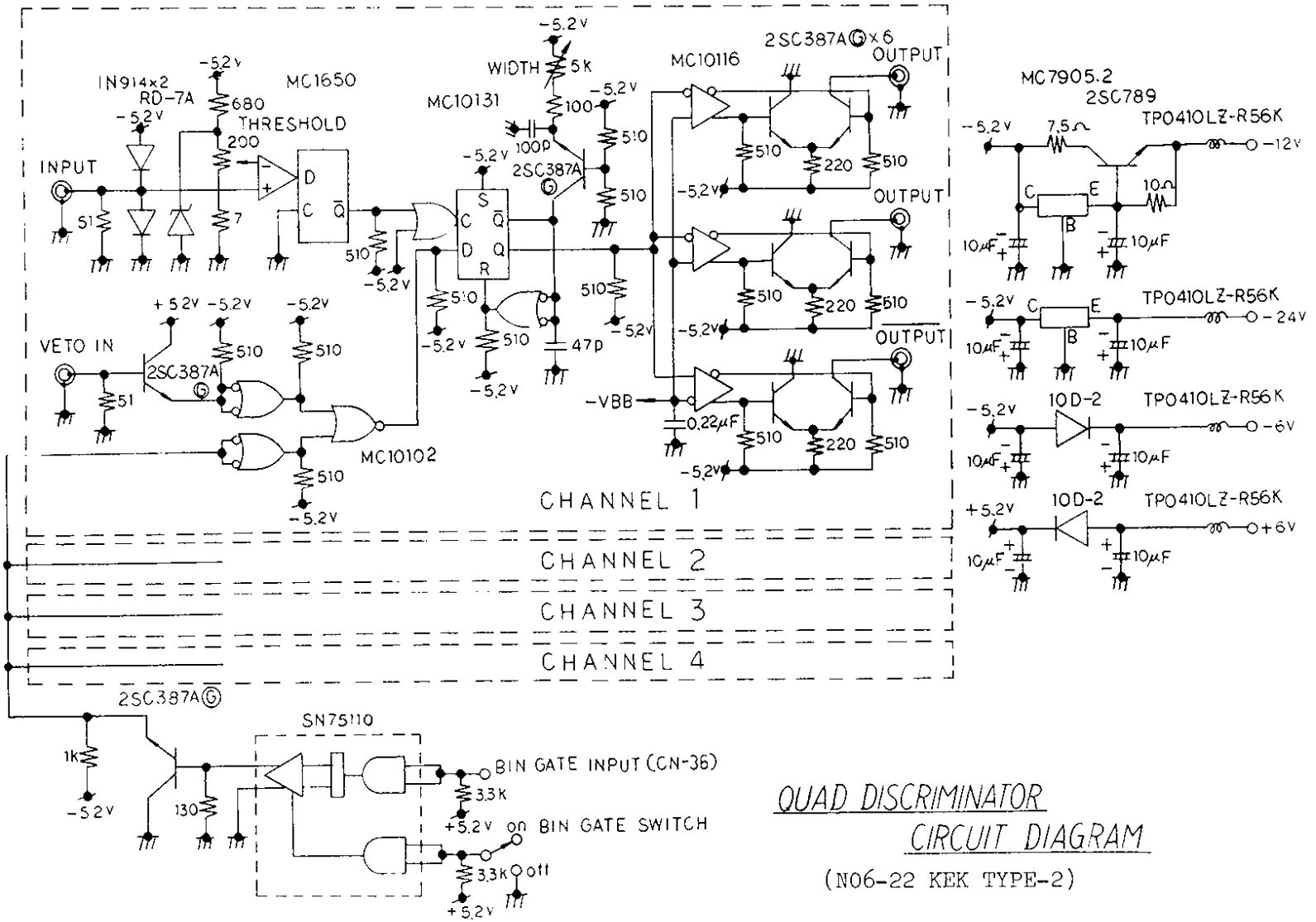
Under Shoot: < 4%.

Propagation Delay Time: 10 ns (In-Out).

(6) POWER REQUIREMENTS

+6 Volts: 83 mA.
-6 Volts: 490 mA.
-12 Volts: 450 mA.
-24 Volts: 33 mA.

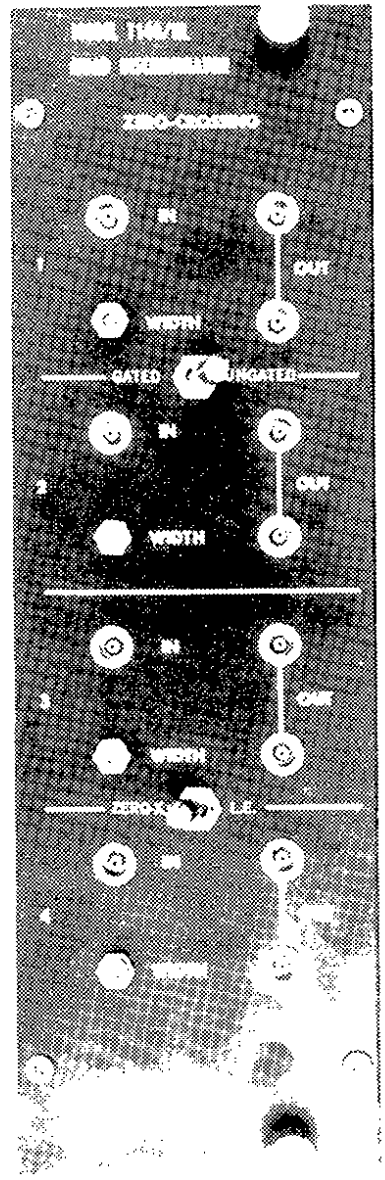
(7) DIMENSION: Single width AEC-NIM module, 1.35" wide x 8.75" high in accordance with TID-20893 (Rev. 2).
Lemo-type connectors.



QUAD DISCRIMINATOR
CIRCUIT DIAGRAM

(N06-22 KEK TYPE-2)

N06-30 QUAD ZERO CROSSING DISCRIMINATOR (EGG T140/NL)



KEK NIM MODULE (N06-30)
QUAD ZERO-CROSSING
DISCRIMINATOR (EG&G T140/NL)

KEK NIM STANDARD MODULE (NOG-30) NOG-30
QUAD ZERO-CROSSING DISCRIMINATOR (EGG T140/NL)

SPECIFICATIONS

Input: Protected limiting input for photomultiplier signals. 50 ohm input impedance, with less than 10% reflections from -10 V, 1 nsec risetime signals. Maximum non-destructive input limits: ±5 V dc; ±10 V, 100 nsec pulse of duty-factor less than 10%; ±100 V fast transients. Overload recovery typically 2 nsec from -5 V input.

Threshold: Typically -200 mV (-250 mV maximum) in zero-crossing mode; typically +250 mV in leading-edge mode.

Output: "Dual" NIM-standard fast logic signal output, for fan-out factor of two. T_{01} and T_{10} less than 2 nsec. Width adjustable by recessed front-panel multiturn control from less than 5 nsec to greater than 10 nsec.

Delay: Typically 8 nsec, from input zero-crossing to half-amplitude output.

Maximum Rate: Typically ±150 psec from threshold crossing detector maintains timing to typically 250 MHz.

Slewing: Typically ±150 nsec from threshold to 10X threshold in zero-crossing mode; typically less than 1 nsec from threshold to 10X threshold in leading-edge mode.

Gating: Switch-selected NIM-standard slow logic signal gating via system gating line at power connector. -2 V to +1.5 V or low impedance to ground inhibits unit; +3 V to +12 V or high impedance to ground enables unit. Gate input impedance greater than 2.5 K. Gate response time less than 50 nsec for +5 V gating signal.

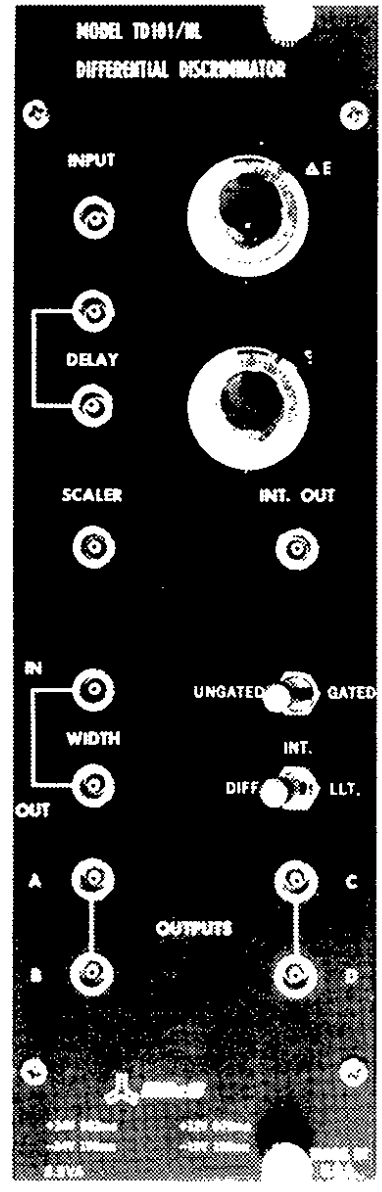
Temperature Range: -15°C to +60°C.

Power Requirement: +24 V, 210 mA.
+12 V, 220 mA.
-12 V, 190 mA.
-24 V, 195 mA.

Panel Color: Black.

Dimension: Double width AEC-NIM module, 2.70" wide x 8.75" high in accordance with TID-20893(Rev.).

N06-40 DIFFERENTIAL DISCRIMINATOR (EGG TD101/NL)



KEK NIM MODULE (N06-40)
DIFFERENTIAL DISCRIMINATOR
(EG&G TD101/NL)

KEK NIM STANDARD MODULE (N06-40) N06-40
DIFFERENTIAL DISCRIMINATOR (EGG TD101/NL)

SPECIFICATIONS

Input: 50 ohm input impedance. Reflections <10% for -10 V input with <1 nsec rise- and fall-times. Input offset adjustable to zero. Overload recovery <4 nsec from -10 V input. Maximum nondestructive inputs: ±7 Vdc; ±15 V, 100 nsec pulses of duty factor <10%; ±200 V fast transients.

Threshold: Range: E, -100 mV to -1000 mV; $\triangle$E, 0 to 900 mV; (E + $\triangle$E) must be less than 1000 mV. Calibration: E, typically within ±15 mV over full range; $\triangle$E, typically within ±20 mV over full range. Temperature coefficient: E, and $\triangle$E, typically -0.5 mV/°C.

Intout: Logic signals. Typically 1.2 nsec T_{01}, 1.2 nsec T_{10}.

Outputs A-D: Two "dual" logic signal outputs A-B and C-D. Typically 1.6 nsec T_{01}, 2.5 nsec T_{10}.

Scaler Output: Typically +2.5 V into 50 ohms, with 3 nsec T_r, 5 nsec T_f, 30 nsec width and 15 MHz maximum rate.

Gating: Switch-selected gating from pin 22 of module power connector (system gating line). +9 V to +20 V or high impedance from gating line to ground gates TD101 "on"; 0V to +5 V or low impedance gates TD101 "off". In gated-off condition even ±200 V transient input signals will not trigger the TD101. Gate input impedance 2.4 K to +10 V. Typical gating signal source: EG&G GG200 GATE GENERATOR Module.

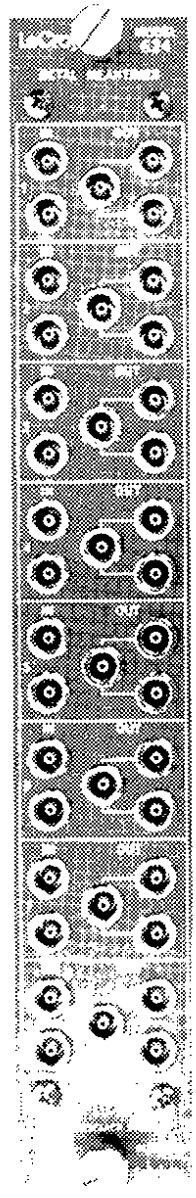
Temperature Range: -15°C to +60°C.

Power Drain: +20 V, 100 mA.
+10 V, 115 mA.
-10 V, 80 mA.
-20 V, 205 mA.

Panel Color: Black.

Dimension: Double width AEC-NIM module, 2.70" wide x 8.75" high in accordance with TID-20893(Rev.).

N06-50 OCTAL MEAN TIMER (LeCroy 624)



KEK NIM MODULE (N06-50)
OCTAL MEAN TIMER
(LeCROY 624)

KEK NIM STANDARD MODULE (N06-50) N06-50-01
OCTAL MEAN TIMER (LeCROY 624)

SPECIFICATIONS

(1) INPUT CHARACTERISTICS

Number of Channels: 8, all identical.

Logic Inputs: Two, 50Ω direct-coupled; reflections <7% for standard NIM fast logic signals (-600 mV minimum) of 2 nsec risetime.

(2) OUTPUT CHARACTERISTICS

Number and Type: Three, bridged, driven from 45 mA current source; quiescently, 0 mA; 45 mA during output (-750 mV with all 3 terminated into 50Ω). Maximum output amplitude, -2 volts.

Duration: Input pulse duration less approximately 4 nsec.

Risetime: 2.5 nsec maximum, with all outputs terminated.

(3) GENERAL

Delay Line Elements: 16 nsec, 17 pickoff points* (15 taps, plus ends).

Time Resolution: 0.5 nsec.*

Input-Output Delay: 5 nsec plus $t_d+(D-t_d)/2$, where t_d= time delay between the two input pulses and D = value of delay line element.

Total Meantime Calculation: With reference to the actual time the particle passes through the scintillator, the time of output is 5 nsec plus one-half the sum of all the delays through the loop, including total scintillator transit time, delay line element value, all cable and discriminator delays. NOTE: This total time is constant with respect to the scintillator impact time, regardless of impact position.

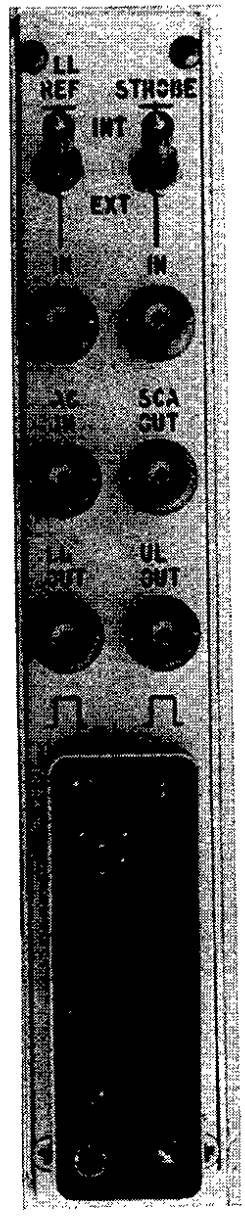
Packaging: In RF-shielded AEC/NIM #1 module, (AEC Report TID-20893); Lemo-type connectors.

Approximate Current Requirements: +6 V at 240 mA
-6 V at 285 mA
+12V at 50 mA
-12V at 150 mA
-24V at 20 mA

*Other options available (i.e., 32 nsec total delay with 1 nsec resolution)

N06-60 TIMING SINGLE CHANNEL ANALYZER (ORTEC 551)

KEK NIM MODULE (N06-60)
TIMING SINGLE CHANNEL
ANALYZER (ORTEC 551)



TIMING SINGLE CHANNEL ANALYZER
(ORTEC 551),REAR SIDE VIEW

KEK NIM STANDARD MODULE (N06-60) N06-60
TIMING SINGLE CHANNEL ANALYZER (ORTEC 551)

SPECIFICATIONS

Dynamic Range: 200:1.

Pulse-Pair Resolving Time: Output pulse width plus delay (as selected by delay controls) plus 100 ns for fast output or plus 200 ns for positive output. Minimum resolving time for negative output, 220 ns; for positive output, 800 ns.

Threshold Temperature Instability: $\leq$0.01%/°C of full scale, 0 to 50°C using a NIM class A supply (referenced to -12 V).

Discriminator Nonlinearity: $\leq \pm$0.25% of full scale (integral) for both discriminators.

Delay Temperature Instability: $\leq$0.03%/°C of full scale, 0 to 50°C.

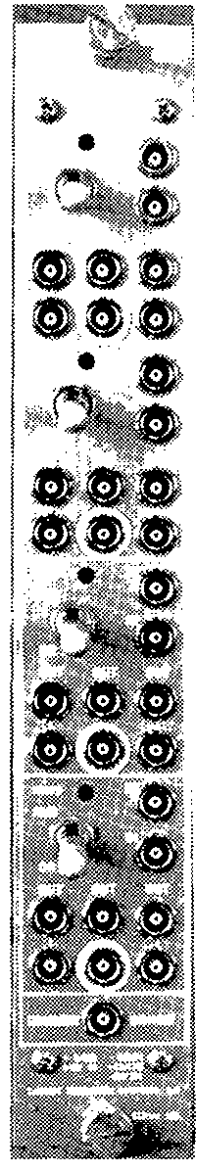
Delay Nonlinearity: $<\pm$2% of delay range.

Window Width Constancy: $<$0.1% variation of full-scale window width, over the linear 0 to 10 V range.

Minimum Input Threshold: 50 mV for lower-level discriminator.

Dimension: Single width AEC-NIM module, 1.35" wide x 8.75" high in accordance with TID-20893(Rev.3).

N07-10 QUAD 2-FOLD LOGIC UNIT (LeCroy 622)



KEK NIM MODULE (N07-10)
2-FOLD LOGIC UNIT
QUAD COINCIDENCE (LeCROY-622)

KEK NIM STANDARD MODULE (N07-10) N07-10-01
QUAD 2-FOLD LOGIC UNIT (LeCROY 622)

SPECIFICATIONS

(1) INPUT CHARACTERISTICS

Number of Channels: 4, all identical.
Logic Inputs: Two, 50 ohms direct-coupled; reflections < 7% for standard AEC fast logic signals (-600 mV minimum.) of 2 ns risetime.
Slow Bin Gate: Via rear connector, with rear-panel, ON/OFF switch; quiescently +4 volts, clamping to ground inhibits logic unit; direct-coupled; risetimes and falltimes approximately 50 ns.
Veto: Front-panel connector permits simultaneous inhibiting of all channels; 50 ohms; requires NIM-level signal (> -600 mV); direct-coupled; must overlap leading edge of input signal that would otherwise cause the coincidence condition; must precede input by approximately 5 ns.

(2) OUTPUT CHARACTERISTICS

Bridged Negative Outputs: 2 pairs; NIM, quiescently 0 mA, -32 mA during output; duration, 5 ns to 1 μs, continuously variable up to 600 ns via front-panel screwdriver control (narrower widths possible at slight expense of amplitude); risetimes and falltimes (all outputs terminated in 50 ohms) typically 2.0 ns (max. 2.5 ns), 10% to 90%. Output falltimes slightly longer on wide output durations. Width stability better than ± 0.2%/°C maximum. Updating.
Fast Nagative Timing Output: One, NIM; quiescently 0 mA, -16 mA during output. Other characteristics same as above, except risetimes are typically 1.5 ns (max. 2.0 ns) and minimum width is ≤6 ns.
Complementary Output: One; quiescently, -16 mA, 0 mA during output. Other characteristics same as for Fast Negative Timing Output.

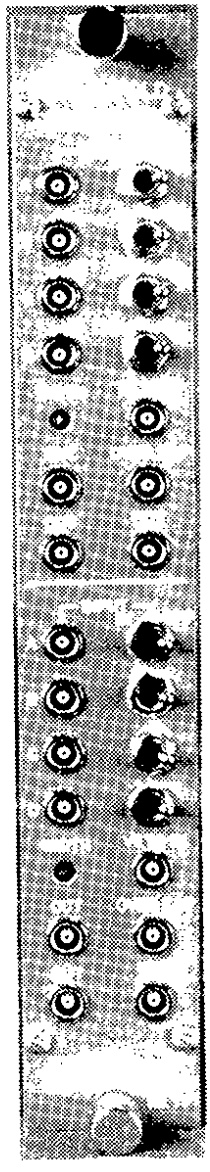
(3) GENERAL

Functions: Fan-in (2-fold); coincidence; inhibit.
Maximum Rate: 110 MHz typical, input and output.
Coincidence Width: Determined by input pulse durations; total widths from approximately 1.0 ns up without limit.

Double-Pulse Resolution: Less than 9 ns at minimum output width setting.
Input-output Delay: 9.5 ns typical.
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.

(4) Current Requirements: -6 Volts at 450 mA;
+6 Volts at 215 mA;
-12 Volts at 165 mA;
+12 Volts at 20 mA;
-24 Volts at 85 mA.

N07-21 DUAL 4-FOLD 1-VETO COINCIDENCE (KEK TYPE-1)



KEK NIM STANDARD MODULE (N07-21)
DUAL 4 FOLD 1 VETO COINCIDENCE
KEK TYPE-1

KEK NIM STANDARD MODULE (N07-21)
DUAL 4-FOLD 1-VETO COINCIDENCE KEK TYPE-1

SPECIFICATIONS

(1) LOGIC INPUT CHARACTERISTICS

Number of Channels: 2 (all identical)

Impedance: 50 ohms (direct-coupled)

Reflections: < 10%

Voltage: Standard negative "NIM" logic signal
Threshold level -500 mV

Width: Shortest pulse to produce full outputs
< 4 ns for logic input (at -600 mV)

Maximum Rate: Maximum repetition rate to produce full output > 50 MHZ (at preset outputs of 6 ns)

(2) VETO INPUT CHARACTERISTICS

Impedance: 50 ohms (direct-coupled)

Reflections: < 10%

Voltage: Standard negative "NIM" logic signal
Threshold level -500 mV
This input permits simultaneous inhibiting of all outputs

(3) OUTPUT CHARACTERISTICS

Negative Outputs: Two outputs (independent each output)
Quiescently 0 mA, current source switches to -16 mA (-800 mV into 50 ohm load) during output

Complementary Output: One output
Quiescently -16 mA (-800 mV into 50 ohm load),
switching to zero volts during output

Output Width: 7 ns to 70 ns
Continuously adjustable by means of front-panel width control

Rise and Fall Time: Negative output, rise time, < 1 ns, fall time < 800 ps
Complementary output, rise time < 800 ps, fall time < 2 ns

Over shoot: < 10%

Under shoot: < 4%

Propagation Delay Time: 13 ns

Coincidence Width: 1 ns up, determined by input pulse width

Multiple Pulsing: None, only one output pulse of preset width is produced for each input pulse, regardless of input pulse amplitude or duration

(4) OVERLAP OUTPUT CHARACTERISTICS

Voltage: One output
Quiescently 0 mA, current source switches to -16 mA during output

Rise and Fall Time: Rise time < 1 ns, fall time < 800 ps

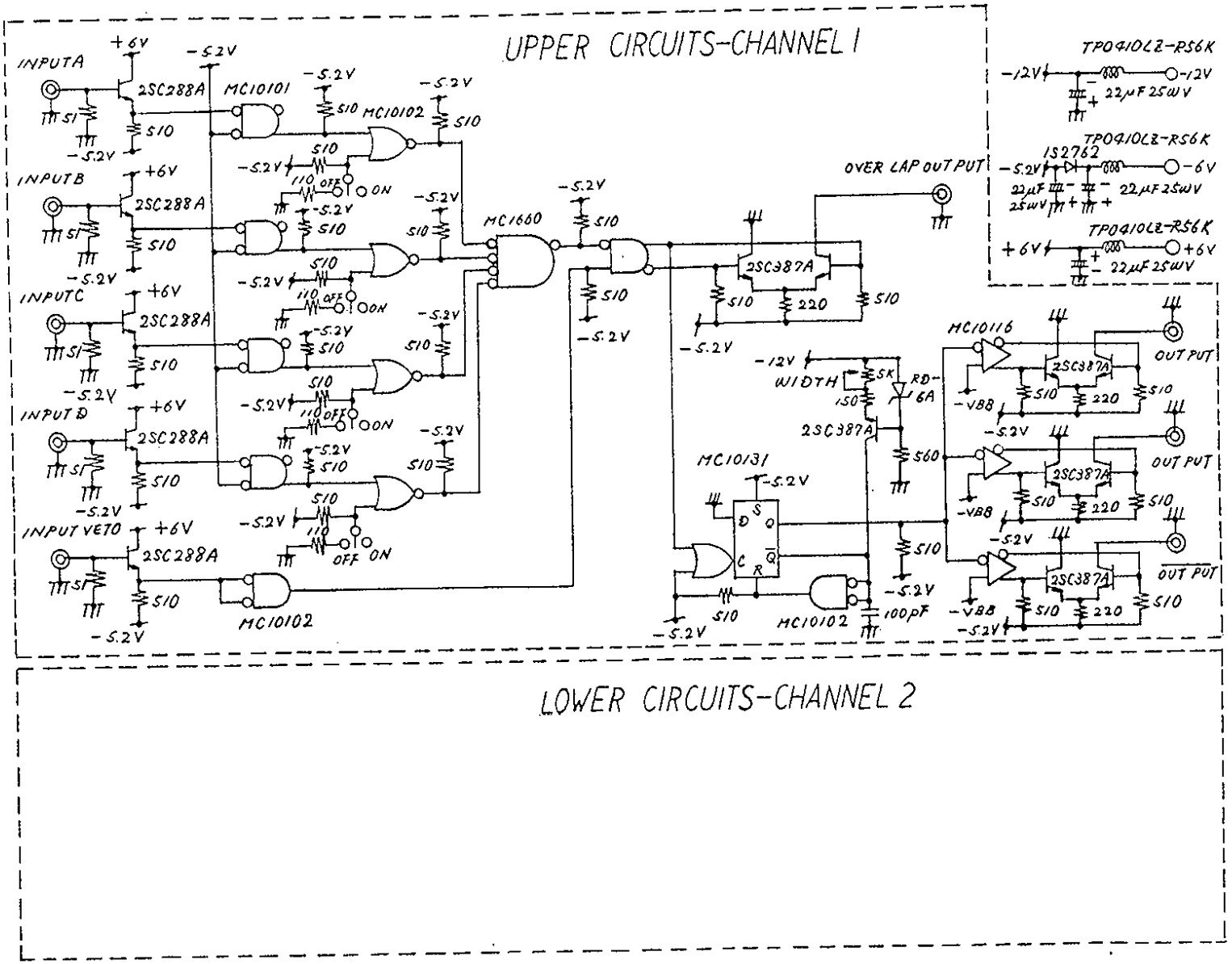
Propagation Delay Time: 8 ns

(5) POWER CONSUMPTION

+6 Volts: 82 mA

-6 Volts: 820 mA

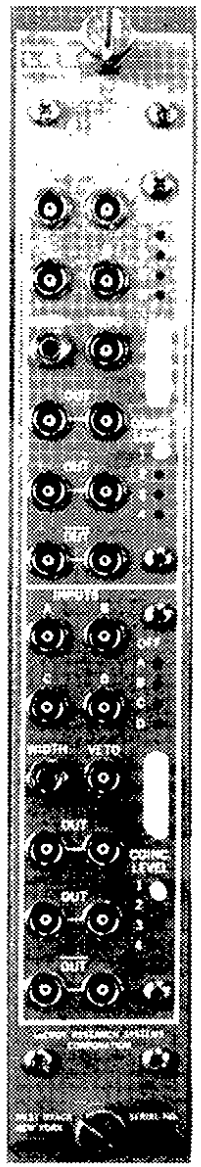
-12 Volts: 30 mA



DUAL 4-FOLD I-VETO COINCIDENCE CIRCUIT DIAGRAM

(NO7-21 KEK TYPE I)

N07-30 DUAL 4-FOLD MAJORITY LOGIC UNIT
(LeCroy 365 AL)



KEK NIM MODULE (N07-30)
4-FOLD 1-VETO COINCIDENCE
4-FOLD LOGIC UNIT (LeCROY-365AL)

KEK NIM STANDARD MODULE (N07-30) NC7-30-01
DUAL 4-FOLD MAJORITY LOGIC UNIT (LeCROY 365AL)

SPECIFICATIONS

(1) INPUT CHARACTERISTICS

Logic Inputs: 4 LEMO-type connectors; 50 Ω impedance ; NIM level input requirements; each input can be separately enabled or disabled.

Veto Input: LEMO-type connector; 50 Ω impedance; NIM level input requirements. Model 364AL requires 3 ns minimum prompt leading edge overlap in fixed width position; complete overlap in overlap position. Model 365AL requires 3 ns minimum width delayed 3 ns from leading edge of input.

Bin Gate: Via rear connector; clamp to ground from +4 volts inhibits; rise and fall times <50 ns.

(2) OUTPUT CHARACTERISTICS

Outputs: Three; two negative (quiescently 0 mA, -32 mA during output), one positive (quiescently -32 mA, 0 mA during output).

Fan-Out: 6 fold, if each output drives two 50 Ω loads. (Any used output pair should drive 25 Ω for proper amplitude and shape.)

Duration: Model 364AL: switch-selected to be either fixed 3.8 ±0.3 ns with inputs >5 ns or equal to time overlap. Non-updating.
Model 365AL: continuously adjustable from less than 4 ns to greater than 50 ns by means of front-panel screwdriver-adjustable potentiometer. Updating.

Output Rise and Fall Times: 1.2 ns typical. (Fall time of 365AL is slightly longer except at minimum width.)

(3) GENERAL

Functions: AND; OR; Majority Logic; Leading Edge Inhibit; Complement; Pulse standardization without multiple pulsing; coincidence level determined by front-panel selector.

Coincidence Width: 1 ns up, determined by input pulse durations.

Rate: 150 MHz minimum.

Input-Output Delay: Model 364AL: approximately 6 ns;
Model 365AL: approximately 10 ns.

Double Pulse Resolution: Typical 5 ns; (6.5 ns for triple pulses).

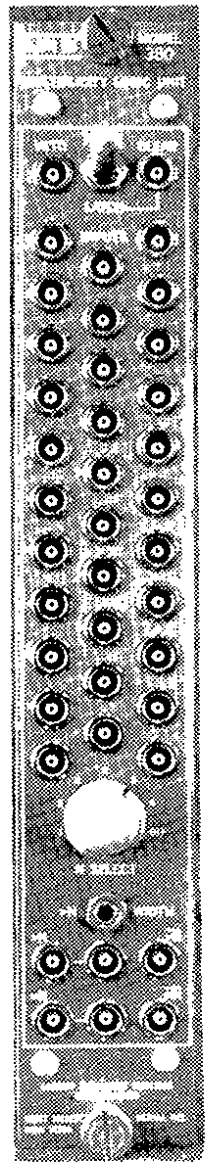
Packaging: NIM single-width module; LEMO-type connectors used for all inputs and outputs.

(4) Power Requirements:

Model 364AL	Model 365AL
+12 V at 55 mA*	+12 V at 55 mA*
-12 V at 145 mA	-12 V at 165 mA
115 V AC at 70 mA	-24 V at 22 mA
	115 V AC at 70 mA

*Increases to 120 mA if both channels in 4-fold coincidence.

N07-40 32-INPUT MULTIPLICITY LOGIC UNIT (LeCroy 380)



KEK NIM MODULE (N07-40)
MALTIPLICITY LOGIC UNIT (LeCROY-380)

KEK NIM STANDARD MODULE (N07-40) N07-40-01
32-INPUT MULTIPLICITY LOGIC UNIT (LeCROY 380A)

SPECIFICATIONS

(1) INPUT CHARACTERISTICS

Logic Inputs: 32; reflections < 7% for inputs of 2 ns risetime; input range -650 mV to - 900 mV (NIM level); minimum input width 6 ns.

Veto: Common to all channels; direct-coupled; -600 mV or greater inhibits; impedance 50 Ω ; reflections < 7% for inputs of 2 ns risetime. Veto must overlap logic inputs.

Slow (Bin) Gate: Via rear connector, with rear-panel On-Off switch; risetimes and falltimes approximately 20 ns; quiescently above +4 volts, clamping to ground inhibits; direct-coupled.

Clear: NIM level; minimum duration 10 ns.

(2) OUTPUT CHARACTERISTICS

>N Outputs: 2 bridged negative outputs (quiescently 0 mA, -32 mA during output); one complement (quiescently -16 mA, 0 mA during output); duration variable from 25-100 ns by means of front panel-multiturn potentiometer in pulsed mode, dc level in latched mode. Must be set ≥ maximum possible overlap time of the logic inputs (since it serves to inhibit the = N outputs when present).

=N Outputs: 2 bridged negative outputs (quiescently 0 mA, -32 mA during output); one complement (quiescently -16 mA, 0 mA during output); duration 20 ns (internally adjustable) in pulse mode, dc level in latched mode.

Risetimes and Falltimes: 3 ns.

Analog Summing Output: One; amplitude -50 mV into 50 Ω for each coincident input pulse; duration equal to the overlap time of the coincident input signals; impedance approx. 6 Ω .

(3) GENERAL

Coincidence Level Control: From 1 to 6 plus "off"; front-panel switch.

Input Double-Pulse Resolution: < 10 ns.

Output Double-Pulse Resolution: < 30 ns.

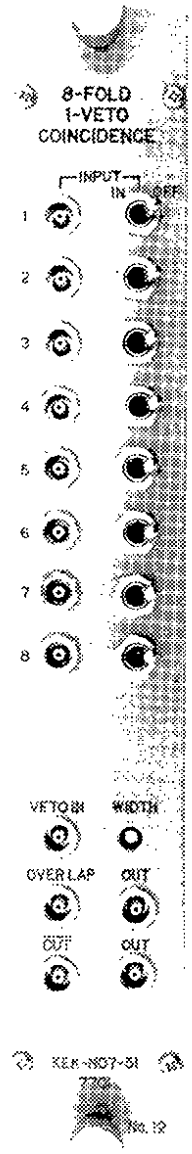
Modes: Pulse or latched; controls output duration.

Delay: Input-Output, 12 ns for > N output, 8 ns following end of = N condition for = N output.

Packaging: Inconformance with AEC standard for nuclear modules (AEC Report TID-20893); RF shielded AEC #1 module fitting 12/bin; dimensions 1.375 x 8.75 x 10 inches deep.

(4) Current Requirements: +6 V at 95 mA
-6 V at 400 mA
+24 V at 45 mA

N07-51 8-FOLD 1-VETO COINCIDENCE (KEK TYPE-1)



KEK NIM STANDARD MODULE (N07-51)
8-FOLD 1-VETO COINCIDENCE
KEK TYPE-1

KEK NIM STANDARD MODULE (N07-51)
8-FOLD 1-VETO COINCIDENCE KEK TYPE-1

SPECIFICATIONS

(1) LOGIC INPUT CHARACTERISTICS

Number of Inputs: 8

Impedance: 50 ohms (direct-coupled)

Reflections: < 10%

Voltage: Standard negative "NIM" logic signal
Threshold level -450 mV (at 10 ns)

Width: Shortest pulse to produce full outputs
< 3 ns for logic input (at -600 mV)

Maximum Rate: Maximum repetition rate to produce full output > 50 MHZ (at preset outputs of 7 ns)

(2) VETO INPUT CHARACTERISTICS

Impedance: 50 ohms (direct-coupled)

Reflections: < 10%

Voltage: Standard negative "NIM" logic signal
Threshold level -500 mV
This input permits simultaneous inhibiting of all outputs

(3) OUTPUT CHARACTERISTICS

Negative Outputs: Two outputs (independent each output)
Quiescently 0 mA, current source switches to -16 mA (-800 mV into 50 ohm load) during output

Complementary Output: One output
Quiescently -16 mA (-800 mV into 50 ohm load), switching to zero volts during output

Output Width: 7 ns to 70 ns
Continuously adjustable by means of front-panel width control

Rise and Fall Time: Negative output, rise time < 1 ns, fall time < 800 ps
Complementary output, rise time < 800 ps, fall time < 1.5 ns

Over shoot: < 10%

Under shoot: < 4%

Propagation Delay Time: 16 ns

Coincidence Width: 1 ns up, determined by input pulse width

Multiple Pulsing: None, only one output pulse of preset width is produced for each input pulse, regardless of input pulse amplitude or duration

(4) OVERLAP OUTPUT CHARACTERISTICS

Voltage: One output
Quiescently 0 mA, current source switches to -16 mA during output

Rise and Fall Time: Rise time < 1 ns, fall time < 800 ps

Propagation Delay Time: 9.5 ns

(5) POWER CONSUMPTION

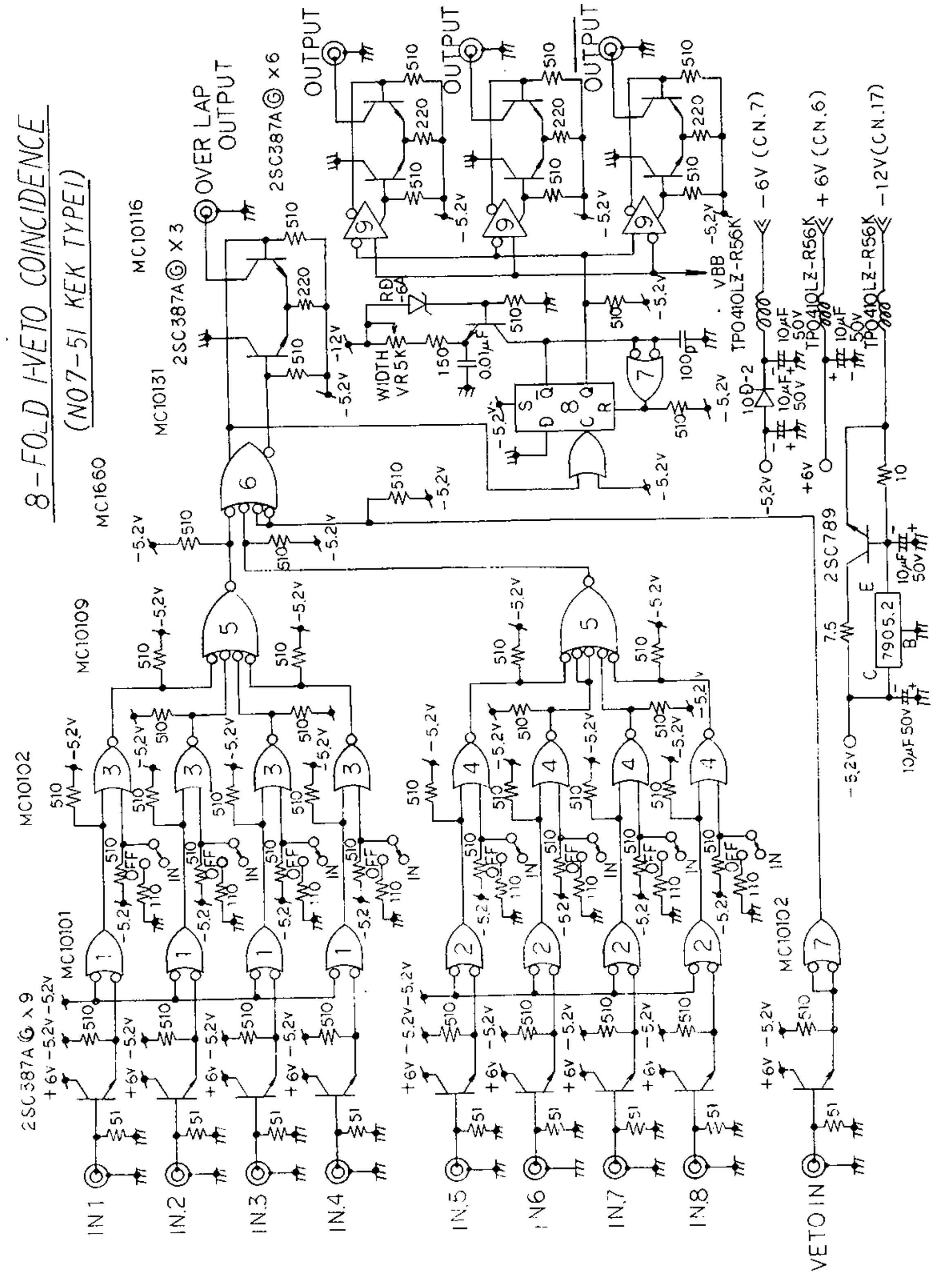
+6 Volts: 77 mA

-6 Volts: 355 mA

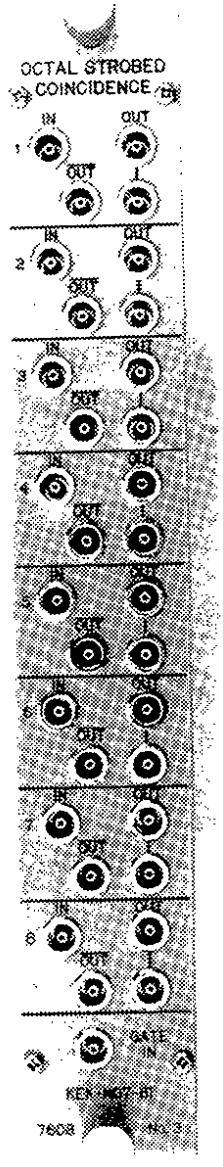
-12 Volts: 264 mA

8-FOLD I-VETO COINCIDENCE

(N07-51 KEK TYPE I)



N07-61 OCTAL STROBED COINCIDENCE (KEK TYPE-1)



KEK NIM STANDARD MODULE (N07-61)
OCTAL STROBED COINCIDENCE
KEK TYPE-1

KEK NIM STANDARD MODULE (NO7-61) NO7-61-01
OCTAL STROBED COINCIDENCE KEK TYPE-1

SPECIFICATIONS

(1) LOGIC INPUT

Number of Inputs: 8, one for each of eight independent.

Impedance: 50 ohms (direct-coupled).

Voltage: Standard negative "NIM" logic signal, threshold level -450 mV.

Width: Shortest pulse to produce full outputs $<$ 2 ns for logic input (at -600 mV).

Reflections: $<$10% for input of 1 ns rise time.

Maximum Rate: Maximum repetition rate to produce full output $>$ 65 MHz.

(2) GATE INPUT

Input: Common to all eight logic inputs.

Impedance: 50 ohms (direct - coupled).

Voltage: Standard negative "NIM" logic signal, threshold level -500 mV.

Reflections: $<$10% for input of 1 ns rise time.

Precede Time: 2 ns, gate input should precede logic inputs by 2 ns to compensate for internal propagation delay.

(3) BIN GATE INPUT

Input: Via rear connector, with rear panel On-Off switch.

Impedance: 1.6 K ohms, 2 standard TTL loads (direct-coupled).

Voltage: Quiescently above +3 volts, clamping to ground inhibits.

(4) OUTPUT

Normal Outputs: Two outputs (independent each output). Quiescently 0 mA, current source switches to -16 mA (-800 mV into 50 ohms load) during output.

Complementary Output: One output.
Quiescently -16 mA (-800 mV into 50 ohms load), switching to zero volts during output.

Width: Duration equal to overlap between input logic signal and fast gate signal. Non-updating.

Rise and Fall Time: Normal output, rise time $<$ 800 ps, fall time $<$ 1.2 ns.
Complementary output, rise time $<$ 1.2 ns fall time $<$ 800 ps.

Over Shoot: $<$ 5%

Under Shoot: $<$ 4%

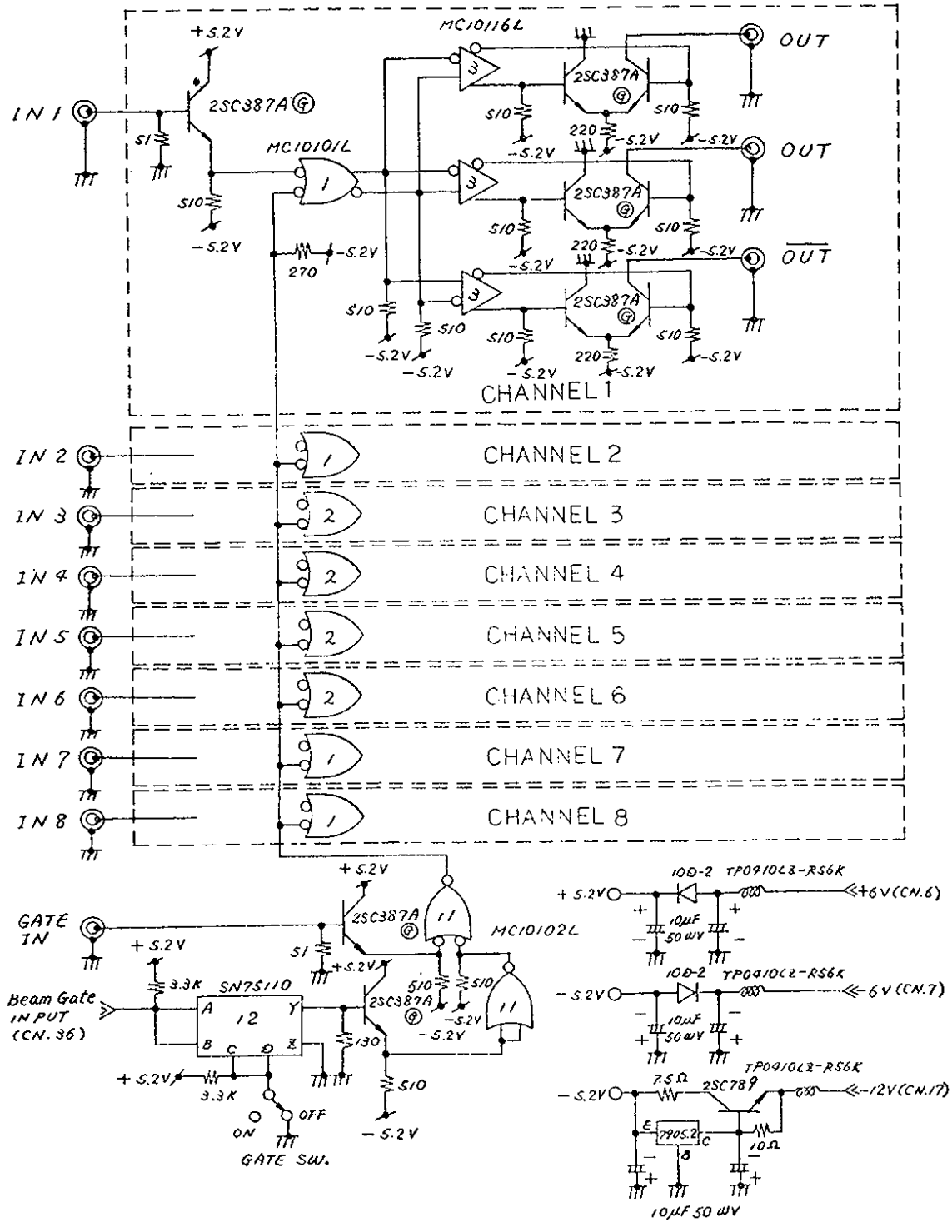
Coincidence Overlap: Mimimum overlap of 1.6 ns produce full amplitude output.

Propagation Delay Time: 6.8 ns (In-Cut).

(5) POWER REQUIREMENTS

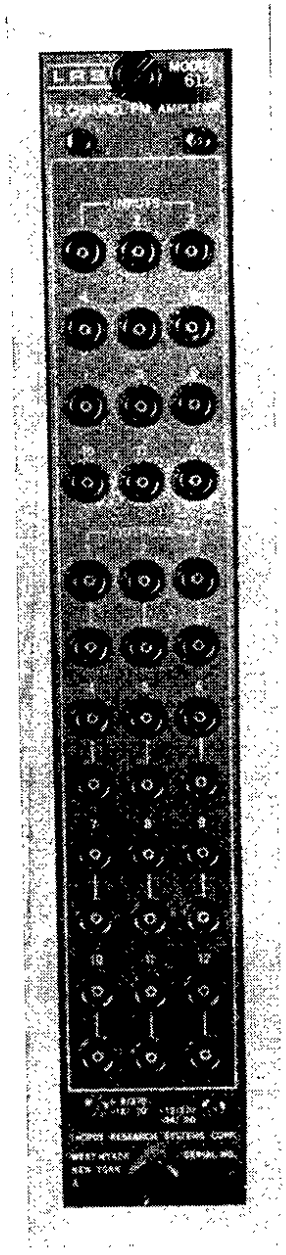
+6 Volts: 110 mA.
-6 Volts: 725 mA.
-12 Volts: 435 mA.

(6) DIMENSION: Single width AEC-NIM module, 1.35" wide x 8.75" high in accordance with TID-20893 (Rev. 2).
Lemo-type connectors.



OCTAL STROBED COINCIDENCE (NO7-61 KEK TYPE 1)

N08-10 12-CH PHOTO-MULTIPLIER AMPLIFIER
(GAIN FIXED X10) (LeCroy 612)



KEK NIM MODULE (N08-10)
UNIPOLAR AMPLIFIER
12 CHANNEL PM AMPLIFIER (LeCROY-612)

KEK NIM STANDARD MODULE (N08-10)
UNIPOLAR AMPLIFIER
12-CHANNEL PHOTOMULTIPLIER AMPLIFIER (LeCROY-612)

SPECIFICATIONS

(1) INPUT CHARACTERISTICS

Number of Channels: 12

Impedance: 50 ohms (direct-coupled)

Input Protection: ±5 A for 0.5 μsec
±500 mA continuous input voltage
Clamps at ±600 mV

Reflection Coefficient: Less than 5% over input dynamic range

Quiescent Voltage: ±0.5 mV

(2) OUTPUT CHARACTERISTICS

Maximum Positive Amplitude (Linear): +200 mV

Maximum Negative Amplitude (Linear): -2 volts with -6 V supply
-5 volts with -12 V supply
(selected by rear-panel switch)

Overshoot: Less than ±10% for input risetimes > 1.5 nsec

Quiescent Voltage: Ground, adjustable with internal potentiometer

Output Voltage DC Offset: Typically 50 μV/°C

Output Voltage Variation: < 1 mV for ±0.5 V variation of any supply voltage

(3) GENERAL

Gain: Fixed gain of 10, non-inverting
Long-term stability ±1%
Gain tolerance ±5%

Linearity: 0.1% integral

Coupling: Direct-coupling

Propagation Delay Time: Approx. 2.5 nsec

Noise: Less than 50 μV rms, referred to input, total

Overload Recovery: (a) Operation with 12 volt supply; saturated for approximately 15 nsec after 10 X overload
(b) Operation with 6 volt supply; saturated for approximately 50 nsec after 10 X overload

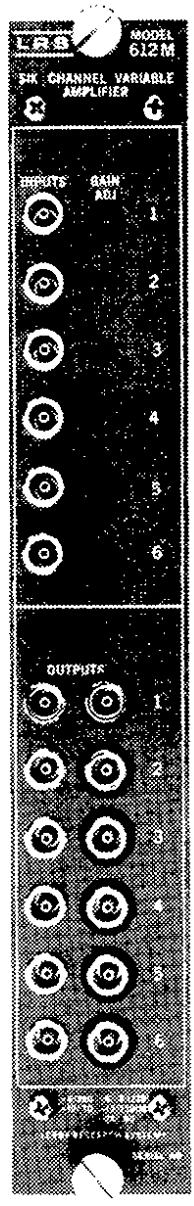
Packaging: RF-shielded AEC-NIM single width module conforming to specifications outlined in AEC Report TID-20893
Lemo-type connectors

(4) POWER CONSUMPTION

+6 volts: 240 mA

-6 volts or -12 volts: 240 mA
(selected by rear-panel switch)

N08-10 6-CH PHOTO-MULTIPLIER AMPLIFIER (GAIN VARIABLE X40) (LeCroy 612M)



KEK NIM MODULE (N08-10)
6-CH PHOTO-MULTIPLIER
AMPLIFIER (LeCROY 612M)

KEK NIM STANDARD MODULE (N08-10) N08-10-01
6-CH PHOTO-MULTIPLIER AMPLIFIER (GAIN VARIABLE X40) (LeCROY 612M)

SPECIFICATIONS

(1) INPUT CHARACTERISTICS

Impedance: 50 Ω .

Input Protection: ±5 A for 0.5 μsec; ±0.5 A continuous; clamps at ±0.6 V.

Reflection Coefficient: Less than 5% over input dynamic range.

Quiescent Voltage: ±0.5 mV.

(2) OUTPUT CHARACTERISTICS (Both outputs of each used channel must be terminated for optimum waveshape.)

Maximum Positive Amplitude (Linear): +200 mV.

Maximum Negative Amplitude (Linear); -2 volts with -6V supply; -5 volts with -12 V supply.

Overshoot: Less than ± 10% for input risetimes > 1.5 nsec.

Quiescent Voltage: 0V ±3 mV.

Output Voltage DC Offset Temperature Coefficient: 400 μV/°C maximum.

Output Voltage Variation with Supply Voltage: < 4 mV for ±1% variation of any supply voltage.

(3) GENERAL

Gain: 1 to 40, non-inverting. Long-term stability ±1%.

Linearity: 0.2% integral.

Coupling: Direct.

Risetime: <3.0 nsec, 10% to 90%.

Delay: Approx. 5 nsec.

Noise: Less than 40 μVrms, referred to input, total.

Interchannel Crosstalk: Output in one channel affects any other channel by no more than -40 dB.

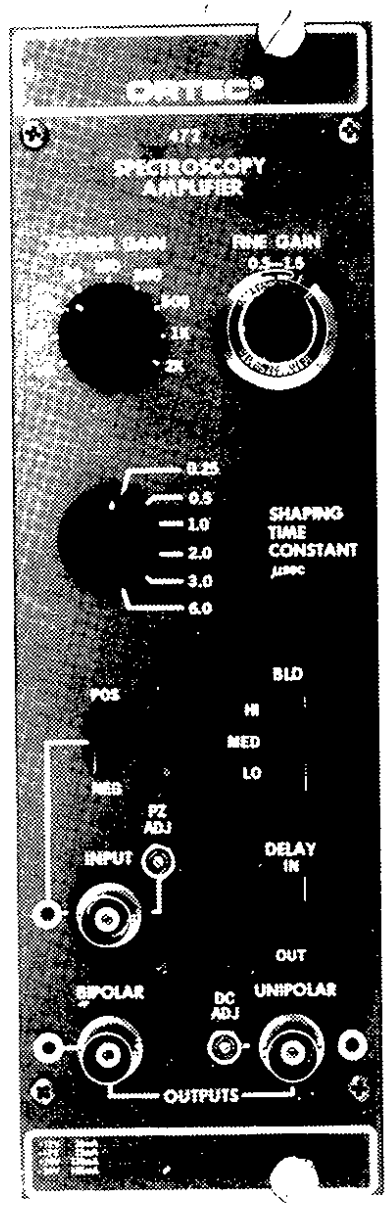
Overload Recovery: a) Operation with -12 volt supply: saturated for approximately 15 nsec after 10X overload.

b) Operation with -6 volt supply: saturated for approximately 50 nsec after 10X overload. For wide pulses (i.e., >5 μsec) it is recommended to use - 12V supply for best overload recovery.

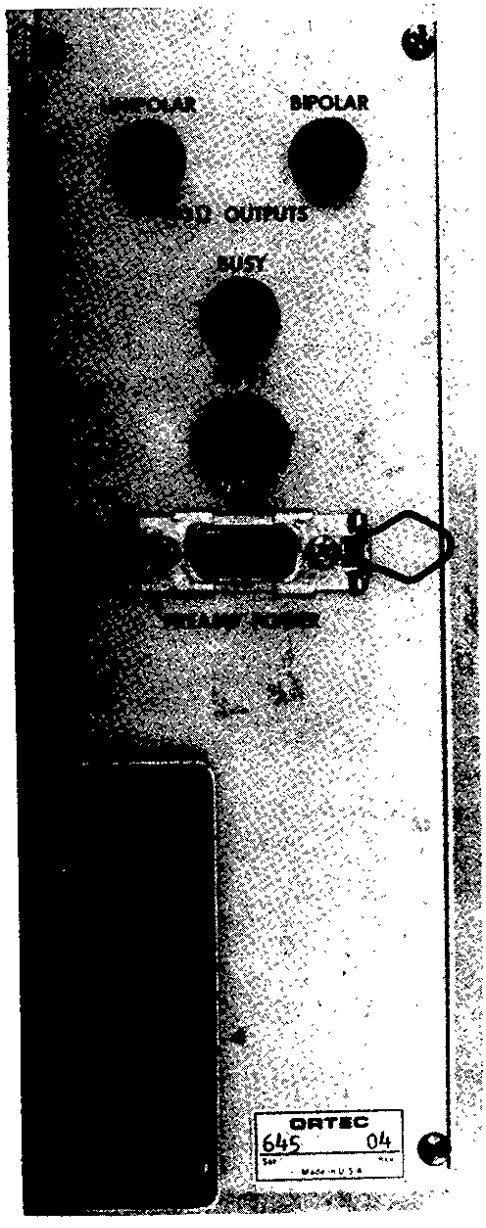
Packaging: RF-shielded AEC/NIM #1 width module conforming to specifications outlined in AEC Report TID-20893; Lemo-type connectors.

Current Requirements: +6 V at 280 mA; -12 V or -6 V at 230 mA (selected by rear-panel switch); +12 V at 10 mA; -24 V at 80 mA.

N08-40 SPECTROSCOPY AMPLIFIER (ORTEC 472)



KEK NIM MODULE (N08-40)
SPECTROSCOPY AMPLIFIER
(ORTEC 472)



SPECTROSCOPY AMPLIFIER
(ORTEC 472), REAR SIDE VIEW

KEK NIM STANDARD MODULE (N08-40)
SPECTROSCOPY AMPLIFIER (ORTEC 472)

N08-40

SPECIFICATIONS

Gain Range: Continuously adjustable form 2.5 to 3000.

Integral Nonlinearity: $<0.05\%$

Noise: <4 μV unipolar and <7 μV bipolar referred to the input, using 3 μs shaping and coarse gain ≥ 100.

Temperature Instability:
Gain: 0.005%/°C, 0 to 50°C.
dc Level: $<\pm 100$ μV/°C, 0 to 50°C.

Count Rate Stability: A pulser peak at 85% of analyzer range shifts $<0.1\%$ in the presence of 0 to 70,000 counts/s from a ^{137}Cs source with its peak stored at 75% of analyzer range, using 1 μs shaping.

Overload Recovery: Recovers to within 2% of rated output from X1000 overload in 2.5 nonoverloaded bipolar pulse widths, using maximum gain; degrades to X200 for unipolar.

Delay: Switch selects either 2 μs delay (in) or prompt (out) timing for unipolar output.

Inputs: Accept either positive or negative pulses with rise times of 10 to 650 ns and decay times of 25 to 2000 μs; $Z_{in} \cong 1000\,\Omega$, dc-coupled; linear maximum, 5.5 V; absolute maximum, 20 V.

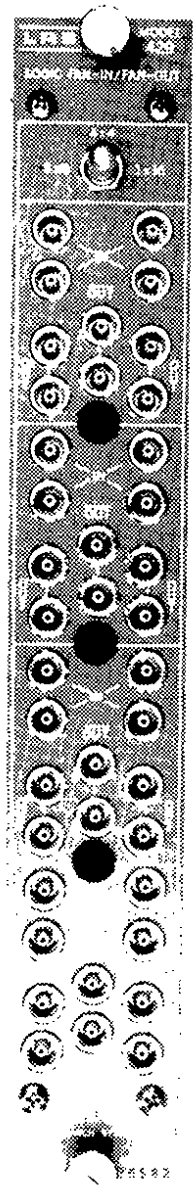
Unipolar Outputs: Front panel connector with $Z_o < 1\,\Omega$ and rear panel connector with $Z_o = 93\,\Omega$, short-circuit-proof; prompt or delayed with full-scale linear range of +10 V; active-filter-shaped; dc-restored; dc level adjustable to ±100 mV.

Bipolar Outputs: Front panel connector with $Z_o < 1\,\Omega$ and rear panel connector with $Z_o = 93\,\Omega$, short-circuit-proof; prompt output with positive lobe leading and linear range of ±10 V; active-filter-shaped.

Busy Cutput: Provides a +5 V logic pulse for the duration that the input pulse exceeds the baseline discriminator, $Z_o < 10\,\Omega$.

Dimension: Double width AEC-NIM module, 2.70" wide x 8.75" high in accordance with TID-20893(Rev.2).

N09-10 QUAD LOGIC FAN-IN/FAN-OUT (LeCroy 429)



KEK NIM MODULE (N09-10)
QUAD LOGIC FAN-IN/FAN-OUT
(LeCROY 429)

KEK NIM STANDARD MODULE (NC9-10) NC9-10-01
QUAD LOGIC FAN-IN/FAN-OUT (LeCROY 429)

SPECIFICATIONS

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

(1) INPUT CHARACTERISTICS

Number of Inputs: Four per section.

Impedance: 50 Ω ±5%.

Reflections: < 10% for input risetimes > 2 ns.

Quiescent Level: 0 volts dc.

Signal Level Requirements: Standard NIM logical 1 input levels: -12 mA to -36 mA into 50 Ω.

Signal Width Requirements: 4 ns minimum, FWHM.

Coupling: Direct.

(2) OUTPUT CHARACTERISTICS

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

Output Levels: Normal: quiescently 0 volts, > -700 mV into 50 Ω during output; complementary: quiescently > -700 mV into 50 Ω, 0 volts during output.

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

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

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

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

(3) GENERAL

Rate: > 100 MHz.

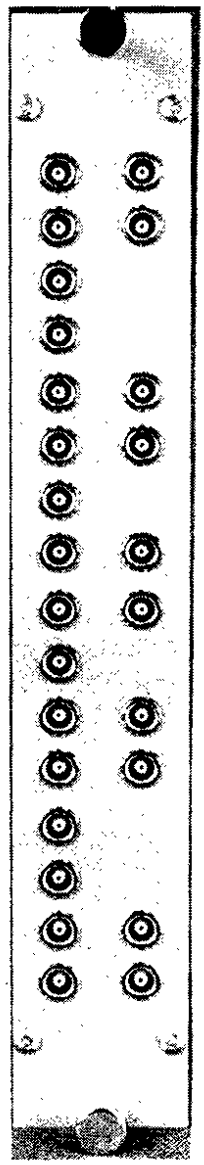
Stage Delay: < 6.5 ns.

Duty Cycle Limitations: None.

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

Current Requirements: +12 V at 35 mA +6 V at 175 mA
-12 V at 50 mA -6 V at 450 mA

N09-11 QUAD 4-INPUT OR LOGIC UNIT (KEK TYPE-1)



KEK NIM STANDARD MODULE (N09-11)
QUAD 4-INPUT OR LOGIC UNIT KEK TYPE-1

KEK NIM STANDARD MODULE (NOG-11) NOG-11
QUAD 4-INPUT OR LOGIC UNIT KEK TYPE-1

SPECIFICATIONS

(1) NUMBER OF SECTIONS: Four sections, four 4-fold fan-in/2 - fold fan-out, or single 16-fold fan-in/2-fold fan-out.

(2) INPUT

Number of Inputs: Four per section.

Impedance: 50 ohms (direct-coupled).

Voltage: Standard negative "NIM" logic signal, threshold level -450 mV.

Width: Shortest pulse to produce full outputs, <4 ns for logic input (at -600 mV).

Reflections: <10% for input of 1 ns rise time.

Maximum Rate: Maximum repetition rate to produce full output >150 MHz.

(3) OUTPUT

Voltage: Two outputs (independent each output).
Quiescently 0 mA, current source switches to -16 mA (-800 mV into 50 ohms load) during output.
At least one output of each pair must be terminated in 50 ohms.

Width: Equal to the logical sum of the input durations.
Non-updating.

Rise and Fall Time: Rise time<800 ps.
Fall time<1.2 ns.

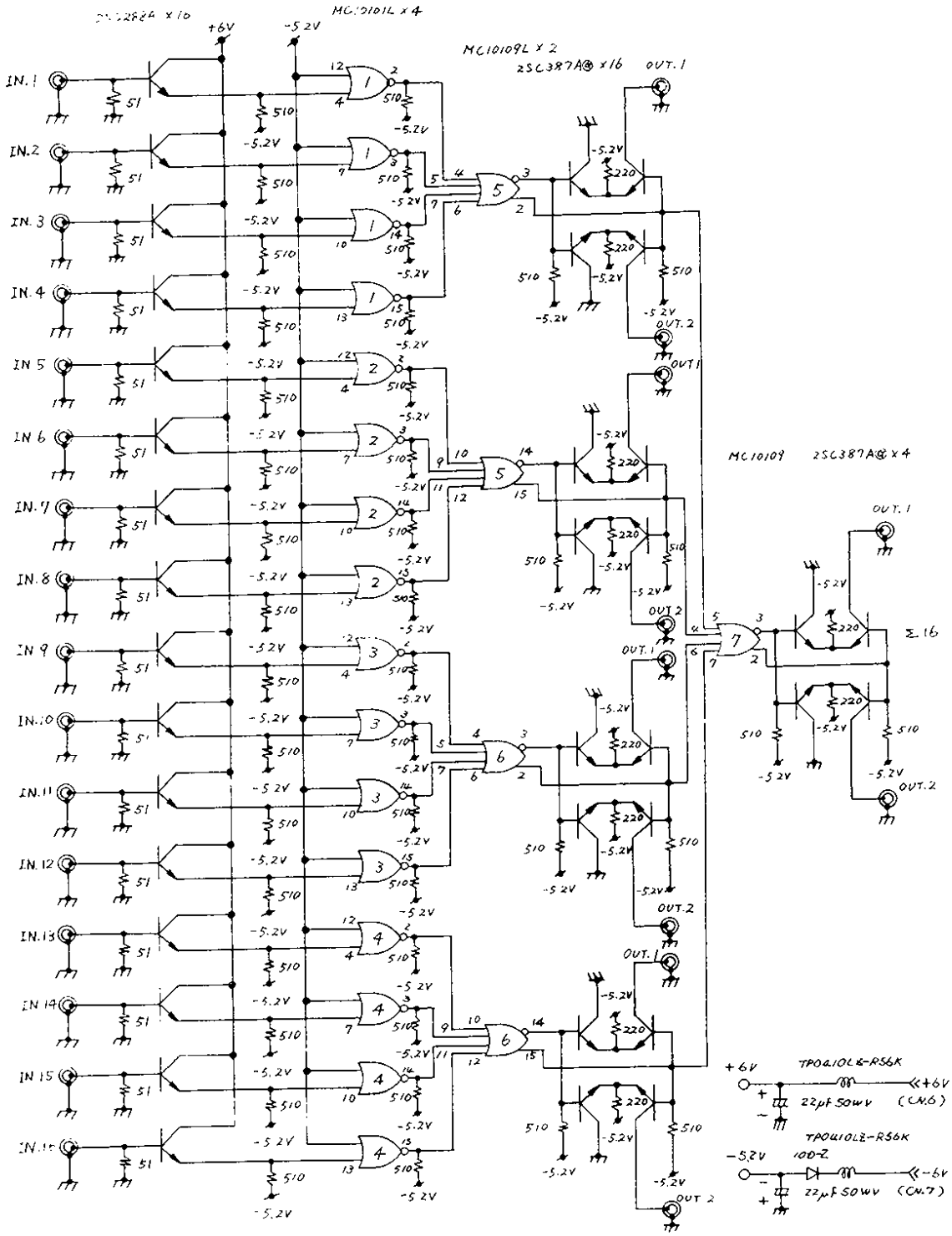
Over Shoot:< 5%.

Under Shoot:< 4%.

Propagation Delay Time: 8 ns at 4-fold fan-in, 10 ns at 16-fold fan-in.

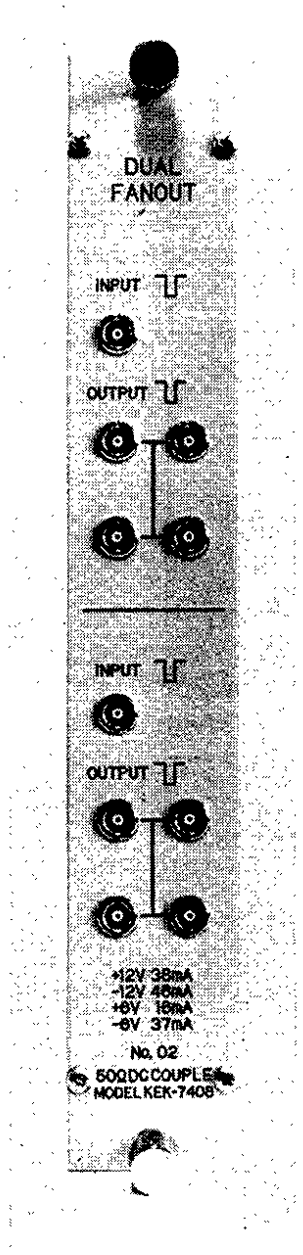
(4) POWER REQUIREMENTS: +6 Volts: 136 mA. -6 Volts: 595 mA.

(5) DIMENSION: Single width AEC-NIM module, 1.35" wide x 8.75" high in accordance with TID-20893 (Rev. 2).
Lemo-type connectors.



QUAD 4-INPUT OR LOGIC UNIT
KEK TYPE-1 (N09-11)

N09-21 DUAL FANOUT (KEK TYPE-1)



KEK NIM STANDARD MODULE (N09-21)
DUAL FAN OUT KEK TYPE-1

KEK NIM STANDARD MODULE (N09-21)
DUAL FAN OUT KEK TYPE-1

SPECIFICATIONS

(1) INPUT

Number: 2

Impedance: 50 ohms

Reflections: < 15%

Voltage: Threshold according to "NIM" specifications
Threshold level -400 mV

Width: Shortest pulse to produce full output
< 3 ns for logic input (at -600 mV)

Maximum Rate: Maximum repetition rate to produce full output > 190 MHZ

(2) OUTPUT

Number: For every single input
4 non-inverted

Voltage: When output is loaded with 50 ohms
-1000 mV (independent each output)

Rise and Fall Time: Rise time < 1.5 ns
Fall time < 1.7 ns

Overshoot: < 15%

Undershoot: < 4%

Propagation Delay: 4.5 ns

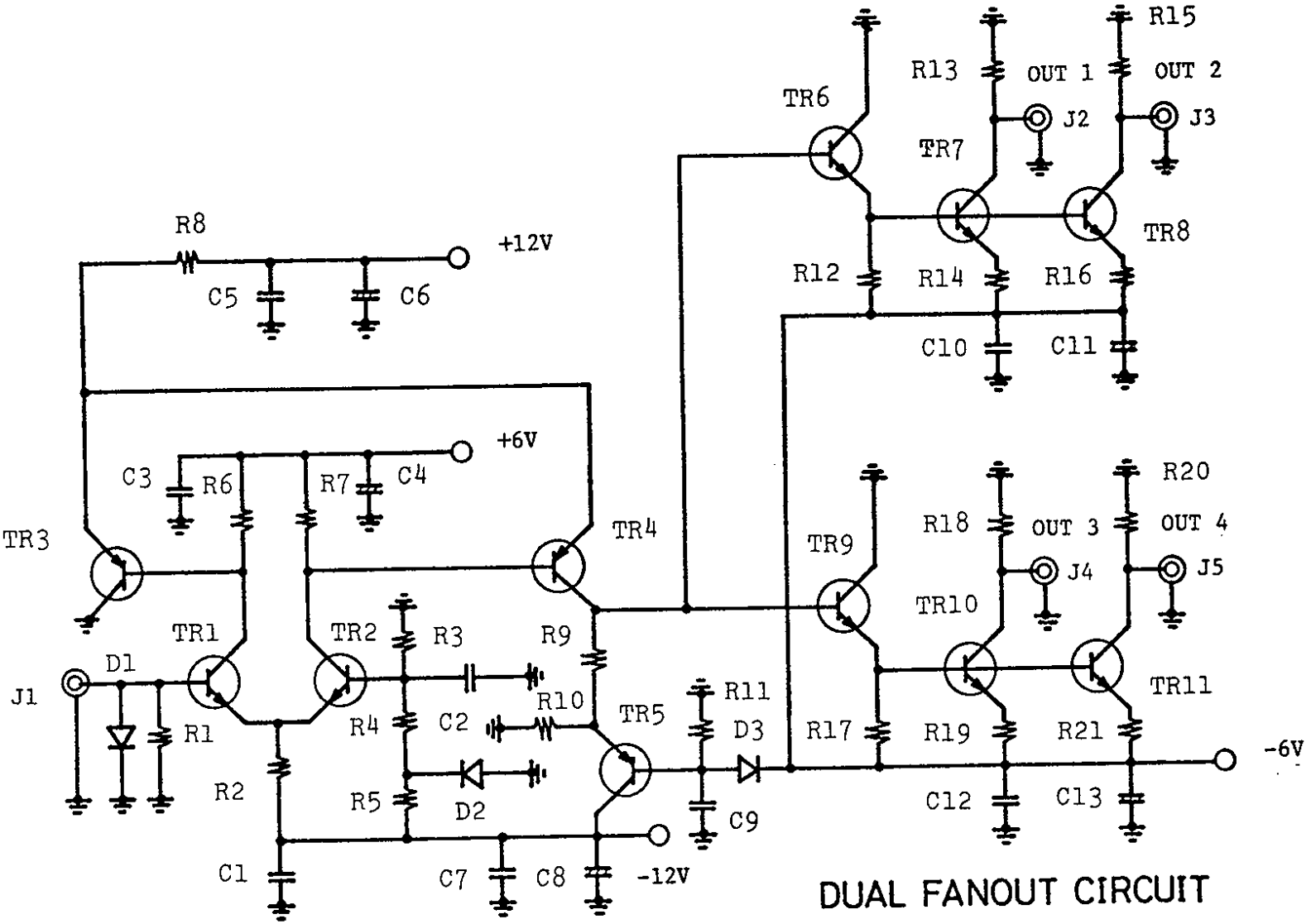
(3) POWER CONSUMPTION

+12 Volts: 38 mA

+ 6 Volts: 16 mA

-12 Volts: 46 mA

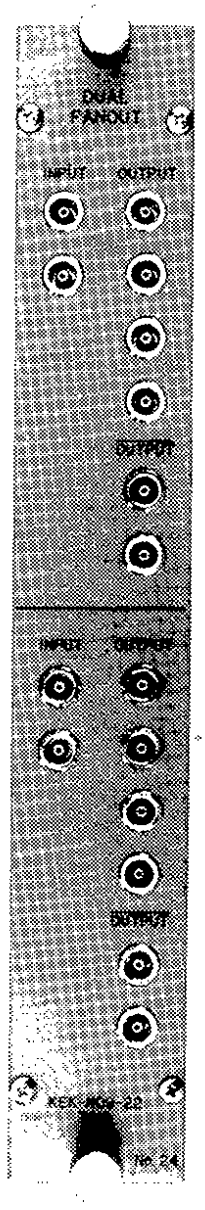
- 6 Volts: 37 mA



DUAL FANOUT CIRCUIT

KEK Dual Fanout Circuit Diagram
(Type-1 N09-21)

N09-22 DUAL FANOUT (KEK TYPE-2)



KEK NIM STANDARD MODULE (N09-22)
DUAL FANOUT KEK TYPE-2

KEK NIM STANDARD MODULE (N09-22) N09-22
DUAL FANOUT KEK TYPE-2

SPECIFICATIONS

(1) NUMBER OF CHANNELS: Two

(2) INPUT

Number: 2

Impedance: 50 ohms

Reflections: $<10\%$

Voltage: Threshold according to "NIM" Specifications
Threshold level -500 mV

Width: Shortest pulse to produce full output <3 ns for logic input (at -600 mV)

Maximum Rate: Maximum repetition rate to produce full output >143 MHz

(3) OUTPUT

Number: For every single input; 4 non-inverted, 2 complementary.

Voltage: When output is loaded with 50 ohms -800 mV (independent each output)

Rise and Fall Time: Rise time $<$ 800 ps
Fall time $<$ 1 ns

Overshoot: $<10\%$

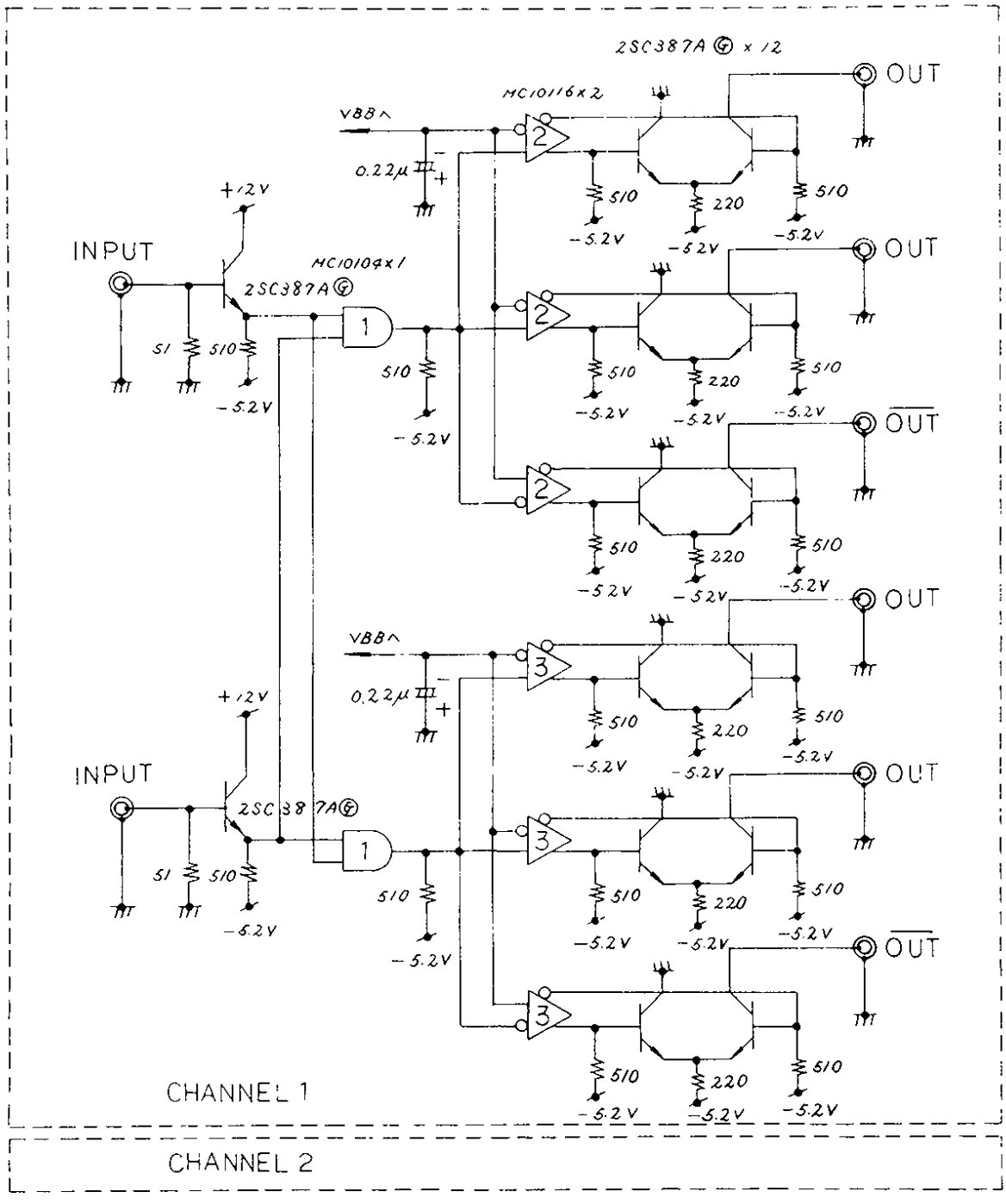
Undershoot: $<4\%$

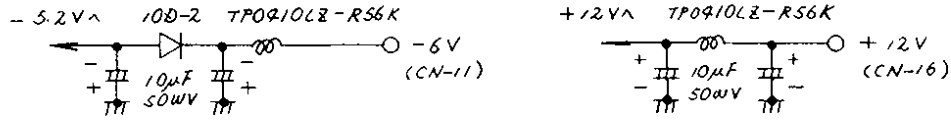
Propagation Delay: 7 ns

(4) POWER CONSUMPTION:

-6 Volts: 525 mA.
+24 Volts: 37 mA.

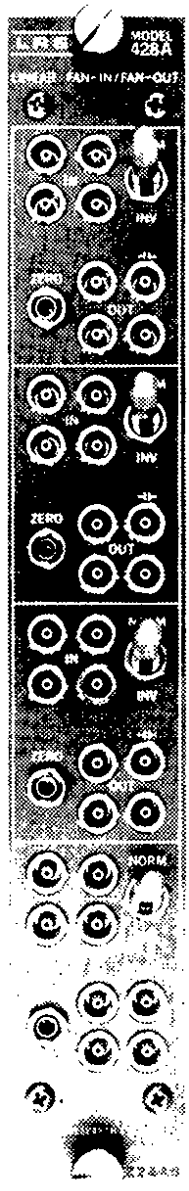
(5) DIMENSION: Single width AEC-NIM module, 1.35" wide x 8.75" high in accordance with Tid-20893(Rev.3).
Lemo-type connectors.





NIM DUAL FANOUT (KEK-N09-22) TYPE2

N10-10 QUAD LINEAR FANIN/FANOUT (LeCroy 428A)



KEK NIM MODULE (N10-10)
QUAD LINEAR FAN-IN/FAN-OUT
(LeCROY 428A)

KEK NIM STANDARD MODULE (N10-10) N10-10-01
QUAD LINEAR FAN-IN/FAN-OUT (LeCROY 428A)

SPECIFICATIONS

(1) INPUT CHARACTERISTICS

Number of Channels: Four

Inputs: 4 per channel; direct-coupled. (Unused inputs need not be terminated.)

Impedance: 50 Ω .

Polarity: Positive or negative.

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

Input Protection: Inputs protected against 0.5 μs transient overloads, up to ± 5A.

(2) OUTPUT CHARACTERISTICS

Outputs: 4 per channel; reverse-terminated; 3 direct-coupled, 1 capacitively-coupled (C = 0.1 μf); for optimum output shape, three outputs must be terminated into 50 Ω. For proper operation, at least 2 outputs must be terminated on each channel used.

Integral Non-Linearity: ± 1% up to -1 volt.

Linear Range: Normal Mode: +100 mV to > -2 volts.
Inverting Mode: +100 mV to > -1.5 volts.

Maximum Amplitude: Normal Mode: > -2.0 volts into 50 Ω .
Inverting Mode: > -1.5 volts into 50 Ω .

Risetimes and Falltimes: ≤ 2.5 ns, 10% to 90%, with outputs terminated in 50 Ω .

Gain: Normal Mode: 1.0 ±2% up to -2 volts.
Inverting Mode: Approximately 0.98 up to -1.5 volts.

Duty Cycle Limitations: None for direct-coupled outputs.

DC Offset: Adjustable with front-panel potentiometer. Care should be taken to readjust DC level whenever the Normal/Inverting switch is used.

DC Offset Stability: Normal Mode: < 1.0 mV/°C with 50 Ω load.
Inverting Mode: < 1.2 mV/°C with 50 Ω load.

Output DC Level Voltage Coefficient: Normal Mode: < 2.0 mV/% variation in +24 V supply. Inverting Mode: < 1.3 mV/% variation in +6 V supply, and < 0.25 mV/% variation in -24 V supply.

Noise: < 750 μV rms.

Stage Delay: < 6 ns.

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

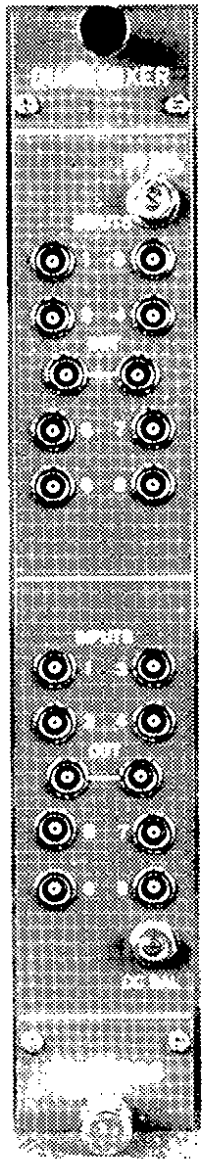
(3) GENERAL

Polarity Inversion: A front-panel switch on each channel selects normal or inverting operation.

Packaging: RF shielded AEC/NIM #1 module; dimensions 1.375 x 8.75 x 10 inches deep. Lemo-type connectors.

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

N10-11 DUAL LINEAR MIXER (KEK TYPE-1)



KEK NIM STANDARD MODULE (N10-11)
DUAL LINEAR MIXER KEK TYPE-1

KEK NIM STANDARD MODULE (N10-11) N10-11-01
DUAL LINEAR MIXER KEK TYPE-1

SPECIFICATIONS

(1) INPUTS

Inputs 1 - 8: LEMO connectors accept input signals.

Impedance: 50 Ω dc-coupled.

Polarity: Positive or negative.

Reflections: < 5% for ±2 V, 1 nsec rise-time input.

Linear Range: +2 V to -2 V.

Protection: ±5 V dc, ±50 V transient.

Offset: < ±5 mV with all inputs terminated in 50 Ω .

Temperature Coefficient: <100 μV/°C.

(2) OUTPUTS

Out: Two LEMO connectors for fanout of one bridging current source per section.

Polarity: Noninverted input polarity.

Linear Range: +40 mA to -40 mA.

Offset: Adjustable from +150 mV to -150 mV on 50Ω load.

Temperature Coefficient: <300 μV/°C on 50Ω load.

Rise and Fall Times: <2 nsec with all inputs terminated in 50Ω .

Overshoot: < 5% with all inputs terminated in 50Ω .

(3) CONTROLS

DC Bal.: Front panel 22-turn potentiometer controls the output offset.

(4) PERFORMANCE

Gain: 0.91 ± 1.5% over full linear range with all inputs and outputs terminated in 50Ω .

Bandwidth: >180 MHz.

Propagation Delay: Typically 2.5 nsec.

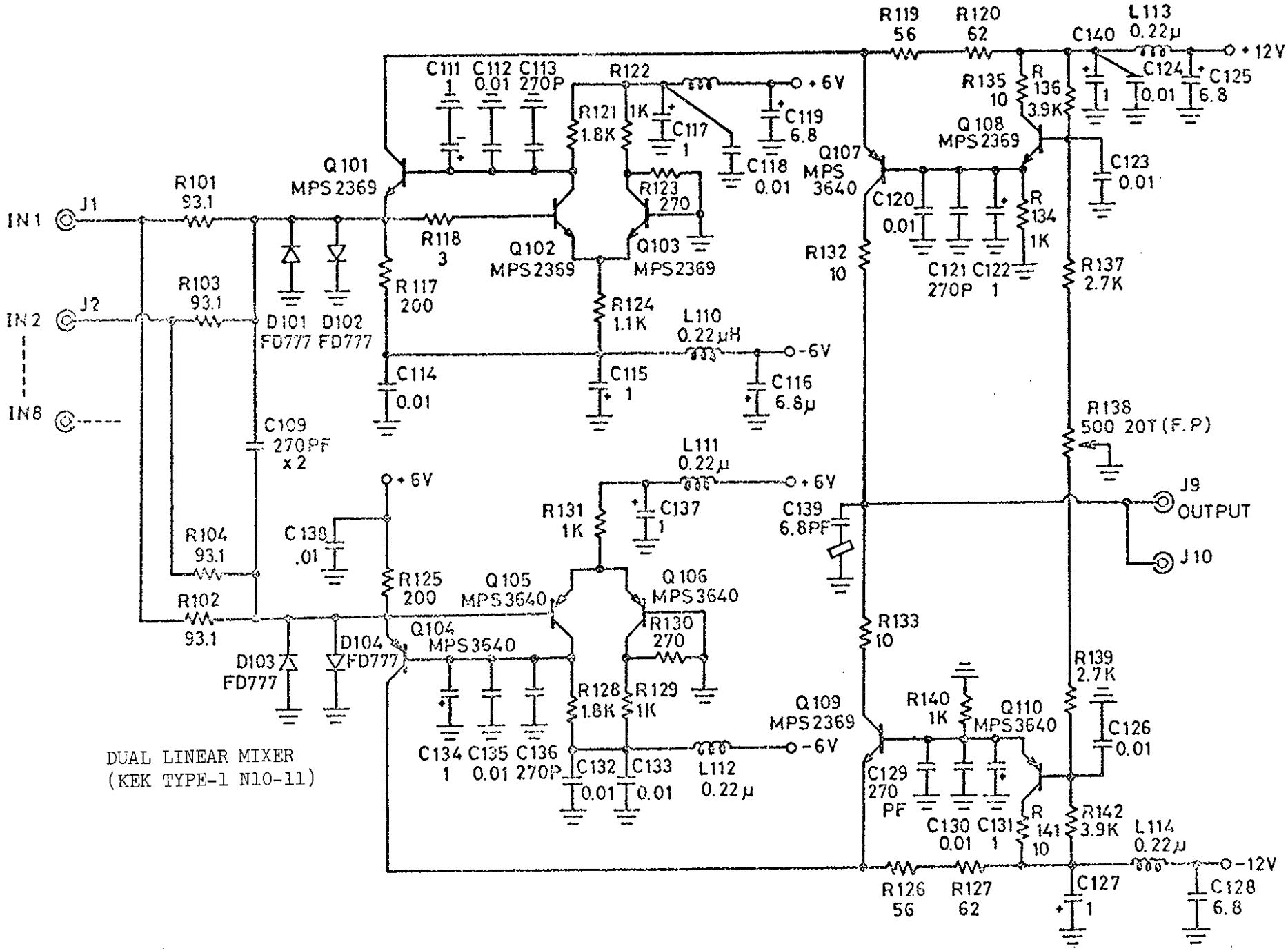
Operating Range: 0 - 50°C.

(5) ELECTRICAL AND MECHANICAL

Dimensions: Single-width NIM standard module.

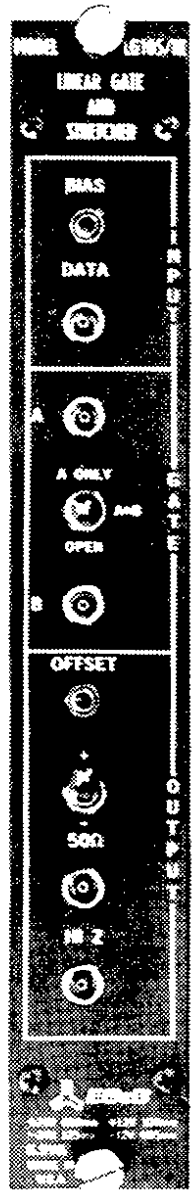
Connectors: LEMO RA00250.

Power Required: +6 V 90 mA +12 V 130 mA
-6 V 88 mA -12 V 130 mA



DUAL LINEAR MIXER
(KEK TYPE-1 N10-11)

N10-20 LINEAR GATE AND STRETCHER (EGG LG105/NL)



KEK NIM MODULE (N10-20)
LINEAR GATE AND STRETCHER
(EG&G LG105/NL)

KEK NIM STANDARD MODULE (N10-20) N10-20-01
LINEAR GATE AND STRETCHER (EGG LG105/N)

SPECIFICATIONS

Dynamic Range: 3 to 100 pC.

Accuracy: ±5% of full range.

Integral Nonlinearity: ±1% (10 to 110% of output range).

Data Input: BNC type connector accepts negative pulses in the linear range to -1.3 V (26 mA); impedance, 50 Ω ±5%.

Gate Inputs: BNC type connector accepts two identical inputs; NIM-standard fast logic signals.

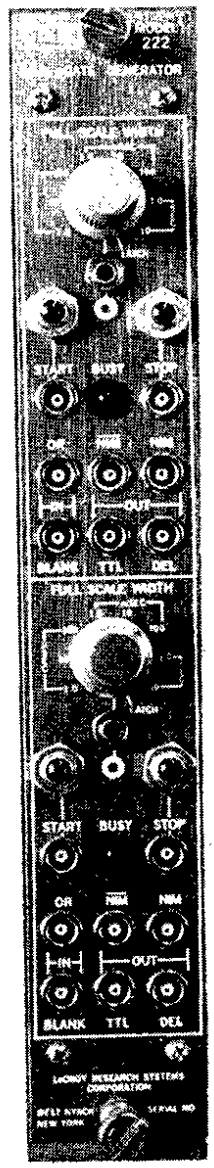
Hi-Z Output: BNC type connector furnishes positive or negative signals (switch selectable); 50 Ω source impedance to drive high-impedance loads, limits at 14 V or 24 mA.

50 Ω Output: BNC type connector furnishes positive or negative signals (switch selectable); 450 Ω output impedance to drive 50 Ω loads, limits at 1.2V (24 mA).

Power Required: +24 V, 90 mA; -24 V, 125 mA; +12 V, 100 mA; -12 V, 55 mA; VA = 7.0.

Dimension: Single width AEC-NIM module, 1.35" wide X 8.75" high in accordance with TID-20893 (Rev.2).

N11-10 DUAL GATE GENERATOR (LeCroy 222)



KEK NIM MODULE (N11-10)
GETE GENERATOR
DUAL GETE GENERATOR (LeCROY-222)

KEK NIM STANDARD MODULE (N11-10) N11-10-01
DUAL GATE GENERATOR (LeCROY 222)

SPECIFICATIONS

EACH CHANNEL

(1) INPUT CHARACTERISTICS

Start Input: One: responds to both fast NIM-level and TTL-level inputs.

Fast NIM input Requirements: Greater than -600 mV enables; minimum width 5 ns; 50 Ω impedance for any input from +100 mV to -5.0 V.

TTL input Requirements: Greater than +2.5 volts enables; minimum width approx. 20 ns; high impedance for any input from +400 mV to +6 volts. (Requires +4.5 mA at +2.5 V.)

Stop Input: One: Characteristics same as for "Start" input.

Blanking Input: One: Requires fast NIM-level inputs (>-600 mV) 50Ω impedance; blanks all outputs which occur during its presence, including the delayed output.*

"OR" Input: One: Requires fast NIM-level inputs (>-600 mV); 50 Ω impedance; extends preset gate duration by the portion of its input signal that occurs after the preset output time.

(2) OUTPUT CHARACTERISTICS

Gate Outputs: One standard fast NIM-level output (quiescently 0 volts; -750 mV during pulse) of approx. 2 ns risetime; falltime slightly longer on wide widths.

One complementary fast NIM-level output (quiescently -750 mV; 0 volts during pulse).

One TTL-level output (quiescently 0 volts; > +2.5 volts into 50 Ω during pulse).

Delayed Output: Delivers 10 ns (FWHM) fast NIM-level signal into 50 Ω . Occurs at trailing edge of gate output (including any gate extension due to input "OR"); < 2.5 ns risetime.

Presettable Gate Durations: Continuous from < 100 ns to > 11 sec.; full-scale switch determines range. On Lemo version, screwdriver-adjustment vernier permits fine adjustment from < 10% to > 110% of full scale.

On BNC version, front panel locking potentiometer replaces the screwdriver adjust pot and monitor point.

(3) GENERAL

Recovery Time: None; unit may be retriggered immediately after gate output returns to its quiescent state.

Input-Output Delay: 14 ns.

Front-Panel Monitor Point: On Lemo version, front-panel test point gives DC voltage related to gate width. Conversion chart included with module. On BNC version, monitor point is eliminated.

Manual: Front-panel "Start" and "Stop" pushbuttons permit manual operation when full-scale switch set on "latch", and single-shot presettable operation when full-scale switch is in any other position.

Bin Gate Driver: Each channel has one rear-panel Lemo-type connector which switch selectably drives external bins in either normal of inverted direction.

Channel Select Switch: Rear panel 3-position switch (A/B/OFF) determines which channel drives the bin in which the Model 222 is located.

Gate Monitor: Front panel LED remains on when gate output is present, even if extended by "OR" input.

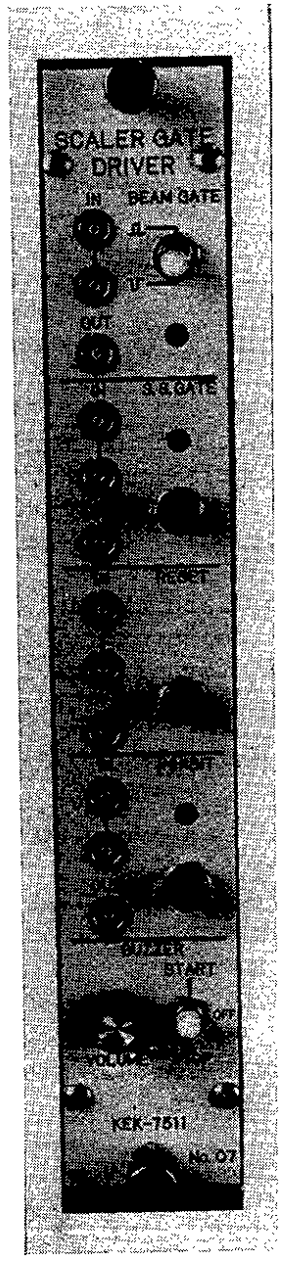
Packaging: Model 222: NIM standard single-width module; Lemo-type connectors.

Model 222N: NIM standard double-width module; BNC connectors.

(4) Current Requirements: +12 V at 95 mA +24 V at 45 mA
-12 V at 160 mA -24 V at 80 mA
+6 V at 235 mA

* Blanking of the delayed output may be disabled by factory option.

N11-31 SCALER GATE DRIVER (KEK TYPE-1)



KEK NIM STANDARD MODULE (N11-31)
SCALER GATE DRIVER KEK TYPE-1

SPECIFICATIONS

(1) BEAM GATE (BIN GATE)

(a) INPUT

Input: Two inputs, positive and negative logic level.

Logic Polarity: Toggle switch on the front panel selects logic polarity of the input signal.

Pull-up Resistor: 1 K ohms (direct-coupled).
Logic "0" requires -6.6 mA.

Voltage: TTL standard positive logic level.
Logic "1" = >+2 V.
Logic "0" = 0 to 0.8 V.

(b) OUTPUT

Output: Two outputs, one is on the front panel, another on the rear panel (CN-36).

Voltage: TTL standard positive logic level.
Logic "1" > +2.5 V.
Logic "0" < +0.4 V.
Quiescently above +2.5 V for gate "ON".

Low Level Clamp Capability: 54 mA at 0 ± 500 mV.

Propagation Delay Time: 140 ns (positive input).
140 ns (negative input).

Indicator: LED is illuminated while the input logic level is logic "1".

Output Duration: Approximately equal to the input duration.

(2) S.S. GATE (START-STOP GATE):

Control gate to permit or inhibit counting.

(a) INPUT

Input: Feed-through signal and the internal status signal is generated with the push-buttom switch.

Pull-up Resistor: 1 K ohms (direct-coupled).
Logic "1" requires -6.6 mA.

Voltage: TTL standard negative logic level.
Logic "1" = 0 to +0.8 V.
Logic "0" => +2 V.

Push Switch: Output level is changed with push by push.

(b) OUTPUT

Output: Two outputs, one is on the front panel, another on the rear panel (CN-14).

Voltage: TTL standard negative logic level.
Logic "1" < +0.4 V.
Logic "0" > +2.5 V.
Clampped to ground (logic "1") for counter start, quiescently above +2.5V (logic "0") for counter stop.

Low Level Clamp Capability: 54 mA at 0 ± 500 mV.

Propagation Delay Time: 19 ns.

Indicator: LED is illuminated while the input is in the logic "1" counting condition.

Output Duration: Approximately equal to input duration.

(3) INHIBIT: Control gate to inhibit the input signal into other fast modules.

(a) INPUT

Input: Feed-through signal and the internal status signal is generated with the push-buttom switch.

Pull-up Resistor: 1 K ohms (direct-coupled).
Logic "1" requires -6.6 mA.

Voltage: TTL standard negative logic level.
Logic "1" = 0 to +0.8 V.
Logic "0" = >+ 2 V.

Push Switch: Output level is changed with push by push.

(b) OUTPUT

Output: Two outputs, one is on the front panel, another on the rear panel (CN-12).

Voltage: TTL standard negative logic level.
Logic "1" < 0.4 V.
Logic "0" > +2.5 V.
Quiescently above +2.5 V, clampped to ground for inhibition.

Low Level Clamp Capability: 54 mA at 0 ± 500 mV.

Propagation Delay Time: 20 ns.

Indicator: LED is illuminated while the input is in the logic "1" inhibiting condition.

Output Duration: Approximately equal to input duration.

(4) RESET: Command signal to reset fast modules to an initial condition.

(a) INPUT

Input: Feed-through signal and generated signal by the push switch.

Pull-up Resistor: 1 K ohms (direct-coupled).
Logic "1" requires -6.6 mA.

Voltage: TTL standard negative logic level.
Logic "1" = 0 to +0.8 V.
Logic "0" > +2 V.

Push Switch: Resets output signal when pressed manually.

(b) OUTPUT

Output: Two outputs, one is on the front panel, another on the rear panel (CN-35).

Voltage: TTL standard negative logic level.
Logic "1" < +0.4 V.
Logic "0" > +2.5 V
Quiescently above +2.4 V, clampped to ground for reset.

Low Level Clamp Capability: 300 mA at 0 ± 500 mV.

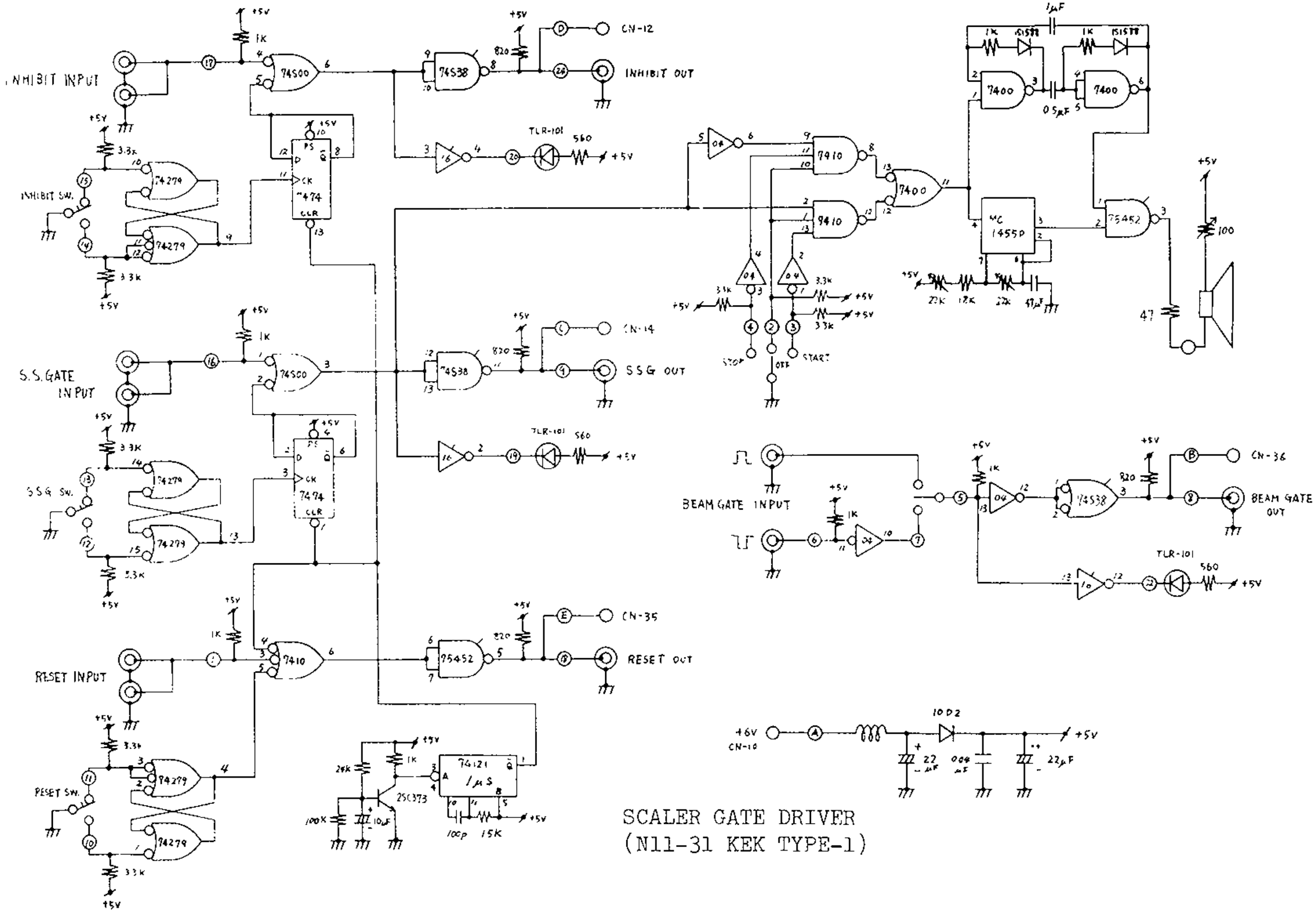
(5) BUZZER: Function to make conditions of the start-stop gate known with the alarm.

Mode: 3 - position toggle switch selects the alarm function.
"Start" raises the alarm in the "Start" condition of the start-stop gate.
"Stop" raises the alarm in the "Stop" condition of the start-stop gate.
"OFF" inhibits to raise the alarm.

(6) POWER REQUIREMENTS

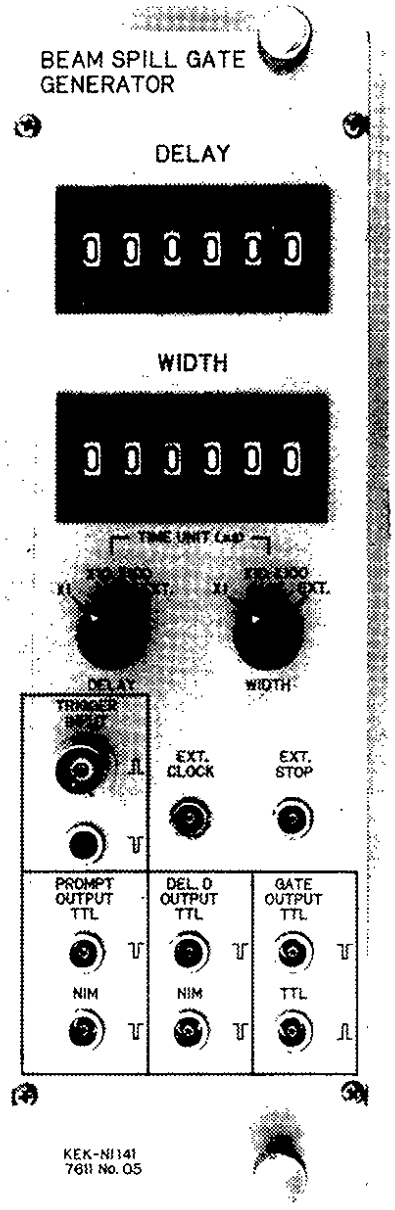
+6 V : 280 mA.

(7) DIMENSION: NIM standard single width module, 1.35" wide x 8.75" high in accordance with TID-20893 (Rev.3)
Lemo-type connectors.



SCALER GATE DRIVER
(N11-31 KEK TYPE-1)

N11-41 BEAM SPILL GATE GENERATOR (KEK TYPE-1)



KEK NIM STANDARD MODULE (N11-41)
BEAM SPILL GATE GENERATOR
KEK TYPE-1

KEK NIM STANDARD MODULE (N11-41)
BEAM SPILL GATE GENERATOR KEK TYPE-1

GENERAL DESCRIPTION

This module is designed to generate the gate pulse which is synchronized (within 100 nsec) with the accelerator timing signals. The input pulse from the accelerator has an amplitude of + 10 V and the duration of 2 μsec. The pulse is accepted through the optial isolater in order to reject the common mode noise. The timing signals from the accelerator are the injection start, the accelerator start, and the flat top start. These signals are available in the separate cable lines from the control room of the accelerator. The TTL pulse is also accepted at the other input connector as a trigger pulse.

The delay and width of the gate pulse are determined by the thumb wheel decade switch (6 digits) with a unit of 1 μsec, 10 μsec, and 100 μsec if the internal clock pulse is selected. The internal clock is provided from the free-running 10 MHZ quartz oscillator. It causes the time jitter of 0.1 μsec in the output gate pulse.

This module generates also timing pulses of prompt and delayed in both NIM and CAMAC level for an input trigger pulse.

SPECIFICATIONS

(1) DELAY / WIDTH

DELAY : 6 digits thumb wheel switch

The delay time of the gate pulse from the arrival of the trigger input is determined with this thumb wheel switch. The time range is from 1 to 10^6 times a time unit which is selected by the rotary switch. The time jitter is 0.1 μsec.

DELAY TIME UNIT : Rotary switch

1 μsec: Delay time range = 1 μsec to 1 sec.
10 μsec: Delay time range = 10 μsec to 10 sec.
100μsec: Delay time range = 100 μsec to 100 sec.
EXT. : The delay time unit is the period of the external clock pulse given from the EXT. CLOCK input.
Delay time range = 1 to (10^6-1) times clock period.

WIDTH : 6 digits thumb wheel switch

The width of the gate pulse is defined by this thumb wheel switch. The time width is set in the range of 1 to (10^6-1) times the unit which is selected by the rotary switch. The time jitter is less than 0.1 μsec.

WIDTH TIME UNIT : Rotary switch

1 μsec: Width range = 1 μsec to 1 sec.
10 μsec: Width range = 10 μsec to 10 sec.
100 μsec: Width range = 100 μsec to 100 sec.
EXT. : Width range = 1 to (10^6-1) times the external clock period.

(2) WIDTH LED: The LED is on in the duration of the gate output.

(3) TRIGGER INPUT

BNC Input:	Input impedance	50 Ω
	Voltage	Positive going pulse greater than 5 V.
	Coupling	Optically isolated.
LEMO Input:	Voltage	TTL negative going pulse with a pull up resistor 1kΩ
	Duration	> 100 nsec.
	Coupling	Direct coupling.

(4) EXT. CLOCK INPUT :

Voltage	TTL logic level with a pull up resistor 1 kΩ .
Max. freq.	2 MHZ.

(5) EXT. STOP INPUT

Voltage	TTL negative going pulse with a pull up resistor 1kΩ .
Duration	> 100 nsec.

The duration of the output gate pulse can be paused by the EXT. STOP input pulse.

(6) PROMPT OUTPUT

TTL Output:	Voltage	TTL negative logic pulse. Open collector output pulled up with 1 KΩ.
	Duration	400 nsec.
	Rise time	8 nsec.
	Fall time	70 nsec.
	High level drive capability	2.5 mA at 2.5 V.
	Low level clamp capability	35 mA at 0±0.5V.
NIM Output:	Output impedance	50 Ω
	Voltage	NIM negative logic pulse.
	Duration	400 nsec.
	Rise/Fall times	4 nsec / 6 nsec.

The prompt signals are generated after a propagation time of 35 nsec.

(7) DELAYED OUTPUT

TTL Output:	Voltage	TTL negative logic pulse. Open collector output pulled up with 1 kΩ .
	Duration	400 nsec.
	Rise /Fall time	8 nsec / 70 nsec
	High level drive capability	2.5 mA at 2.5 V.
	Low level clamp capability	35 mA at 0± 0.5V.
NIM Output:	Voltage	NIM negative logic pulse.
	Duration	400 nsec.
	Rise/Fall times	4 nsec / 6 nsec.

The delayed output signals are generated after a time set in the DELAY thumb wheel switch. The time jitter is 0.1 μsec if the internal clock is used.

(8) GATE OUTPUT

TTL Output:	Voltage	TTL negative logic level. Open collector output pulled up with 1 kΩ .
	Width	determined by the thumb wheel switch.
	Rise time	8 nsec.
	Fall time	70 nsec.
	High level drive capability	2.5 mA at 2.5 V.
	Low level clamp capability	35 mA at 0± 0.5 V.
NIM Output:	Voltage	NIM logic level current source - 16 mA.
	Width	determined by the thumb wheel switch.
	Rise time	4 nsec.
	Fall time	6 nsec.

If the internal clock is used, the uncertainty of the width is 0.1 μsec.

The width of the gate output pulse is defined by the thumb wheel switch. The duration can be paused by the EXT. STOP.

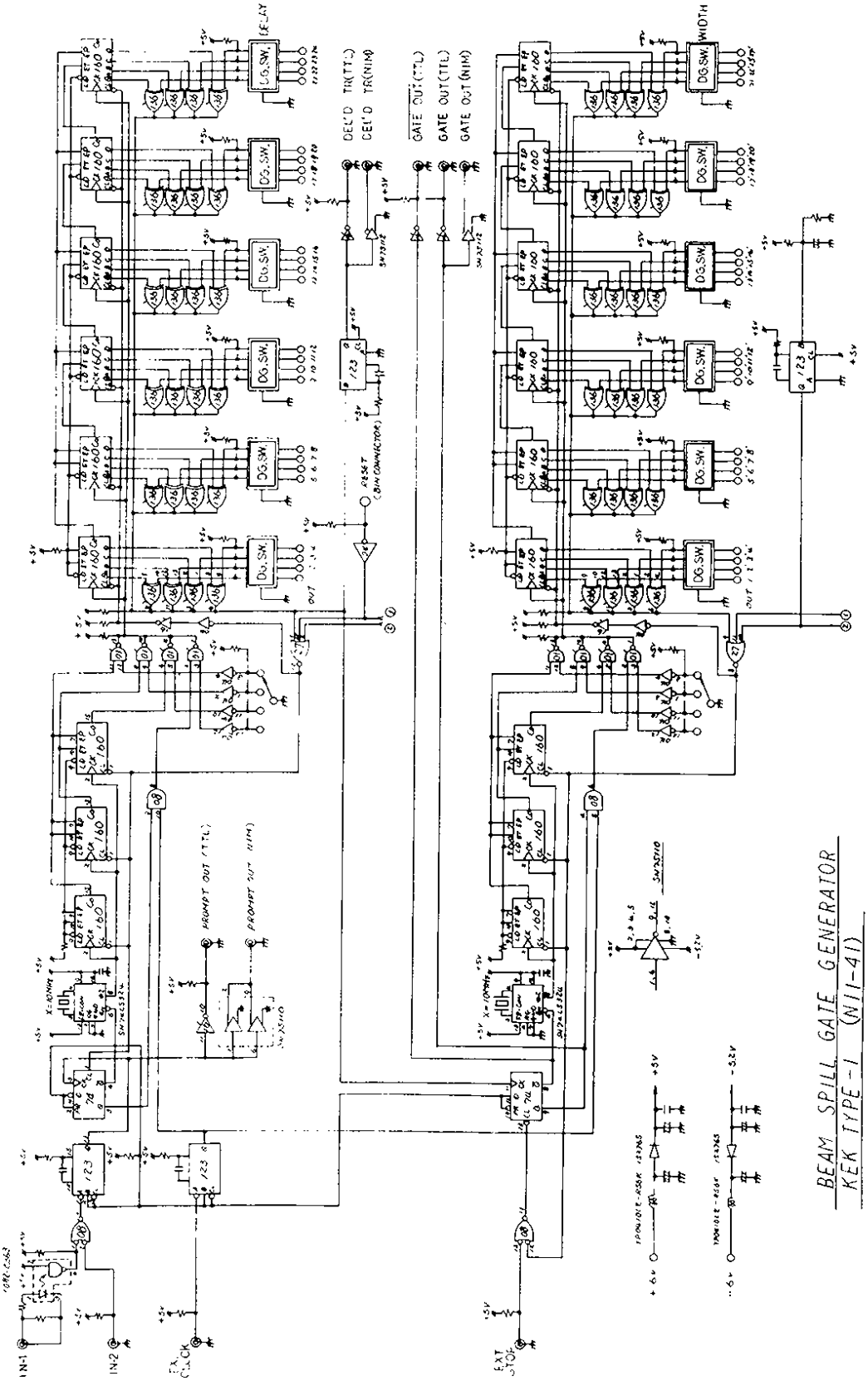
(9) POWER REQUIREMENT

+ 6 V : 900 mA.

- 6 V : 65 mA.

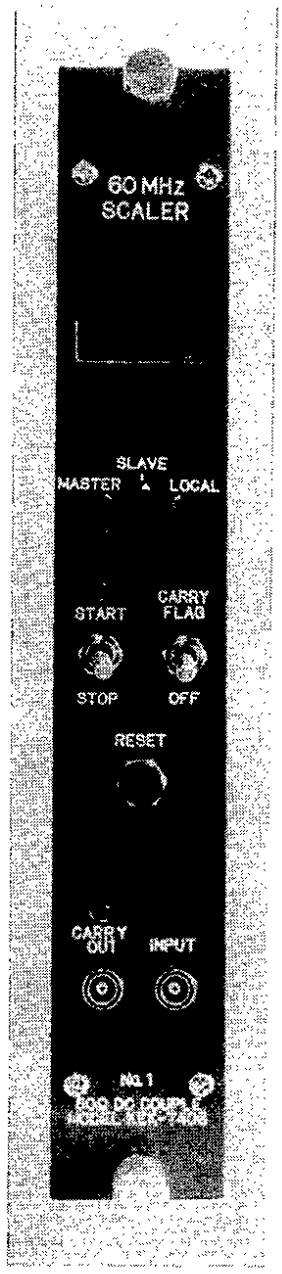
(10) DIMENSION

NIM double width module, 2.70" wide x 8.75" high in accordance with TID-20893(Rev.3).



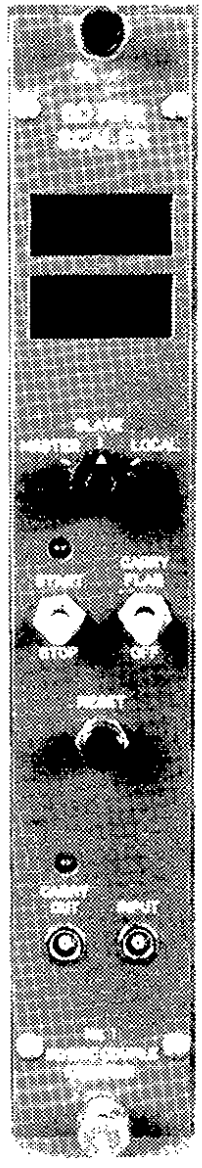
BEAM SPILL GATE GENERATOR
KEK TYPE-1 (N11-41)

N12-21 60MHZ VISUAL SCALER (6-DIGIT)
(KEK TYPE-1)



KEK NIM STANDARD MODULE (N12-21)
60MHz SCALER KEK TYPE-1

N12-22 80MHZ VISUAL SCALER (6-DIGIT)
(KEK TYPE-2)



KEK NIM STANDARD MODULE (N12-22)
80MHz SCALER KEK TYPE-2

KEK NIM STANDARD MODULE (N12-21)(N12-22)* N12-21-01
60 MHz (80 MHz)* VISUAL SCALER KEK TYPE-1 (TYPE-2)*

SPECIFICATIONS

(1) COUNT CAPACITY: Six decades, from 0 to 999,999.

(2) COUNTING RATE: From DC to 6 x 10^7 (8 x 10^7)* counts/sec, max. repetition rate 60 MHz (80 MHz)*.

(3) PULSE PAIR RESOLUTION: 16.7 (12.5)* nsec.

(4) INPUT

Impedance: 50 ohms (direct-coupled).

Voltage: NIM standard negative fast logic signal, threshold level -400 mV.

Width: Min. pulse width for normal counting is < 3 ns for -600 mV input.

Reflections: $< \pm 5\%$.

(5) CARRY OUTPUT

Voltage: NIM standard fast logic signal
Quiescently 0 mA, -16 mA (-800 mV into 50 ohms load) during output.

Width: 100 ns fixed.

Output Condition: Carry signal is generated whenever the counter overflows from 999,999 to 000,000.

(6) INDICATORS

Data Display: Six decades, direct reading 7 - segment LED display.

Carry Output: LED is illuminated from a first overflow until reset.

Start: LED is illuminated while the start-stop gate in the "ON" condition.

(7) FRONT PANEL CONTROLS

Master/Slave/Local: 3 - position rotary switch selects the operation mode. Master allows control over all slaves within the data acquisition system through the start-stop gate and the reset lines. Slave subordinates this unit to some other module in the system loop that is operating as a Master.
Local set isolates the start-stop gate and the reset lines from the system lines.

Start/Stop: Toggle switch selects manually counting or non-counting condition.

Carry Flag: Toggle switch selects whether the carry flag and the carry signal will or will not be sent to the rear connector.

Reset: Push-button switch resets displays and the internal logic to the initial condition when pressed in the start-stop gate "OFF" condition.

(8) CONTROL SIGNALS

Connected through the 42-pin AMP type 202515-2 connector is amounted on the rear panel.

Data: BCD (1-2-4-8) code outputs.
Data are presented by the read-out gate and clock signals.
Output is TTL negative logic, open collector.
Nominally 0 V (logic "1") for "true", +5 V (logic "0") for "false".

Inhibit: Control gate to inhibit counting.
Input is two TTL loads.
Nominally 0 V (logic "1") for inhibiting, +2.4 V (logic "0") for counting.

Carry Signal: Overflow signal from the last decade counter.
Output is negative TTL logic, open collector.
Nominally 0 V (logic "1") for 100 ns width carry signal, +5 V (logic "0") for nothing.

Carry Flag: Carry flag is generated with the overflow signal.
Output is negative TTL logic, open collector.
Nominally 0 V (logic "1") for "ON" flag, +5 V (logic "0") for non-flag.

Start-Stop Gate: Control gate to permit or inhibit counting.
Nominally 0 V (logic "1") for counting,
+2.4 V (logic "0") for non-counting.

Read-out Clock: Timing signal for readout.
Input is amount of two TTL loads.
Data are present at the negative-going edge from +2.4 V to 0 V of the readout clock signal.

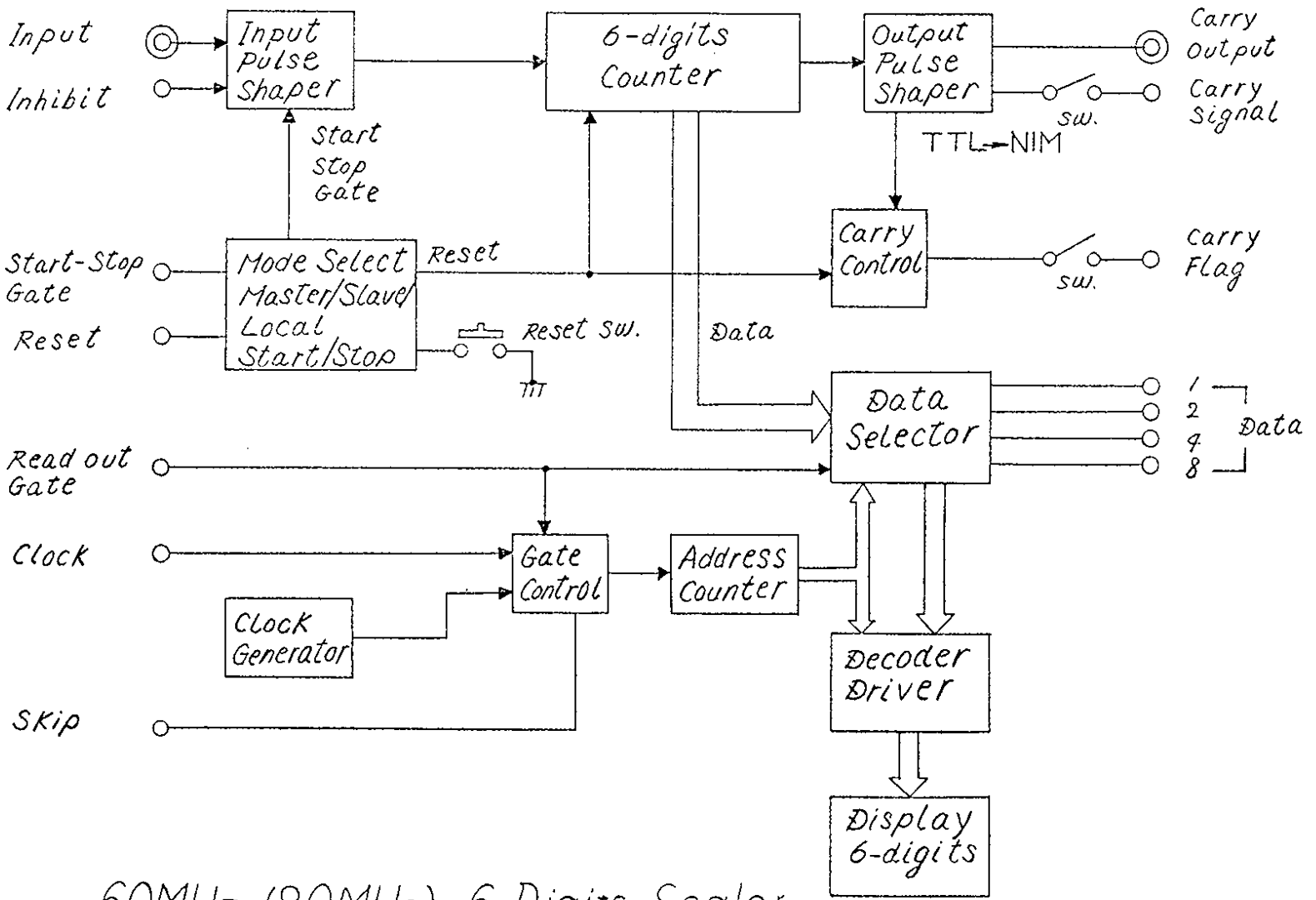
Read-out Gate: Command signal for the skip of non-readout modules.
Skip signal is generated when the unit is appointed by the readout gate.
Nominally 0 V (logic "1") for the readout gate "true", +5 V (logic "0") for "false".

Reset: Command signal to reset the module to the initial condition. Nominally +2.4 V (logic "0") for non-reset, 0V (logic "1") for reset.

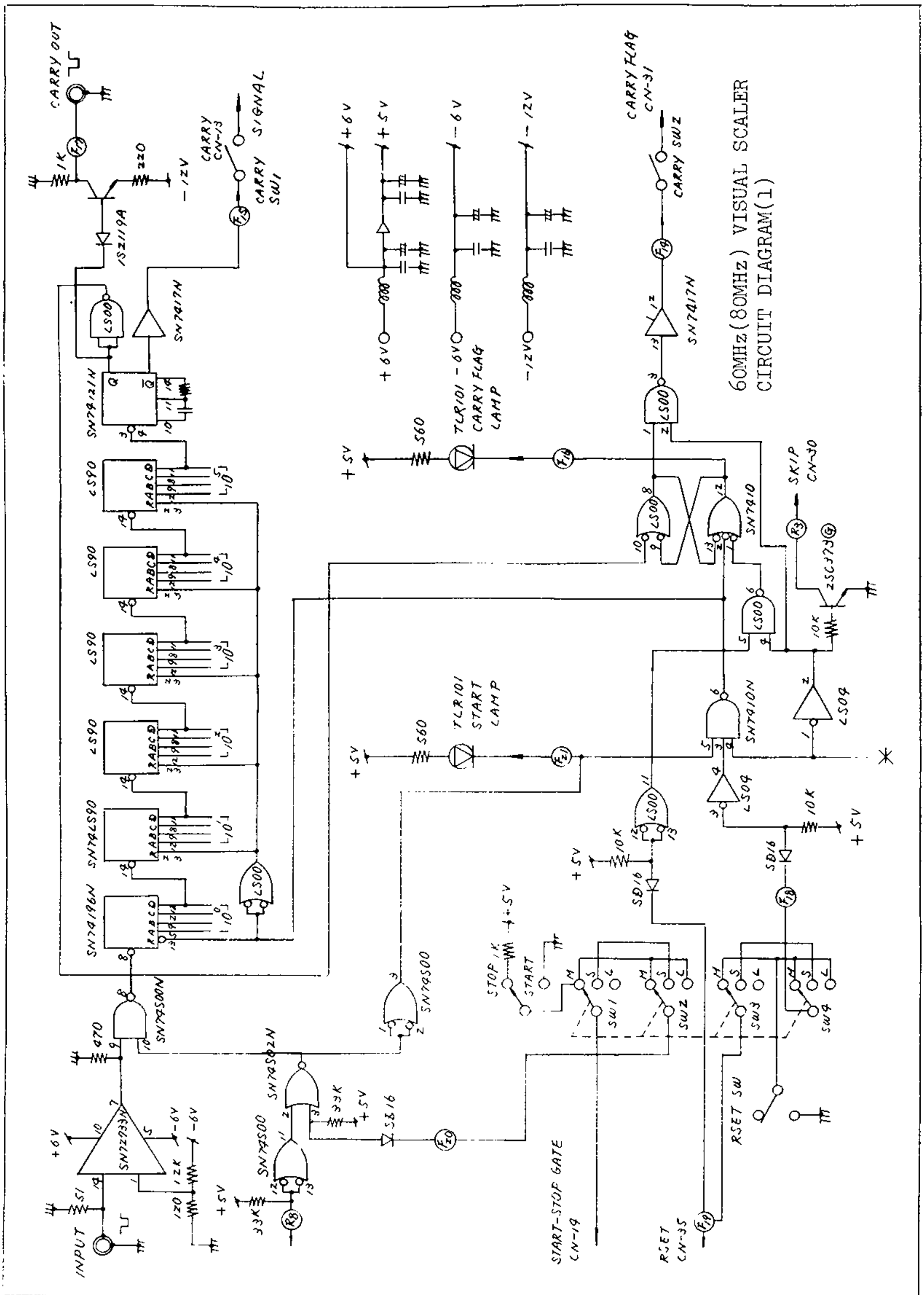
(9) POWER REQUIREMENTS

+6 Volts: 550 mA
-6 Volts: 20 mA
-12 Volts: 8 mA

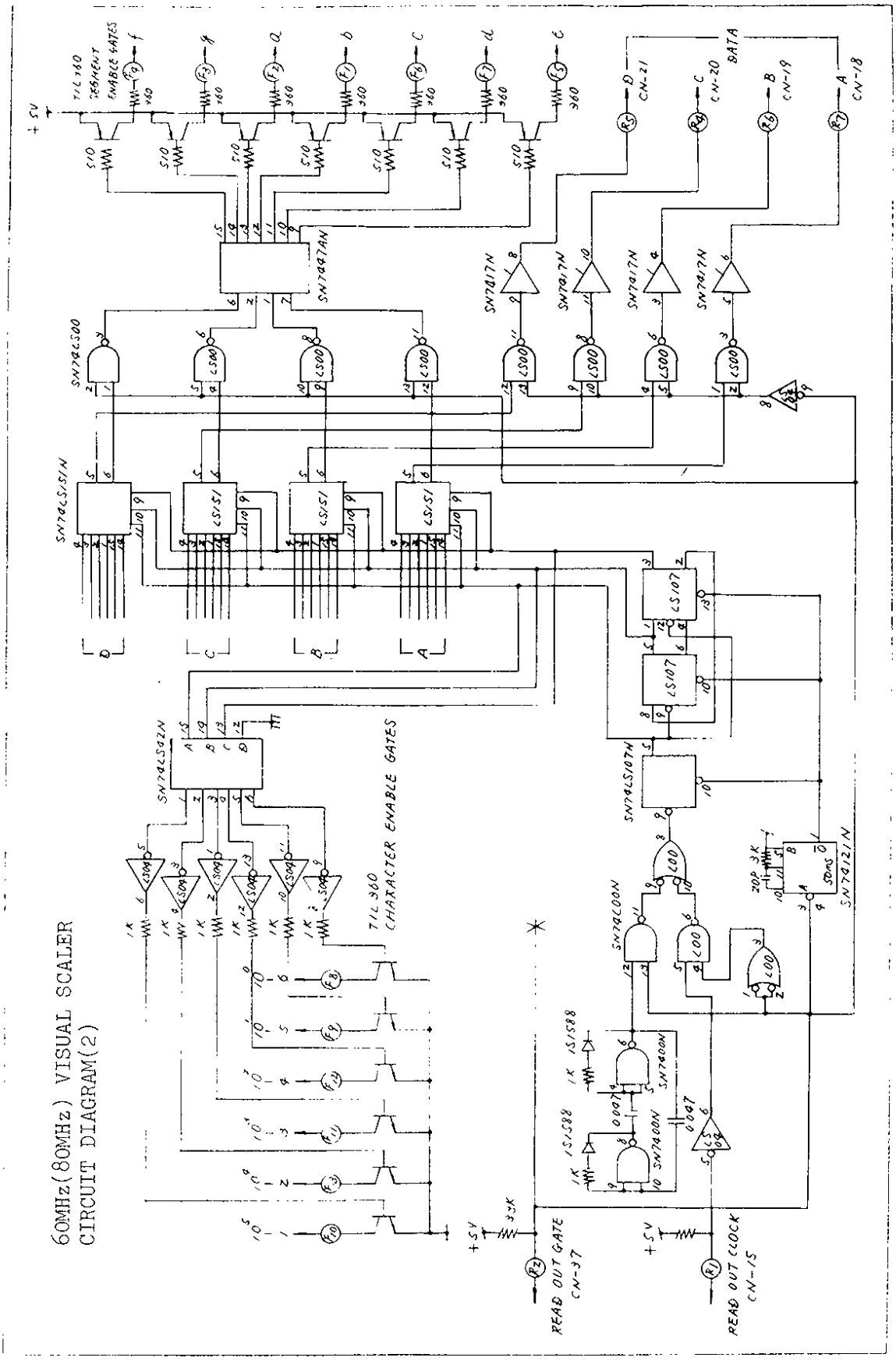
(10) DIMENSION: NIM standard single width module,
1.35" wide x 8.75" high in accordance with TID-20893 (Rev. 3).
Lemo-type connectors.



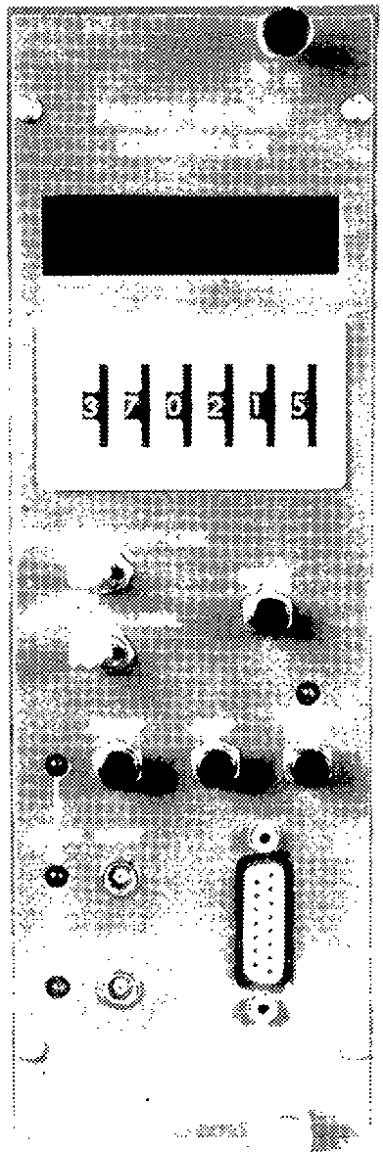
60MHz (80MHz) 6-Digits Scaler



60MHz(80MHz) VISUAL SCALER CIRCUIT DIAGRAM(1)


60MHz(80MHz) VISUAL SCALER
CIRCUIT DIAGRAM(2)
7/L 360 SEGMENT ENABLE GATES
7/L 360 CHARACTER ENABLE GATES
DATA
READ OUT GATE
READ OUT CLOCK

N12-31 PRESET SCALER CONTROLLER (6-DIGIT)
(KEK TYPE-1)



KEK NIM STANDARD MODULE (N12-31)
PRESET SCALER CONTROLLER KEK TYPE-1

KEK NIM STANDARD MODULE (N12-31) N12-31-01
PRESET SCALER CONTROLLER KEK TYPE-1

SPECIFICATIONS

(1) COUNT CAPACITY: Six decades, from 0 to 999,999.

(2) COUNTING RATE: From DC to 3.6×10^6 counts/sec,
max. repetition rate 3.6 MHz.

(3) PULSE PAIR RESOLUTION: 277.8 nsec.

(4) INPUT

Impedance: 50 ohms (direct-coupled).

Voltage: NIM standard negative fast logic signal,
threshold level -400 mV.

Width: Min. pulse width for normal counting is < 8 ns for -600 mV input.

Reflections: < ± 5%.

(5) S.S. GATE OUTPUT (START-STOP GATE OUTPUT)

Control gate to permit or inhibit counting.

Voltage: TTL standard negative logic level.
Logic "1" < +0.4 V permits and logic "0" > +2.5 V inhibits counting.

Low Level Clamp Capability: 48 mA at 0 ± 500 mV.
Open collector output.

Output Condition: Counting condition for the Scaler (logic "1" level) is generated when a first input signal is accepted.
This gate is returned to an initial condition when the contents of the counter have agreed with the indications of the digital switches.

(6) INDICATORS

Data Display: Six decades, direct reading 7 - segment LED display.

Start: LED is illuminated when the Start Switch is pushed.

Ready: LED is illuminated when the unit is in the counting condition.

S.S. Gate: LED is illuminated while the start-stop gate in the "ON" condition.

Forced Stop: LED is illuminated when the forced stop switch is pushed.

(7) FRONT PANEL CONTROLS

On-line/Off-line: 2 - position toggle switch selects the control mode. In the on-line mode, the unit is controlled with external signals through the front panel connector. In the off-line mode, the unit is isolated from external signals, and the Scaler System is controlled with this unit only.

Master/Slave: 2 - position toggle switch selects the operation mode. Master mode permits to control all slave scalers in the data acquisition system through the start-stop gate and the reset lines. In the slave mode, the unit is slaved by another module in the system loop that is operating as a Master.

Start: Preset Scaler Controller and other slave scalers are set to counting condition when a first input signal is accepted, after this push-button was pressed.

Stop: Preset Scaler Controller and other slave scalers are set to non-counting condition when a next input signal is accepted, after this push-button was pressed.

Forced Stop: Scalers stop immediately counting when this push-button is pressed.

Reset: Push switch resets displays and internal logic to an initial condition of the scalers in the start-stop gate "OFF" condition.

Count Preset: 6 - digital switches select any count level within the capacity of the unit.

Control Connecter: Front panel Cannon type DA-15S-ZN (15-pin) connector includes ten control signal lines. The unit is controlled with the external controller through the adapter.

(8) CONTROL SIGNALS

Connected through 42-pin AMP type 202515-2 connector is amounted on the rear panel.

Data: BCD (1-2-4-8) code outputs.
Data are presented by the read-out gate and clock signals.
Output is TTL negative logic, open collector.
Nominally 0 V (logic "1") for "true", +5 V (logic "0") for "false".

Start-Stop Gate: Control gate to permit or inhibit counting.
Nominally 0 V (logic "1") for counting,
+2.4 V (logic "0") for non-counting.

Read-out Clock: Timing signal for readout.
Input is amount of two TTL loads.
Data are presented at the negative-going edge from +2.4 V to 0 V of the readout clock signal.

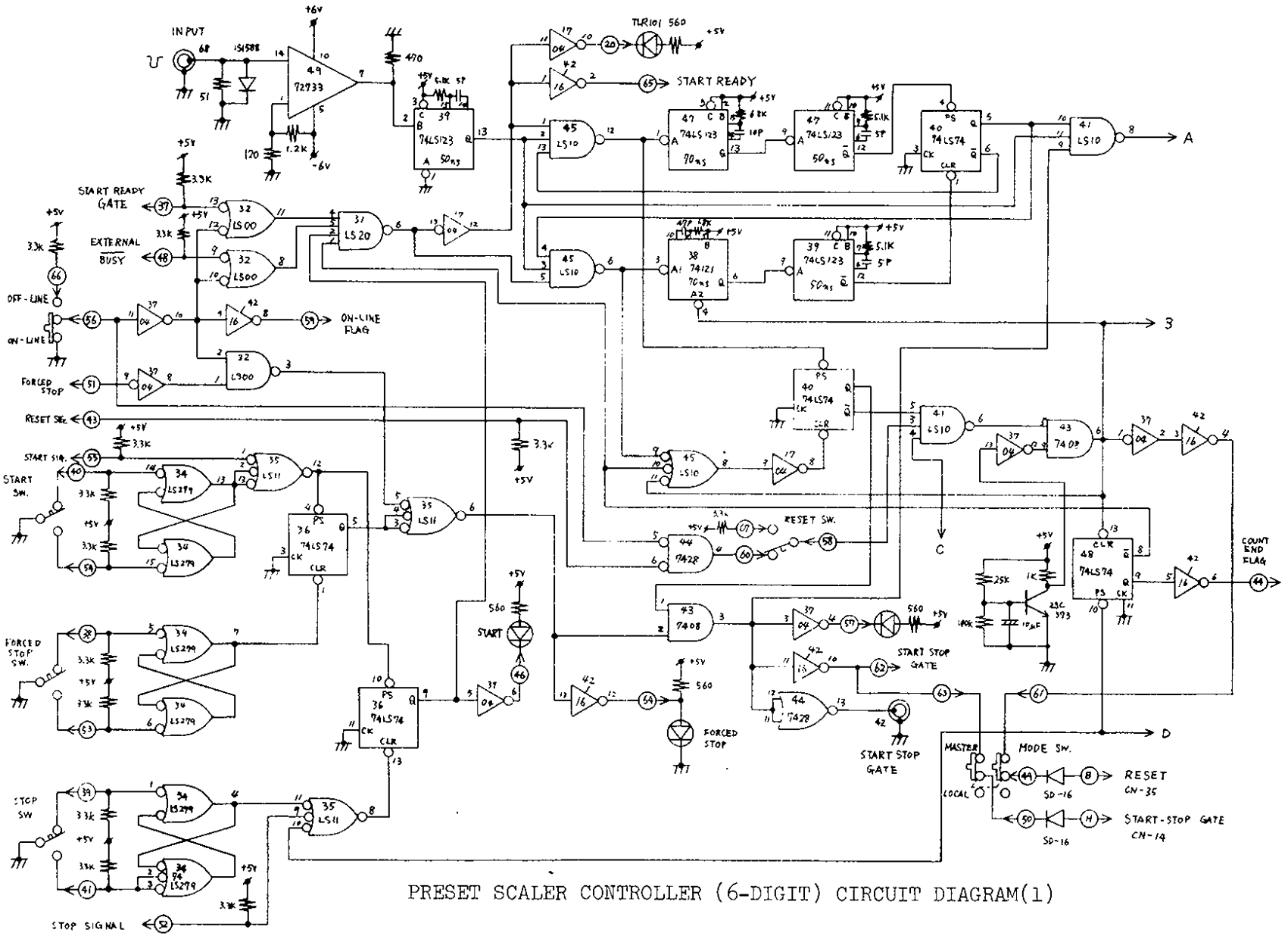
Read-out Gate: Control gate for readout.
Data are presented for the duration of the readout gate.
Input is amount of ten TTL loads.
Nominally 0 V (logic "1") for readout, +5 V (logic "0") for non-readout.

Reset: Command signal to reset scalers and internal logic to the initial condition.
Nominally +2.4 V (logic "0") for non-reseting, 0 V (logic "1") for reseting.

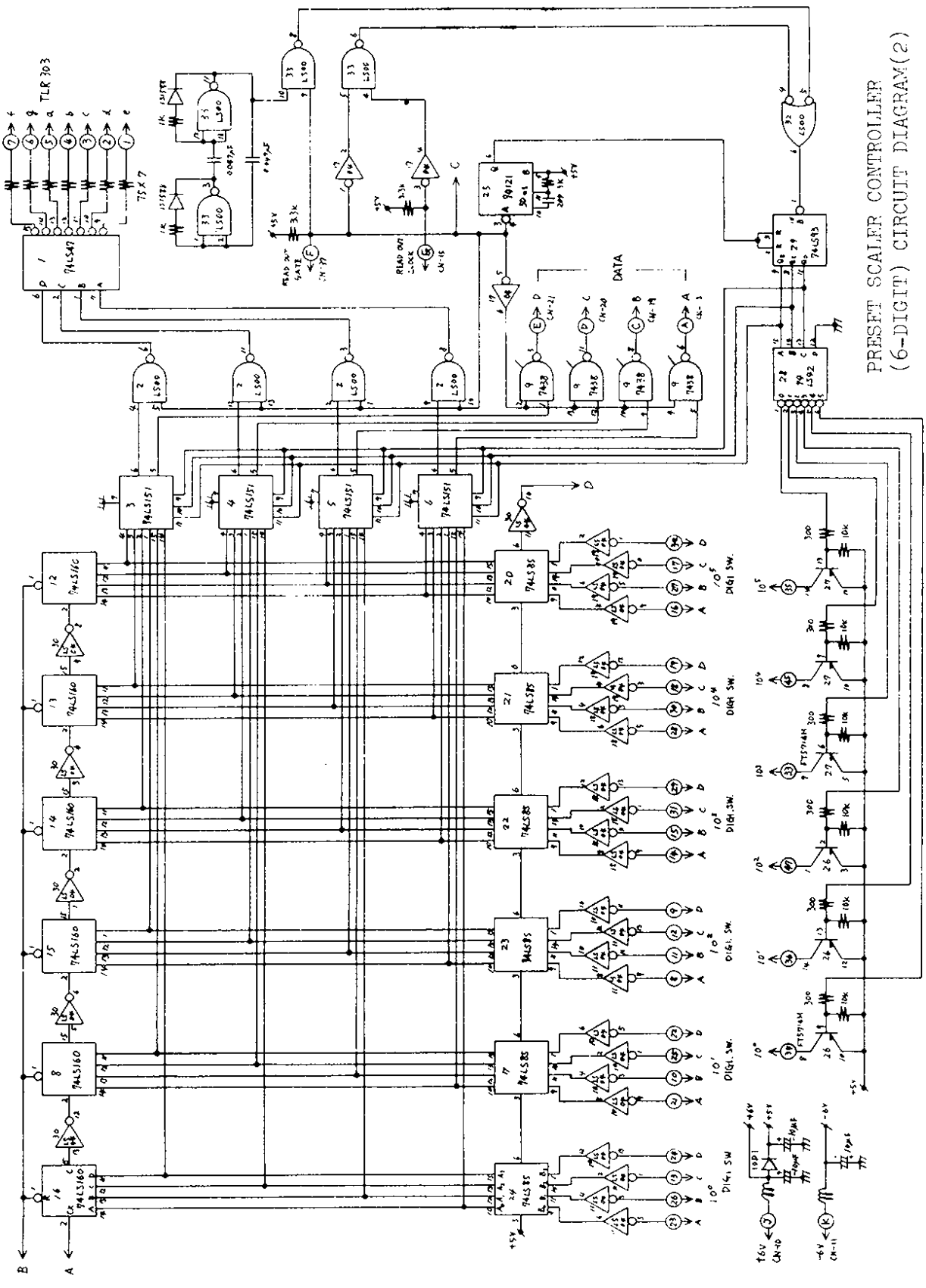
(9) POWER REQUIREMENTS

+6 V : 700 mA
-6 V : 20 mA

(10) DIMENSION: NIM standard double width module,
2.70" wide x 8.75" high in accordance with TID-20893 (Rev.3).
Lemo-type connectors.



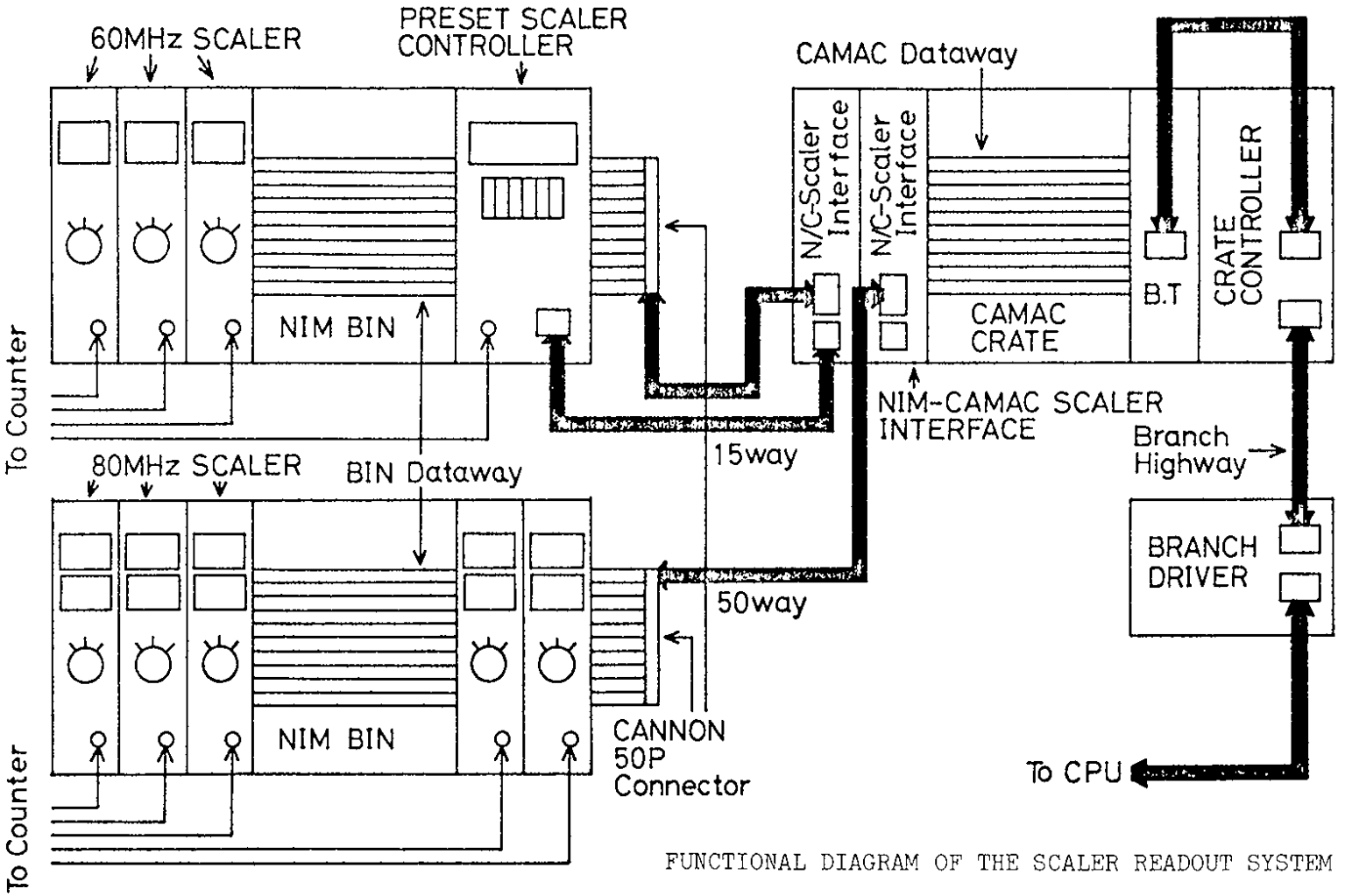
PRESET SCALER CONTROLLER (6-DIGIT) CIRCUIT DIAGRAM(1)


PRESET SCALER CONTROLLER
(6-DIGIT) CIRCUIT DIAGRAM(2)
DATA
DIGI. SW.

PIN	FUNCTION
1	START READY GATE
2	EXTERNAL BUSY
3	RESET SIGNAL
4	RESET SIGNAL PAIR RETURN
5	FORCED STOP SIGNAL
6	FORCED STOP SIGNAL PAIR RETURN
7	START READY
8	START READY PAIR RETURN
9	PRESET COUNT END FLAG
10	ON-LINE FLAG
11	START STOP GATE
12	START STOP GATE PAIR RETURN
13	START SIGNAL
14	STOP SIGNAL
15	POWER RETURN GND

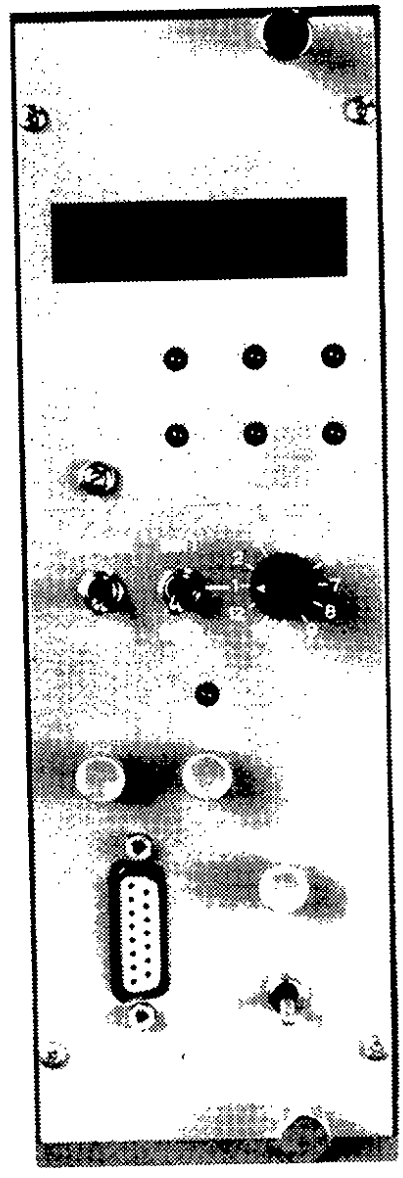
USED CONNECTOR DA-15S-ZN

PRESET SCALER CONTROLLER
EXTERNAL CONTROL CONNECTOR
PIN ASSIGNMENTS



FUNCTIONAL DIAGRAM OF THE SCALER READOUT SYSTEM

N12-41 SCALER AUTOMATIC TESTER (KEK TYPE-1)



KEK NIM STANDARD MODULE (N12-41)
SCALER AUTOMATIC TESTER KEK TYPE-1

KEK NIM STANDARD MODULE (N12-41) N12-41-01
SCALER AUTOMATIC TESTER KEK TYPE-1

The KEK Automatic Scaler Tester has been developed in order to test simultaneously the twenty-two KEK Scalers and the Preset Scaler Controller.

SPECIFICATIONS

(1) INDICATORS

Data Display: 7 - segment LED display indicates six decades data from the Scalers and the Preset Scaler Controller.

Start Ready: LED is illuminated while the start ready gate in the "ON" condition.

On-Line: LED is illuminated while the Preset Scaler Controller is in the on-line mode.

Preset Count End: LED is illuminated when the count end signal from the Preset Scaler Controller is accepted.

S. S. Gate Start: LED is illuminated while the start-stop gate is in the "ON" condition.

Carry Signal: LED is illuminated when the carry signal from the Scaler is accepted.

Carry Flag: LED is illuminated when the carry flag signal from the Scaler is accepted.

Forced Stop: LED is illuminated when the forced stop switch is pushed.

(2) FRONT PANEL CONTROLS

Repeat/Single: 2 - position toggle switch selects the readout operation mode.
In the Repeat mode, the modules in the system are reset after readout, and recycled automatically.
In the Single mode, the modules in the system stop after readout and restarted by pushing the Reset and the Start switches.

Bin Address: 2 - position toggle and 12 - position rotary switches select the Bin number and the station number of the NIM standard Bin, respectively.

Start: Preset Scaler Controller is set in counting condition when this switch is pushed.

Forced Stop: Scaler and the Preset Scaler Controller are immediately set in non-counting condition when this switch is pushed.

Reset: Push-button switch resets displays and internal logic of the scalers to an initial condition when pressed in the start-stop gate "OFF" condition.

Inhibit: 2 - position toggle switch selects whether the inhibit command will or will not be generated to the scalers.

Control Connector: Front panel Cannon type DA-15S-ZN (15-pin) connector is used to control the Preset Scaler Controller.

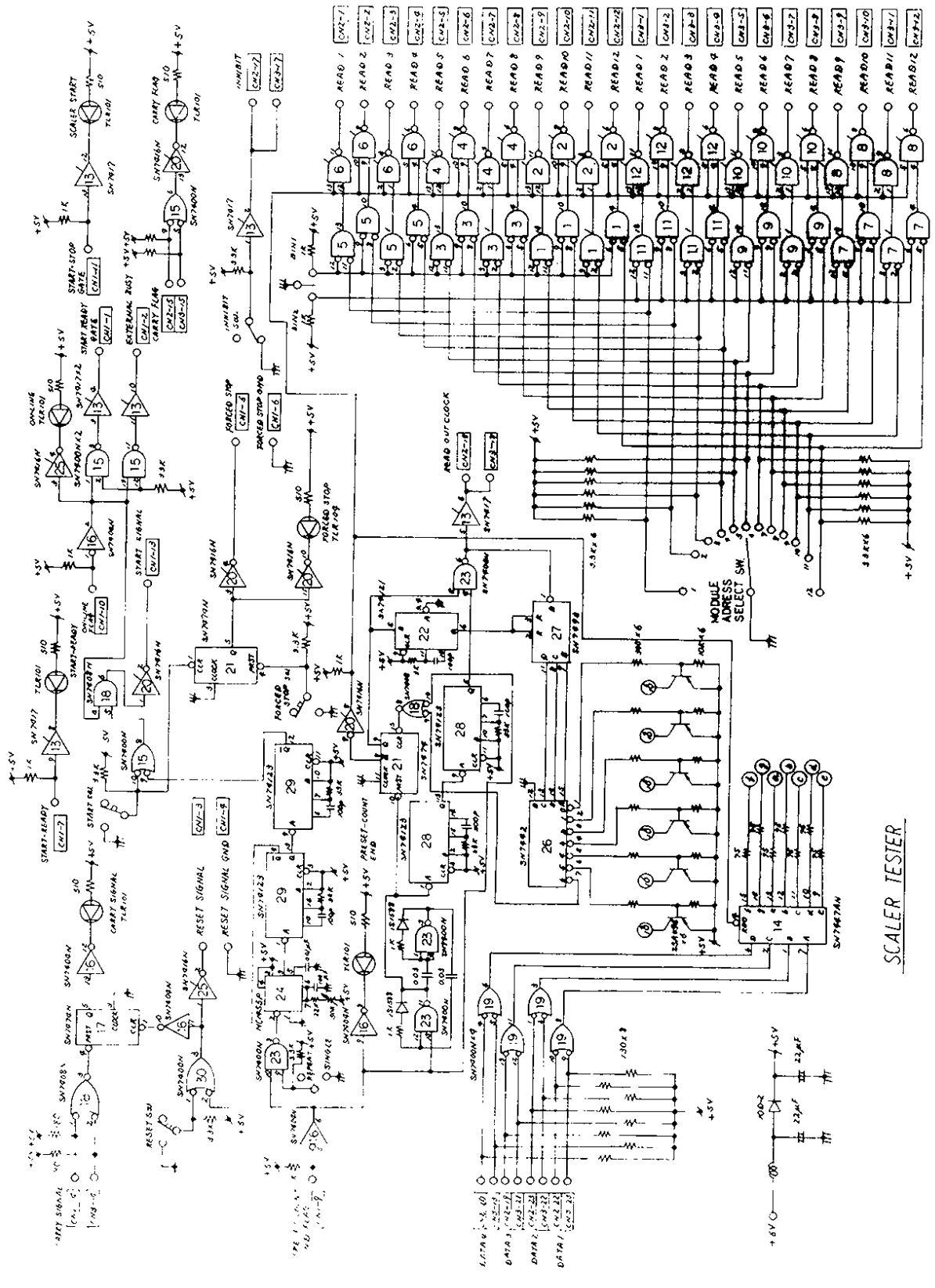
(3) REAR CONNECTORS

Bin 1 and Bin 2: Two Cannon type DC-50S-ZN (50-pin) connectors are mounted on the rear panel. Modules in the system are controlled through each connectors.

(4) POWER REQUIREMENTS

+6 V : 580 mA

(5) DIMENSION: Double width AEC-NIM module, 2.70" wide x 8.75" high in accordance with TID-20893 (Rev. 3).


SCALER TESTER
MODULE ADRESS SELECT SW.
START-READY
START SIGNAL
RESET SIGNAL
RESET SIGNAL GND
FORCED STOP
FORCED STOP GND
READ OUT CLOCK
INHIBIT
EXTERNAL BUSY
CARRY FLAG
START-STOP GATE
START READY GATE
SCALER START
PRESET-COUNT END
READ 1
READ 2
READ 3
READ 4
READ 5
READ 6
READ 7
READ 8
READ 9
READ 10
READ 11
READ 12
+5V
+6V

PIN	FUNCTION
1	START READY GATE
2	EXTERNAL BUSY
3	RESET SIGNAL
4	RESET SIGNAL PAIR RETURN
5	FORCED STOP SIGNAL
6	FORCED STOP SIGNAL PAIR RETURN
7	START READY
8	START READY PAIR RETURN
9	PRESET COUNT END FLAG
10	ON-LINE FLAG
11	START STOP GATE
12	START STOP GATE PAIR RETURN
13	START SIGNAL
14	STOP SIGNAL
15	POWER RETURN GND

USED CONNECTOR DA-15S-ZN

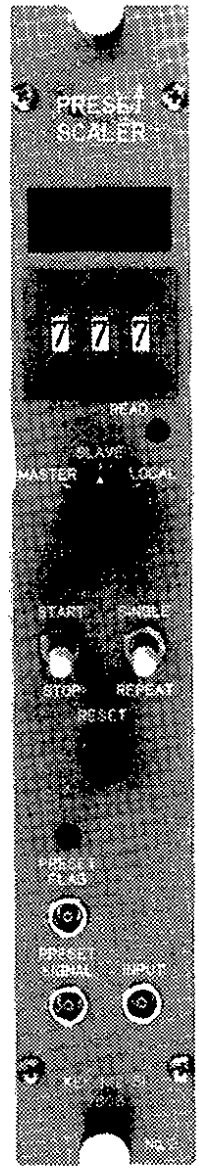
PRESET SCALER CONTROLLER
EXTERNAL CONTROL CONNECTOR
PIN ASSIGNMENTS

PIN	FUNCTION	PIN	FUNCTION
1	READ-OUT GATE 1	31	
2	PIN 1 PAIR RETURN	32	
3	READ-OUT GATE 2	33	PIN 17 PAIR RETURN
4	PIN 3 PAIR RETURN	34	PIN 18 PAIR RETURN
5	READ-OUT GATE 3	35	RESET
6	PIN 5 PAIR RETURN	36	PIN 35 PAIR RETURN
7	READ-OUT GATE 4	37	START STOP GATE
8	PIN 7 PAIR RETURN	38	PIN 37 PAIR RETURN
9	READ-OUT GATE 5	39	INHIBIT
10	PIN 9 PAIR RETURN	40	PIN 39 PAIR RETURN
11	READ-OUT GATE 6	41	BEAM GATE
12	PIN 11 PAIR RETURN	42	PIN 41 PAIR RETURN
13	READ-OUT GATE 7	43	DATA (1)
14	PIN 13 PAIR RETURN	44	PIN 43 PAIR RETURN
15	READ-OUT GATE 8	45	DATA (2)
16	PIN 15 PAIR RETURN	46	PIN 45 PAIR RETURN
17	READ-OUT GATE 9	47	DATA (4)
18	READ-OUT GATE 10	48	PIN 47 PAIR RETURN
19	READ-OUT GATE 11	49	DATA (8)
20	PIN 19 PAIR RETURN	50	PIN 49 PAIR RETURN
21	READ-OUT GATE 12		
22	PIN 21 PAIR RETURN		
23	CARRY SIGNAL		
24	PIN 23 PAIR RETURN		
25	CARRY FLAG		
26	PIN 25 PAIR RETURN		
27	READ-OUT CLOCK		
28	PIN 27 PAIR RETURN		
29	SKIP		
30	PIN 29 PAIR RETURN		

NIM BIN KEK TYPE-2
CONTROL (Dataway) CONNECTOR
PIN ASSIGNMENTS

USED CONNECTOR: DDC-50S-FO
(Cannon)

N12-51 PRESET SCALER (3-DIGIT) (KEK TYPE-1)



KEK NIM STANDARD MODULE (N12-51)
PRESET SCALER (3-DIGIT)
KEK TYPE-1

KEK NIM STANDARD MODULE (12-51) N12-51-01
PRESET SCALER (3-DIGIT) KEK TYPE-1

SPECIFICATIONS

(1) COUNT CAPACITY: 3 decades, for 0 through 999.

(2) COUNTING RATE: From DC to 1.4×10^7 counts/sec,
max. repetition rate 14 MHz.

(3) PULSE PAIR RESOLUTION: 71.4 nsec.

(4) INPUT

Impedance: 50 ohms (direct-coupled)

Voltage: NIM standard negative logic signal, threshold level -400 mV.

Width: Min. pulse width for normal counting is $<$ 4 ns for -600 mV input.

Reflections: $<$ ± 5%.

(5) PRESET SIGNAL OUTPUT

Voltage: NIM standard negative logic signal.
Quiescently 0 mA, -20 mA (-1000 mV into 50 ohms load) during output.

Width: 30 ns fixed.

Output Condition: Preset signal is generated when the contents of the counter have agreed with the indications of digital switches.

(6) PRESET FLAG OUTPUT

Voltage: NIM standard negative logic signal.
Quiescently 0 mA, -20 mA (-1000 mV into 50 ohms load) during "ON" flag.

Output Condition: Preset flag is generated when the contents of the counter have agreed with the indications of digital switches.

(7) INDICATORS

Data Display: Three decades direct reading 7 - segment LED display.

Gate Start: LED is illuminated while the unit is in the counting condition (the start-stop gate "ON").

Read: LED is illuminated while the unit is in the readout condition through the external controller.

Preset Flag: LED is illuminated from preset counting end until reset.

(8) FRONT PANEL CONTROLS

Master/Slave/Local: 3 - position rotary switch selects the operation mode.
Master allows control overall slaves within the data acquisition system through the start-stop gate and the reset lines.
Slave subordinates this unit to some other module in the system loop that is operating as a Master.
Local set isolates the start-stop gate and the reset lines from the system lines.

Start/Stop: Toggle switch selects manually counting or non-counting condition.

Single/Repeat: Toggle switch selects automatically counting repeat or counting end at one cycle.

Reset: Push switch resets the displays and internal logic to an initial condition when pressed in the start-stop gate "OFF" condition.

Count Preset: 3 - digital switches select any count level within the capacity of the unit.

(9) CONTROL SIGNALS

Connected through 42-pin AMP type 202515-5 connector is amounted on the rear panel.

Data: BCD (1-2-4-8) code outputs.
Data are presented by the readout gate and clock signals.
Output is TTL negative logic, open collector.
Nominally 0 V (logic "1") for "true", +5 V (logic "0") for "false".

Inhibit: Control gate to inhibit counting.
Nominally 0 V (logic "1") for inhibiting, +2.4 V (logic "0") for counting.

Start-Stop Gate: Control gate to permit or inhibit counting.
Nominally 0 V (logic "1") for counting, +2.4 V (logic "0") for non-counting.

Read-out Clock: Timing signal for readout.
Input is amount of two TTl loads.
Data are presented at the negative-going edge from +2.4 V to 0 V of the readout clock signal.

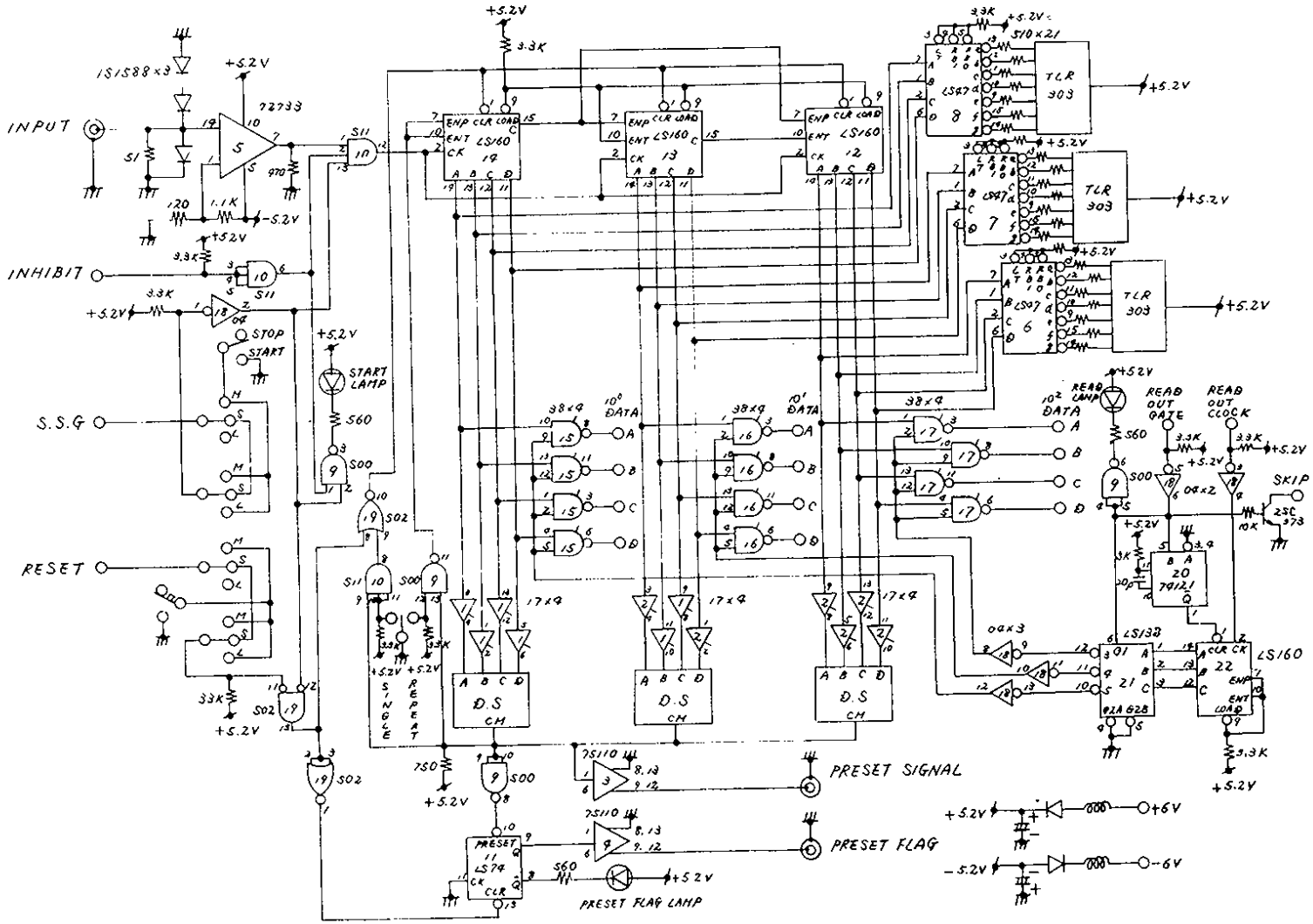
Read-out Gate: Command signal for the skip of non-readout modules. Skip signal is generated when the unit is appointed by the readout gate.
Nominally 0 V (logic "1") for the readout gate "true", +5 V (logic "0") for "false".

Reset: Command signal to reset the module to an initial condition. Nominally +2.4 V (logic "0") for non-reset, 0 V (logic "1") for reset.

(9) POWER REQUIREMENTS

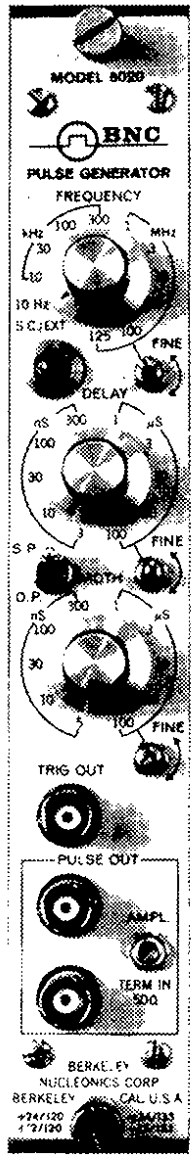
+6 V : 650 mA
-6 V : 80 mA

(10) DIMENSION: NIM standard single width module,
1.35" wide x 8.75" high in accordance with TID-20893 (Rev.3).
Lemo-type connectors.



PRESET SCALER N-12-51

N13-10 125MHZ PULSE GENERATOR (BNC 8020)



KEK NIM MODULE (N13-10)
PULSE GENERATOR (BNC-8020)

KEK NIM STANDARD MODULE (N13-10)
125 MHz PULSE GENERATOR (ENC 8020)

N13-10-01

SPECIFICATIONS

Repetition Rate: a) 0.5 Hz-10 Hz, continuously variable,
3 kHz-125 MHz continuously variable.
b) Ext Trigger, 0-125 MHz.
c) Single Cycle.

Delay: 0 to 100 μsec, continuously variable.

Width: 3 nsec to 100 μsec, continuously variable.

Jitter: Rep rate, delay or width less than 50 psec or 0.1%, whichever is greater.

Double Pulse: 6 nsec min. separation. Pulse spacing set by delay controls.

Resolution of Fine Controls: Less than 0.4%.

Temperature Coefficient of Frequency, Delay or Width: Less than 0.1%/°C.

Duty Factor: Greater than 50%.

Output Pulses: Two parallel output connectors providing greater than -32 mA. When terminated in 50 Ω , there are two -0.8 V pulses. (Standard NIM fast logic level.)

Rise Time: 1 nsec.

Fall Time: 1.3 nsec.

Amplitude Adjustment: 10:1 range (from -32 mA to -3.2 mA), continuously variable.

Output Pulse Aberrations: Baseline or pulse top, less than 5%.

Trigger Out: -0.8 V, 50 Ω , 1 nsec rise time. (Two outputs on front and rear panel.)

External Trigger: -0.6 V, 50 Ω . (Rear panel.)

Ext Gate: NIM logic. (-0.6 V to gate on, at rear panel.) synchronous. Rear panel slide switch provides gated or ungated operation.

Ambient Temperature: 55°C max.

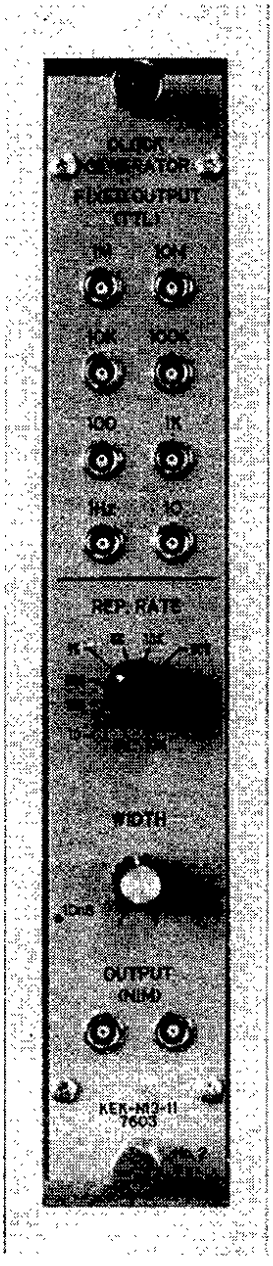
Protection: Open and short circuit proof.

Power Requirements: +24 V : 120 mA, +12 V : 120 mA, -24 V : 135 mA, -12 V : 135 mA.

Mechanical: Single width AEC module, 1.35" wide x 8.70" high in accordance with TID-20893 (Rev. 2).

Weight: 2½ lbs., net, 7 lbs. shipping.

N13-11 10MHZ PULSE GENERATOR (KEK TYPE-1)



KEK NIM STANDARD MODULE (N13-11)
10MHz PULSE GENERATOR KEK TYPE-1

KEK NIM STANDARD MODULE (N13-11)
10 MHz PULSE GENERATOR KEK TYPE-1 N13-11

SPECIFICATIONS

(1) TTL OUTPUT

Repetition Rate: 8, independent outputs, 10 MHz, 1 MHz, 100 KHz, 10 KHz, 1 KHz, 100 Hz, 10 Hz, 1 Hz.

Pulse Width: 20% of each repetition rate.

Output Pulse: Standard positive TTL logic level,
logic "1" $>$+2.4 Volts,
logic "0" $<$+0.4 Volts,
15 standard TTL loads.

Jitter: Less than 0.1%

(2) NIM OUTPUT

Repetition Rate: 1 Hz - 10 MHz, 12 step variable,
10 MHz, 1 MHz, 500 KHz, 100 KHz, 50 KHz,
10 KHz, 5 KHz, 1 KHz, 500 Hz, 100 Hz,
10 Hz, 1 Hz.

Pulse Width: 5~130 ns, continuously variable.

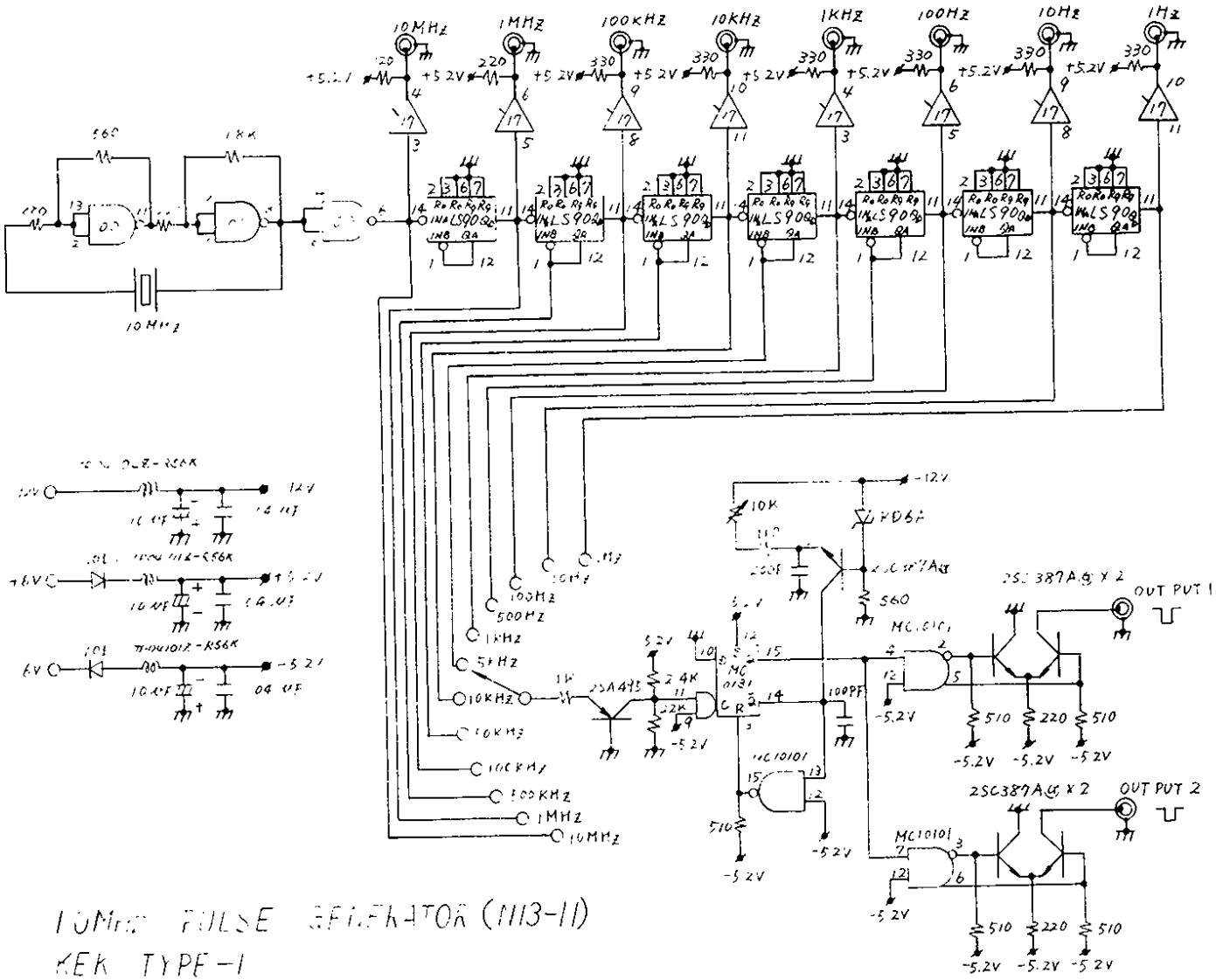
Output Pulse: Two independent outputs.
When terminated in 50 ohms, there are -800 mV pulses. (Standard NIM fast logic level.)

Rise and Fall Time: Rise time $<$1 ns.
Fall time $<$800 ps.

(3) POWER REQUIRED

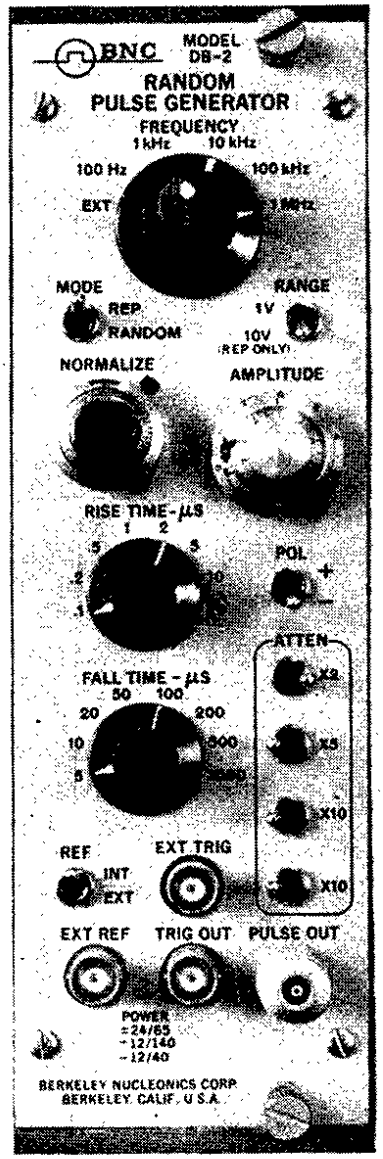
+6 Volts: 255 mA.
-6 Volts: 137 mA.
-12 Volts: 21 mA.

(4) DIMENSION: Single width AEC-NIM module,
1.35" wide x 8.75" high in accordance with TID-20893 (Rev. 2).



10MHz PULSE GENERATOR (NI13-II)
KEK TYPE-I

N13-20 RANDOM PULSE GENERATOR (BNC DB-2)



KEK NIM MODULE (N13-20)
RANDOM PULSE GENERATOR (BNC-DB-2)

KEK NIM STANDARD MODULE (N13-20) N13-20-01
RANDOM PULSE GENERATOR (BNC DB-2)

SPECIFICATIONS

Count Rate: 10Hz to 1 MHz, continuously adjustable.

Mode: Random or Repetitive.

Random Distribution: Poisson for intervals greater than 1.4 μs.

Pulse Shape: Tail pulse with independently adjustable rise and fall times.

Pulse Amplitude (Step)
Characteristics: a) Amplitude Shift with Count Rate; Less than ±0.05% from 10 Hz to 100 kHz.

b) Jitter (Resolution): 0.01% RMS.

c) Temperature Coefficient: ±0.02%/°C.

Frequency Jitter (Repetitive Mode): Less than 0.1%.

External Trigger: Requires 1 V positive pulse.
Input impedance 1 K.

Trigger Out: Positive 3 V pulse, 20 ns rise time, 100 ns width, 50 Ω output impedance.

Rise Time of Output: 0.1 - 20 μs, in 8 steps.
(10 - 90%)

Decay Time Constant: 5 - 1000 μs, in 8 steps.
(100 - 37%) Rise and Decay time independent of each other for Decay Time/Rise Time >10.

Output Amplitude Ranges: Repetitive only, ±10V maximum.
Repetitive or Random, ±1 V maximum.
Adjustable by ten-turn potentiometer from zero to maximum. AC coupled.

Normalize: Ten-turn control varies amplitude by 60%.

Output Impedance: 50 Ω .

Attenuation: 4 step attenuators of X2, X5, X10 and X10 for a maximum of X1000.

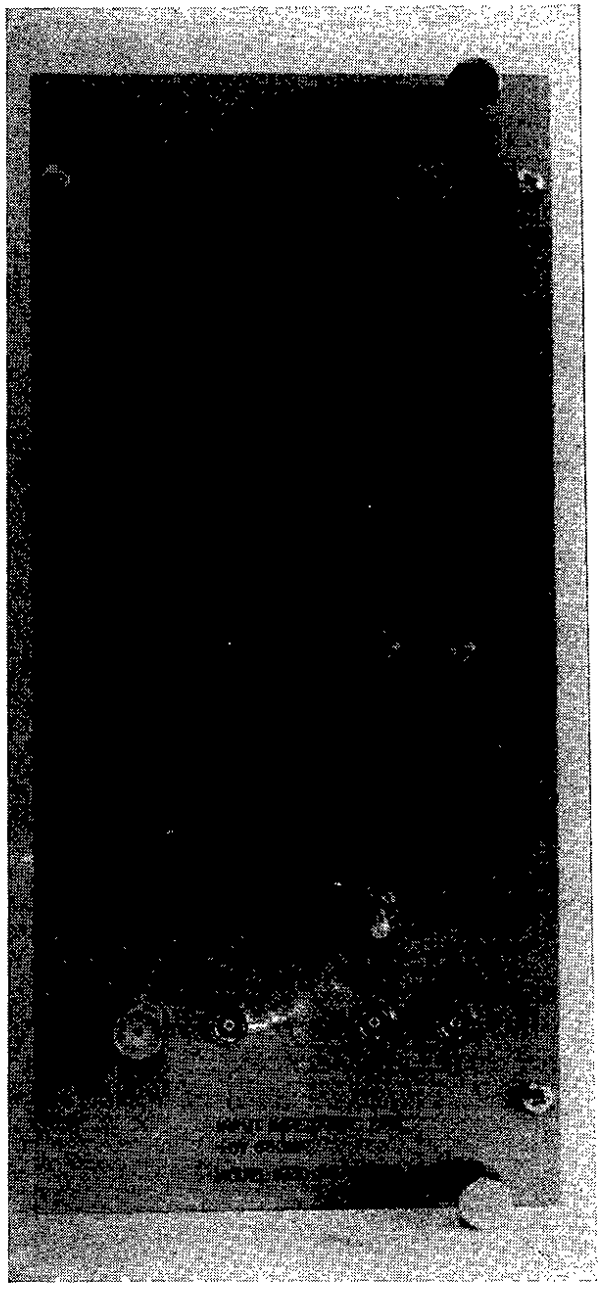
External Reference Input: +10 V maximum; 10 K input impedance.

Power Requirements: ±24V at 65 mA, +12 V at 140 mA,
-12V at 40 mA.

Mechanical: Double width NIM module, 2.70" wide by 8.70" high in accordance with TID-20893 (Rev. 3).

Weight: 3-1/2 lbs. net; 7 lbs. shipping.

N14-11 DIGITAL VOLTMETER (3.5-DIGIT)
(KEK TYPE-1)



KEK NIM STANDARD MODULE (N14-11)
DIGITAL VOLTMETER (3.5-DIGIT) KEK TYPE-1

KEK NIM STANDARD MODULE (N14-11)
DIGITAL VOLTMETER MODULE (3.5-DIGIT) KEK TYPE-1

SPECIFICATIONS

(1) DISPLAY OUTPUT

Display consists of four LED's (7 segment) for data digits, overrenge and polarity indications.
Overload : Three data digits display zero and flashes.
Decimal Points : Selectable at input voltage switch.
Leading "0" Display Blanking : controlled externally.

(2) INPUT

Full Scale Range : 0 to ±199.9 mV (at 200 mV range)
0 to ±1.999 V (at 2 V range)
0 to ±19.99 V (at 20 V range)
0 to ±199.9 V (at 200 V range)
Automatic Zero
Automatic Polarity
Bias Current : 3 nA
DC Impedance : 10 MΩ
External Trigger : A negative trigger pulse of 1.0 μs minimum applied to the "TRIGGER INPUT" will initiate conversion in the same manner as the internal mode. The external trigger should not be repeated, however, until the "status" indicates completion of the conversion in process.

(3) ACCURACY

Maximum Error : 0.05% of reading ±1 digit.
Resolution : 0.1 mV (at 200 mV range).
Temperature Range : 0 to 60°C operating.
Temperature Coefficient : 50 ppm/°C.

(4) SPEED

External Trigger : up to 24 conversions per second.
Internal Trigger : 4 conversions per second.

(5) CONVERSION TIME

Normal Conversion : 42 ms max.
Overload Conversion : 62 ms max.

(6) OUTPUTS

Logic Level : TTL compatible.

	input	output
logic "0"	< 0.8 V	< 0.4 V
logic "1"	> 2.0 V	> 2.4 V

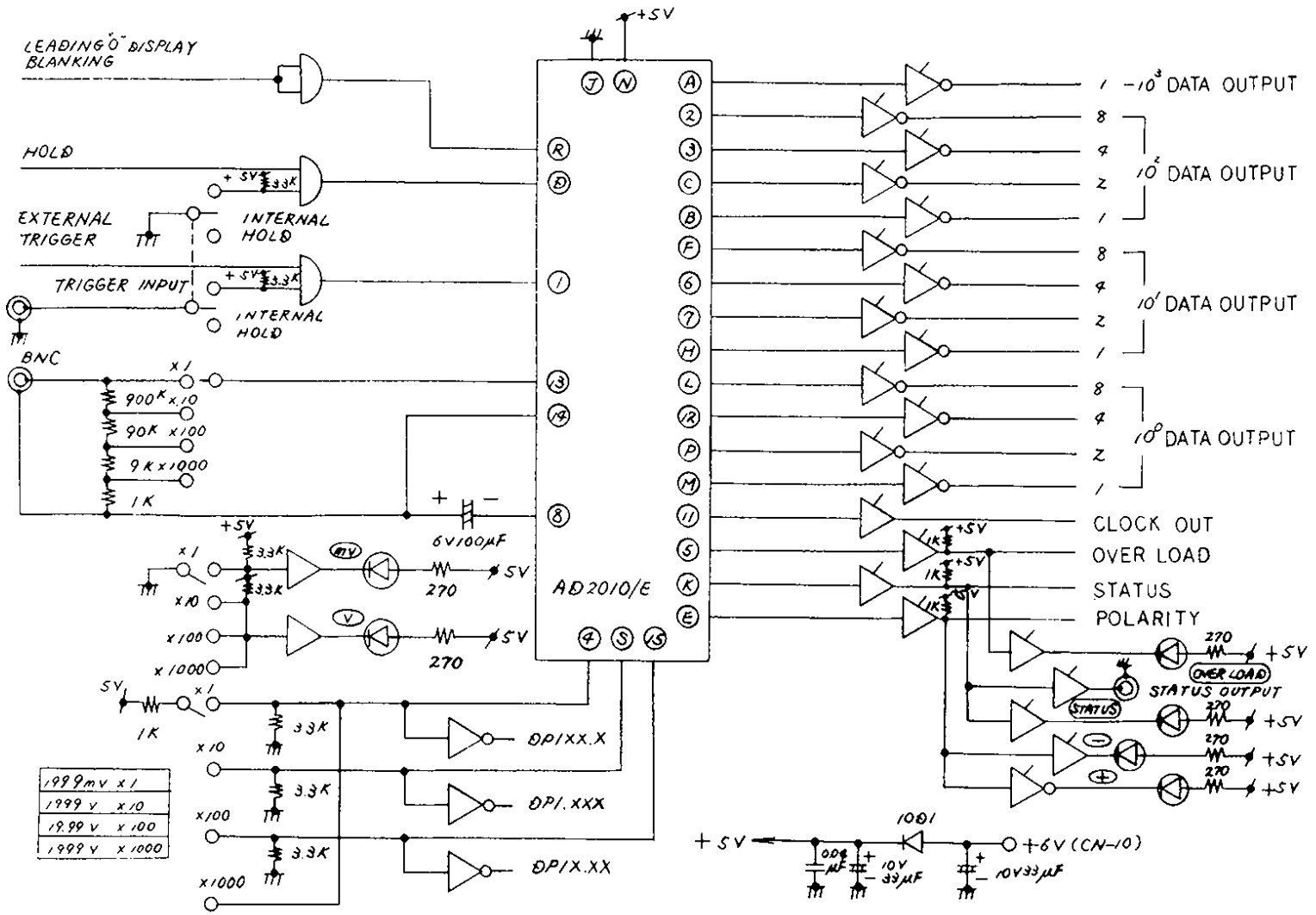
3 BCD Digits : logic "0" indicates data true.
Overrange : logic "0" indicates overrenge.
Overload : logic "0" indicates overload.
logic "1" indicates data valid.
Polarity : logic "1" indicates positive polarity.
logic "0" indicates negative polarity.
Status : logic "0" indicates conversion in process.
logic "1" indicates conversion complete.

(7) POWER CONSUMPTION

+6 Volts : 600 mA

(8) DIMENSION

Triple width AEC-NIM module



DIGITAL VOLT METER CIRCUIT DIAGRAM (N14-11 KEK TYPE-1)

PIN	PIN FUNCTION	PIN	PIN FUNCTION
1	EXTERNAL TRIGGER	A	1000'S DIGITS
2 =KEY	800'S DIGITS	B	100'S DIGITS
3	400'S DIGITS	C	200'S DIGITS
4	DPIXX.X	D	HOLD
5	OVER LOAD	E	POLARITY
6	40'S DIGITS	F	80'S DIGITS
7	20'S DIGITS	H	10'S DIGITS
8	DIGITAL GROUND	J	ZERO VOLT GRND
9	REF IN (2010R ONLY)	K	STATUS
10	REF OUT	L	8'S DIGITS
11	CLOCK OUT	M	1'S DIGITS
12	4'S DIGITS	N	+5V SUPPLY
13	ANALOG IN	P	2'S DIGITS
14	ANALOG GRND	R	LEADING ZERO
15	DPIX.XX	S	DPI.XX

USED CONNECTOR 2VK150/1-2 7412E

AD2010 CONNECTOR

N14-11 KEK TYPE-1
DIGITAL VOLT METER
PIN DESIGNATIONS (1)

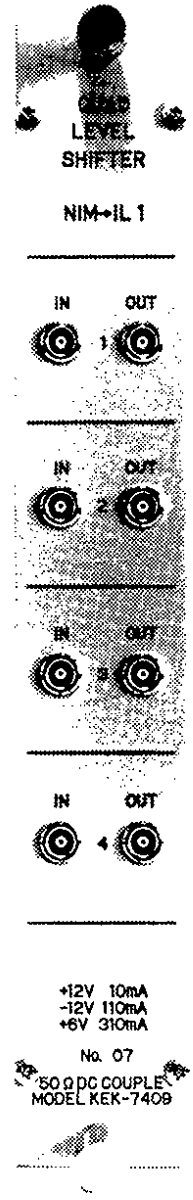
PIN	PIN FUNCTION	PIN	PIN FUNCTION
1	GROUND	19	GROUND
2	DATA 1000'S DIGITS	20	LEADING "0" DISPLAY
3	DATA 800'S DIGITS	21	EXTERNAL TRIGGER
4	DATA 400'S DIGITS	22	HOLD
5	DATA 200'S DIGITS	23	OVER LOAD
6	DATA 100'S DIGITS	24	REFERENCE OUTPUT
7	DATA 80'S DIGITS	25	CLOCK OUTPUT
8	DATA 40'S DIGITS	26	POLARITY
9	DATA 20'S DIGITS	27	STATUS
10	DATA 10'S DIGITS	28	NC
11	DATA 8'S DIGITS	29	NC
12	DATA 4'S DIGITS	30	NC
13	DATA 2'S DIGITS	31	NC
14	DATA 1'S DIGITS	32	NC
15	DATA IXX.X	33	NC
16	DATA IX.XX	34	NC
17	DATA I.XXX	35	NC
18	GROUND	36	GROUND

USED CONNECTOR-RIBBON 57-40360

REAR PANEL CONTROL CONNECTOR

N14-11 KEK TYPE-1
DIGITAL VOLT METER
PIN DESIGNATIONS (2)

N15-11 QUAD NIM TO CAMAC LEVEL ADAPTER (KEK TYPE-1)



KEK NIM STANDARD MODULE (N15-11)
QUAD NIM TO CAMAC LEVEL ADAPTER KEK TYPE-1

KEK NIM STANDARD MODULE (N15-11)
QUAD NIM TO CAMAC LEVEL ADAPTER KEK TYPE-1

SPECIFICATIONS

(1) INPUT

Number: 4

Impedance: 50 ohm

Reflections: < 10%

Voltage: Threshold according to "NIM" specifications
Threshold level -500 mV

Width: Shortest pulse to produce full output
< 7 ns for logic input (at -600 mV)

Maximum Rate: Maximum repetition rate to produce
full output > 32 MHZ

(2) OUTPUT

Number: 4

Voltage: "0"-level output (emitter follower)
When output is loaded with 50 ohm
+2.4 V to +3.2 V
"1"-level output (saturated transistor)
+80 mV to +100 mV
Sink current > 80 mA

Rise and Fall Time: Rise time < 20 ns
Fall time < 5 ns

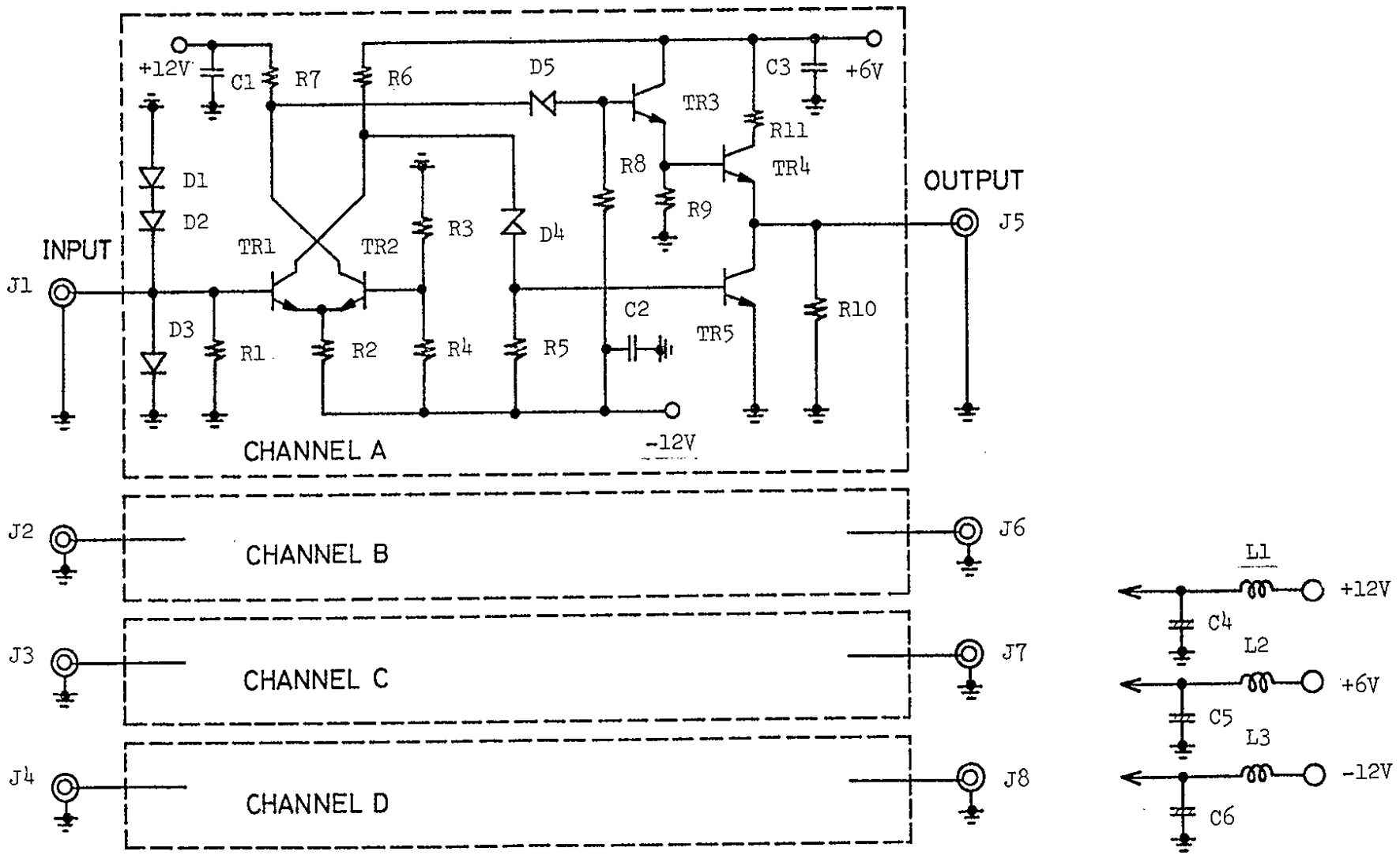
Overshoot: < 5%

Undershoot: no undershoot

Propagation Delay Time: 10 ns

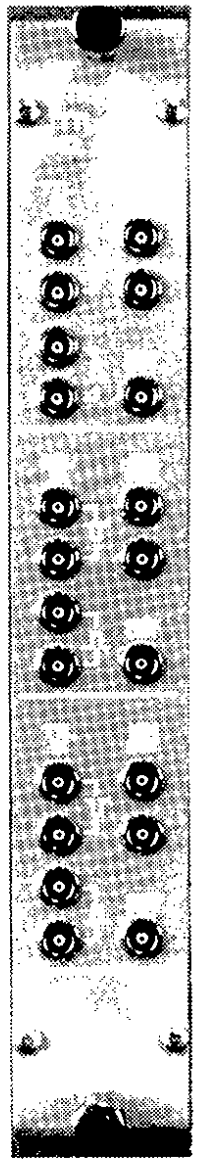
(3) POWER COMSUMPTION

+12 Volts: 10 mA
+6 VOlts. 120 mA
-12 Volts: 110 mA



Circuit Diagram of Quad NIM→ILl Level Adapter

N15-21 TRIPLE TTL TO NIM LEVEL ADAPTER (KEK TYPE-1)



KEK NIM STANDARD MODULE (N15-21)
TRIPLE TTL→NIM LEVEL ADAPTER
KEK TYPE-1

KEK NIM STANDARD MODULE (N15-21)
QUAD CAMAC TO NIM LEVEL ADAPTER KEK TYPE-1

SPECIFICATIONS

(1) INPUT

Number of Channels: Three
Inputs: 2 normal and 2 complementary TTL logic inputs per channel
Direct-coupled
Impedance: Normal input 10kohms
Complementary input 390ohms
Reflections: <10%
Voltage: Threshold according to TTL logic specifications
Threshold level 1.6V
Width: Shortest pulse to produce full output < 3ns for logic input (at 2.4V)
Maximum Rate: Maximum repetition rate to produce full output >125MHZ

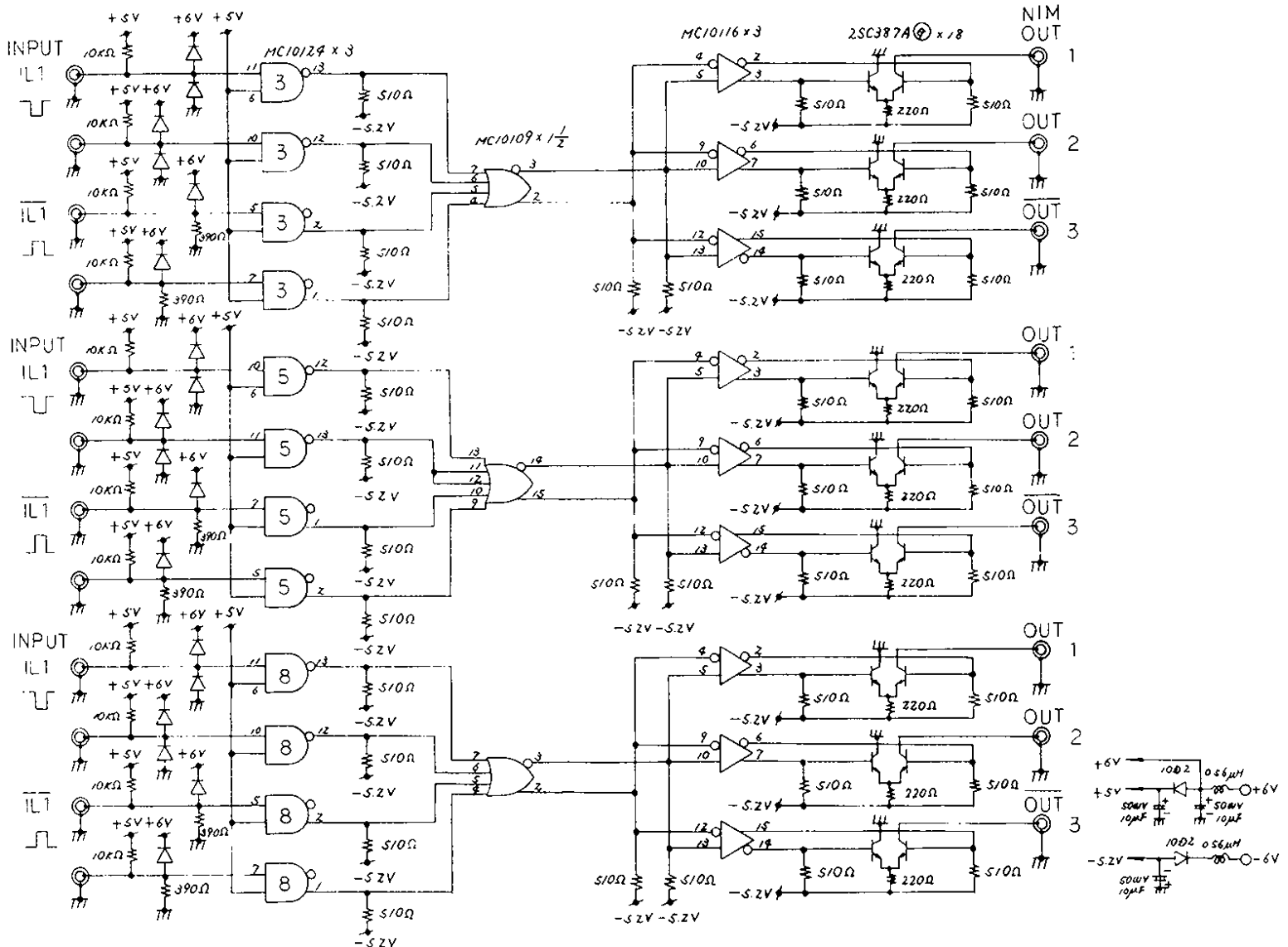
(2) OUTPUT

Outputs: Standard NIM logic signal
For every signal input, 2 normal outputs and 1 complementary output
Voltage: When output is loaded with 50ohms -800mV (independent each output)
Rise and Fall Time: Rise time <800ps
Fall time < 1ns
Overshoot: <10%
Undershoot: < 4%
Propagation Delay Time: 8ns

(3) POWER CONSUMPTION

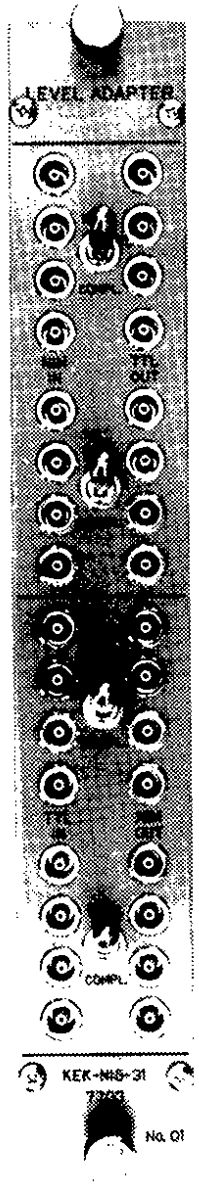
+6 Volts: 42mA
-6 Volts: 570mA

(4) DIMENSION: NIM Standard Single Width Module



TRIPLE TTL-NIM LEVEL ADAPTER (NIS-21 KEK TYPE-I)

N15-31 QUAD LOGIC LEVEL ADAPTER (KEK TYPE-1)



KEK NIM STANDARD MODULE (N15-31)
QUAD LOGIC LEVEL ADAPTER
KEK TYPE-1

KEK NIM STANDARD MODULE (N15-31) N15-31-01
QUAD LOGIC LEVEL ADAPTER KEK TYPE-1

SPECIFICATIONS

(A) NIM TO TTL SECTION

(1) NUMBER OF CHANNELS: Eight channels.

(2) INPUT

Impedance: 50 ohms (direct-coupled).

Voltage: Normal or complementaly fast "NIM" logic levels.
Threshold level -300 mV.

Width: Shortest pulse to produce full output $<$ 5 ns (at input pulse height -600 mV).

Reflections: $<$10% for input of 1 ns rise time.

Maximum Rate: Maximum repetition rate to produce full output
$>$ 40 MHz (at input pulse width 6 ns).

(3) OUTPUT

Voltage: Standard negative TTL logic levels.
Logical "1" $<$+0.4 volts,
Logical "0" $>$+2.5 volts.

High Level Drive Capability: 42 mA at 2.5 volts.

Low Level Clamp Capability: 48 mA at 0 ±500 mV.

Rise and Fall Time: Rise time $<$ 6 ns.
Fall time $<$ 5 ns.

Output Duration: Approximately equal to input duration.

Propagation Delay Time: 13 ns (In-Out).

Logic Polarity: Two front panel switches, each common to four channels, provide normal operation or complementaly operation. When operated in normal mode, input logical "1" gives output logical "1".

(B) TTL TO NIM SECTION

(4) NUMBER OF CHANNELS: Eight channels.

(5) INPUT

Voltage: Standard negative TTL logic levels.
Logical "1" = 0 to 0.8 volts, requires -1.6 mA.
Logical "0" => +2 volts, requires +100 μA.

Width: Shortest pulse to produce full output < 5 ns (at input pulse height +2 volts).

Maximum Rate: Maximum repetition rate to produce full output > 65 MHz (at input pulse width 6 ns).

Protection: Clamping at +6 volts and -0.7 volts.

(6) OUTPUT

Output: One output (independent each output).
Quiescently 0 mA, current source switches to - 16 mA (-800 mV into 50 ohms load) during output (at normal operation).

Rise and Fall Time: Rise time < 4 ns.
Fall time < 6 ns.

Output Duration: Approximately equal to input duration.

Propagation Delay Time: 12 ns (In-Out).

Logic Polarity: Two front panel switches, each common to four channels, provide normal operation or complementaly operation. When operated in normal mode, input logical "1" gives output logical "1".

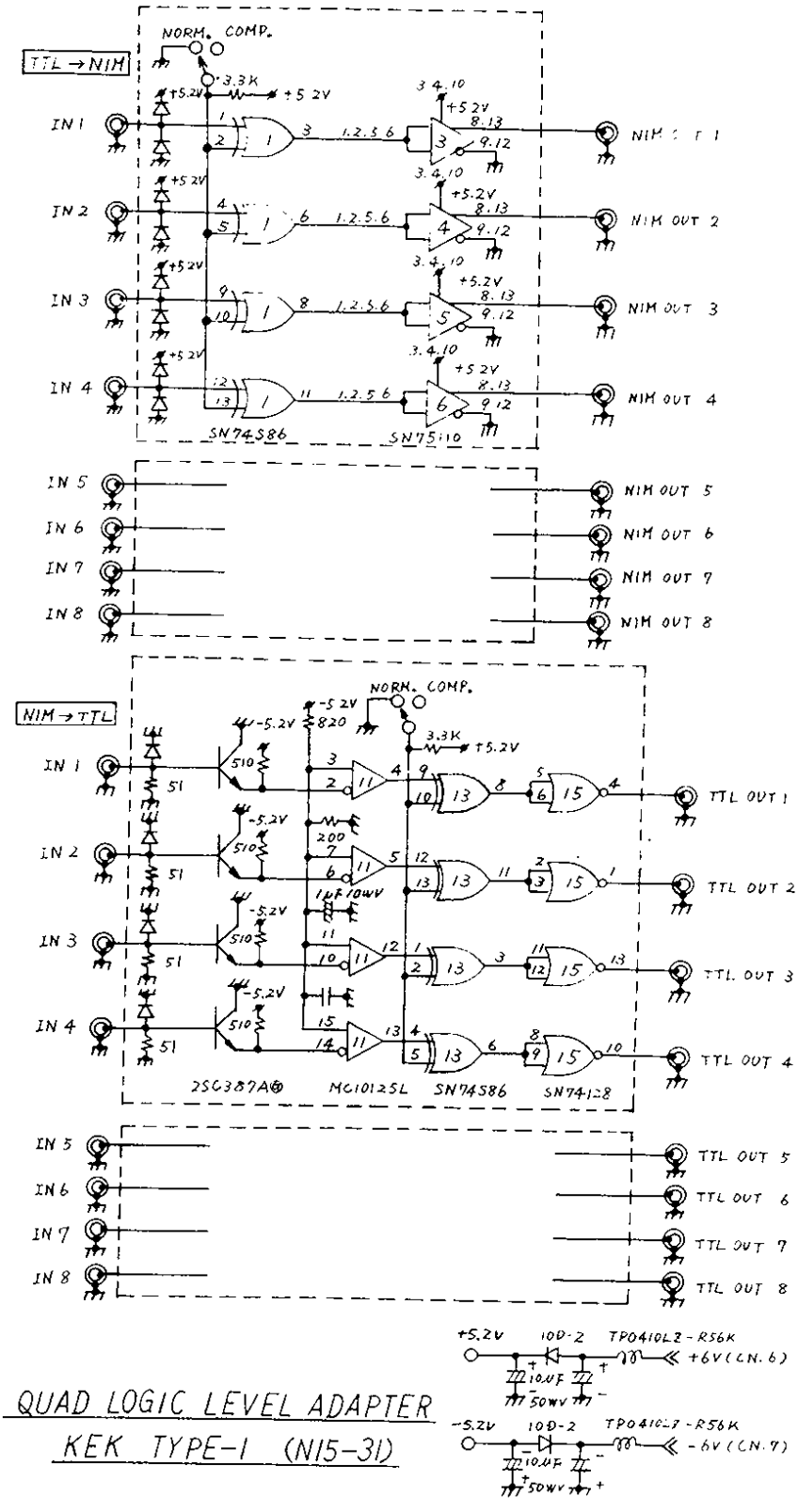
Over shoot: < 5%

Under shoot: < 4%

(7) POWER REQUIREMENTS

+6 Volts: 630 mA
-6 Volts: 350 mA

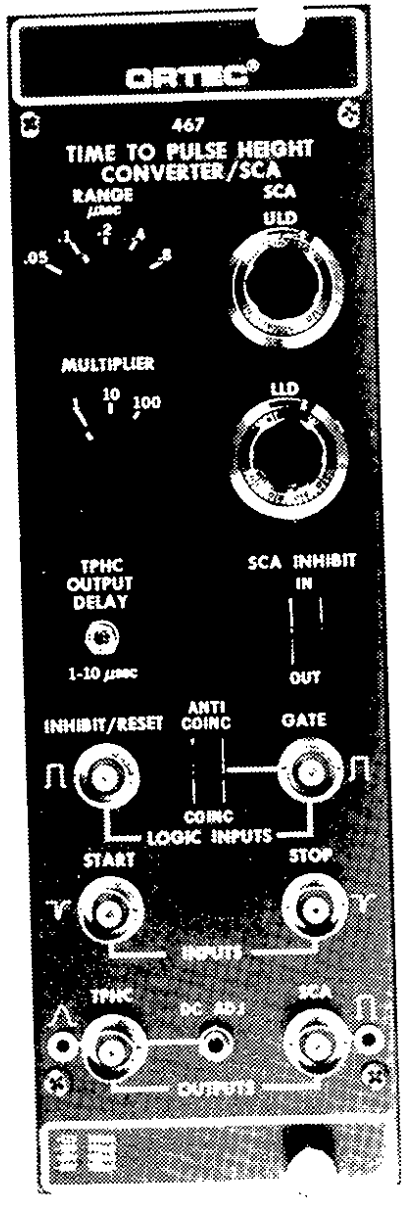
(8) DIMENSION: Single width AEC-NIM module, 1.35" wide x 8.75" high in accordance with TID-20893 (Rev. 2).
Lemo-type connectors.



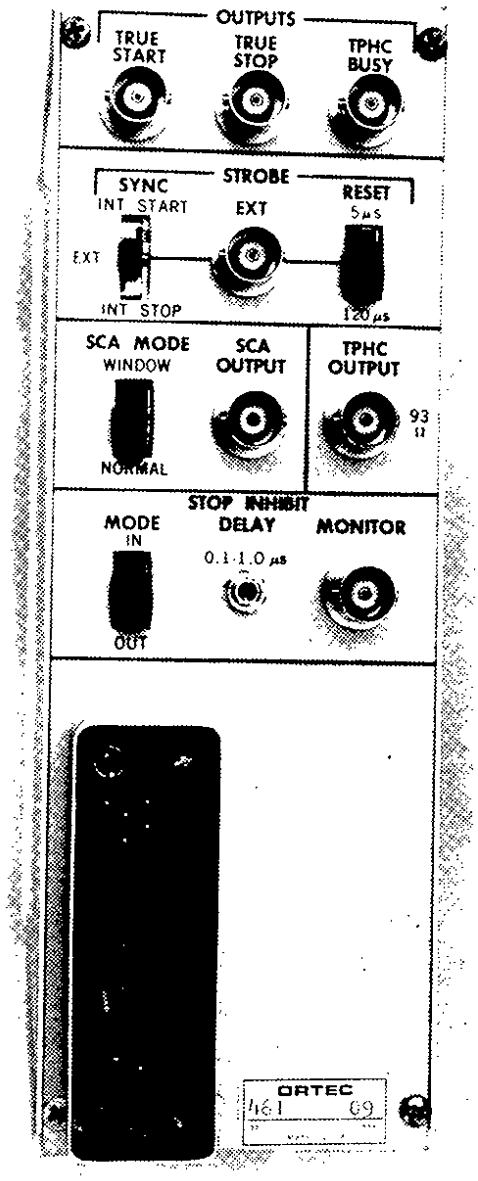
QUAD LOGIC LEVEL ADAPTER

KEK TYPE-1 (N15-31)

N16-20 TIME TO PULSE HEIGHT CONVERTER
(ORTEC 467)



KEK NIM MODULE (N16-20)
TIME TO PULSE HEIGHT
CONVERTER/SCA (ORTEC 467)



TIME TO PULSE HEIGHT CONVERTER/SCA
(ORTEC 467),REAR SIDE VIEW

KEK NIM STANDARD MODULE (N16-20) N16-20
TIME TO PULSE HEIGHT CONVERTER (ORTEC 467)

SPECIFICATIONS

Time Resolution (TPHC): $<$10 ps (10^{-11}s) FWHM on 50 and 100 ns ranges; $<$ 0.01% FWHM of full range for all other ranges.

Temperature Instability (TPHC): $<\pm$10 ps/°C for 50 ns ranges; $<\pm$0.015%/°C for higher ranges.

Differential Nonlinearity (TPHC): $<\pm$2% from 10 ns through full range for 50 ns range; $<\pm$2% from 5% range to full range for all higher ranges.

Integral Nonlinearity (TPHC): $<\pm$0.1% from 10 ns through full range for 50 ns range; $<\pm$0.1% from 5% range to full range for all higher ranges.

Temperature Instability (SCA): Upper-level discriminator, $<\pm$ 0.01%/°C; lower-level discriminator, $<\pm$0.01%/°C.

Nonlinearity (SCA): ULD AND LLD, $<\pm$0.5% over 10 V range.

Start Input: Accepts -250 mV (min.) pulses, protected to $\pm$100 V; Z_{in} 50 Ω , dc-coupled; width, 3 ns at -250 mV; maximum limit, ~ 4 μs.

Stop Input: Same as start input.

Dimension: Double width AEC-NIM module, 2.70" wide x 8.75" high in accordance with TID-20893(Rev.3).

APPENDIX

TYPE MODULENM.SR
MODULENM.SR

DATE MAY 26,1990
THE STOCK LIST OF KEK STANDARD MODULES FOR COUNTER EXPERIMENTS

(1) NIM MODULE AND RELATED ITEMS

N-00	NIM BLANK MODULE CASE
N-01	NIM BIN AND NIM FRAME
N-02	NIM POWER SUPPLY
N-03	NIM COOLING FAN
N-04	FIXED AND VARIABLE ATTENUATOR
N-05	FIXED AND VARIABLE DELAY
N-06	FAST,SLOW AND ZERO CROSSING DISCRIMINATOR
N-07	COINCIDENCE AND MALTIPLICITY LOGIC
N-08	FAST AND SLOW LINEAR AMPLIFIER
N-09	LINEAR AND LOGIC FAN IN/ FAN OUT
N-10	LINEAR ADDER AND LINEAR GATE
N-11	GATE GENERATOR AND GATE DRIVER
N-12	SCALER AND PRESET CONTROLLER
N-13	PULSE GENERATOR
N-14	DIGITAL VOLTMETER
N-15	LOGIC LEVEL ADAPTER
N-16	A-D,T-D CONVERTER AND VOLTAGE INTEGRATOR
N-17	INTERRUPT CONTROLLER
N-18	PRINTER CONTROLLER

(2) CAMAC MODULE AND RELATED ITEMS

C-00	CAMAC BLANK MODULE CASE
C-01	CAMAC CRATE
C-02	CAMAC POWER SUPPLY
C-03	MODULE EXTENDER
C-04	CRATE CONTROLLER
C-05	BRANCH DRIVER
C-06	BRANCH TERMINATOR AND BRANCH TRANSCEIVER
C-07	POWER INDICATOR
C-08	IN/OUT, INTERRUPT, COINCIDENCE, AND SWITCH REGISTER
C-09	LAM GRADER
C-10	SCALER AND PRESET COUNTER
C-11	A-D AND T-D CONVERTER
C-12	PULSE GENERATOR
C-13	NIM MODULE AND TTY/CRT INTERFACE
C-14	FAN IN AND FAN OUT
C-15	MEMORY BUFFER
C-16	PROGRAMMABLE ATTENUATOR AND DELAY

(3) ACCESSORY EQUIPMENT FOR NIM AND CAMAC MODULE

A-01	BNC AND LEMO SIGNAL CABLE
A-02	BNC AND LEMO 50-OHM TERMINATOR
A-03	DATAWAY AND POWER SUPPLY CABLE

( ) NIM MODULE

	NUMBERS
N-00-11 NIM BLANK MODULE CASS KEK TYPE-1	
N-01-10 NIM BIN	0003
N-01-11 NIM BIN KEK TYPE-1 (WITH POWER CABLE)	0100
N-01-21 NIM BIN KEK TYPE-2 (WITH BOTH 117 AND POWER CABLE)	0049
N-01-30 NIM BIN POWERED (12V-2A 24V-1A)	0003
N-01-41 NIM BIN FRAME KEK TYPE-1	0070
N-02-11 NIM POWER SUPPLY KEK TYPE-1 (6V-10A,12V-4A,24V-2A)	0023
N-02-11 NIM POWER SUPPLY KEK TYPE-2 (6V-33A,12V-6A,24V-4A)	0021
N-02-21 6V POWER SUPPLY MODULE (6V-3A) KEK TYPE-1	0003
N-02-30 HIGH VOLTAGE POWER SUPPLY (ORTEC USE)	0002
N-03-10 NIM COOLING FAN	0002
N-03-11 NIM COOLING FAN KEK TYPE-1	0130
N-04-11 DUAL VARIABLE ATTENUATOR (0-31DB) KEK TYPE-1	0450
N-05-11 DUAL VARIABLE DELAY (0-31NS) KEK TYPE-1	0500
N-05-21 FIXED DELAY (100NS) KEK TYPE-1	0100
N-05-22 DUAL FIXED DELAY (100NS) KEK TYPE-1	0070
N-05-23 FIXED DELAY (200NS) KEK TYPE-2	0050
N-05-71 16-CH FIXED LOGIC DELAY (100NS) KEK TYPE-1	0025
N-06-10 DUAL DISCRIMINATOR (ESG T105/NL)	0006
N-06-10 OCTAL DISCRIMINATOR (LECROY 620L)	0001
N-06-10 QUAD DISCRIMINATOR (LECROY 621L)	0001
N-06-10 QUAD DISCRIMINATOR (ESG T120/N)	0001
N-06-11 DUAL DISCRIMINATOR KEK TYPE-1	0001
N-06-20 OCTAL UPDATING DISCRIMINATOR (LECROY 623)	0052
N-06-20 OCTAL UPDATING DISCRIMINATOR (ORTEC A2?)	0003
N-06-20 QUAD UPDATING DISCRIMINATOR (ESG T133-NL)	0006
N-06-21 QUAD NON-UPDATING DISCRIMINATOR KEK TYPE-1	0010
N-06-22 QUAD NON-UPDATING DISCRIMINATOR KEK TYPE-2	0120
N-06-32 QUAD UPDATING DISCRIMINATOR KEK TYPE-1	0040
N-06-35 DUAL ZERO CROSSING DISCRIMINATOR (ESG T140-NL)	0013
N-06-38 QUAD CONSTANT FRACTION DISCRIMINATOR (EGG 934)	0032
N-06-36 QUINT PICOSECOND COMPENSATED DISCRIMINATOR (LECROY 820)	0001
N-06-31 QUAD CONSTANT FRACTION DISCRIMINATOR KEK TYPE-1	0130
N-07-40 DIFFERENTIAL DISCRIMINATOR (ESG T010/NL)	0002
N-08-50 MEAN TIMER (ORTEC 462)	0002
N-08-50 OCTAL MEAN TIMER (LECROY 624)	0010
N-08-60 TIMING SINGLE CHANNEL ANALYZER (ORTEC 551)	0002

		NUMBERS
N-07-10	QUAD 2-FOLD LOGIC UNIT (LECROY 622)	0011
N-07-10	QUAD 2-FOLD LOGIC UNIT (LECROY 328A)	0038
N-07-20	4-FOLD 1-VETO COINCIDENCE (EGG CIMA-N)	0001
N-07-21	DUAL 4-FOLD 1-VETO COINCIDENCE KEK TYPE-1	0105
N-07-22	TRIPLE 4-FOLD 1-VETO COINCIDENCE KEK TYPE-1	0020
N-07-30	DUAL 4-FOLD MAJORITY LOGIC UNIT (LECROY 365AL)	0021
N-07-40	32-INPUT MULTIPLICITY LOGIC UNIT (LECROY 380)	0004
N-07-40	32-INPUT MULTIPLICITY LOGIC UNIT (LECROY 380A)	0017
N-07-42	12-CH MATRIX LOGIC UNIT KEK TYPE-1	0003
N-07-43	8-INPUT PRIORITY LOGIC UNIT KEK TYPE-1	0005
N-07-51	6-FOLD 1-VETO COINCIDENCE KEK TYPE-1	0033
N-07-61	OCTAL STROBED COINCIDENCE KEK TYPE-1	0070
N-08-10	QUAD AMPLIFIER (EGG AN201/NL)	0004
N-08-10	12-CH PHOTO-MULTIPLIER AMPLIFIER (GAIN FIXED X10)(LECROY 612)	0017
N-08-10	6-CH PHOTO-MULTIPLIER AMPLIFIER (GAIN VARIABLE X40)(LECROY 613M)	0007
N-08-11	OCTAL PULSE AMPLIFIER (GAIN FIXED X8) KEK TYPE-1	0070
N-08-20	PICK-UP AMPLIFIER (BORER 511)	0002
N-08-20	DUAL BIPOLAR LINEAR AMPLIFIER (LECROY 234)	0001
N-08-30	SHAPING AMPLIFIER (SEN FE260)	0004
N-08-30	DUAL SUM AND INVERT AMPLIFIER (ORTEC 433A)	0001
N-08-30	GATED BIASED AMPLIFIER (ORTEC 444)	0001
N-08-40	SPECTROSCOPY AMPLIFIER (ORTEC 472)	0006
N-09-10	QUAD LOGIC FAN-IN/FAN-OUT (LECROY 429)	0013
N-09-11	QUAD 4-INPUT OR LOGIC UNIT KEK TYPE-1	0030
N-09-12	QUAD LOGIC FAN-IN/FAN-OUT KEK TYPE-2	0020
N-09-20	DUAL FANOUT (SEN FE2F1)	0002
N-05-21	DUAL FANOUT KEK TYPE-1	0035
N-05-22	DUAL FANOUT KEK TYPE-2	0050
N-05-23	32-OUTPUT FANOUT KEK TYPE-2	0030
N-09-24	DUAL LOGIC FAN-IN/FAN-OUT KEK TYPE-1	0030
N-09-25	OCTAL FANOUT KEK TYPE-1	0040
N-05-25	QUAD FANOUT KEK TYPE-1	0010
N-10-10	DUAL BIPOLAR LINEAR FANIN (LECROY 1177DL)	0021
N-10-10	DUAL BIPOLAR LINEAR FANIN (LECROY 1177FL)	0002
N-10-10	QUAD LINEAR FANIN/FANOUT (LECROY 4034)	0005
N-10-10	QUAD LINEAR FANIN/FANOUT (LECROY 428F)	0007
N-10-10	DUAL LINEAR MIXER (EGG ANTIP-NL)	0004
N-10-11	DUAL LINEAR MIXER KEK TYPE-1	0002
N-10-12	OCTAL SIGNAL DIVIDER KEK TYPE-1	0008
N-10-20	LINEAR GATE (SEN FE33L)	0003
N-10-20	LINEAR GATE (EGG LG101/N)	0006
N-10-20	LINEAR GATE AND STRETCHER (EGG LG105/NL)	0007
N-10-23	LINEAR GATE AND STRETCHER (ORTEC 442)	0001

	NUMBERS
N-11-10 GATE AND DELAY GENERATOR (GATED 4150)	0004
N-11-16 DUAL GATE GENERATOR (LECROY 222)	0022
N-11-11 DUAL GATE GENERATOR NEW TYPE-1	0025
N-11-20 FAST TRIGGER UNIT (EGG TRG4-N)	0002
N-11-21 OCTAL FAST TRIGGER UNIT KEK TYPE-1	0010
N-11-71 SCALER GATE DRIVER KEK TYPE-1	0025
N-11-41 BEAM SPILL GATE GENERATOR (F1 TYPE-1)	000F
N-12-10 200MHZ PPS SCALER (1-DIGIT)(EGG 2110A)	0001
N-12-11 100MHZ VISUAL SCALER (5-DIGIT) KEK TYPE-1	0014
N-12-21 80MHZ VISUAL SCALER (5-DIGIT) KEK TYPE-1	0057
N-12-22 80MHZ VISUAL SCALER (6-DIGIT) KEK TYPE-2	0175
N-12-31 PRESET SCALER CONTROLLER (5-DIGIT) KEK TYPE-1	0028
N-12-41 SCALER AUTOMATIC TESTER KEK TYPE-1	0002
N-12-51 PRESET SCALER (2-DIGIT) KEK TYPE-1	0020
N-12-52 DUAL PRESET SCALER (2-DIGIT) KEK TYPE-1	0010
N-12-61 HEX 80MHZ VISUAL PRE SCALER (1-DIGIT) KEK TYPE-1	0020
N-17-10 NORMALIZING PULSE GENERATOR (TOYO SM910)	0002
N-13-10 125MHZ PULSE GENERATOR (SHC 9020)	0004
N-17-10 50MHZ PULSE GENERATOR (SHC 9010)	0002
N-13-11 10MHZ PULSE GENERATOR KEK TYPE-1	0025
N-17-20 RANDOM PULSE GENERATOR (SHC 05-2)	0002
N-14-11 DIGITAL VOLTMETER (3 1/2-DIGIT) KEK TYPE-1	0002
N-15-11 QUAD NIM TO CAMAC LEVEL ADAPTER KEK TYPE-1	0020
N-15-21 TRIPLE TTL TO NIM LEVEL ADAPTER KEK TYPE-1	0010
N-15-30 QUAD LOGIC LEVEL ADAPTER (EGG LI32A/LI)	0010
N-15-31 QUAD LOGIC LEVEL ADAPTER KEK TYPE-1	0030
N-15-10 8CH MULTI-CHANNEL ANALYZER (LECROY 2001)	0001
N-15-20 TIME TO PULSE HEIGHT CONVERTER (ORTEC 467)	0010
N-15-31 8-CH VOLTAGE INTEGRATOR KEK TYPE-1	0002
N-17-11 PDP-11 INTERRUPT CONTROLLER (FOR DR11-C) KEK TYPE-1	0010
N-19-11 PRINTER CONTROLLER (C) TYPE-1)	0005

(?) CAMAC MODULE

	NUMBERS
C-00-11 CAMAC BLANK MODULE CASE KEK TYPE-1	
C-01-10 POWERED CRATE (SCHLUMBERGE CJAL-41)	0004
C-01-10 POWERED CRATE (SEN 2057)	0010
C-01-10 POWERED CRATE (SEN 2057-S)	0006
C-01-10 POWERED CRATE (ITC 5000)	0023
C-01-10 POWERED CRATE (ITC 5001)	0001
C-01-10 POWERED CRATE (SEC ULTIMA 3000)	0005
C-01-20 UNPOWERED CRATE (JAC JC-661)	0006
C-01-20 UNPOWERED CRATE (NE 7005)	0001
C-01-20 UNPOWERED CRATE (SCHLUMBERGE CJAL-41)	0002
C-02-10 CAMAC POWER SUPPLY (NE 9001)	0001
C-02-10 CAMAC POWER SUPPLY (JAC JC-562)	0002
C-03-10 CAMAC MODULE EXTENDER (NE 7007)	0001
C-03-10 CAMAC MODULE EXTENDER (SEC ER-01)	0004
C-03-11 CAMAC MODULE EXTENDER KEK TYPE-1	0010
C-03-11 CAMAC MODULE EXTENDER KEK TYPE-2	0004
C-04-10 CRATE CONTROLLER TYPE-A1 (EGG CC-101)	0001
C-04-10 CRATE CONTROLLER TYPE-A1 (SEN HCC2034)	0027
C-04-10 CRATE CONTROLLER TYPE-A1 (BORER 1502)	0003
C-04-10 CRATE CONTROLLER TYPE-A2 (SEC CCA2)	0022
C-04-10 CRATE CONTROLLER TYPE-A2 (SEN HCC2089)	0007
C-04-20 PDP-11 DEDICATED CRATE CONTROLLER (EGG 05011)	0002
C-04-20 PDP-8 DEDICATED CRATE CONTROLLER (NE 7048-2)	0001
C-04-20 NOVA-01 CRATE CONTROLLER (SEN CC2023)	0006
C-04-30 MANUAL CRATE CONTROLLER (SCHLUMBERGE JCMC10)	0002
C-04-30 MANUAL CRATE CONTROLLER (NE 7024-1)	0001
C-04-30 MANUAL CRATE CONTROLLER (SEC MCC-240)	0002
C-04-31 MANUAL CRATE CONTROLLER KEK TYPE-1	0005
C-04-40 PROGRAMMED PLUGBOAD TEST CONTROLLER (NE SPS2040)	0001
C-05-10 BRANCH DRIVER (EGG PDP-11) (EGG 60011)	0003
C-05-20 MANUAL BRANCH DRIVER (SCHLUMBERGE CCMB10)	0001

	NUMBERS
C-06-10 BRANCH TERMINATOR (EGG TC031)	0001
C-06-10 BUS TERMINATOR ([illegible]) (SEN BT2032)	0004
C-06-21 BRANCH TERMINATOR (WITH DISPLAY) KEK TYPE-1	0011
C-06-31 BRANCH TERMINATOR AND BRANCH HIGHWAY CABLE TESTER KEK TYPE-1	0002
C-06-40 BRANCH HIGHWAY TRANSCEIVER (SCHLUMBERGE JBHT 8)	0002
C-06-40 BRANCH HIGHWAY TRANSCEIVER (SEC 3455B1)	0002
C-06-41 BRANCH HIGHWAY RECEIVER/TRANSMITTER KEK TYPE-1	0010
C-06-42 BRANCH HIGHWAY MULTIPLEX RECEIVER/TRANSMITTER KEK TYPE-2	0003
C-07-10 POWER INDICATOR (NE 704-1)	0001
C-07-11 POWER INDICATOR KEK TYPE-1	0028
C-08-10 DUAL INPUT REGISTER (NE 9041)	0001
C-08-10 DUAL INPUT REGISTER (EGG RI224)	0002
C-08-11 DUAL 24-BIT INPUT REGISTER KEK TYPE-1	0005
C-08-20 DUAL OUTPUT REGISTER (EGG RO224)	0002
C-08-21 16-BIT OUTPUT REGISTER KEK TYPE-1	0010
C-08-22 DUAL 24-BIT OUTPUT REGISTER KEK TYPE-1	0005
C-08-30 16-CHANNEL COINCIDENCE REGISTER (LECROY 2341A)	0002
C-08-31 16-CHANNEL COINCIDENCE REGISTER KEK TYPE-1	0041
C-08-32 16-CHANNEL COINCIDENCE REGISTER KEK TYPE-2	0001
C-08-33 12-CH OVERLAPPED COINCIDENCE REGISTER KEK TYPE-1	0010
C-08-41 16-BIT SWITCH REGISTER KEK TYPE-1	0025
C-08-42 24-BIT SWITCH REGISTER KEK TYPE-1	0010
C-08-50 8-BIT INTERRUPT REGISTER (NE 7013)	0001
C-08-50 8-BIT INTERRUPT REGISTER (NE 7021A)	0001
C-08-50 12-BIT INTERRUPT REGISTER (EGG IR025)	0001
C-08-51 8-BIT INTERRUPT REGISTER KEK TYPE-1	0002
C-08-60 TEST MODULE (EGG TM024)	0001
C-08-60 TEST MODULE (SEN TD2040)	0002
C-08-60 TEST MODULE (SEN TM2040)	0001
C-09-10 LAM GRADER (NE 064)	0002
C-09-11 LAM GRADER KEK TYPE-1	0030
C-10-10 QUAD ACD 20MHZ SCALER (NE 9021)	0001
C-10-11 QUAD BINARY 60MHZ SCALER KEK TYPE-1	0015
C-10-12 QUAD BINARY 80MHZ SCALER KEK TYPE-2	0060
C-10-20 PRESET COUNTING REGISTER (NE 7029)	0001
C-11-10 OCTAL ANALOG TO DIGITAL CONVERTER (LECROY 2248)	0002
C-11-10 12-CH ANALOG TO DIGITAL CONVERTER (LECROY 2249A)	0026
C-11-10 12-CH ANALOG TO DIGITAL CONVERTER (LECROY 2249W)	0002
C-11-10 32-INPUT DIFFERENTIAL A-D CONVERTER (LECROY 2232)	0005
C-11-10 1024-CH ANALOG TO DIGITAL CONVERTER (SCHLUMBERGE JCAN[illegible])	0001
C-11-20 OCTAL TIME TO DIGITAL CONVERTER (LECROY 2228A)	0043
C-11-21 OCTAL TIME TO DIGITAL CONVERTER KEK TYPE-1	0010

	NUMBERS
C-12-11 10MHZ CLOCK PULSE GENERATOR KEK TYPE-1	0010
C-12-20 DELAYED PULSE GENERATOR (HE 7045)	0001
C-13-10 TTY/CRT INTERFACE (SEC TCC-100)	0002
C-13-11 NIM-CAMAC SCALER INTERFACE KEK TYPE-1	0017
C-13-20 OUT-CAMAC INTERFACE (LECROY 2301)	0001
C-14-11 DUAL FANOUT KEK TYPE-1	0036
C-15-10 MEMORY BUFFER (256 X16 B/U) (SCHLUMBERGE JMT 20)	0001
C-16-10 PROGRAMMABLE DELAY UNIT (SEN 3PD-2048)	0003
C-16-20 PROGRAMMABLE ATTENUATOR (SEN 3PD-2048)	0002

(3) ACCESSORY EQUIPMENT FOR NIM AND CAMAC MODULE

A-01-11 BNC CONNECTOR SIGNAL CABLE (RG-58C/U)
A-01-21 LEMO CONNECTOR SIGNAL CABLE (RG-174/U)

A-02-11 BNC 50-OHM TERMINATOR
A-02-21 LEMO 50-OHM TERMINATOR

A-03-11 POWER SUPPLY CABLE FOR NIM BIN (3P)
A-03-21 DATAWAY CABLE FOR NIM-CAMAC INTERFACE (50P)
A-03-31 CAMAC BRANCH HIGHWAY CABLE (13P)
A-03-41 CAMAC LAM GRADER CABLE (50P)

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