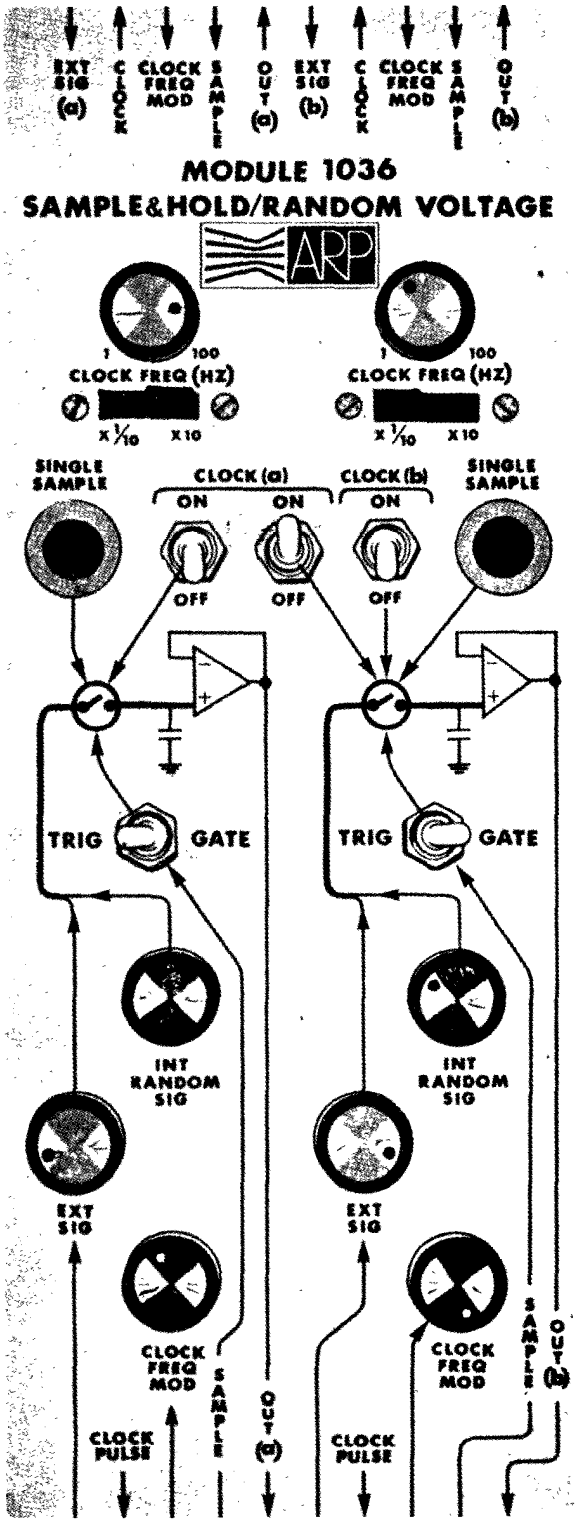
Arp 1036 (2500 Series)

The ARP 1036 Dual Sample & Hold/Random Voltage module is a functional circuit package designed for use in the ARP series 2000 Electronic Music Synthesizers. The module contains two sample and hold circuits, two random noise generators, and two voltage controlled pulse generators. The 1036 is usually used in conjunction with ARP voltage controlled oscillators to produce random tone sequences, scales, arpeggios and programmed melodic patterns. The module can also be used to control voltage controlled filters, amplifiers, etc.

A sample and hold circuit has a signal input, a signal output, and a sample command input. When a pulse is applied to the sample command input, the output signal voltage immediately assumes the same value as the input signal voltage. In the case of the 1036 sample and hold circuits, this process takes about 10 microseconds. After the sample command pulse, the output signal voltage will hold at that same level until another sample command pulse is applied. During the holding period between pulses, the input signal has no effect on the output signal. In the case shown in Figure A, a sawtooth waveform is applied from an external oscillator to the "Ext Sig" input of a 1036 sample and hold. Sample command pulses can be generated by pushing the "Single Sample" button, applying an external pulse (as from an oscillator or keyboard trigger) to the "Sample" input (with the "Trig/Gate" switch set to "Trig"), or by using an internal clock pulse generator.

There are two separate clock pulse generators. The frequencies of the clock pulse generators are determined by the front panel "Clock Freq" knobs and range switches. An external signal applied to the "Clock Freq Mod" inputs will also affect clock frequency. Clock (a) can be used to provide sample command pulses to both the (a) and (b) sample and hold circuits. Of the three toggle switches between the "Single Sample" buttons, two are connected to clock (a). The switch on the left connects clock (a) to sam-



ACTUAL SIZE

ple and hold (a) while the center switch connects clock (a) to the sample and hold circuit (b). The right hand switch connects clock (b) to sample and hold (b).

The "Clock Pulse" output is a 10 volt pulse that corresponds to the sample period of any sample command pulse reaching the sample and hold circuit. The internal clock, the "Single Sample" button, or external pulses all produce pulses at the "Clock Pulse" output. Usually this pulse can be used to trigger envelope generators, sequencers, and so forth.

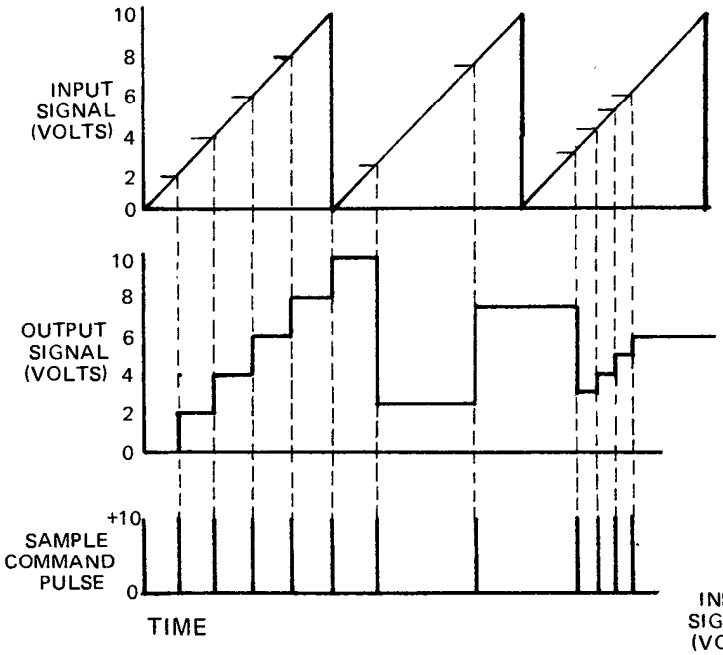
When a sample command pulse is received from the clock, "Single Sample" button, or external pulse, the output voltage appearing at "Out (a)" or "Out (b)" assumes the same value as the input voltage. In the case of Figure A, a sawtooth wave going from 0 volts to +10 volts is sampled at irregular intervals by the application of sample command pulses.

Any external signal which one desires to sample must be applied to the "Ext Sig" inputs. The knobs associated with the "Ext Sig" inputs are used to attenuate the incoming signal.

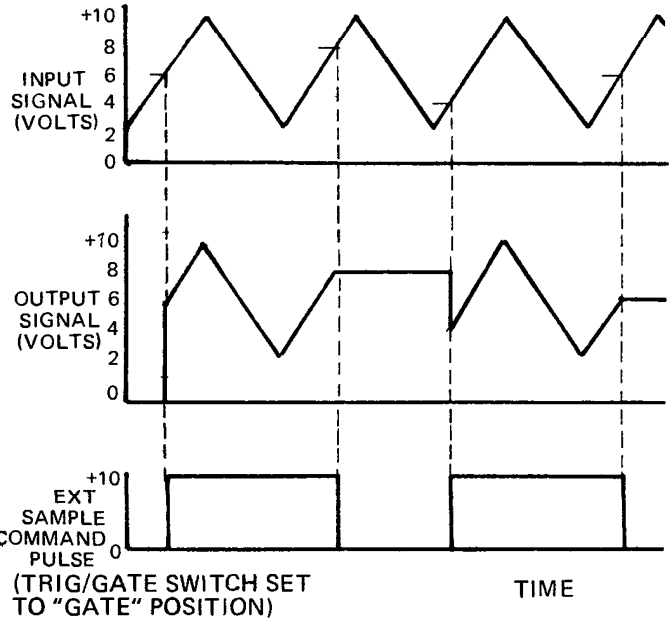
The output voltage from the sample and hold circuit will usually be a series of steps or discrete voltages. The output signal shown in Figure A is typical. Normally this output signal is used to control voltage controlled oscillators, filters, amplifiers, and so forth. If a waveform is sampled at a high enough frequency, however, the output signal can be used as an audio source.

In addition to sampling external signals, the module 1036 has built-in random signal generators. By advancing the front panel knobs labelled "Int Random Sig", noise can be applied to the signal input of the sample and hold circuits. When this random signal is sampled by the application of a sample command pulse, the output signal is a series of stepwise random voltages, as shown in Figure B. If an external signal is also applied, the random signal and the external signal will be mixed internally before being sampled.

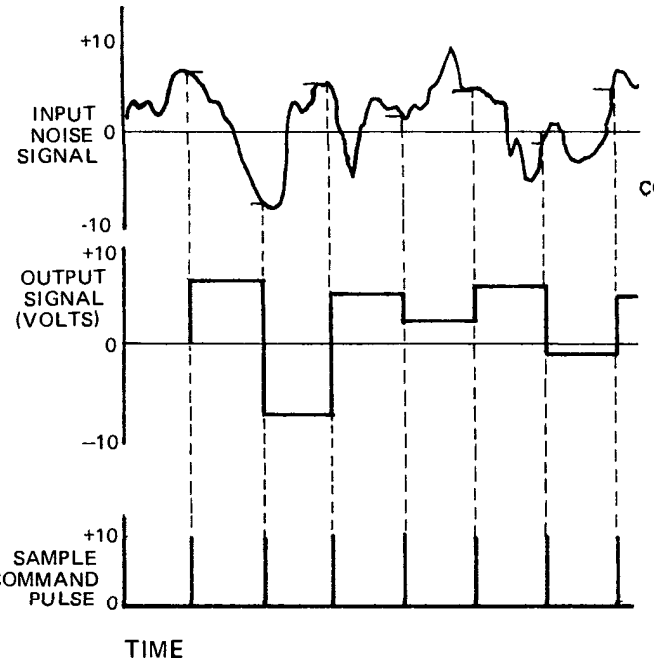
When an external sample command pulse (as from an oscillator) is applied to the "Sample" input, two different results can be selected by the "Trig/Gate" switch. In the "Trig" position, the input pulse is differentiated and the leading or positive-going edge of the external pulse triggers the sampling circuit for 10 microseconds. The duration of the external pulse under these conditions is immaterial. When the "Trig/Gate" switch is in the "Gate" position, the output signal of the sample and hold circuit will track the input signal as long as the external sample command pulse is positive. As soon as the pulse ends and the voltage at the "Sample" input returns to zero, the sample and hold circuit will store and hold the last value of the input signal voltage before the sample command pulse returned to zero. Figure C shows an example; when the sample command pulse is high, the output signal tracks the triangle wave at the signal input. When the sample pulse goes to zero volts, the output signal voltage holds at the voltage which was present when the sample command pulse dropped to zero.


10
8
6
4
2
0
INPUT SIGNAL (VOLTS)
OUTPUT SIGNAL (VOLTS)
+10
SAMPLE COMMAND PULSE
TIME

(A)


+10
8
6
4
2
0
INPUT SIGNAL (VOLTS)
OUTPUT SIGNAL (VOLTS)
EXT SAMPLE COMMAND PULSE
(TRIG/GATE SWITCH SET TO "GATE" POSITION)
TIME

(B)


+10
INPUT NOISE SIGNAL
0
-10
OUTPUT SIGNAL (VOLTS)
–10
SAMPLE COMMAND PULSE
TIME

(C)

1036 TEST PROCEDURE (PRELIMINARY)

January 12, 1973

1. Test Equipment Required:
   - 1.1 Oscilliscope
   - 1.2 Digital Voltmeter
   - 1.3 Function Generator (1004 module)
   - 1.4 2500 wing cabinet

2. Applicable Documents
   - 2.1 C-1036-009 Rev. F (P.C. Layout)
   - 2.2 C-1036-001 Rev. E (Schematic)

3. Preliminary Set-up:
   - 3.1 Thoroughly inspect the module per the sample
   - 3.2 Measure the resistance between all five power supply inputs. It must be greater than 400Ω
   - 3.3 Check the alignment of the knobs and the switches
   - 3.4 Set all of the pots fully CCW
   - 3.5 Set all of the switches down or left
   - 3.6 Set all of the trimpots to mid range
   - 3.7 Plug the module into the wing cabinet using an extender cord
   - 3.8 Apply power

4. Internal Clock Test:
   - 4.1 Internal Clock freq. adjustment
     - 4.1.1. Connect the scope to the left channel lower clock pulse output
     - 4.1.2. Switch the left CLOCK(a) switch ON
     - 4.1.3. Adjust trimpot R10 for a period of 10 seconds
     - 4.1.4. Set the clock freq. pot fully CW
     - 4.1.5. Verify that the clock freq. is greater than 10 HZ
     - 4.1.6. Switch the clock freq. switch to X10
     - 4.1.7. Verify that the clock freq. is greater than 1KHZ
     - 4.1.8. Set the clock freq. pot fully CCW
     - 4.1.9. Verify that the clock freq. is less than 10 HZ
     - 4.1.10. Connect the scope to the upper left clock output
     - 4.1.11. Verify that the clock is there
   - 4.2 Clock Freq. Modulation Test:
     - 4.2.1. Connect a 1HZ Sawtooth at 10V P-P to the left lower clock freq. mod. input
     - 4.2.2. Connect the scope to the upper left clock output
     - 4.2.3. Verify that there is no change in the clock freq.
     - 4.2.4. Set the clock freq. MOD pot fully CW
     - 4.2.5. Verify that the clock freq. is now frequency modulated by the 1HZ sawtooth
     - 4.2.6. Repeat steps 4.2.1. thru 4.2.5. for the left upper clock freq. mod. input
   - 4.3 Clock pulse width adjustment
     - 4.3.1. Set all of the pots fully CCW
     - 4.3.2. Set all of the switches down or left
     - 4.3.3. Set the left clock(a) ON
     - 4.3.4. Set the left clock freq. switch to X10
     - 4.3.5. Set the clock freq. pot to mid range → PULSE
     - 4.3.6. Connect the scope to the left clock output(a)
     - 4.3.7. Trim the pulse width to 12 μsec. ± 1.5 μsec. with a cap-

1036 TEST PROCEDURE (PRELIMINARY) continued

acitor (N50pf) from R54 and R36 to the Collector of Q9

5. Sample and Hold Test
   5.1 Output offset adjustment and drift test
      5.1.1. Set all of the pots fully CCW
      5.1.2. Set all of the switches down or left
      5.1.3. Switch ON the left clock(a) switch
      5.1.4. Switch the clock freq. to X10
      5.1.5. Connect a digital voltmeter and a scope to the left lower output(a)
      5.1.6. Adjust trimpot R30 for 0V .05 VDC on the scope
      5.1.7. Switch the clock(a) to OFF
      5.1.8. Measure the drift. It must not be greater than 2mv/sec.
   5.2 Int. Random Sig. Adjustment
      5.2.1. Switch left clock (a) switch to ON
      5.2.2. Set the clock freq. pot to mid range
      5.2.3. Set the Int. Random Sig. pot fully CW
      5.2.4. Adjust trimpot R46 for an occasional sample greater than 10V P-P
      5.2.5. If a sample of 10V P-P cannot be reached select Q11 for a larger noise signal
      5.2.6. Verify that the sample and hold signal is clean and not distorted
      5.2.7. Connect the scope to the left upper output(a)
      5.2.8. Verify that the sample and hold is there
   5.3 External Signal adjustment:
      5.3.1. Set the int. random sig. fully CCW
      5.3.2. Connect a 10 HZ sawtooth at 10V P-P to the left lower Ext. Sig.(a) input
      5.3.3. Verify that there is no output
      5.3.4. Set the Ext. Sig. pot fully CW
      5.3.5. Set the clock freq. pot fully CW
      5.3.6. Trim R59 for a 10V P-P sawtooth on the output(a)
      5.3.7. Connect the 10 HZ sawtooth to the left upper Ext. sig.(a) input
      5.3.8. Verify the sawtooth appears as in step 5.3.6.
   5.4 External Sample Test:
      5.4.1. Set all pots fully CCW
      5.4.2. Set all switches left or down
      5.4.3. Connect the scope to the left output(a)
      5.4.4. Connect a 10V P-P square wave to the lower sample input
      5.4.5. Set the int. random sig. fully CW
      5.4.6. Verify that the sample rate is now controlled by the external square wave
      5.4.7. Connect the 10V P-P square wave to the left upper sample input
      5.4.8. Verify that the output is the same as in step 5.4.6.
      5.4.9. Set the Trig-Gate switch to Gate
      5.4.10 Verify that the signal looks like fig. 5-1:

TRIM FOR UNITY GAIN FROM DC SOURCE

1036 TEST PROCEDURE (PRELIMINARY) continued

5.5 Single Sample Test:
- 5.5.1. Set all of the pots fully CCW
- 5.5.2. Set all of the switches down or left
- 5.5.3. Set the Int. Random Sig. pot fully CW
- 5.5.4. Connect the scope to output(a)
- 5.5.5. Push the left Single Sample button repeatedly and verify that the module samples equally positive and negative
- 5.5.6. If the module sample mostly positive then insert a 10K resistor between pin C of the push button switch and the wire attached to it.

6. Repeat Steps 3 thru 5 for the right channel(b)

7. Internal Clock Switches:
   - 7.1 Set all of the pots fully CCW
   - 7.2 Set all of the switches down or left
   - 7.3 Connect the scope to the right output (b)
   - 7.4 Set the right Int. Random Sig. pot fully CW
   - 7.5 Set both clock freq. switches to X10
   - 7.6 Set both clock freq. pots to mid range
   - 7.7 Switch the right clock (a) switch ON
   - 7.8 Verify that the output(b) is sampled at a rate controlled by the left clock freq.

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DWN BY	6-19-75	
Rev	By	Date
A		
B		
C	ECO 0094	
D	0304	

DWG. NO. APL-1036-005-D

1 of 5

TITLE P.C. ASSY. MODULE 1036

Sample + Hold / Random Voltage

ITEM	REF	DESCRIPTION OF PART	VENDOR	VENDOR PART NO.	TONUS PART NO.	QUANTITY REQUIRED
1	C1,2 +4A+B	CAPACITOR, TANTALUM 1µfd 35V 20%	ITT	TAG-00 1/35 - 20/20		6
2	C3,6 15	CAPACITOR, CERAMIC DISC .01µ 50V 20%	ACI	AC-3		6
3	C5	CAPACITOR, POLYCARBONATE .027µ 50V 10%	TRW	463 UW		2
4	C8,14,7	CAPACITOR, CERAMIC DISC .001µ 50V 20%	ACI	AC-1		6
5	C9	CAPACITOR, POLYCARBONATE .015µ 50V 10%	TRW	463 UW		2
6	C10, C19	CAPACITOR, CERAMIC DISC 50 pf 50V 20%	ACI	AC-2		4
6a	C13	CAPACITOR, CERAMIC DISC 100 pf 50V 20%	ACI	AC-1		2
8	C18	CAPACITOR, CERAMIC DISC .1µ 25V +80% -20%	ERIE	5815-000-Y5U0-104Z		2
9	C16, C11,12, 17	CAPACITOR, CERAMIC DISC 30 pf 50V 20%	ACI	AC-1		8
9a	SEL.	CAPACITOR, CERAMIC DISC				2
10	CR1-CR9	DIODE, SI, SIGNAL		1N4148		18
11	Q1,2,4,6,10	TRANSISTOR, PNP	GE	2N4248		10
12	Q3	TRANSISTOR, Uni-Junction		2N4870		2

NOV 6 1975

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DR'N BY

Rev	By	Date

DWG. NO. AFL-1036-COE-D

TITLE P.C. ASSY, MODULE 1036

2 of 5

ITEM	REF	DESCRIPTION OF PART	VENDOR	VENDOR PART NO.	TONUS PART NO.	QUANTITY REQUIRED
13	Q5,9	TRANSISTOR, NPN	GE	2N5172		6
14	Q7	TRANSISTOR FET	LEDEL	LS4392		2
15	Q8	TRANSISTOR - DUAL FIELD EFFECT, N CHANNEL	INTERSIL	IMF 3958		2
16	Q11	TRANSISTOR NOISE GENERATING SELECTED 2N5172				2
17	Q12	TRANSISTOR NPN	SPRAGUE	TZ81 (OR 2N5249)		2
18	IC 1-3	OPERATIONAL AMPLIFIER	NSC	LM301AH		6
19						
20						
21						
22						
23						
24						

NOV 6 1975

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DRAWN BY | Rev | By | Date | DWG. NO. APL-1036-005-D

TITLE

P.C. ASSY, MODULE 1036

3 of 5

ITEM	REF	DESCRIPTION OF PART	VENDOR	VENDOR PART NO.	TONUS PART NO.	QUANTITY REQUIRED
25	R16	Resistor, 1/4W 10% 22Meg	A-B	CB 2261		2
26	R44	" 1.5 MEG		CB 1551		2
27	R47, R49	" 1.0 "		CB 1051		4
28	R3, 6, 9, 20	"		CB 1541		4
29	R4, 22, 34, 35	"		CB 1041		4
30	R19	"		CB 6831		1
31	R26, 52	"		CB 4731		2
31a	R29	"		CB 3331		2
32	R31, 58	"		CB		4
33	R36, 40, 54	"		CB 1		6
34	R56	"		CB 1531	VUV 61975	2
35						
36	R18, 21, 32, 38, 39	"		CB 1031		10

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DRF BY | Rev | By | Date | DWG. NO. APL-1036-005-D

TITLE

P.C. ASSY, MODULE 1036

4 of 5

ITEM	REF	DESCRIPTION OF PART	VENDOR	VENDOR PART NO.	TONUS PART NO.	QUANTITY REQUIRED
37	R 5, 37	[illegible] 7.5K	A-1	CB4721		4
38	R 15, 17	5.6K		CB5621		4
39	R 7, 8	1.8K		CB1821		4
40	R 14, 35	1.5K		CB1521		4
41	RN 23, 43, 48	[illegible] K		CB1021		8
42						
43	R 12	330		CB [illegible]		[illegible]
44	R 33			CB2211		
45	R 13	[illegible]		CB1011		
46	R 24, 25	[illegible]		CB [illegible]		4
47	R 53, 59	[illegible] SELECT	A-1			4
48	R 44, 46	Resistor, Trim Pot 10K	CTS	1201R103B		4

NOV 6 1975

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Date

DWG. NO. APL-1036-C05-D

TITLE P.C. ASSY, MODULE 1036

5 of 5

ITEM	REF	DESCRIPTION OF PART	VENDOR	VENDOR PART NO.	TONUS PART NO.	QUANTITY REQUIRED
49	R10	[illegible] — 50K	CTS	X201R503B		2
49A		SCHEMATIC	ARP		C-1036-001E	REF
50						
50A		TAPE MASTER	ARP		C-1036-002B	REF
51		P.C. BOARD (P-036)	ARP		C-1036-003B	1
51A		P.C. ASSY	ARP		C-1036-004F	REF
52						
53						
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56						
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58						
59						
60						
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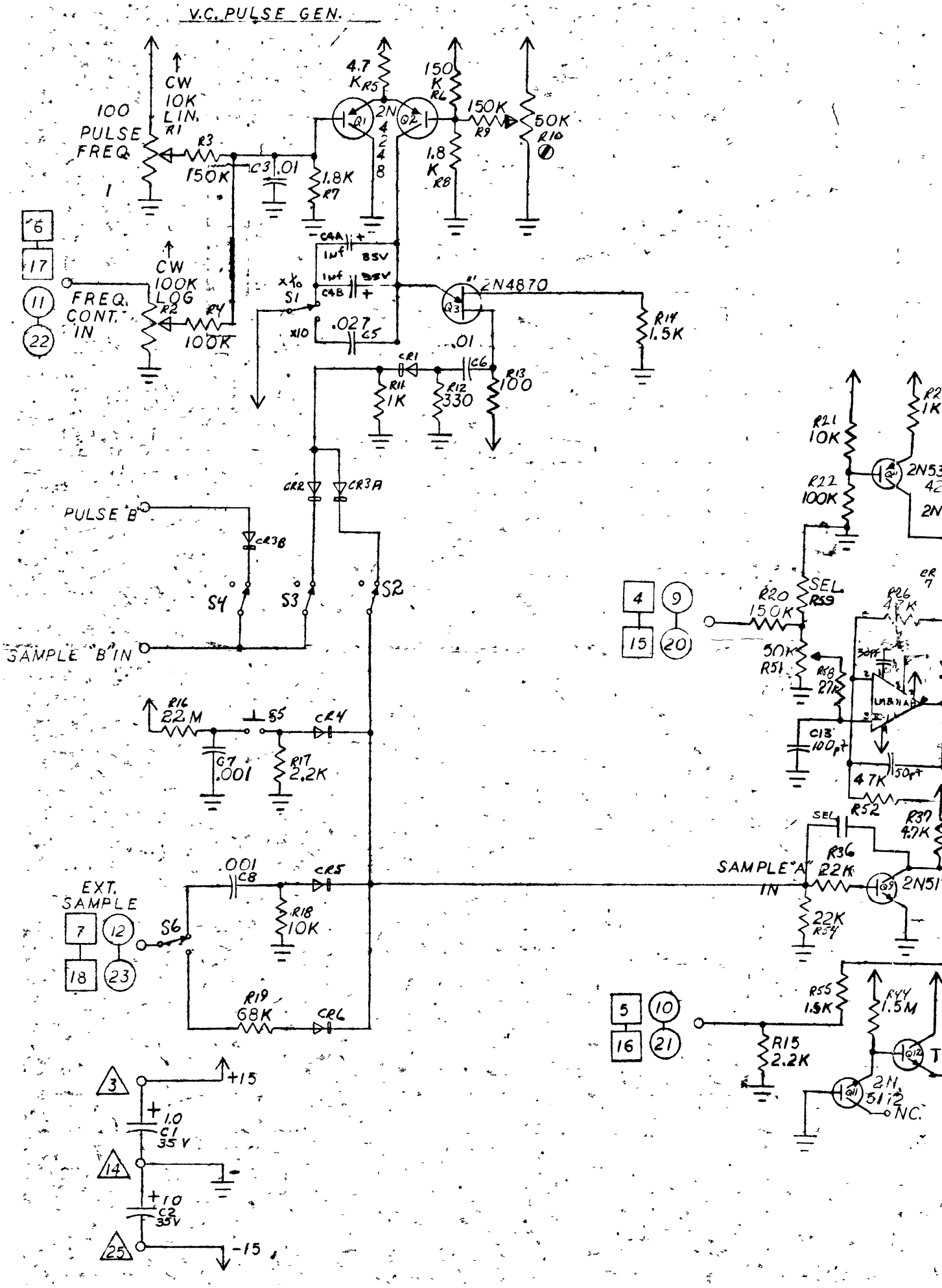
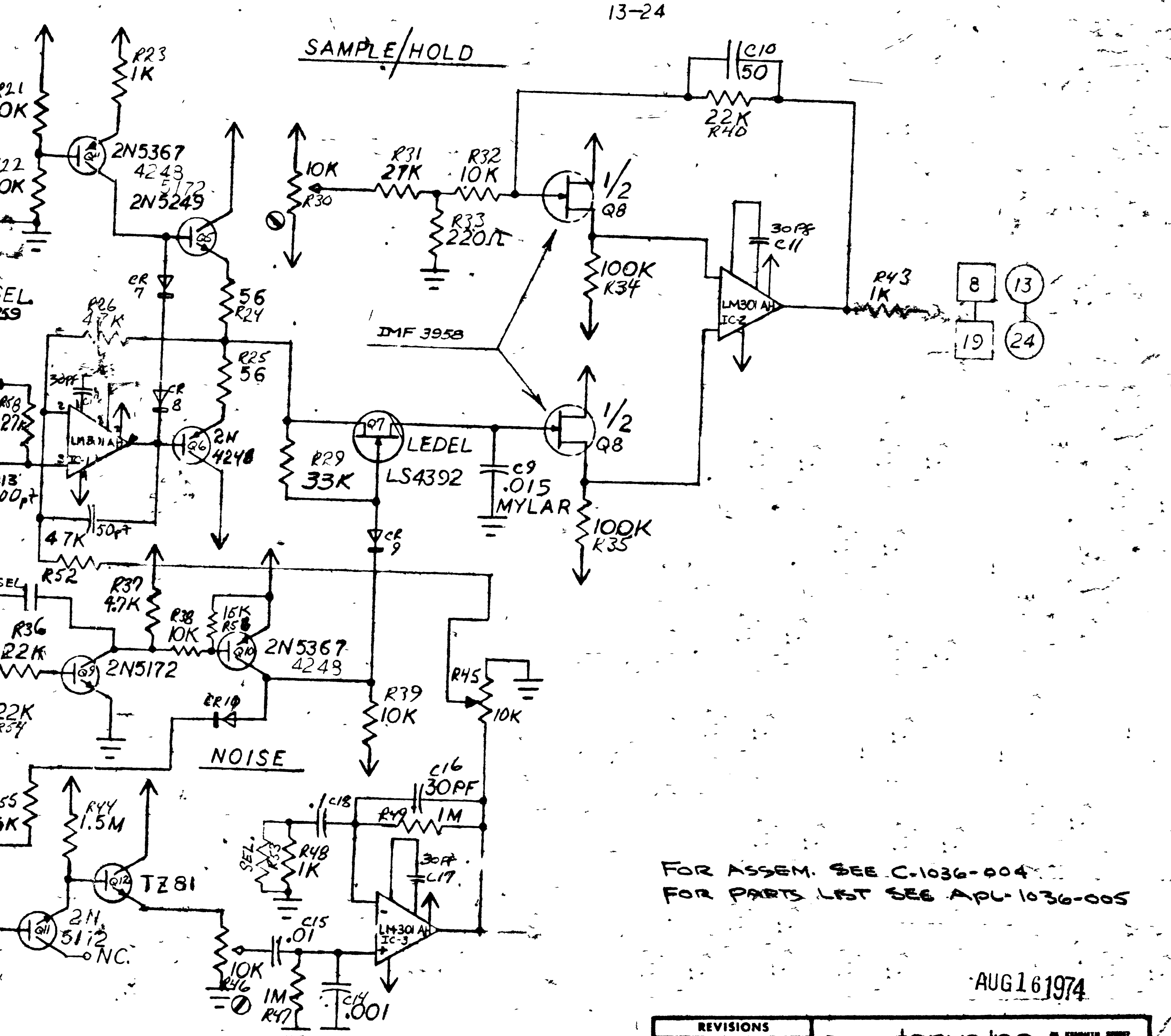
62						

NOV 6 1975


V.C. PULSE GEN.
100 PULSE FREQ.
CW 10K LIN. R1
R3 150K
C3 .01
1.8K R7
4.7 K R5
2N 4248
Q1
Q2
150 K R4
1.8 K R8
150K R9
50K R10
C4A 1mf 35V
C4B 1mf 35V
x1/10 S1
x10
.027 C5
Q3 2N4870
R14 1.5K
CW 100K LOG R2
R4 100K
FREQ. CONT. IN
6
17
11
22
.01 C6
CR1
R11 1K
R12 330
R13 100
CR2
CR3A
CR3B
PULSE B
S4
S3
S2
SAMPLE "B" IN
R16 2.2 M
S5
CR4
C7 .001
R17 2.2K
.001 C8
CR5
EXT. SAMPLE
7
12
18
23
S6
R18 10K
R19 68K
CR6
3
+15
+ 1.0 C1 35 V
14
+10 C2 35V
25
-15
4
9
15
20
R21 10K
R22 100K
R20 150K
SEL. R59
50K R51
R58 27K
C13 100pf
47K
50pf
R52
SEL
R36 22K
SAMPLE "A" IN
22K R54
R37 4.7K
5
10
16
21
R55 1.5K
R15 2.2K
R44 1.5M
2N5112
NC.

NOTES

1. △3 ▢A ◯B = PC. FINGERS
2. DIODES = IN4148
3. Switchs Shown ON
4. ⊘ = TRIMPOT
5. JUMPER—
   4—15
   5—16
   6—17
   7—18
   8—19
   9—20
   10—21
   11—22
   12—23
   13—24
6. STRAP Q1 + Q2 Together For Thermal Tracking
7. Q12 (TZ81) MAY BE SUBSTITUTED WITH 2N5249
8. 1036 MODULE CONTAINS 2 CIRCUITS, ONLY ONE IS SHOWN HERE.



FOR ASSEM. SEE C-1036-004
FOR PARTS LIST SEE APL-1036-005

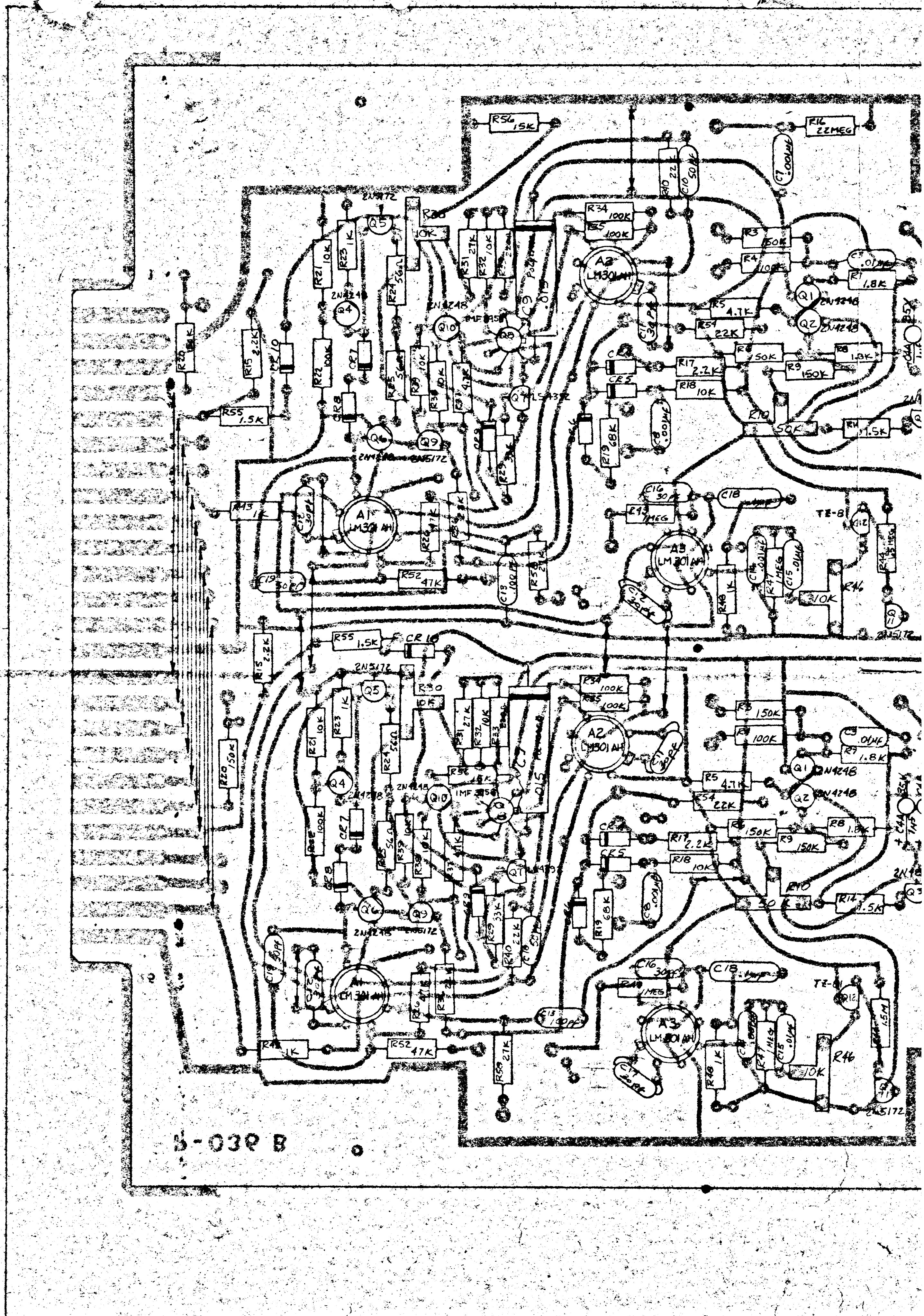
AUG 16 1974

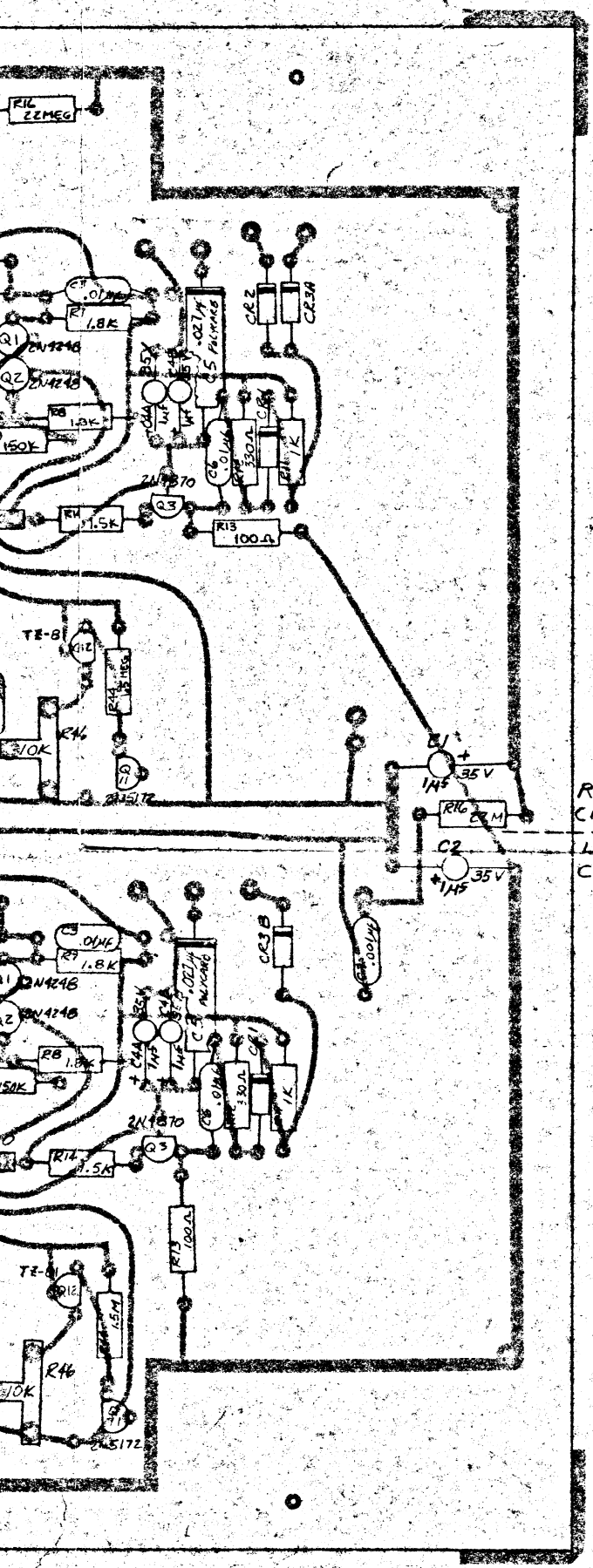
REVISIONS		
NO.	DATE	BY
A	6-15-70	GJE
B	8-14-70	AJE
C	CHANGED Q2 TO TZ81	BA 7-15-70
D	ECO-0094 CES 2/7/72	A
E	ECO-0304	KPF 2-…

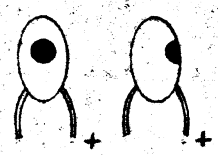
tonus, inc. 45 KENNETH STREET NEWTON HIGHLANDS MASSACHUSETTS 02161

MODULE 1036 SAMPLE & HOLD/RANDOM VOLTAGE

DRAWN BY: GJE · SCALE: — · MATERIAL:
CHK'D · DATE: 5-14-70
APP'D FOR PRODUCTION · APP'D FOR ECO
DRAWING NO. C-1036-… · E


R56 15K
R16 22MEG
C7 .001µF
R34 100K
R35 100K
A2 LM301AH
A1 LM301AH
A3 LM301AH
R3 150K
R4 100K
R7 1.8K
R5 4.7K
R54 22K
R17 2.2K
R18 10K
R19 68K
R9 150K
R10 50K
R14 1.5K
R55 1.5K
R43 1K
R52 47K
R13 1MEG
R15 2.2K
R20 150K
R21 10K
R22 100K
R23 1K
R24 56Ω
R30 10K
2N5172
2N4248
LM301AH
B-039 B





POLARITY OF C1, C2, C4A, C4B

NOTES

1. INSTALL 16 INSULATED JUMPERS AS SHOWN (⟶) USING AWG#24 SOLID WIRE AND BIRNBACH T-500-22 SLEEVING (OR EQUAL)
2. ALL DIODES ARE IN4148 OBSERVE POLARITY
3. OBSERVE POLARITY OF POLARIZED CAPACITORS AND OP AMPS
4. FOR SCHEMATIC SEE C-1036-001
5. FOR PARTS LIST SEE APL-1036-005

FEB 22 1974

FEB 2[illegible]

REVISIONS			
REV.	DATE	BY	
A			
B			
C			
D	BETRAW SA 3-26-71		
E	ECO 0094 CRB 7/2/71		
F	ECO-0304	CBZ 2-21-74	

tonus, Inc. 45 KENNETH STREET NEWTON HIGHLANDS MASSACHUSETTS 02161

P.C. ASSY DUAL 5% H/RANGE VOLTAGE MODULE 1036

DRAWN BY C.A. 3-26-71 | SCALE 2:1 | MATERIAL

CHK'D AE R 3-26-71 | DATE

APP'D FOR PROTOTYPE

APP'D FOR PROD.

DRAWING NO. C-1036-004 REV F

72072