OPERATING INSTRUCTIONS

TYPE 1150-D

RING COUNTING UNITS

1150-D

GENERAL RADIO COMPANY

A

Specifications

		Type 1150-D1	Type 1150-D2
Maximum Counting Rate		220 kc	50 kc
Input Pulse	Negative Step	12-volt amplitude < 0.2-μsec rise time	12-volt amplitude < 1.0-μsec rise time
	Negative Pulse	12-to-20-volt amplitude < 0.2-μsec rise time 1-to-3-μsec duration	12-to-20-volt amplitude < 1.0-μsec rise time 2-to-6-μsec duration
Supply Voltage		20 volts for 14-volt lamps, less for other loads.	
Maximum Load Current		85 ma in one stage.	
Total Power-Supply Load		Approximately 170 ma at 20 volts.	
Operating Temperature Range		0 to +50 C, ambient.	
Load Requirements		Load should be resistive. If inductive loads, such as relays, are used, damp the loads to prevent excessive overshoot.	
Reset and Set-Zero Voltage and Pulse Requirements		+15 to +16 volts.	

TYPE 1150-D

RING COUNTING UNITS

1. GENERAL.

The main power supply required for these counting units is 20 volts, 160 ma, nominal. Some variation in this voltage is tolerable, but prolonged applied voltage above 20 volts will reduce lamp life. For the reset and set-zero busses, a source of +15 to +16 volts is required (refer to paragraph 4).

The Type 1150-D Ring Counting Units are designed for use with Types IND-0300 and IND-1801 Numerik® Indicators which are manufactured for General Radio by KGM Electronics. These indicators contain Type 330 miniature incandescent lamp bulbs, rated at 14 volts and 80 ma. The indicators should not be used with higher-current lamps.

A Type 1150-D Ring Counting Unit plugs directly into a multiterminal socket (GR Part No. 4230-2699). An assembly that includes this socket, a cable, and an indicator is also available (GR Part No. 1150-0201).

2. OPERATING PRINCIPLES.

Figure 2-1 is an elementary schematic diagram of a Type 1150-D Ring Counting Unit. The Type 1150-D1 differs from the Type 1150-D2 only in the values of its components. Each unit consists of a ring of ten bistable circuits. Each bistable circuit has one "high-current" transistor cable of driving the associated incandescent lamp for a Numerik indicator.

In Figure 2-1, assume that the counting unit has been set to its zero state. Q101 will be off and Q102 on. Q102 has its base forward bias current provided by R103 to keep it saturated and passing 80 ma to light the 0 lamp in the indicator. This 80-ma current will produce a voltage rise of 5.5 volts across R101. The base of Q101 is returned via R102 to the set-zero buss voltage of about -5.0 volts. The base of Q101 is, therefore, reverse-biased with respect to the emitter and Q101 will remain off. The circuit is stable in this state.

All other pairs in the ring will have the opposite stable state. The left-hand transistors (Q103, etc) and all saturated right-hand transistor (Q104, etc) are off. When Q103, for example, is on the R105 clear buss (not the same -5.0-volt potential as the set-zero buss), it will have nearly 1 ma of forward drive. The drop across the 68-ohm resistor (R104) on the common emitter will be only 0.07 volt and the full 20-volt collector-supply voltage will appear across R106. The very small drop in emitter-to-collector voltage of Q103 will normally be below the conduction knee-voltage of Q104 and will keep it off. Complete cutoff of Q104 for all possible transistor combinations at elevated temperature is ensured by the silicon diode (CR103 in series with the emitter of D104).

The input signal advances the state of the decade by one stage per pulse. A negative pulse is applied to the base of the advance chain Q121, turning it off. The on-lamp chain Q102 loses base forward drive and goes off. The common-emitter voltage rises from -5.5 volts to 0 and Q101 goes on. The positive pulse at the common emitter is fed through C101, turning Q103 off and Q104 (the 1 driver) on. Each succeeding pulse applied to Q101 will advance the count by one digit. At the count of 10 the zero pair is switched to the initial conditions, and the negative pulse generated as the 9 lamp extinguishes can be fed from this ring counting unit as a carry pulse to the advance driver of the succeeding unit.

In Figure 2-1, the zero-set system is depicted as a switch for simplicity. When this switch is opened, the clear buss will return to -20 volts, causing all the left-hand transistors of the bistable circuits to saturate, turning the lamp drives for 1 through 9 off. Q101, on the other hand, will lose forward bias, desaturate, and permit Q102 to go on, thereby turning on the zero lamp. In high-speed electronic applications, a fast transistor switch must be used for resetting.

3. DRIVING CIRCUITS.

The advance drivers of the ring counting units should be driven with negative pulses to advance the count. A negative step with a fall time faster than 0.2 μsec is satisfactory. The input capacitor, C111, is chosen to provide the optimum advance pulse duration when a 20-volt step is applied to the Type 1150-D1 or a 10-volt step is applied to the Type 1150-D2. (The Type 1150-D2 input circuit is designed to operate from the output of either a Type 1150-D1 or a Type 1150-D2.) To drive a ring counting unit from shorter pulses at lower amplitude, C111 must be replaced with a larger capacitor. If, for example, C111 is changed to 0.01 μf, then a Type 1150-D1 unit will respond to negative pulses with amplitudes from 2 to 3 volts and durations from 1 to 3 μsec; a Type 1150-D2 will respond to pulses with amplitudes from 2 to 3 volts and durations from 2 to 6 μsec.

4. RESET CIRCUITS.

The simplest reset circuit is the single-pole, single-throw switch shown in Figure 2-1. For some low-speed applications a switch or relay is sufficient. For higher speed applications, electronic switching must be provided. Since the reset circuit operates on the bias voltage of the low-current sides of the counting stages, the circuit used must provide a low source impedance and the voltage produced at the reset and set-zero busses must be accurately and stably established with respect to the power-supply voltage.

The reset-circuit source impedance should be no more than 500/n ohms, where n is the number of ring counting units to be reset. For example, for five decades the resistance between +20 v and the set-zero buss should be about 100 ohms. The resistance from the reset buss to ground should be about 300 ohms.

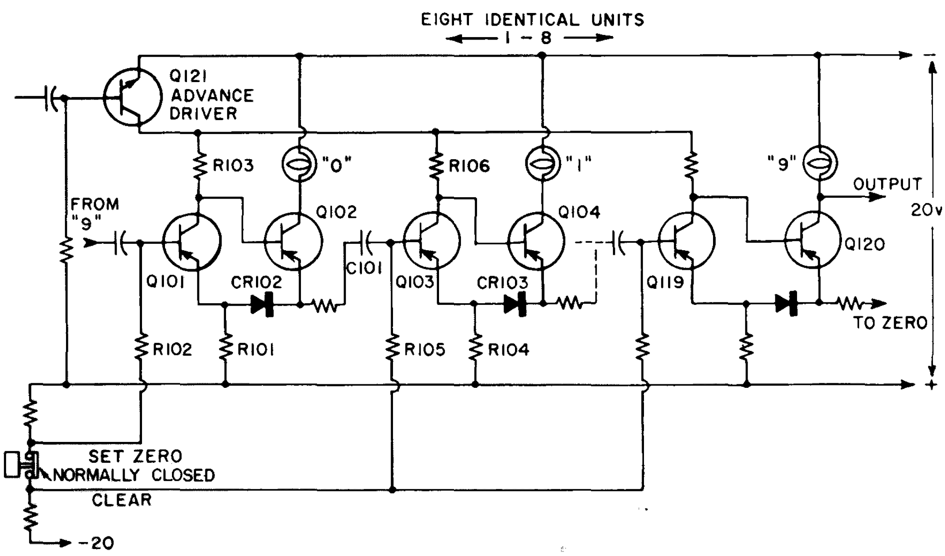


Figure 2-1. Elementary schematic diagram of a typical ring counting unit.

A possible reset circuit with five-decade capacity is shown in Figure 4-1. This circuit both establishes the proper reset time of 3 msec and provides the correct dc voltage and output impedance for the ring counting units. Q213 and Q214 comprise a monostable multivibrator producing a 3-msec interval during which Q215 will be turned off and Q216 will be turned on.

5. SERVICE AND MAINTENANCE.

5.1 WARRANTY.

We warrant that each new instrument or component sold by us is free from defects in material and workmanship, and that, properly used, it will perform in full accordance with applicable specifications for a period of two years after original shipment. Any instrument or component that is found within the two-year period not to meet these standards after examination by our factory, district office, or authorized repair agency personnel, will be repaired, or, at our option, replaced without charge, except for tubes or batteries that have given normal service.

5.2 SERVICE.

The two-year warranty stated above attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible. If the difficulty cannot be eliminated, please write or phone our Service Department (see rear cover) giving full information of the trouble and of steps taken to remedy it. Be sure to mention the serial and type numbers of the instrument.

Before returning an instrument to General Radio for service, please write to our Service Department or nearest district office, requesting a Returned Material Tag. Use of this tag will ensure proper handling and identification. For instruments not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay.

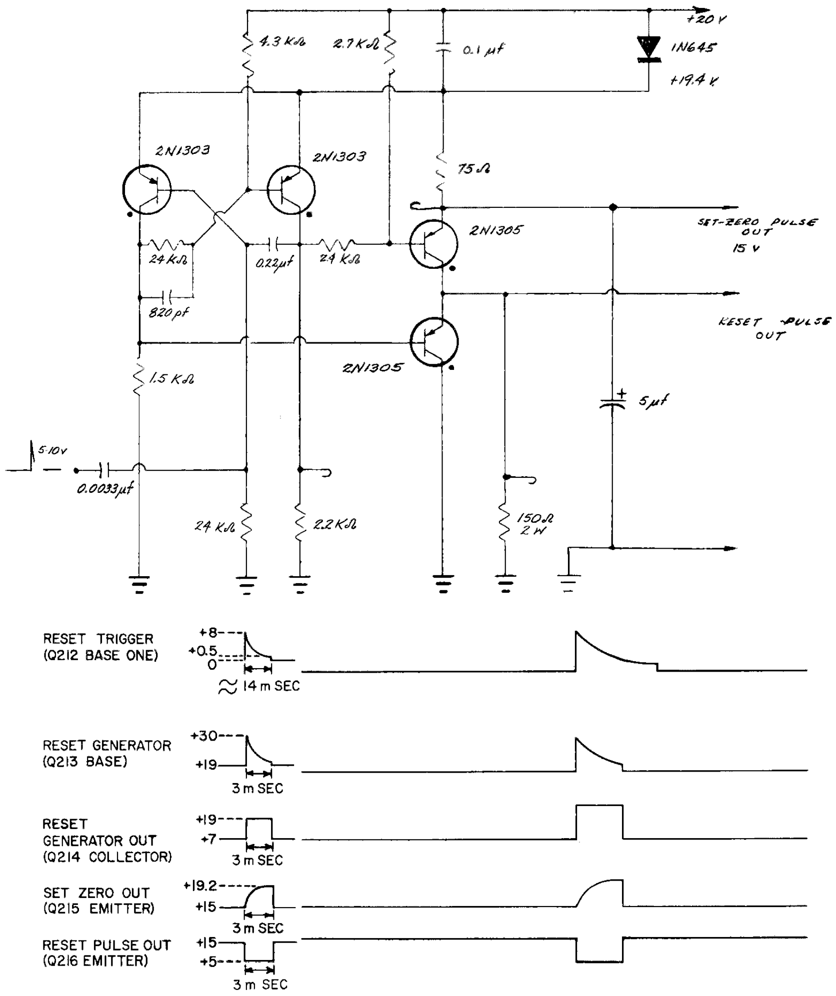


Figure 4-1. A reset circuit with five-decade capacity.

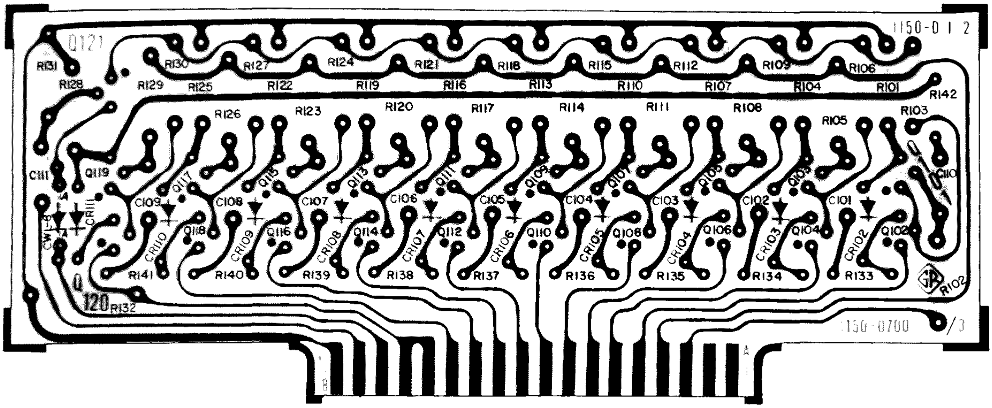


Figure 5-1. 50-kc ring counting unit etched board.

RESISTORS

R101	68 Ω	±5%	1/2 w	REC-20BF(680B)
R102	4.3 k	±5%	1/2 w	REC-20BF(432B)
R103	3.3 k	±5%	1/2 w	REC-20BF(332B)
R104	68 Ω	±5%	1/2 w	REC-20BF(680B)
R105	4.3 k	±5%	1/2 w	REC-20BF(432B)
R106	3.3 k	±5%	1/2 w	REC-20BF(332B)
R107	68 Ω	±5%	1/2 w	REC-20BF(680B)
R108	4.3 k	±5%	1/2 w	REC-20BF(432B)
R109	3.3 k	±5%	1/2 w	REC-20BF(332B)
R110	68 Ω	±5%	1/2 w	REC-20BF(680B)
R111	4.3 k	±5%	1/2 w	REC-20BF(432B)
R112	3.3 k	±5%	1/2 w	REC-20BF(332B)
R113	68 Ω	±5%	1/2 w	REC-20BF(680B)
R114	4.3 k	±5%	1/2 w	REC-20BF(432B)
R115	3.3 k	±5%	1/2 w	REC-20BF(332B)
R116	68 Ω	±5%	1/2 w	REC-20BF(680B)
R117	4.3 k	±5%	1/2 w	REC-20BF(432B)
R118	3.3 k	±5%	1/2 w	REC-20BF(332B)
R119	68 Ω	±5%	1/2 w	REC-20BF(680B)
R120	4.3 k	±5%	1/2 w	REC-20BF(432B)
R121	3.3 k	±5%	1/2 w	REC-20BF(332B)
R122	68 Ω	±5%	1/2 w	REC-20BF(680B)
R123	4.3 k	±5%	1/2 w	REC-20BF(432B)
R124	3.3 k	±5%	1/2 w	REC-20BF(332B)
R125	68 Ω	±5%	1/2 w	REC-20BF(680B)
R126	4.3 k	±5%	1/2 w	REC-20BF(432B)
R127	3.3 k	±5%	1/2 w	REC-20BF(332B)
R128	82 Ω	±5%	1/2 w	REC-20BF(820B)
R129	4.3 k	±5%	1/2 w	REC-20BF(432B)
R130	3.3 k	±5%	1/2 w	REC-20BF(332B)
R131	5.1 k	±5%	1/2 w	REC-20BF(512B)
R132	560 Ω	±10%	1 w	REC-30BF(561C)
R133	330 Ω	±10%	1/4 w	REC-9BF(331C)
R134	330 Ω	±10%	1/4 w	REC-9BF(331C)
R135	330 Ω	±10%	1/4 w	REC-9BF(331C)
R136	330 Ω	±10%	1/4 w	REC-9BF(331C)
R137	330 Ω	±10%	1/4 w	REC-9BF(331C)
R138	330 Ω	±10%	1/4 w	REC-9BF(331C)
R139	330 Ω	±10%	1/4 w	REC-9BF(331C)
R140	330 Ω	±10%	1/4 w	REC-9BF(331C)
R141	330 Ω	±10%	1/4 w	REC-9BF(331C)
R142	330 Ω	±10%	1/4 w	REC-9BF(331C)

CAPACITORS

C101	0.0022 μf	±10%	500 dcwv	COC-62(222C)
C102	0.0022 μf	±10%	500 dcwv	COC-62(222C)
C103	0.0022 μf	±10%	500 dcwv	COC-62(222C)
C104	0.0022 μf	±10%	500 dcwv	COC-62(222C)
C105	0.0022 μf	±10%	500 dcwv	COC-62(222C)
C106	0.0022 μf	±10%	500 dcwv	COC-62(222C)
C107	0.0022 μf	±10%	500 dcwv	COC-62(222C)
C108	0.0022 μf	±10%	500 dcwv	COC-62(222C)
C109	0.0022 μf	±10%	500 dcwv	COC-62(222C)
C110	0.0022 μf	±10%	500 dcwv	COC-62(222C)
C111	0.0033 μf	±10%	500 dcwv	COC-62(332C)

DIODE

CR102	2RED1016/1N645

TRANSISTORS

Q101	TR-19/2N1303	Q112	TR-19/2N1303
Q102	TR-19/2N1303	Q113	TR-19/2N1303
Q103	TR-19/2N1303	Q114	TR-19/2N1303
Q104	TR-19/2N1303	Q115	TR-19/2N1303
Q105	TR-19/2N1303	Q116	TR-19/2N1303
Q106	TR-19/2N1303	Q117	TR-19/2N1303
Q107	TR-19/2N1303	Q118	TR-19/2N1303
Q108	TR-19/2N1303	Q119	TR-19/2N1303
Q109	TR-19/2N1303	Q120	TR-19/2N1303
Q110	TR-19/2N1303	Q121	TR-18/2N1302
Q111	TR-19/2N1303		

MISCELLANEOUS

SO102	Socket	CDMS-38, 18
SO103	Socket	CDMS-38, 18
SO104	Socket	CDMS-38, 18
SO105	Socket	CDMS-38, 18

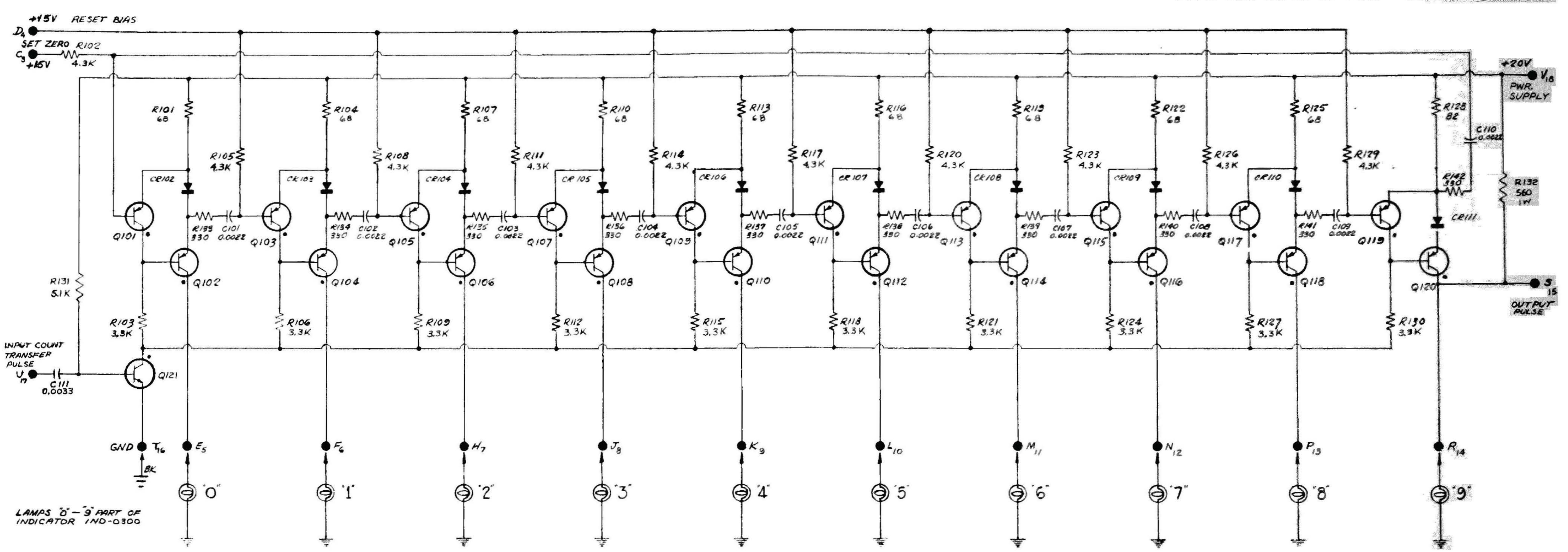
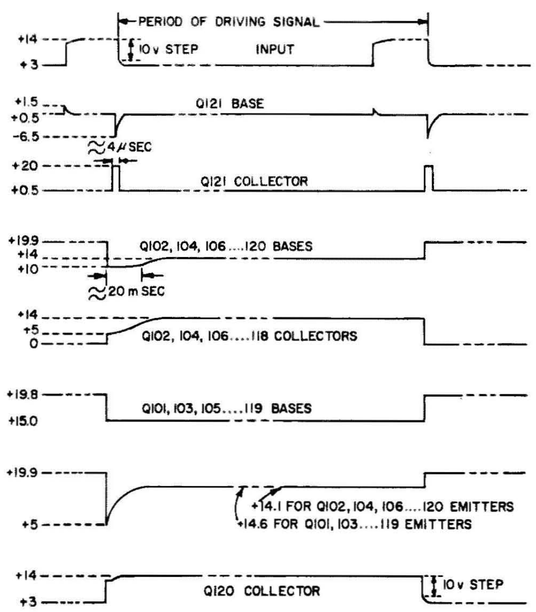


Figure 5-2. Schematic diagram of the 50-kc ring counting unit.



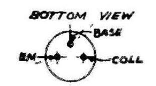
Transistor (Type)	Terminal	Dc Volts to Ground
Q101 (TR-19/2N1303)	E B C	14.6 15.0 14.0
Q102 (TR-19/2N1303)	E B C	14.1 14.0 14.0
Q103, Q105, Q107, Q109, Q111, Q113, Q115, Q117, Q119 (TR-19/2N1303)	E B C	19.9 19.8 19.9
Q104, Q106, Q108, Q110, Q112, Q114, Q116, Q118 (TR-19/2N1303)	E B C	19.9 19.9 0
Q120 (TR-19/2N1303)	E B C	19.9 19.9 3.0
Q121 (TR-18/2N1302)	E B C	0 0.5 0

Conditions of Measurement:

No input signal.
Operate RESET switch to give a display of "O"

SOCKET PIN CONNECTIONS; SO 102 THRU SO 105

- A_1, B_2 — NO CONNECTION
- C_3 ● SET ZERO PULSE, POS. PULSE FROM 15 VOLTS (WH-BR-BK)
- D_4 ● RESET PULSE, NEG. PULSE FROM 15 VOLTS (WH-GN-BL)
- E_5 ● TO "0" LAMP (WH-BK)
- F_6 ● TO "1" LAMP (WH-BR)
- H_7 ● TO "2" LAMP (WH-RD)
- J_8 ● TO "3" LAMP (WH-OR)
- K_9 ● TO "4" LAMP (WH-YE)
- L_{10} ● TO "5" LAMP (WH-GN)
- M_{11} ● TO "6" LAMP (WH-BL)
- N_{12} ● TO "7" LAMP (WH-VT)
- P_{13} ● TO "8" LAMP (WH-GY)
- R_{14} ● TO "9" LAMP (WH)
- S_{15} ● OUTPUT PULSE
- T_{16} ● GND. (BK)
- U_{17} ● INPUT COUNT TRANSFER PULSE (WH-RD-BK)
- V_{18} ● +20 VOLT SUPPLY (WH-GN-BR)



Q101 THRU Q121

NOTE:
RESISTORS ½ WATT UNLESS SPECIFIED
RESISTANCE IN OHMS UNLESS SPECIFIED
K=1000Ω, M=1 MEGOHM
CAPACITANCE VALUES ONE AND OVER IN PICOFARADS, LESS THAN ONE IN MICROFARADS UNLESS SPECIFIED

TYPE 1150-D1 220-kc RING COUNTING UNIT

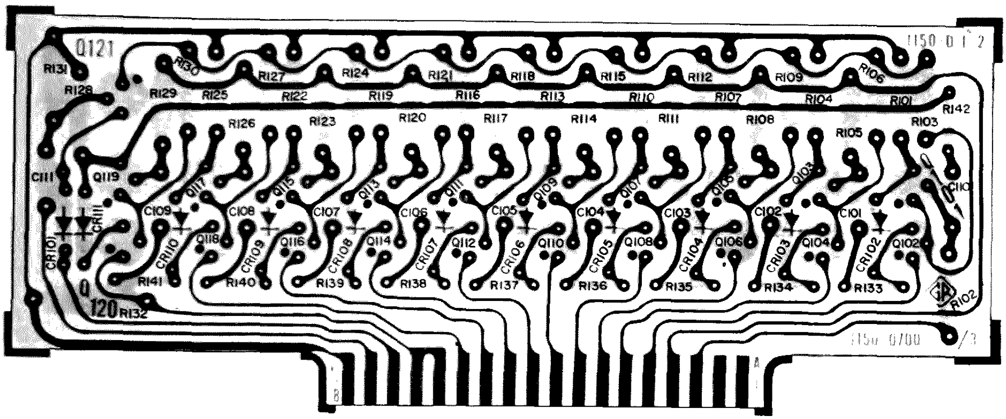


Figure 5-3. 220-kc ring counting unit etched board.

RESISTORS

R101	68Ω	±5%	1/2 w	REC-20BF(680B)
R102	4.3 k	±5%	1/2 w	REC-20BF(432B)
R103	2.7 k	±5%	1/2 w	REC-20BF(272B)
R104	68Ω	±5%	1/2 w	REC-20BF(680B)
R105	4.3 k	±5%	1/2 w	REC-20BF(432B)
R106	2.7 k	±5%	1/2 w	REC-20BF(272B)
R107	68Ω	±5%	1/2 w	REC-20BF(680B)
R108	4.3 k	±5%	1/2 w	REC-20BF(432B)
R109	2.7 k	±5%	1/2 w	REC-20BF(272B)
R110	68Ω	±5%	1/2 w	REC-20BF(680B)
R111	4.3 k	±5%	1/2 w	REC-20BF(432B)
R112	2.7 k	±5%	1/2 w	REC-20BF(272B)
R113	68Ω	±5%	1/2 w	REC-20BF(680B)
R114	4.3 k	±5%	1/2 w	REC-20BF(432B)
R115	2.7 k	±5%	1/2 w	REC-20BF(272B)
R116	68Ω	±5%	1/2 w	REC-20BF(680B)
R117	4.3 k	±5%	1/2 w	REC-20BF(432B)
R118	2.7 k	±5%	1/2 w	REC-20BF(272B)
R119	68Ω	±5%	1/2 w	REC-20BF(680B)
R120	4.3 k	±5%	1/2 w	REC-20BF(432B)
R121	2.7 k	±5%	1/2 w	REC-20BF(272B)
R122	68Ω	±5%	1/2 w	REC-20BF(680B)
R123	4.3 k	±5%	1/2 w	REC-20BF(432B)
R124	2.7 k	±5%	1/2 w	REC-20BF(272B)
R125	68Ω	±5%	1/2 w	REC-20BF(680B)
R126	4.3 k	±5%	1/2 w	REC-20BF(432B)
R127	2.7 k	±5%	1/2 w	REC-20BF(272B)
R128	82Ω	±5%	1/2 w	REC-20BF(820B)
R129	4.3 k	±5%	1/2 w	REC-20BF(432B)
R130	2.7 k	±5%	1/2 w	REC-20BF(272B)
R131	5.1 k	±5%	1/2 w	REC-20BF(512B)
R132	560Ω	±10%	1 w	REC-30BF(561C)
R133	330Ω	±10%	1/4 w	REC-9BF(331C)
R134	330Ω	±10%	1/4 w	REC-9BF(331C)
R135	330Ω	±10%	1/4 w	REC-9BF(331C)
R136	330Ω	±10%	1/4 w	REC-9BF(331C)
R137	330Ω	±10%	1/4 w	REC-9BF(331C)
R138	330Ω	±10%	1/4 w	REC-9BF(331C)
R139	330Ω	±10%	1/4 w	REC-9BF(331C)
R140	330Ω	±10%	1/4 w	REC-9BF(331C)
R141	330Ω	±10%	1/4 w	REC-9BF(331C)
R142	330Ω	±10%	1/4 w	REC-9BF(331C)

CAPACITORS

C101	0.001 µf	±10%	500 dcwv	COC-62(102C)
C102	0.001 µf	±10%	500 dcwv	COC-62(102C)
C103	0.001 µf	±10%	500 dcwv	COC-62(102C)
C104	0.001 µf	±10%	500 dcwv	COC-62(102C)
C105	0.001 µf	±10%	500 dcwv	COC-62(102C)
C106	0.001 µf	±10%	500 dcwv	COC-62(102C)
C107	0.001 µf	±10%	500 dcwv	COC-62(102C)
C108	0.001 µf	±10%	500 dcwv	COC-62(102C)
C109	0.001 µf	±10%	500 dcwv	COC-62(102C)
C110	0.001 µf	±10%	500 dcwv	COC-62(102C)
C111	820	±10%	500 dcwv	COC-62(821C)

DIODES

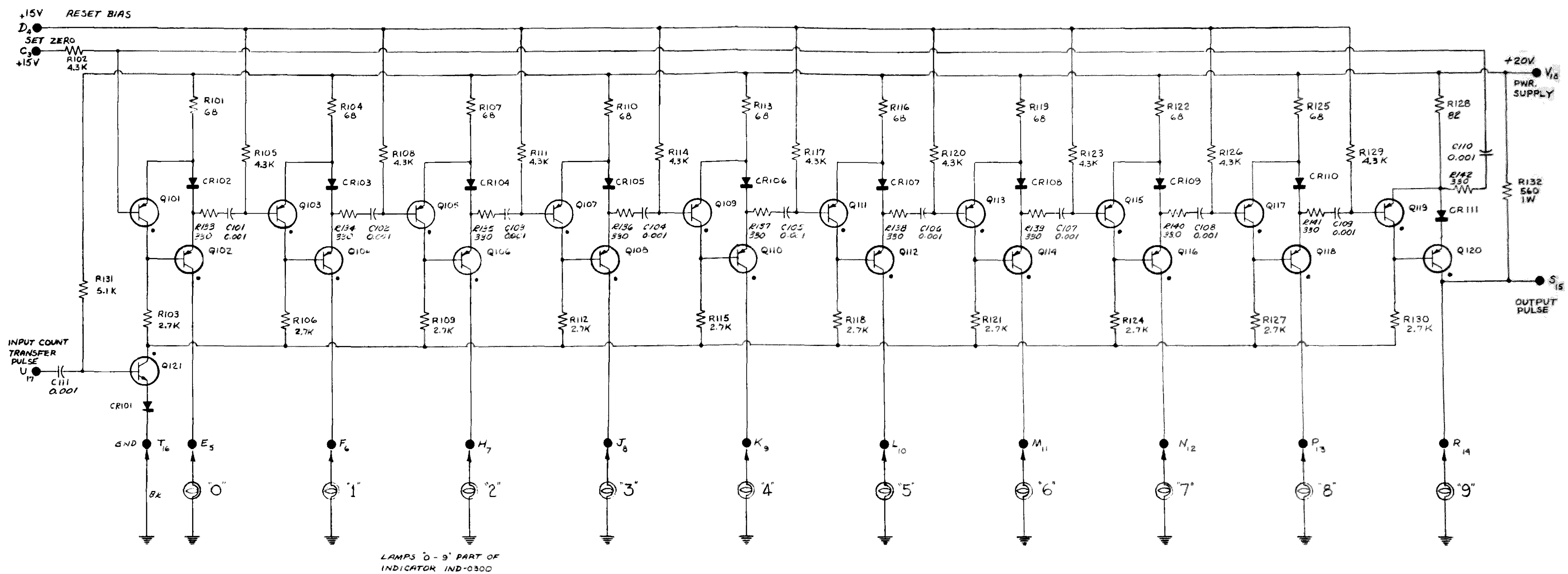
CR101	2RED1006/1N118A
CR102, CR103, CR104, CR105, CR106, CR107, CR108, CR109, CR110, CR111	2RED1016/1N645

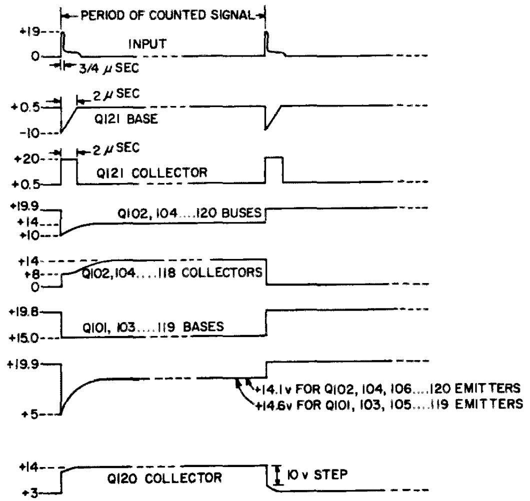
TRANSISTORS

Q101	TR-19/2N1303	Q112	TR-19/2N1303
Q102	TR-19/2N1303	Q113	TR-19/2N1303
Q103	TR-19/2N1303	Q114	TR-19/2N1303
Q104	TR-19/2N1303	Q115	TR-19/2N1303
Q105	TR-19/2N1303	Q116	TR-19/2N1303
Q106	TR-19/2N1303	Q117	TR-19/2N1303
Q107	TR-19/2N1303	Q118	TR-19/2N1303
Q108	TR-19/2N1303	Q119	TR-19/2N1303
Q109	TR-19/2N1303	Q120	TR-19/2N1303
Q110	TR-19/2N1303	Q121	TR-28/MM-487
Q111	TR-19/2N1303		

MISCELLANEOUS

SO101	Socket	CDMS-38	18





Transistor (Type)	Terminal	Dc Volts to Ground
Q101 (TR-19/2N1303)	E B C	14.6 15.0 14.0
Q102 (TR-19/2N1303)	E B C	14.1 14.0 14.0
Q103, Q105, Q107, Q109, Q111, Q113, Q115, Q117, Q119 (TR-19/2N1303)	E B C	19.9 19.8 19.9
Q104, Q106, Q108, Q110, Q112, Q114, Q116, Q118 (TR-19/2N1303)	E B C	19.9 19.9 0
Q120 (TR-19/2N1303)	E B C	19.9 19.9 3.0
Q121 (TR-28/MM-487)	E B C	0 0.5 0

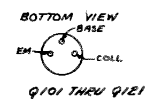
Conditions of Measurement:

No input signal.
Operate RESET switch to give a display of "O".

Figure 5-4. Schematic diagram for the 220-kc ring counting unit.

SOCKET PIN CONNECTIONS : SO 101

- A_1, B_2 } NO CONNECTION
- C_3 SET ZERO PULSE, POS. PULSE FROM 15 VOLTS (WH-RD-BK)
- D_4 RESET PULSE, NEG. PULSE FROM 15 VOLTS (WH-GN-BK)
- E_5 TO "0" LAMP (WH-BK)
- F_6 TO "1" LAMP (WH-BR)
- H_7 TO "2" LAMP (WH-RD)
- J_8 TO "3" LAMP (WH-OR)
- K_9 TO "4" LAMP (WH-YE)
- L_{10} TO "5" LAMP (WH-GN)
- M_{11} TO "6" LAMP (WH-BL)
- N_{12} TO "7" LAMP (WH-VT)
- P_{13} TO "8" LAMP (WH-GY)
- R_{14} TO "9" LAMP (WH)
- S_{15} OUTPUT PULSE
- T_{16} GND. (BK)
- U_{17} INPUT COUNT TRANSFER PULSE (WH-RD-BK)
- V_{18} +20 VOLT SUPPLY (WH-GN-BR)



NOTES:

RESISTORS ½ WATT UNLESS SPECIFIED
RESISTANCE IN OHMS UNLESS SPECIFIED
K=1000Ω, M= 1 MEGOHM
CAPACITANCE VALUES ONE AND OVER IN PICOFARADS, LESS THAN ONE IN MICROFARADS UNLESS SPECIFIED

GENERAL RADIO COMPANY

WEST CONCORD, MASSACHUSETTS

EMerson 9-4400 | **MIssion 6-7400**

DISTRICT OFFICES

NEW YORK*

Broad Avenue at Linden
Ridgefield, New Jersey
Telephone N.Y. WOrth 4-2722
N.J. WHitney 3-3140

SYRACUSE

Pickard Building
East Molloy Road
Syracuse 11, New York
Telephone GLenview 4-9323

PHILADELPHIA

1150 York Road
Abington, Pennsylvania
Telephone TUrner 7-8486
Phila., HAncock 4-7419

WASHINGTON*

Rockville Pike at Wall Lane
Rockville, Maryland
Telephone 946-1600

CHICAGO*

6605 West North Avenue
Oak Park, Illinois
Telephone VIllage 8-9400

* Repair services are available at these district offices.

LOS ANGELES*

1000 North Seward Street
Los Angeles 38, California
Telephone HOllywood 9-6201

SAN FRANCISCO

1186 Los Altos Avenue
Los Altos, California
Telephone WHitecliff 8-8233

DALLAS

2501-A West Mockingbird Lane
Dallas 35, Texas
Telephone FLeetwood 7-4031

FLORIDA

113 East Drive
Orlando, Florida
Telephone GArden 5-4671

CANADA*

99 Floral Parkway
Toronto 15, Ontario
Telephone CHerry 6-2171

* Repair services are available at these district offices.

General Radic witzerland
Represent ntries

Form 1150-0120-A
November, 1962

Printed in USA