

# SERVICE MANUAL

## NUTONE MODEL S-2250 SECURITY ALARM SYSTEM



**NuTone Housing Products**

**Scovill**

MADISON & RED BANK ROADS

CINCINNATI, OHIO 45227

PHONE 1-513-527-541

Part No. FE895  
Printed in U.S.A. 12/76 HI

## REPLACEMENT PARTS LIST

CAPACITORS: Value in micro (10<sup>-6</sup>) farads; other specifications as noted.

RESISTORS: Value in ohms ±5%, ¼ watt, carbon film, except as noted.

K = Kilo = 1,000

M = Mega = 1,000,000

Schematic Symbol	NuTone Part No.	Description
<b>MODEL S-2280 EXIT ENTRY TIMER</b>		
	10660-900	Complete Assembly
<b>CAPACITORS</b>		
C401, C402	35100-127	.1, + 80%, - 10%, 100V, Ceramic Disc
C403, C405	35100-139	.01, + 80%, - 20%, 50V, Ceramic Disc
C404	35100-139	.01, + 80%, - 20%, 50V, Ceramic Disc
C404	35100-166	(Early Production) .01, ± 20%, 25V Ceramic Disc
C406	35024-101	(Later Production) .47, ± 20%, 75V Polyester Film
<b>DIODES</b>		
D401-D404	36549-000	Silicon Rectifier Type, 1 Amp DC, 100 PIV; 1N4002
<b>CONNECTORS</b>		
P400	39521-103	Plug, 10 Pin, Male, for connecting to Control Unit
<b>TRANSISTORS</b>		
Q401	36613-000	NPN Silicon Motorola MPS-A20
Q402, Q403	36580-000	Texas Instrument T1S-98 NPN Planar Silicon, low noise; Motorola SPS-1216 National Semiconductor SMO-7329 Texas Instrument SKA-4220
<b>RESISTORS</b>		
R401, R407, R409	33082-104	100K
R402	33082-225	2.2M
R403	33082-105	1M
R404, R405	33082-103	10K
R406	33082-681	680
R408, R410	33082-473	47K
R411	33082-154	150K
R412	34042-000	100K, ± 30%, 0.1 watt, Rheostat 255° rotation minimum; C.T.S. Corp Type X-201 Stackpole Carbon Co #1556
R413	33082-183	18K
<b>SWITCHES</b>		
S401	39495-000	Slide Type, DP3T, DEPART (position 1, momentary contact), TIMED ENTRY; HOME:
	39524-000	Mounting Channel, Switch S401
	25511-015	Screw, #6-32 x ¼", Slit Pan, switch to channel mounting
	41730-000	Switch, Wire, and Channel Assembly

Schematic Symbol	NuTone Part No.	Description
<b>INTEGRATED CIRCUITS</b>		
Z401	36629-000	Quad, 2-input NOR Gates; Motorola MC14001CP RCA CD4001AE Solid State Scientific SCL 4001AE
Z402	36633-000	Solitron CM 4001AE Timer Motorola MC14541 CP
<b>MISCELLANEOUS</b>		
	47171-000	Installation Instructions
	5553-003	Screw, #4 x ¼", Sltd Rd. Switch Assembly to Chassis Mounting
<b>MODEL S-22/23R MASTER UNIT ROUGH-IN HOUSING</b>		
	10518-900	Complete Assembly
	13028-000	Ground Screw
	38667-000	Junction Box
	38668-005	Cover, junction box
	41698-000	Power Transformer Assembly
T1	30596-000	Power Transformer, (see listing under Master Unit, T1, below)
P2	39486-101	Plug, 3-pin, female type, for connecting T1 to Master Unit PC Board
	39122-038	Screw, #6-32 x 1 ¼" Slit Fit, Transformer Mounting
	14823-038	Screw, #8 x ⅜" Slit Pan, Junction Box Cover Mounting
TB1	39488-000	Terminal Strip, 20-Connector, #6-32 x ½" Slit Tr Screws and Nuts
P1	39491-101	Plug, 18-pin, (20 sockets), female type to Master Unit PC Board
	41700-000	P1 plug and wire assembly
	41699-000	TB1, P1 and Wire, complete Assembly
	39494-000	Polarizing Key (2 required, installed in each end socket of P1)
	39489-000	Eyelet
	31507-001	Screw #6 x ¾" Ph Rd, (TB1 mounting (3 required)
	47097-000	Installation Instructions

## MODEL S-2250 MASTER UNIT

10520-900 Complete Assembly  
41764-000 PC Board Assembly

## HORNS AND BUZZERS

B1	36070-000	Buzzer, SIGNAL; 12V, Screw, #8-32 x ¾", Slit Rd. Hd. Machine; Buzzer mounting
B2	26604-000	Horn, ALARM, 12V, complete assembly with connecting wires
	41708-000	

Schematic Symbol	NuTone Part No.	Description
<b>CAPACITORS</b>		
C1	35091-101	470, + 100%, - 10%, 35WVDC Electrolytic
C2, C15	35091-104	33, + 100%, - 10%, 25WVDC Electrolytic
C3	35091-116	100, + 100%, - 10%, 25WVDC Electrolytic
C4, C11, C13	35024-101	.47, ±20%, 75V, Polyester Film
C5, C10, C17, C18	35100-139	.01, + 80%, - 20%, 50V Ceramic Disc
C6, C7, C8	Not Used	
C9	35024-103	.047, ±20%, 100V, Polyester Film
C12	Not Used	
C14, C16, C21, C22	35100-127	.1, + 80%, - 20%, 100V Ceramic Disc
C19, C20	Not Used	
<b>DIODES</b>		
D1, D2	36608-000	Silicon Rectifier Power Supply, 3 Amp DC, 100PIV; General Instrument 1N540Z
D3 - D6, D8, D9, D13, D15, D16, D25, D27	36549-000	Silicon Rectifier Type, 1 Amp DC, 100 PIV; 1N4002
D7	36539-000	Zener, Silicon, 12V ±5%: 1N4742A
D10, D11, D12	Not Used	
D14, D18, D24	36632-000	Zener Silicon, 27V ±10%: 1N4750
D17, D19, D20	Not Used	
D21, D21, D23	36631-000	Zener, Silicon, 15V, ±5%: 1N744Z
<b>FUSES</b>		
F1	31160-000	2 Amp. AGC3, 12Vdc line to P1/J1-8
F2	31160-000	2 Amp, AGC3, Remote Alarm Horns and/or Bell
	39634-000	Clip, F1 and F2 (2 required for each fuse)
	9686-004	Clip, spare fuse
<b>INDICATOR LAMPS</b>		
I1	36637-000	LED, Green, 50 ma maximum 5PIV: AC ON PILOT Xciton XC556-G-2
I2	36637-000	LED, Green, 50 ma maximum 5 PIV: INTRUDER CIRCUIT ARMED
	41725-000	Xciton XC556-G-2 I2, Wire and Sleeving, Complete Assembly
I3	Not Used	
I4	39438-000	Neon, 105-125V, Alarm Horn Circuit Protection: G.E. Glow Lamp Xc2A-ET(NE-2H3T) or engineering equivalent
<b>CONNECTORS</b>		
J1	39500-000	18-Pin male, connect through P1 to TB1
J2	41814-000	3-pin male and wire assembly, connect through P2 to a-c voltage from T1
J3	Not Used	
J4	39499-107	10-Pin (12 sockets) female, connect through P4 to S-2280 Exit/Entry Timer

Schematic Symbol	NuTone Part No.	Description
J5	39499-106	8-Pin (10-sockets) female, connect through P5 to S-2375 Auxiliary Contacts
J6	39499-107	10-Pin (12-sockets) female, connect through P6 to S2330 Alarm Shutdown Timer
J7	39499-103	3-Pin (6-socket) female, connect through P307 to S-2370 Battery Charger
	39494-000	Key, polarizing, for use in extra sockets in J4, J5, J6 and J7
<b>RELAYS</b>		
K1	39505-000	DPDT, AC/DC supply switching: Contact Rating .03 to 5 Amp resistive; and 2.5 Amp Inductive @ 24Vdc. Coil: 400 ohms ±10%; Nominal 12Vdc ±33%; must pull-in at 8V or less at 25°C. RBM 164-321104-1110
K2	39506-000	Cornell Dubilier 683-674B SPST, OFF/ON switch for alarm horns and/or bell. Contact Rating .03 to 5 Amp resistive; and 2.5 Amp inductive @ 24Vdc. Coil: 360-550 ohms; nominal 12Vdc ±33%; must pull-in at 8V or less at 25°C. Cornell Dubilier 601-675B. RBM #64-153151-100. Price Electronic 28B111AE-0120. North Amer. Phillips 28B111AE-0120.
K3	Not Used	
<b>TRANSISTORS</b>		
Q1, Q6	36613-000	NPN Silicon Motorola MPS A20
Q2	36605-000	Texas Inst. T1S-98
Q3	36615-000	NPN Silicon Power Regulator Motorola MPS-U05
Q4, Q5	Not Used	
<b>RESISTORS</b>		
R1	33101-102	1K ±10%, ½ watt, carbon
R2, R3, R17	33082-561	560
R4, R5	Not Used	
R6	33082-822	8.2K
R7, R32, R47	33082-105	1M
R8, R18, R30, R34	33082-104	100K
R9, R27, R28	33082-224	220K
R10	Not Used	
R11, R25, R41, R49	33082-103	10K
R12, R24, R50	33082-102	1K
R13	33051-101	620K ±2%, ½ watt, Metal Film
R14, R15, R16, R19, R20, R21, R22, R23	Not Used	
R26	33082-334	330K
R29	33101-105	1M ±10%, ½ watt, carbon
R31	33082-221	220
R33	Not Used	
R35	34042-000	100K, Rheostat, Bias Generator Frequency Adjust (Early Production Only)
R35	33082-104	100K (Later Production)

Schematic Symbol	NuTone Part No.	Description
R36, R37, R38, R39, R40, R42, R43, R48	Not Used	
R44	33082-273	27K
R45	33082-220	22
R46	Not Used	
R51	33082-474	470K
R52	33082-183	18K
R53	33082-121	120
R54	33082-182	1.8K
	Not Used	

### SWITCHES

S1	Not Used	
S2	34621-000	5-Position Rotary, 2 end positions are momentary contact:
S3	39512-000 39508-000	Knob, S2 rotary switch DPDT, Slide, RESET; momentary in Reset Position Switchcraft XW-2790
S4	Not Used	
S5	39502-000	DPST, Slide, INTERIOR INTRUDER OFF/ON: Switchcraft 4620LR (modified) Bracket, switch S5 Screw, #6-32 x 1/4" Slit. Pan "23"
	38669-003 25511-015	S5 to bracket mounting S5 and Bracket complete assembly
	41797-000	

### TRANSFORMER

T1	41697-000	Complete assembly, including: transformer, Junction box cover, wire, and plug P2 (normally supplied with S-22/23R Rough-in Housing)
	30596-000	Transformer only: Primary 120Vac, 60 Hz; Secondary 28Vac (14Vac each side of center tap), 30VA; Rectified DC 1.5A average; Primary circuit protected by automatic reset thermo breaker operating at 114°C ±5°C.

### TERMINAL BOARDS

TB1	39488-000	See listing under S-22/23R Rough-in Housing, above.
-----	-----------	---

### INTEGRATED CIRCUITS

Z1	36625-000	14-Pin Monolithic Quad Norton Operational Amplifier: Motorola MC-3301-P Nat Semiconductor LM-3900N or LM2900N
Z2	36630-000	14-Pin, Quad 2-input AND Gates: Motorola MC 14081 CP Solid State Scientific SCL-4081-AE
Z3, Z4	36644-000	14-Pin, Quad 2-input Nor Gates: RCA CD4001 AE (only)

### IC SOCKETS

	39501-000	14-Pin
--	-----------	--------

### MISCELLANEOUS

	41766-000	Control Panel, complete assembly
	41767-000	Door, complete assembly
	39509-000	Lock, 3-position
	39510-003	Cam
	39568-000	Hinge Pin

Schematic Symbol	NuTone Part No.	Description
	41710-000	Mounting bracket and screws, assembly
	39415-000	Retainer Strap
	76845-015	Screw, #8 x 1/2" Ph Truss
	38673-000	Mounting, retainer strap
	46455-000	Cover, battery and wiring
	47185-000	Label, fuse
	3867-000	Label, Operating Instructions
	2257-000	Inlay, Control
	47092-000	Label, Warning
	47187-000	Installation Instruction Sheet Homeowners Manual

## MODEL S-2330 ALARM SHUTDOWN TIMER

10780-900	Complete Assembly
-----------	-------------------

### CAPACITORS

C601, C602, C603, C608	35100-127	.1, +80%, -20%, 100V, Ceramic Disc
C604	35100-127	.1, +80%, -20%, 100V, Ceramic Disc
C605, C606	35024-101	.47 ±20%, 75V Polyester Film (Early Production Only)
C607	35100-159	.01 ±10%, 500V Ceramic Disc
C609	35100-166	.01 ±20%, 150V Ceramic Disc (Later Production Only)
C610	35100-127	.1, +80%, -20%, 100V Ceramic Disc (Later Production Only)

### DIODES

D601-D607	36617-000	Silicon Switching, 50ma., 75 PIV: 1N914
-----------	-----------	--

### CONNECTORS

P600	39521-103	10-Pin (12-sockets), male: Connect at J6 to Master Unit PC Board
------	-----------	--

### TRANSISTORS

Q601	36613-000	NPN Silicon: Motorola MPS-A20 Texas Inst. T1S-98
------	-----------	--

### RESISTORS

R601	34058-000	750K Rheostat, Timer Control
R602	33082-474	C.T.S. Corp. X-201 470K
R603, R604, R607	33082-105	1M
R605	33082-564	560K
R606	33082-104	100K
R608, R609, R610, R612	33082-225	2.2M
R611, R614	33082-224	220K
R613	33081-473	47K (Early Production)
R613	33082-183	18K (Later Production)
R616	33082-104	100K (Later Production only)

### INTEGRATED CIRCUITS

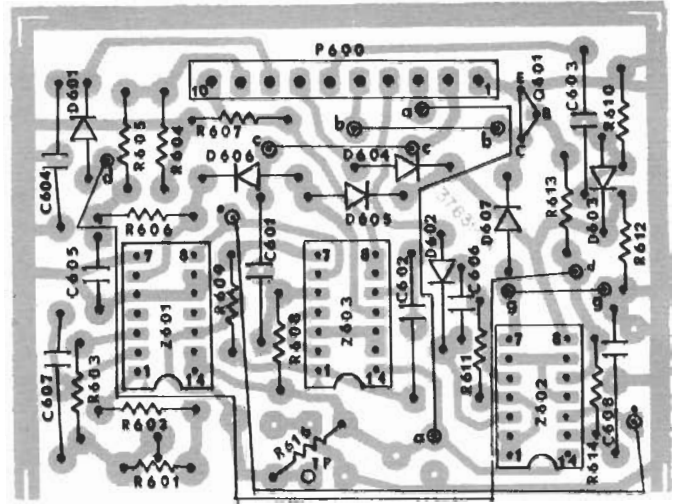
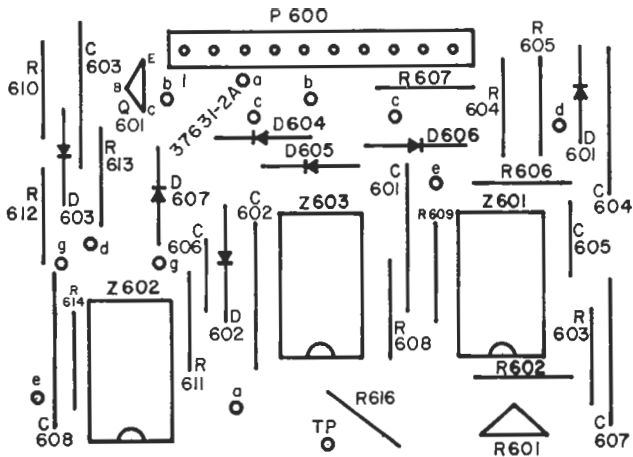
Z601	36633-000	14-Pin, Oscillator Timer Motorola MC 14541 CP
Z602, Z603	36644-000	14-Pin, Quad 2-input Nor Gates: RCA CD4001 AE (only)

## MODEL S-2370 BATTERY CHARGER

10860-900	Complete Assembly
41732-000	PC Board, complete assembly

Schematic Symbol	NuTone Part No.	Description
<b>CAPACITORS</b>		
C301	35091-108	100, + 100%, - 10%, 25WVDC Electrolytic
C302	35055-102	.15 ±20%, 100V Polyester Film
C303	35091-113	330, + 100%, - 10%, 35WVDC Electrolytic
<b>DIODES</b>		
D301	36638-000	Zener, Silicon, 13V ±1%: Motorola .5M13ZS1 1N4743
D302-D308	36549-000	Silicon Rectifier Type 1 Amp DC, 100 PIV: 1N4002
<b>FUSES</b>		
F301	31160-000 41735-000 47521-000 39528-000	2 Amp, AGC3 Fuseholder, for F301, complete Assembly Label, Fuse Rating Insulating Pod, fuseholder
<b>INDICATOR LIGHT</b>		
LED301	36637-000 41785-000	Light Emitting Diode, Green, 50 ma Maximum, 5PIV; BATTERY CHARGING INDI- CATOR Xciton XC556-G-2 LED301, wire, and sleeving, complete assembly
<b>CONNECTORS</b>		
P307	39521-101	3-connections (6-sockets), male, for connecting at J7 to Master Unit Control PC Board
<b>TRANSISTORS</b>		
Q301	36605-000	NPN Silicon, Power: Motorola MPS-U05
Q302	36577-000	PNP Epitaxial Planar Silicon: Texas Instrument SKA-4223
Q303, Q304	36613-000	NPN Silicon Motorola MPS A-20 Texas Instrument T1S-98
Q305	36614-000 38613-000 31990-015	PNP Silicon single diffused: Motorola MJE-A-20 Heat Sink for Q305 Screw, #4-40 x 1/2" Ph. Pan, Heat Sink Mounting
Q306	11159-003 36606-000	Nut, #4-40, Hex PNP Silicon Motorola MPS-K71

Schematic Symbol	NuTone Part No.	Description
<b>RESISTORS</b>		
R301, R305	33101-151	150 ±10%, 1/2 watt Carbon
R302	33101-180	18 ±10%, 1/2 watt Carbon
R303, R309	33101-102	1K ±10%, 1/2 watt Carbon
R304	33101-221	220 ±10%, 1/2 watt Carbon
R306	33030-110	5 ±10%, 5 watt, Wire Wound
R307	33082-471	470
R308	33082-223	22K
R310	33101-391	390 ±10%, 1/2 watt Carbon
<b>MISCELLANEOUS</b>		
	41733-000	Envelope Assembly including Insulating Pod for battery connecting cables; LED301 Label; Cable Clamp; and Mounting Screw
	47104-000	Label, Battery, Neg
	47105-000	Label, Battery, Pos
<b>MODEL S-2375 AUXILIARY CONTACTS</b>		
	10885-900	Complete Assembly
<b>DIODES</b>		
D501, D502	36549-000	Silicon Rectifier Type 1 Amp DC, 100 PIV: 1N4002
<b>RELAYS</b>		
K501, K502	39522-000	SPDT, Auxiliary power switch- ing. Contact Rating: 2 Amp Resistive; 1 Amp inductive; @ 24V. Coil: 400 ohms ±10%; nominal 12Vdc; must pull-in at 9Vdc or less at 25°C. Sigma Instruments 78RE1-12DC
<b>CONNECTORS</b>		
P500	39521-102	3-Pin (6-socket), male, connect at J7 to Master Unit PC Board
<b>TRANSISTORS</b>		
Q501, Q502	36613-000	NPN Silicon Motorola MPS-A20 Texas Instrument T1S-98
<b>RESISTORS</b>		
R501, R502	33082-393	39K



**MODEL S-2330 ALARM SHUTDOWN TIMER  
OPERATING VOLTAGES AND LOGIC STATE**

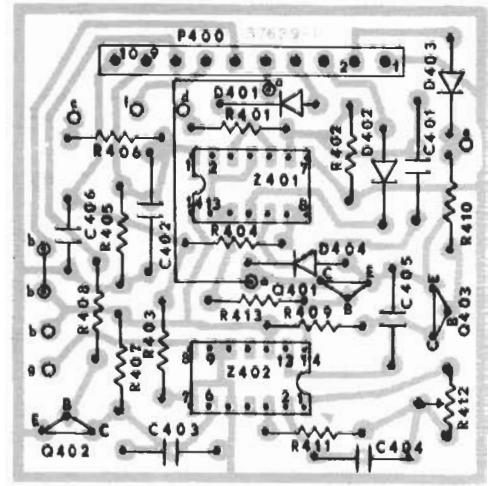
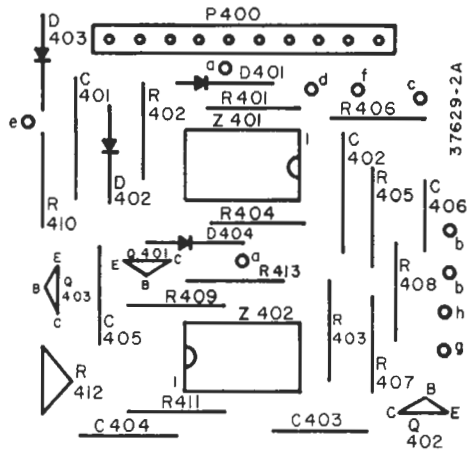
When the system is in standby (no alarm circuit activated) the voltages and logic state are as shown in schematic diagram.

INTRUDER DETECTION CIRCUIT(S) ACTIVATED			
Device	Terminal	Alarm Horn On	Alarm Horn Off
Z601	1	5.45V	OV
	2	5.85V	11.4V
	3	5.30V	OV
	5/7/9/10	OV	OV
	6 (INPUT)	OV	10.7V
	8 (OUTPUT)	OV	11.4V - OV*
	12/13/14	11.4V	11.4V
Z602A**	1/2	LO	—
	3 (OUTPUT)	HI	—
Z602B**	5	LO	—
	6	HI	LO
	4 (OUTPUT)	LO	—
Z602C	8	LO	LO
	9	HI	LO
	10 (OUTPUT)	LO	HI
Z602D	12	LO	LO
	13	LO	HI
	11 (OUTPUT)	HI	LO
Z603A	1	LO	LO
	2	LO	LO
	3 (OUTPUT)	HI	HI
Z603B	5	HI	HI
	6	LO	LO
	4 (OUTPUT)	LO	LO
Z603C	8/9	HI	HI
	10 (OUTPUT)	LO	LO
Z603D	12/13	HI	HI
	11 (OUTPUT)	LO	LO
Q601***		OFF	ON

NOTE: (\*) Timing cycle begins when alarm is activated and Z601-6 goes LO. When timing cycle is completed, Z601-8 goes HI (11.4V) for a short pulse, system resets and Z601-8 goes LO. Timing cycle is controlled by R601. Full clockwise position: 15-minutes. Full Counter Clockwise position: 5-minutes. Normally set near center for 10 minutes.

(\*\*) Z602A/Z602B: form multivibrator that is ON when Z602B-6 is LO. When output at Z602A-3 goes LO, the Buzzer Pulsar in S-2300 Master Unit is turned ON.

(\*\*\*) Q601 is on (saturated) when Z602C-10 is HI; Vc = Ve.

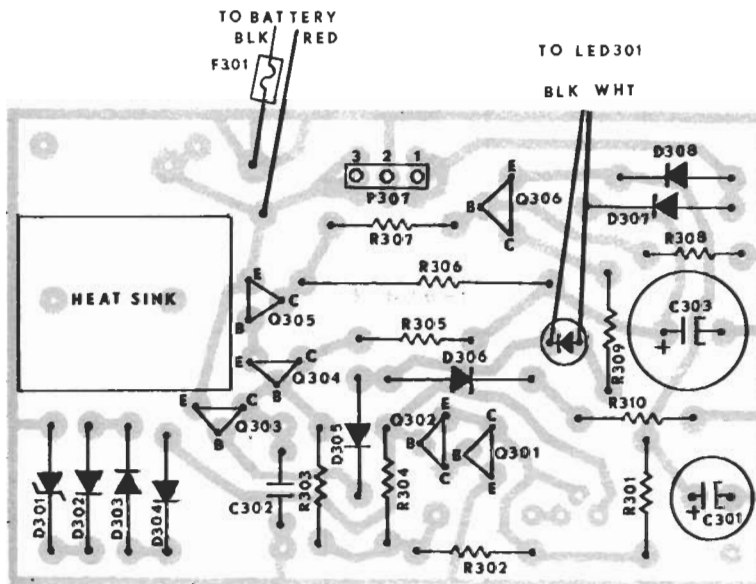
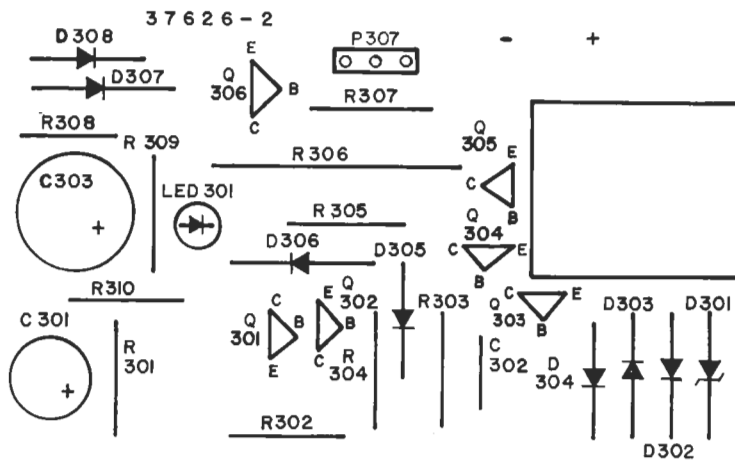


### MODEL S-2280 EXIT/ENTRY TIMER OPERATING VOLTAGES AND LOGIC STATE

When S401 is in INSTANT (Position #3), it does not effect the system operation. Voltages and logic state are as shown in the schematic diagram.

Device	Terminal	S401 POSITION AND OPERATING MODE					
		Depart	Before Door Opened	#2		Door Opened To Re-Enter Bldg. (Delayed Alarm)	
				Leaving Bldg.	Door Opened To Re-Enter Bldg. (Delayed Alarm)		
					Door Opened	Door Closed	Alarm Off
Z401A	1	HI	LO	LO	LO	LO	LO
	2	HI	HI	HI	LO	LO	LO
	(OUT) 3	LO	LO	LO	HI	HI	HI
Z401B	5	LO	LO	LO	HI	HI	HI
	6	LO	LO	LO	LO	LO	LO
	(OUT) 4	HI	HI	HI	LO	LO	LO
Z401C	8/9	LO	LO	HI	LO	HI*	HI*
	10	HI	LO	LO	HI	LO*	LO*
Z401D	12/13	HI	HI	HI	LO	LO	LO
	11	LO	LO	LO	HI	HI	HI
Q401		ON**	ON	ON	OFF**	OFF	OFF
Q402		OFF**	OFF	OFF	OFF	ON**	ON
Q403***		OFF	OFF	OFF	OFF	OFF	OFF
Z402	1	OV	OV	OV	OV	6V	5.9V
	2	11.4V	11.4V	11.4V	11.4V	5.4V	5.4V
	3	OV	OV	OV	OV	5.8V	5.8V
	5/7	OV	OV	OV	OV	OV	OV
	(IN) 6	11.4V	11.4V	11.4V	11.4V	0.8V	0.56V
	(OUT) 8	OV	OV	OV	OV	0.07V	11.4V
	9/10	OV	OV	OV	OV	OV	OV
	12/14	11.4V	11.4V	11.4V	11.4V	11.4V	11.4V
****	(CON) 13	11.4V	11.4V	11.4V	11.4V	11.4V	11.4V

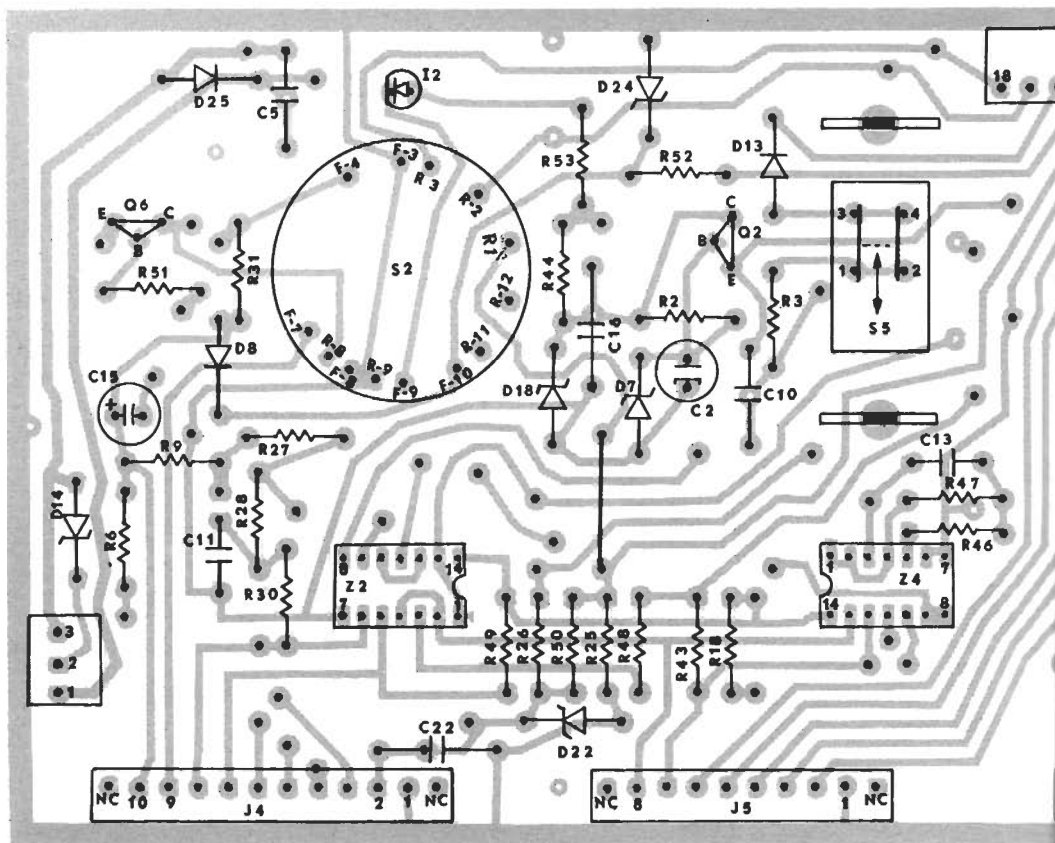
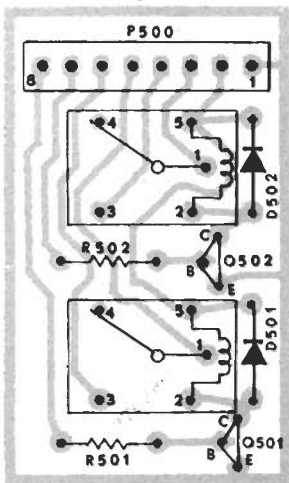
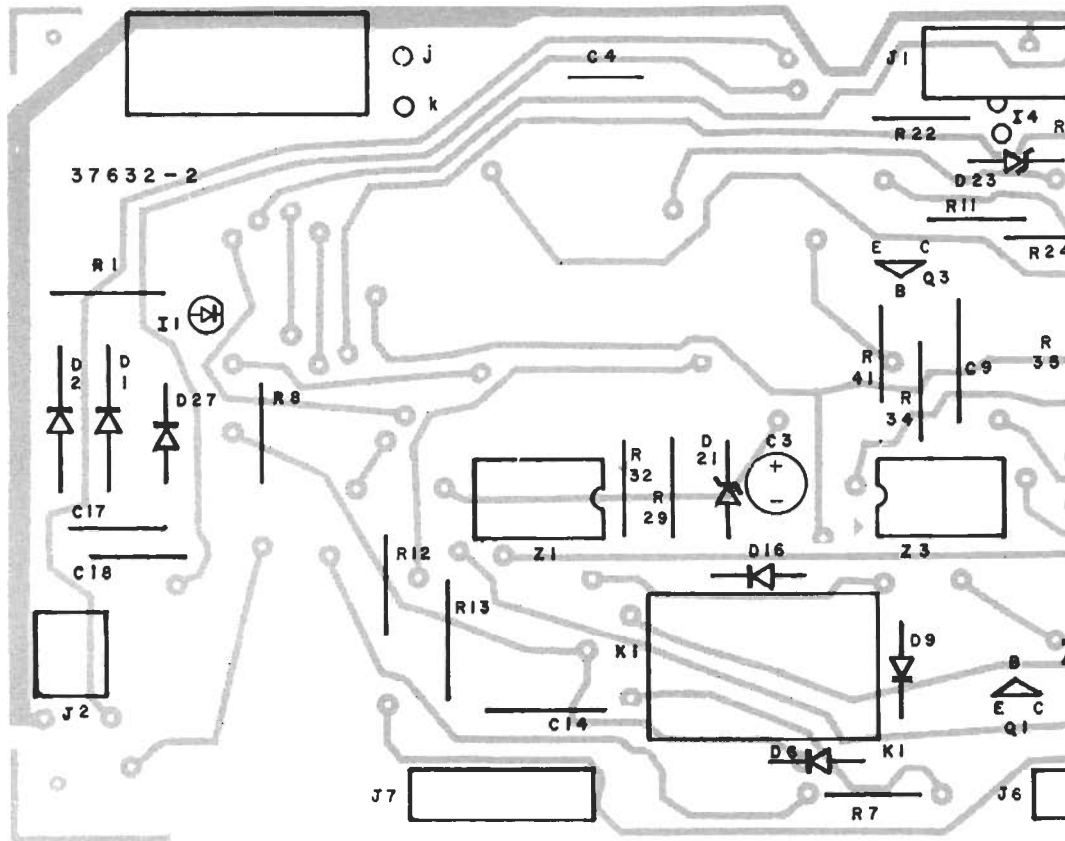
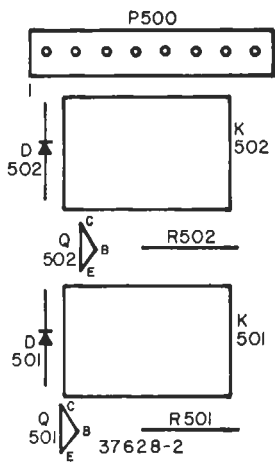
- NOTE: (\*) If door is immediately closed, input and output state will be reversed, but positive pulse from HI output will not change state of Z401B.
- (\*\*) When transistors are ON, their bases are forward biased and their Vc is approximately equal Ve. When transistors are OFF, their bases are not forward biased and their Vc is equal to VDD. (11.4V).
- (\*\*\*) Normally OFF, will be turned on if the Interior Intruder Detection Circuit and/or the Manual Emergency Alarm Circuit is activated.
- (\*\*\*\*) If S401 is in DEPART or DELAYED ENTRY, and Q403 is turned ON, Z402-13 goes LO, and the timing cycle of Z402 is completed immediately.

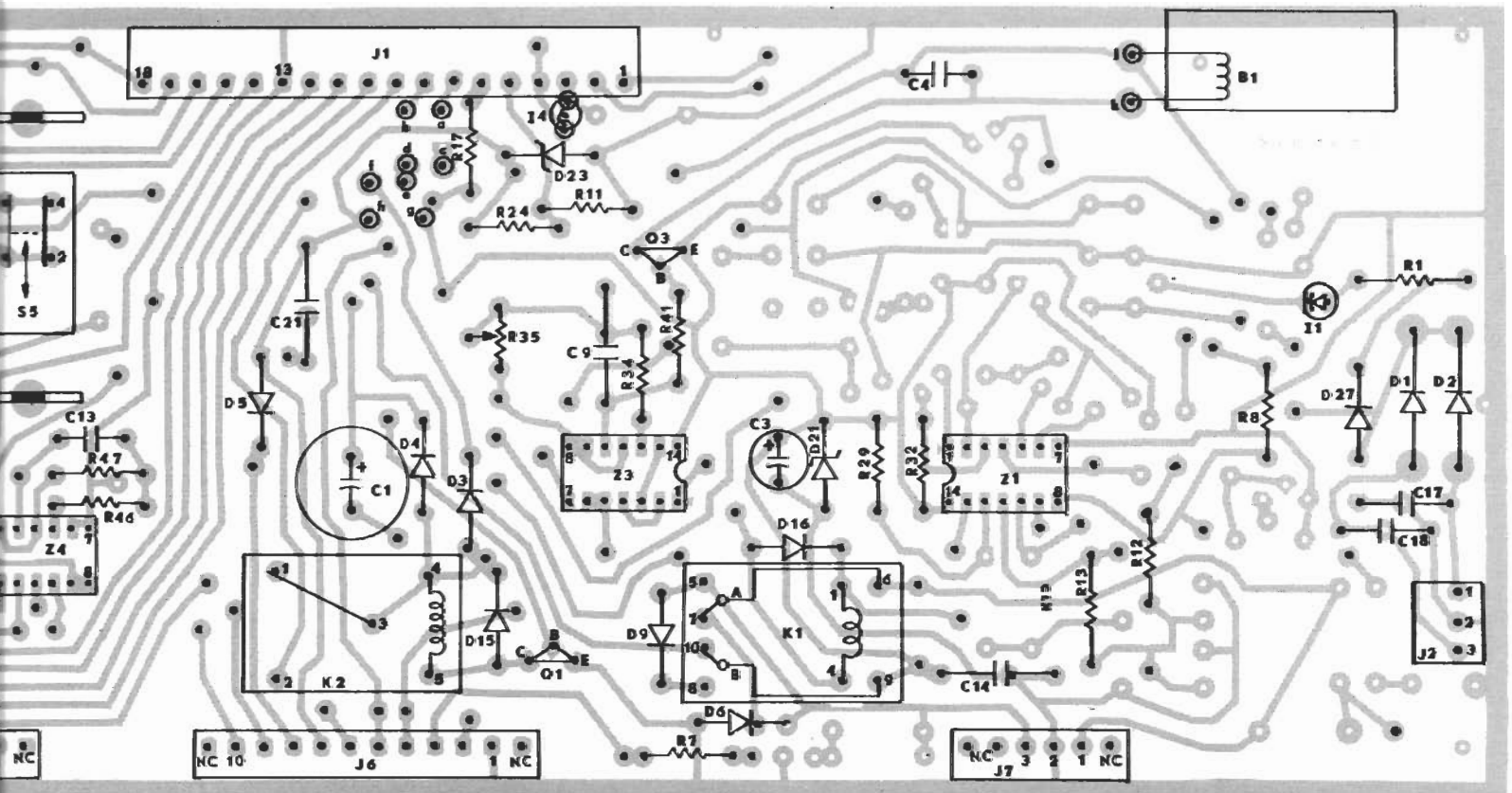
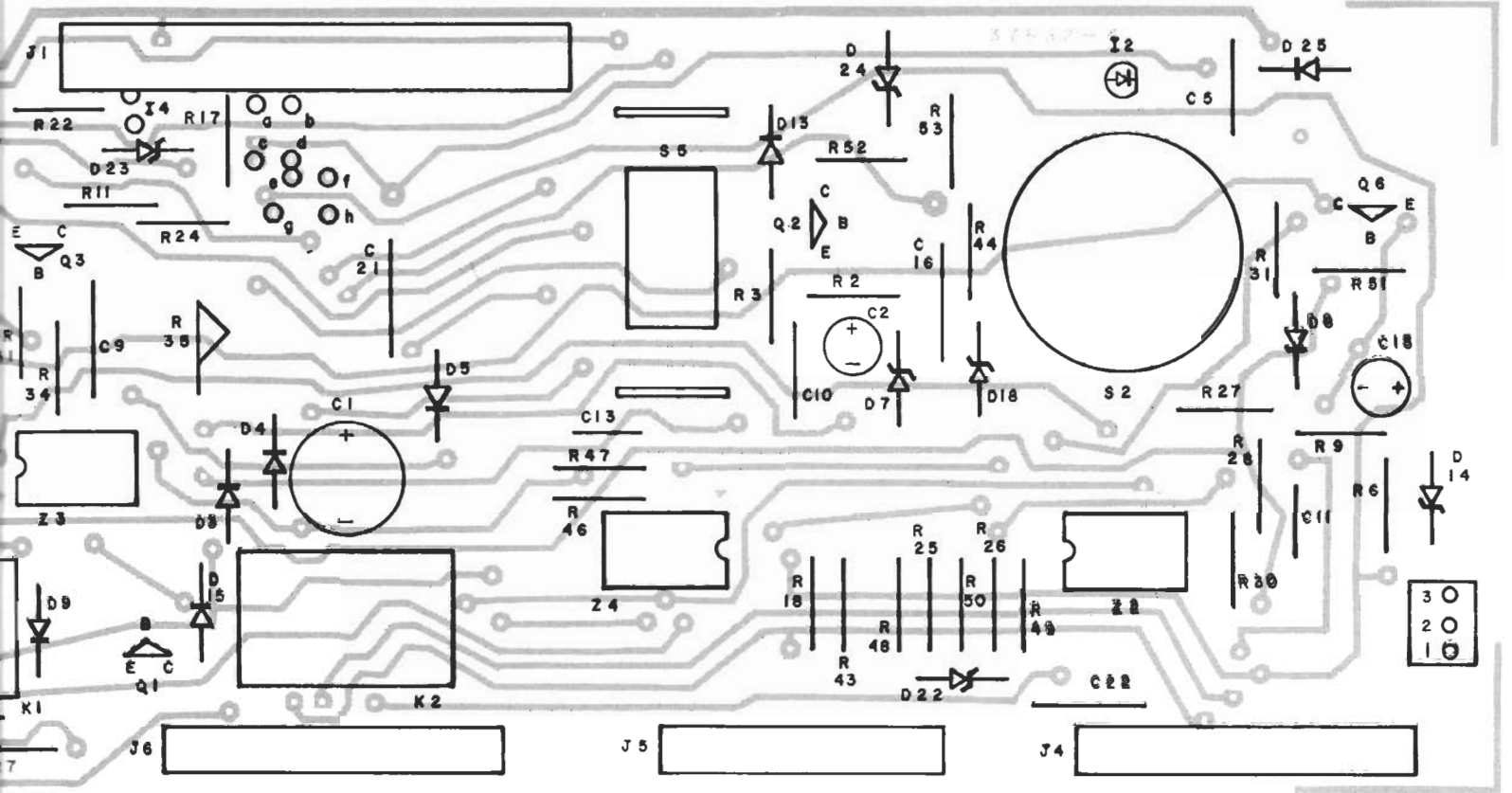


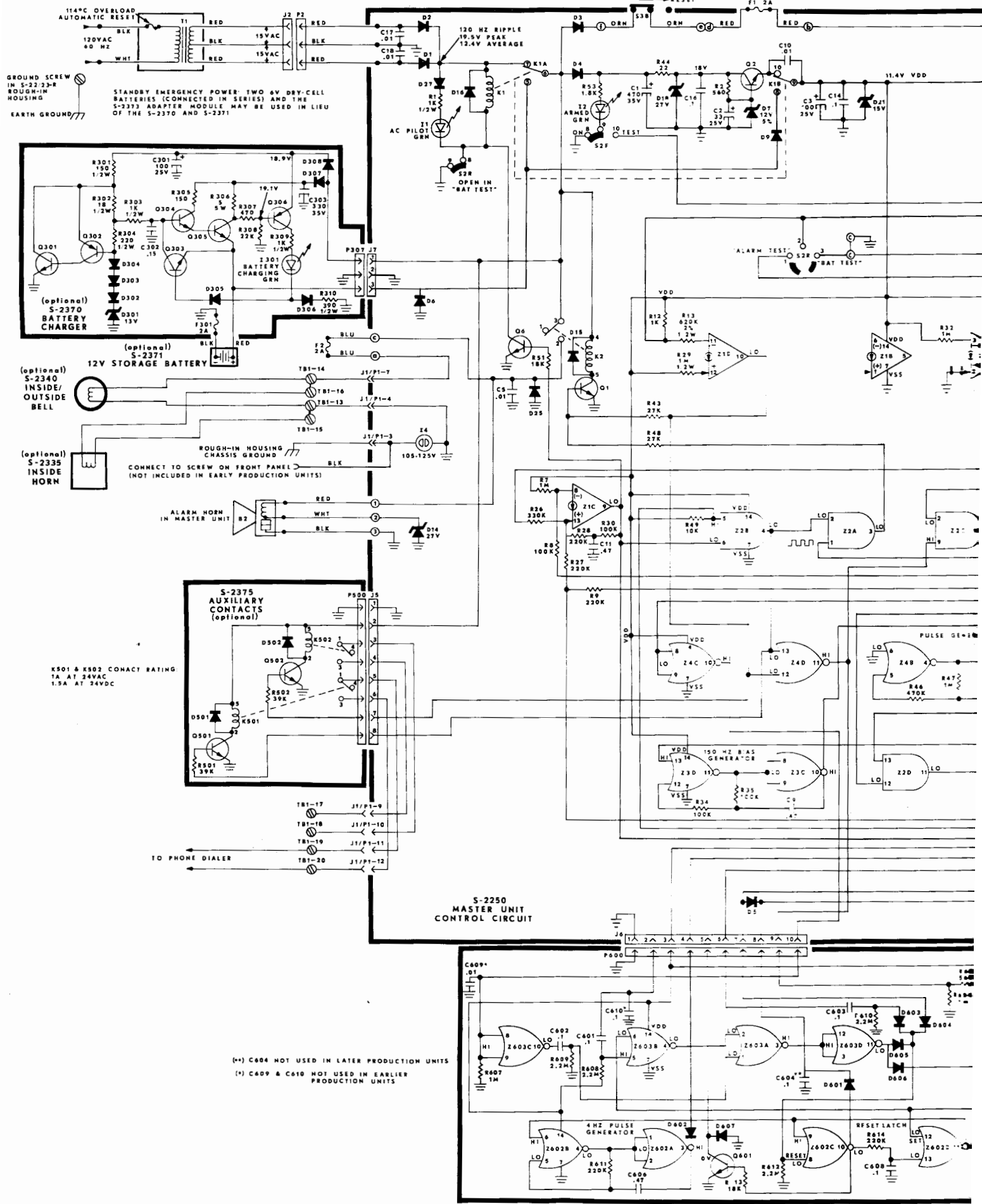
S-2370 BATTERY CHARGER  
 OPERATING VOLTAGES  
 START OF CHARGING CYCLE  
 LED301 ON

DEVICE	E	B	C
Q301	0	.6	14.6
Q302	14.6	14.0	.6
Q303	12.2	4.32	13.8
Q304	13.0	13.8	13.1
Q305	12.4	13.0	12.5
Q306	16.7	15.8	16.5





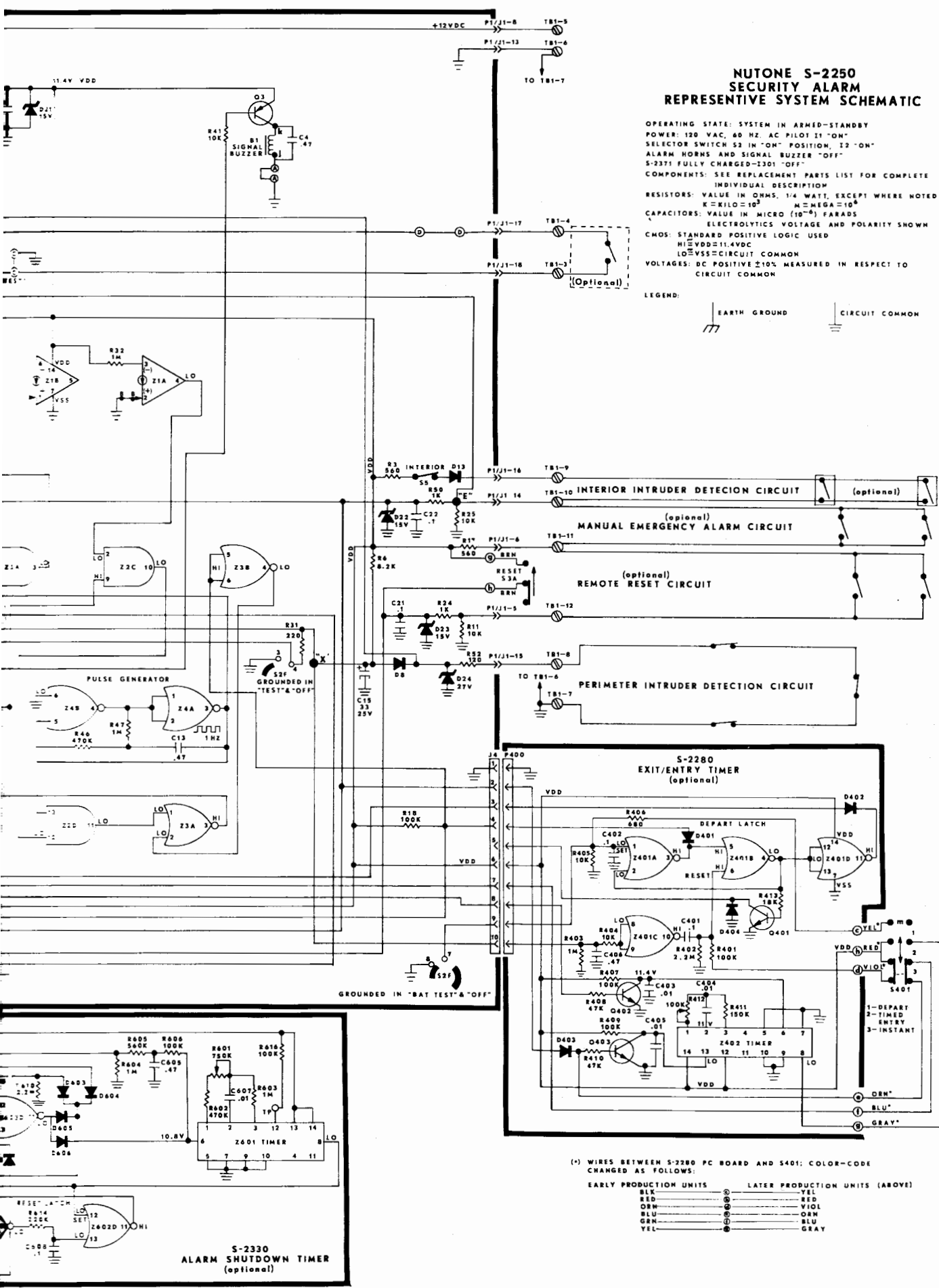




## NUTONE S-2250 SECURITY ALARM REPRESENTATIVE SYSTEM SCHEMATIC

OPERATING STATE: SYSTEM IN ARMED-STANDBY  
 POWER: 120 VAC, 60 HZ, AC PILOT 11 "ON"  
 SELECTOR SWITCH S2 IN "ON" POSITION, I2 "ON"  
 ALARM HORNS AND SIGNAL BUZZER "OFF"  
 S-2371 FULLY CHARGED-1301 "OFF"  
 COMPONENTS: SEE REPLACEMENT PARTS LIST FOR COMPLETE  
 INDIVIDUAL DESCRIPTION  
 RESISTORS: VALUE IN OHMS, 1/4 WATT, EXCEPT WHERE NOTED  
 K=KILO=10<sup>3</sup> M=MEGA=10<sup>6</sup>  
 CAPACITORS: VALUE IN MICRO (10<sup>-6</sup>) FARADS  
 ELECTROLYTICS VOLTAGE AND POLARITY SHOWN  
 CMOS: STANDARD POSITIVE LOGIC USED  
 HI=VDD=11.4VDC  
 LO=VSS=CIRCUIT COMMON  
 VOLTAGES: DC POSITIVE ±10% MEASURED IN RESPECT TO  
 CIRCUIT COMMON

LEGEND:  
 EARTH GROUND  
 CIRCUIT COMMON



(\*) WIRES BETWEEN S-2280 PC BOARD AND S401: COLOR-CODE CHANGED AS FOLLOWS:

EARLY PRODUCTION UNITS	LATER PRODUCTION UNITS (ABOVE)
BLK	YEL
RED	RED
ORN	VIOL
BLU	ORN
GRN	BLU
YEL	GRAY

DEVICE	TERMINAL	OPAMP Z1 STAGES	
Z1C	(-) 8	lin (greater)	lin (less)
	(+) 13	lin (less)	lin (greater)
	(OUT) 9	LO	HI
Z1D	(-) 11	lin (greater)	lin (less)
	(+) 12	lin (less)	lin (greater)
	(OUT) 10	LO	HI

**"AND" GATE TRUTH TABLE**

DEVICE	TERMINAL	LOGIC STATES				DEVICE	TERMINAL	LOGIC STATES			
Z2A	(IN) 1*	HI	LO	HI	LO	Z2C	(IN) 8	HI	LO	HI	LO
	(IN) 2	HI	HI	LO	LO		(IN) 9	HI	HI	LO	LO
	(OUT) 3	HI	LO	LO	LO		(OUT) 10	HI	LO	LO	LO
Z2B	(IN) 5	HI	LO	HI	LO	Z2D	(IN) 12	HI	LO	HI	LO
	(IN) 6	HI	HI	LO	LO		(IN) 13*	HI	HI	LO	LO
	(OUT) 4	HI	LO	LO	LO		(OUT) 11	HI	LO	LO	LO

\*Inputs: Z2A-1 and Z2D-13, are normally switched between HI and LO at a one HZ. rate as determined by output of the Pulser Z4A/Z4B.

**"NOR" GATES TRUTH TABLE**

DEVICE	TERMINAL	LOGIC STATES				DEVICE	TERMINAL	LOGIC STATES			
Z3A	(IN) 1	HI	HI	LO	LO	Z4D	(IN) 12	HI	HI	LO	LO
	(IN) 2	HI	LO	HI	LO		(IN) 13	HI	LO	HI	LO
	(OUT) 3	LO	LO	LO	HI		(OUT) 11	LO	LO	LO	HI

**INVERTERS**

DEVICE	TERMINAL	STATES		DEVICE	TERMINAL	STATES	
Z3B	(INPUT) 5/6	HI	LO	Z4C	(INPUT) 8/9	HI	LO
	(OUTPUT) 4	LO	HI		(OUTPUT) 10	LO	HI