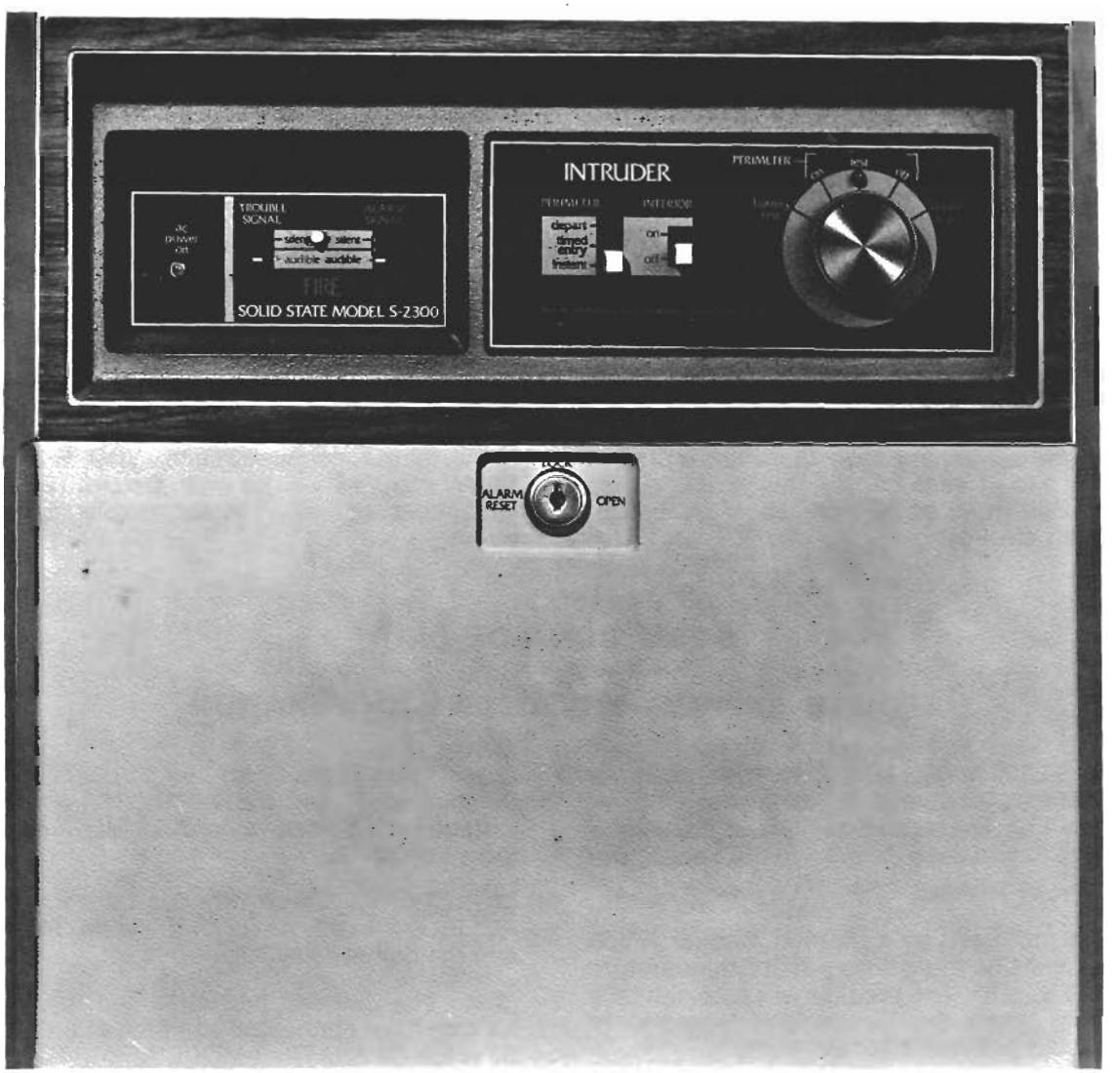
# SERVICE MANUAL
# NUTONE MODEL S-2300
# INTRUDER/FIRE ALARM SYSTEM

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# THEORY OF OPERATION

## GENERAL—SEE SCHEMATIC DIAGRAM

(1) The voltages specified in the following discussion and in the schematic diagram are DC positive (+) measured in relation to circuit common ground, unless otherwise noted.

(1.1) The specific voltages in individual systems may vary ±10% but the relationship between the various voltages should be very close to those shown.

(2) The Norton OpAmps (quad package, Z1A, Z1B, Z1C and Z1D) are current operated devices.

(2.1) When the current to the inverting (−) input is greater than the current to the non-inverting (+) input, the output is LO. (LO ≅ VSS = GROUND)

(2.2) When the current to the non-inverting (+) input is greater than that to the inverting (−) input the output is HI. (HI ≅ VDD = 11.4V)

(2.3) The actual voltage on the output terminals when they are LO may measure something less than .05V. Voltages of this magnitude on the output terminals may be disregarded.

(2.4) Voltages on the output terminals when HI may measure something less than full VDD—in the order of 9 to 11 volts. Again, this variation may be disregarded when considering the operation of the detection circuits.

(2.5) The current to either the inverting, or non-inverting input should not exceed 10 milliamps. Use of the high value resistors to the input terminals in the S-2300 limits these currents to a value approaching 10 to 12 microamps. If these resistors are shorted, they could cause an increase in input current great enough to destroy the quad OpAmps.

(3) The Master Unit utilizes standard CMOS quad, dual-input, NOR and AND gates. Positive logic is used throughout in describing the operation of these circuits:

(3.1) NOR gates Z3 and Z4: HI on either or both inputs will result in a LO output. (Each gate considered separately)

(3.1.1.) LO on both inputs results in a HI output.

(3.2) AND gate Z2: HI on both inputs results in a HI output.

(3.2.1) LO on either or both inputs results in LO output.

(3.3) HI input should exceed 70% of VDD to overcome noise rejection of the NOR and AND gates.

(3.4) In the actual circuits, VDD will approach 11.4V, and VSS will be near ground. (See possible exceptions as defined in paragraphs (2.3) and (2.4) above).

## S-2300 CONTROL UNIT

## POWER SUPPLY—120VAC, 60 HZ. OPERATION

(1) The S-2300 Master Unit is normally powered by the 120Vac, 60 Hz. that is fed through power transformer T1. The system will operate with a +10%, −15% variation (102Vac to 132Vac) in the supply.

(1.1) T1 is protected by a thermal breaker which opens one side of the primary if its temperature reaches 114°C ±5°. The breaker will automatically reset (close) when the transformer temperature falls below the activating temperature.

(1.2) When the source is 120Vac, T1's secondary voltage is 30Vac (15Vac each side of center-tap) at 30VA.

(2) T1's secondary 15Vac is full-wave rectified by D1 and D2.

(2.1) C18 and C17 suppress the diode switching noise which may be generated by D1 and D2. These capacitors also tend to attenuate any stray RF signals which may be present on the power line and coupled through T1.

(2.2) The full-wave rectified output at the cathode junction of D1 and D2 is a 120 Hz. positive ripple voltage with a peak value of 19.5V and an average d-c value of 12.4V.

(3) The unfiltered 12.4Vdc powers the green AC PILOT Light I1 (LED) through D27 and R1; and the coil of relay K1.

(3.1) The cathode end of I1 and the low end of K1's coil are connected to terminal 8 of S2R(rear). S2 is the OPERATING MODE SELECTOR SWITCH.

(3.2) When S2 is in PERIMETER INTRUDER POSITIONS: ON; TEST; or OFF; or when in (FIRE) ALARM TEST, S2R-8 will be connected to ground through S2R-9; I1 will be on (indicating that the system is operating on 120Vac; K1's coil will be energized; K1A will connect K1A-6 to K1A-7; and K1B will connect K1B-9 to K1B-10.( For Q6 function, see INTRUDER DETECTION CIRCUIT, below.)

(3.3) The unfiltered 12.4Vdc will power the system's S-188L (Smoke) and/or S-188LH (Smoke/Heat) Detectors, through RESET SWITCH S3B and the 2 Amp fuse F1.

(3.4) From K1A-6 the unfiltered +12.4Vdc supplies collector voltage to Q1 through alarm signal relay K2's coil, and when K2's contacts are closed it supplies power to the master unit alarm horn B2, and when used, to the external horn(s) through F2.

(3.5) When the system includes an S-2371 Storage Battery and S-2370 Battery Charger; and/or an S-2375 Phone Dialer, the unfiltered 12.4Vdc powers the Charger through J7/P307-1 and the Phone Dialer through J5/P500-2.

(3.6) This unfiltered 12.4Vdc also powers the collector of Q5 through the Fire Detection Circuit changeover relay K3's coil.

(4) The unfiltered 12.4Vdc is fed through D4 to the high (+) side of C1. This capacitor's filtering action results in a DC supply of approximately 19V.

(5) The 19V supply powers-through R23- the green PERIMETER INTRUDER CIRCUIT ON (AND TEST) INDICATOR LIGHT I2 (LED). The cathode end of I2 is connected to terminal S2F-9. When S2 is in ON, S2F-9 is connected to ground through S2F-8 and I2 will be on.

(5.1) When S2 is in TEST, S2F-9 is connected through S2F-10 and the Perimeter Intruder Detection Circuit, to ground and the light I2 will be on. If there is a break in the Detection Circuit, I2 will be off. (See INTRUDER DETECTION CIRCUIT, below.)

(6) The +19Vdc is fed through R22 to the collector of Q2, (Q2's Vc = 18V). The base of Q2 is clamped at 12Vdc by the 12V ±5% Zener diode D7, and Q2 acts as a voltage regulator.

(7) Q2's Ve is 11.4Vdc, (Ve = Vb-Veb = 12V −0.6V). This regulated 11.4V is fed through K1B-10/9 to the VDD line that powers Q3; Q4; Q5; Z1; Z2; Z3; Z4, and when used: the S-2280 Exit/Entry Timer; and the S-2330 Alarm Shutdown Timer.

## POWER SUPPLY—12V STANDBY BATTERY OPERATION

(1) The standby battery should be capable of powering the system, including five S-188L's and/or S-188LH's with all detector circuits armed, for 24-hours. At the end of the 24-hours, it should be capable of powering the alarm horn B2; an S-2340 Outside-Inside Alarm Bell; and an S-2335 Inside Alarm Horn for 4-minutes, if a detection circuit is activated.

(2) If the 120Vac power fails, or if S2 is in BATTERY TEST position, relay K1's coil will be de-energized and K1A will connect K1A-5 to K1A-6; and K1B will connect K1B-8 to K1B-9.

(3) If the S-2371 Storage Battery is used, it is protected against reverse connection by the 2 Amp fuse F301 that is in line with the black (−) battery lead. D6 protects the electronics by limiting the voltage to K1A-5/6.

(4) When S2 is in BATTERY TEST position, S2R-2 is connected to S2R-3 (FIRE TEST) and the steady fire alarm signal should be activated.

(5) After completing BATTERY TEST, activate the RESET SWITCH S3 to silence alarms.

## FIRE DETECTION CIRCUIT

(1) The regulated 11.4VDD is connected through R12 and R13 to the inverting (−) input terminal Z1D-11; and VDD is connected through R29 to non-inverting (+) input terminal Z1D-12.

(1.1) Current to Z1D-11 will exceed that at Z1D-12 and Z1D will be clamped off and the output at Z1D-10 will be LO.

(2) The normally positive first leg of the Fire Detection Circuit is connected internally, from the junction of R12 and R13 through K3-8/9 and J1/P1-1 to TB1-1.

(2.1) When the system does not include an S-188L nor S-188LH, this first leg is connected externally from TB1-1 to TB1-4, and internally to J1/P1-17.

(2.1.2) When the system includes an S-188L or S-188LH, the first leg is connected externally from TB1-1, through the closed contacts of relay K11 in the Smoke Detector to TB1-4 and then internally to P1/J1-17. THE SMOKE DETECTOR MUST BE CONNECTED EXACTLY AS SHOWN.)

(2.2) From J1-17 the first leg branches to S2R-2 and through R21 to ground; and the other branch goes through R37 to (−) terminal Z1B-6.

(3) The normally circuit grounded second leg of the Fire Detection Circuit is connected from circuit ground through K3-5/6 and J1/P1-2 to TB1-2, and then, externally from TB1-2 to TB1-3, and then internally through P1/J1-18.

(3.1) From J1-18, the second leg is connected through D11 and R19 to VDD. At the high side of R19, VDD is connected through R38 to the (+) terminal Z1B-1.

(4) Input current to Z1B-6 is greater than that to Z1B-1 and Z1B is turned off and output terminal Z1B-5 is LO.

(5) VDD is connected through R32 to (−) input terminal Z1A-3 and the (+) input terminal Z1A-2 is connected through R20 and D11 to ground and through R33 and R23 to LO Z1B-5.

(6) The current to terminal Z1A-3 is greater than that to Z1A-2 and Z1A is clamped off with output terminal Z1A-4 LO.

(7) The Heat Sensors; and the smoke detection switch K12-a in the Smoke Detectors(s) are connected between the two legs of the Fire Detection Circuit, if one or more of them are activated (closed) they will short the two legs of the circuit.

(7.1) If the OPERATING MODE SELECTOR SWITCH is in (fire) alarm TEST position, S2R-3 is connected to S2R-2 and the two legs of the Fire Detection circuit are shorted.

(8) When the two legs of the detection circuit are shorted, the voltage at the junction of R12 and R13 decreases to near zero and the input current of Z1D-11 decreases to less than that of Z1D-12—turning Z1D on and the output at Z1D-10 will go HI.

(9) At the same time the low-end of R37 is connected to ground and the current to Z1B-6 goes less than that to Z1B-1; Z1B is turned on and the output at Z1B-5 goes HI.

(9.1) The HI output of Z1B-5 is fed through R23 and R33 to terminal Z1A-2, making its current go greater than that of Z1A-3; turning Z1A on and its output terminal Z1A-4 will go HI.

(9.2) R23 and C8 form an RC time constant that delays rise in turn-on current to Z1A-2, preventing the trouble buzzer from sounding when power is restored after it has been interrupted.

(10) When Z1A-4 goes HI, the base of NPN transistor Q5 goes positive, turning Q5 on and energizing coil of K3.

(11) When K3's coil is energized, the external part of the first leg of the Fire Detection Circuit is connected to ground (K3-9 to K3-10); and the normally grounded second leg will be connected through K3-6 and K3-7 and R12 to VDD. This will clamp Z1B and Z1A on, even if the short between the two legs is removed.

(12) The HI (positive voltage) from Z1D-10 is connected through R15 and R14 to Z1D-12—clamping the input current of Z1D-12 greater than that of Z1D-11 even if the short between the two legs of the Fire Detection Circuit is removed; keeping Z1D turned on and its output at Z1D-10 latched to HI.

(13) The HI from Z1D-10 is connected through R43 to the base of NPN transistor Q1; turning it on (saturated), and energizing the coil of relay K2.

(13.1) When K2 is energized, K2-3 is connected to K2-2 and the unfiltered 12.4Vdc will energize the Master Unit alarm horn B2 through ①, and when used, the remote S-2335 Horn and/or S-2340 Bell through F2 and TB1-14/16.

(13.2) I4 is a 105-125V neon lamp that protects against static charges between the Master Unit PC board circuit ground and earth ground.

(13.3) D15 protects Q1 from excessive reverse kick-back voltages when K2 is turned off.

(14) The HI on Z1D-10 is connected to Timer Gate Z4D-12 causing Z4D-11 to go LO. The LO from Z4D-11 is connected to Buzzer Inhibit Z2C-9, keeping Z2C-10 LO.

(15) The LO on Z2C-10 is connected to Z2D-12, keeping Buzzer Gate Z3A-3 HI and the Buzzer Pulser Multivibrator off with its output at Z3C-10 HI. The HI from Z3C-10 is fed through R41 to the base of PNP transistor Q3—keeping Q3 off and B1 de-energized (silent).

(16) The LO output of the Timer Gate Z4D-11 is also fed through J6/P600-9 to the Alarm Shutdown Timer. (See ALARM SHUTDOWN TIMER operation, below.)

(17) When Z1A-4 goes HI, the HI is connected to Z2C-8, but because Z2C-9 is held LO by Z4D-11, the Buzzer Inhibit output Z2C-10 is held LO, and the trouble buzzer B1 can not be activated (refer Para (14) above).

(18) To turn the alarm horn(s) and bell off, and to return the Fire Detection Circuit to its normal "Standby-Armed" condition, throw RESET SWITCH S3 to on.

(18.1) S3A will connect VDD from ⓖ to ⓗ and then through D5 and R45 to Z1D-11(−) causing its input current to exceed that of Z1D-12 (+); Z1D will be turned off and the output at Z1D-10 will go LO.

(18.2) VDD will also be fed from ⓗ through D19 and R10 to terminal Z1A-3(−), causing its input current to exceed that of Z1A-2, turning Z1A off and the output at Z1A-4 will go LO.

(19) When Z1D-10 is LO, Q1 is turned off and K2's contacts will break the 12V to the alarm horns.

(20) When Z1A-4 is LO, Q5 will be turned off and K3's contacts will return to their normal position, i.e. K3-9 to K3-8 and K3-6 to K3-5.

(21) If, when K3 is returned to normal, the short between the two legs of the Fire Detection Circuit is absent, the circuit will return to its normal "Standby-Armed" condition, Note also, that Z1B will now be turned off with its output at Z1B-5 switched to LO.

(22) THE REMOTE RESET CIRCUIT: Connected from VDD, through R17; J1/P1-6 to TB1-11 internally, and then externally from TB1-11 to the open remote reset button—PB-14 Pushbutton(s) and/or S-2284 Key Switch(es). The other side of the circuit is connected from the other side of the switches to TB1-12. Then internally from TB1-12 through J1/P1-5; and R24 to the anode line of D5.

(22.1) R11 will offer a static discharge path, and D23 will clamp the line at 15V, preventing a pickup voltage on this line from damaging other components.

(22.2) When a remote reset switch is closed, the circuit will act as described in paragraphs (18.1) through (21) above.

(23) **TROUBLE IN THE FIRE DETECTION CIRCUIT:** If one or both of the legs of the Fire Detection Circuit is opened, the trouble buzzer B1 will be turned on—pulsating approximately once a second.

(23.1) If the normally positive first leg is opened, the input current to Z1B-6 will be turned off and

the current to Z1B-1 will remain on and Z1B will be turned on with its output on Z1B-5 going HI. This HI will turn Z1A on and the HI output from Z1A-4 will turn on Q5 and energize K3's coil.

(23.2) At the same time, the voltage at the junction of R12 and R13 will go slightly more positive. (its ground through R21 is broken, and when K3 is switched, D11 blocks its path.) With the increase in voltage at junction of R12 and R13, there is a slight increase in the input current to Z1D-11—Z1D will remain off and the output on Z1D-10 will be kept LO. The fire alarm horn(s) and/or bell will remain off.

(23.3) If the normallly grounded second leg of the circuit is broken, the current from VDD, through R19 and D11, stops; and the voltage at junction of R19 and D11 goes to VDD.

(23.4) This VDD voltage results in the input current to Z1A-2 going greater than that to Z1A-3; Z1A will be turned on and its output at Z1A-4 will be HI. Q5 and K3 will be turned on.

(23.5) Z1D-11's input current will remain greater than the input current to Z1D-12; Z1D will remain off, and its output at Z1D will remain LO.

(23.6) When K3 has been switched, Z1B-6 will be grounded through R37 and its input current will be turned off, i.e. go less than the input current to Z1B-1; Z1B will be turned on and its output at Z1B-5 will go HI.

(24) If the break in the line(s) is repaired, K3 will remain energized and the normally positive leg will be connected to ground through K3-9/10. This will keep Z1B-6 grounded with its output at Z1B-5 HI; keeping Z1A turned on and the output at Z1A-4 HI and Q5 and K3 will be on. The trouble buzzer B1 will remain on.

(25) When Z1A-4 is HI, Z2C-8 will be high, and since Z1D is off, Z4D-11 will be HI, and Z2C-9 will remain HI.

(26) With Z2C-8 and Z2C-9 both HI, the output at Z2C-10 will be HI. This HI will be present on Z2D-12.

(27) The other input, Z2D-13, is determined by the Alarm and Trouble Light Pulser. Z4B and Z4A form a multivibrator that pulses approximately once every second.

(28) When the output at Z4A-3 goes HI, it will switch Z2D-13 HI. With Z2D-12 held HI, and Z2D-13 going high once every second, the output on Z3A-3 goes LO once every second.

(29) When Z3A-3 goes LO, the Buzzer Pulser Multivibrator Z3D/Z3C will be turned on, with its output connected through R41 to the base of Q3. Q3 will be turned on when the Buzzer Pulser output at Z3C-10 goes LO. The Buzzer Pulser's nominal frequency is 200 Hz., and may be varied by adjusting R35. The result is a 200 Hz. buzzer pulsating approximately once a second.

(30) If the break in the line(s) is repaired, the buzzer may be silenced by activating the RESET SWITCH S3.

(30.1) When S3A or a remote reset switch is closed, VDD will be applied through the switch; ⓗ; D19; and R10, to the inverting input terminal Z1A-3. The current to Z1A-3 will exceed that to Z1A-2; Z1A will be turned on and output at Z1A-4 will go LO.

(30.2) When Z1A-4 goes LO: Q5 and K3 will be turned off and the relay's contacts will return to normal; the input to Z2C-8 will go LO and Z3A-3 will go HI—Q3 and B1 will be turned off.

(31) **TROUBLE IN THE SMOKE DETECTOR:** When the 12Vdc is connected to the Smoke Detector, its red PILOT light is on and the coil of K11 is energized. The positive leg of the detection circuit is completed through the closed contacts of K11. Its diode D11 is reverse biased.

(31.1) If the power to the Smoke Detector fails or if LED11 opens, the relay K11 coil will be de-energized and the positive leg of the detection circuit will open; the trouble circuit will be activated as described above—trouble buzzer B1 will be on, and relay K3's coil will be energized.

(31.2) When K3 is energized, the normally positive leg of the detection circuit is connected through K3-9 and K3-10 to ground and D11 in the Smoke Detector becomes forward biased, healing the break in the first leg. The trouble buzzer B1 will continue on (pulsating).

(31.3) If the OPERATING MODE SWITCH S2 is thrown to TEST, or if one or more of the Heat Sensors and/or Smoke Detectors is/are activated —shorting the two legs of the detection circuit— the fire alarm circuit will be activated and the alarm horn(s) and/or bell will be sounded. Note that the path for the alarm signal is now through the defective Smoke Detector's D11. The trouble buzzer B1 will be turned off.

(31.4) Close the RESET SWITCH S3:

(31.4.1) If the defective Smoke Detector has been replaced and/or power restored as required, and the short across the two legs of the detection circuit (from S2, Heat Sensors or other Smoke Detectors) has been removed, the fire alarm will be turned off and the trouble buzzer will be turned off.

(31.4.2) If the defective Smoke Detector has not been replaced nor power restored, the fire alarm will be turned off and the trouble buzzer B1 will resume on.

(32) In a normal system with one or more Smoke Detectors, if the trouble buzzer is turned on, throw OPERATING MODE SWITCH to (FIRE) TEST:

(32.1) If the fire alarm is activated, the malfunction will be in one or more smoke detectors. If the power fails to the maximum of five Smoke Detectors that are recommended, the diodes D11 in each detector will be forwarded biased in the first leg of the detection circuit.

(32.1.1) Smoke Detector(s) that have lost their power may be identified because their pilot lights will be off.

(32.2) If when S2 is thrown to TEST, the fire alarms are not activated, the wiring in either or both legs is open.

**(33) TROUBLE AUDIBLE/SILENT SWITCH S1; ALARM AUDIBLE SILENT SWITCH S4; YELLOW TROUBLE/ALARM INDICATOR LIGHT I3:**

(33.1) S1 and S4 should normally be operated in the AUDIBLE position.

(33.2) When the system is powered—by 120Vac, 60 Hz., or by the 12V standby battery, the Alarm and Trouble Light Pulser Z4B/Z4A should be on.

(33.3) The output at Z4A-3 changes between HI and LO at a one Hz. rate. This output is coupled through R4 to the base of PNP transistor Q4. When the output is LO, Q4 is turned ON. If the cathode of I3 is grounded—through the TROUBLE SWITCH S1 and/or the ALARM SWITCH S4—the light will be on, pulsating at the one Hz. rate of the Alarm and Trouble Light Pulser.

(33.4) When S1 is in SILENT B1's low end is floating and can not be turned on even though base of Q3 is forward biased. (The Alarm Shutdown Timer and the Exit Entry Timer can turn the buzzer on under conditions noted in their discussion below.)

(33.5) When the ALARM SWITCH S4 is in SILENT position, the light will pulsate.

(33.5.1) When S4 is in SILENT, VDD is connected through R5 to the inverting (−) input terminal Z1D-11. This will keep Z1D clamped off and its output at Z1D-10 LO, even though there may be a short between the two legs of the detection circuit.

(33.5.2) This offers a convenient way of silencing the fire alarms in case of a short or intermittent activation of the detection circuit.

## INTRUDER ALARM (S2 IN PERIMETER ON POSITION)

(1) The Norton OpAmp Z1C is the control device for:

The Perimeter Intruder Detection Circuit;
The Interior Intruder Detection Circuit;
The Manual Emergency Alarm Circuit.

(1.1) When system is in "Standby," the inverting (−) input terminal Z1C-8 is connected to VDD through R7 and its input current is approximately 11 microamps.

(1.2) The non-inverting (+) input terminal Z1C-13 is connected through R26; R50; and J1/P1-14 to TB1-10, and then externally from TB1-10 through one wire of the Interior Intruder Detection Circuit to one side of the detection switches (Floor Mats, etc.). The other side of the detection circuit is connected externally from the other side of the switches through TB1-9, and then internally from TB1-9 through P1/J1-16; D13; INTERIOR INTRUDER SWITCH S5; and R3 to VDD.

(1.2.1) When S5 is in off position, the Interior Intruder Detection Circuit can not activate the intruder alarm(s).

(1.3) One side of the Manual Emergency Alarm Circuit is also connected from TB1-10 to the S-2270 Emergency Pushbutton(s). The other side of the pushbutton(s) is/are connected externally to TB1-11 and then internally from TB1-11 through P1/J1-6 and R17 to VDD.

(1.3.1) The Manual Emergency Detection Circuit can not be turned off, i.e. it can always activate the intruder alarms.

(1.4) The switches in the Manual Emergency and Interior Intruder Detection Circuits are normally open and no input current to Z1C-13 will flow through R26.

(1.4.1) If one or more of the switches in either detection circuit is closed, VDD will be connected through R26 to Z1C-13. Z1C-13's input current will exceed that of Z1C-8; Z1C will be turned on and the output at Z1C-9 will go HI.

(1.5) The non-inverting (+) input terminal Z1C-13 is also connected through R27 and R9 to the junction of C15 and D8 and from this point through R6 to VDD.

(1.5.1) The Intruder Detection Circuit is connected from the junction, through D8; R52; and JI/P1/15 to TB1-8 internally, and then externally from TB1-8 through the normally closed Intruder Detection Devices (S-2263; S-2261, et al.) to TB1-7/TB1-6, and then internally from TB1-6 through P1/J1-13 to circuit ground.

(1.5.2) The junction of C15, D8 and R6 is normally held near circuit ground and input current to Z1C-13—through R27 and R9—will be essentially zero; Z1C will be off and Z1C-9 is LO.

(1.5.3) If one of the detection switches is opened and/or if the Window Foil or wiring is broken, the voltage at junction of C15 and D8 will rise to near VDD. The input current, through R9 and R27, to Z1C-13 will rise above that to Z1C-8, Z1C will be turned on and the output at Z1C-9 will be switched to HI.

(2) The HI from Z1C-9 is connected through R30 and R28 to Z1C-13. This HI will keep Z1C latched on, even though the detector switch is closed and/or the circuit wiring is repaired.

(2.1) If Z1C is turned on by closing an Emergency Pushbutton in the Manual Circuit or by a Floor Mat switch in the Interior Circuit, and then the switch is opened, Z1C will remain latched on (para (2) above).

(3) When Z1C is on, the HI from Z1C-9 will be connected through R51 to the base of Q6, turning it on (saturated) and the low side of I1 and K1's coil will be connected to circuit ground, keeping K1 energized (set powered by 120Vac line) and I1 on, if S2 is thrown to BAT TEST position.

(3.1) This will prevent turning the intruder alarm off by throwing S2 to BAT TEST in systems that do not include a standby battery.

(3.2) When S2 is switched to BAT TEST position, the fire alarm is activated and the alarm signal will change from the pulsating intruder alarm to the steady fire alarm signal. (See para (5) below.)

(4) When the intruder device is activated, the HI from Z1C-9 is connected to Z2B-6 (Z2B-5 is normally HI) and the output at Z2B-4 will go HI and this HI is connected to input terminal Z2A-2.

(4.1) Z2A-1 switches between HI and LO (one Hz. rate) due to the output of the Alarm and Trouble Light Pulser terminal Z4A-3.

(4.2) The output at Z2A-2 will pulse HI in response to the input pulse on Z2A-1, and this pulsating HI is connected through R48 to the base of Q1.

(4.3) Q1 is turned off and on at the one Hz. rate, K2 is in turn energized and de-energized with the resulting pulsating voltage to the alarm horn B2 and when used, through F2 to the optional alarm horn and/or bell.

**(5) IF THE INTRUDER AND FIRE ALARMS ARE ACTIVATED AT THE SAME TIME (CONCURRENTLY OR CONSECUTIVELY), THE CONSTANT HI FROM Z1D-10 WILL BE CONNECTED TO THE BASE OF Q1—KEEPING K2'S COIL CONSTANTLY ENERGIZED—AND THE STEADY FIRE ALARM SIGNAL WILL OVERRIDE THE PULSATING INTRUDER ALARM SIGNAL.**

(6) The HI from Z2B-4 is fed through J5/P500-8 to the S-2375 Phone Dialer (when used). This HI is also fed to the Timer Gate input Z4D-13, and the consequent LO output from Z4D-11 will be fed through J6/P600-9 to the S-2330 Alarm Shutdown Timer when it is included in system.

**(7) RESET**

(7.1) To turn the intruder alarm(s) off:

The Floor Mat switch(es) in the Interior Intruder Detection Circuit must be open.

The Emergency Pushbutton(s) in the Manual Emergency Alarm Circuit must be open.

The Perimeter Intruder Detection Circuit must be closed, i.e., the wire and Window Foil must not be broken and all Intruder Detection Switches must be closed.

(7.2) Throw the RESET SWITCH S3 to RESET: VDD will be connected from the high side of R6, through ⓖ ; S3A; ⓗ ;D5; and R8 to the inverting input terminal Z1C-8.

(7.3) The input current to Z1C-8 will now exceed that to Z1C-13; Z1C will be turned off and the output on Z1C-9 will be LO.

(7.4) The LO from Z1C-9 is connected through R51 to the base of Q6 and Q6 is turned off.

(7.5) The LO at Z1C-9 is connected to Z2B-6 and the output at Z2B-4 is LO.

(7.6) The LO from Z2B-4 is fed to Z2A-2 keeping Z2A-3 LO. With Z2A-3 LO, Q1 is turned off, K2's coil is de-energized; and the alarms are silenced.

(7.7) The LO from Z2B-4 is also fed to Timer Gate input terminal Z4D-13 (Z4D-12 is held LO by output of Z1D-10) and the output at Z4D-11 is HI.

**(8) NOTE: IF, ONE OF THE SWITCHES IN THE INTERIOR INTRUDER DETECTION CIRCUIT OR MANUAL EMERGENCY ALARM CIRCUIT IS CLOSED; AND/OR THE PERIMETER INTRUDER DETECTION CIRCUIT IS OPEN (WIRE OPEN; BAD CONNECTION: OPEN SWITCH: ETC.), THE SYSTEM WILL REACTIVATE THE INTRUDER ALARM IMMEDIATELY AFTER OPENING S3A (RELEASING RESET SWITCH).**

**(9) S2 IN PERIMETER TEST:**

(9.1) With S2 in TEST, the cathode of I2, the green INTRUDER ARMED INDICATOR LIGHT, is connected from S2F-9 through S2F-10; R52; J1/P1/15; TB1-8 and the exterior detection circuit back through TB1-7/TB1-6 and P1/J1-13 to circuit ground.

(9.2) If I2 is on when S2 is in TEST, the intruder circuit's integrity is maintained. If light is off when S2 is in TEST, check that all doors and windows are closed; and the continuity of the wiring in the perimeter circuit.

**(10) S2 IN PERIMETER OFF**

(10.1) When S2 is in OFF, the junction of C15 and D8 will be connected through R31; S2F-4 and S2F-3 to circuit ground.

(10.2) If the perimeter intruder circuit is opened, the voltage at the high side of R31 will be near zero, or at least so low that the input current to Z1C-13 will remain less than that to Z1C-8 and the output at Z1C-9 will remain LO. Opening a door or window will not activate the intruder alarm.

## MODEL S-2280 EXIT/ENTRY TIMER

(1) S401 is normally in INSTANT (3) position and the voltages and logic states of the S-2280's devices are as shown in the schematic diagram. The Timer has no effect on the system's operation when S401 is in position 3.

(1.1) S401 is supplied with, and used only with, the S-2280. Its location on S-2300's front panel is blank when system does not include the Exit/Entry Timer.

**(2) WHEN PREPARING TO LEAVE THE PREMISES, THROW S401 TO DEPART (1) POSITION.**

(2.1) Trouble buzzer B1 in S-2300 Master Unit will be turned on—a steady 200 Hz. Buzz.

**(3) Section B of S401:**

(3.1) The forward bias, which is fed from the junction of R49 and Z2B-5, is removed from base

of Q403; Q403 is turned off and the voltage on Z402-13 goes to VDD.

(3.2) Z402-8 (timer output) is floating.

**(4) Section A of S401:**

(4.1) VDD is disconnected from Z401B-6 and terminal 6 goes LO.

(4.2) VDD is connected to Z401A-1 and terminal 1 goes HI.

(4.3) When Z401A-1 goes HI, output at Z401A-3 goes LO and the input at Z401B-5 goes LO.

(4.4) With both inputs to Z401B LO, its output at Z401B-4 is HI, forming a stable latch between Z401A and Z401B. This HI is connected to both inputs of inverter Z401D and the output at Z401D-11 goes LO.

(4.5) The HI from Z401B-4 is connected to input terminal Z401A-2 and acts as a latch, keeping Z401A-3 LO.

(4.6) The HI from Z401B-4 is also connected through R413 to the base of Q401, turning Q401 on (saturated).

(4.7) When Q401 is on, it effectively shorts, through J4/P400-5, the low end of B1 to ground. This allows audible operation of the buzzer regardless of the position of AUDIBLE/SILENCE SWITCH S1.

(4.8) The LO from Z401A-3 is fed through D401 and J4/P400-4 to both input terminals of inverter Z3B, and the output at Z3B-4 goes HI.

(4.9) The HI from Z3B-4 is fed to input Z3A-2 of Buzzer Gate and the output of Z3A-3 goes LO.

(4.10) When Z3A-3 is LO, the Buzzer Pulser Multivibrator is turned ON and its output at Z3C-10 switches between HI and LO (200 Hz. rate).

(4.11) When Z3C-10 is LO, Q3 is forward biased (Veb sat) and Trouble Buzzer B1 is turned on (200 Hz buzz).

(4.12) The LO at Z401D-11 is connected through D402 and J4/P400-3 to the junction of R27 and R9, and it effectively grounds the junction.

(4.13) When junction of R27 and R9 is grounded, no input current to Z1C-13 can flow through R27, and Z1C-13 can not be turned on even though the Perimeter Intruder Detection Circuit is opened and the voltage at junction of C15 and D8 goes to VDD.

(4.14) If a Floor Mat switch in the Interior Intruder Detection Circuit and/or an Emergency Pushbutton in the Manual Emergency Alarm Circuit is closed, the voltage at junction of C22, D22, and R50 will go to VDD and input current to Z1C-13, through R26 will exceed the input current to Z1C-8 and the output at Z1C-9 will go HI and the pulsating intruder alarm signal will be turned on.

(5) S401 is momentary contact in position 1, and when the switch is released it will automatically spring to TIMED ENTRY (2) position.

**(6) S401, section B, position 2, before door is opened:**

(6.1) The LO at Timer output Z402-8 is connected through ⓖ; S401B-2; ⓕ; and J4/P400-7 to the junction of R49 and Z2B-5.

(6.2) The LO on Z2B-5 holds Z2B-4 LO. Z1C-9 may go HI, but the intruder alarm can not be turned ON until Z2B-5 goes HI.

**(7) S401, section A, position 2, before door is opened:**

(7.1) VDD is floating (open ended) at S401A-2.

(7.2) When VDD is open ended, Z401A-1 goes LO.

(7.3) Z401A-2 is held HI by the output from Z401B-4 and the output of Z401A-3 is kept LO.

(7.4) With Z401A-3 LO, the buzzer B1 will be kept on (see para (4.8) through (4.11) above).

(7.5) Z401B inputs are LO, and the output remains HI—latching Z401A and keeping Q401 turned on. The buzzer B1 will be grounded through Q401 as described in para (4.7) above.

(7.6) The HI to Z401D inputs keeps the output at Z401D-11 LO and the junction of R27 and R9 grounded. (Para (4.12) through (4.14 above)

**(8) WITH S401 IN TIMED ENTRY, OPEN DOOR TO LEAVE PREMISES.**

(8.1) When door is opened, the Perimeter Intruder Detection Circuit is broken, the junction of C15 and D8 goes to VDD.

(8.2) This VDD is connected through R9 to ground (through J4/P400-3 and D402 to LO on output terminal Z401D-11), and can not turn Z1C on.

(8.3) This VDD is also connected through J4/P400-10 and R404 to input of inverter Z401C—the output at Z401C-10 goes LO.

(8.4) From Z401C-10 the LO is coupled through C401 to form a LO pulse at Z401B-6, keeping Z401B-4 HI. Alarms will be silent and trouble buzzer B1 will continue on.

**(9) WITH S401 IN TIMED ENTRY, CLOSE DOOR AFTER LEAVING.**

(9.1) When the door is closed (completing the Perimeter Intruder Detection Circuit), the junction of C15 and D8 goes to near ground (logic LO).

(9.2) This LO is coupled through J4/P400-10 and R404 to the input of inverter Z401C and output Z401C goes HI.

(9.3) The HI is pulsed through C401 to input terminal Z401B-6 with the output at Z401B-4 going LO. This LO is connected to Z401A-2 (Z401A-1 is already LO) and the output at Z401A-3 is latched HI. This unlatches Z401A and Z401B (see para. (4.4) above).

(9.3.1) When Z401A-3 is HI, the input of Z3B goes HI and output of Z3B-4 goes LO; and the output of Z3A-3 goes HI—turning off the Buzzer Pulser Z3D/Z3C.

(9.3.2) When Buzzer Pulser is off, Q3 and B1 are turned off.

(9.4) The LO from Z401B turns off Q401, and removes the ground from low side of B1 through Q401.

(9.5) The LO on input of Z401D is inverted and the output at Z401D-11 goes HI. The Z401D-11 is HI, the ground is removed from the junction of R9 and R27. D402 blocks VDD at Z401D from being connected to the junction.

**(10) WITH S401 IN TIMED ENTRY, OPEN DOOR TO REENTER HOUSE.**

(10.1) The junction of C15 and D8 goes HI (VDD).

(10.2) The HI is connected through R9 and R27 to the input terminal Z1C-13 and the output at Z1C-9 goes HI.

(10.3) The HI from Z1C-9 is connected to Z2B-6, but output at Z2B-4 remains LO because Z2B-5 is held LO by the LO state of Timer output terminal Z402-8.

(10.4) The HI from Z1C-9 is also fed through J4/P400-8 and R408 to the base of Q402. Q402 is turned on (saturated) and the voltage to Timer input terminal Z402-6 goes LO.

(10.5) Z402 timing action starts and when timing-cycle is completed the output terminal Z402-8 will go HI.

(10.5.1) The duration of timing-cycle can be adjusted with R412. When R412 is set in full counter clockwise position the alarm will sound immediately when the Perimeter Intruder Detection Circuit is opened. If the resistor is set in full clockwise position, the alarm will be activated approximately 90 seconds after circuit is opened. R412 is normally set near its center point for a delay of approximately 30 seconds.

(10.6) If, during the timing cycle, the Interior Intruder Detection Circuit and/or the Manual Emergency Alarm Circuit is activated, the junction of C22 and R50 goes HI, and this HI is connected through J4/P400-2; D403; and R410 to the base of Q403. Q403 is turned on and Timer terminal Z402-13 is effectively connected to ground.

(10.6.1) When Z402-13 goes to ground, the timing cycle is speeded up, and Z402-8 will go HI in approximately 0.2 seconds.

(10.7) If, during the timing cycle, the RESET SWITCH S3 is closed, Z1C will be turned off and its output at Z1C-9 will go LO.

(10.7.1) When Z1C-9 goes LO, Q402 is turned off and Z402-6 goes HI. The timing cycle is reset (stopped) and Z402-8 will remain LO and the alarms will not be activated.

(10.8) If on re-entering the building, S401 is returned to INSTANT (3) position before the RESET SWITCH is closed, the alarms will immediately be activated.

(11) After re-entering the home, activate RESET SWITCH before delay time cycle is completed and throw S401 to INSTANT for normal operation.

## MODEL S-2330 ALARM SHUTDOWN TIMER

### (1) FIRE DETECTION CIRCUIT:

(1.1) When the Fire Detection Circuit is activated, Z1D-10 goes HI; the alarm Horn(s) are turned on; Z1A-4 goes HI; and the fire circuit relay K3 is energized. (See THEORY OF OPERATION, S-2300 CONTROL UNIT, FIRE DETECTION CIRCUIT above.)

(1.1.1) The HI on Z1A-4 is connected to Buzzer Inhibit input Z2C-8.

(1.1.2) The HI at Z1D-10 is connected to Timer Gate input Z4D-12 and the output on Z4D-11 goes LO.

(1.2) The LO at Z4D-11 is connected to Buzzer Inhibit input Z2C-9, keeping Z2C-10 LO.

(1.3) Z4D-11 is connected through J6/P600-9; R605; and R606 to the Timer input Z601-6.

(1.4) When Z4D-11 goes LO, Z601-6 goes LO and the timing cycle starts.

(1.4.1) Z601-6 must remain LO during the timing cycle.

(1.4.2) If Z601-6 is switched HI during the timing cycle, the timing cycle is cancelled. Then if Z601-6 is again switched LO the timing cycle will be restarted, and will require full timing cycle duration before turning alarm horns off.

(1.5) The duration of Z601's timing cycle is determined by the setting of R601.

(1.5.1) When R601 is set in full counter clockwise position, the timing cycle duration is approximately 5 minutes.

(1.5.2) When R601 is set in full clockwise position, the timing cycle duration is approximately 15 minutes.

(1.5.3) The control is normally set near its center position for a timing cycle duration of approximately 10 minutes.

(1.6) When the timing cycle is completed, the Timer output terminal Z601-8 goes HI, for an output pulse of 150-200 milliseconds (ms).

(1.7) The HI pulse from Z601-8 is connected to Z603B-6, but does not change the state of Z603B-4 because Z603B-5 is normally HI.

(1.8) The HI pulse from Z601-8 is also connected to the flip/flop set Z602D-12—latching Z602C-10 HI and Z602D-11 LO.

(1.9) The HI from Z602C-10 is fed through D601; P600/J6-8; and R45 to inverting input terminal Z1D-11—output at Z1D-10 will go LO; alarm horns will be turned off, Z4D-12 will go LO and Z4D-11 will go HI.

(1.9.1) Z1A-4 stays HI; K3 remains energized; and Buzzer Inhibit input Z2C-8 is HI.

(1.10) When Z4D-11 is HI, Z2C-9 is HI. With both inputs on Z2C HI, output Z2C-10 is HI.

(1.10.1) The HI on Z2C-10 is connected to Z2D-12, and Z2D-13 is pulsed HI at a one Hz. rate by the output of the Alarm and Trouble Light Pulser Z4A-3, resulting in a one Hz. HI pulse on the Buzzer Gate input Z3A-1.

(1.11) When Z4D-11 is switched HI, Timer input Z601-6 is switched HI in 150-200 milliseconds. The delay is caused by the RC charging time of R605/C605.

(1.11.1) It requires approximately 20 ms for Z1D-10 to be switched LO because of the decay delay introduced by C6 in conjunction with R14 and R15.

(1.11.2) The Timer output Z601-8 goes LO when Z601-6 goes HI. The delay of 150 to 200 ms in rise of the input voltage makes certain that Z601-8 remains HI until Z1D-10 is switched to full LO.

(1.12) The HI from Z602C-10 is also connected through R613 to the base of Q601—turning it on (saturated).

(1.12.1) The low side of trouble buzzer B1 is connected from S1 terminal 6 through J6/P600-5 to the collector of Q601, and it is effectively grounded when Q601 is on. This allows the buzzer to be turned on regardless of the setting of TROUBLE AUDIO/SILENT SWITCH S1.

(1.13) The LO on Z602D-11 is connected to Z602B-6, which is the control input for the 4 Hz. multivibrator Z602B/Z602A.

(1.13.1) Output terminal Z602A-3 pulses HI and LO at a 4 Hz. rate. The LO pulses are fed through D602; P600/J6-4 to the Inverter Z3B input, and the output at Z3B-4 pulses HI at a 4 Hz rate and the HI is connected to Buzzer Gate input Z3A-2.

(1.14) When either Z3A-1 is HI (see para (1.10) and (1.10.1) above), the output is LO. With the one Hz. HI pulses on one input, and the 4 Hz. HI pulses to the other input, the output from Z3A-3 will be random width LO pulses.

(1.15) These random width LO pulses will turn on the 200 Hz. Buzzer Pulser Z3D/Z3C at a random rate. When the output Z3C-10 is LO, Q3 is turned on and B1 is on. (See para (1.12) and (1.12.1) above.

(1.15.1) The random-pulse, 200 Hz. tone from the trouble buzzer indicates that the fire alarm had been activated and that the alarm timing cycle has been completed.

**(1.16) If the initiating detector opens during the timing cycle, and then, it or one of the other heat (or smoke) detectors is activated:**

(1.16.1) The junction of R12 and R13 will go HI when the initiating detector opens, but will not effect the Alarm Shutdown Timer operation.

(1.16.2) The junction of R12 and R13 will go LO (grounded) when the second detector is activated (closed).

(1.16.3) The LO from junction of R12 and R13 is connected through J6/P600-2, and then it is pulsed through C601 to Z603B-5, and during the pulse width, Z603B-4 will be HI. (Z603B-6 is held LO except when Z601-8 is pulsed HI at completion of timing cycle.)

(1.16.4) The HI from Z603B-4 is connected to NOR gate Z603A-2 input, and Z603A-3 goes LO, and this LO is inverted through Z603D, and Z603D-11 goes HI.

(1.16.5) The HI pulse from Z603D-11 is fed through D606 to Z601-6—which will cancel the timing cycle. When the pulse is ended, Z603D-11 will go LO; Z601-6 will go LO; and the timing cycle will be restarted.

(1.16.5.1) The HI pulse from Z603D-11 is also connected through D605 to flip-flop reset terminal Z602C-8, but the flip-flop is in normal state (before timing cycle is completed), and the HI on Z602C-8 will not change the flip-flop.

**(1.17) If the initiating detector opens during, or after completion of the timing cycle, and the second detector activates the Fire Detection Circle after the random pulsed trouble buzzer is on (timing cycle completed):**

(1.17.1) The junction of R12 and R13 will go LO, and the timing cycle will be interrupted and then restarted as described in para. (1.16.2) through (1.16.5) above.

(1.17.2) The HI from Z603D-11 will be connected through D605 to the flip-flop reset terminal Z602C-8 (flip-flop was switched to set state when Z601-8 was pulsed HI at the completion of the timing cycle), and flip-flop will resume normal state, i.e. Z602C-10 will be latched LO and Z602D-11 will be latched HI.

(1.17.3) When Z602C-10 goes LO, the input current to Z1D-11 is reduced and Z1D-10 goes HI; Alarm horns are turned on; Z4D-12 goes HI; Z4D-11 goes LO and Buzzer Inhibit Z2C-9 goes LO.

(1.17.4) When Z2C-9 goes LO, Z2C-10 goes LO; Z2D-12 goes LO and Buzzer Gate input Z3A-1 goes LO.

(1.17.5) The LO from Z602C-10 also turns off Q601—removing the constant ground from the low-side of B1.

(1.17.6) The HI from Z602D-11 will turn off the 4 Hz multivibrator and with the output at Z602A-3 HI, The inverter output Z3B-4 will be LO, and Buzzer Gate input Z3A-3 will be LO.

**(1.18) If, while the fire alarm circuit is activated and during the timing cycle the Perimeter Intruder Detection Circuit is activated (one or more of the intruder detection switches is/are opened):**

(1.18.1) When the intruder detection switch is opened, the junction of C15 and D8 goes HI (approximately to VDD).

(1.18.2) The HI from junction of C15 and D8 is fed through R31 to the Inverter input Z46-8/9 and Z4C-10 goes LO.

(1.18.3) The LO from Z4C-10 is connected through J6/P600-10 to Inverter input Z603C-8/9 and Z603-10 goes HI, and a HI pulse is fed through C602 to NOR Gate input Z603A-1 and output Z603A-3 goes LO.

(1.18.4) The LO pulse from Z603A-3 is inverted through Z603D and a HI pulse appears on Z603D-11.

(1.18.5) The HI pulse from Z603D-11 is fed through D606 to Z601-6—turning the timing cycle off. When Z603D-11 goes LO, Z601-6 goes LO and the timing cycle is restarted.

(1.18.5.1) The HI pulse is also fed through D605 to latch reset Z602C-8, but the flp-flop is in normal and its state does not change.

(1.18.6) The HI from junction of C15 and D8 is also fed through R9 and R27—increasing input current to Z1C-13 and switching Z1C-9 to HI. When Z1C-9 is HI, Z2B-6 is HI.

(1.18.6.1) If Z2B-5 is HI (normal), Z2B-4 will be switched to HI.

(1.18.6.2) NOTE: If the S-2280 Exit/Entry Timer's mode switch S401 is in TIMED ENTRY (position 2), Z2B-5 will be held LO until the delay timing cycle of Z402 is completed and Z402-8 goes HI.

(1.18.7) The HI on Z2B-4 is connected to Alarm Pulser Gate input Z2A-2, turning it on, but the alarm does not change because the fire alarm is on and overrides the intruder alarm signal.

(1.18.8) The HI from Z2B-4 is also fed to Timer Gate input Z4D-13 but does not change its state as Z4D-12 is held HI by Z1D-10.

(1.18.9) When the latter timing cycle (see Para (1.18.5) above) is completed, the alarm horns are turned off and trouble buzzer B1 will be turned on by the random pulse 200 Hz. tone.

**(1.19) If the fire alarm timing cycle has been completed: Z1D-10 is LO; alarm horn(s) are off; and the trouble buzzer B1 is on in the random pulse tone mode, and then, the Intruder Detection Circuit is activated.**

(1.19.1) The HI at junction of C15 and D8 will restart the timing cycle of Z601 as described in para (1.18.2) through (1.18.5) above.

(1.19.2) The HI pulse from Z603D-11 is also fed through D605 to reset terminal Z602C-8—latching Z602C-10 LO, and Z602D-11 HI.

(1.19.3) When Z602C-10 goes LO, the input current to Z1D-11 and to Z1C-9, which resulted from the HI on Z602C-10 will be turned off.

(1.19.3.1) If one of the Heat Sensors or Smoke Detectors in the Fire Detection Circuit is still activated (closed), Z1D will again be turned on and Z1D-10 will be switched to HI, reactivating the fire alarm circuit—powering the alarm horns with the steady fire alarm signal.

(1.19.3.2) If all Heat Sensors and Smoke Detectors are deactivated (opened), Z1D will remain off and Z1D-10 will stay LO.

(1.19.4) The LO from Z602C-10 also turns off Q601, removing its effective ground path of trouble buzzer B1.

(1.19.5) The HI from Z602D-11 turns off the multivibrator Z602B/Z602A—turning off the 4 Hz. pulsing of the Buzzer Pulser Z3D/Z3C.

(1.19.6) At the same time, the HI at the junction of C15 and D8 is connected, through R9 and R27 to Z1C-13—increasing its input current and switching Z1C-9 to HI.

(1.19.6.1) NOTE: If S-2280 Exit/Entry Timer's S401 is in DEPART (position 1) or, it is in TIMED ENTRY (position 2)—before leaving building and closing door—Z401D-11 is LO, and the junction of R9 and R27 is LO (grounded) and Z1C will not be turned on.

(1.19.7) When Z1C-9 goes HI, Q6 is turned on, grounding low-end of K1 and I1; Z2B-6 goes HI and if Z2B-5 is HI (normal) Z2B-4 will go HI.

(1.19.7.1) Note: if the S-2280 Exit/Entry Timer's mode switch S401 is in TIMED ENTRY, Z2B-5 will be held LO until the delay timing cycle of Z402 is completed and Z407-8 goes HI.

(1.19.7.2) The HI from Z1C-9, which is fed through J4/P400-8; and R408, turns on Q402—switching Z402-6 to LO, which starts the entry delay timing cycle.

(1.19.8) When Z2B-4 goes HI, the Alarm Pulser Gate output Z2A-3 goes HI at a one Hz. rate, which is determined by the Alarm and Trouble Light Pulser Z4B/Z4A, and if Z1D-10 is LO, the alarm horn(s) will be turned on by the pulsating intruder alarm signal.

(1.19.8.1) If Z1D-10 is HI (see para (1.19.3.1) above) the steady fire alarm signal will power the alarm horn(s).

(1.19.9) At the completion of Z601's timing cycle, Z601-8 will be pulsed HI, and flip-flop set input Z602D-12 will be pulsed HI—latching Z602D-11 LO and Z602C-10 HI.

(1.19.10) The HI from Z602C-10 will be fed through D601; and P600/J6-8, and then through R45 to Z1D-11; and through R8 to Z1C-8, turning both OpAmps off with Z1D-10 and Z1C-9 going LO.

(1.19.10.1) The HI from Z602C-10 also turns Q601 on, effectively grounding the low-end of B1 regardless of the setting of S1.

(1.19.11) The LO from Z602D-11 turns on the 4 Hz. multivibrator.

(1.19.12) The one Hz. trouble buzzer pulse is also on, and the trouble buzzer B1 will be on in the random pulse width mode.

## (2) PERIMETER INTRUDER DETECTION CIRCUIT:

(2.1) When the Intruder Detection Circuit is opened, the junction of C15 and D8 goes HI, and the input current, through R9 and R27, to Z1C-13 increases—Z1C is latched on with Z1C-9 going HI.

(2.1.1) If S-2280 Exit/Entry Timer's S401 is in DEPART (position 1) or, in TIMED ENTRY (position 2)—before leaving building and closing door—Z401D-11 is LO and the junction of R9 and R27 is LO (grounded) and Z1C will not be turned on.

(2.2) When Z1C-9 is HI, Q6 is turned on—grounding low-end of l1 and K1's coil; Z2B-6 is HI and if Z2B-5 is HI (normal), Z2B-4 will go HI.

(2.2.1) If the S-2280 Exit/Entry Timer's mode switch S401 is in TIMED ENTRY, Z2B-5 will be held LO until the delay timing cycle of Z402 is completed and Z402-8 goes HI.

(2.2.2) The HI from Z1C-9, which is fed through J4/P400-8; and R408, turns on Q402—switching Z402-6 to LO and starting the entry delay timing cycle.

(2.3) When Z2B-4 goes HI, the Alarm Pulser Gate output Z2A-3 goes HI at a one Hz. rate, which is determined by the Alarm and Trouble Light Pulser output Z4A-3.

(2.4) When Z2A-3 is pulsed HI, Q1 is pulsed on and the alarm horn(s) are energized in one Hz. pulses.

(2.5) The HI from Z2B-4 is inverted through Timer Gate Z4D, with the output at Z4D-11 going LO.

(2.5.1) The LO at Z4D-11 is connected to Buzzer inhibit input Z2C-9, keeping Z2C-10 LO.

(2.6) Z4D-11 is connected through J6/P600-9; R605; and R606 to the Timer input Z601-6.

(2.7) When Z4D-11 goes LO, Z601-6 goes LO and the timing cycle starts.

(2.7.1) Z601-6 must remain LO during the timing cycle.

(2.7.2) If Z601-6 is switched HI during the timing cycle, the timing cycle is cancelled. Then if Z601-6 is again switched LO, the timing cycle will be restarted, and will require full timing cycle duration before turning the alarm horns off.

(2.8) The duration of Z601's timing cycle is determined by the setting of R601.

(2.8.1) When R601 is set in full counter clockwise position, the timing cycle duration is approximately 5 minutes.

(2.8.2) When R601 is set in full clockwise position, the timing cycle duration is approximately 15 minutes.

(2.8.3) The control is normally set near its center position for a timing cycle duration of approximately 10 minutes.

(2.9) When the timing cycle is completed, the Timer output terminal Z601-8 goes HI, for an output pulse of 150 to 200 milliseconds (ms).

(2.10) The HI pulse from Z601-8 is connected to Z603B-6, but does not change the state of Z603B-4 because Z603B-5 is normally HI.

(2.11) The HI pulse from Z601-8 is also connected to the flip-flop set Z602D-12—latching Z602C-10 HI and Z602D-11 LO.

(2.12) The HI from Z602C-10 is fed through D601; P600/J6-8; and R8 to the inverting input terminal Z1C-8—output at Z1C-9 will go LO; alarm horns will be turned off; Z4D-13 will go LO and Z4D-11 will go HI.

(2.12.1) Although Z2C-9 is HI, Z2C-8 is LO and Buzzer Inhibit output Z2C-10 is LO, keeping the Buzzer Gate input Z3A-1 LO.

(2.13) When Z4D-11 is switched HI, Timer input Z601-6 is switched HI in 150-200 ms. The delay is caused by the RC charging time of R605/C605.

(2.13.1) It requires approximately 20 ms for Z1C-9 to be switched LO because of the decay delay introduced by C11 in conjunction with R28 and R30.

(2.13.2) The Timer output Z601-8 goes LO when Z601-6 goes HI. The delay of 150 to 200 ms in rise of the input voltage makes certain that Z601-8 remains HI until Z1C-9 is switched to full LO.

(2.14) The HI from Z602C-10 is also connected through R613 to the base of Q601—turning it on (saturated).

(2.14.1) The low side of trouble buzzer B1 is connected from S1 terminal 6, through J6/P600-5 to the collector of Q601, and it is effectively grounded when Q601 is on. This allows the buzzer to be turned on regardless of the setting of TROUBLE AUDIO/SILENT SWITCH S1.

(2.15) The LO on Z602D-11 is connected to Z602B-6, which is the control input for the 4 Hz. multivibrator Z602B/Z602A.

(2.15.1) Output terminal Z602A-3 pulses HI and LO at a 4 Hz. rate. The LO pulses are fed through D602; P600/J6-4 to inverter input Z3B input.

(2.15.2) When Z3B input is LO, its output at Z3B-4 is HI. These HI pulses are connected to Buzzer Gate input Z3A-2 and Z3A-3 output pulses LO.

(2.15.3) The LO pulses on Z3A-3 turn on the 200 Hz. Buzzer Pulser at a 4 Hz. rate.

(2.15.4) When Z3C-10 goes LO (200 Hz. at a 4 Hz. rate), Q3 is turned on and trouble buzzer B1 is on.

(2.15.5) When the trouble buzzer B1 is heard operating at a 4 Hz. rate, it indicates that the Intruder Detection Circuit was activated and that the alarm horns were on for their set time.

(2.16) If the initiating intruder detector switch (or glass foil or circuit wiring) remains open during, and after completion of, the timing cycle: opening another detector in the circuit will not change the timing cycle nor will it restart the alarm horns.

**(2.17) If, during the timing cycle, the initiating detector is closed, and then, it or another detector is opened:**

(2.17.1) When the second detector is opened, the junction of C15 and D8 goes HI. This HI is connected through R31 to the inverter Z4C input and output Z4C-10 goes LO.

(2.17.2) The LO from Z4C-10 is connected through J6/P600-10 to Z603C-8/9 and Z603C-10 goes HI.

(2.17.3) The HI from Z603C-10 is pulsed through C602 to NOR gate input Z603A-1; Z603A-3 pulses LO; is inverted through Z603D; and Z603D-11 is pulsed HI.

(2.17.4) The HI pulse on Z603D-11 is fed through D606 to Timer input Z601-6, terminating the timing cycle. When the pulse is ended, Z601-6 goes LO—restarting the timing cycle. The alarm horns will not be terminated until the end of the latter timing cycle, and when they are terminated the 200 Hz. at 4 Hz. rate trouble buzzer signal will be turned on.

**(2.18) If, after completion of the timing cycle—when the alarm horns are off and the 4 Hz. trouble buzzer pulses are on—the initiating intruder is closed, and then it or another intruder detector is activated (opened):**

(2.18.1) When the second detector is opened, the HI from the junction of C15 and D8 is fed through R31 to the inverter Z4C input and the timing cycle is cancelled and restarted as described in para (2.17.1) through (2.17.4) above.

(2.18.2) When Z603D-11 is pulsed HI, the HI pulse is fed to flip-flop reset Z602C-8, latching Z602C-10 LO and Z602D-11 HI.

(2.18.3) When Z602C-10 goes LO, the HI through D601; P600/J6-8; and R8 to Z1C-8 is removed and at the same time, the HI from the junction of C15 and D8 is connected through R9 and R27 to Z1C-13—Z1C is turned on Z1C-9 will go HI.

(2.18.4) When Z1C-9 goes HI, Z2B-6 goes HI, and if Z2B-5 is in its normal HI state, Z2B-4 will go HI.

(2.18.4.1) Note: If the S-2280 Exit/Entry Timer's mode switch S401 is in TIMED ENTRY, Z2B-5 will be LO (connected to the LO on Z402-8).

(2.18.4.2) The HI from Z1C-9, which is fed through J4/P400-8; and R408, turns on Q402—switching Z402-6 to LO and starting the entry delay timing cycle of Z402.

(2.18.4.3) When the entry delay timing cycle is completed, Z402-8 goes HI and Z2B-5 goes HI and with the HI on Z2B-6, Z2B-4 will go HI.

(2.18.5) When Z2B-4 is HI, Z2A-3 will be pulsed HI—determined by the output of the Alarm and Trouble Light Pulser—and the alarm horns will be energized by the pulsating intruder alarm signal.

(2.18.6) The HI from Z2B-4 is also fed to Timer Gate input Z4D-13, and Z4D-11 goes LO, and this LO is connected to Z601-6—restarting the shutdown timing cycle.

(2.18.6.1) If the signal was not delayed at the input of Z2B, this timing cycle will correspond to the timing cycle restart of para (2.18.1) above.

(2.18.6.2) If the signal was delayed by the entry delay timing cycle, the horns will be on until the conclusion of the timing cycle restarted in para (2.18.6) above.

(2.18.7) At the end of the latest timing cycle, the alarm horns will be turned off and the buzzer pulser will be turned on at the 4 Hz. pulse rate.

**(2.19) If the fire detection circuit is activated during the intruder shutdown timing cycle while the pulsating intruder alarm horns are on:**

(2.19.1) Z1D will be turned on; Z1D-9 will go HI and the steady fire alarm signal will energize the alarm horns—overriding the pulsating intruder alarm signal.

(2.19.2) Z1A will be turned on; Z1A-4 will go HI; Q5 will be turned on; relay K3 will be energized and Z2C-8 will go HI.

(2.19.3) When the fire detection circuit is activated, the junction of R12 and R13 will go to ground (logic LO). The LO will be fed through J6/P600-2 and pulsed through C601 to Z603B-5—Z603B-4 will be pulsed HI.

(2.19.4) The HI pulse will be connected to NOR gate input Z603A-2 and Z603A-3 will be pulsed LO. The LO pulse will be inverted by Z603D and Z603D-11 will be pulsed HI.

(2.19.5) The HI pulse will be fed through D606 to timer input Z601-6, cancelling the timing cycle. When the HI pulse is ended and Z601-6 returns to LO, the timing cycle will be restarted.

(2.19.5.1) The HI pulse from Z603D-11 will also be fed through D605 to the flip-flop reset Z602C-8, but since the flip-flop is in its normal state the output of Z602C-10 will remain LO and that at Z602D-11 will remain HI.

(2.19.6) When this latter timing cycle has been completed, Z601-8 will go LO; flip-flop set Z602D-12 will go LO, latching Z602C-10 HI and Z602D-11 LO.

(2.19.7) The HI from Z602C-10 will be fed through D601 and P600/J6-8: through R8 to Z1C-8—turning Z1C off with Z1C-9 going LO; and through R45 to Z1D-11—turning Z1D off with Z1D-10 going LO.

(2.19.7.1) Z1A remains on, and Z1A-4 remains HI.

(2.19.7.2) The alarm horns are turned off and K3 remains energized.

(2.19.8) The HI from Z603C-10 also turns on Q601 and trouble buzzer B1's low-end is grounded regardless of the position of S1.

(2.19.9) Buzzer Inhibit inputs Z2C-8 and Z2C-9 are both HI; Z2C-10 is HI; Z2D-12 is HI; Z2D-13 is pulsed HI at a one Hz. rate by the Alarm and Trouble Light Pulser; and Buzzer Gate input Z3A-1 is pulsed HI at this one Hz. rate.

(2.19.10) The LO from Z602D-11 turns on the 4 Hz. multivibrator Z602B/Z602A and the LO output

pulses from Z602A-3 are fed through D602 and P600/J6-4 to Inverter input Z3B-5/6, and when Z3B-4 is pulsed HI, the Buzzer Gate input Z3A-2 is HI.

(2.19.11) The one Hz. HI pulses on Z3A-1 and the 4 Hz. HI pulses on Z3A-2 results in a pulsing LO on Z3A-3 which turns on the 200 Hz. Buzzer multivibrator Z3D/Z3C at an irregular random width pulse rate.

(2.19.12) The irregular random width LO pulses at the output Z3C-10 will forward bias, through R41, Q3—energizing the trouble buzzer B1.

**(2.20) If the Fire/Smoke Detection Circuit is activated after completion of the intruder shutdown timing cycle—i.e. when the alarm horns are turned off and the trouble buzzer is being energized by the 200 Hz. tone at the 4 Hz. pulse rate:**

(2.20.1) Z1D is turned on—Z1D-10 goes HI and the alarm horns are energized by the steady fire alarm signal.

(2.20.2) Z1A is turned on—Z1A-4 goes HI; Q5 is turned on; K3's coil is energized; and Buzzer Inhibit input Z2C-8 goes HI.

(2.20.3) The HI from Z1D-10 is fed to Timer Gate input Z4D-12 and Z4D-11 goes LO.

(2.20.3.1) The LO from Z1D-11 is fed to Buzzer Inhibit input Z2C-9 keeping Z2C-10 LO.

(2.20.3.2) The LO from Z1D-11 is also fed through J6/P600-9; R605 and R606 to the Timer input Z601-6—starting the shutdown timing cycle.

(2.20.4) When the Fire/Smoke Detection Circuit is activated, the junction of R12 and R13 goes to ground (logic LO). This LO is fed through J6/P600-2 and is pulsed through C601 to Z603B-5 and Z603B-4 goes HI, and the HI is fed to NOR gate input Z603A-2 with Z603A-3 going LO. This LO pulse is inverted through Z603D and the resulting HI pulse from Z603D-11 is fed through D605 to flip-flop reset Z602C-8—latching Z602C-10 LO and Z602D-11 HI.

(2.20.5) The LO from Z602C-10 will turn off Q601 removing its grounding of the low-end of trouble buzzer B1.

(2.20.6) At the same time the HI from Z602D-11 turns off the 4 Hz. multivibrator Z602B/Z602C—removing the 4 Hz. drive to the Buzzer Pulser. (The one Hz. drive to the Buzzer Pulser is kept off by the LO on Z2C-9. Buzzer is silent.

(2.20.7) When the timing cycle is completed, Z402-8 goes HI. This HI is connected to flip-flop set Z602D-12—latching Z602C-10 HI and Z602D-11 LO.

(2.20.8) The HI on Z602C-10 will be connected through D601; P600/J6-8; and R45 to Z1D-11—turning Z1D off with Z1D-10 going LO.

(2.20.9) The HI on Z602C-10 is connected through R613 to base of Q601—turning Q601 on which grounds the low-end of trouble buzzer B1 regardless of the position of S1.

(2.20.10) The LO from Z602D-11 will turn on the 4 Hz. multivibrator Z602B/Z602A; the LO pulses from Z602A-3 are inverted through Z3B; and Buzzer Gate input Z3A-2 is pulsed HI at the 4 Hz. rate.

(2.20.11) The LO from Z1D-10 is connected to Timer Gate input Z4D-12 (Z4D-13 is already LO) and the output at Z4D-11 goes HI. This HI is connected to Buzzer Inhibit input Z2C-9 (Z2C-8 is held HI by Z1A-4) and the output Z2C-10 goes HI.

(2.20.12) The HI from Z2C-10 is connected to Z2D-12; Z2D-13 is HI at a one Hz. rate, and the output from Z2D-11 sets Z3A-1 at the one Hz. pulse rate.

(2.20.13) Thus at the termination of the timing cycle, the alarm horns are turned off and the trouble buzzer B1 is energized by the irregular random width 200 Hz. tone.

## (3) INTERIOR INTRUDER DETECTION AND MANUAL EMERGENCY ALARM CIRCUITS

(3.1) When INTERIOR SWITCH S5 is closed and an interior intruder detection switch (Floor Mat, etc.) is closed and/or when an Emergency Pushbutton switch is closed, VDD (logic HI) is connected to the junction of D22 and C22.

(3.2) This HI is connected through J6/P600-6 and then pulsed through C603 and D603 to latch reset input Z602C-8.

(3.2.1) If the interior or manual circuit is activated during the timing cycle, i.e. while the pulsating intruder alarm horns are on, and the flip-flop Z602C/Z602D is in its normal state, no change will occur.

**(3.3) Perimeter Intruder Circuit activated; shutdown timing cycle completed and trouble buzzer B1 on in 4 Hz. pulses:**

(3.3.1) Flip-flop latch Z602C/Z602D is in set state. HI pulse to Z602C-8 will reset—latching Z602C-10 LO and Z602D-11 HI.

(3.3.2) When Z602C-10 goes LO, the HI through D601; P600/J6-8 and R8 to Z1C-8 is removed; Q601 is turned off; and the low-end of B1 is no longer grounded through Q601.

(3.3.3) The HI from Z602D-11 turns off the 4 Hz. multivibrator Z602B/Z602A and the 4 Hz. pulses from the Buzzer Pulser Z3D/Z3C are turned off.

(3.3.4) At the same time, the HI from the junction of D22 and C22 is fed through R26 to Z1C-13—turning Z1C on with Z1C-9 going HI.

(3.3.5) The HI is connected to Z2B-6 and Z2B-4 goes HI.

(3.3.5.1) NOTE: If S-2280 Exit/Entry Timer's S401 is in TIMED ENTRY, the HI from Z1C-9 will be fed through J4/P400-8 and R408 to the base of Q402. Q402 will be turned on and the Timer input Z402-6 will go LO—starting its timing cycle.

(3.3.5.2) At the same time, the HI from junction of D22 and C22 is connected through J4/P400-2; D403; and R410 to the base of Q403. The collector of Q403 and terminal Z402-13 will go LO. The LO on Z402-13 will cause Z402's timing cycle to be immediately completed (approx. 0.2 seconds) and Z402-8 will go HI—switching Z2B-5 HI.

(3.3.6) The HI from Z2B-4 turns on the Alarm Pulser Gate, and it is also fed to the Timer Gate input Z4D-13 with Z4D-11 going LO. The LO from Z4D-11 is fed through J6/P600-9; R605; and R606 to Timer input Z601-6—starting the timing cycle.

(3.3.7) At the end of the timing cycle, Z601-8 is pulsed HI; the alarm horns are turned off; and the 4 Hz. trouble buzzer pulses are turned on through the normal shutdown timer's operation.

**(3.4) The Fire/Smoke Detection Circuit has been activated and the timing cycle is completed, i.e. the trouble buzzer is turned on by the irregular random width pulses. The initiating detector remains closed:**

(3.4.1) The junction of D22, C22, and R50 goes HI. This HI is connected through J6/P600-6 and pulsed through C603 and D603 to the flip-flop reset Z602C-8, latching Z602C-10 LO and Z602D-11 HI.

(3.4.2) When Z602C-10 goes LO, the HI through D601; P600/J6-8; and R45 to Z1D-11 is removed, and with Z1D-11 being grounded through R13 and the initiating detector, Z1D will be turned on and Z1D-10 will go HI.

(3.4.3) The LO Z602C-10 will turn off Q601—removing the constant ground from the low-end of B1.

(3.4.4) The HI from Z602D-11 will turn off the 4 Hz. multivibrator, and cancel the 4 Hz. part of the irregular random width trouble pulses.

(3.4.5) When Z1D-10 goes HI, the alarm horns will be turned on with the steady fire alarm signal, and Timer Gate input Z4D-12 will go HI and Z4D-11 will go LO.

(3.4.5.1) The LO from Z4D-11 will be connected to Buzzer Inhibit input Z2C-9, and even though Z2C-8 is held HI by Z1A-4, Z2C-10 will be LO and the one Hz. part of the irregular random width trouble pulses are turned off. Trouble buzzer now silent (see para (3.4.4) above).

(3.4.5.2) The LO from Z4D-11 will be connected to Timer input Z601-6, starting the timing cycle.

(3.4.6) When the timing cycle is completed, the alarm horns will be turned off and the trouble buzzer will be turned on by the irregular random width pulses.

(3.5) If the interior or manual circuit is activated during the timing cycle, i.e. while the steady fire alarm horns are on, no change will take place—the flip-flop Z602C/Z602D is in its normal state, and the alarm horns are being energized by the steady fire alarm signal.

## (4) RESET

(4.1) When RESET SWITCH S3 is closed, VDD is connected from ⓖ through S3A to ⓗ.

(4.1.1) If a Pushbutton in the Remote Reset Circuit is closed, VDD will be connected through R17; JL/P1-6; TB1-11; one side of the external wiring; through the closed Pushbutton; from other side of Pushbutton; TB1-12; J1/P1-5; and R24 to ⓗ. (ⓗ is at logic HI.)

(4.2) The HI from h is connected through D19 and R10 to Z1A-3—Z1A will be off and Z1A-4 will be LO.

(4.2.1) When Z1A-4 is LO, Q5 is off, K3's coil is de-energized and its contacts are in normal standby position; and Buzzer Inhibit input Z2C-8 is LO, keeping Z2C-10 LO.

(4.3) The HI from h is connected through D5; through R8 to Z1C-8; and through R45 to Z1D-11. Z1C and C1D are turned off; and Z1C-9 and Z1D-10 are LO.

(4.3.1) If the RESET SWITCH (local or remote) is closed while the alarm horns are on (before completion of the timing cycle), they will be turned off regardless of whether they were turned on by the steady fire alarm signal or by the pulsating intruder alarm signal.

(4.4) The HI from h is also fed through J6/P600-7 and D604 to the flip-flop Z602C/Z602D reset terminal Z602C-8.

(4.4.1) If the RESET SWITCH is closed during timing cycle (while alarm horn is on) no change in the flip-flop latch will occur, as it is in its normal state.

(4.4.1.1) When Z1C-9 and Z1D-10 go LO, the Timer Gate output goes HI—terminating the timing cycle at the same time that the alarm horn(s) is/are turned off.

(4.4.2) If the RESET SWITCH is closed after completion of the timing cycle (alarm horn(s) silent and trouble buzzer on) the latch will be flip-flopped with Z602C-10 being latched LO and Z602D-11 being latched HI.

(4.5) When Z602C-10 goes LO, trouble buzzer B1's ground through Q601 is removed, and the HI through D601 to Z1D-11 and Z1C-8 is removed.

(4.6) The HI from Z602D-11 turns off the 4 Hz. multivibrator Z602B/Z602A—eliminating the 4 Hz. pulses from the Buzzer Pulser Z3D/Z3C.

(4.7) The one Hz. pulses from Buzzer Pulser are turned off with Buzzer Inhibit output Z2C-10 being kept LO. (See para (4.2.1) above.)

(4.8) If when the RESET SWITCH is released (opened): the Perimeter Intruder Detection Circuit is open; or if the Interior Intruder Detection Circuit and/or the Manual Emergency Alarm Circuit is/are closed; the pulsating intruder alarm horn(s) will be turned on; the Alarm Shutdown Timer will

complete its timing cycle, turn off the alarm horn(s) and turn on the trouble buzzer B1 at the 4 Hz. rate.

(4.8.1) If the S-2280 Exit/Entry Timer's S401 is in TIMED ENTRY, and the Intruder Detection Circuit is open when the RESET SWITCH is released (opened), the alarm horn(s) will be turned on, and the Alarm Shutdown Timer cycle will be started after the entry delay timing cycle of Z402 is completed.

(4.9) If when the RESET SWITCH is released (opened): the Fire/Smoke Detection Circuit has one or more heat and/or smoke detectors activated; the steady fire alarm signal will be turned on, the alarm shutdown timing cycle will be started, and when the timing cycle is completed, the alarm horn(s) will be turned off and the trouble buzzer turned on with the intermittent random width pulses.

(5) **DECREASING TIMING CYCLE DURATION:** When checking operation and/or trouble shooting the S-2330, it may be desirable to shorten the timing cycle.

(5.1) Connect Z601-12 (at TP ) to ground. This will reduce the timing cycle by a factor of 60, i.e. a normal 10-minute timing cycle duration will be reduced to 10-seconds.

## MODEL S-2375 PHONE DIALER

(1) The S-2375 is powered by the unfiltered 12.4Vdc through J5/P500-2.

(2) When the system is in standby (no alarm activated), relays K501 and K502 are de-energized and their switch contacts are open.

(3) When the Fire/Smoke Detection circuit is activated, Z1D-10 goes HI. This HI is connected through J5/P500-7 and R502 to the base of Q502.

(3.1) Q502 is turned on (saturated) and the coil of K502 is energized, K502-1 is connected to K502-3 and terminal TB1-17 is shorted to TB1-18.

(3.2) When the Alarm Shutdown Timer has completed its timing cycle, Z1D-10 goes LO; Q502 is turned off; K502's contacts are open; and TB1-17 is disconnected from TB1-18.

(4) When the Intruder Detect Latch Z1C is turned on (by Perimeter Intruder Detection Circuit; Manual Emergency Alarm Circuit; or Interior Intruder Detection Circuit), Z1C-9 goes HI, and Z2B-4 goes HI. This HI is fed through J5/P500-8 and R501 to the base of Q501.

(4.1) Q501 is turned on (saturated and the coil of K501 is energized, K501-1 is connected to K501-3 and terminal TB1-19 is shorted to TB1-20.

(4.2) If the S-2280 Exit/Entry Timer's S104 is in TIMED ENTRY, Z2B-4 will not go HI until the timing cycle of Z402 is completed and Z402-8 goes HI—putting a HI on Z2B-5.

(4.3) When the Alarm Shutdown Timer has completed its timing cycle, Z1C-10 and Z2B-4 will go LO; Q501 is turned off; K501's contacts are open; and TB1-19 is disconnected from TB1-20.

(5) The contacts of relays K501 and K502 are capable of switching 24V circuits with a 1-amp inductive load, or a 1.5-amp resistive load.

(6) The relay contacts must be closed long enough to provide power for the time required by the load. Timing cycle of Z-2330 must be set to equal or exceed this time.

## MODEL S-2371 BATTERY CHARGER

(1) When the system is powered by the 120V, 60 Hz. a-c supply, the Charger is powered by the unfiltered 12.4Vdc through J7/P301-1.

(1.1) The 12.4Vdc is fed through D307 and is filtered by C303, supplying Vc to Q304 and Q305; and through D308 where it is filtered by C301, supplying operating voltage to the voltage regulating circuit D301-D304; Q301 and Q302; and to Q306.

(2) The operating voltages shown in the schematic diagram are approximately those that may be expected when the battery is fully charged and the green BATTERY CHARGING INDICATOR LIGHT is off.

(3) The voltages shown in the table with the PC layout are those that may be expected when starting the recharging of a NuTone Model 2371 Storage Battery which is fully discharged, i.e. its terminal potential is approximately 9 volts under load. The BATTERY CHARGING INDICATOR LIGHT LED301 is on.

(3.1) Although the battery will measure approximately 9 volts when under load, its terminal potential will read approximately 12 volts as soon as the recharging begins.

(4) The battery charging current is supplied through the Darlington connected transistors Q304/Q305.

(4.1) Under full charge the collector of Q305 will be at approximately 12.5V. This voltage is connected through R307 to the base of Q306—turning it on, with the voltage on its collector going to 16.5 volts.

(4.2) This voltage is connected through R309; LED301; D306; and R310 to circuit ground. LED301 will be turned ON.

(4.3) As the battery becomes fully charged, its positive potential increases, and its charging current decreases to near zero, actually there may be a very small trickle or holding current (approximately 1 ma).

(4.4) As the charging current decreases, the voltage on the collector of Q305 rises toward 19.5 volts. With the rise of this voltage, Q306 approaches cutoff and its collector voltage drops to near 0.38V—LED301 will dim and finally be turned off when charging current is reduced to approximately 60 ma.

(5) **BATTERY SHORT CIRCUIT PROTECTION:** If the positive terminal of the battery should be connected through a very low resistance (in the order of 5-ohms) to ground, the emitter voltage (Ve) of Q305 and Q303 will go very low and the charging current would tend to rise beyond safe limits.

(5.1) At the same time, there is a positive voltage on Q303's base; and with Q303's Ve going very low, Q303 will be turned on (saturated) and its collector voltage will be near Ve of Q303 and Q305. This will tend to turn the charging current off when there is a low resistance path between ground and the positive terminal of the battery

(6) **REGULATION—VOLTAGE AND TEMPERATURE:** One percent Zener Diode D301; and diodes D302, D303 and D304 clamp the junction of R302, R303 and R304 to 15.2 Volts, ± 0.1V.

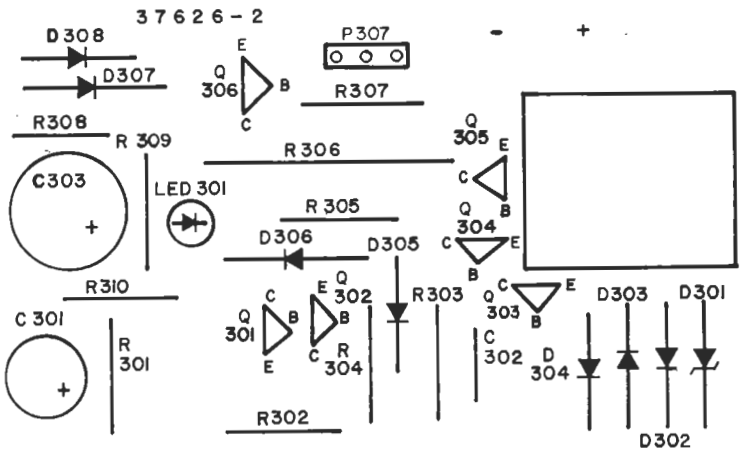
(6.1) If the voltage at the positive (+) side of C301 rises, the voltage on the emitter of Q302 rises—increasing the forward bias on Q301. The resulting increase of Q301's current will cause an increased voltage drop across R301—stabilizing the voltage at the junction of the resistors.

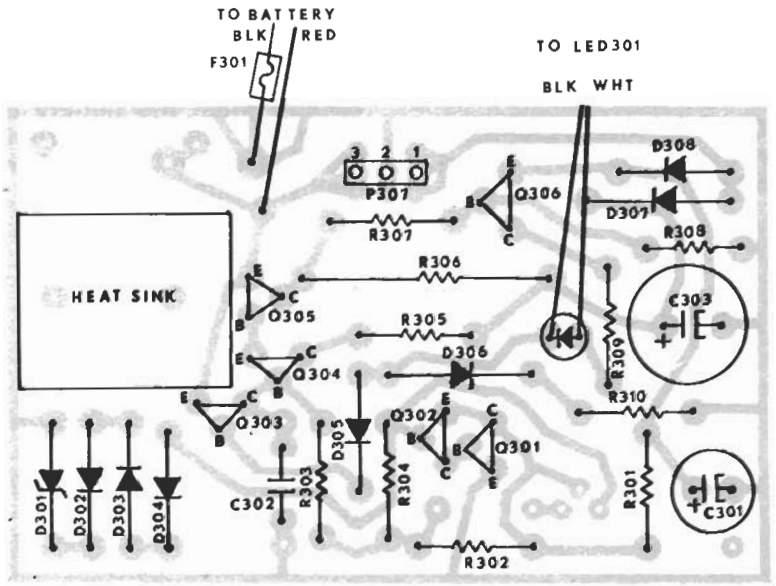
(6.2) If the Darlington temperature increases, and its operating voltages remain the same, its current will increase.

(6.3) At the same time D302; D303; and D304 act as temperature tracking diodes, whose voltage decreases with an increase in temperature. This will reduce the voltage at the resistor junction, and thus the forward bias on base of Q304, reducing the Darlington current and compensating for the rise in temperature.

(6.4) The Zener diode D301 has a positive temperature coefficient which is offset by the negative temperature coefficient of diodes D302; D303; and D304.

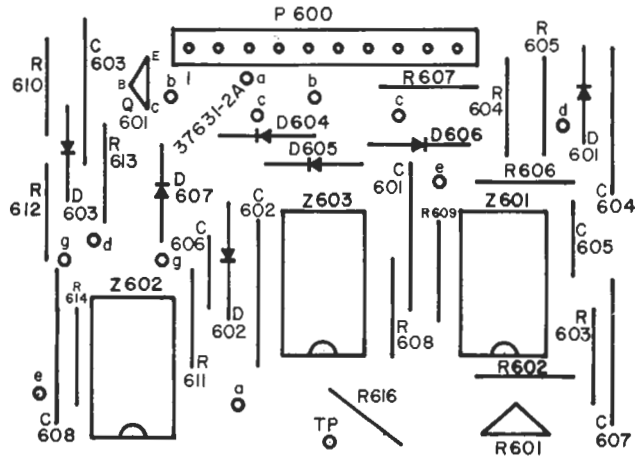
(7) Note that the voltages at the cathode of D307 and D308 is higher when the battery is fully charged (minimum charging current) than the voltage when the battery is at minimum charge (maximum charging current). This results from the IR losses in the transformer T1 and associated rectifying circuit.

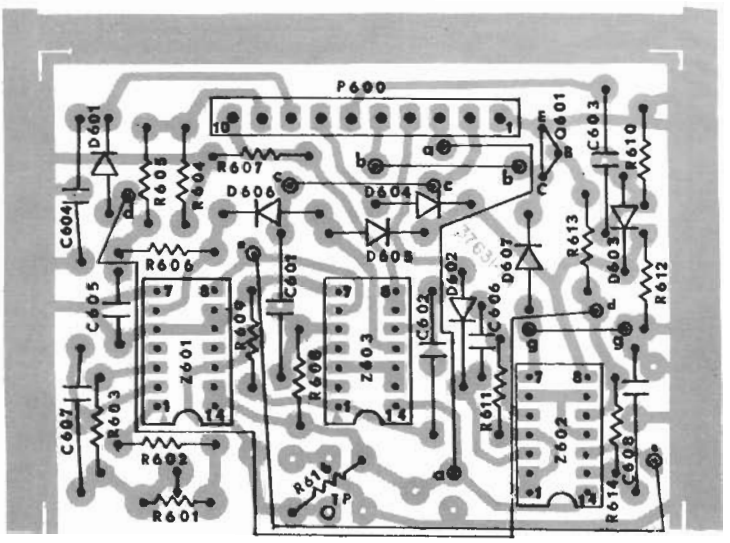



**S-2370 BATTERY CHARGER**
**OPERATING VOLTAGES**
**START OF CHARGING CYCLE**
**LED301 ON**

| 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 |




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

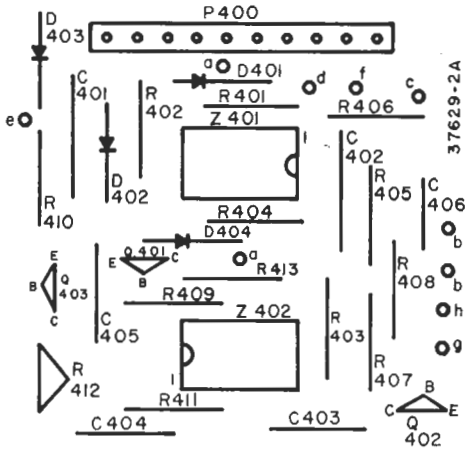
When the system is in standby (no alarm circuit activated) the voltages and logic state are as shown in schematic diagram.

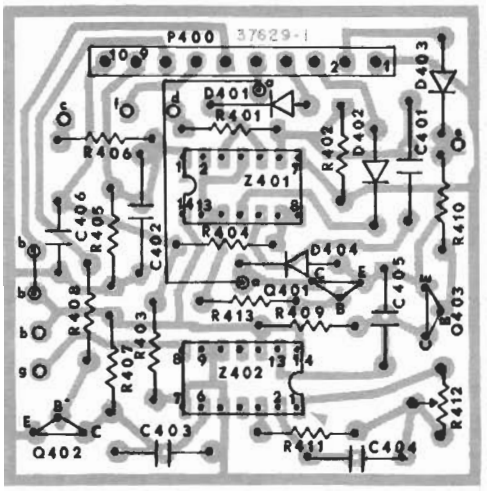
| FIRE AND/OR INTRUDER DETECTION CIRCUIT(S) ACTIVATED | | | |
|---|---|---|---|
| Device | Terminal | Alarm Horn On | Alarm Horn Off |
| Z601 | 1 | 5.45V | OV |
| | 2 | 5.85V | 11.4V |
| | 3 | 5.30V | OV |
| | 5/7/9/10 | OV | OV |
| | 6 (INPUT) | OV | 10.7V |
| | 8 (OUTPUT) | OV | 11.4V - OV* |
| | 12/13/14 | 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 Pulser 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.

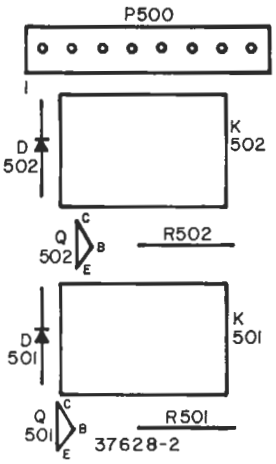
| Device | Terminal | S104 POSITION AND OPERATING MODE | | | | | |
|---|---|---|---|---|---|---|---|
| | | #1 | #2 | | | | |
| | | | | Leaving Bldg. | | Door Opened To Re-Enter Bldg. (Delayed Alarm) | |
| | | Depart | Before Door Opened | Door Opened | Door Closed | Alarm Off | Alarm On |
| Z401A | 1 | 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 |

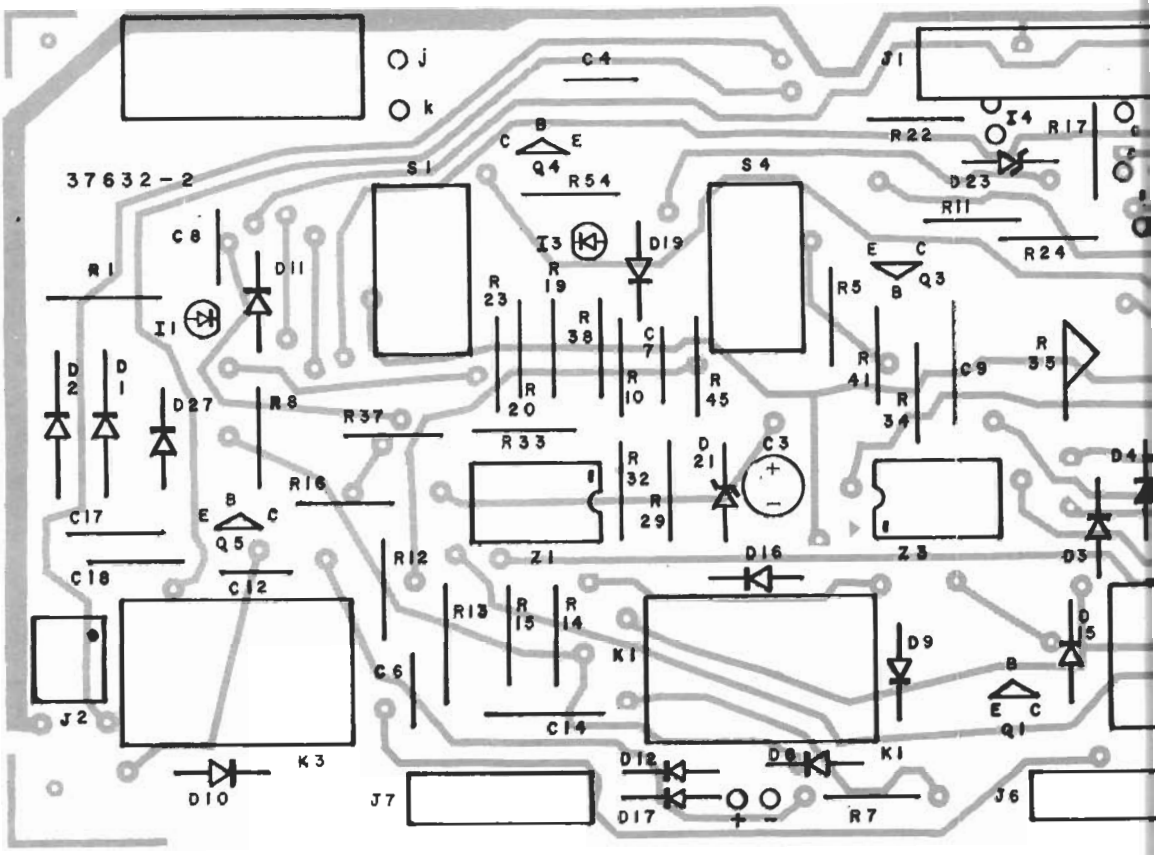
NOTE: (*) If door is immediately closed, input and output state will be reversed, but positive pulse from HI output will not change state of Z401B.

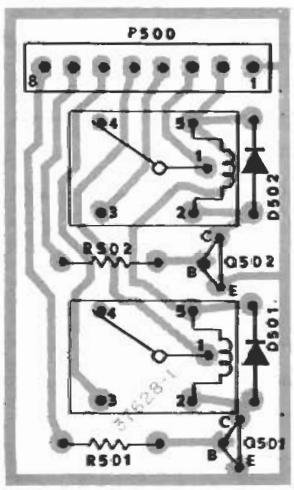
(**) When transistors are ON, their bases are forward biased and their Vc is approximately equal Ve. When transistors are OFF, their bases are not forward biased and their Vc is equal to VDD. (11.4V).

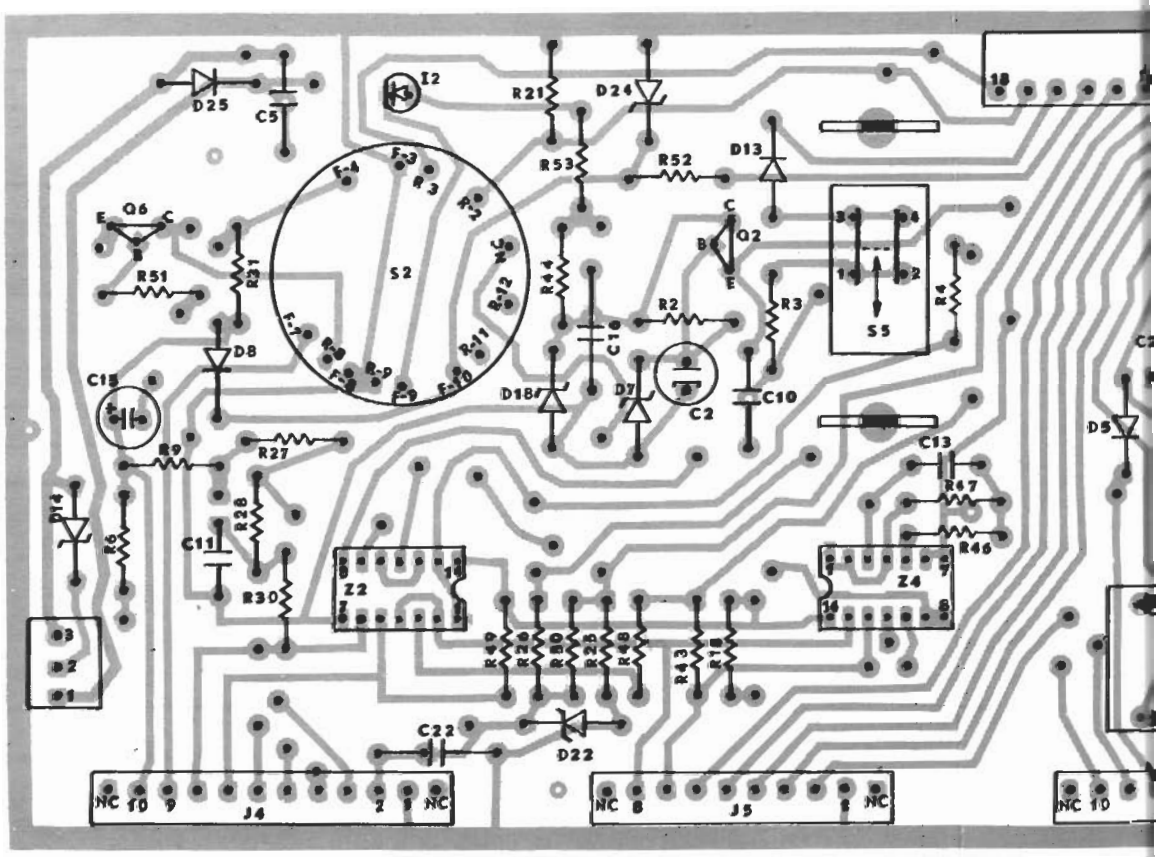
(***) Normally OFF, will be turned on if the Interior Intruder Detection Circuit and/or the Manual Emergency Alarm Circuit is activated.

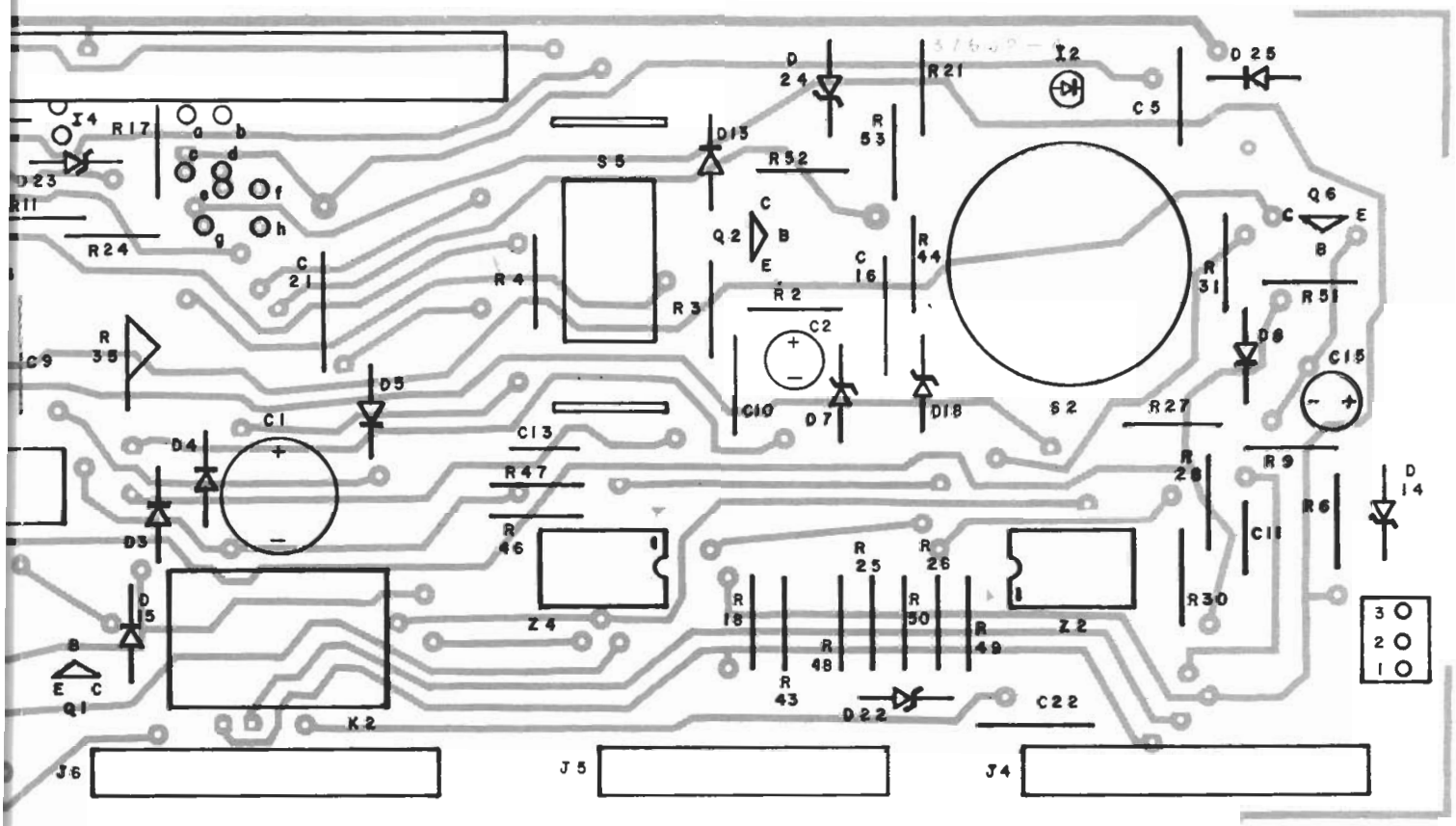
(****) If S401 is in DEPART or DELAYED ENTRY, and Q403 is turned ON, Z402-13 goes LO, and the timing cycle of Z402 is completed immediately.

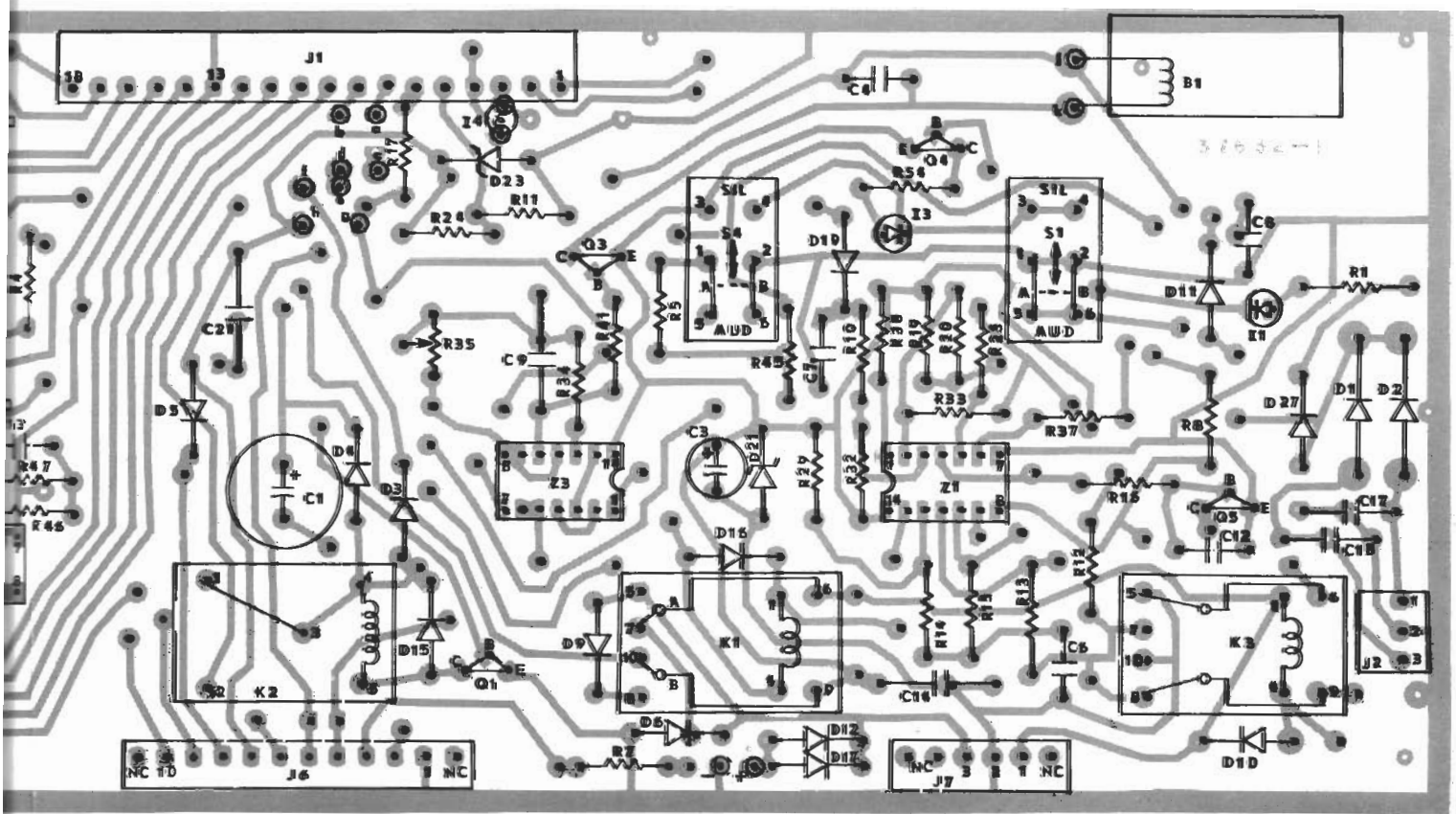

P500
D 502
K 502
Q 502
R502
D 501
K 501
Q 501
R501
37628-2


37632-2
J1
J2
J4
J5
J6
J7
S1
S4
Z1
Z3
K1
K3
Q1
Q3
Q4
Q5
C3
C4
C6
C7
C8
C9
C12
C14
C17
C18
D10
D16
D23
R1
R5
R7
R8
R11
R12
R16
R17
R22
R24
R33
R37
R54


P500
D502
Q502
R502
D501
Q501
R501
37628-1


S2
S5
Z2
Z4
J4
J5
C2
C5
C10
C11
C13
C15
C22
D22
D24
D25
Q2
Q6
R2
R3
R4
R27
R30
R46
R47
R51
R52
R53


I4
R17
D23
R11
R24
C21
R4
S5
D15
R52
D24
R21
I2
D25
C5
R53
Q2
C
B
E
R3
R2
C2
C16
R44
Q6
R31
R51
C9
R35
D5
C1
D4
D3
C13
R47
R46
Z4
C10
D7
D18
S2
R27
D8
C15
R9
R28
R6
D14
C11
R30
R18
R25
R26
R50
R48
R49
R43
D22
C22
Z2
D15
Q1
K2
J6
J5
J4
3
2
1


J1
18
13
1
B1
C6
I4
R17
D23
R11
R24
Q4
R54
I3
S4
S1
S1L
AWD
D19
D11
I1
C8
R1
C21
R35
C9
R34
R41
R5
R45
C7
R10
R38
R39
R40
R43
R33
R37
R8
D27
D1
D2
D5
C1
D6
D3
Z3
C3
D21
R29
R32
Z1
R15
Q5
C12
C17
C18
D16
K2
D15
Q1
K1
D9
R14
R13
R12
K3
C14
C5
J2
D10
J6
R7
D12
D11
J7
NC
TD
NC

| DEVICE | TERMINAL | OPAMP Z1 STAGES | |
|---|---|---|---|
| Z1A | (−) 3 | Iin (greater) | Iin (less) |
| | (+) 2 | Iin (less) | Iin (greater) |
| | (OUT) 4 | LO | HI |
| Z1B | (−) 6 | Iin (greater) | Iin (less) |
| | (+) 1 | Iin (less) | Iin (greater) |
| | (OUT) 5 | LO | HI |
| Z1C | (−) 8 | Iin (greater) | Iin (less) |
| | (+) 13 | Iin (less) | Iin (greater) |
| | (OUT) 9 | LO | HI |
| Z1D | (−) 11 | Iin (greater) | Iin (less) |
| | (+) 12 | Iin (less) | Iin (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 Alarm and Trouble Light 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 |

NOTE: 120V, 60 HZ. OPERATION; S2 ON

DC VOLTAGES: POSITIVE, ±10%, MEASURED IN RESPECT TO PC BOARD CIRCUIT GROUND.

RESISTORS: VALUE IN OHMS, ± 10%; 1/4 WATT; EXCEPT WHERE NOTED. (K=$10^3$; M=$10^6$)

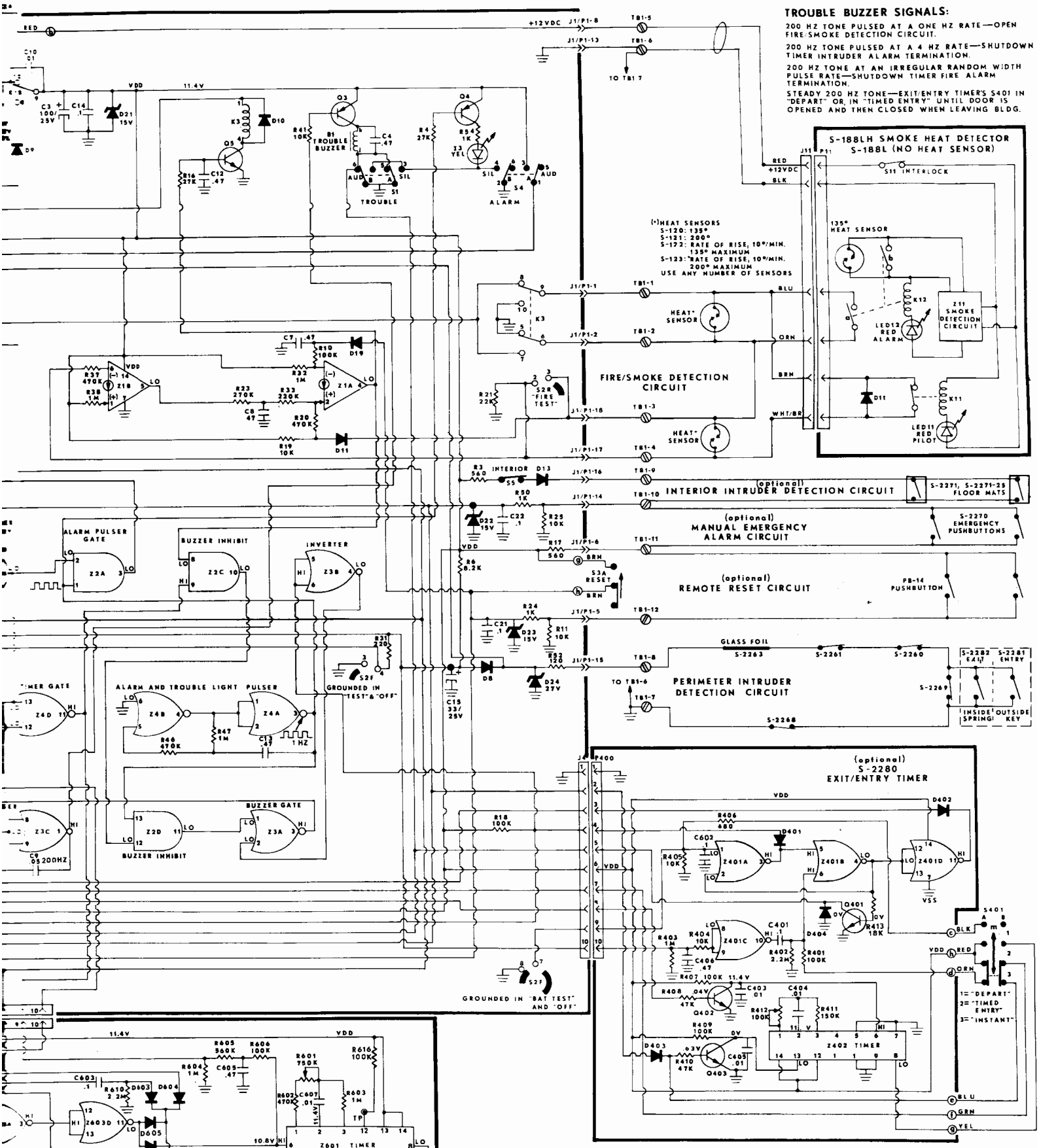
CAPACITORS: VALUE IN MICRO ($10^{-6}$) FARADS; ELECTROLYTICS WVDC AND POLARITY AS SHOWN.

SEE REPLACEMENT PARTS LIST FOR COMPLETE DESCRIPTION OF INDIVIDUAL COMPONENTS.

S-2370 OPERATING VOLTAGES SHOWN WITH S-2371 FULLY CHARGED AND LED301 IS OFF.

SYSTEM IN STANDBY; DETECTION CIRCUITS ARMED BUT NOT ACTIVATED; ALARM HORNS AND TROUBLE BUZZER ARE OFF.

CMOS: POSITIVE LOGIC; LO≅VSS=CIRCUIT GROUND; HI≅VDD=11.4V




**NUTONE MODEL S-2300 ALARM SYSTEM**
**(REPRESENTATIVE INSTALLATION)**

# REPLACEMENT PARTS LIST

CAPACITORS: Value in micro ($10^{-6}$) farads. Other specifications as noted.
RESISTORS: Value in ohms ±10%, ¼ watt carbon composition, except as noted.
K = Kilo = 1,000. M = Mega = 1,000,000

| Schematic Symbol | NuTone Part No. | Description |
|---|---|---|
| **MODEL S-188L SMOKE DETECTOR** | | |
| | 10391-900 | Complete Assembly |
| | 5073A-000 | Cover |
| | 38601-000 | Mounting Plate |
| J11 | 5006A-000 | Receptacle and Wire Assembly |
| | 69740-000 | Filter Set |
| | 47000-000 | Label,data |
| | 47045-000 | Label, instructions |
| **MODEL S-188LH SMOKE/HEAT DETECTOR** | | |
| | 10392-900 | Complete Assembly |
| | 5392A-000 | Cover |
| | 38601-000 | Mounting Plate |
| J11 | 5006A-000 | Receptacle and Wire Assembly |
| | 69740-000 | Filter Set |
| | 47000-000 | Label, data |
| | 47045-000 | Label, instructions |
| **MODEL S-2280 EXIT/ENTRY TIMER** | | |
| | 10620-900 | Complete Assembly |
| **CAPACITORS** | | |
| C401, C402 | 35100-127 | .1, +80%, −10%, 100V, Ceramic |
| C403, C404, C405 | 35100-139 | .01, +80%, −20%, 50V, Ceramic |
| C406 | 35024-101 | .47, ±20%, 75V Polyester Film |
| **DIODES** | | |
| D401, D402, D403, D404 | 36549-000 | Rectifier Type, 1 Amp DC, 100 PIV; 1N4002 |
| **CONNECTORS** | | |
| P400 | 39521-103 | Plug, 10 Pin, Male, for connecting to Control Unit |
| **RESISTORS** | | |
| R401, R407, R409 | 33081-104 | 100 K |
| R402 | 33081-225 | 2.2M |
| R403 | 33081-105 | 1M |
| R404, R405 | 33081-103 | 10K |
| R406 | 33081-681 | 680 |
| R408, R410 | 33081-473 | 47K |
| R411 | 33081-154 | 150K |
| R412 | 34042-000 | 750K, Rheostat |
| R413 | 33081-183 | 18K |
| **SWITCHES** | | |
| S401 | 39495-000 | Slide Type, DP3T, DEPART (position 1, momentary contact), TIMED ENTRY, HOME |
| | 39524-000 | Switch Mounting Channel |
| | 25169-004 | Screw, #6-32 x ⅜", Slt Rd, Switch to Channel |
| | 41730-000 | Switch, Wire and Channel Assembly |
| | 38688-000 | Inlay Switch to Master Unit Panel |
| **TRANSISTORS** | | |
| Q401 | 36613-000 | NPN Silicon; Texas Inst. TIS-98; Mot MPS-A20 |
| Q402, Q403 | 36580-000 | NPN Planar Silicon, low noise: TexInst SKA-4220; Mot SPS-1216 National Semi-conductor SMO-7329 |
| **INTEGRATED CIRCUITS** | | |
| Z401 | 36629-000 | Quad, 2-input NOR Gates, CMOS: RCA CD4001AE; Solid State Scientific SCL 4001AE series; Solitron CM 4001 AE Series Mot MC 14001 CP |
| Z402 | 36633-000 | Oscillator Timer: Mot MC14541 CP |
| **MISCELLANEOUS** | | |
| | 47092-000 | Installation Instructions |
| **MODEL S-22/23R MASTER UNIT ROUGH-IN HOUSING** | | |
| | 10515-900 | 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 1¾" Slt Flt, Transformer Mounting |
| | 14823-038 | Screw, #8 x ⅜" Slt Pan, Junction Box Cover mounting |
| TB1 | 39488-000 | Terminal Strip, 20 connector, #6-32 x ½" Slt 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 Iinstructions |
| **MODEL S-2300 MASTER UNIT** | | |
| | 10650-900 | Complete Assembly |
| | 41706-000 | PC Board Assembly |
| **HORNS AND BUZZERS** | | |
| B1 | 36070-000 | Buzzer, 12V, TROUBLE |
| | 10437-003 | Screw, #8-32 x ⅜", Slt Rd, Buzzer Mounting |
| B2 | 41708-000 | Horn, 12V, ALARM |
| | 54377-015 | Screw, #8-32 x ½" Ph. Truss Horn Mounting |
| **CAPACITORS** | | |
| C1 | 35091-101 | 470, +100%, −10%, @ 35 WVDC Electrolytic |
| C2, C15 | 35091-104 | 33, +100%, −10%, @ 25 WVDC Electrolytic |
| C3 | 35091-108 | 100, +100%, −10%, @ 25 WVDC Electrolytic |
| C4, C6, C7, C8, C11, C12, C13 | 35024-101 | .47, ±20%, 75V, Polyester Film |

| Schematic Symbol | NuTone Part No. | Description |
|---|---|---|
| C5, C10, C17, C18 | 35100-139 | .01, +80%, −20%, 50V, Ceramic Disc |
| C9 | 35100-146 | .05, ±20%, 50V Ceramic Disc |
| C14, C16, C21, C22 | 35100-127 | .1, +80%, −20%, 100V, Ceramic Disc |
| C19, C20 | Not Used | |
| **DIODES** | | |
| D1, D2 | 36608-000 | Silicon Rectifier, Power Supply, 3 Amp DC, 100 PIV: Mot MR-502 General Instrument 1N540Z |
| D3-D6, D8-D13, D15-D17, D19, D25, D27 | 36549-000 | Silicon Rectifier type, 1 Amp DC, 100 PIV: 1N4002 |
| D7 | 36539-000 | Zener, Silicon 12V ±5%: 1N4742A |
| D14, D18, D24 | 36632-000 | Zener, Silicon, 27V ±10%: 1N4750 |
| D20 | Not used | |
| D21, D22, D23 | 36631-000 | Zener, Silicon, 15V ±5%: 1N744Z |
| **FUSES** | | |
| F1 | 31160-000 | 2 Amp, AGC3, Smoke Detector Power Supply |
| F2 | 31160-000 | 2 Amp, AGC3, Master Unit and Remote Alarm Horns and/or Bells |
| | 38671-000 | Clip, F1 and F2 (2 required for each fuse) |
| | 9686-004 | Clip, spare fuse |
| | 90958-004 | Screw, #6 x ⅜" Ph Pan, fuse clip mounting |
| **INDICATOR LAMPS** | | |
| I1 | 36637-000 | LED, Green, AC ON PILOT |
| I2 | 36637-000 | LED, Green INTRUDER CIRCUIT ARMED |
| | 41725-000 | 12, LED, Wire and Sleeving, complete assembly |
| I3 | 36636-000 | LED, Yellow TROUBLE/ALARM |
| I4 | 39438-000 | Neon, 105-125V, Alarm Horn Circuit Protection: G.E. Glow Lamp #c2A-ET(NE-2H3T) or engineering equivalent |
| **CONNECTORS** | | |
| J1 | 39500-000 | 18-Pin, male, connect through P1 to TB1 |
| J2 | 39422-101 | 3-Pin, male, connect through P2 to AC voltage from T1 |
| J3 | Not Used | |
| J4 | 39499-107 | 10-Pin (12-sockets), female, connect through P4 to S-2280 Exit/Entry Timer |
| J5 | 39499-106 | 8-Pin (10-sockets), female, connect through P5 to S-2375 Phone Dialer |
| J6 | 39499-107 | 10-Pin (12-sockets), female, connect through P6 to S-2330 Alarm Shutdown Timer |
| J7 | 39499-103 | 3-Pin (6-socket), female, connect through P7 to S-2370 Battery Charger |
| | 39494-000 | Key, polarizing, for use in extra sockets in J4, J5, J6 and J7 |
| **RELAYS** | | |
| K1 | 39505-000 | DPDT, AC/DC supply switching: Contact Rating .03 to 5 Amp Resistive; 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 Cornell-Dubilier Series 683-674B |
| K2 | 39506-000 | SPST, Alarm Indicator Horns and/or Bell switching, ON/OFF. Contact Rating .03 to 5 Amp Resistive; 2.5 Amp Inductive; @ 24Vdc. Coil: 360 to 550 ohms; nominal 12Vdc ±33%; must pull-in at 8V or less at 25°C. Cornell-Dubilier Series 601-675B; RBM Series #64-153151-100; Price Electronic Series 28B111AE-0120; North Amer. Phillips 28B111AE-0120 |
| K3 | 39507-000 | DPDT, Fire Detector Circuit Switching. Contact Rating 500 microamps to 10 ma Resistive @ 9 to 15Vdc. Coil: 400 to 550 ohms; nominal 12Vdc; must pull-in at 9V or less at 25°C. RBM X301BR (modified); Cornell-Dubilier Series 683-715G |
| **TRANSISTORS** | | |
| Q1, Q5, Q6 | 36613-000 | NPN Silicon: TexInst TIS-98; Mot MPS-A20 |
| Q2 | 36605-000 | NPN Silicon, Power, Regulator Mot MPS-U05 |
| Q3 | 36615-000 | PNP Silicon: Mot MPS A56 Fairchild Semiconductor TEH-0224 |
| Q4 | 36606-000 | PNP Silicon: Mot MPS K71 |
| **RESISTORS** | | |
| R1 | 33101-102 | 1K, ½W |
| R2, R3, R17 | 33081-561 | 560 |
| R4, R16, R43, R48 | 33081-273 | 27K |
| R5, R8, R10, R18, R30, R34, R45 | 33081-104 | 100K |
| R6 | 33081-822 | 8.2K |
| R7, R29, R32, R38, R47 | 33081-105 | 1M |
| R9, R27, R28, R33 | 33081-224 | 220K |
| R11, R19, R25, R41, R49 | 33081-103 | 10K |
| R12, R24, R50, R54 | 33081-102 | 1K |
| R13 | 33051-101 | 620K ±2%, ½W Metal Film |
| R14, R15 | 33081-154 | 150K |
| R20, R37, R46 | 33081-474 | 470K |
| R21 | 33081-223 | 22K |
| R22 | Not Used | |
| R23 | 33081-274 | 270K |
| R26 | 33081-334 | 330K |
| R31 | 33081-221 | 220 |
| R35 | 34042-000 | 100K, Rheostat, Buzzer Pulser Frequency Adjust |
| R36, R39, R40, R42 | Not Used | |
| R44 | 33081-220 | 22 |
| R51 | 33081-183 | 18K |
| R52 | 33081-121 | 120 |
| R53 | 33081-182 | 1.8K |
| **SWITCHES** | | |
| S1 | 39503-000 | DPDT, Slide TROUBLE BUZZER AUDIBLE-SILENCE: Switchcraft XW-2791 |
| S2 | 39504-000 | 5-Position Rotary; 2 end positions momentary contact: Standard Grigsby 42467-42LR-1 |
| | 39512-000 | Knob, rotary switch S2 |
| S3 | 39508-000 | DPDT, Slide, RESET: Switchcraft XW-2790 |

| Schematic Symbol | NuTone Part No. | Description |
|---|---|---|
| S4 | 39503-000 | DPDT, Slide, ALARM SILENT-AUDIBLE Switchcraft XW-2791 |
| S5 | 39502-000 | DPST, Slide, INTERIOR INTRUDER OFF-ON Switchcraft 46204LR-modified |
| | 38669-003 | Bracket, switch S5 |
| | 16851-004 | Screw, #6-32 x ¼ Slt Rd, S5 to bracket mounting |
| | | **TRANSFORMER** |
| | 41697-000 | Complete assembly including transformer, junction box cover and plug P2 (supplied with S-22/23R Rough-in Housing) |
| T1 | 30596-000 | 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 Mot MC-3301-P Nat Semiconductor LM-3900N or LM2900N |
| Z2 | 36630-000 | 14-Pin, Quad 2-input AND Gates: Mot MC 14081CP Solid State Scientific SCL 4081-AE |
| Z3, Z4 | 36629-000 | 14-Pin, Quad 2-input NOR Gates: RCA CD4001AE Solid State Scientific SC1 4001-AE solitron CM 4001-AE Mot MC 14001 CP |
| | 39501-000 | Socket, 14-pin, for ICs. |
| | | **MISCELLANEOUS** |
| | 41707-000 | Control Panel, complete assembly |
| | 41709-000 | Door, complete assembly |
| | 39509-000 | Lock, 3-position |
| | 39510-003 | Cam |
| | 39511-000 | Hinge Pin |
| | 41710-000 | Mounting Bracket and screws |
| | 39415-000 | Retainer Strap |
| | 22391-001 | Screw #8 x ⅜" Ph. Truss Secure retainer strap |
| | 38673-000 | Cover, battery and wiring |
| | 47107-000 | Label, accessory |
| | 47096-000 | Label, door lock instructions |
| | 38676-000 | Inlay, Control |
| | 22577-000 | Label, Warning |
| | 47111-000 | Installation Instruction Sheet |
| | 47112-000 | Homeowners Operating Manual |

## MODEL S-2330 ALARM SHUTDOWN TIMER

| | | |
|---|---|---|
| | 10680-900 | Complete Assembly |
| | | **CAPACITORS** |
| C601, C602, C603, C604, C608 | 35100-127 | .1, +80%, −20%, 100V Ceramic Disc |
| C605, C606 | 35024-101 | .47, ±20%, 75V Polyester Film |
| C607 | 35100-159 | .01, ±10%, 500V Ceramic Disc |
| | | **DIODES** |
| D601-D607 | 36617-000 | Silicon Switching, 50ma, 75 PIV: 1N914 |

| Schematic Symbol | NuTone Part No. | Description |
|---|---|---|
| | | **CONNECTORS** |
| P600 | 39521-103 | 10-Pin (12-sockets), male: Connect through J6 to Master Unit PC board. |
| | | **TRANSISTORS** |
| Q601 | 36613-000 | NPN Silicon: TexInst TIS-98; Mot MPS-A20 |
| | | **RESISTORS** |
| R601 | 34058-000 | 75K, Rheostat, Timer Control |
| R602 | 33081-474 | 470K |
| R603, R604, R607 | 33081-105 | 1M |
| R605 | 33081-564 | 560K |
| R606 | 33081-104 | 100K |
| R608, R609, R610, R612 | 33081-225 | 2.2M |
| R611, R614 | 33081-224 | 220K |
| R613 | 33081-473 | 47K |
| | | **INTEGRATED CIRCUITS** |
| Z601 | 36633-000 | Osçillator Timer, 14-Pin: Mot MC14541 CP |
| Z602, Z603 | 36629-000 | 14-Pin, Quad 2-input NOR Gates: CD 4001-AE Mot 14001 CP |
| | | **MISCELLANEOUS** |
| | 47174-000 | Installation Instruction Sheet |

## MODEL S-2370 BATTERY CHARGER

| | | |
|---|---|---|
| | 10720-900 | Complete Assembly |
| | 41732-000 | PC Board, complete assembly |
| | | **CAPACITORS** |
| C301 | 35091-108 | 100, +100%, −10%, @25 WVDC Electrolytic |
| C302 | 35055-102 | .15, ±20% 100V Polyester Film |
| C303 | 35091-113 | 330, +100%, −10% @ 35 WVDC Electrolytic |
| | | **DIODES** |
| D301 | 36638-000 | Zener, Silicon, 13V ±1%; Mot .5M13ZS1; 1N4743 |
| D302-D308 | 36549-000 | Rectifier type, Silicon, 1 Amp DC, 100 PIV: 1N4002 |
| | | **FUSES** |
| F301 | 31160-000 | 2 Amp, AGC3 |
| | 41735-000 | Holder, complete assembly for F301 |
| | | **INDICATOR LIGHTS** |
| LED301 | 36637-000 | LED, Green, BATTERY CHARGING indicator |
| | | **CONNECTORS** |
| P307 | 39421-101 | 3-Pin (6-socket), male, for connecting through P7 to Master Unit PC Board |
| J307 | 41734-000 | Receptacle 3-pin with wire, complete assembly (not used with S-2300 system) |
| | | **TRANSISTORS** |
| Q301 | 36605-000 | NPN Silicon, Power: Mot MPS-u05 |
| Q302 | 36577-000 | PNP Epitaxial Planar Silicon: TexInst SKA-4223 |

| Schematic Symbol | NuTone Part No. | Description |
|---|---|---|
| Q303, K304 | 36613-000 | NPN Silicon; TexInst TIS-98 Mot MPS A-20 |
| Q305 | 36614-000 | NPN Silicon single diffused: Mot MJE-A20 |
| | 38613-000 | Heat Sink for Q305 |
| | 15448-004 | Screw, #4-40 x 5/16" Slt Pan, heat sink mounting |
| | 11159-003 | Nut, #4-40 Hex |
| Q306 | 36606-000 | PNP Silicon: Mot MPS-K71 |
| | **RESISTORS** | |
| R301, R305 | 33101-151 | 150, ½ W |
| R302 | 33101-180 | 18, ½ W |
| R303, R309 | 33101-102 | 1K, ½ W |
| R304 | 33101-221 | 220, ½ W |
| R306 | 33030-110 | 5, 5W, wire wound |
| R307 | 33081-471 | 470 |
| R308 | 33081-223 | 22K |
| R310 | 33101-391 | 390, ½ W |
| | **MISCELLANEOUS** | |
| | 39528-000 | Envelope assembly including Insulating Pod for battery connecting cable; LED 301 label; cable clamp; and mounting screw |
| | 47104-000 | Label, Battery, Neg |
| | 47105-000 | Label, Battery, Pos |
| | 47125-000 | Installation Instruction Sheet |

| Schematic Symbol | NuTone Part No. | Description |
|---|---|---|
| | **MODEL S-2375 TELEPHONE DIALER** | |
| | 10725-900 | Complete Assembly |
| | **DIODES** | |
| D501, D502 | 36549-000 | Rectifier type, Silicon 1 Amp DC, 100 PIV; 1N4002 |
| | **RELAY** | |
| K501, K502 | 39522-000 | SPDT, Dialer power switching, Contact Rating: 2 Amp Resistive; 1 Amp Inductive; @ 12Vdc Coil 400 ohms ±10%; nominal 12Vdc; must pull-in at 9Vdc or less at 25°C. Sigma Instruments 78RE1-12DC |
| | **CONNECTORS** | |
| P500 | 39521-102 | 3-Pin (6-socket), male, connect through J7 to S2300 Master Unit PC board |
| | **TRANSISTORS** | |
| Q501, Q502 | 36613-000 | NPN Silicon; TexInst TIS-98 Mot MPS-A20 |
| | **RESISTORS** | |
| R501, R502 | 33081-393 | 39K |
| | **MISCELLANEOUS** | |
| | 47120-000 | Installation Instruction Sheet |