

# **SERVICE MANUAL**

## **NUTONE APARTMENT HOUSE COMMUNICATION SYSTEM 4**

### **INCORPORATING MODEL 478 CONTROL UNIT**

**NuTone** Housing Products

**Scovill**

MADISON & RED BANK ROADS

• CINCINNATI, OHIO 45227 •

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### SYSTEM COMPONENT CHART

SYSTEM FEATURES	REQUIRED NUTONE EQUIPMENT BY MODEL NUMBER								
	POWER TRANSFORMER	CONTROL UNIT	MODULE(S) ADDED TO CONTROL UNIT	APT. SPKR. (MINIMUM ONE IN EACH APT.)	BUILT-IN APARTMENT SPEAKER ROUGH-IN	SURFACE-MOUNT APT. SPKR. ROUGH-IN	ELECTRIC DOOR RELEASE	ENTRANCE DIRECTORY AND ROUGH-IN	POSTAL LOCK SWITCH
ONE-ENTRY SYSTEM WITH TENANT CONTROLLED MOMENTARY ELECTRIC DOOR RELEASE. (Door Release remains activated while the Apt. Spkr. Door Release Switch is held in position 1 or 2.) ①	301-N	478	NONE	485	IR-3 or IR-4 ****	IA-15	DR-1 (t)	2-20 Apts., 498, installed in 490-1 Rough-in. 2-145 Apts., 494* 2-135 Apts., 494(T)** Any No. of Apts., 495 or 495(T)	NONE
ONE-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK ②	301-N	478	467	485	IR-3 or IR-4 ****	IA-15	DR-1 (t)	2-20 Apts., 498, installed in 490-1 Rough-in. 2-135 Apts., 494(P) or 494(TP)* Any No. of Apts., 495(P) or 495(TP)**	499*** NONE NONE
TWO-ENTRY SYSTEM WITH TENANT CONTROLLED, SELECTIVE, MOMENTARY ELECTRIC DOOR RELEASE AT BOTH ENTRIES. (Door release at Entry No. 1 remains activated while the Apt. Spkr. Door Release Switch is held in position 1; and Door Release at Entry No. 2 remains activated while the switch is held in position 2) ③	301-N	478	466	485	IR-3 or IR-4 ****	IA-15	DR-1 Both Doors (t)	2-20 Apts., 498, installed in 490-1 Rough-in at both entries. 2-145 Apts., 494* 2-135 Apts., 494(T) installed at both entries. Any No. of Apts., 495 or 495(T) installed at both entries.	NONE
TWO-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK AT MAIN ENTRY, AND TIMED DOOR RELEASE AT SECOND ENTRY ④	301-N	478	467 466	485	IR-3 or IR-4 ****	IA-15	DR-1 Both Doors (t)	2-20 Apts., 498, installed in 490-1 Rough-in at both entries. 2-135 Apts., 494(P) or 494(TP) at Main Entry; and 494 or 494(T) at Second Entry. Any No. of Apts., 495(P) or 495(TP) at Main Entry; and 495 or 495(T) at Second Entry	499 MAIN ENTRY NONE NONE
TWO-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK AT BOTH ENTRIES; AND AUTO CALL TRANSFER (UNUSED DIRECTORY LOCKOUT) ⑤	301-N	478	469	485	IR-3 or IR-4 ****	IA-15	DR-1 Both Doors (t)	Any No. of Apts. 496(P) or 496(TP) at both entries NOTE: If Postal Lock Switch is not required at Second Entry, use 496 or 496(T)	NONE

NOTE: (\*) Rough-in Housing for 494; 495; and 496 Entrance Directories is determined by the number of apartments served.

(\*\*) Suffix "(T)" indicates directories supplied with telephone handsets instead of speakers.

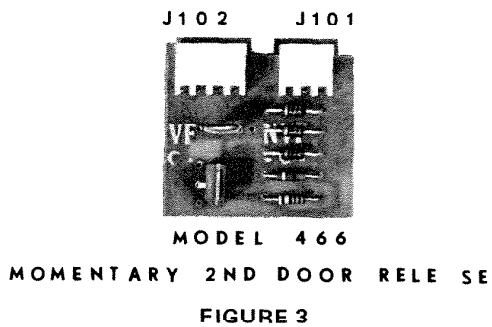
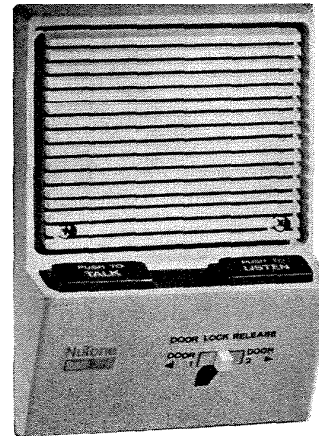
Suffix "(P)" indicates directories supplied with Postal Lock provisions.

Suffix "(TP)" indicates directories that are supplied with telephone handsets and Postal Lock provisions.

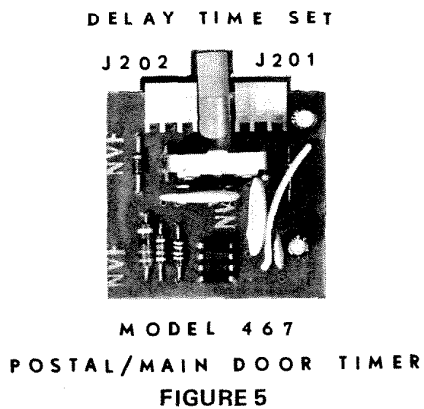
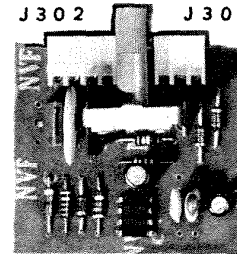
(\*\*\*) Postal Lock Switch Model 499 may be used at entries with Models: 494, 495; and 496 Entrance Directories installed, i.e. where a remote Postal Lock release is desired.

(\*\*\*\*) When riser cable to apartment speakers is run free (not in conduit), use IR-3 Rough-in Frame. When riser cable to apartment speakers is run in conduit, use IR-4 Rough-in Housing (closed back).

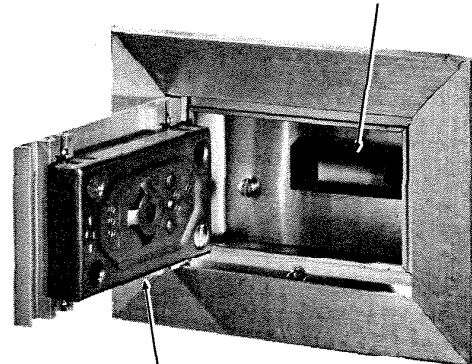
(t) Use NuTone Model DR-1 with wood frame and door. For metal frame and door, use Electric Door Release supplied by door manufacturer. (Door Release should operate on 6 to 8 V average pulsating DC.)

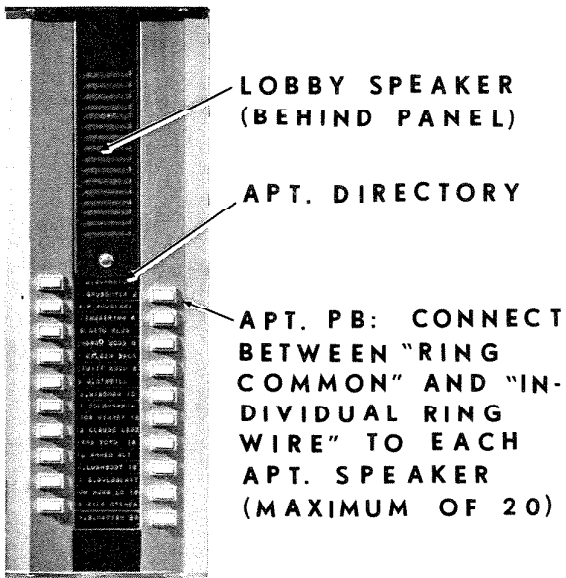


DELAY TIME SET  
J302 J301

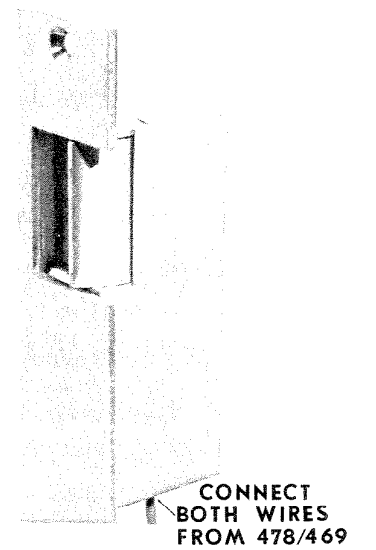


CONNECT "POSTAL LOCK" FROM  
CONTROL UNIT TO SWITCH

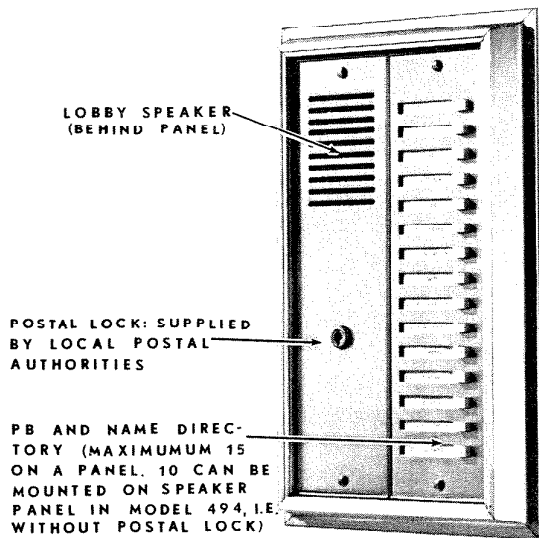




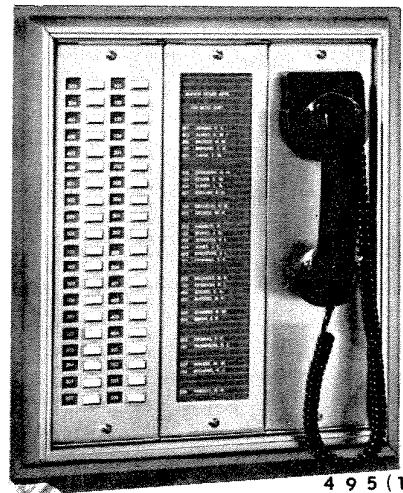
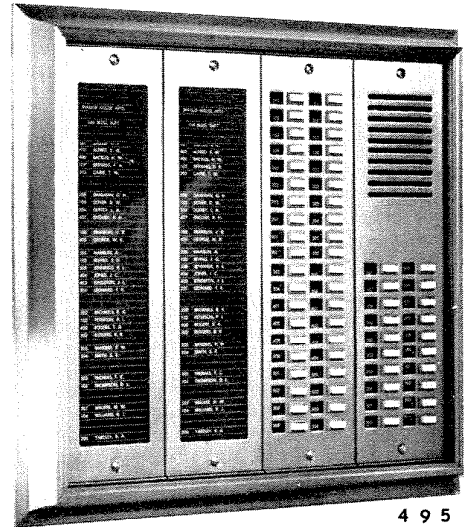
MODEL 498  
ENTRANCE DIRECTORY  
FIGURE 7



DR-1 ELECTRIC DOOR RELEASE  
FIGURE 8



MODEL 494(P)  
ENTRANCE DIRECTORY  
FIGURE 9



Model 496 same as Model 495, except: Model 496 includes "IN USE" indicator lamp on speaker and handset panels.

Push Buttons cannot be installed on speaker panel when postal lock provision is included — (P) and (TP) series.

FIGURE 10

## GENERAL

(1) The NuTone Apartment House Communication System 4 can be installed in any one of five different methods.

(1.2) These five different systems are shown in the SYSTEM COMPONENT CHART, page 3, from which the individual component requirements can be determined.

(2) All equipment should be installed according to the specific installation instructions, which are supplied with all NuTone equipment.

(3) The system's wire and cable should be installed according to the representative wiring diagrams.

(3.1) For systems No. 1 through 4 (page 3), use WIRING DIAGRAM NO. 1—REPRESENTATIVE INSTALLATION (page 25/26). (These systems use the Model 478 terminal board. Figure 12, page 20.)

(3.2) For system No. 5, page 3, use WIRING DIAGRAM NO. 2—REPRESENTATIVE INSTALLATION (page 27/28). (This system uses the Model 469 terminal board, Figure 13, page 21.)

(4) The Common Cable; Riser Cables; and Individual Ring Wires should be connected together at the Cable Junction. The recommended method is shown in Figure 14, page 21. Other means, such as solderless connectors, may be used.

(4.1) The Cable Junction may be made in the Entrance Directory (either Directory in a two-entry system) or in a remote junction or utility box.

(5) When a system malfunction is reported, it should be checked according to SYSTEM OPERATIONAL CHECKOUT, page 14, and it should be

determined whether the fault lies in the Control Unit and/or optional modules; or in the interconnecting wires and cables and/or in one or more of the remote components.

(6) Before servicing this system, a complete understanding of the THEORY OF OPERATION, pages 7 through 13 is essential.

(7) The operating voltage charts, pages 22 and 23; and the resistance charts page 24 will assist in determining the faulty circuit and/or component.

(8) Wiring and installation errors should be corrected during installation operation checkout. If additional mistakes are reported after the system has been in operation, they must be corrected before proceeding with the service checkout.

(9) The system should always be returned to full operating condition as soon as possible.

(9.1) If the Master Unit and/or optional modules require bench servicing, NuTone Authorized Service Centers may service these systems by replacing the defective units; repairing the faulty unit; and then using the repaired unit as a replacement in future trouble calls.

(10) The PC boards are shown on pages 32-34 and should be used for locating and servicing the individual components.

(10.1) When servicing PC boards and components, do not overheat the boards nor components. Do not damage the foil paths. Use solder-sucker tool or iron when removing components. BE CAREFUL.

(11) Refer to the REPLACEMENT PARTS LIST, pages 44-46 for a complete description of the individual components.

## THEORY OF OPERATION

### POWER SUPPLY AND COMMON FEATURES

- (1) The Model 478 Control Unit is powered by 120V, 60 Hz. supply.
- (2) The 120V, 60 Hz is connected to the primary of NuTone's 30 VA transformer Model 301-N. The secondary has a nominal rating of 16Vac.
- (3) See Schematics No. 1 and No. 2: The secondary 16Vac is connected through the AC and AC/DOOR COMMON terminals of P5/J5-8 and P5/J5-7.
- (3.1) See Schematic No. 3: In systems incorporating the Model 469 Auto Call Transfer, the secondary 16Vac is connected through the AC and AC/DOOR COMMON terminals of P506/J506-6 and P507/J507-1; across the Model 469 PC board; and through the AC and AC/DOOR COMMON terminal of P505/J5-8 and P505/J5-7.
- (4) From J5-8, the AC lead is connected to one side of the full-wave bridge rectifier Z4; to the cathode of SCR1; and to 16Vac terminal P2-1.
- (4.1) The AC/DOOR COMMON is connected from J5-7 to the other side of the bridge rectifier Z4.
- (5) The 16Vac is rectified by Z4 and filtered by C17. The potential at the high-side (+) of C17 is approximately +20Vdc. (Unless otherwise noted, all voltages are made in respect to common circuit ground J5-6.)
- (6) The +20Vdc is connected through the coil of relay K1 to the collector of normally "Off" transistor Q1, and it will power the relay K1 when Q1 is turned on (saturated).
- (7) The +20Vdc is also connected to the collector of voltage regulator transistor Q4.
- (7.1) The base of Q4 is clamped at +15V by the Zener diode D13.
- (7.2) The voltage at Q4's emitter is held very close to 14.4Vdc through the voltage and current requirements of the system's various operating modes.
- (7.3) NOTE: For convenience, this voltage is referred to as the +15Vdc in the text and schematics of this manual.
- (7.4) The 15Vdc is Vdd to the OpAmp Z1 in the Model 478 and to the NOR gates Z501 in the Model 469. It is also the supply to the other devices in all components.
- (8) The quad OpAmps Z1 operate on the current difference principle, i.e. current comparators.
- When the current to the inverting (-) input terminal is greater than the current to the non-inverting (+) input terminal, the output terminal will be LO.
- When the current to the non-inverting (+) input terminal is greater than the current to the inverting (-) input terminal, the output will be HI.
- (8.1) Z1A is the RING COMPARATOR.
- (8.2) Z1B is the TALK/LISTEN COMPARATOR.
- (8.3) Z1C is the ENTRY NO. 1 DOOR RELEASE COMPARATOR in the basic systems (see Schematics No. 1 and No. 2).
- (8.3.1) Z1C is COMPARATOR for the DOOR RELEASE function in systems using the Model 469 Auto Call Transfer (Schematic No. 3).
- (8.4) Z1D is the ENTRY NO. 2 DOOR RELEASE COMPARATOR in the two-entry systems that incorporate the Model 466 Momentary 2nd. Door Release or, the Model 468 Timed 2nd. Door Release. (See Schematic No. 1 and No. 2)
- (9) The quad, two-input NOR gate Z501 in the Model 469 Auto Call Transfer, utilizes CMOS positive logic. (See Schematic No. 3)
- When there is a HI on either or both inputs of a gate, that gate's output will be LO.  
When there is a LO on both inputs of a gate, that gate's output will be HI.
- (9.1) The performance of the individual NOR gates will be described in the section, TWO ENTRY SYSTEMS WITH AUTO CALL TRANSFER AND TIMED DOOR RELEASE/POSTAL LOCK.
- (10) HI = VDD = +15VDC  
LO = VSS = CIRCUIT GROUND
- (10.1) In operation, actual potentials may measure slightly less than VDD when an element is HI, and slightly higher than ground when LO. These slight differences are insignificant and may be disregarded.
- (11) When a transistor is said to be on (saturated), its Vec is very small and the collector may be regarded as being at emitter potential.
- (12) The IR drops through the interconnecting wires and cables should be very small and their effects negligible in a properly installed system which is operating normally.

## ONE-ENTRY SYSTEM WITH MOMENTARY DOOR RELEASE

(See Schematic No. 1)

(1) When system is in standby:

(1.1) RING COMMON line is at VDD (+15Vdc).

(1.2) CONTROL LINE is at approximately VDD: There will be a slight drop from the +15Vdc due to the IR drop across R2 which results from the minute currents to the inverting (-) input terminals of Z1B; Z1C; and Z1D.

(1.3) COMPARATOR REFERENCE LINE IS AT VDD. The potential on this line should not appreciably change during any operation.

(1.4) The resistors in series with the non-inverting (+) input terminals of all OpAmps are much greater than the resistors in series with their inverting (-) input terminals; the current to the inverting terminals is greater than that to the non-inverting terminals and the output of each OpAmp is LO.

(2) When PB1 at ENTRY NO. 1 is closed, the RING COMMON wire is connected through PB1 and the INDIVIDUAL RING WIRE to the RING terminal in apartment 1's Model 485 APARTMENT SPEAKER.

(2.1) From the 485's RING TERMINAL it is connected through T/L SWITCH S401B's normal (standby position-switch not activated) contacts; the 16-ohm speaker voice coil; and back through S401A's normal contacts; GROUND wire and terminal P5/J5-6 to ground.

(3) When the RING COMMON line goes to near ground, the voltage at low-side of R1 and the input current to Z1A-3 goes to near zero.

(3.1) When Z1A-3's input current is near zero, the current to the non-inverting terminal Z1A-2 is greater and the output at Z1A-4 is HI.

(4) The HI from Z1A-4 is connected to the Ring Tone Generator Input Z2-4, turning it on.

(4.1) The HI from Z1A-4 is also connected through R12 to the base of Q2 turning it on (saturated), which will ground any signal appearing at the base of the audio preamplifier Q3.

(4.2) The Ring Tone Generator oscillates at a frequency (100 Hz. to 2 KHz.) determined by the setting of RING PITCH CONTROL R33, and will continue to oscillate as long as the input terminal Z2-4 is HI.

(4.3) The Ring Tone is fed from the output terminal Z2-3 to the high-side of the RING VOLUME CONTROL R17, and through R34 and D9 to the AUDIO IN leads; and then through K1 and J5/P5-2 and J5/P5-4 to the lobby speaker. This allows the caller to hear the ring tone (at a low level) and lets him know that the system is in operation.

(4.4) The ring tone (level controlled by R17) is fed through the RING SIGNAL line; R28; and C12 to the input terminal Z3-6 of the Audio Amplifier Integrated Circuit.

(4.5) The ring tone is amplified through Z3; fed from Z3-8; through RFC1; C16; RING COMMON terminal J5/P5-3; RING COMMON wire; PB1 (held closed by the caller); INDIVIDUAL RING WIRE to Apartment Speaker No. 1, the 16 ohm speaker voice coil to ground—allowing the ring signal to be heard in the called apartment.

(4.5.1) The RING COMMON wire connects Z1A-3 to d-c ground, and simultaneously, carries the a-c ring signal to the apartment speaker—while the caller keeps the pushbutton PB1 closed (i.e. pushed in).

(5) When the caller releases PB1 and the ring tone stops, the dweller in apartment 1 can speak to the caller by pressing the T/L SWITCH S401 to TALK position.

(5.1) When S401C is in TALK, the CONTROL LINE is connected through the 1.2 K ohm resistor R402 to ground, and the CONTROL LINE at the anode of D1 goes to approximately 9.6 volts and the input current to Z1B-6 will be reduced below that to Z1B-1 and the output at Z1B-5 will go HI.

(6) The HI from Z1B-5 is connected to the base of Q1, turning it on (saturated).

(6.1) When Q1 is saturated, Talk/Listen Relay Coil K1 is energized and the relay contacts are switched to TALK (2) position.

(6.1.1) When K1 is in TALK position, AUD 1 and AUD 2 are connected across the input transformer T1.

(6.1.2) When K1 is in TALK position, one LOBBY SPKR lead is connected to AUDIO OUT, and the other LOBBY SPKR lead is connected to ground, putting the lobby speaker across the audio amplifier output.

(7) When the Model 485 Apt. Spkr's S401 is in TALK, the speaker voice coil is connected through S401A to AUD 2 and through S401B to AUD 1.

(7.1) With AUD 2 and AUD 1 connected across the audio input transformer T1, the dweller can talk into the apartment speaker and the signal will be amplified and fed through the lobby speaker wires to the lobby speaker.

(8) After completing the message from the apartment speaker to the lobby speaker, the dweller should switch S401 from TALK to LISTEN.

(9) When S401 is in LISTEN, the CONTROL LINE is open; current to the inverting (-) input terminal Z1B-6 is higher than that to the non-inverting (+) terminal Z1B-1 and the output at Z1B-5 returns to its normal standby LO state.

(9.1) The LO turns Q1 off; K1 is de-energized; K1's contacts are switched to their normal LISTEN position.

(10) When K1's contacts are in LISTEN, the lobby speaker is connected through LOBBY SPKR wires; P5/J5-2 and P5/J5-4; K1C and K1D across the audio input transformer T1.



(11) At the same time, with S401 in LISTEN, the apartment speaker voice coil is connected through S401A to AUD 2, and through S401B to AUD 1. AUD 2 is connected through K1B to AUDIO OUTPUT, and AUD 1 is connected through K1A to ground.

(12) With the apartment speaker S401 in LISTEN, the caller can speak into the lobby speaker, the signals will be fed through T1 and amplified through Q3 and Z3; and then fed between AUDIO OUT and ground to the apartment speaker.

(13) The level of the audio signal (TALK and LISTEN) is controlled by AUDIO VOLUME R27.

(14) The DR-1 Door Release can be activated from the apartment speaker by throwing the DOOR REL'S SWITCH S402 to position 1.

(14.1) When S402 is in position 1, the CONTROL LINE is connected through the 330 ohm resistor R401 to ground; and the voltage on the CONTROL LINE goes to approximately 5 volts with the input

current to Z1C-8 going less than that to Z1C-13 and the output at Z1C-9 will go HI.

(14.2) The HI from Z1C-9 is connected through D4 and R6 to Z1B-6—latching Z1B-5 LO. D1 blocks the HI of Z1C-9 from being shorted by the low-resistance of the CONTROL LINE.

(14.3) The HI from Z1C-9 is also fed through D5 and R14 to the control gate of SCR1—turning it on. When SCR1 is forward biased between cathode and anode (on half of a-c cycle that puts cathode negative with respect to anode) current will flow from the anode through the DOOR REL'S line to DR-1, the other side of DR-1 is connected to AC/DOOR COMMON.

(14.3.1) DR-1 will remain energized while S402 in the apartment speaker is held in position 1.

(14.3.2) NOTE: In the One-Entry System With Momentary Door Release, the Electric Door Release DR-1 will also be energized if S402 is in position 2.

## TWO-ENTRY SYSTEM WITH MOMENTARY DOOR RELEASE

(See Schematic No. 1)

(1) To expand the One-Entry System with Momentary Door Release to a Two-Entry System With Momentary Door Release, the ENTRY No. 2 components and associated wiring must be added.

(2) The Model 466 Momentary 2nd. Door Release Module must be installed at P1 and P2 on the Module 478 Control Unit PC board.

(3) When a caller activates PB1 at either entry, the ring tone is heard in apartment No. 1 speaker as described under ONE-ENTRY SYSTEM WITH MOMENTARY DOOR RELEASE, para (2) through (4.5.1) above.

(3.1) NOTE: Since the lobby speakers are connected in parallel, the ring tone will be heard at both lobby speakers.

(4) When the apartment speaker "Talks" to the lobby speaker, the circuit operates the same as described in para (5) through (7.1) above, except, the signal from the apartment speaker will be heard at both lobby speakers.

(5) The apartment speaker "Listens" to the lobby speaker as described in para (8) through (13) above, except, both lobby speakers will be connected across the input transformer T1, and sounds in the vicinity of both lobby speakers will be heard by the apartment speaker.

(5.1) Sounds from one lobby speaker will not be heard by the other lobby speaker.

(6) The DR-1 Door Release at ENTRY NO. 1 is activated in the same manner as described in para (14) through (14.3.1) above.

(6.1) NOTE: The DR-1 at ENTRY NO. 1 will not be activated if the apartment speaker's S402 is in position 2.

(7) To activate DR-1 at ENTRY NO. 2, throw DOOR REL'S SWITCH S402 in apartment speaker to position 2.

(7.1) When S402 is in position 2, the CONTROL LINE is connected to ground and the voltage and current at Z1D-11 falls to zero, and the output at Z1D-10 goes HI.

(7.2) The HI from Z1D-10 is fed through P1/J101-7, and from J101-7 through D105 and R6 to Z1B-6—clamping Z1B-5 LO; and through D104 and R8 to Z1C-8—clamping Z1C-9 LO and SCR1 off, preventing activation of ENTRY NO. 1's DR-1 Door Release.

(7.3) The HI from Z1D-10 is fed through D107 and R114 to the control gate of SCR101—turning it on.

(7.4) When SCR101 is on, one half of the AC will flow through the anode, out J101/P2-2 and DOOR REL'S 2 line to the DR-1 at ENTRY NO. 2, and then back through the AC/DOOR COMMON line to the other side of the 16Vac.

## ONE- OR TWO-ENTRY SYSTEM WITH TIMED DOOR RELEASE AT BOTH ENTRIES AND TIMED POSTAL LOCK AT MAIN ENTRY

(See Schematic No. 2, pages 35-37)

(1) A one-entry system must include the Model 467 Postal/Main Door Timer connected to P3 and P4 on the Model 478 Control Unit PC board.

(2) A two-entry system must include the Model 467 Postal/Main Door Timer connected to P3 and P4; and the Model 468 Timed 2nd. Door Release connected to P1 and P2 on the Model 478 Control Unit PC board.

(2.1) The entry with the Postal Lock installed must be considered the main entry for installation wiring and connections and for theory of operation.

(3) The systems' RING; TALK; and LISTEN functions are the same as for two-entry systems that do not include the timed postal lock and door release features.

### (4) ONE-ENTRY SYSTEM WITH TIMED POSTAL LOCK AND DOOR RELEASE FEATURES: (USING MODEL 467)

(4.1) To open DR-1 at ENTRY NO. 1: S402 in the apartment speaker should be thrown to position 1. The switch may be released, i.e. it is not necessary to hold the switch closed until the door is opened.

(4.2) When S402 is in position 1, the CONTROL LINE is connected through the 330 ohm resistor R401 to ground. The input current to Z1C-8 will go less than that to Z1C-13 and the output at Z1C-9 will go HI—for the time that the switch is in position 1.

(4.3) The HI from Z1C-9 is connected through P3/J201-5 and R205 to the base of Q201, turning it on. When Q201 is on, its collector is LO and the Timer's triggering input Z201-2 goes LO.

(4.4) When the Timer is triggered by the LO at Z201-2, Z201-3 goes HI and will remain HI for the timing cycle duration. The duration is determined by the setting of DELAY TIME SET R203, and is variable from 3 to 20 seconds.

(4.5) The HI from Z201-3 is connected through D202; J202/P4-1; and R14 to the control gate of SCR1, turning it on for the timing cycle duration. When SCR1 is on, the DR-1 Door Release at ENTRY NO. 1 will be energized.

(4.6) POSTAL LOCK OPERATION: When the Postal Lock Switch is closed, the Timer Triggering Input Z201-2 is connected through R201; J202/P4-2; and the POSTAL LOCK line to ground. When the Triggering Terminal goes LO, the timing cycle starts; SCR1 is turned on and the DR-1 at the entry is energized, and will remain energized for the timing cycle duration.

(4.7) NOTE: The timing cycle starts with the triggering pulse. Additional LO pulses—throwing S402 to position 1—during the timing cycle do not restart the timer, nor change the timing cycle duration.

(4.8) When the timing cycle is completed, Z201-3 goes LO; SCR1 is turned off; and the DR-1 Door Release is de-energized.

(4.9) NOTE: In the one-entry system with timed postal lock and door release, S402 in the apartment speaker can be thrown to either position 1 or 2 for timed door release.

### (5) TWO-ENTRY SYSTEMS WITH TIMED POSTAL LOCK AND DOOR RELEASE AT MAIN ENTRY AND TIMED DOOR RELEASE AT ENTRY NO. 2: (USE MODELS 467 and 468)

(5.1) The door release and postal lock at MAIN ENTRY (Entry No. 1) operate as described for the one-entry system above, except, the DOOR REL'S SWITCH S402 in the apartment Speaker must be thrown to position 1 to operate the timed door release at MAIN ENTRY.

(5.2) When the apartment speaker's DOOR REL'S SWITCH S402 is thrown to position 2, the CONTROL LINE is connected to ground; the input current to Z1D-11 goes to zero and the output Z1D-10 goes HI.

(5.3) The HI from Z1D-10 is connected through P1/J301-7; and D305 and D304 to the inverting input terminals of Z1B and Z1C, clamping the outputs Z1B-5 and Z1C-9 LO.

(5.3.1) Z1C's output is prevented from going HI instantaneously, and triggering the Z201 Timer when the CONTROL LINE is grounded, by C301, which keeps a positive voltage on Z1C-8 during the switching time required for Z1D.

(5.4) The HI is also connected through R305 to the base of Q301. Q301 is turned on—when its collector goes LO, the Triggering Input Z301-2 goes LO, starting the timing cycle and switching Z301-3 HI. Z301-3 will remain HI for the timing cycle duration, which is determined by the setting of DELAY TIME SET R303 (3 to 20 seconds).

(5.5) The HI from Z301-3 is connected through D307 and R314 to the control gate of SCR301, turning it on. When SCR301 is on, the DR-1 Door Release at ENTRY NO. 2 is energized and will remain energized until the timing cycle of Z301 is terminated.

## TWO-ENTRY SYSTEM WITH AUTO CALL TRANSFER AND TIMED DOOR RELEASE/POSTAL LOCK

(See Schematic No. 3, pages 38-43)

(1) When the system includes Auto Call Transfer, the Model 467 Postal/Main Door Timer, which is supplied with the Model 469, must be installed in the Model 478 Control Unit PC board at P3 and P4.

(2) Remove the Model 478 Terminal Board (FIGURE 11) and install the Model 469 Auto Call Transfer—connecting P505 to J5.

(3) Connect the Terminal Board supplied with the Model 469 (FIGURE 12)—P506 to J506 and P507 to J507.

(4) The AUD 2; AUD 1; CONTROL; 16VAC; and AC/DOOR COMMON lines are connected from J5 on the Model 478, through P505; across the Model 469 PC board; through J506/P506 and J507/P507 to the Model 469 Terminal Board, where they are connected to the external components as shown in Schematic No. 3.

(5) The RING COM (1 or 2); POSTAL LOCK (1 or 2); LOBBY SPKR (1 or 2); and DOOR REL'S (1 or 2) are used only at the ENTRY (1 or 2) which is activated by the caller.

(5.1) These functions are locked-out at the entry that is not in use.

(6) When the system is activated—at either directory—the "IN USE" indicator lamps are turned on (flashing) at both ENTRY DIRECTORIES.

### (7) CALLER AT ENTRY NO. 1:

(7.1) When the caller activates (closes) PB1 at ENTRY NO. 1, the RING COM 1 line is connected to ground through the apartment speaker voice coil.

(7.2) When the RING COM 1 line is grounded:  
Z501A-1 goes LO;  
Z502-2 goes LO;  
RING COM line through P505/J5-3 goes LO;  
input current to Z1A-3 is reduced below that to Z1A-2 and Z1A-4 goes HI.

(7.3) When Z501A-1 goes LO, Z501-3 goes HI, and this HI is connected to input Z501B-6 and the output on Z501B-4 remains LO. The LO on Z501B-4 keeps Q501 turned off and relay K501 de-energized. (K501's contacts remain in their normal ENTRY 1 position.)

(7.4) When the Timer Trigger Input Z502-2 goes LO the timing cycle starts and Z502-3 goes HI and will remain HI for the duration of the timing cycle (30 to 60 seconds as determined by the setting of R516—the STANDBY TIMER CONTROL, which can be adjusted through the Model 469 Terminal Board (FIGURE 12).

(7.5) The HI from Z502-3 is inverted through Z501C with Z501C-10 going LO. This LO is fed through D504 to Z501A-1 and latches the output at

Z501B-4 LO—keeping ENTRY NO. 1 in the system, and ENTRY NO. 2 locked out of the system.

(7.5.1) If another caller should activate a PB at ENTRY NO. 2, it will not effect the system: The RING COM 2 line is open-ended at K501B-2 and the input at Z501B-5 is already LO.

(7.6) Meanwhile, the HI from Z502-3 is connected to the LAMP PULSER CONTROL INPUT Z503-4. As long as Z503-4 is HI, the output at Z503-3 will pulse HI at a 2 Hz. rate.

(7.6.1) The HI pulses (VDD) will power the LED indicating lamps in the entrance directories.

(7.7) When Z1A-4 is HI, the Ring Tone Generator Z2 is on. (See para (7.2) above.)

(7.7.1) The Ring Tone signal is amplified through Z3 and fed through RING COMMON terminal J5/P505-3; K501B-1; J507/P507-7; PB1 (held closed at ENTRY NO. 1 by the caller); apartment one's INDIVIDUAL RING WIRE; and the apartment speaker voice coil to ground.

(7.7.2) The Ring Tone is also fed from the high-side of R17 through R34 and D9 to the AUDIO IN leads; then through K1D and K1C-LISTEN; LOBBY SPKR terminals J5/P505-2 and J5/P505-4; K501D-1 and K501C-1; LOBBY SPKR 1 terminals J506/P506-12 and J506/P506-10; and the twisted pair to the LOBBY SPKR in ENTRY NO. 1.

(7.8) When the caller releases PB1, the apartment dweller can speak to the lobby by pressing the apartment speaker SWITCH S401 to TALK.

(7.8.1) When S401 is in TALK, the CONTROL LINE is connected through the 1.2 Kohm resistor R402 and S401C to ground. The CONTROL line potential will drop to approximately 9.6 volts and the T/L Comparator output Z1B-5 will go HI.

(7.9) The HI from Z1B-5 will turn on Q1, energize T/L relay K1; and K1's contacts will be switched to TALK position.

(7.9.1) When K1's contacts are in TALK, the apartment speaker is connected across the input transformer T1; and the LOBBY SPKR 1 will be connected across Audio Out and Ground. Signals from the apartment speaker will be amplified through Q3 and Z3; audio level controlled by AUDIO VOLUME R27; and fed to LOBBY SPKR 1.

(7.10) When the T/L Comparator output Z1B-5 is HI, the HI is also connected through T/L COMP OUT terminals J5/P505-10; and R510 to Z501D-12 input and Z501D-11 output goes LO.

(7.10.1) The LO from Z501D-11 is connected through R512 and D505 to the high side (+) of the Control Timer's timing capacitor C509, and the capacitor will be discharged. (LO = ground)

(7.11) After C509 is discharged and the T/L SWITCH S401 is released, the timing cycle restarts and Z502-3 output goes HI and will remain HI until completion of Z502's timing cycle duration as determined by R516.

(7.12) To hear the LOBBY SPKR 1 answer, the apartment dweller; throws the apartment speaker S401 to LISTEN.

(7.12.1) When S401 is in LISTEN, the CONTROL LINE IS freed from ground and its voltage goes to VDD; the T/L comparator output goes LO; Q1 is turned off; K1 is de-energized; and its contacts return to their normal LISTEN position; Z501D-12 goes LO; and Z501D-11 output goes HI.

(7.12.2) When K1's contacts are in LISTEN, the LOBBY SPKR 1 is connected across the audio input transformer T1; and the apartment speaker is connected across Audio Out and Ground. Signals from LOBBY SPKR 1 will be amplified through Q3 and Z3 and be heard by the apartment speaker whose S401 is in LISTEN position.

(7.13) When the apartment dweller has determined that the caller may enter, he can throw DOOR RELS SWITCH S402 to either position 1 or 2. This will take the CONTROL LINE to either 4.9V or to ground and the Door Rel's 1 Comparator output Z1C-9 will go HI. The switch S402 may be held closed for just an instant, resulting in a HI pulse from Z1C-9.

(7.14) The HI pulse will be coupled through P3/J201-5 to the Model 467—starting its timing cycle. For the timing cycle duration, as determined by the setting of R203, SCR1 will be on, and the DOOR REL'S 1 line through J5/P505-9 and DOOR REL'S line through K501A-1 to J506/P506 2; and then through DOOR REL'S 1 line to the DR-1 Electric Door Release at ENTRY NO. 1. The other side of DR-1 is connected to the AC/DOOR COM line.

(7.15) When the Timer output Z201-3 is HI, the HI is connected through J202/P4-3; DOOR TIMER OUT line; J5/P505-12 and R509 to Z501D-13 and Z501D-11 is switched LO. This LO is connected to the high-side of C509, and the timing cycle of Z402 is restarted.

(7.15.1) With the longer timing cycle of Z503 as compared with the timing cycle of Z201, the DOOR REL'S voltage will be latched to the DR-1 at ENTRY NO. 1.

(7.16) When Z201's timing cycle is completed, the DR-1 at ENTRY NO. 1 is de-energized and the DOOR TIMER OUT from Z201-3 goes LO. This LO is connected to Z501D-13 and Z501D-11 goes HI.

(7.17) When DOOR TIMER OUT goes LO, a LO pulse is transmitted from TIMER OUT terminal P505-12 through C502 to Control Timer Reset Terminal Z502-4—turning it off with its output at Z502-3 going LO.

(7.17.1) This LO turns off the Lamp Pulser Z503 and the indicating lamps (LEDs) in the directories are turned off.

(7.17.2) This LO is also inverted through Z501C with Z501C-10 going HI and the latch Z501A/Z501B being reset to its normal standby state.

## (8) CALLER AT ENTRY NO. 2

(8.1) When PB1 at ENTRY NO. 2 is closed, the RING COM 2 line is connected to ground through the apartment speaker's voice coil.

(8.2) When the RING COM 2 line is grounded, input Z501B-5 goes LO and output at Z501B-4 goes HI.

(8.3) The HI from Z501B-4 turns Q501 and Directory Transfer Relay K501 on; K501's contacts are thrown to position 2.

(8.4) When K501B is in position 2, the LO on the RING COM 2 line is connected to Control Timer Z502's Triggering Input Z502-2, and its timing cycle starts with Z502-3 going HI and remaining HI for the timing cycle duration.

(8.4.1) The HI from Z502-3 turns on the Lamp Pulser and the LED indicating lamps in the directories are on (flashing).

(8.4.2) The HI is inverted through Z501C with Z501C-10 going LO. This LO sets the latch Z501A/Z501B and clamping its output Z501B-4 HI, keeping K501 latched to Entry No. 2 until the timer is reset. ENTRY NO. 1 will be locked out.

(8.5) With K501 latched into ENTRY NO. 2, K501C-2 and K501D-2 connect LOBBY SPKR 2 into the system, and K501A-2 connects the DR-1 at ENTRY NO. 2 into the system.

(8.6) The grounded exterior RING COM 2 line is connected through K501B-2 to the RING COM line, switching the output of the Ring Comparator Z1A-4 to HI.

(8.6.1) The Ring Tone Generator is turned on, the apartment speaker will hear the signal as described above. The Ring Tone will be fed to the LOBBY SPKR lines and is transferred at K501C and K501D to LOBBY SPKR 2.

(8.7) When the T/L SWITCH S401 in the apartment speaker is thrown to TALK, the Control Timer's cycle is restarted by the HI output from Z1B-5 of the T/L Comparator.

(8.7.1) The apartment speaker is connected across the audio input transformer T1; the LOBBY SPKR leads are connected across Audio Out and Ground; and the signals are switched at K501C and K501D to the ENTRY NO. 2 LOBBY SPKR.

(8.8) When S401 in the apartment speaker is in LISTEN, the apartment speaker is connected across Audio Out and Ground; and the LOBBY SPKR is connected through K501C-2 and K501D-2 through the LOBBY SPKR leads to in the input of T1.

(8.9) When DOOR REL'S SWITCH S402 in the apartment speaker is thrown to either position 1 or 2, the CONTROL LINE will go to 4.9V or to ground and the Door Rel's Comparator output Z1C-9 will go HI. The switch S402 may be held in either position 1 or 2 for only an instant.

(8.10) The HI pulse will start the Model 467's timing cycle; SCR1 will be turned on and the DOOR REL's line will be activated. At K501A-2 the door release voltage will be connected through the DOOR REL's 2 line to the DR-1 at ENTRY NO. 2, the other side of the DR-1 is connected to AC/DOOR COMMON.

(8.11) When Z201 has completed its timing cycle, Z201-3 goes LO. The LO is pulsed through P4/J202 and C502 to Timer Reset Terminal Z502-4.

(8.11.1) When Z502 is reset, Z502-3 will go LO; Lamp Pulser Z503 is turned off; and the LED indicating lamps at the directories will be turned off.

(8.12) The LO from Z502-3 will be inverted by Z501C with Z501C-10 going HI. This HI will reset the latch Z501A/Z501B to its normal state; Z501B-4 will go LO; Q501 will be turned off; K501 is de-energized; and K501's contacts will be connected to their normal ENTRY NO. 1 position.

#### **(9) POSTAL LOCK 1 OPERATION:**

(9.1) When the POSTAL LOCK SWITCH at ENTRY NO. 1 is closed, the POSTAL LOCK line is taken to ground. This grounds (through D511) the model 467 POSTAL LOCK INPUT, turning Z201 and SCR1 on—energizing the DOOR REL'S 1 line.

(9.3) The DOOR REL'S voltage is connected through K501A-1 to the DR-1 at ENTRY NO. 1 and is returned through AC/DOOR COMMON.

(9.4) When the ground is fed through D510, the Control Timer Triggering Input Z502-2 goes LO; the Timer is turned on; latch Z501A/Z501B output is clamped LO keeping the DR-1 at ENTRY NO. 1 in the circuit; ENTRY NO. 2 locked out; and indicator lamps on.

(9.5) When the Timer Z201 completes its cycle, Z201-3 goes LO and a LO pulse is transmitted through C502 to Timer Reset Z502-4—cancelling the timing cycle; resetting latch Z501A/Z501B; and turning off the directory indicating lamps.

#### **(10) POSTAL LOCK 2 OPERATION:**

(10.1) When the POSTAL LOCK SWITCH at ENTRY NO. 2 is closed, the POSTAL LOCK 2 line is taken to ground. This grounds (through D508) the Model 467 POSTAL LOCK INPUT; turning Z201 and SCR1 on; energizing the DOOR REL'S 1 line on the Model 478.

(10.2) At the same time the ground from the POSTAL LOCK 2 line is fed through D509 to Z501B-5 and the latch output Z501B-4 goes HI.

(10.3) The HI from Z501B-4 turns on Q501; energizing K501 and the relay's contacts are switched to ENTRY NO. 2.

(10.4) The grounded POSTAL LOCK 2 line is also connected through D509 and K501B-2 to Timer Triggering Input Z502-2—turning it on with its output Z502-3 going HI.

(10.4.1) The HI from Z502-3 is inverted through Z501C and the HI from Z501C-10 clamps the latch output Z501B-4 HI—Q501 will be on; K501 energized and its contacts connected to ENTRY NO. 2; Lamp Pulser Z503 on; and indication lamps at directories on.

(10.5) The voltage on the DOOR REL'S 1 line at J5/P505-9 (see para (10.1) above) is fed across the DOOR REL'S line on the Model 469; through K501A-2; J507/P507-17; and the DOOR REL'S 2 line to the DR-1 at ENTRY NO. 2 and the power is returned through AC/DOOR COMMON.

(10.6) When the Timer Z201 has completed its cycle, Z201-3 goes LO. The LO is pulsed through DOOR TIMER OUT line; J5/P505-12; and C502 to Control Timer Reset Input Z502-4; Z502-3 will return to its standby LO state; latch Z501A/Z501B will be reset with its output Z501B-4 going LO; Q501 will be turned off, K501 will be de-energized and its contacts returned to the normal standby position 1 (to ENTRY DIRECTORY 1).

## SYSTEM OPERATIONAL CHECKOUT

(Systems 1 and 2, page 3)

### (1) RING CIRCUIT

(1.1) At the Entrance Directory, signal an apartment by activating (push-in) that apartment's pushbutton. (Figures 7, 9, and 10)

(1.2) While the pushbutton is held in, the ring tone should be heard in the signaled Apartment Speaker and at a somewhat lower level at the Entrance Directory speaker (or handset).

(1.3) The amplitude of the Apartment Speaker's ring tone can be adjusted by the RING VOLUME CONTROL in the Master Unit. Using a small screwdriver, turn control clockwise to increase volume; or turn control counterclockwise to decrease volume. (Figure 1)

(1.3.1) The amplitude of the ring tone to the lobby speaker is fixed and very little, if any, change will be noticed when the RING VOLUME CONTROL is adjusted.

(1.4) The pitch of the ring tone — to both lobby and apartment speaker — can be adjusted by the RING PITCH CONTROL in the Model 478. Use a small screwdriver, turn clockwise to raise pitch; or turn counterclockwise to lower pitch. (Figure 1)

### (2) APARTMENT SPEAKER TALK

(2.1) Push down the Apartment Speaker's PUSH TO TALK SWITCH and speak into the unit. The message should be heard in the lobby speaker. (Figure 2)

### (3) APARTMENT SPEAKER LISTEN

(3.1) Push down the Apartment Speaker's PUSH TO LISTEN SWITCH and the caller can speak into the lobby speaker and the tenant will hear the message through the Apartment Speaker.

### (4) TALK/LISTEN VOLUME

(4.1) The amplitude of the TALK/LISTEN signals — at both the lobby and apartment speaker — can be adjusted by the AUDIO VOLUME CONTROL in the Master Unit. Turn the control clockwise to increase volume; or turn the control counterclockwise to decrease the volume.

(4.2) The control should be set so that there is sufficient volume in any Apt. Spkr., paying particular attention to the Apt. Speaker that is on the end of the longest speaker riser cable.

### (5) DOOR RELEASE (MOMENTARY)

(5.1) When the DOOR LOCK RELEASE SWITCH is thrown to position 1 or 2, the Electric Door Release will be activated — allowing the door to be opened.

(5.2) The Door Release will remain activated so long as the Apartment Speaker's DOOR LOCK RELEASE SWITCH is held in position 1 or 2.

### (6) TIMED DOOR RELEASE (MODEL 467 MODULE MUST BE INSTALLED IN THE 478 MASTER UNIT-System 2, page 3)

(6.1) Throw the DOOR LOCK RELEASE SWITCH to position 1 or 2 and release. The Electric Door Release will remain energized — allowing the door to be opened for the length of the timing cycle.

(6.2) The duration of the timing cycle can be adjusted by the 467 TIMER SET CONTROL. Turn the control full counterclockwise for minimum (3 seconds) to full clockwise for maximum (20 seconds) timing cycle duration.

### (7) TIMED POSTAL LOCK DOOR RELEASE

(7.1) Activate (close) the Postal Lock Door (Release Switch and release.

(7.1.1) MODEL 499 REMOTE POSTAL LOCK SWITCH: (Figure 6)

Before installation of Postal Lock: press in the pushbutton and release;

After installation of Postal Lock: with postman present, open door, press in the pushbutton and release.

(7.1.2) MODEL 494(P) AND MODEL 495(P) DIRECTORIES (WITH POSTAL LOCK PROVISION): (Figures 9 and 10)

Before installation of Postal Lock: open speaker (or handset) panel; remove tape or rubber band that holds switch open; allow switch to close for an instant; replace tape or rubber band keeping switch open;

After installation of Postal Lock: with postman present, unlatch postal lock — allowing switch to close; relatch postal lock and remove key — holding switch open.

(7.2) When the Postal Lock Switch is closed, the Electric door release is energized and will remain energized for the length of the Model 467 timing cycle.

(7.2.1) The duration of the Model 467 timing cycle is determined by the setting made in paragraph (6.2) above, and will allow the postman from 3 to 20 seconds for opening the door.

(8) The RING circuit between each pushbutton and each apartment speaker; the TALK/LISTEN and DOOR RELEASE operation from each Apartment Speaker should be checked as directed in paragraphs (1) through (6.1) above.

## TWO-ENTRY SYSTEM (Systems 3 and 4, page 3)

### (1) RING CIRCUIT

(1.1) At either Entrance Directory, signal an apartment by activating (push-in) that apartment's pushbutton. (Figures 7, 9, and 10)

(1.2) While the pushbutton is held in, the ring tone should be heard in the signaled Apartment Speaker and at a somewhat lower level at the speaker (or hand-set) in both Entrance Directories.

(1.3) The amplitude of the Apartment Speaker's ring tone can be adjusted by the RING VOLUME CONTROL in the Master Unit. Using a small screwdriver, turn control clockwise to increase volume; or turn control counterclockwise to decrease volume. (Figure 1)

(1.3.1) The amplitude of the ring tone to the lobby speaker is fixed, and very little, if any, change will be noticed when the RING VOLUME CONTROL is adjusted.

(1.4) The pitch of the ring tone — to both lobby speakers and the apartment speaker — can be adjusted by the RING PITCH CONTROL in the Master Unit. Use a small screwdriver, turn clockwise to raise pitch; or turn counterclockwise to lower pitch. (Figure 1)

### (2) APARTMENT SPEAKER TALK

(2.1) Push down the Apartment Speaker's PUSH TO TALK SWITCH and speak into the unit. The message will be heard in both lobby speakers. (Figure 2)

(2.2) The lobby speakers are connected in parallel. When the system is in "Standby," they are connected across the audio amplifier input. When the Apartment Speaker is in "TALK," the lobby speakers are switched to the audio amplifier output.

### (3) APARTMENT SPEAKER LISTEN

(3.1) Push down the Apartment Speaker's PUSH TO LISTEN SWITCH and when the caller speaks into the lobby speaker at his entrance, the message will be heard through the Apartment Speaker.

(3.2) The lobby speaker at the other directory will not "Hear" the audio message from the in-use lobby speaker, but sound in the vicinity of the out-of-use speaker will be heard at the Apartment Speaker.

### (4) TALK LISTEN VOLUME

(4.1) THE AMPLITUDE OF THE TALK/LISTEN signals — at both lobby speakers and at the apartment speaker — can be adjusted by the AUDIO VOLUME CONTROL in the Master Unit. Turn the control clockwise to increase volume; or turn the control counterclockwise to decrease volume. (Figure 1)

(4.2) The control should be set so that there is sufficient volume in any speaker; paying particular attention to the Apartment Speaker that is on the end of the longest speaker riser cable.

### (5) SELECTIVE MOMENTARY DOOR RELEASE (MODEL 466 MODULE MUST BE INSTALLED IN THE 478 MASTER UNIT, System 3, page 3)

(5.1) The tenant must determine (by asking) which entrance the caller is using.

(5.2) If the caller is at Entry No. 1, throw the Apartment Speaker's DOOR LOCK RELEASE SWITCH to position 1; the Electric Door Release at Entry No. 1 will be activated — allowing its door to be opened — while the DOOR LOCK RELEASE SWITCH is held in position 1. (Figure 14)

(5.3) If the caller is at Entry No. 2, throw the Apartment Speaker's DOOR LOCK RELEASE SWITCH to position 2; the Electric Door Release at Entry No. 2 will be activated — allowing its door to be opened — while the DOOR LOCK RELEASE SWITCH is held in position 2. (Figure 14)

### (6) SELECTIVE TIMED DOOR RELEASE (MODEL 467 AND 468 MODULES MUST BE INSTALLED IN THE 478 MASTER UNIT — System 4, page 3)

(6.1) The tenant must determine (by asking) which entrance the caller is using.

(6.1.1.) In two-entry systems that include the Model 467 Postal/Main Door Timer Module, the Entry at which the Postal Lock Release Switch is installed is considered the "MAIN" Entry, the other entry is "2ND Entry."

(6.2) If the caller is at the MAIN entry, throw the DOOR LOCK RELEASE SWITCH in the apartment speaker to position 1 and release. The Electric Door Release at the MAIN entry will remain energized — allowing its door to be opened — for the length of the timing cycle.

(6.2.1) The duration of the timing cycle can be adjusted by the 467 TIMER SET CONTROL in the Master Unit. Turn the control full counterclockwise for minimum (3 seconds) to full clockwise for maximum (20 seconds) timing cycle duration. (Figure 1)

(6.3) If the caller is at the 2ND Entry, throw the DOOR LOCK RELEASE SWITCH in the apartment speaker to position 2 and release. The Electric Door Release at the 2ND Entry will remain energized — allowing its door to be opened — for the length of the timing cycle.

(6.3.1) The duration of the timing cycle can be adjusted by the 468 TIMER SET CONTROL in the Master Unit. Turn the control full counterclockwise for minimum (3 seconds) to full clockwise for maximum (20 seconds) timing cycle duration. (Figure 1)

### (7) TIMED POSTAL LOCK DOOR RELEASE

(7.1) The Postal Lock Door Release Switch is installed at the MAIN Entry.

(7.2) Activate (close) the Postal Lock Door Release Switch, and release.

(7.2.1) MODEL 499 REMOTE POSTAL LOCK SWITCH: (Figure 6)

Before installation of Postal Lock: press in the pushbutton, and release;

After installation of Postal Lock: with postman present, open door; press in the pushbutton and release.

(7.2.2) MODEL 494(P) AND MODEL 495(P) DIRECTORIES (WITH POSTAL LOCK PROVISION): (Figures 9 and 10)

Before installation of Postal Lock: open speaker (or handset) panel; remove tape or rubber band that holds switch open; allow switch to close for an instant; replace tape or rubber band keeping switch open;

After installation of Postal Lock: with postman present, unlatch postal lock — allow-

ing switch to close; relatch postal lock and remove key — holding switch open.

(7.3) When the Postal Lock Switch is closed, the MAIN Electric Door Release is energized and will remain energized for the length of the Model 467 timing cycle.

(7.3.1) The duration of the Model 467 timing cycle is determined by the setting made in paragraph (6.2.1) above, and will allow the postman from 3 to 20 seconds for opening the door.

(8) AT THE MAIN ENTRY: The RING circuit between each pushbutton and each apartment speaker; the TALK/LISTEN and DOOR RELEASE operation from each Apartment Speaker should be checked as directed in paragraphs (1) through (6.3.1) above.

(9) AT THE 2ND ENTRY: Repeat paragraph (8) above.

## TWO-ENTRY SYSTEM WITH MODEL 469 AUTO CALL TRANSFER

### (1) RING CIRCUIT

(1.1) At either Entrance Directory, signal an apartment by activating (push-in) that apartment's pushbutton. (Figure 10)

(1.1.1) The 496(P) series Entrance Directories are designed for use with this system. The 496 Directory may be substituted if the Model 499 Remote Postal Lock Door Release Switch is used.

(1.2) While the pushbutton is held in, the ring tone should be heard in the signaled Apartment Speaker and at a somewhat lower level at the lobby speaker in the originating directory.

(1.2.1) When the pushbutton is activated, the "IN USE" indicator lamp (LED) should be turned on — flashing — at both directories. The lamp should remain on for the length of the Control Timing Cycle, which starts when the pushbutton is pushed-in.

(1.2.2) The Control Timing Cycle may be adjusted by the CONTROL TIMER SET in the Model 469. (Figure 1)

(1.2.3) Insert a small screwdriver in the 469 Terminal Board opening. Turn the control full counterclockwise for minimum (30 seconds) to full clockwise for maximum (60 seconds) Control Timing Cycle Duration.

(1.3) During the CONTROL TIMING CYCLE the pushbuttons; lobby speaker; and electric door release; are locked-out at the unused directory.

(1.3.1) If, ring is originated at Directory No. 1 and Directory No. 2 is locked-out; and the Postal Lock Door Release Switch at Entry No. 2 is closed, the Electric Door Release at Entry No. 2 will not be activated but, the Electric Door Release at Entry No. 1 will be activated.

(1.3.2) If, ring is originated at Directory No. 2 and Directory No. 1 is locked-out; and the Postal Lock Door Release Switch at Entry No. 1 is closed, the Electric Door Release at Entry No. 1 will not be activated but, the Electric Door Release at Entry No. 2 will be activated.

(1.4) The amplitude of the Apartment Speaker ring tone may be adjusted by the RING VOLUME CONTROL in the Model 478 Control Unit. Use a small screwdriver, turn control clockwise to increase; and turn control counterclockwise to decrease. (Figure 1)

(1.4.1) The amplitude of the ring tone to the lobby speaker is fixed, and very little, if any, change will be noticed when RING VOLUME CONTROL is adjusted.

(1.5) The pitch of the ring tone — to both lobby and apartment speaker — can be adjusted by the RING PITCH CONTROL in the Model 478. Use a small screwdriver, turn clockwise to raise pitch; and counterclockwise to lower pitch. (Figure 1)

### (2) APARTMENT SPEAKER TALK

(2.1) Push down the Apartment Speaker's PUSH TO TALK SWITCH and speak into the unit. The message should be heard in the "IN USE" lobby speaker.

(2.2) When the Apartment Speaker PUSH TO TALK SWITCH is activated (closed), the CONTROL TIMING CYCLE is restarted and the locked-out directory will remain locked-out for the full timing cycle duration, which will commence when the SWITCH is released.

### (3) APARTMENT SPEAKER LISTEN

(3.1) Push down the Apartment Speaker's PUSH TO LISTEN SWITCH and the caller at the "IN USE" directory can speak into the lobby speaker and the tenant will hear the message through the Apartment Speaker.



#### **(4) TALK LISTEN VOLUME**

(4.1) The amplitude of the TALK/LISTEN signals—at both the lobby and apartment speaker—can be adjusted by the AUDIO VOLUME CONTROL in the 478 Master Unit. Turn the control clockwise to increase volume; or turn the control counterclockwise to decrease the volume. (Figure 1)

#### **(5) TIMED DOOR RELEASE**

(5.1) When the Apartment Speaker's DOOR LOCK RELEASE SWITCH is thrown to either position 1 or 2, the Electric Door Release at the "IN USE" Entrance will be activated—and remain activated for the 467's timing cycle—allowing the door to be opened.

(5.2) The duration of the timing cycle can be adjusted by the 467 TIMER SET CONTROL. Turn the control full counterclockwise for minimum (3 seconds) to full clockwise for maximum (20 seconds) Door Release Timing Cycle Duration.

(5.2.1) NOTE: The Model 467 Module is included with the Model 469 Auto Call Transfer and must be installed in the 478 Master Unit. (See Model 469 Installation Instructions.)

(5.3) When the 467 Door Release Timing Cycle has been completed, the Control Timing Cycle will be terminated; the "IN USE" indicator lamps in both directories will be turned off; and the system returned to its "Standby" condition.

#### **(6) TIMED POSTAL LOCK DOOR RELEASE**

(6.1) Activate (close) the Postal Lock Door Release Switch, and release.

(6.2) When Postal Lock Switch is closed, the Electric Door Release at that entry will be activated—and remain activated for the duration of the 467 Timing Cycle. (See paragraphs (5.2) through (5.3) above.

(6.2.1) While the Door Release is energized, the "IN USE" indicator lamps will be turned on (flashing); and the lobby speaker, ring and door release function at the other directory will be locked-out. (See paragraphs (1.3.1) and (1.3.2) above.)

(7) Repeat complete checkout from each push-button and each apartment speaker while originating calls at each directory.

### **CONTROL UNIT-OPTIONAL MODULES, ASSEMBLY/DISASSEMBLY**

(1) The required module(s) should be inserted in the Control Unit when the system is installed.

(1.1) No optional module is required with System No. 1—One-Entry System with Tenant Controlled Momentary Electric Door Release.

(2) To install or remove the optional module(s), remove the screws that hold the Model 478 Control Unit chassis to its mounting base and lift chassis with its PC boards away from base.

(2.1) When the Model 478 is installed, use caution with wires and cables connected to its terminal board. Unit may be disassembled, but do not put strain on wires and cables.

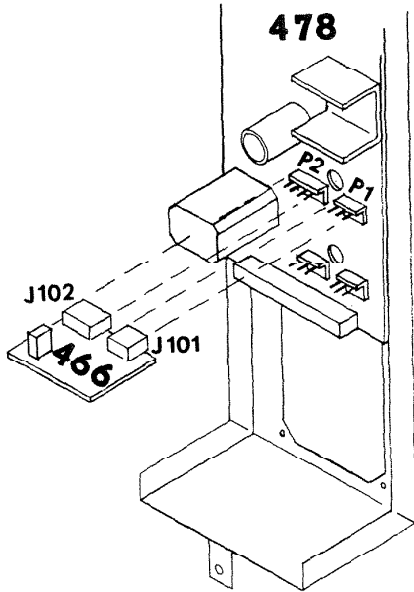
(3) The correct optional module must be used with Systems No. 2, 3, 4, and 5. (Chart, page 3 and Figure 11, page 18)

(3.1) Model 467 Postal/Main Door Timer is used in Systems No. 2, 4, and 5. The Model 467 is included with the Model 469 Auto Call Transfer Module.

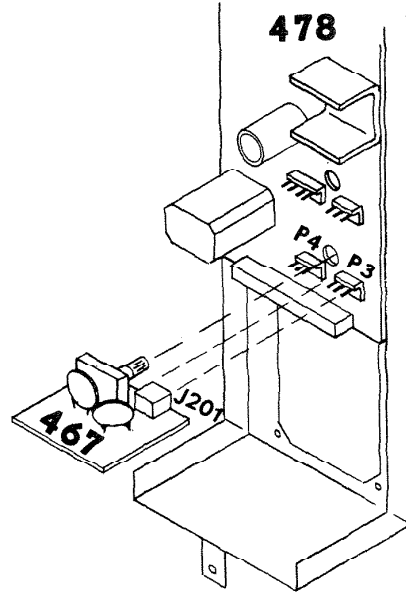
(4) The Model 467 and Model 468 must be aligned so that their control shafts are aligned with their access holes.

(5) When the Model 469 is used, the Model 478 Terminal Board is removed and discarded.

(6) When reassembling the Control Unit, make certain that the earth ground wire is reconnected at the proper chassis mounting screw.



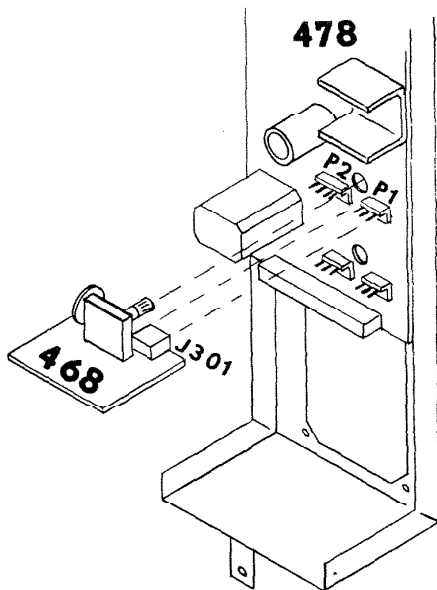
(A) SYSTEM 3: TWO-ENTRY SYSTEM WITH TENANT CONTROLLED MOMENTARY ELECTRIC DOOR RELEASE



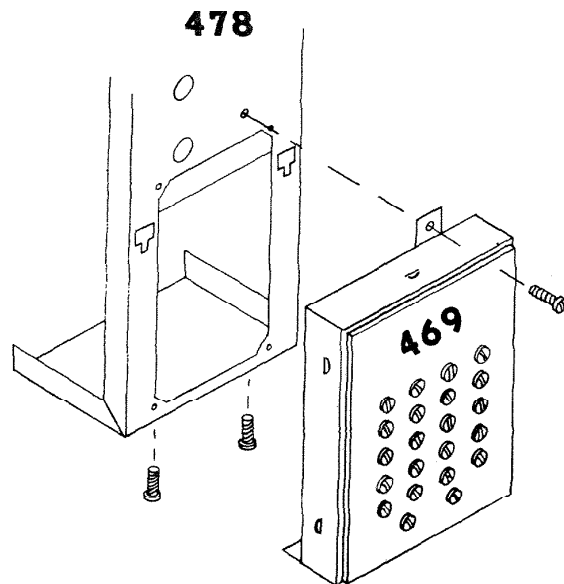
(B) SYSTEM 2: ONE-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK

SYSTEM 4: See Figure 11(C) below

SYSTEM 5: See Figure 11(D) below



(C) SYSTEM 4: TWO-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK AT MAIN ENTRY, AND TIMED DOOR RELEASE AT SECOND ENTRY. (Must include Model 467)



(D) SYSTEM 5: TWO-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK AT BOTH ENTRIES, AND AUTO CALL TRANSFER (Must include Model 467)

FIGURE 11

## TROUBLE SHOOTING

**SYSTEM 1: ONE-ENTRY SYSTEM WITH TENANT CONTROLLED MOMENTARY ELECTRIC DOOR RELEASE.**

**SYSTEM 3: TWO-ENTRY SYSTEM WITH TENANT CONTROLLED, SELECTIVE, MOMENTARY ELECTRIC DOOR RELEASE AT BOTH ENTRIES. (Model 466 Module installed in 478)**

Model 478 Terminal Board Wiring Diagram, Figure 12, page 20.  
Model 478 Terminal Board Operating Voltages, Figure 15, page 22.  
Wiring Diagram No. 1—Representative System, pages 25/26.  
Schematic Diagram No. 1, pages 29-31.

**SYSTEM 2: ONE-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK (Model 467 Module installed in 478)**

**SYSTEM 4: TWO-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK AT MAIN ENTRY, AND TIMED DOOR RELEASE AT SECOND ENTRY. (Models 467 and 468 Modules installed in 478)**

Model 478 Terminal Board Wiring Diagram, Figure 12, page 20.  
Model 478 Terminal Board Operating Voltages, Figure 15, page 22.  
Wiring Diagram No. 1—Representative System, pages 25/26.  
Schematic Diagram No. 2, pages 35-37.

**SYSTEM 5: TWO-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK AT BOTH ENTRIES, AND AUTO CALL TRANSFER (UNUSED DIRECTORY LOCKOUT). (Model 469 (including 467) Module installed in 478)**

Model 469 Terminal Board Wiring Diagram, Figure 13, page 21  
Model 469 Terminal Board Operating Voltages, Figure 16, page 23.  
Wiring Diagram No. 2—Representative System, pages 27/28.  
Schematic Diagram No. 3, pages 38-43.

### VOLTAGE MEASUREMENTS

A standard 20 Kohm/volt multi-meter may be used, but when available, suggest that a high-impedance-input meter (such as a VTVM or digital readout) be used.

All d-c voltages are positive, measured in respect to GROUND terminal on terminal board, except where noted.

Measurements may vary  $\pm 15\%$ , but the relationship between the various voltages, and the change in voltage with different operating states should be as shown.

### RESISTANCE MEASUREMENTS

Resistance of interconnecting wires and at terminal board connections when operating in the various modes can be determined from the charts, page 24.

### FIELD SERVICE

When trouble shooting the system in the field (at installation), it should first be determined whether the mal-function(s) is/are in the wiring, remote components, or Control Unit. (See paragraphs (5) through (9.1), page 6.

NOTE: Interconnecting wires must make good contact with the foil under the terminal screw. A loose screw may not make contact with the foil terminal and may allow the wire to spring away from the terminal— opening that particular circuit.

In properly installed systems, the Control Unit is connected to earth ground. Make certain that no interconnecting wire is shorted to rough-in housing, conduit; etc.

### BENCH SERVICING:

When possible connect a Model 485 Apartment Speaker to the four common terminals on the Control Unit—see appropriate schematic.

Connect a 16-20 ohm speaker to LOBBY SPKR terminals. (A separate speaker to each set of LOBBY SPKR terminals for System No. 5.

RING operation can be simulated by connecting a wire between the RING terminal in Apartment Speaker and RING COMMON terminal on Control Unit terminal board. (Either RING COMMON terminal for System No. 5)

When a Model 485 Apartment Speaker is not available, the various operations may be simulated at the Control Unit terminal board as follows:

**RING:** Connect a wire between RING COMMON and GROUND terminals; voltage on RING COMMON terminal should go to approximately zero ohms.

**APARTMENT SPEAKER TALK:** Connect a 1200 ohm resistor between CONTROL and GROUND terminals, voltage on CONTROL terminal should go to 9.6 volts and Relay K1 should be activated.

**APARTMENT SPEAKER LISTEN:** Connect a speaker across AUD 1 and AUD 2 terminals to simulate Apartment Speaker, and a speaker across LOBBY SPKR terminals to simulate Lobby Speaker, talk into the latter speaker and signals should be heard in simulated Apartment Speaker.

**DOOR RELEASE:** One- and two-entry systems; connect a 330 ohm resistor between CONTROL and GROUND terminal, CONTROL terminal should go to approximately 5.6 volts, and MAIN DOOR RELEASE high terminal should measure approximately 7 volts to ground.

**SECOND DOOR RELEASE:** Two-Entry System (With 466, 468 or 469 modules installed); short CONTROL terminal to GROUND, CONTROL terminal will go to zero volts and SECOND DOOR RELEASE high terminal should measure approximately 7 volts to ground.

### 16VAC POWER TO CONTROL UNIT

(1) At the terminal board, measure the voltage between the 16VAC terminals—should read 16-20Vac.

(2) If voltage is not present across the 16VAC terminals, check:

For 16-20Vac across secondary screw terminals of Module 301-N transformer; 120Vac supply to primary of 301-N;

For shorts and open in wiring between transformer and Control Unit's terminal board.

(3) NOTE: A short in the Master Unit may cause the thermal protector in the 301-N to open. This can be determined by disconnecting the wires from the 16VAC terminals; allowing the transformer to cool; and then again measuring the voltage across 301-N's secondary.

(3.1) If voltage is present on the leads, and disappears when they are connected to the 16VAC terminals, there is probably a short in the Control Unit. Check the PC board connections and foil path; and the DC rectifier power supply Z4; C17; etc.

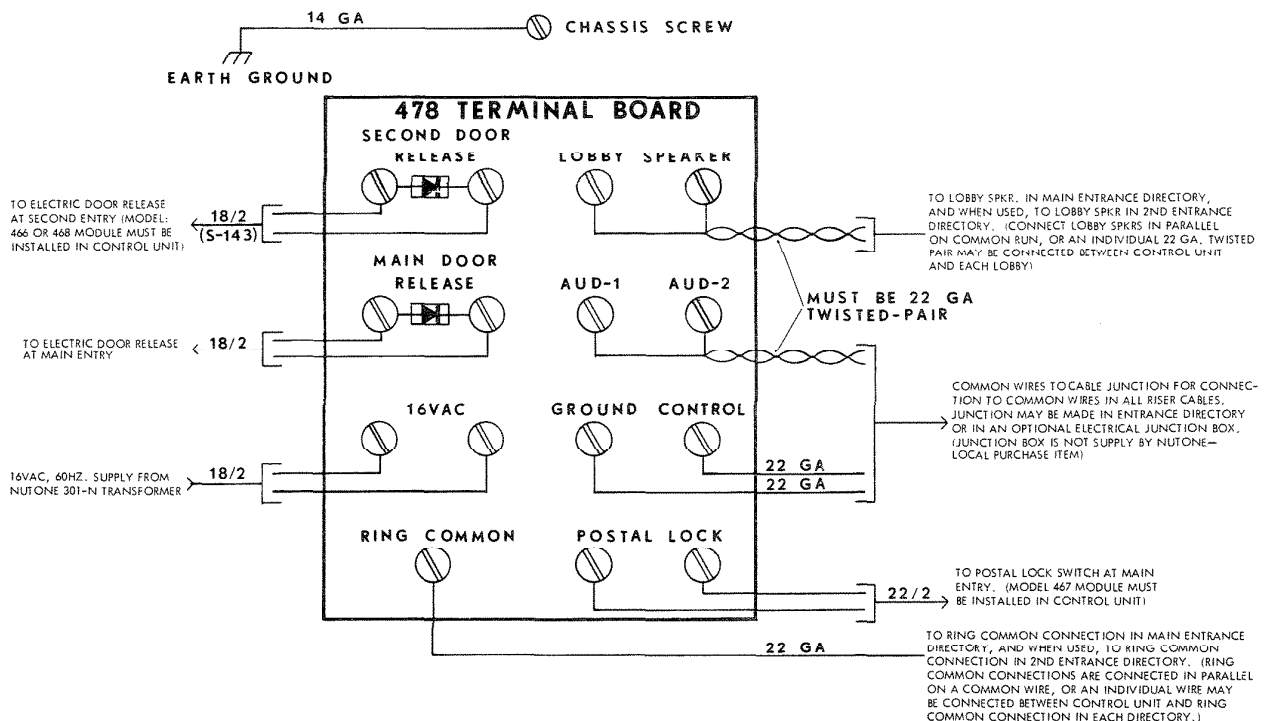
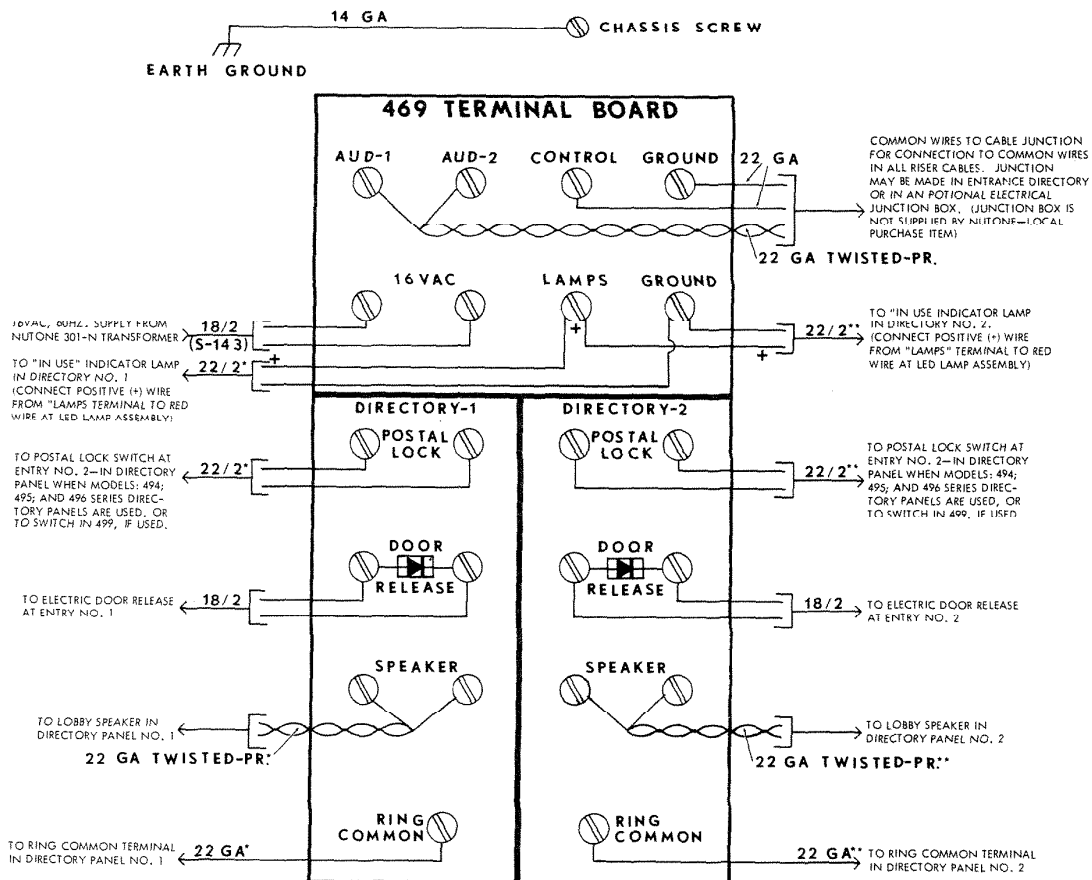


FIGURE 12

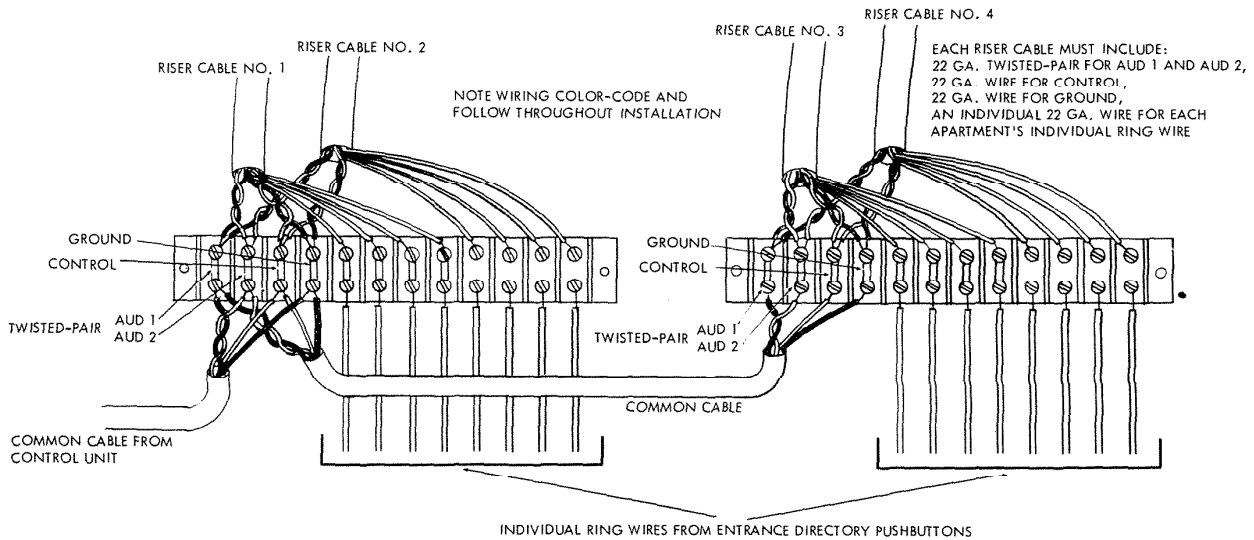


NOTE: (1\*) THESE WIRES MAY BE INCLUDED IN A RUN OF NUTONE'S IW-8 (4 TWISTED-PAIR, COLOR-CODED) CABLE BETWEEN THE CONTROL UNIT AND NO. 1 ENTRANCE DIRECTORY.  
 (1\*\*) THESE WIRES MAY BE INCLUDED IN A RUN OF NUTONE'S IW-8 CABLE BETWEEN THE CONTROL UNIT AND NO. 2 ENTRANCE DIRECTORY.

FIGURE 13

SELECT RISER CABLE FROM CHARTS INCLUDED WITH WIRING DIAGRAMS 1 AND 2

NUTONE IW-8 CAN BE USED FOR RISER CABLES SERVING A MAXIMUM OF 4 APARTMENTS



NOTE: TERMINAL STRIPS ARE NOT SUPPLIED BY NUTONE—MUST BE PURCHASED LOCALLY

CABLE JUNCTION REPRESENTATIVE INSTALLATION  
 FIGURE 14

TERMINAL STRIPS MAY BE INSTALLED IN REMOTE JUNCTION BOX OR, IN ENTRANCE DIRECTORY

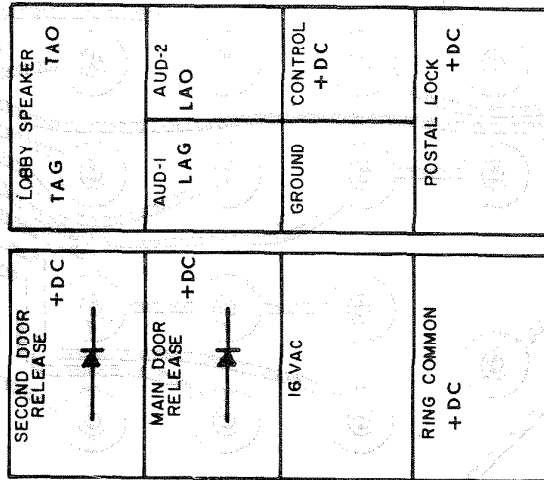
### MODEL 478 TERMINAL BOARD OPERATING VOLTAGES

INPUT VOLTS 16-20VAC; MEASURE ACROSS 16VAC TERMINALS  
 ALL VOLTAGES DC  $\pm$  15%, MEASURED IN RESPECT TO GROUND TERMINAL, UNLESS OTHERWISE VOTED  
 (TEST MEASUREMENTS MADE WITH 19VAC ACROSS 16VAC TERMINALS)

VOLTAGE AT TERMINAL	System In Standby	Directory Pushbutton Closed	Apt. Spkr. In Talk	Apt. Spkr. In Listen	Apt. Spkr. Door Rpt's S402		Man Entry Postal Switch Closed
					Position 1	Position 2	
RING COMMON	15	0.21	15	15	15	15	45
CONTROL	15	15	9.6	15	5.6	0.01 (Note 1)	15
POSTAL LOCK (With Model 467) (Measure at Hi Term) (Less Model 467)	15	15	15	15	0	15	0
MAIN DOOR RELEASE (Across Terminals) AC/Door COM + (Hi Term to GROUND)	0	0	0	0	0	0	0
SECOND DOOR RELEASE (Across Terminals) AC/DOOR COM + (Hi Term to GROUND)	0	0	0	0	5DC 14AC (Note 2)	0 or 5DC 0 or 14AC (Note 3)	5DC 14AC (Note 4)
AC/DOOR COMMON (Measure to GROUND)	0	0	0	0	7DC 4.4AC (Note 2)	0 or 7DC 0 or 4.4AC (Note 3)	7DC 14AC (Note 4)
LOBBY SPEAKERS (Across Terminals)	0	0	0	0	0	0	0
AUD 1 - AUD 2 (Across Terminals)	0	0	0	0	0	5DC 14AC	0
AC/DOOR COMMON (Measure to GROUND)	8DC 9.6AC	8DC 9.5AC	8DC 9.5AC	8DC 9.6AC	11.2DC 9.6AC	11.2DC 9.6AC	11.2DC 9.6AC
LOBBY SPEAKERS (Across Terminals)	0	Low Level Ring Tone	AUDIO OUT	AUDIO IN	0	0	0
AUD 1 - AUD 2 (Across Terminals)	0	0	AUDIO IN	AUDIO OUT	0	0	0

NOTES: (1) In a one-entry system, closing S402 in position 1 or position 2 will operate the Electric Door Release. In a two-entry system, including the Model 466 or Model 468, S402 will operate the 2nd. Entry Electric Door Release when it is in position 2.  
 (2) In system without the Model 467, these voltages will be present while S402 is closed in position 1. In systems that include the Model 467, these voltages will be held until the completion of the timing cycle, or until S402 is released, whichever comes later.  
 (3) In two-entry systems that include the Model 466 or Model 468, voltages are zero. (For one-entry system, the voltages are as shown, see Note 1 above.)  
 (4) These voltages will be present only when system includes the Model 467, and will be retained for the duration of the timing cycle or until the Postal Switch is opened, whichever comes later.

P5 15 14 13 12 10 9 8 7 6 5 4 3 2 1



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MODEL 478 TERMINAL BOARD  
 (Use with Wiring Diagram No. 1 and Schematic Diagrams Nos. 1 and 2)

FIGURE 15

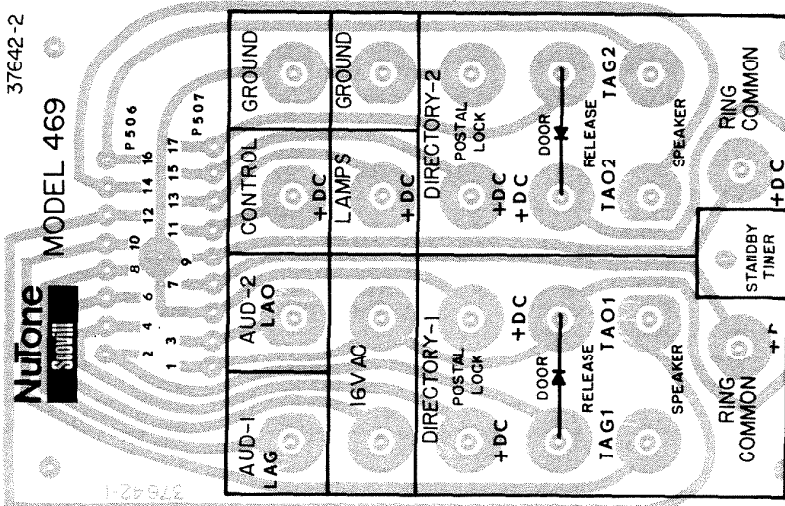
**MODEL 469 TERMINAL BOARD OPERATING VOLTAGES**

INPUT VOLTS 16-20VAC; MEASURE ACROSS 16VAC TERMINALS

ALL VOLTAGES DC ± 15%, MEASURED IN RESPECT TO GROUND TERMINAL, UNLESS OTHERWISE NOTED  
(TEST MEASUREMENTS MADE WITH 19VAC ACROSS 16VAC TERMINALS)

MEASURE VOLTAGE AT	OPERATION									
	STANDBY	PUSHBUTTON AT DIRECTORY NO. 1 CLOSED	PUSHBUTTON AT DIRECTORY NO. 2 CLOSED	APT. SPKR. IN TALK	APT. SPEAKER IN LISTEN	APT. SPKR. DOOR REL'S S402 IN POSITION 1 (Call from Directory 1)	APT. SPKR. DOOR REL'S S402 IN POSITION 2 (Call from Directory 2)	POSTAL LOCK SWITCH 1 CLOSED	POSTAL LOCK SWITCH 2 CLOSED	
RING COM 1	15	0.42	15	15	15	15	15	-1.14	15	
RING COM 2	15	15	0.43	15	15	15	15	15	-1.14	
CONTROL	15	15	15	9.5	15	5	0	15	15	
LAMPS (Hi Side to GROUND)	0	Pulsating DC (15V max) that comes on when either directory pushbutton or when Postal Lock Switch is closed; anc remains on for completion of timing cycle.								
DOOR RELEASE 1 (Measure across Term's) AC/DOOR COM (+)	0	0	0	0	0	5DC 14.2AC (Note 1)	0	5DC 14.2AC (Note 2)	0	
HIGH-SIDE to GROUND	0	0	0	0	0	7DC 4.5AC	0	7DC 4.5AC	0	
DOOR RELEASE 2 (Measure across Term's) AC/DOOR COM (+)	0	0	0	0	0	0	5DC 14.2AC (Note 3)	0	5DC 14.2AC (Note 4)	
HIGH-SIDE to GROUND	0	0	0	0	0	0	7DC 4.5AC	0	7DC 4.5AC	
AC/DOOR COM (Measure to GROUND)	8.2DC 9.8AC	8.2DC 9.8AC	8.2DC 9.8AC	9.2DC 9.8AC	8.2DC 9.8AC	11.4DC 9.8AC	11.4DC 9.8AC	11.4DC 9.8AC	11.4DC 9.8AC	
POSTAL LOCK 1 (Hi Side to GROUND)	15	15	15	15	15	14.6	15	0	15	
POSTAL LOCK 2 (Hi Side to GROUND)	15	15	15	15	15	15	14.6	15	0	

- NOTES: (1) Voltages are retained across Door Release 1 and Hi-Side to ground, while S402 is in position 1 plus timing cycle after switch is released — when call is initiated at Directory No. 1.  
 (2) Voltages are retained across Door Release 1 and Hi-Side to ground, while Postal Lock Switch No. 1 is held closed plus the timing cycle duration.  
 (3) Voltages are retained across Door Release 2 and Hi-Side to ground, while S402 is in position 2 plus timing cycle after switch is released — when call is initiated at Directory No. 2.  
 (4) Voltages are retained across Door Release 2 and Hi-Side to ground, while Postal Lock Switch No. 2 is held closed plus the timing cycle duration.



**MODEL 469 TERMINAL BOARD**  
(Use with Wiring Diagram No. 2 and Schematic Diagram No. 3)

**FIGURE 16**

**AUDIO TERMINALS RESISTANCE MEASUREMENTS (IN DC OHMS)  
MODEL 478 TERMINAL BOARD (FIGURE 14)**

System	Measure Between	STANDBY		OPERATING MODE	
		Wires Off Terminals	Wires On Terminals	Talk	Listen
1 AND 2 ONE LOBBY SPEAKER	TAO-TAG	14	6.9	10	6.9
	TAO-GROUND	8.6	6.9	10	6.9
	TAG-GROUND	8.5	6.7	0	6.7
3 AND 4 2-LOBBY SPEAKERS	TAO-TAG	14	4.7	5.7	4.7
	TAO-GROUND	8.6	6.2	5.9	6.2
	TAG-GROUND	8.5	6.2	0	6.2
ALL SYSTEMS	AUD 1-AUD 2	47	47	6.7	10
	AUD 2-GROUND	47	47	6.7	10
	AUD 1-GROUND	0	0	6.2	0

**MODEL 469 TERMINAL BOARD-SYSTEM 5 (FIGURE 15)**

Measure Between	STANDBY		OPERATING MODE			
	Wires Off Terminals	Wires On Terminals	CALL FROM DIRECTORY 1		CALL FROM DIRECTORY 2	
			Talk	Listen	Talk	Listen
LOBBY SPKR. 1						
TAO1-TAG1	14	6.8	10	6.8	14	14
TAO1-GROUND	8.6	6.9	10	6.9	OPEN	OPEN
TAG1-GROUND	8.5	6.7	0	6.7	OPEN	OPEN
LOBBY SPKR. 2						
TAO2-TAG2	OPEN	14	14	14	10	6.7
TAO2-GROUND	OPEN	OPEN	OPEN	OPEN	10	6.7
TAG2-GROUND	OPEN	OPEN	OPEN	OPEN	0	6.6
AUD 1-AUD 2	47	47	6.7	10	6.7	10
AUD 2-GROUND	47	47	6.6	10	6.7	10
AUD 1-GROUND	0	0	6.5	0	6.5	0

NOTE: TAO = Audio Amplifier Output when system is in "Talk" mode.  
TAG = Audio Amplifier Ground when system is in "Talk" mode.  
LAO = Audio Amplifier Output on AUD 2 terminal when system is in "Listen" mode.  
LAG = Audio Amplifier Ground on AUD 1 terminal when system is in "Listen" mode.  
TAO1 = Audio Amplifier Output when System 5 is in "Talk" mode and call is originated at Directory No. 1.  
TAG1 = Audio Amplifier Ground when System 5 is in "Talk" mode and call is originated at Directory No. 1.  
TAO2 = Audio Amplifier Output when System 5 is in "Talk" mode and call is originated at Directory No. 2.  
TAG2 = Audio Amplifier Ground when System 5 is in "Talk" mode and call is originated at Directory No. 2.

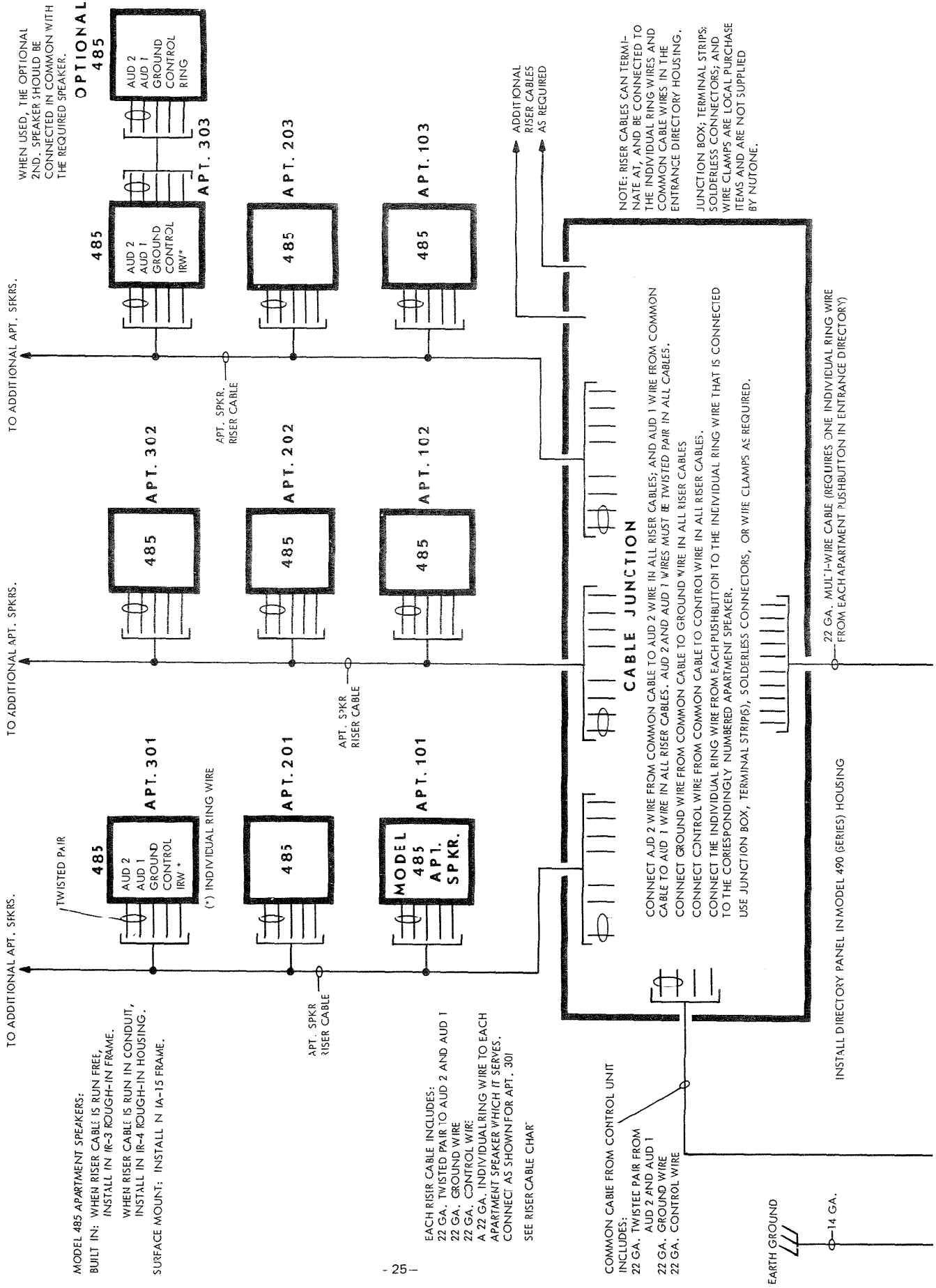
**AUDIO WIRES RESISTANCE MEASUREMENTS (IN DC OHMS)  
(REMOVE WIRES FROM MASTER UNIT TERMINAL BOARD)**

Measure Between Wires	Standby	One Apt. Spkr. Talk Switch Closed	One Apt. Spkr. Listen Switch Closed
ALL SYSTEMS AUD 1-AUD 2	OPEN	14	14

14 ohms is d-c resistance of Apartment Speaker voice foil. Actual resistance measured will equal the 14 ohms plus resistance of the 22 ga. twisted-pair used for AUD 1 and AUD 2 wires. If more than one Apt. Spkr. TALK and/or LISTEN switch is closed, the total resistance = 14/N; where N = number of switches closed.

LOBBY SPKR. TWISTED-PAIR	14	14	14
SPKR. DISCONNECTED	OPEN	OPEN	OPEN
SYSTEM 3 AND 4 TWISTED PAIR TO BOTH LOBBY SPEAKERS CON- NECTED IN PARALLEL	7	7	7





WHEN USED, THE OPTIONAL 2ND. SPEAKER SHOULD BE CONNECTED IN COMMON WITH THE REQUIRED SPEAKER.

TO ADDITIONAL APT. SPKRS.

TO ADDITIONAL APT. SPKRS.

TO ADDITIONAL APT. SPKRS.

**MODEL 485 APARTMENT SPEAKERS:**  
 BUILT IN: WHEN RISER CABLE IS RUN FREE, INSTALL IN IR-3 ROUGH-IN FRAME.  
 WHEN RISER CABLE IS RUN IN CONDUIT, INSTALL IN IR-4 ROUGH-IN HOUSING.  
 SURFACE MOUNT: INSTALL IN IA-15 FRAME.

(\*) INDIVIDUAL RING WIRE

EACH RISER CABLE INCLUDES:  
 22 GA. TWISTED PAIR TO AUD 2 AND AUD 1  
 22 GA. GROUND WIRE  
 22 GA. CONTROL WIRE  
 A 22 GA. INDIVIDUAL RING WIRE TO EACH APARTMENT SPEAKER WHICH IT SERVES.  
 CONNECT AS SHOWN FOR APT. 301  
 SEE RISER CABLE CHART

COMMON CABLE FROM CONTROL UNIT INCLUDES:  
 22 GA. TWISTED PAIR FROM AUD 2 AND AUD 1  
 22 GA. GROUND WIRE  
 22 GA. CONTROL WIRE

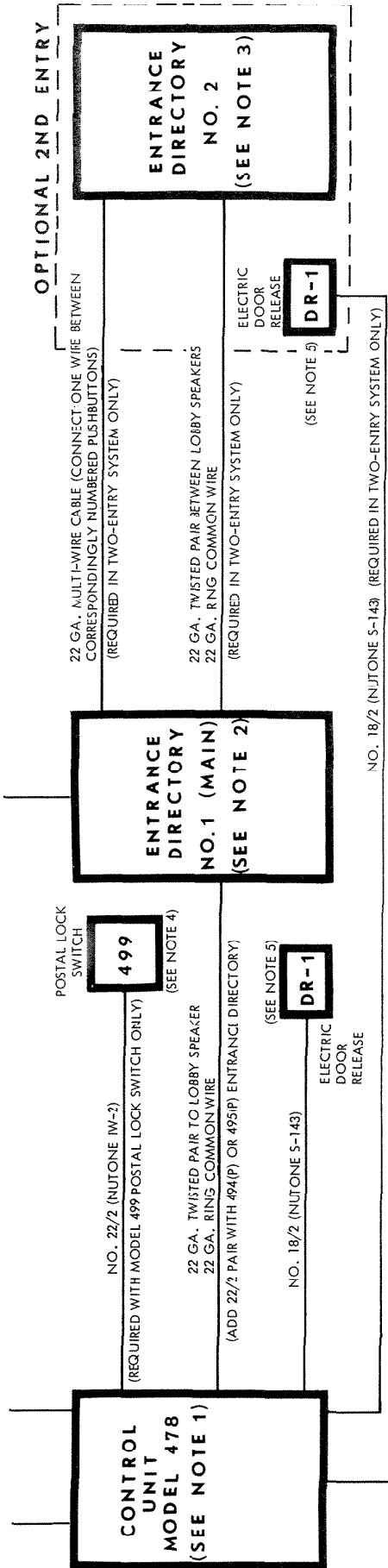
**CABLE JUNCTION**  
 CONNECT AUD 2 WIRE FROM COMMON CABLE TO AUD 2 WIRE IN ALL RISER CABLES; AND AUD 1 WIRE FROM COMMON CABLE TO AUD 1 WIRE IN ALL RISER CABLES. AUD 2 AND AUD 1 WIRES MUST BE TWISTED PAIR IN ALL CABLES.  
 CONNECT GROUND WIRE FROM COMMON CABLE TO GROUND WIRE IN ALL RISER CABLES  
 CONNECT CONTROL WIRE FROM COMMON CABLE TO CONTROL WIRE IN ALL RISER CABLES.  
 CONNECT THE INDIVIDUAL RING WIRE FROM EACH PUSHBUTTON TO THE INDIVIDUAL RING WIRE THAT IS CONNECTED TO THE CORRESPONDINGLY NUMBERED APARTMENT SPEAKER.  
 USE JUNCTION BOX, TERMINAL STRIPS, SOLDERLESS CONNECTORS, OR WIRE CLAMPS AS REQUIRED.

INSTALL DIRECTORY PANEL IN MODEL 490 (SERIES) HOUSING

22 GA. MUL-TI-WIRE CABLE (REQUIRES ONE INDIVIDUAL RING WIRE FROM EACH APARTMENT PUSHBUTTON IN ENTRANCE DIRECTORY)

NOTE: RISER CABLES CAN TERMINATE AT, AND BE CONNECTED TO THE INDIVIDUAL RING WIRES AND COMMON CABLE WIRES IN THE ENTRANCE DIRECTORY HOUSING.  
 JUNCTION BOX, TERMINAL STRIPS, SOLDERLESS CONNECTORS, AND WIRE CLAMPS ARE LOCAL PURCHASE ITEMS AND ARE NOT SUPPLIED BY NUTONE.

ADDITIONAL RISER CABLES AS REQUIRED



NOTE 1: MODEL 478 CONTROL UNIT:  
 FOR ONE-ENTRY SYSTEM WITH MOMENTARY DOOR RELEASE, USE AS SUPPLIED  
 FOR ONE-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK, ADD MODEL 467 POSTAL/MAIN DOOR TIMER.  
 FOR TWO-ENTRY SYSTEM WITH MOMENTARY DOOR RELEASE AT BOTH ENTRIES, ADD MODEL 466 2ND DOOR RELEASE  
 AT ENTRY NO. 2. ADD MODEL 467 POSTAL/MAIN DOOR TIMER AND MODEL 468 TIMED 2ND DOOR RELEASE.

NOTE 2: ENTRANCE DIRECTORY NO. 1 (MAIN):  
 USE MODEL 498 ENTRANCE DIRECTORY FOR A MAXIMUM OF 20 APARTMENTS.  
 USE MODEL 494 ENTRANCE DIRECTORY FOR A MAXIMUM OF 145 APARTMENTS (MAXIMUM OF 135 APARTMENTS WITH  
 TELEPHONE HANDSET AND/OR POSTAL LOCK (494(P) OR 494(TP)).  
 USE MODELS: 495; 495(P); AND 495(TP) FOR ANY NUMBER OF APARTMENTS.

NOTE 3: ENTRANCE DIRECTORY NO. 2: SAME REQUIREMENTS AS FOR MAIN ENTRY, EXCEPT, THE POSTAL LOCK VERSION IS  
 NOT REQUIRED.

NOTE 4: POSTAL LOCK SWITCH:  
 MODEL 495 POSTAL LOCK SWITCH IS USED WITH MODEL 498 ENTRANCE DIRECTORY, AND MAY ALSO BE USED WITH THE  
 MODEL 494 AND 495 ENTRANCE DIRECTORIES.  
 MODELS: 494(P); 494(TP); 494(P); AND 495(TP) ARE SUPPLIED WITH POSTAL LOCK SWITCH.

NOTE 5: ELECTRIC DOOR RELEASE:  
 USE NUTONE MODEL DR-1 WITH WOOD FRAME AND DOOR.  
 FOR METAL FRAME AND DOOR, USE ELECTRIC DOOR RELEASE SUPPLIED BY DOOR MANUFACTURER. (DOOR RELEASE SHOULD  
 OPERATE ON 6 TO 8 V AVERAGE PULSATING DC.)

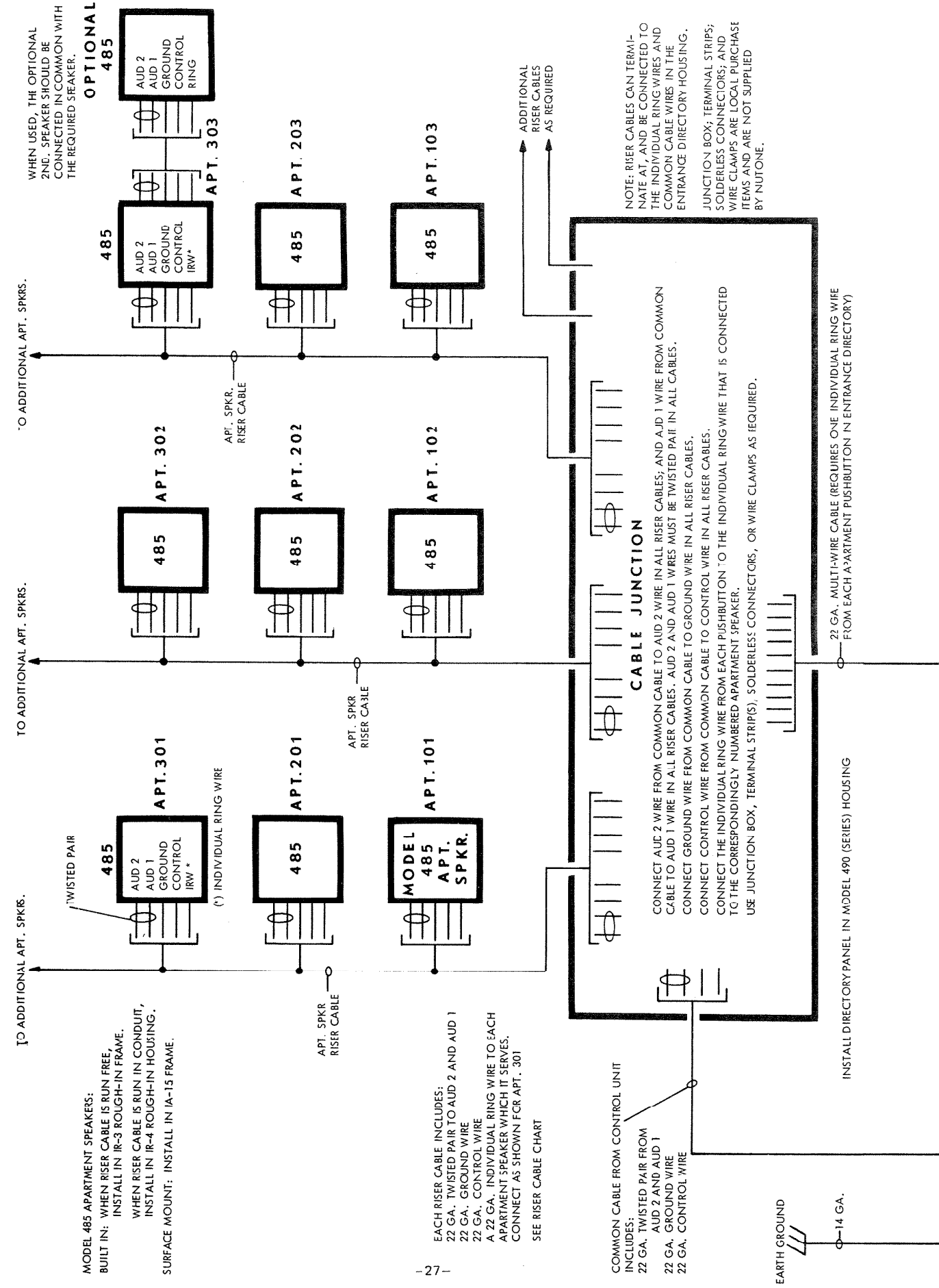
**RISER CABLE CHART**

NUMBER OF APARTMENTS SERVED	NUMBER OF WIRES REQUIRED*	CABLE ** MAKE/NUMBER	CABLE SIZE NOMINAL O.D
1-2	5-6	NuTone IW-4 (3-Twisted-Pair)	7/32 In.
3-4	7-8	NuTone IW-8 (4-Twisted-Pair)	1/4 In.
5-8	9-12	Belden No. 8743*** (6-Twisted-Pair)	5/16 In.
9-14	13-18	Belden No. 8744 (9-Twisted-Pair)	3/8 In.
15-18	19-22	Belden No. 8753 (11-Twisted-Pair)	13/32 In.
19-22	23-26	Belden No. 8754 (13-Twisted-Pair)	7/16 In.
23-26	27-30	Belden No. 8745 (15-Twisted-Pair)	15/32 In.

NOTE: (\*): Must contain at least 1-Twisted Pair-for AUD 1 and AUD 2 leads.  
 (\*\*): Cables that are the engineering equivalent of those listed may be used.  
 (\*\*\*) Belden cable not supplied by NuTone. It or equivalent cable must be purchased locally.  
 USE COLOR CODED CABLE

ONE-ENTRY SYSTEM WITH MOMENTARY DOOR RELEASE  
 ONE-ENTRY SYSTEM WITH TIMED DOOR RELEASE AND POSTAL LOCK  
 TWO-ENTRY SYSTEM WITH MOMENTARY DOOR RELEASE AT BOTH ENTRIES  
 TWO-ENTRY SYSTEM WITH TIMED DOOR RELEASE/POSTAL LOCK AT MAIN ENTRY, AND TIMED DOOR RELEASE AT SECOND ENTRY

WIRING DIAGRAM NO. 1-REPRESENTATIVE INSTALLATION



WHEN USED, THE OPTIONAL 2ND. SPEAKER SHOULD BE CONNECTED IN COMMON WITH THE REQUIRED SPEAKER.

**OPTIONAL 485**

**MODEL 485 APARTMENT SPEAKERS:**  
 BUILT IN: WHEN RISER CABLE IS RUN FREE, INSTALL IN IR-3 ROUGH-IN FRAME.  
 WHEN RISER CABLE IS RUN IN CONDUIT, INSTALL IN IR-4 ROUGH-IN HOUSING.  
 SURFACE MOUNT: INSTALL IN IA-15 FRAME.

(\*) INDIVIDUAL RING WIRE

EACH RISER CABLE INCLUDES:  
 22 GA. TWISTED PAIR TO AUD 2 AND AUD 1  
 22 GA. GROUND WIRE  
 22 GA. CONTROL WIRE  
 A 22 GA. INDIVIDUAL RING WIRE TO EACH APARTMENT SPEAKER WHICH IT SERVES.  
 CONNECT AS SHOWN FOR APT. 301

SEE RISER CABLE CHART

COMMON CABLE FROM CONTROL UNIT INCLUDES:  
 22 GA. TWISTED PAIR FROM AUD 2 AND AUD 1  
 22 GA. GROUND WIRE  
 22 GA. CONTROL WIRE

**CABLE JUNCTION**

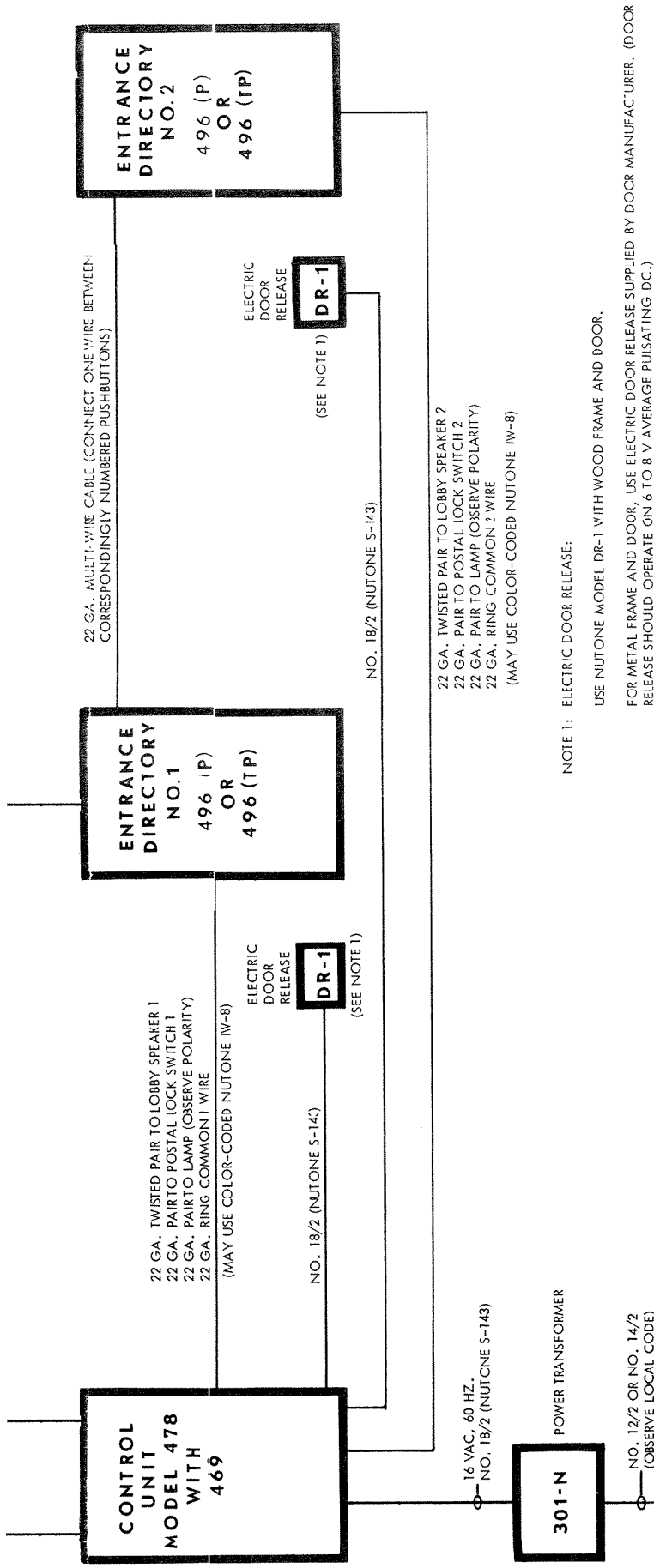
CONNECT AUD 2 WIRE FROM COMMON CABLE TO AUD 2 WIRE IN ALL RISER CABLES; AND AUD 1 WIRE FROM COMMON CABLE TO AUD 1 WIRE IN ALL RISER CABLES. AUD 2 AND AUD 1 WIRES MUST BE TWISTED PAIR IN ALL CABLES.  
 CONNECT GROUND WIRE FROM COMMON CABLE TO GROUND WIRE IN ALL RISER CABLES.  
 CONNECT CONTROL WIRE FROM COMMON CABLE TO CONTROL WIRE IN ALL RISER CABLES.  
 CONNECT THE INDIVIDUAL RING WIRE FROM EACH PUSHBUTTON TO THE INDIVIDUAL RING WIRE THAT IS CONNECTED TO THE CORRESPONDINGLY NUMBERED APARTMENT SPEAKER.  
 USE JUNCTION BOX, TERMINAL STRIPS, SOLDERLESS CONNECTORS, OR WIRE CLAMPS AS REQUIRED.

EARTH GROUND

INSTALL DIRECTORY PANEL IN MODEL 490 (SERIES) HOUSING

22 GA. MULTI-WIRE CABLE (REQUIRES ONE INDIVIDUAL RING WIRE FROM EACH APARTMENT PUSHBUTTON IN ENTRANCE DIRECTORY)

NOTE: RISER CABLES CAN TERMINATE AT, AND BE CONNECTED TO THE INDIVIDUAL RING WIRES AND COMMON CABLE WIRES IN THE ENTRANCE DIRECTORY HOUSING.  
 JUNCTION BOX; TERMINAL STRIPS; SOLDERLESS CONNECTORS; AND WIRE CLAMPS ARE LOCAL PURCHASE ITEMS AND ARE NOT SUPPLIED BY NUTONE.



**RISER CABLE CHART**

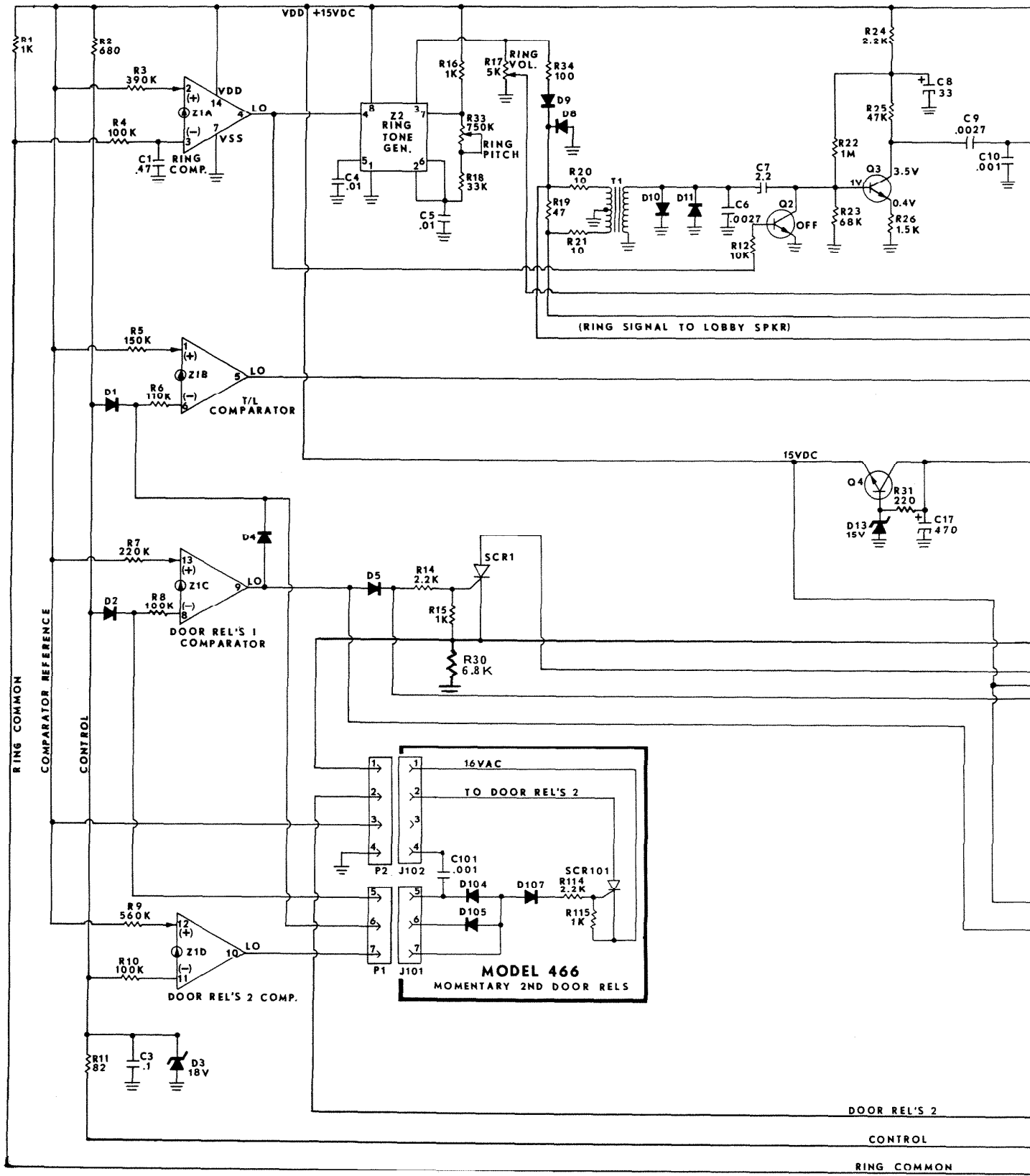
NUMBER OF APARTMENTS SERVED	NUMBER OF WIRES REQUIRED*	CABLE ** MAKE/NUMBER	CABLE SIZE NOMINAL O. D.
1-2	3-6	NuTone IW-6 (3-Twisted-Pair)	7/32 in.
3-4	7-8	NuTone IW-8 (4-Twisted-Pair)	1/4 in.
5-8	9-12	Belden No. 8743*** (6-Twisted-Pair)	5/16 in.
9-14	13-18	Belden No. 8744 (9-Twisted-Pair)	3/8 in.
15-18	15-22	Belden No. 8753 (11-Twisted-Pair)	13/32 in.
19-22	23-26	Belden No. 8754 (13-Twisted-Pair)	7/16 in.
23-26	27-30	Belden No. 8745 (15-Twisted-Pair)	15/32 in.

NOTE: (\*) Must contain at least 1-Twisted Pair for AUD 1 and AUD 2 leads.  
(\*\*) Cables that are the engineering equivalent of those listed may be used.  
(\*\*\*) Belden cable not supplied by NuTone. If or equivalent cable must be purchased locally.  
USE COLOR CODED CABLE

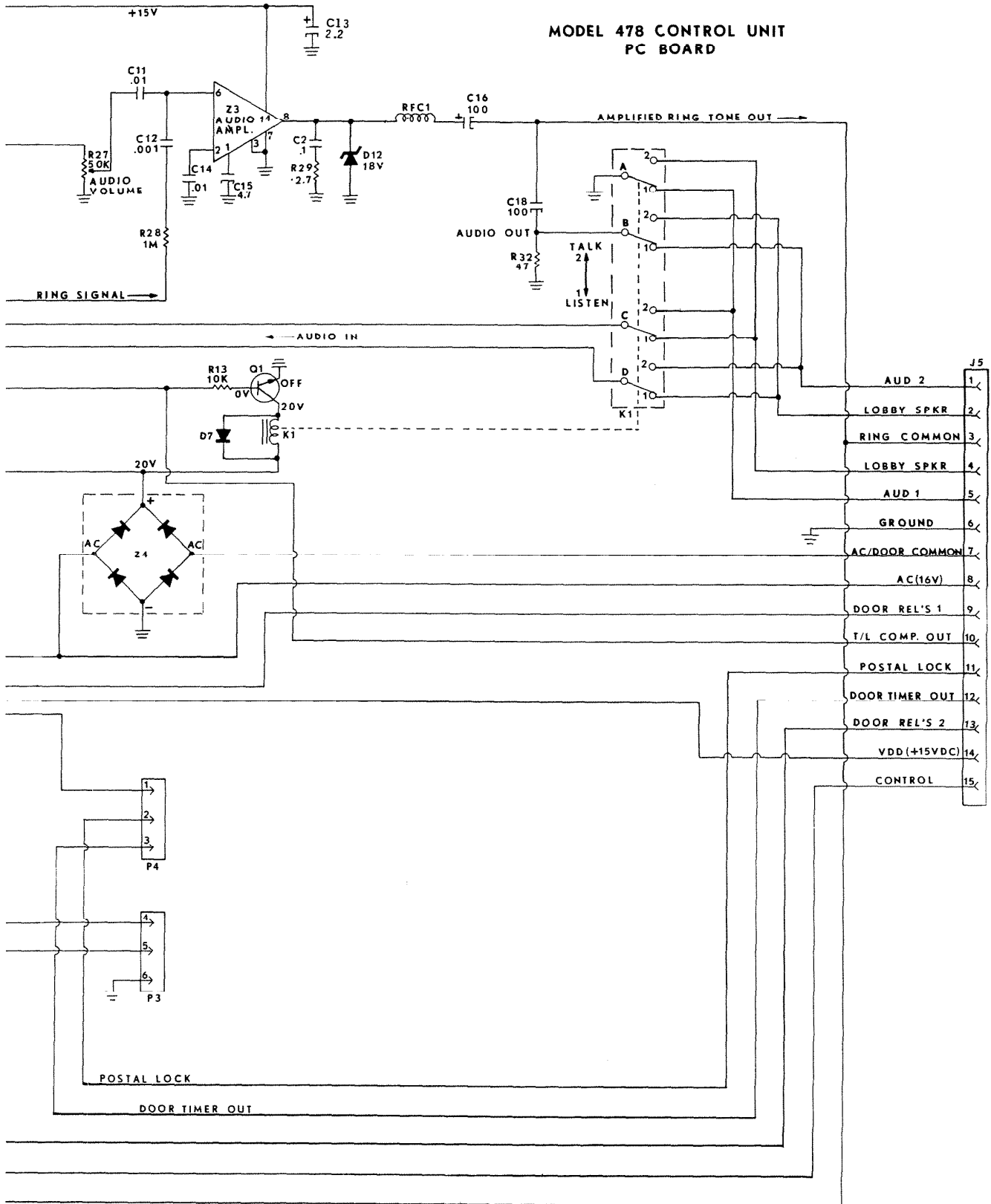
**NUTONE WIRE AND CABLE**

NUTONE MODEL NO.	DESCRIPTION	HOW SUPPLIED
IW-2	22 Ga. Twisted Pair (Color Coded)	IW-2-100 (100 Ft. Spool) IW-2-500 (500 Ft. Spool)
IW-6	22 Ga. 3-Twisted Pairs (Color Coded)	IW-6-200 (200 Ft. Spool) IW-6-1000 (1,000 Ft. Spool)
IW-8	22 Ga. 4-Twisted Pairs (Color Coded)	IW-8-250 (250 Ft. Spool) IW-8-1000 (1,000 Ft. Spool)
S-142	18 Ga. Single Conductor	500 Ft. Spool
S-143	18/2 (Insulation marked for polarity)	500 Ft. Spool

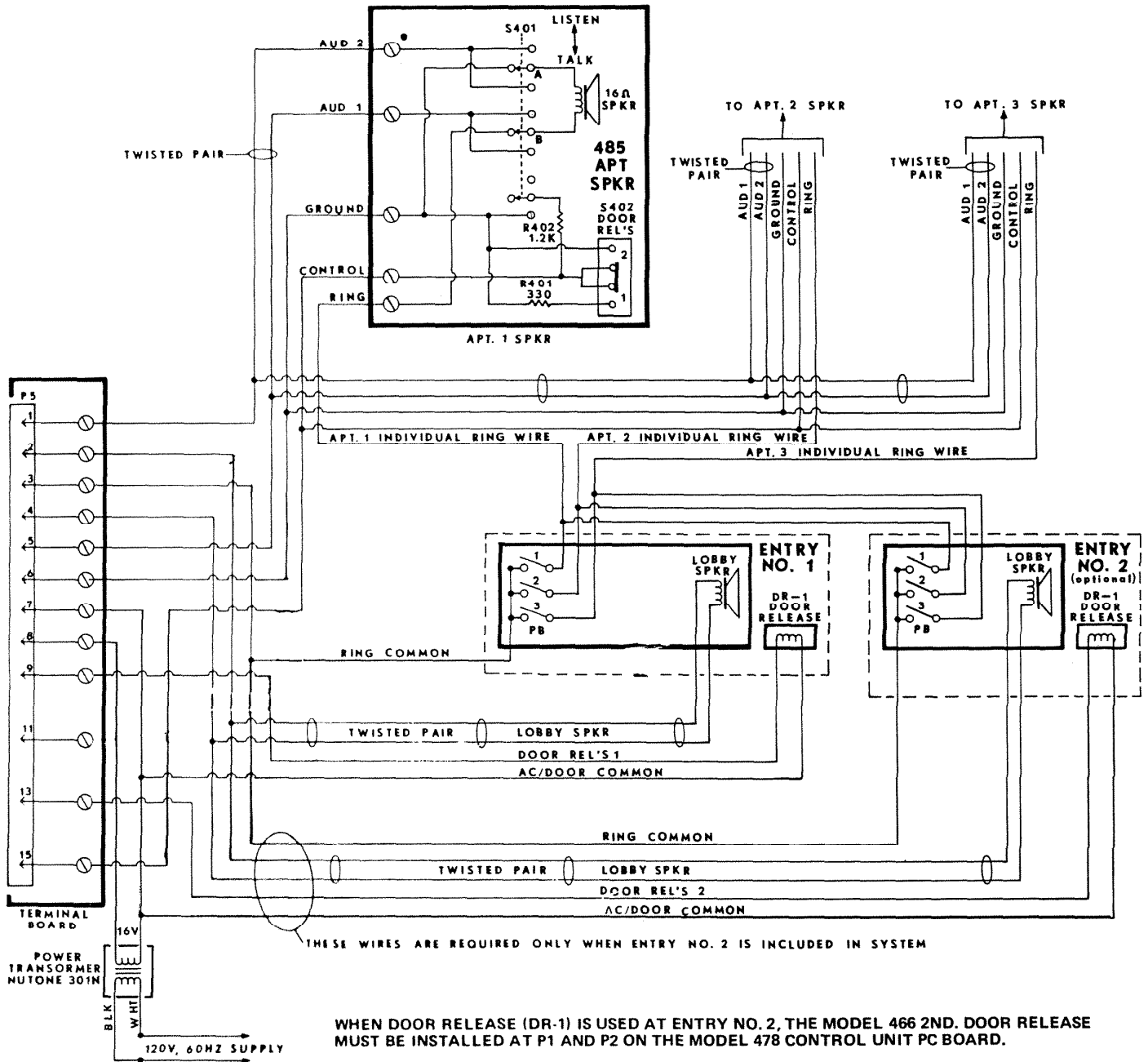
TWO-ENTRY SYSTEM WITH TIMED DOOR RELEASE/POSTAL LOCK AT BOTH ENTRIES AND AUTO-CALL TRANSFER  
WIRING DIAGRAM NO. 2-REPRESENTATIVE INSTALLATION

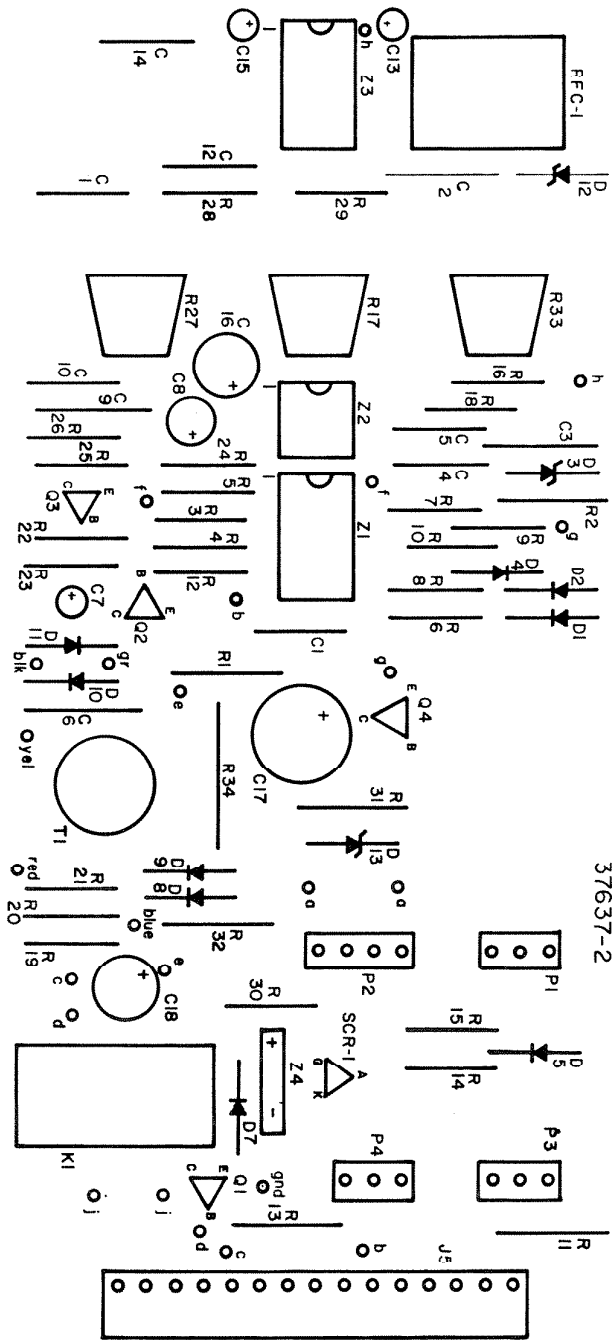


MODEL 478 CONTROL UNIT  
PC BOARD

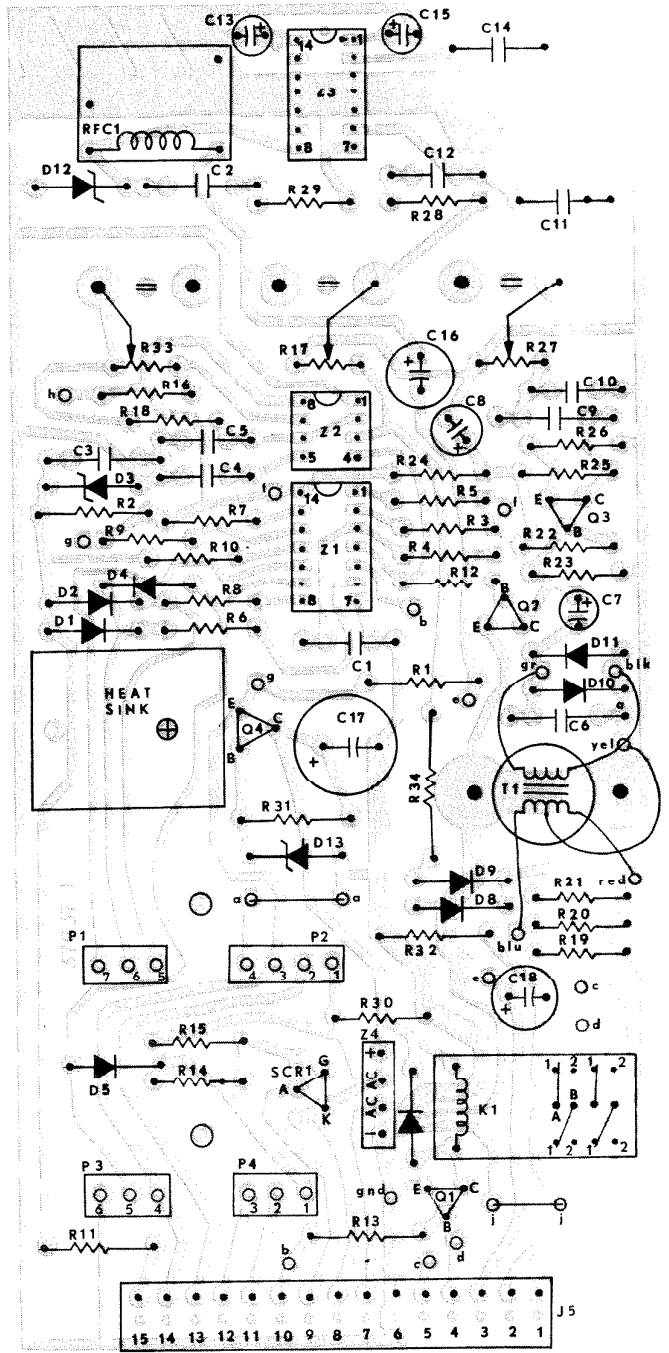


SCHMATIC NO. 1  
ONE OR TWO ENTRY SYSTEM WITH MOMENTARY DOOR RELEASE





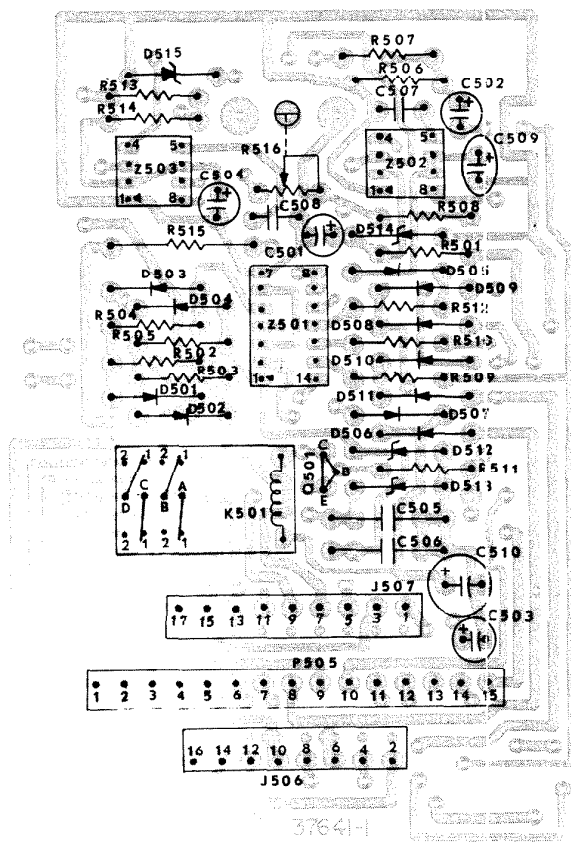
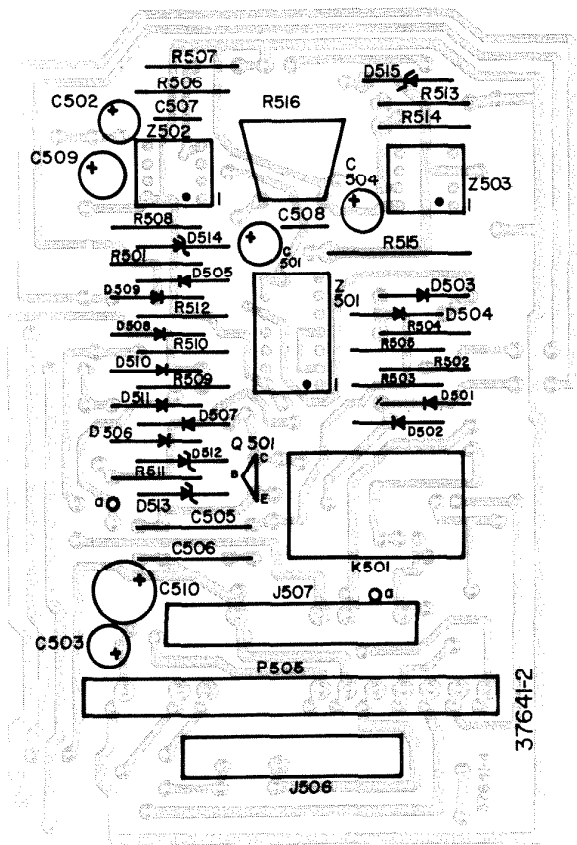
TOP VIEW—COMPONENT LOCATION



BOTTOM VIEW—FOIL PATTERN/COMPONENT CONNECTION

MODEL 478 MASTER UNIT PC BOARD





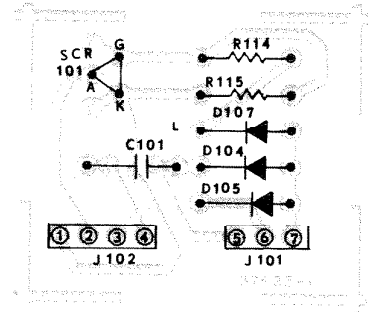
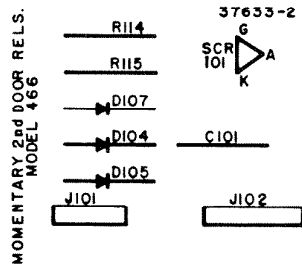
TOP VIEW-FOIL PATTERN/COMPONENT LOCATION

BOTTOM VIEW-FOIL PATTERN/COMPONENT CONNECTION

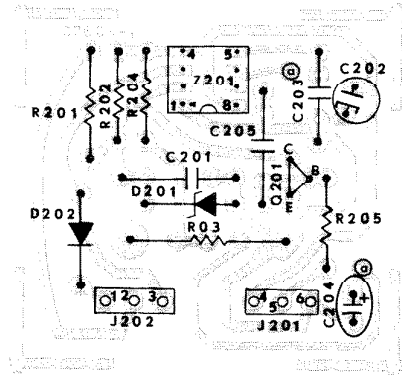
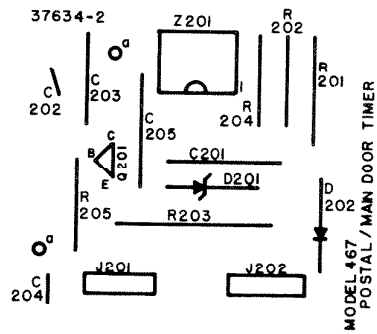
MODEL 469 AUTO CALL TRANSFER  
(USE WITH SCHEMATIC NO. 3)

TOP VIEW-COMPONENT LOCATION

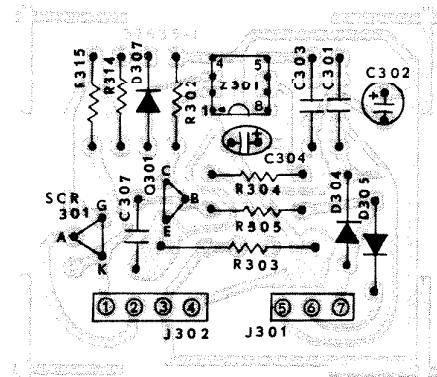
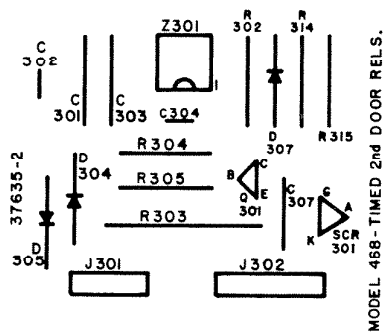
BOTTOM VIEW  
FOIL PATTERN/COMPONENT CONNECTION



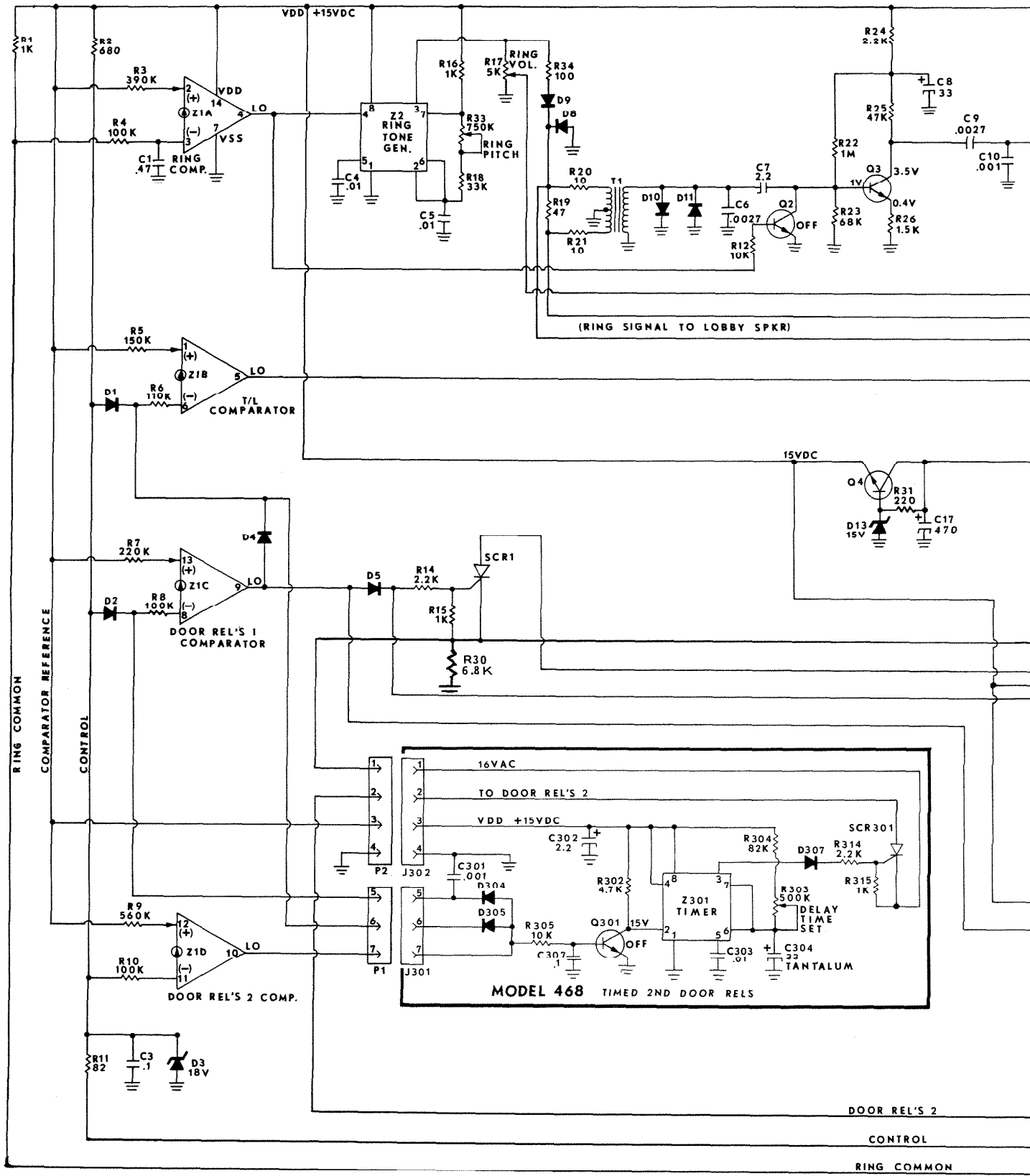
MODEL 466 MOMENTARY 2ND. DOOR RELEASE



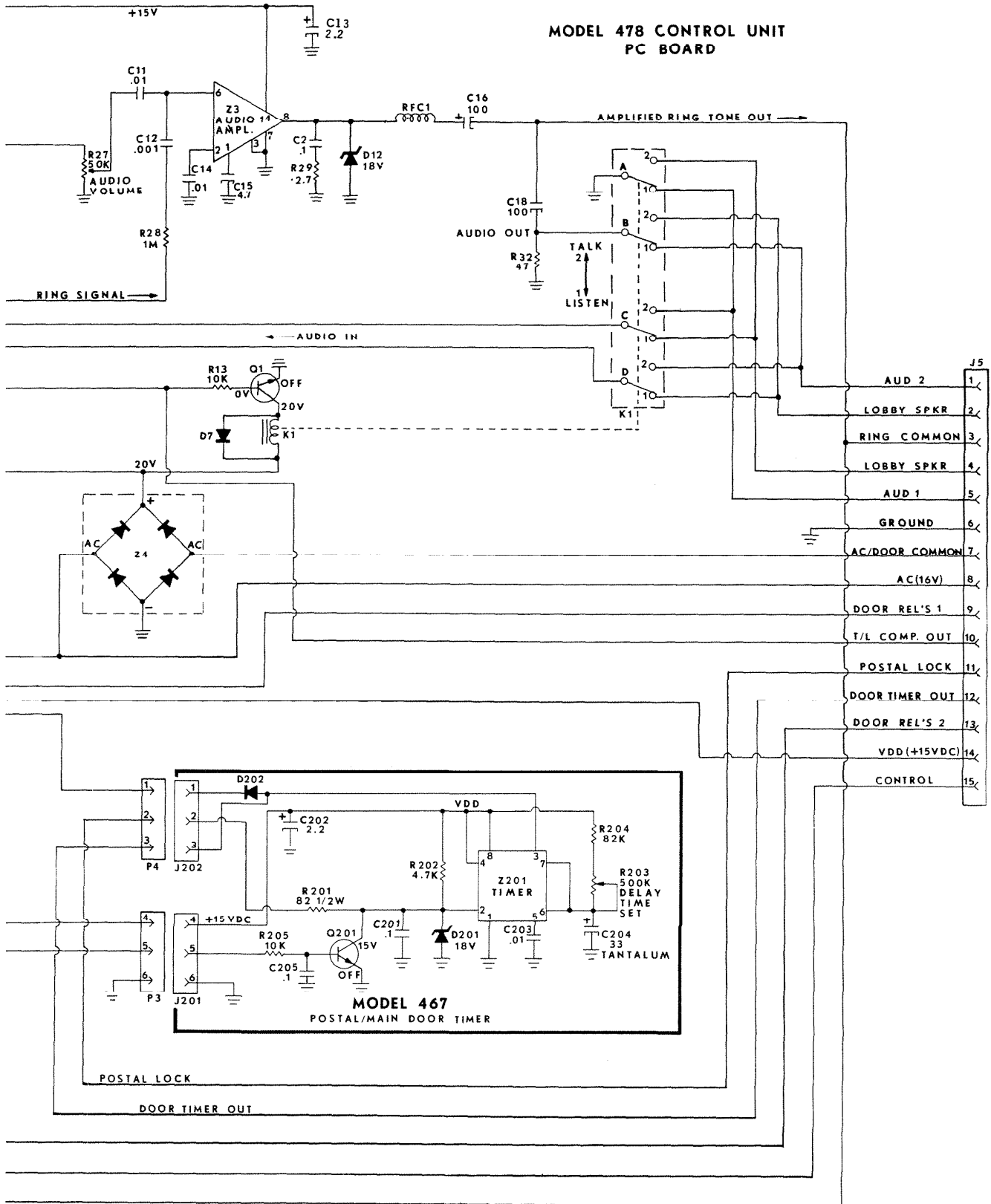
MODEL 467 POSTAL/MAIN DOOR TIMER  
(Also used and supplied with Model 469)



MODEL 468 TIMED 2ND. DOOR RELEASE

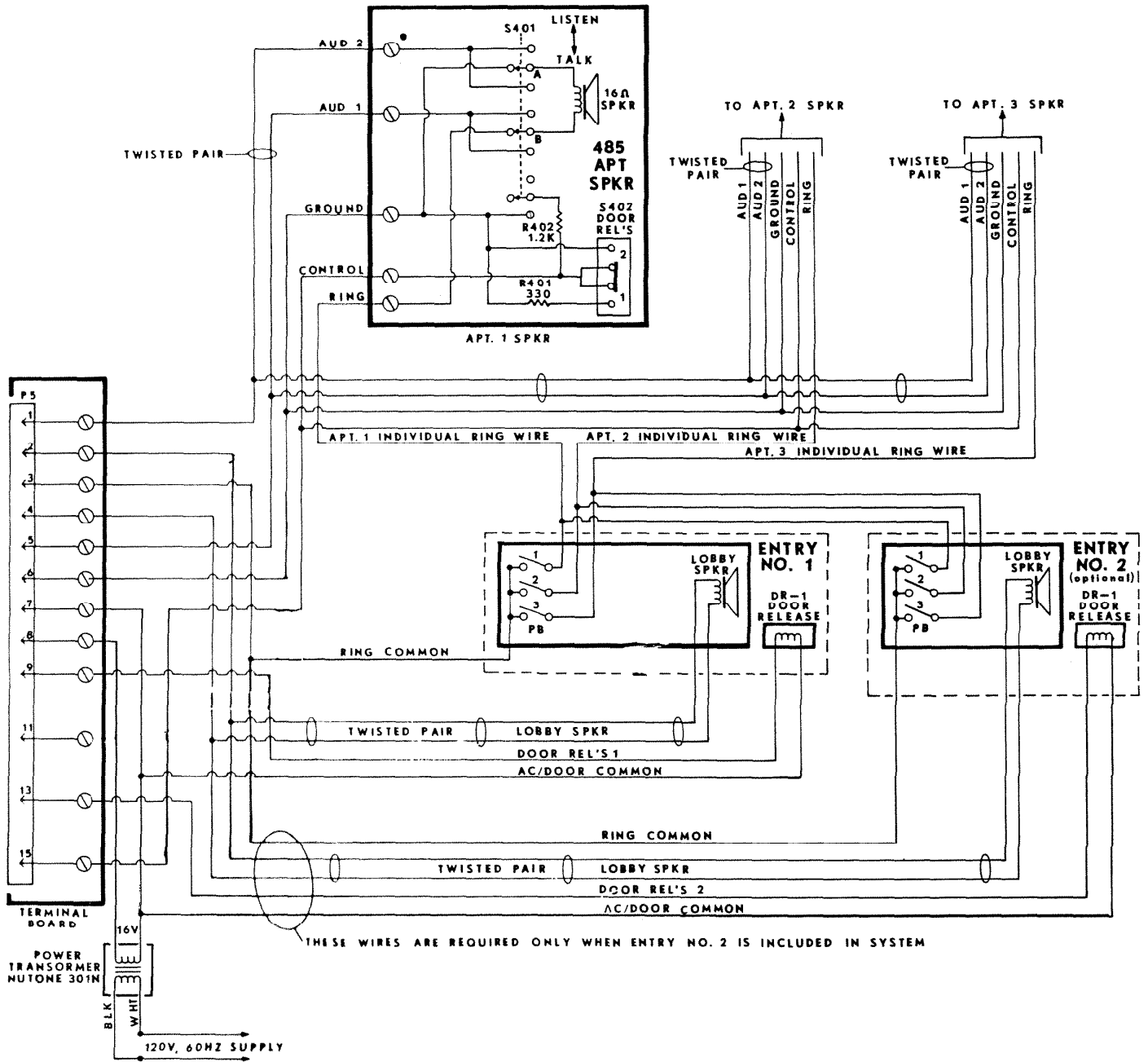


MODEL 478 CONTROL UNIT  
PC BOARD



SCHMATIC NO. 2

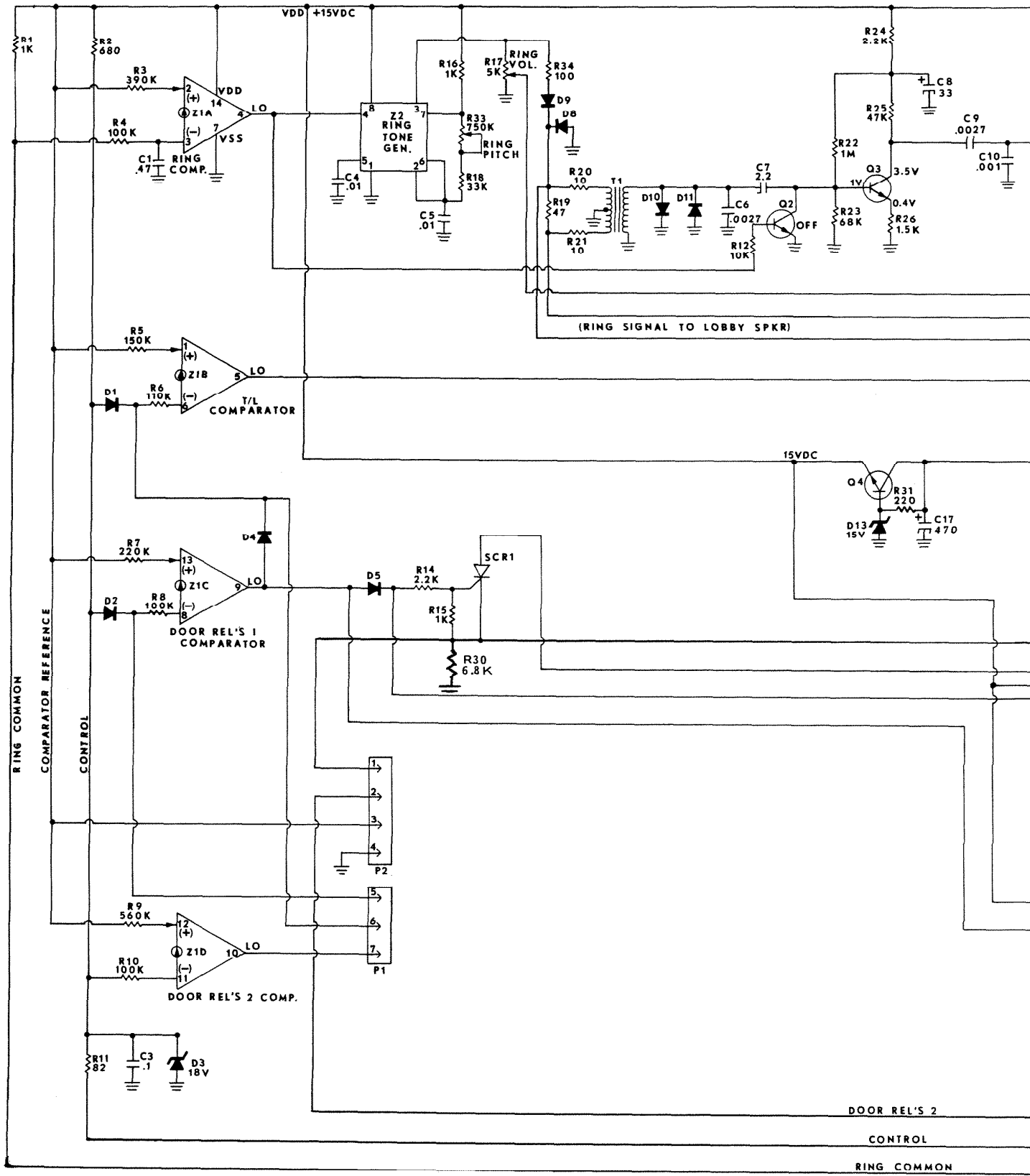
ONE OR TWO ENTRY SYSTEM WITH TIMED DOOR RELEASE  
AT BOTH ENTRIES AND TIMED POSTAL LOCK AT MAIN ENTRY



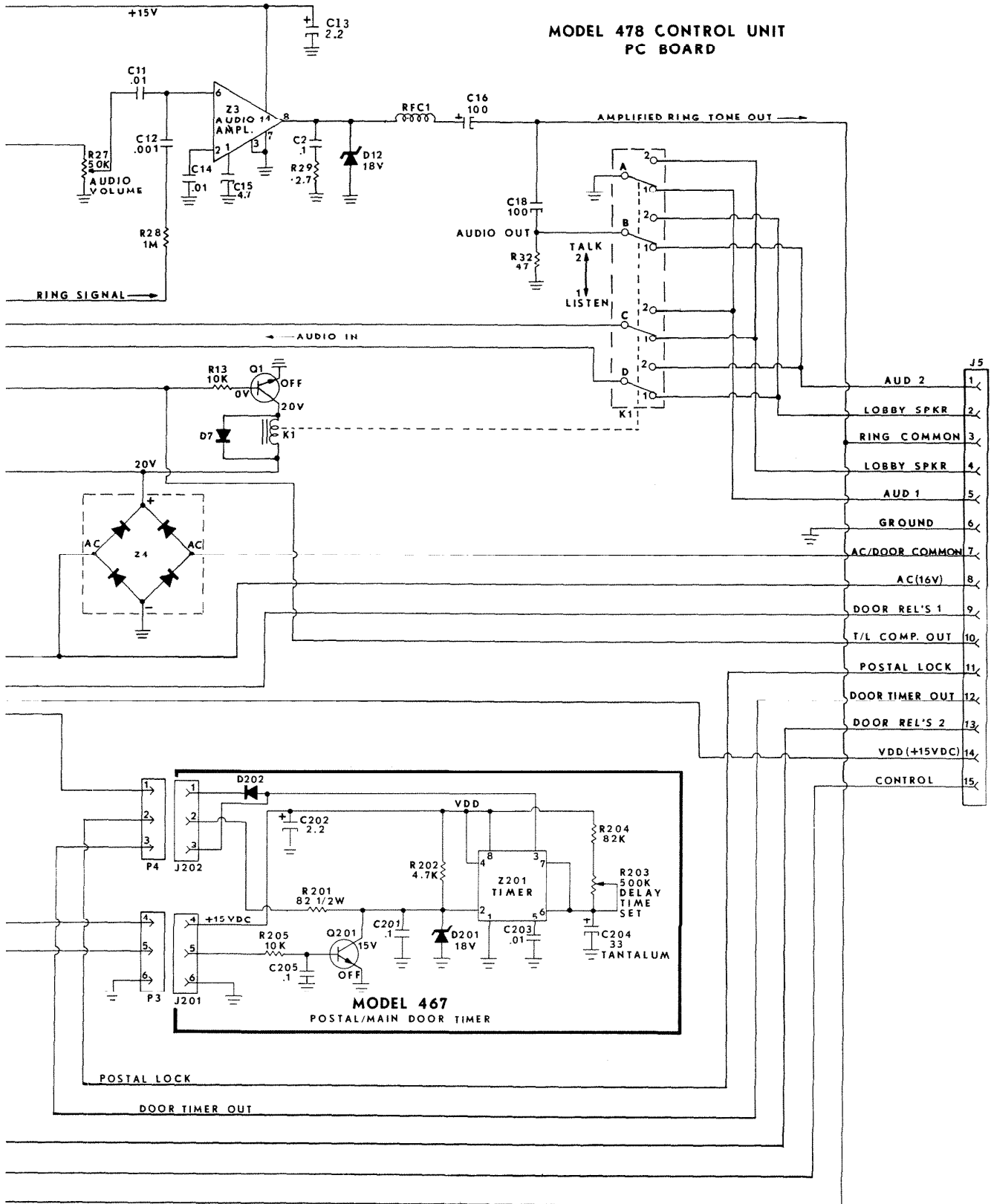
**MODEL 469 AUTO CALL TRANSFER MODULE**  
**OPERATING MODE LOGIC STATES**  
**STANDBY STATES AS SHOWN ON SCHEMATIC**

DEVICE/TERMINAL		DIRECTORY 1 PUSHBUTTON CLOSED	DIRECTORY 2 PUSHBUTTON CLOSED	APT SPKR TALK	APT SPKR LISTEN	APT SPKR DOOR RELEASE SWITCH CLOSED	END OF 478 DOOR RELEASE TIMING CYCLE
Z501A	1 (IN)	LO	LO	Z501A/Z501B form directory latch, keeping all functions at Directory 1 when call is originated at Directory 1; and at Directory 2 when call is originated there.  Latch output Z501B-4 controls Q501.			
	2 (IN)	LO	HI				
	3 (OUT)	HI	LO				
Z501B	5 (IN)	LO	LO	When call is originated at Directory 1, Z501B-4 is LO; Q501 is off; and relay K501's coil is de-energized and its contacts are in position 1.  When call is originated at Directory 2, Z501B-4 is HI; Q501 is on, and relay K501's coil is energized and its contacts are in position 2.			
	6 (IN)	HI	LO				
	4 (OUT)	LO	HI				
Z501C	8/9 (IN)	HI	HI	HI	HI	HI	LO
	10 (OUT)	LO	LO	LO	LO	LO	HI
Z501D	12 (IN)	LO	LO	HI**	LO	LO	LO
	13 (IN)	LO	LO	LO	LO	HI***	LO****
	11 (OUT)	HI	HI	LO**	HI	LO***	HI
Z502	2 (TRIGGER)	LO*	LO*	HI	HI	HI	HI
	4 (RESET)	HI	HI	HI	HI	HI	LO****
	3 (OUTPUT)	HI	HI	HI	HI	HI	LO
Z503	4 (RESET)	HI	HI	Lamp Flasher Z503 is controlled by timer output Z502-3, and will flash as a 2 Hz. rate as long as the timer output is HI.			
	3 (OUTPUT)	HI/LO	HI/LO				
Q501	E	OV	OV	Q501 will be on and K501 will be energized when call is originated at Directory No. 2, and they will stay on until call is terminated by timer Z502.			
	B	OV	0.7V				
	C	20V	0.5V				
K501		OFF	ON				

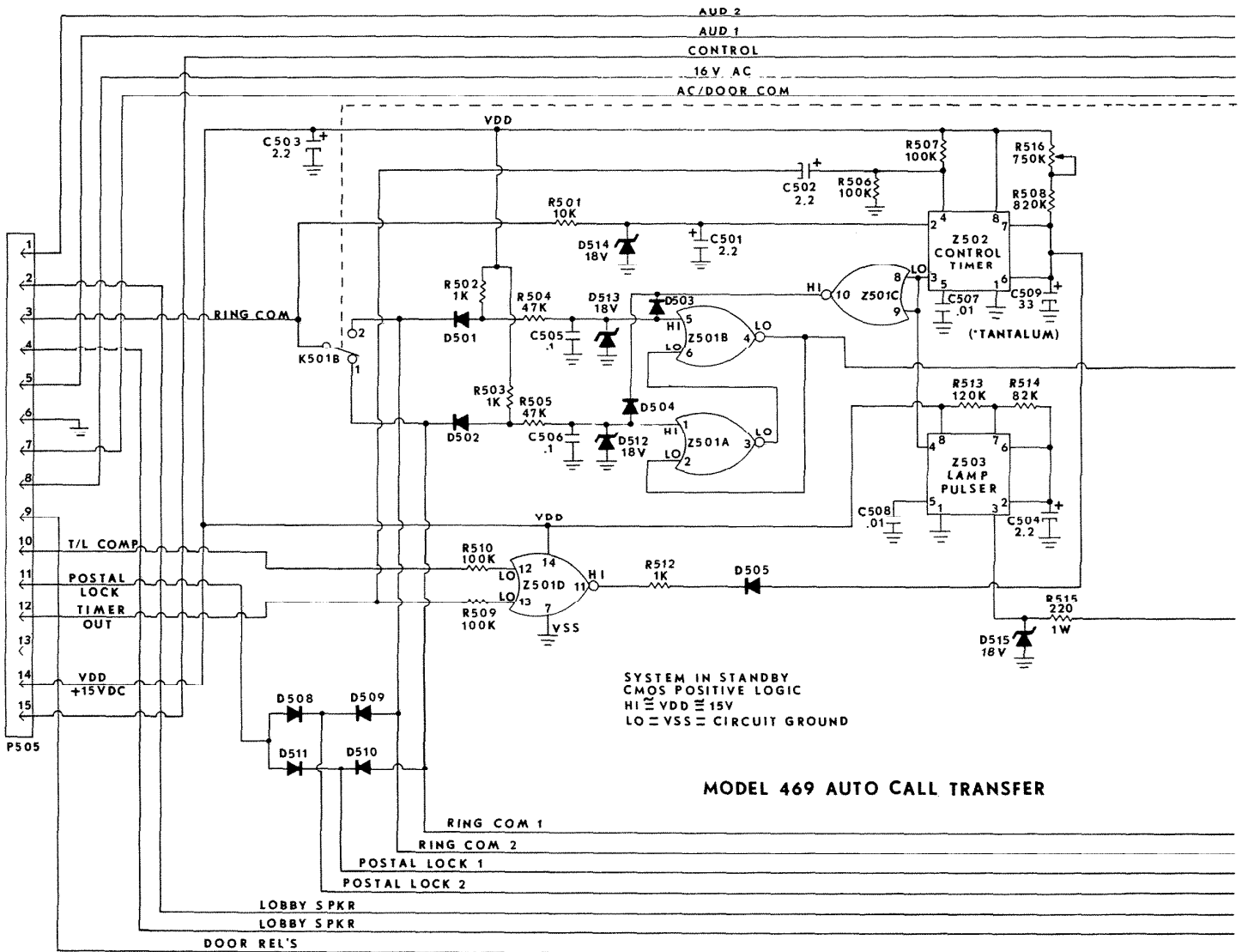
NOTE: (\*) Triggering pulse to Z502 timer, LO while pushbutton is held closed.  
(\*\*) HI to input is from TALK LISTEN COMPARATOR Z1B-5 while TALK switch in apartment speaker is closed and the LO on output interrupts the timing cycle of Z502.  
(\*\*\*) HI to input is from Model 467 Postal/Main Door Timer Module and is present while Z201 is in its timing cycle; LO on output interrupts the timing cycle of Z502.  
(\*\*\*\*) LO to input is from 467 Door Timer Out and is applied when Z201 completes its timing cycle. This LO is pulsed through C502 to Z502-4 (Reset) and immediately terminates timing cycle of Z502.



MODEL 478 CONTROL UNIT  
PC BOARD

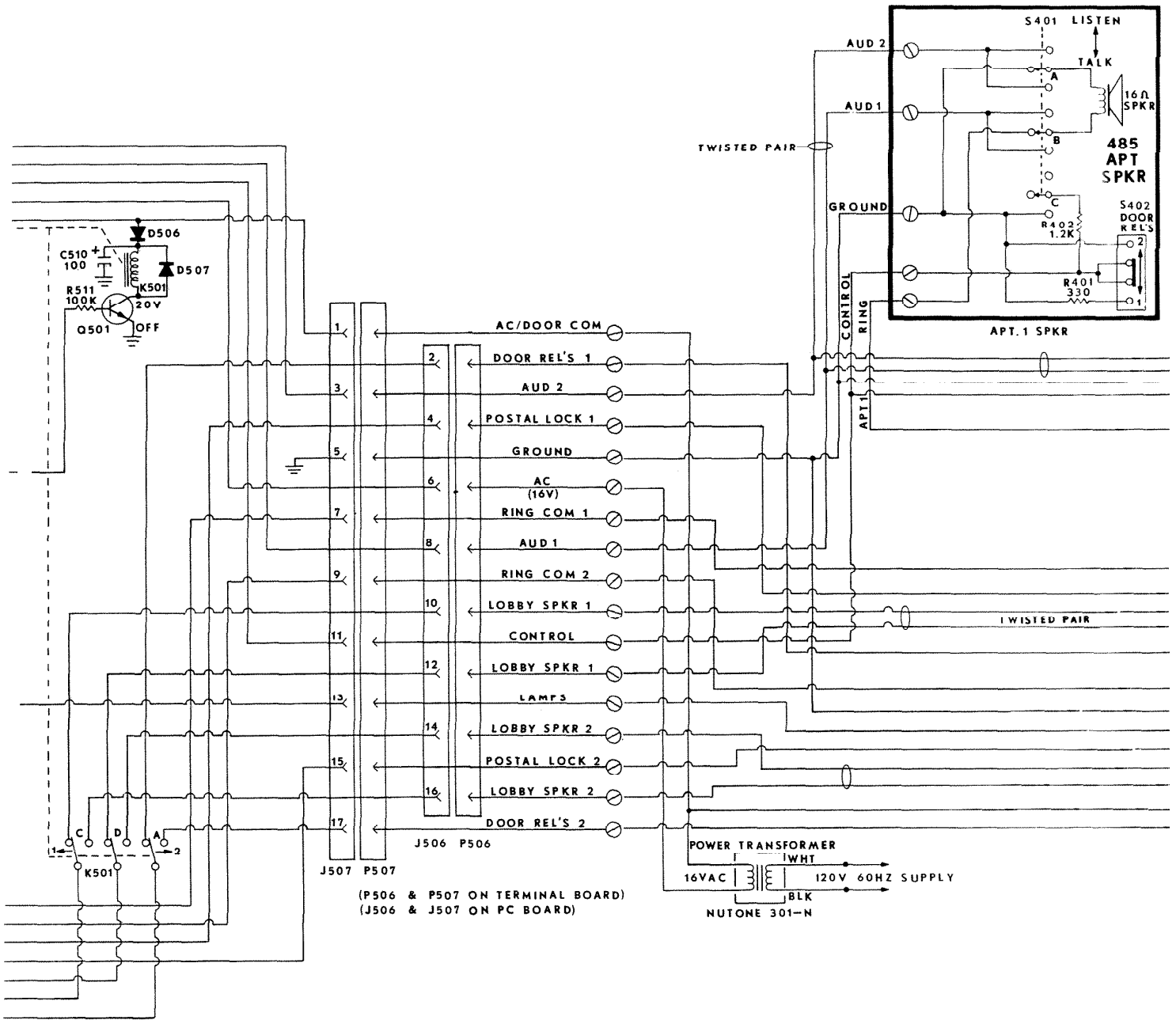


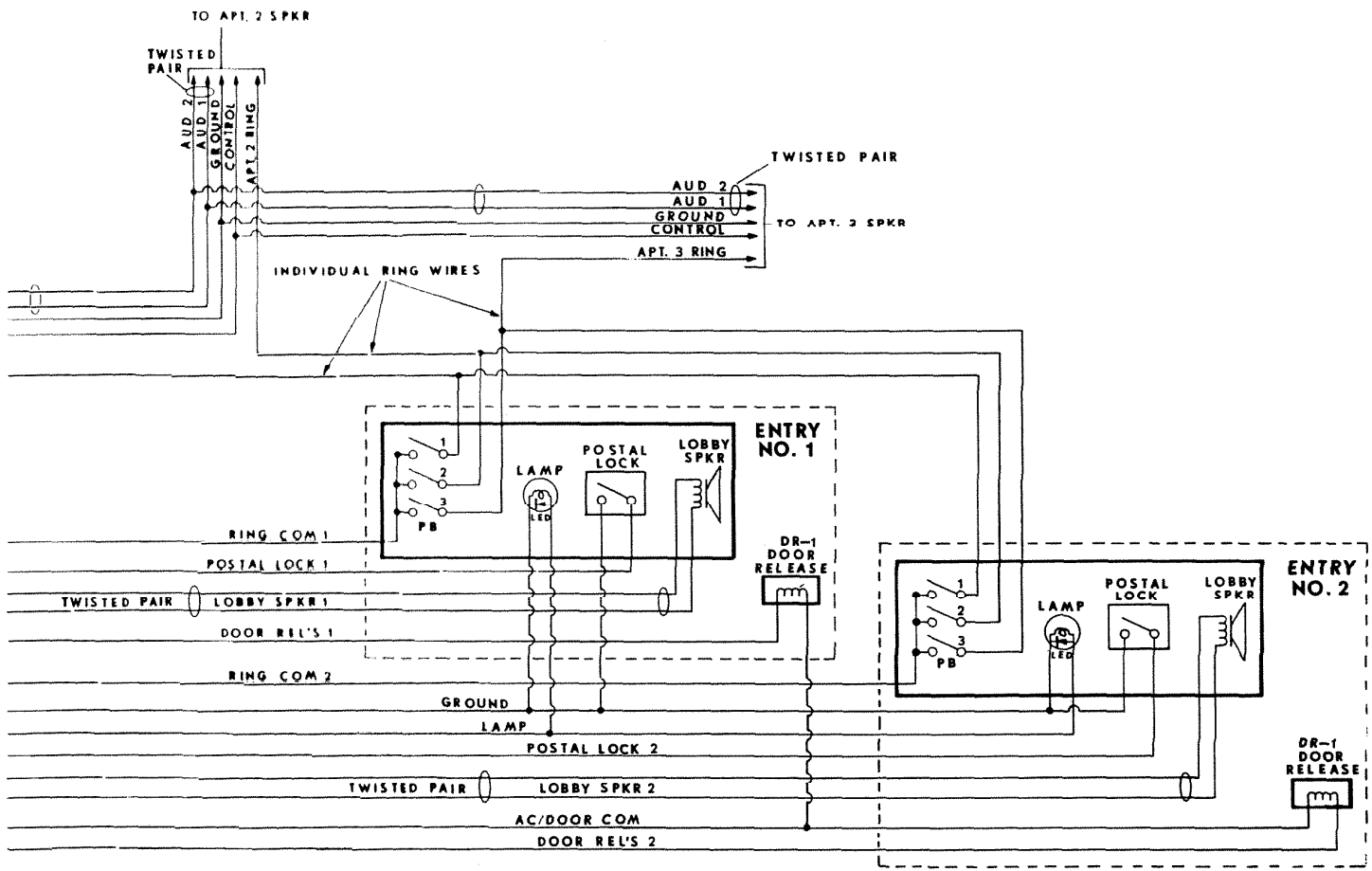




SCHEMATIC NO. 3

TWO ENTRY SYSTEM WITH AUTO CALL TRANSFER AND TIMED DOOR RELEASE/POSTAL LOCK





## REPLACEMENT PARTS LIST

CAPACITORS: Value in micro (10<sup>-6</sup>) farads, other specifications as listed  
RESISTORS: Value in ohms  $\pm$  10%, 1/4 Watt Carbon Composition, except as noted

Schematic Symbol	NuTone Part No.	Description
<b>MODEL 466 MOMENTARY 2ND DOOR RELEASE MODULE</b>		
	12062-900	Complete Assembly
<b>CAPACITORS</b>		
C101	35100-120	.001 + 80%, - 20%, 500V Ceramic Disc
<b>CONNECTORS</b>		
J101	39421-101	Receptacle, 3-pin
J102	39421-102	Receptacle, 4-pin
<b>DIODES</b>		
D104, D105, D107	36549-000	Silicon Rectifier type, 1 Amp DC, 100 PIV; 1N4002
<b>RESISTORS</b>		
R114	33081-222	2.2K
R115	33081-102	1K
<b>SILICON CONTROLLED RECTIFIER</b>		
SCR101	36642-000	G.E. No. C106 F1 type 2

<b>MODEL 467 POSTAL MAIN DOOR TIMER MODULE</b>		
	12064-900	Complete Assembly
<b>CAPACITORS</b>		
C201, C205	35100-127	.1 + 80%, - 20%, 200V Ceramic Disc
C202	35091-111	2.2 + 100%, - 10%, 25WVDC, Electrolytic
C203	35100-139	.01 + 80%, - 20%, 50V Ceramic Disc
C204	35123-101	33 $\pm$ 10%, 15WVDC, Tantalum Electrolytic
<b>CONNECTORS</b>		
J201, J202	39421-101	Receptacle, 3-pin
<b>DIODES</b>		
D201	36639-000	18V $\pm$ 10%, Zener; 1N4746; 1N4746A
D202	36549-000	Silicon Rectifier type, 1 Amp DC, 100 PIV; 1N4002
<b>INTEGRATED CIRCUIT</b>		
Z201	36640-000	TIMER: Signetics NE555V; Nat Semi Con LM555CN; Motorola MC1455P1; Raytheon RC555DN; TexInst SN72555P
<b>RESISTORS</b>		
R201	33101-820	82, 1/2 Watt
R202	33081-472	4.7K
R203	34069-000	500K, $\pm$ 30%, 1/4 Watt, Linear Taper, Rheostat, 290° rotation; DELAY TIME SET: Centralab TKA1 B504C
R204	33081-823	83K
R205	33081-103	10K
<b>TRANSISTORS</b>		
Q201	36613-000	NPN Silicon, Motorola MPS A20; TexInst T1S-98

### MODEL 468 TIMED 2ND DOOR RELEASE MODULE

12066-900 Complete Assembly

Schematic Symbol	NuTone Part No.	Description
<b>CAPACITORS</b>		
C301	35100-120	.001 + 80%, - 20%, 500V Ceramic Disc
C302	35091-111	2.2 + 100%, - 10%, 25WVDC, Electrolytic
C303	35100-139	.01 + 80%, - 20%, 50V Ceramic Disc
C304	35123-101	33 $\pm$ 10%, 15WVDC, Tantalum Electrolytic
C305, C306	Not Used	
C307	35100-127	.1 + 80%, - 20%, 200V Ceramic Disc
<b>CONNECTORS</b>		
J301	39421-101	Receptacle, 3-pin
J302	39421-102	Receptacle, 4-pin
<b>DIODES</b>		
D304, D305, D307	36549-000	Silicon Rectifier type, 1 Amp DC, 100 PIV; 1N4002
<b>INTEGRATED CIRCUIT</b>		
Z301	36640-000	TIMER: Signetics NE555V; Nat Semi Con LM 555CN; Motorola MC1455P1; Raytheon RC555DN; TexInst SN72555P
<b>RESISTORS</b>		
R301	Not Used	
R302	33081-472	4.7K
R303	34069-000	500K $\pm$ 30%, 1/4 Watt, Linear Taper, Rheostat, 290° rotation; DELAY TIME SET; Centralab TKA1 B504C
R304	33081-823	82K
R305	33081-103	10K
R306, R313	Not Used	
R314	33081-222	2.2K
R315	33081-102	1K
<b>SILICON CONTROLLED RECTIFIER</b>		
SCR301	36642-000	G.E. No. C106 F1 type 2
<b>TRANSISTORS</b>		
Q301	36613-000	NPN Silicon, Motorola MPS A20; TexInst T1S-98
<b>MODEL 469 AUTO CALL TRANSFER MODULE</b>		
	12068-900	Complete Assembly
	41812-000	PC Board, Complete Assembly
<b>CAPACITORS</b>		
C501, C504	35091-111	2.2 + 100%, - 10%, 25WVDC Electrolytic
C505, C506	35100-127	.1 + 80%, - 20%, 200V Ceramic Disc
C507, C508	35100-139	.01 + 80%, - 20%, 50V Ceramic Disc
C509	35123-101	33 $\pm$ 10%, 15WVDC, Tantalum Electrolytic
C510	35091-108	100 + 100%, - 10%, 25WVDC, Electrolytic
<b>CONNECTORS</b>		
J506	39339-103	Receptacle, 8-pin
J507	39339-104	Receptacle, 9-pin
P505	39338-105	Plug, 15-pin
<b>DIODES</b>		
D501-D511	36549-000	Silicon Rectifier type, 1 Amp DC, 100 PIV; 1N4002
D512-D515	36639-000	18V $\pm$ 10%, Zener; 1N4746; 1N4746A

Schematic Symbol	NuTone Part No.	Description
<b>INTEGRATED CIRCUITS</b>		
Z501	36629-000	Quad, 2-Input NOR Gates; RCA CD4001AE; Solid State Scientific SCL4001AE Series; Solitron CM4001AE Series; Motorola MC14001CP Series
Z502, Z503	36640-000	Pulser; Signetics NE555V; Control Timer and Lamp Pulser; Signetics NE555V; Nat Semi LM555CN; Motorola MC1455P1; Raytheon RC555DN; TexInst SN72555P
<b>RELAYS</b>		
K501	39336-000	4PDT, Coil 24VDC Nominal Operating; 14VDC Minimum Pull-in; Coil DC Resistance 700 ohm $\pm 10\%$ ; American Zettler AZ429-70-10L; Potter Brumfield R10-E2Z4V700
<b>RESISTORS</b>		
R501	33081-103	10K
R502, R503, R512	33081-102	1K
R504, R505	33081-473	47K
R506, R507, R509, R510, R511	33081-104	100K
R508	33081-824	820K
R513	33081-124	120K
R514	33081-823	82K
R515	33027-136	220, 1 Watt, Wirewound
R516	34068-000	750K $\pm 30\%$ , 0.1 Watt, 255° rotation Rheostat; DELAY TIME SET: CTS Corp. U201RS; Piher PT-15LD-750K
<b>TRANSISTORS</b>		
Q501	36590	NPN Planar Silicon, Darlington; Motorola MPS A13
<b>MISCELLANEOUS</b>		
	41813-000	Envelope Assembly, includes three #6 x 1/4" Ph Pan Hd screws for mounting 469 to 478 chassis.
<b>TERMINAL BOARD (MODEL 469)</b>		
	41811-000	Complete Assembly
	36549-000	Diode, Silicon Rectifier type, 1 Amp DC, 100 PIV; DOOR RELEASE SILENCER; 1N4002
P506	39338-103	Plug, 8-pin
P507	39338-104	Plug, 9-pin
	39564-000	Spacer, Acetal
	15448-004	Screw, #4-40 x 5/16" LG Pan Hd., Spacer Retainer
	39209-003	Screw, #6 x 3/8" Slit. Pan, Terminal Connector (22 required)
	31146-038	Screw, #6 x 1/4", Hex Hd. #1; Mounting (4 required)
<b>DOOR RELEASE/POSTAL LOCK TIMER MODULE</b>		
	12064-900	Same as Model 467—see listing above for individual component specifications. (Model 467 Module is supplied with the Model 469.)
<b>MODEL 478 CONTROL UNIT</b>		
	12134-900	Complete Assembly
	39532-005	Chassis Mounting Base
	39533-005	Chassis Top
	41740-000	Chassis Top Assembly, complete with PC Board Assembly and Terminal Board Assembly
	39064-000	Spacer, PC Board Protector
<b>MAIN PC BOARD</b>		
	41742-000	Complete PC Assembly

Schematic Symbol	NuTone Part No.	Description
<b>CAPACITORS</b>		
C1	35076-103	.47 + 80%, - 20%, 3V Ceramic Disc
C2, C3	35100-127	.1 + 80%, - 20%, 200V Ceramic Disc
C4, C11, C14	35100-139	.01 + 80%, - 20%, 50V Ceramic Disc
C5	35100-166	.01 $\pm 10\%$ , 500V Ceramic Disc
C6, C9	35100-155	.0027 + 80%, - 20%, 500V Ceramic Disc
C7, C13	35091-111	2.2 + 100%, - 10%, 25WVDC, Electrolytic
C8	35091-104	33 + 100%, - 10%, 25WVDC, Electrolytic
C10, C12	35100-120	.001 $\pm 20\%$ , 500V Ceramic Disc
C15	35091-103	4.7 + 100%, - 10%, 25WVDC, Electrolytic
C16, C18	35091-108	100 + 100%, - 10%, 25WVDC, Electrolytic
C17	35091-101	470 + 100%, - 10%, 35WVDC, Electrolytic
<b>COILS</b>		
RFC1	41743-000	Radio Frequency Choke; 150 turns No. 28 wire
<b>CONNECTORS</b>		
J5	39339-107	Receptacle, 15-pin
P1, P3, P4	39422-101	Plug, 3-pin, locking
P2	39422-102	Plug, 4-pin, locking
<b>DIODES</b>		
D1, D2, D4, D5, D7-D11	36549-000	Silicon Rectifier type, 1 Amp DC, 100 PIV; 1N4002
D3, D12	36639-000	18V $\pm 10\%$ , Zener; 1N4746; 1N4746A
D13	36631-000	15V $\pm 5\%$ , Zener; 1N4744A
<b>INTEGRATED CIRCUITS</b>		
Z1	36625-000	Quad, OpAmp Comparator; Motorola MC-3301-P Nat Semi LM-3900N, LM-2900N
Z2	36640-000	RING TONE GENERATOR; Signetics NE555V; Nat Semi LM555CN; Motorola MC1455P1; Raytheon RC555DN; TexInst SN72555P
Z3	36641-000	AUDIO AMPLIFIER; Nat Semi LM380N
Z4	36618-000	Rectifier, Silicon Bridge Gen Inst KBP02
<b>RELAYS</b>		
K1	39336-000	4PDT, Coil 24VDC Nominal Operating; 14VDC Minimum Pull-in; Coil DC Resistance 700 ohm $\pm 10\%$ American Zettler AZ429-70-10L Potter Brumfield R10-E2Z4V700
<b>RESISTORS</b>		
R1	33101-102	1K, 1/2 Watt
R2	33100-681	680, $\pm 5\%$ , 1/2 Watt
R3	33081-394	390K
R4	33081-104	100K
R5	33206-102	150K $\pm 2\%$ , Metal Film
R6	33206-101	110K $\pm 2\%$ , Metal Film
R7	33205-224	220K, $\pm 5\%$
R8, R10	33205-104	100K, $\pm 5\%$
R9	33205-564	560K, $\pm 5\%$
R11	33101-820	82, 1/2 Watt
R12	33081-103	10K
R13	33101-103	10K, 1/2 Watt
R14, R24	33081-222	2.2K
R15, R16	33081-102	1K
R17	34066-000	5K $\pm 30\%$ , 0.1 Watt, 255° rotation, Rheostat; RING VOLUME: CTS Corp U-201R502B Piher PT 15 LD 5K
R18	33081-333	33K
R19	33081-470	47
R20, R21	33081-100	10
R22, R28	33081-105	1M

Schematic Symbol	NuTone Part No.	Description
R23	33081-683	68K
R25	33081-473	47K
R26	33081-152	1.5K
R27	34067-000	50K $\pm$ 30%, 0.1 Watt, 255° rotation, Potentiometer; AUDIO VOLUME: CTS Corp I-20 R503B
R29	33081-027	2.7
R30	33081-682	6.8K
R31	33101-221	220, ½ Watt
R32	33101-470	47, ½ Watt
R33	34068-000	750K $\pm$ 30%, 0.1 Watt, 255° rotation, Rheostat, RING PITCH: CTS Corp U201RS; Piher PT-15LD-750K
R34	33027-132	100, 1 Watt, Wirewound
<b>SILICON CONTROLLED RECTIFIER</b>		
SCR1	36642-000 36643-000	G.E. No. C106 F1 type 2 (Alternate for 36642)
<b>TRANSFORMERS</b>		
T1	30536-000	Audio, Intercom Input Primary DC Resistance: Blue to Yellow (C1) = 2.3 ohms; Red to Yellow (CT) = 2.7 ohms. Secondary DC Resistance: Black to Green 900 (min) — 1250 (Max) ohms. Better Coil & Trans EX-4240-A Bracket, Transformer T1 Mounting
<b>TRANSISTORS</b>		
Q1	36613-000	NPN Silicon; Motorola MPS A20; Texinst T1S-98
Q2, Q3	36580-000	NPN Planar Silicon, Low Noise: TexInst SKA-4220; Motorola SPS-1216; Nat Semi SMO-7329
Q4	36614-000	NPN Silicon Single Diffused, Power: Motorola MJE 520
	38613-000	Heat Sink, for Q4
	39360-000	Washer, Mica, Heat Sink Insulating
	31990-015	Screw, #4-40 $\times$ ½" Ph. Pan., Heat Sink Mounting
	11159-003	Nut, #4-40 Hex, Heat Sink Mounting
<b>TERMINAL BOARD (MODEL 478)</b>		
	41741-000	Complete Assembly
	36549-000	Diode, Silicon Rectifier type, 1 Amp DC, 100 PIV; DOOR RELEASE SILENCER; 1N4002
P5	41744-101 39209-003	Connector, Plug, 15-pin Screw, #6 $\times$ ¾" Slit Pan, Terminal Connector (15 required)
	31146-038	Screw, #6 $\times$ ½", Hex Hd. #1; Mounting (4 required)
<b>MISCELLANEOUS</b>		
	5553-003	Screw, #6 $\times$ ¼" Slit Rd., Chassis Top to Body Mounting (2 required)
	16269-003	Screw, #6 $\times$ ½" Slit Rd., Installation Mounting (4 required)
	47135-000	Installation Instruction Sheet
	47134-000	Label, Model & Data

Schematic Symbol	NuTone Part No.	Description
<b>MODEL 485 APARTMENT SPEAKER</b>		
S401	12153-900 41737-000	Complete Assembly Rocker/Switch Assembly: TALK-LISTEN
	41760-000	PC Board, Complete Assembly
	39530-000	Connector, 2-pin (3 required)
R401	33101-331	330, ½ Watt
R402	33101-122	1.2K
S402	34651-000	4-pole, 3-position, Slide; Door Release
	39531-000	Contact, Spring (2 required)
	39553-000	Contact, Spring (1 required)
	36076-000	Speaker, 3", 16-ohm voice coil (14-ohm DC) Screw, #8 $\times$ 9/32" Ph Pan; Speaker Mounting (2 required)
	39384-003	Screw, #6 $\times$ ¾" Slit Pan; Terminal/PC Board Mounting
	39209-003	Envelope Assembly, includes 2 #6 $\times$ 1¼" Ph Pan Installation Mounting Screws.
	40684-000	Installation Instructions
	47128-000	
<b>ENTRANCE DIRECTORIES</b>		
	38132-000	Pushbutton (494 Series)
	39280-000	Pushbutton (495, 496, 498 Series)
	36076-000	Speaker, Weather Resistant, 3", 16-ohm voice coil (14-ohm DC)
	39397-049	Fastener, ¼ Turn, Brass (All "BA" Directories)
	39316-000	Fastener, ¼ Turn, Silver (All "SA" Directories)
	45771-000	Name Card (494 Series)
	46277-000	Protector, Name Card (494 Series)
	39320-000	Number Plate (495/496 Series)
	39322-000	Protector, Number Plate (495/496 Series)
	38350-000	Name Plate, Blank (495/496 Series)
	47148-000	Card, Directory Panel (498 Series)
	38700-000	Protective Window (498 Series)
	34568-000	Switch, Micro, Postal Lock (494/495/496 Series)
	36637-000	Lamp, LED (496 Series)
	41836-000	Lamp, LED, Complete Assembly (496 Series)
	36084-000	Handset, Telephone (494/495/496 Series)
	36085-000	Cradle, Telephone Handset (494/495/496 Series)
	41451-000	Telephone Handset & Cradle, Complete Assembly (494/495/496 Series)
<b>MODEL 499 REMOTE POSTAL LOCK DOOR RELEASE SWITCH</b>		
	12896-900	Complete Assembly (Model 499-BA)
	12897-900	Complete Assembly (Model 499-SA)
	5120-000	Pushbutton (PB-12)

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## NuTone Housing Products

**Scovill**

MADISON & RED BANK ROADS

CINCINNATI, OHIO 45227

PHONE 1-513-527-5415

Part No. 47137-000  
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