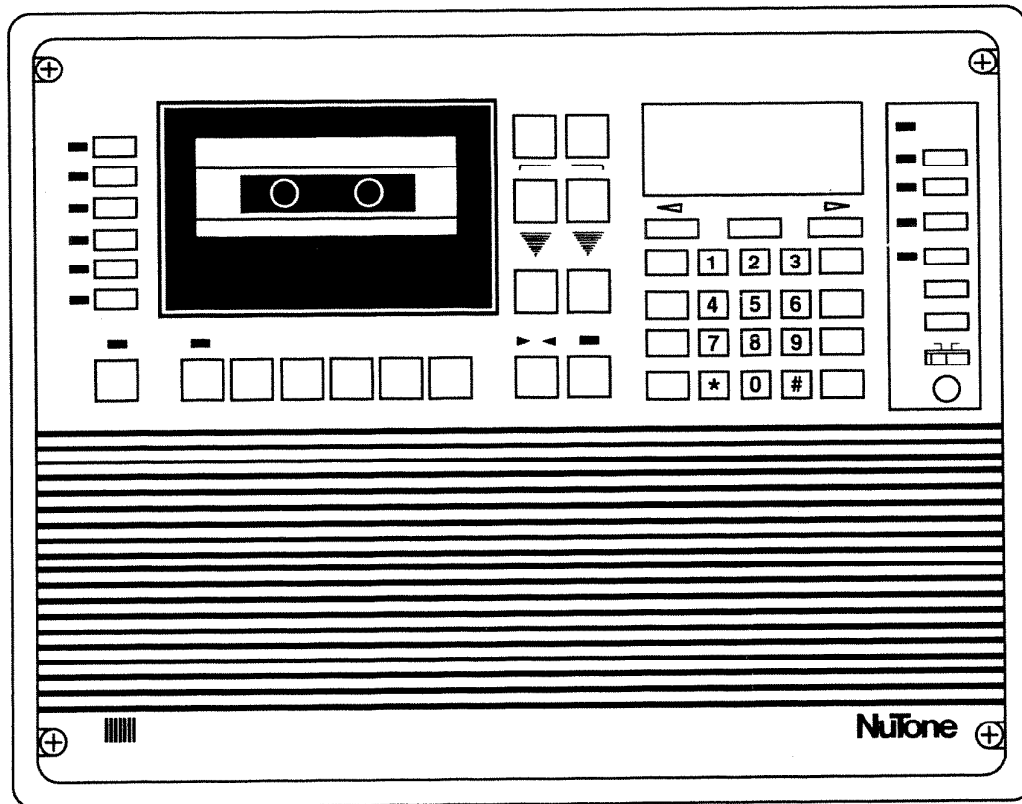


NuTone

IM-5006

Radio-Intercom System Service Manual



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Introduction

This Service Manual contains information required for proper fault diagnosis and repair of the NuTone IM-5006 Radio-Intercom System. The manual is divided into the following sections:

INSTALLATION INSTRUCTIONS: Contains the complete installation instructions for the master and remote stations. Included are the wiring guidelines, the master stations connection diagrams, the operational checkout, the installers troubleshooting guide and the remote stations' installation instructions.

GENERAL SYSTEM DESCRIPTION: A general description of the IM-5006 System. This includes block diagram of the IM-5006 and function descriptions of the intercom communications.

CIRCUIT DESCRIPTIONS: The IM-5006 System is divided into functional sections, such as AM/FM radio, microphone preamp, tone generator, etc. schematic drawings, circuit description and quiescent DC voltages are provided for each section.

TROUBLESHOOTING: Contains information and troubleshooting procedures, aimed at helping the technician identify and localize problems encountered with the IM-5006 System.

COMPONENT/LEAD IDENTIFICATION: Provides information on internal connections and pin assignments for all active components within the IM-5006 System.

SCHEMATICS/PC BOARDS: Provides schematics, PC board circuit trace layouts and component placement diagrams for the IM-5006 System.

REPLACEMENT PARTS LIST: Lists the replacement parts for the IM-5006 System that are available from NuTone.

Wiring Installation Guidelines

WIRING SPECIFICATIONS

NOTE: The system may be home run or loop wired with a maximum of six (6) runs terminated at the master. Also, three (3) runs (maximum) terminated at any one remote station.

NuTone IW-2: 22 GA. Twisted Pair.

NuTone IW-6: 22 GA. 3-twisted pair cable.

NuTone S-143: 18 GA. 2-conductor insulated.

No. 14/2: 120v, 60Hz Power Cable: Class 1, U.L. Listed (not supplied by NuTone).

14 GA.: Ground wire (not supplied by NuTone).

SPEAKER WIRING

An individual 6-wire cable (IW-6) must be connected to each remote speaker or remote control.

Maximum speaker run: 750 feet.

Maximum total of IW-6 per system: 4000 feet.

Maximum number of speakers: The system will accommodate up to 24 remote stations plus up to three (3) door speakers. Maximum IW-2 per system: 750 feet.

Maximum number of remote stations per run: 12.

NOTE: For best results it is suggested that the Intercom System is installed in such a way that a combination of "Home Run" wiring and "Looped" wiring (zone wiring) are both used.

Take a moment and refer to the wiring example.

MAXIMUM NUMBER OF SPEAKERS

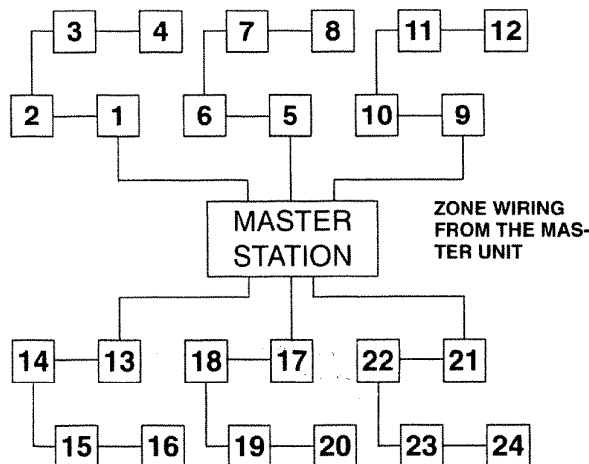
The Intercom System will accommodate up to twenty-four (24) remote speakers.

IMPORTANT: NuTone cannot be responsible for improper radio-intercom operation that results from interference generated by light dimmers, fluorescent lighting fixtures, and similar electrical products, such interference must be corrected at the source. As an aid to help reduce this interference, all remote speaker, door speaker, chime and security alarm cables must be placed at least 12 inches from any A.C. power wiring.

The Intercom System is designed to be used only with NuTone specified wire. No other wire should be used. The use of wire other than NuTone wire may result in faulty installation and improper operation.

- Total output current rating: 19vDC 980mA.
- Current consumption each of the remote units: 19vDC 40mA.
- 980mA should not be exceeded.

SUGGESTED WIRING EXAMPLE



NOTE: ALTHOUGH THE IM-5006 MAY BE INSTALLED IN EITHER A HOME-RUN OR LOOPED CONFIGURATION, IT IS SUGGESTED THAT THE ABOVE ILLUSTRATION IS USED AS A GUIDELINE TO AVOID MASSIVE AMOUNTS OF WIRE AT THE MASTER STATION LOCATION.

IMPORTANT: Always remove the main power from the system when connecting or disconnecting remote stations. Failure to do so may result in permanent damage to the system.

Installation

Terminating the Wiring at the Master Panel

Refer to Figure 1.

1. Dress the speaker wire (NuTone Model: IW-6) thru the oblong hole in the top of the master unit's rough-in frame.
2. Cut the speaker wire to allow approximately 2' of wire to extend thru the top of the rough-in frame.

Refer to Figure 2.

3. Strip 6" of the outer insulation from each piece of speaker wire.

Refer to Figure 3.

4. Using a piece of tape or a wire tie, bind the speaker wiring together.

Refer to Figure 4.

5. Separate and cut the speaker wire into color groups.

Refer to Figure 5.

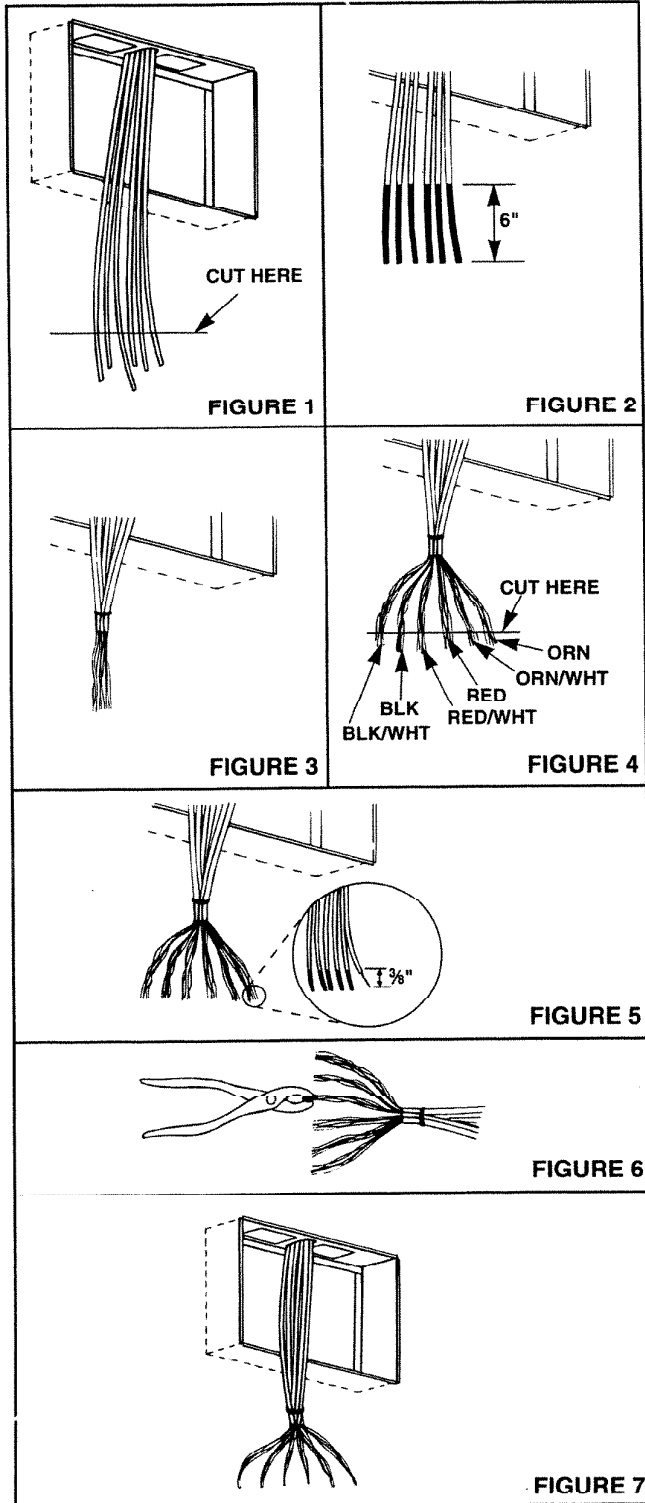
6. Strip 3/8" of insulation from each strand of speaker wire.

Refer to Figure 6.

7. Using a pair of pliers, twist the bare end of each colored set together.

Refer to Figure 7.

8. When this procedure has been completed, the speaker wire is ready to connect to the Master Station.



Installation

Attaching the Master Panel to the Rough-in

Refer to Figure 8.

1. Use two No. 6 x 3/8" screws to attach mounting brackets to the top and bottom of rough-in frame. **Make sure brackets are flush to wall or rough-in.**

Refer to Figures 9 & 10.

2. **For rough-in frames which are recessed into the wall opening.** Insert two shoulder screws (provided) into the front two holes in the rough-in frame. **For rough-in frames which are mounted flush with the wall.** Insert two shoulder screws (provided) into the back two holes in the rough-in frame.

Refer to Figure 11.

3. Attach master panel to rough-in frame by placing keyhole slots in both mounting hinges over screw heads in rough-in frame.

Refer to Figure 12.

4. Slide master panel to the right, then forward until panel is flush with the wall.

Refer to Figure 8.

5. Attach support strap to rough-in by placing hook into hole in rear flange of rough-in frame.

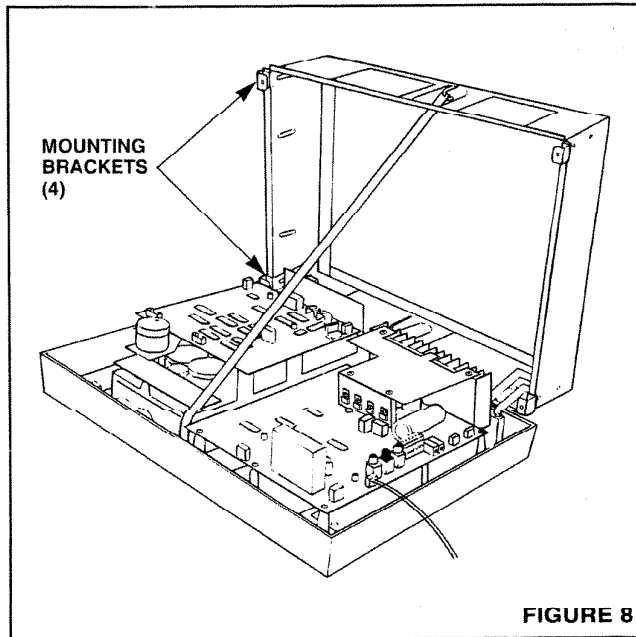


FIGURE 8

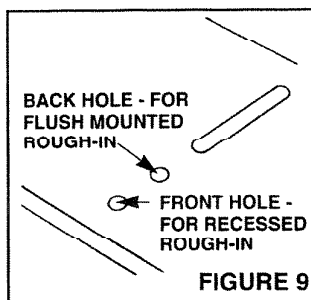


FIGURE 9

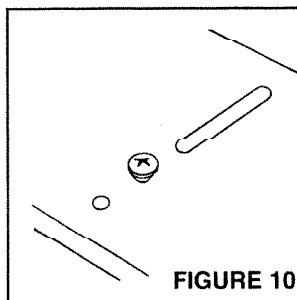


FIGURE 10

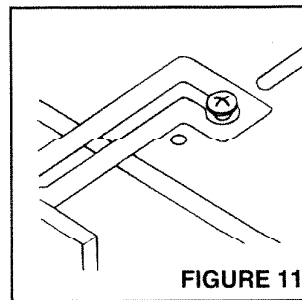


FIGURE 11

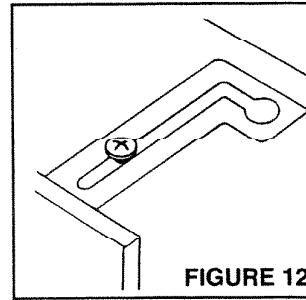


FIGURE 12

Connecting the Transformers

WARNING: Before any connections are made to the transformers, power must be disconnected at the main circuit breaker.

1. The transformer's primary leads should already be connected to the 120vAC house supply wires.
2. Two (2) sets of low-voltage supply leads are located in the bottom center section of the master unit. Connect one pair of supply leads to each transformer located in the bottom of the Rough-In.
3. Dress the wires and secure the box with two (2) screws for each box as illustrated in the rough-in installation instructions.
4. Connect the ground wires from the master unit to one of the transformer boxes mounting screws.
5. For installation of transformer, refer to manual for IR-510 Rough-In Frame.

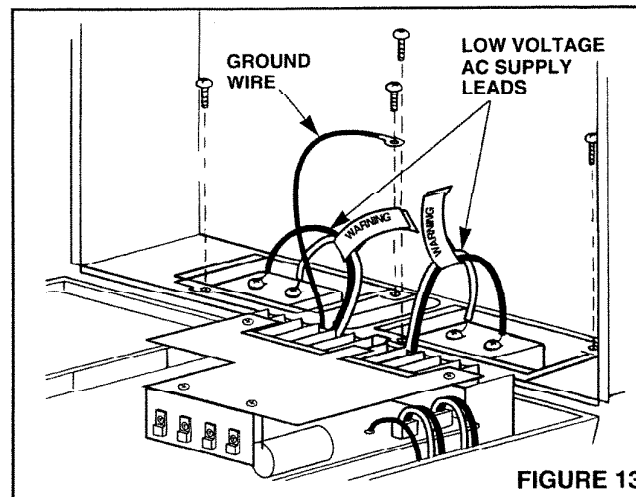
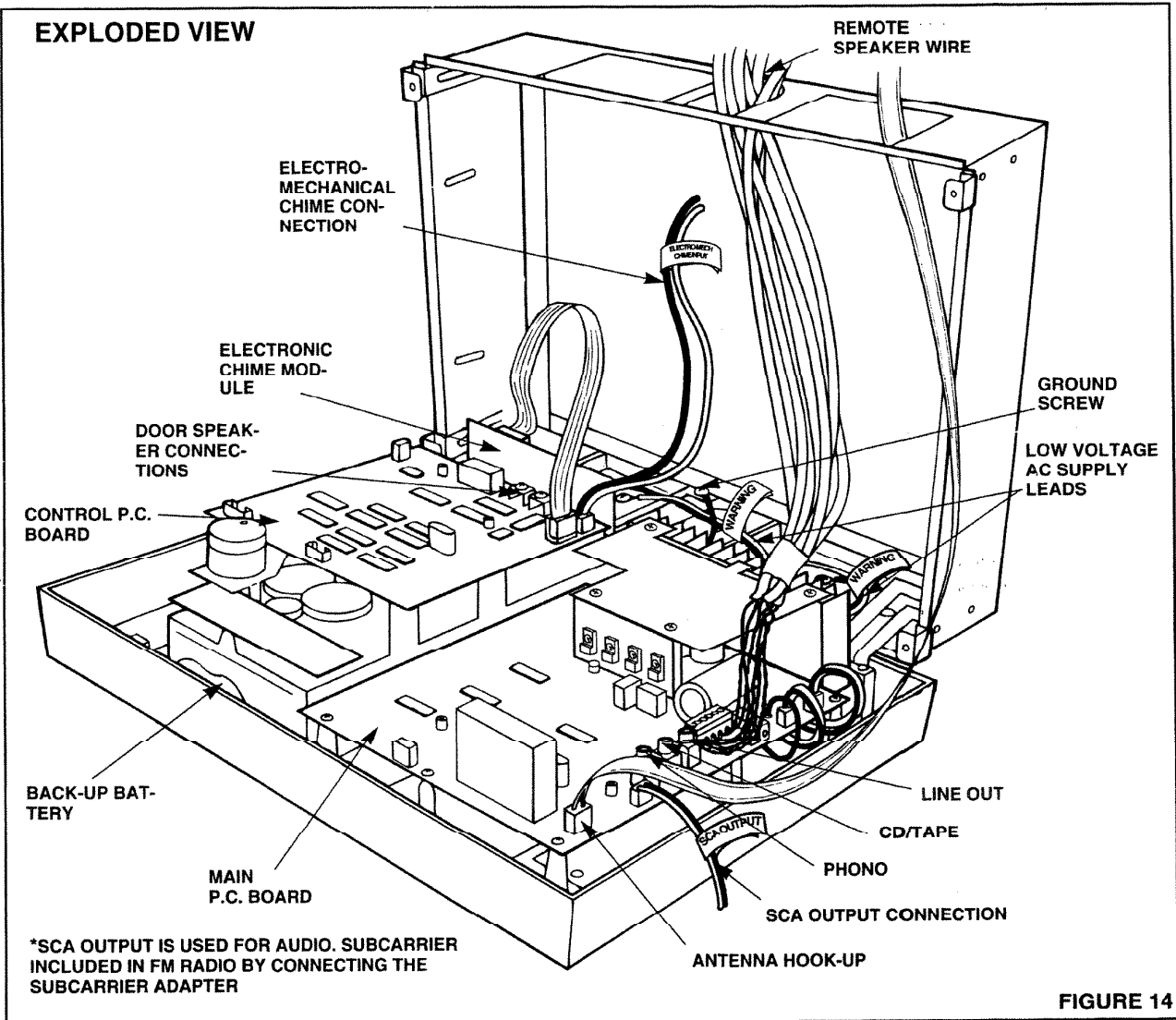


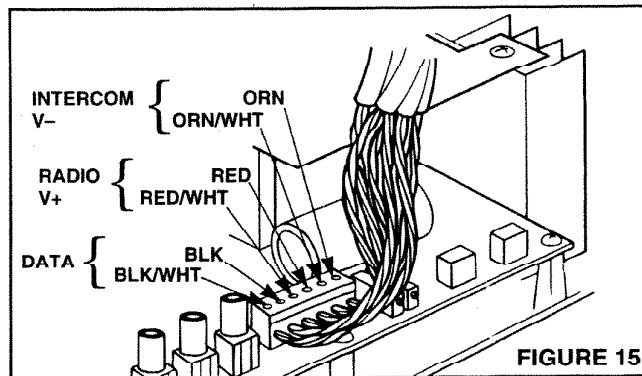
FIGURE 13

Installation



Connecting the Remote Speakers

1. Refer to page 3 of these instructions for information on terminating the speaker wire at the Master Station.
2. Refer to Figure 15. Connect the speaker wires to the terminal block located on the main P.C. board.



Installation

Connecting the Door Speakers

1. The door speaker connects to the Control P.C. board of the master station with 2-conductor, 22 gauge twisted pair wire (IW-2).
2. As illustrated, connect two wires from the door speaker to the two (2) terminals marked DOOR SPEAKER on the P.C. board.

NOTE: When a door speaker that includes a pushbutton is used with the system, two (2) additional wires must be run from the speaker location to the master unit for chime pushbutton operation.

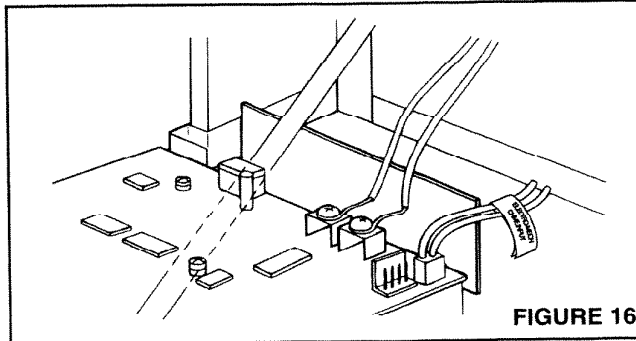


FIGURE 16

Connecting the Antenna

1. As illustrated in Figure 14, connect the Antenna to the 2-pin connector located in the upper right corner of the Main P.C. Board.
2. Refer to the instructions packaged with the Antenna for placement of the Antenna.

Connecting the Optional Electronic Chime Module

MODELS IA-28 OR IA-29

1. Connect wires from door switches – front, rear and side – to chime module. **NOTE:** Refer to the instructions packaged with the chime module.
2. Install fische paper backing onto the chime module. As illustrated, an additional hole must be cut in the fische paper.
3. Refer to Figure 14 to locate the chime module mounting bracket behind the Control P.C. Board.
4. Align the holes in the chime module with the pins on the mounting bracket. Apply firm, even pressure to each side of the chime module. The chime module will snap into place.

FOR MODEL IA-29 ONLY

5. Locate the chime selector switch mounting bracket.
6. Remove the chime selector switch retaining screw.
7. Slide the chime selector switch into the notch and re-install the retaining screw.

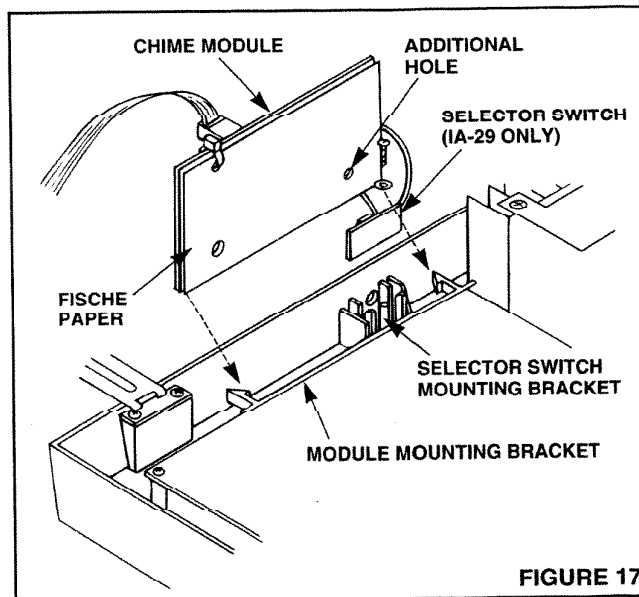


FIGURE 17

Installation

Connecting the Optional Electro-Mechanical Chime

Refer to Figure 18.

1. Connect NuTone IW-2 cable from the chime to the red and white wires, labeled Electro-Mech Chime Input.
2. Refer to the Installation Instructions packaged with the chime for complete wiring information.

IMPORTANT: FAILURE TO USE NUTONE IW-2 CABLE WILL CAUSE THE SYSTEM TO HUM AT ALL TIMES.

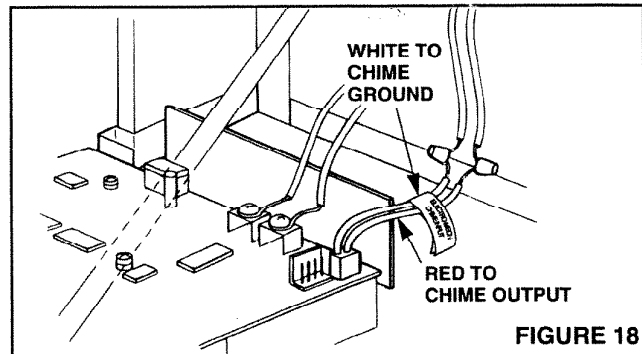


FIGURE 18

Back-up Battery Connection

Refer to Figure 19.

1. Connect the back-up battery as illustrated.

NOTE: The back-up battery retains the correct time, alarm time, intercom name list, radio station memory and note location for approximately 40 hours. If you plan to have 120vAC power off for a longer period of time, the battery should be disconnected.

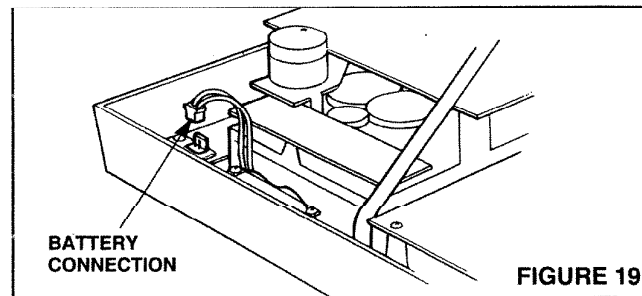


FIGURE 19

Connecting Line Out, CD/Tape Input, Phono Input

Refer to Figure 20.

NOTE: Use shielded cable with RCA type connectors (not supplied by NuTone).

1. To connect an optional record changer, cassette or CD player, locate the PHONO IN, TAPE IN and LINE OUT jacks on the right side of the main circuit board.
2. To play a phonograph thru the intercom system, insert the accessory's output plug into the master panel's PHONO IN jack.
3. To play the CD or tape player thru the intercom system, insert the accessory's output plug into the master panel's CD/TAPE IN jack.
4. To use the radio as a program source for recording onto a cassette recorder, insert the tape recorder's input plug into the master panel's LINE OUT jack.
5. **OPTIONAL HOOK-UP TO PROVIDE RADIO ONLY:**

The radio and optional entertainment source can be channeled through an auxiliary amplifier (purchase NuTone Model: IMA-516 separately) to provide uninterrupted music (no intercom) to separate speakers. This type of installation can be used for a doctor's office, where intercom and music are desired in the office area, but music only in the waiting room.

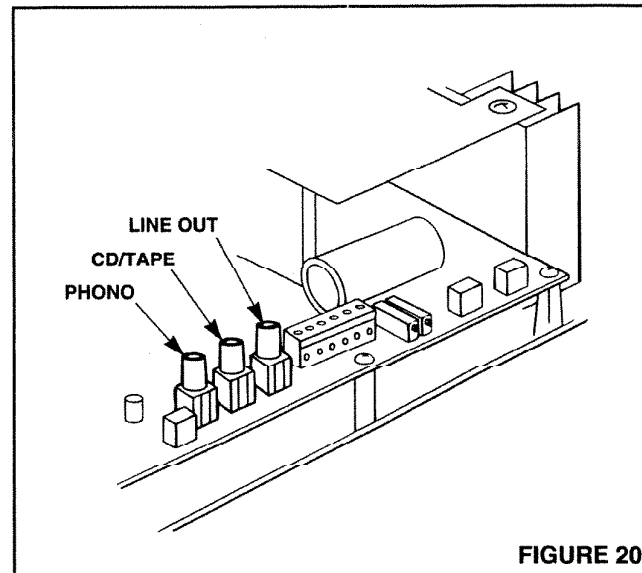


FIGURE 20

NOTE: If an auxiliary amplifier is used, connect the master station's line out jack to the auxiliary amplifier's low-level radio input wire.

Installation

Securing the Master Panel

1. Check all wiring connections to make sure they are complete and correct.
2. Check to make sure antenna connection is secure.
3. Position the Master Panel over rough-in frame and align screw holes in Master Panel with rough-in frame.
Dress the wires carefully on both sides of the panel so as to prevent them from being pinched when closing the panel.
4. Secure the Master Panel to rough-in with four (4) screws provided.

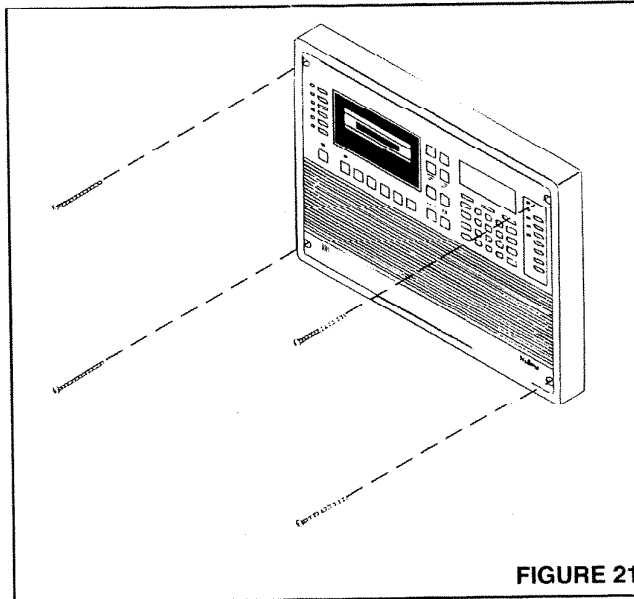


FIGURE 21

General Intercom Operation

NOTE: Refer to the homeowner's manual for complete information on the intercom operation of this system.

1. When an intercom call is initiated, a CALL TONE will be heard at the station from which the call is placed as well as the station that is being called. **NOTE: If one of these stations is a door speaker, a CALL TONE will not be heard at that location.**
2. The station that is being called will be in the "hands-free" mode.
3. The intercom volume is adjusted by using the intercom volume UP-DOWN keys and may only be adjusted during an intercom call. The radio volume cannot be adjusted at a station that is participating in an intercom call.
4. When an intercom call is in progress, the BUSY light will be lit at stations not participating in the communication. An intercom call cannot be initiated from a station when the busy light is lit.

Operational Checkout

NOTE: Please refer to page 10 for a convenient Operational Checklist.

1. When the system is first powered up, the display will appear as 12:00 AM. To ensure that no incorrect data has been stored in the system's memory during shipment and/or installation, a total system reset should be done at the master station by simply pressing * 8# at the master station's keypad.
 2. Select FM radio and tune to a radio station that has a strong signal by using the following procedure:
 - A) **Press the ON/OFF key** - the LED next to the key will be lit.
 - B) **Press the FM key** - the LED next to the key will be lit and FM 87.9 will appear in the display.
 - C) Tune to a station by pressing the < or > key at the master station.
- Beginning with the master station, use the following procedure at each station to check for proper operation:**
1. Adjust the radio volume keys to be certain the volume is operating properly.

NOTE: The radio audio cannot be turned completely off at the master station by using the radio volume key; the mute key must be used.
 2. **Press the PRIVATE key;** the PRIVATE LED will be lit and the station will be in the private mode.

In the private mode, the station cannot accept an intercom call.
 3. **Press the PRIVATE key** again and the PRIVATE LED will go out and the station will again be able to accept intercom calls.
 4. **Press the MONITOR key;** the MONITOR LED will be lit and audio from this station will be heard at all of the other stations.
 5. **Press the MONITOR key** again and the MONITOR LED will go out and the station will no longer be in the monitor mode.
 6. **Press the ALL CALL key;** the ALL CALL LED will be lit at this station. A call tone will be heard at every station in the system. Radio audio will be muted and audio from every station will be heard at the station that initiated the all call.

The intercom volume key may be used to adjust the audio at the initiating station. **NOTE: The intercom volume cannot be completely muted.**
 7. **Press the TALK key.** Audio from the initiating station will be heard at all the stations in the system.

When the TALK key is released, audio from the other stations will be heard at the initiating station.
 8. **Press the END CALL key** and the ALL CALL LED will go out at the initiating station. The radio audio will now be heard at all stations.
 9. **Press the DOOR key;** the DOOR LED will be lit at the initiating station and the BUSY LED's will be lit at each of the other stations. A call tone will be heard at the initiating station only; not at the door speaker. Audio from the door speaker will be heard at the initiating station.
 10. **Press the TALK key.** Audio from the initiating station will be heard at the door speaker.

When the TALK key is released, audio from the door speaker will be heard at the initiating station.
 11. **Press the END CALL key.** The DOOR LED will go out at the initiating station and the BUSY LEDs will also go out at all of the other stations. The radio audio will now be heard at the initiating station.
 12. Use the following procedure to initiate a "select" intercom call:
 - a) Using the station's keypad, call another station in the system.

NOTE: When a station has been assigned a station code of one digit (1-9), the code must be entered with a zero (0) preceding the assigned number. Example: to call station #2, press 02 on the key pad. When the second digit is entered, a call tone will be heard at the station that initiated the call as well as at the station that has been called. Radio audio will be muted at both of these stations.
 - b) The BUSY LED will be lit at all other stations; audio from the station that has been called will be heard at the station that initiated the intercom call.
 - c) **Press the TALK key.** Audio from the station that initiated the intercom call will be heard at the station that has been called.
 - d) **Release the TALK key.** Audio from the station that has been called will be heard at the station that initiated the intercom call.
 - e) **Press the END CALL key.** The radio audio will be heard at both stations. The BUSY LED's will go out at all other stations in the system.
 - f) Continue to check the system by making select intercom calls to each speaker location.

Operational Checkout

Operational Check List

NuTone recommends that the following check list is used to verify that the system is operating properly.

Station Number	Radio Volume	Private	Monitor	All Call	Intercom Volume	Talk	End Call	Door Call	Select Call	Location
01										
02										
03										
04										
05										
06										
07										
08										
09										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

Notes:

Operational Checkout

Setting the Radio Audio Level

In most installations, the audio trimpot will not need to be adjusted. However, follow these steps if an adjustment is necessary.

1. Set the radio volume control to the maximum level at the remote speaker located closest to the master station.
2. Set the radio volume to the OFF position at the other remote stations.
3. Select a strong FM station at the master station.
4. Mute the radio at the master station by pressing the **MUTE** key.
5. Use a small thin-bladed screwdriver to adjust the radio audio trimpot until the audio at the remote speaker is at the desired level. **NOTE:** If the radio audio is increased to a high level, the radio volume may be too loud at the lowest setting at the remote speaker locations.
6. The radio volume control at all remote speaker locations and at the master unit location may now be adjusted to the desired level with no further adjustment to the radio audio trimpot.

Setting the Intercom Audio Level

In most installations, the intercom audio trimpot will not need to be adjusted. However, follow these steps if an adjustment is necessary.

1. At a remote speaker location, ask someone to speak to someone else at the master station location.
2. Set the intercom volume control at the master station to the maximum level. **NOTE:** The intercom volume may only be adjusted when the system is in the intercom mode.
3. Use a small thin-bladed screwdriver to adjust the intercom audio trimpot until the audio level is at the desired level.
4. The intercom volume control at all remote speaker locations and at the master unit location may now be adjusted to the desired level with no further adjustment to the intercom audio trimpot.

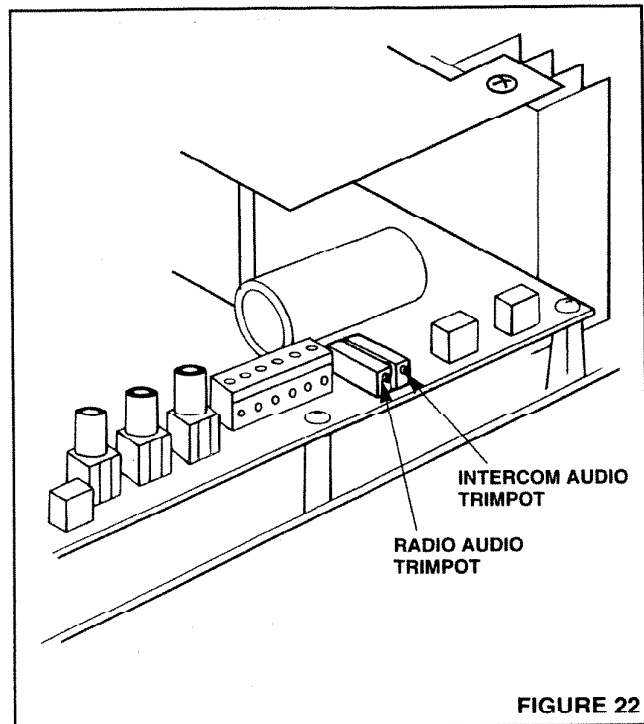


FIGURE 22

Operational Checkout

Setting the Door Speaker Volume Level

In most installations, the door speaker volume will not need to be adjusted. However, follow these steps if an adjustment is necessary.

1. Locate the door speaker volume trimpot on the master station's Control P.C. Board.
2. Call a door speaker from the master station location. Press the **TALK** key and speak in a normal voice.
3. Adjust the door speaker volume trimpot until the desired door speaker volume level is achieved. **NOTE:** This setting controls the audio level to the door speaker only.

Tone Generator Volume Adjustment

The tone generator creates the tones that are heard from each station (call tone, alarm tone, feed back tone, etc.)

A trimpot is located on the master station and on each of the remote speakers.

To adjust the trimpot at the master station:

1. Enter an invalid keypad entry; Example: 3.
2. Adjust the trimpot to the desired level using a small screwdriver.

NOTE: Do not turn the tone generator completely off; the alarm function will be disabled.

NOTE: The trimpot on the remote station is located next to the black wire connection terminals and is labeled ringer volume.

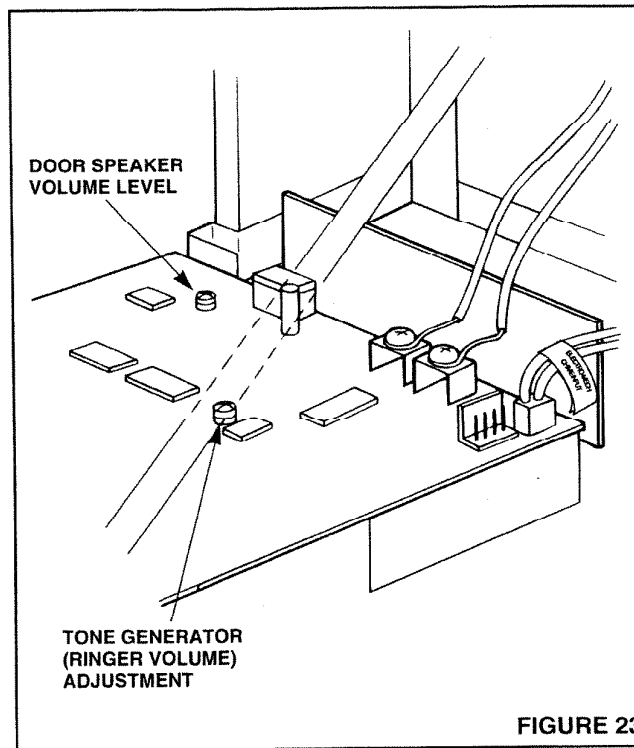


FIGURE 23

Operational Checkout

If you should encounter problems with the Intercom System

If your Intercom System is not operating properly, the Internal Microprocessor might need to be reset. Four (4) levels of reset have been incorporated into the Intercom System:

Begin with Level 1 and proceed to the next level until the problem has been corrected.

NOTE: Levels 2, 3 and 4 will erase the system's memory and defaults the system back to the original factory preset.

LEVEL 1: To reset a station, press *9# on the station's keypad.

When this level of reset is performed at the master station, the master station will be reset and any information stored in the master stations' memory will be retained.

When this level of reset is performed at a remote speaker location, that location will be reset and information stored into the stations' memory will be erased.

LEVEL 2: To totally reset the system, press *8# on the master station's keypad. All stations in the system will be reset and any stored information will be erased from the system's memory.

LEVEL 3: If unit does not respond to a Level 1 or 2 reset, locate the Power Reset Button on the bottom left side of master station. A label marked "For Power Reset Only" will be covering the access hole. Using a pencil, punch a hole in the label and activate button. The master station will reset, and information stored at the master station will be cleared.

LEVEL 4: IMPORTANT: IF YOU ARE NOT CERTAIN AS TO THE CORRECTNESS OF ANY STEP OR PROCEDURE DESCRIBED HERE, SECURE THE SERVICES OF A QUALIFIED TECHNICIAN.

NOTE: This level should only be used after all other levels have been attempted and will involve the partial removal of the intercom's master unit from the rough-in frame.

1. Disconnect AC power from the system.
2. Remove the four (4) mounting screws from the master station's front panel.
3. Slowly lower the master station towards yourself. Be careful not to catch any wires on the rough-in frame. Let the unit rest on the support strap in a face-down position.
4. Disconnect the back-up battery from the master station. Refer to page 9 of this booklet.
5. When two (2) minutes have elapsed, reconnect the battery.
6. Carefully dress the wires and re-install the master unit into the rough-in frame.
7. Restore AC power to the system. If the system has properly reset, the display will appear as 12:00 AM.
8. If the system is not operating properly, disconnect the AC power and notify a NuTone service representative.

Installer's Troubleshooting Guide

TROUBLE	POSSIBLE CAUSE	POSSIBLE REMEDY
Hum in remote speakers.	The intercom wiring has been run too close to the household AC power wiring.	Be certain the intercom wiring is as far away as practical from the household AC power wiring. Do not run the intercom wiring parallel to the AC power wiring.
	Wire installation.	Check the ORN, ORN/WHT, RED, RED/WHT wires for shorts or opens at the master station and at each remote speaker location.
	Interference from household electrical fixtures.	A dimmer or fluorescent light may cause interference. Filters should be used for dimmer or fluorescent light interference (G.E. 89G635 or equivalent – purchase locally).
A select call from the master station to a remote station is not functioning (but the radio operates properly at each remote speaker location).	Wire installation.	Check BLK, BLK/WHT (serial data) wires to be certain they are properly connected to the master station and each remote speaker location.
	*Improperly set station code selector switch.	Check to make sure the station code has been set at all stations and no two stations have the same station code.
No radio or intercom from the remote speakers (Radio operates properly at the master station).	Improper wiring installation at the master station.	Check the wiring going to the remote speaker connector at the master station.
	No electrical power to the remote speakers.	Be certain 120vAC, 60Hz power has been provided to the primaries of both 401T transformers.No less than 24vAC should be measured on the secondary of either transformer.
	Defective transformers.	Replace transformer.
Remote speakers may communicate with each other but the master station does not function.	No electrical power to master station.	Be certain 120vAC, 60Hz power has been provided to the primaries of both 401T transformers.No less than 24vAC should be measured on the secondary of either transformer.
	Defective transformer.	Replace transformer.
No door communication.	Wire installation.	Check the wires to door terminals at door speakers and at the master station.
		Check BLK, BLK/WHT (serial data) wires to be certain they are properly connected to the master station and each remote speaker location.
	Speaker.	Check the continuity of the door speaker.
	Incorrect door speaker volume setting.	Follow "Setting Door Speaker Volume Level" instructions in this booklet. NOTE: This setting effects only the audio going to the door speaker.
Cannot receive a radio station that is being received by another radio in the home.	Faulty antenna connection.	Be certain the antenna connector is properly connected to the antenna pins located in the upper right corner of the master station.
	Improper antenna installation.	The antenna should be located in the attic (refer to the antenna instructions).
The master station will not go into the note mode.	A cassette tape has not been put into the master station.	Place dedicated message tape into the master station.
	Recording lockout tabs have been removed from cassette tape.	Cassette tape that has recording lockout tabs must be used. Or place a piece of masking tape over the holes located in the two (2) corners of the tape.

Installer's Troubleshooting Guide

TROUBLE	POSSIBLE CAUSE	POSSIBLE REMEDY
The radio volume is too loud when the remote speakers are set on the first volume step.	Improper setting of the program audio trim pot.	Decrease the radio audio level by turning the program audio trimpot (counter clockwise) until the desired audio level has been achieved with the remote speaker set in their first volume step (refer to "Setting the Radio Audio Level").
The system squeals when the intercom is being used.	The speaker in the adjacent room(s) is mounted on a common wall (back to back).	If the remote speakers have been mounted back to back, one of them will have to be relocated. If the speakers are on a common wall, place fiberglass insulation behind each speaker or isolate the speaker from the wall by placing rubber washers or weather stripping between the speaker and the wall surface.
Static.	Loose ground connection.	Check the ground connection to the master station and the connection to the earth ground source.
	Interference from household electrical fixture.	A dimmer or fluorescent light may cause interference. For dimmer or fluorescent light interference, use filters (G.E. 89G635 or equivalent, purchase locally).
	Interference from household electrical appliances.	Correct interference at the source: fishtank heater, hand tools, coffee pot, etc.
	Wire installation.	Check all wiring in the system: speaker, chime, and transformer connections at master station and connection at remote speakers.
Optional Electronic Chime (Models IA-28 or IA-29) does not operate or operates at a low level.	Wire installation.	Be certain the chime is properly connected to the master station. Also, be certain the front, side and rear buttons are properly connected to the chime board.
	Improper volume setting.	Adjust the volume of the chime module by turning the volume potentiometer located on the chime module behind the 4-pin ribbon cable connector. NOTE: It may be necessary to remove the chime module from the master station to make this adjustment.
	Wire installation.	Check the door terminals on the chime module by shorting the common terminal to each of the door terminals front, rear and side. The chime should play.
Mechanical chime can't be heard through the master station or remote speakers.	Wire installation.	Be certain the mechanical chime is properly connected to the master station's mechanical chime input wires located next to the electronic chime 4-pin connector on the audio control PC board.
	Improper volume setting.	Adjust the volume of the mechanical chime by turning volume potentiometer, located on the mechanical chime pick-up.
Call tone volume at a station is too loud.	Call tone volume trimpot is not adjusted properly.	Refer to call tone volume adjustment in the home owner's instructions. If volume is still not desirable refer to tone generator adjustment on page 14. NOTE: It is suggested that the tone generator volume not be adjusted to the off position.

***IMPORTANT:** Be certain the system has been disconnected at the main power source prior to setting the selector switch. Powering the system up will allow the station identification to be effective.

Remote Station Installation

WIRING

Refer to Figure 1. Connect the color-coded wires from the master station to the matching terminal screws on the speakers printed circuit board.

SETTING THE STATION CODE

The Selective Call function of the system requires all stations in the system be assigned an address. This is entered into the initiating station's keypad when selective communication with a station is desired. The assigning of the address is accomplished by setting a station code dip switch on the back of each station.

IMPORTANT: The master station has been preset as station #1. The remote speakers will be stations 02 through 25.

1. Refer to Figure 2. Locate the station code dip switch on the back of the remote control unit.
2. Refer to Figure 3. As indicated in Figure 3, set the station code dip switch in the ON and OFF positions.

MOUNTING

1. Carefully place wires inside wall.
2. **IMPORTANT:** Outdoor models must be caulked with a waterproofing compound (Silicone Rubber, RTV or equivalent - not supplied by NuTone). Caulk across the top and both sides of the unit only; the bottom of the unit should not be caulked.
3. Using the mounting holes in the sides of the speaker body, secure the speaker to the frame with the screws provided.

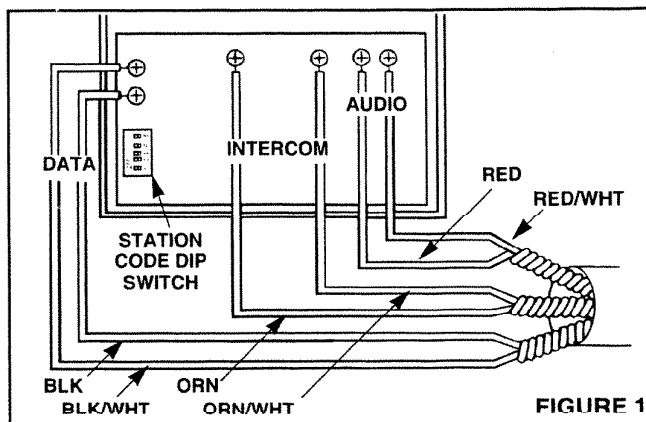


FIGURE 1

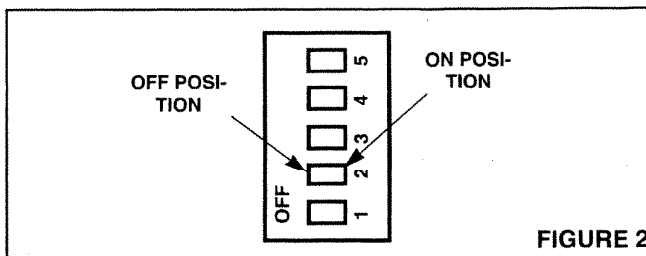


FIGURE 2

IF THE REMOTE UNIT IS TO BE THE STATION NUMBER:	THESE NUMBERS ON THE STATION CODE DIP SWITCH MUST BE IN THE ON POSITION
02	2
03	1 & 2
04	3
05	1 & 3
06	2 & 3
07	1, 2 & 3
08	4
09	1 & 4
10	2 & 4
11	1, 2 & 4
12	3 & 4
13	1, 3 & 4
14	2, 3 & 4
15	1, 2, 3 & 4
16	5
17	1 & 5
18	2 & 5
19	1, 2 & 5
20	3 & 5
21	1, 3 & 5
22	2, 3 & 5
23	1, 2, 3 & 5
24	4 & 5
25	1, 4 & 5

FIGURE 3

General System Description

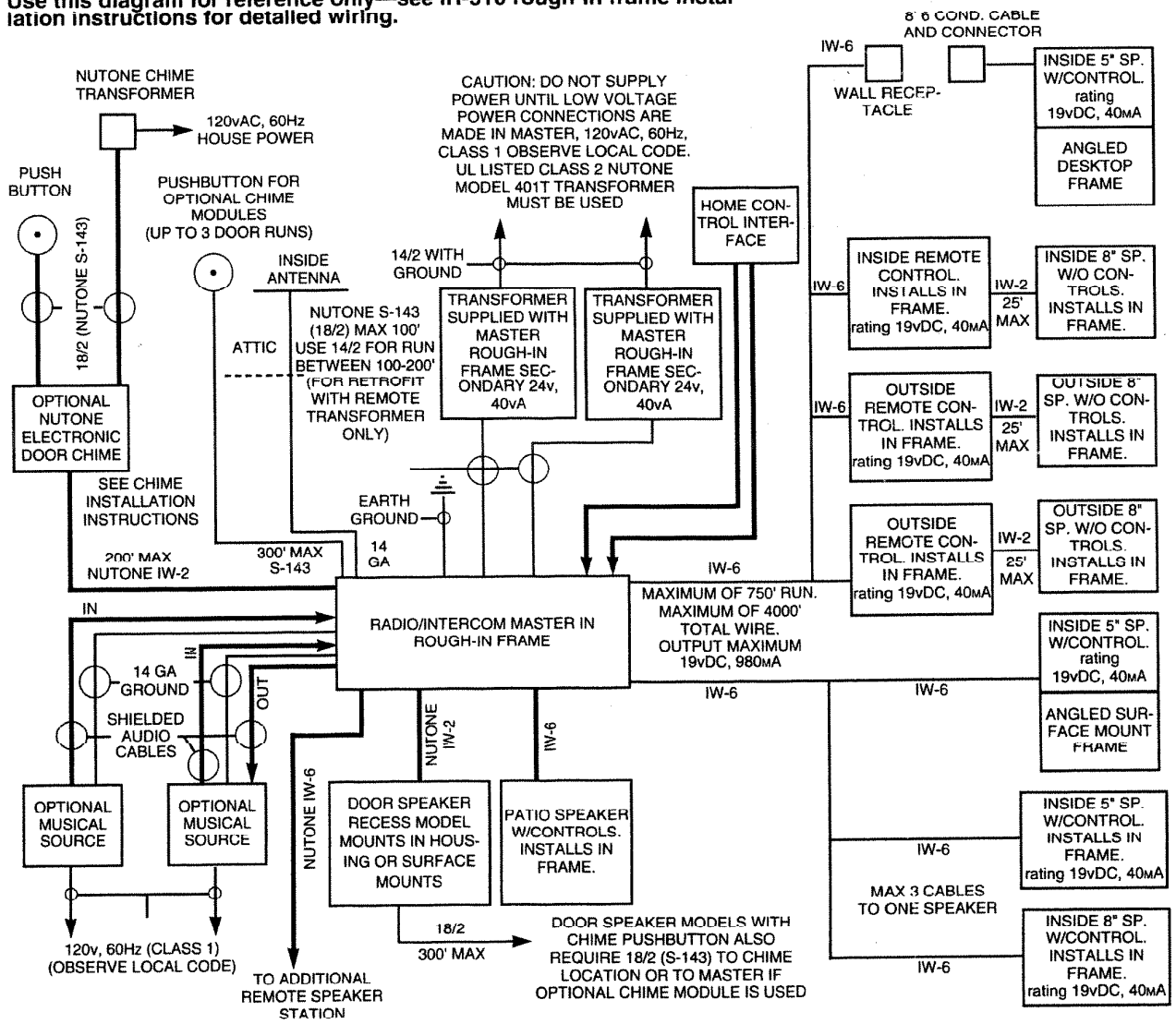
INTRODUCTION

The IM-5006 Radio-Intercom is a Selective-Call Intercom System that includes an auto-reversing cassette deck and an AM/FM Radio. Designed to use NuTone 6-conductor cable, the System may be installed into a new installation as well as replace or upgrade antiquated intercom systems. By incorporating micro-computer and surface mount technologies, the IM-5006 provides a reliable, less complicated, system while increasing the features available to the user.

The information that follows is intended to supply the technician with the knowledge required to develop a general understanding of the NuTone IM-5006 Radio-Intercom System. A more in depth analysis of the various circuits within this System is covered in the "Circuit Description Section."

IM-5006 SERIES REPRESENTATIVE WIRING ILLUSTRATION

Use this diagram for reference only—see IR-510 rough-in frame installation instructions for detailed wiring.



General Description

The IM-5006 Radio Intercom is a selective call intercom and audio distribution system that utilizes newly installed or existing NuTone IW-6 Cable to provide intercom communication and radio-source (Phono, CD, Tape) audio to desired locations.

Usage of the IW-6 cable in the IM-5006 system:

WIRES	FUNCTION
Orange Pair	Balanced low-level intercom audio and negative power supply for the remote stations.
Red Pair	Balanced low level radio-source audio and positive power supply for the remote stations.
Black Pair	Serial data communication.

NOTE: The NuTone IW-6 Cable may be looped, home run, or a combination of both to the Master Station.

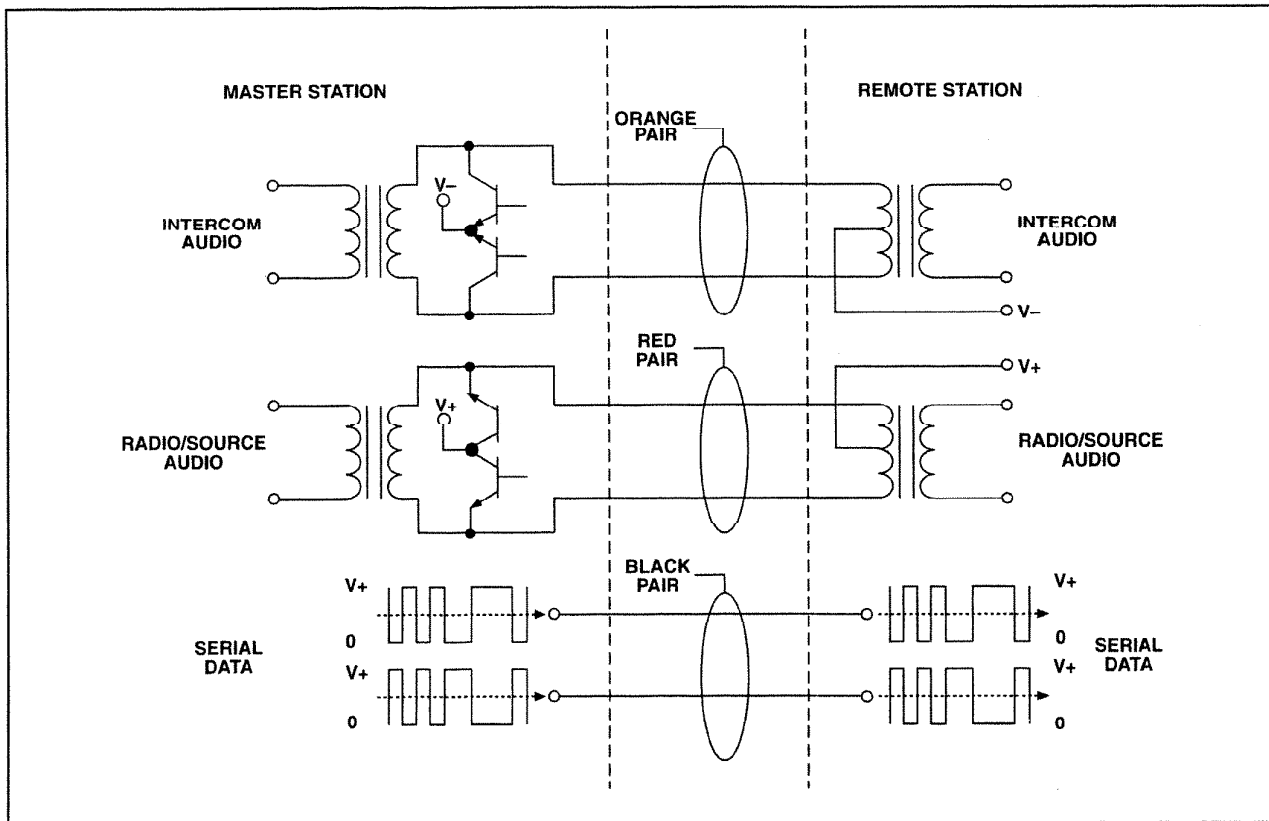
REMOTE STATION POWER SUPPLY

The illustration below shows how power is supplied along with intercom and radio-source audio to the Remote Speakers through the red and orange twisted pairs.

Audio is transmitted and received from the IW-6 cable through 1:1 audio transformers creating a balanced audio path for radio-source and intercom audio. While being less susceptible to external noise, the balanced audio path also allows the power supply voltage to be transmitted over the same lines as the audio.

Pass transistors functioning as high AC impedance voltage sources apply the remote power supply voltage to both sides of the twisted pair. The power supply voltage is removed from the twisted pair by the center tap on the audio transformer at the Remote Stations. Additional stations are connected in parallel with the station that is illustrated, thus receiving power and audio in the same manner.

Serial data communication from the Master Station to the Remote Station is also shown in the illustration below demonstrating the inverse data format used on the black pair of wires. This type of format is used to prevent external noise from disrupting data communication.



General Description

INTERCOM COMMUNICATION INTRODUCTION

The IM-5006 Radio-Intercom System allows the user to conduct intercom communication in the following ways:

Monitor: Continuously couples a station's microphone audio with all the stations in the system via the radio bus.

All Call: An intercom call between the initiating station and all other stations in the system.

Selective Call: A private station-to-station intercom communication.

Door Call: A private station-to-door intercom communication.

COMMUNICATION EXAMPLES: The simplified illustrations that follow provide examples of the various types of communication the IM-5006 Radio-Intercom System can perform. Three stations and a section of NuTone IW-6 Cable are shown in each illustration. The Cable is divided into the three twisted pairs. Each pair is represented by a bus:

Orange Pair – Intercom Bus; Red Pair - Radio-Source Bus; Black Pair - Serial Data Bus.

Three types of communication are illustrated on these buses:

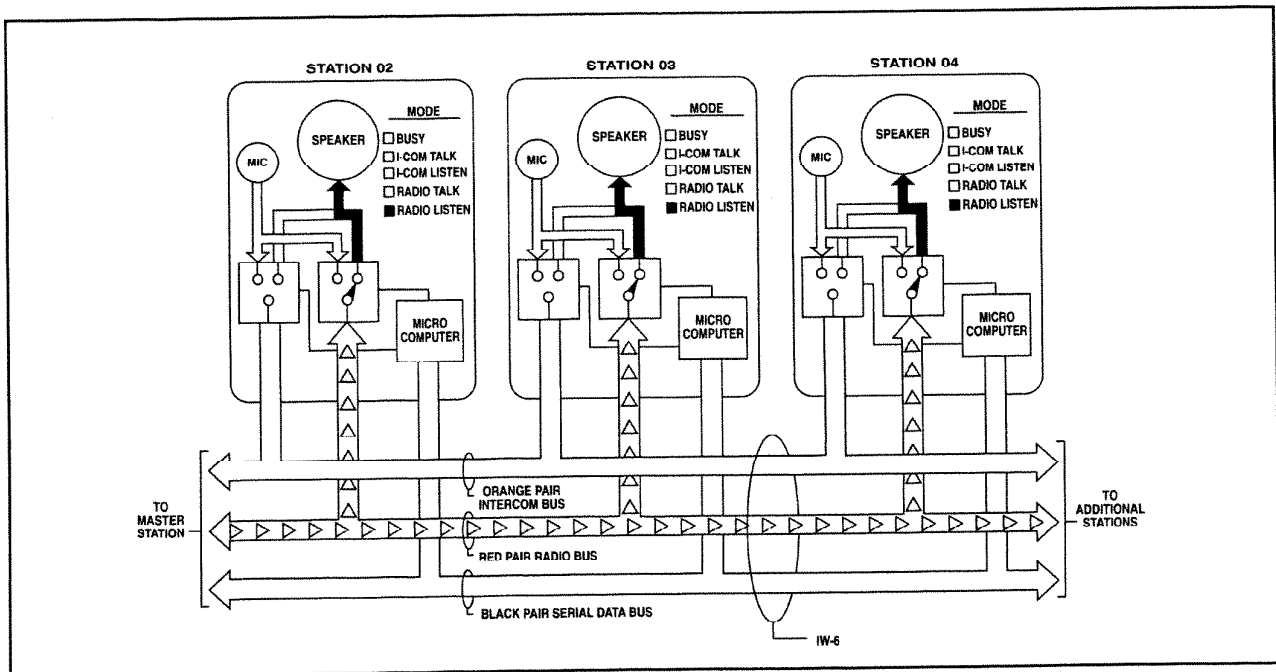
- ▷ = Radio-Source Audio
- ◀ = Microphone Audio
- ↔ = Serial Data.

The stations have been simplified to best illustrate the different modes of operation. A list of the modes of operation is incorporated into each station with the black box indicating the present mode.

NOTE: For this discussion the volume attenuator, power amplifier, microphone pre-amplifier, tone generator, serial data interface, and keyboard have been omitted from these illustrations.

QUIESCENT/STANDBY

The stations in this example are in the Quiescent/Standby Mode and have their Radio Listen gates ON, thus allowing Radio-source audio to be heard at each station.

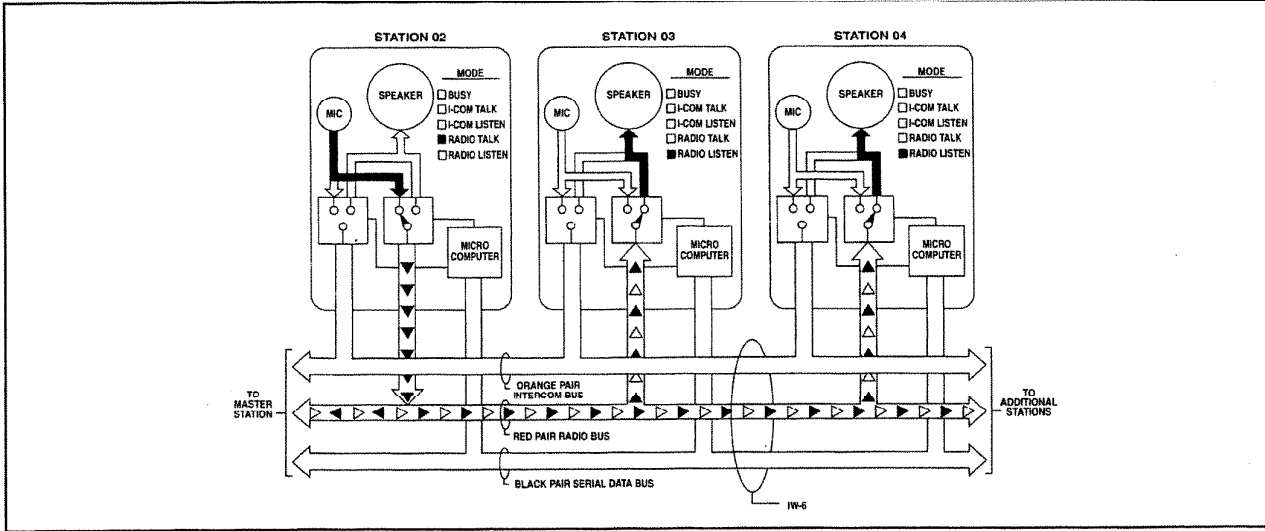


General Description

MONITOR

In this example Station 02 has been placed into the Monitor mode. Its Radio Listen gate has been turned OFF, and its Radio Talk gate has been turned ON. Microphone audio from the station is routed to the Radio bus where it is mixed with Radio-source audio.

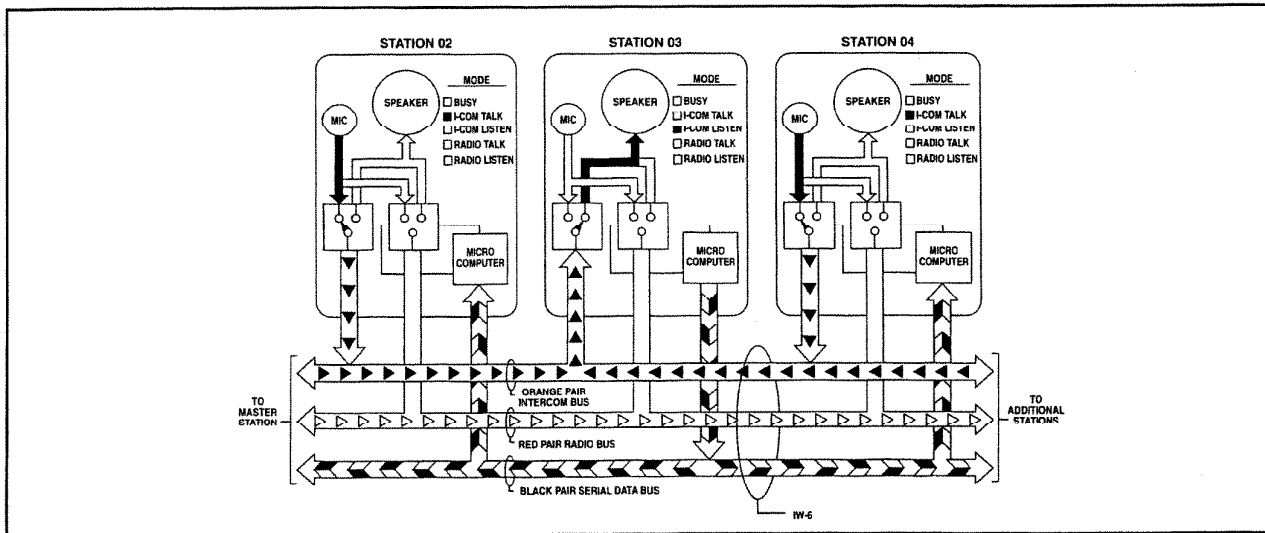
All other stations in the System remain in the Quiescent/Standby mode and receive the Monitor/Radio audio through the Radio Listen gate.



ALL CALL INITIATION

In this example Station 03 initiates an All Call. The station turns OFF its Radio Listen gate, turns ON its Intercom Listen gate, activates its Call tone, and transmits an All Call talk command to the Serial Data bus. All stations in the System respond to the All Call Talk

command by turning OFF their Radio Listen gate, turning ON their Intercom Talk gate, and activating Call tones. Microphone audio from all stations in the System is thus routed to the Intercom bus where it is received by Station 03.

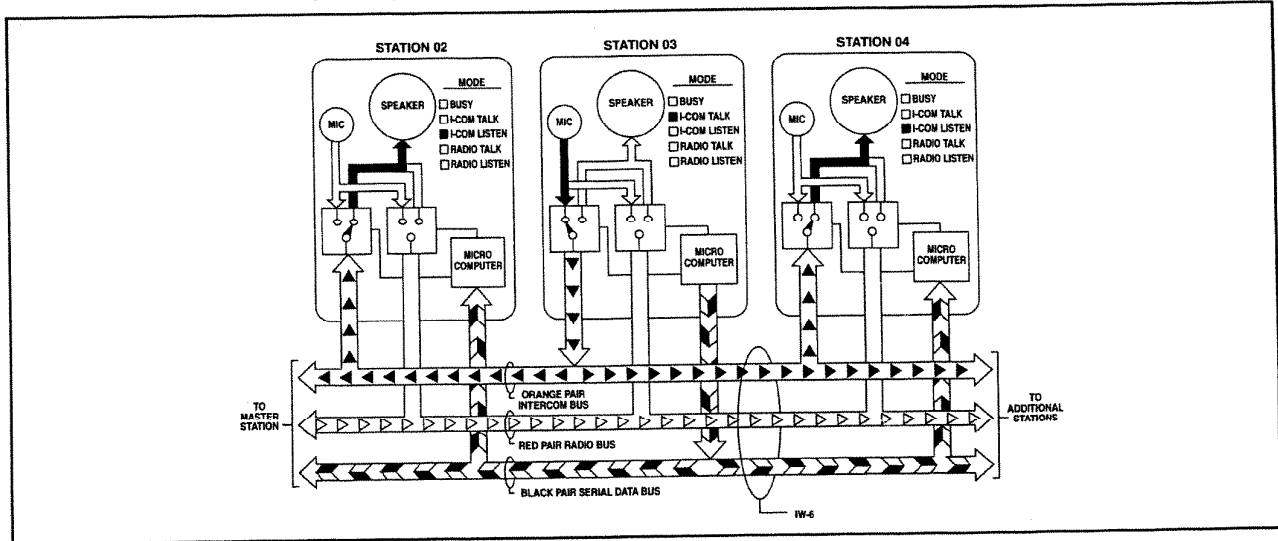


General Description

ALL CALL TALK/LISTEN

Pressing the Talk key at the initiating station turns OFF the Intercom Listen gate and turns ON the Intercom Talk gate. An All Call Listen command is then transmitted to the Serial Data bus. All the stations in the System respond to the All Call Listen command by turning OFF their Intercom

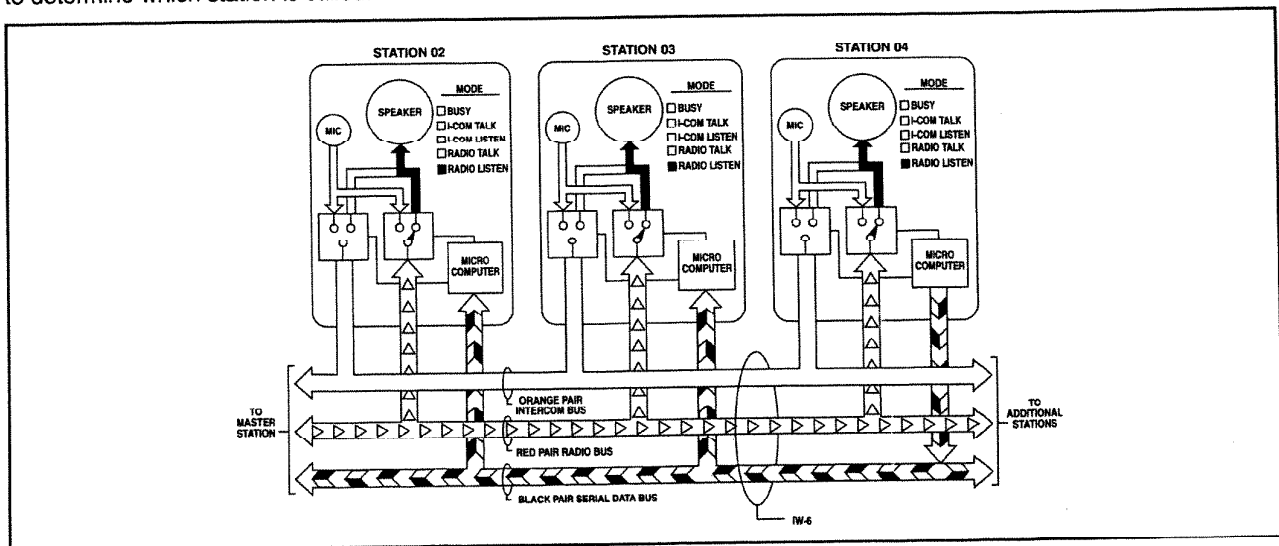
Talk gate and turning ON their Intercom Listen gate. Audio from the initiating station is heard at all stations in the System. Releasing the Talk key returns the System to the All Call Listen mode.



SELECTIVE CALL INITIATION

In this example, a Selective Intercom Call has been initiated by Station 04 to Station 02. Data containing a Selective Call Talk command for Station 02 is transmitted to the Serial Data bus from Station 04. All stations in the System examine the information on the Serial Data bus to determine which station is called.

NOTE: The Selective Call function of the System requires all stations in the System be assigned an address. This is entered into the initiating station's keypad when Selective communication with a station is desired. The assigning of the address is accomplished by setting a station code dip switch on the back of each station.



General Description

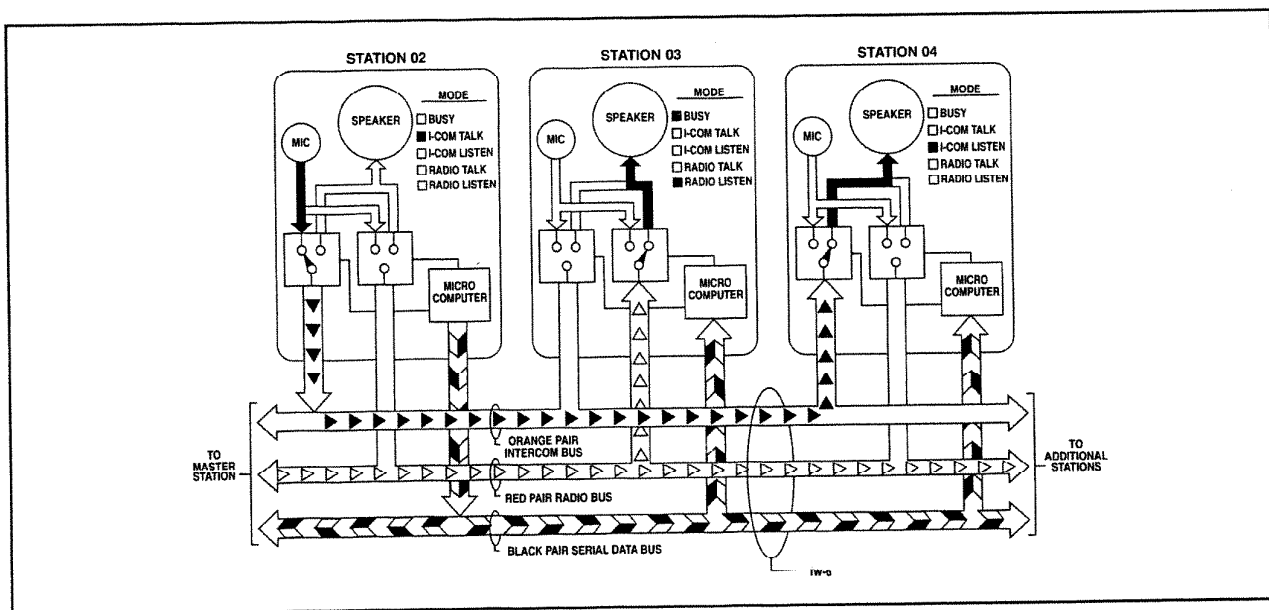
SELECT CALL ACKNOWLEDGE

When Station 02 recognizes that it is the station being called, it turns OFF its Radio Listen gate, turns ON its Intercom Talk gate, activates a Call Tone, and transmits an Acknowledge command to the Serial Data bus. Station 04 responds to the Acknowledge command by turning OFF its Radio Listen gate, turning ON its Intercom Listen gate, and activating its Call Tone. Thus, microphone audio from Station 02 is heard at Station 04. All other stations respond to the Acknowledge command by turning ON their Busy LEDs while they continue to receive Radio-source audio.

NOTE: If an Acknowledge command is not received by Station 04 within a predetermined time, Station 04 will assume no station exists with the transmitted station code. It will then transmit an End Call command to the Serial Data bus and activate an Error Tone indicating an invalid keyboard entry.

SELECT CALL TALK/LISTEN

Pressing and releasing the Talk key during Selective Call Intercom communication activates the same type of data communication as when the call was first initiated. That is, the command transmitted to the Serial Data bus must be acknowledged by the called station before communication can proceed. The Audio Path and corresponding active audio gate will change depending on the command transmitted to the Serial Data bus Talk or Listen.



DOOR CALL

When a Door Call is initiated by a station, the station is actually making a Selective Intercom Call to the Master Station. The Master Station provides the appropriate acknowledge command and internally connects the door speaker to the Intercom bus. The operation of the Serial Data bus, the Intercom bus, and the Radio bus is the same as a Selective Call communication.

PRIVATE

When a station has been placed in the Private mode, it no longer participates in Intercom communication. This, however, does not mean the station will not accept serial data. The station will respond to a Selective Call request from another station by transmitting a Private command to the Serial Data bus. The initiating station will respond to this command by activating the Call Tone Generator with two short "beeps" indicating the station is in the Private mode.

General Description

BLOCK DIAGRAMS

Below is the block diagram for the Remote Stations. On the following pages is the block diagram for the Master Station.

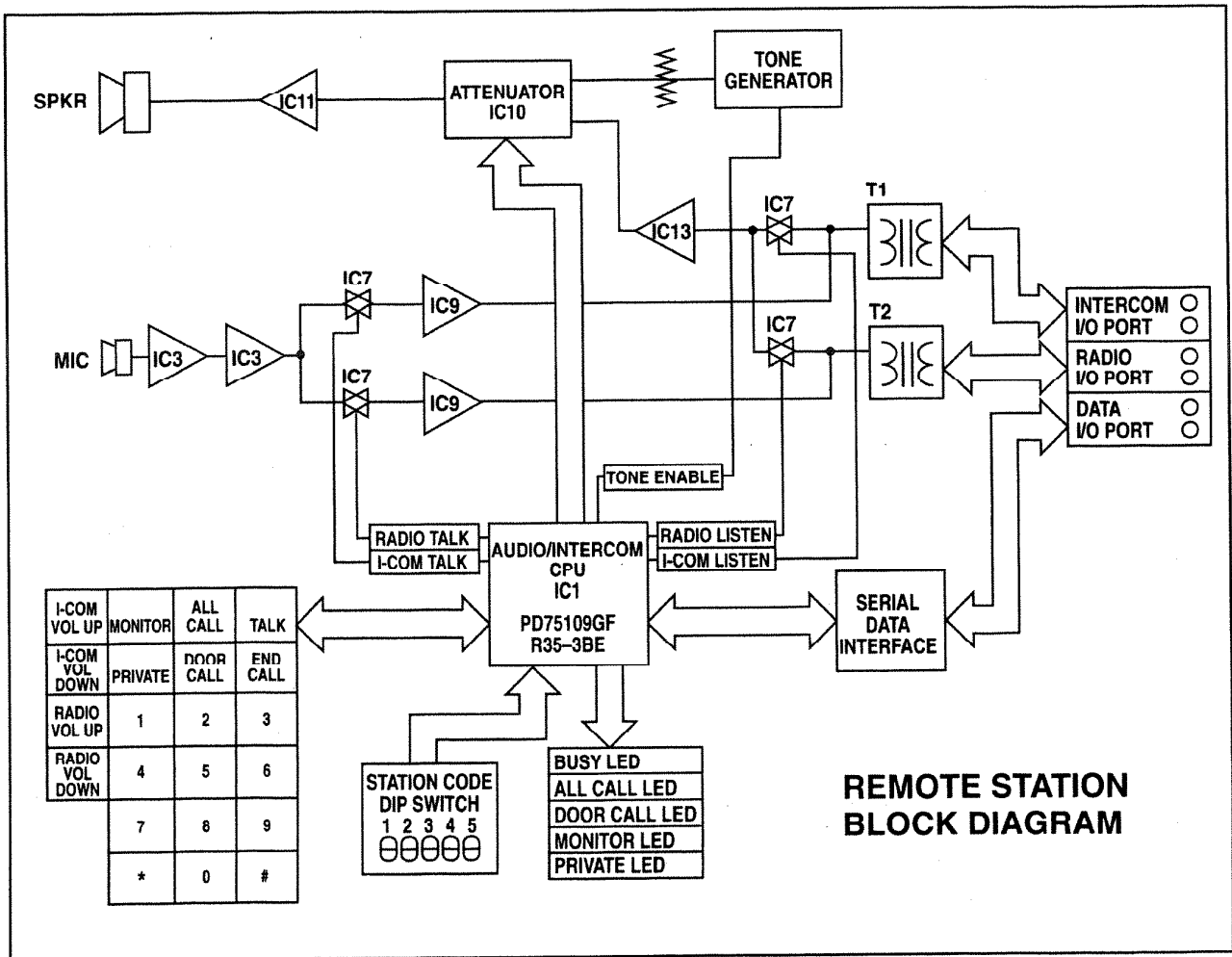
Note in both diagrams:

- The power supply has been omitted.
- The wide lines represent the connection path of two or more lines.
- Strobe lines for the control registers have been omitted.

DESCRIPTION

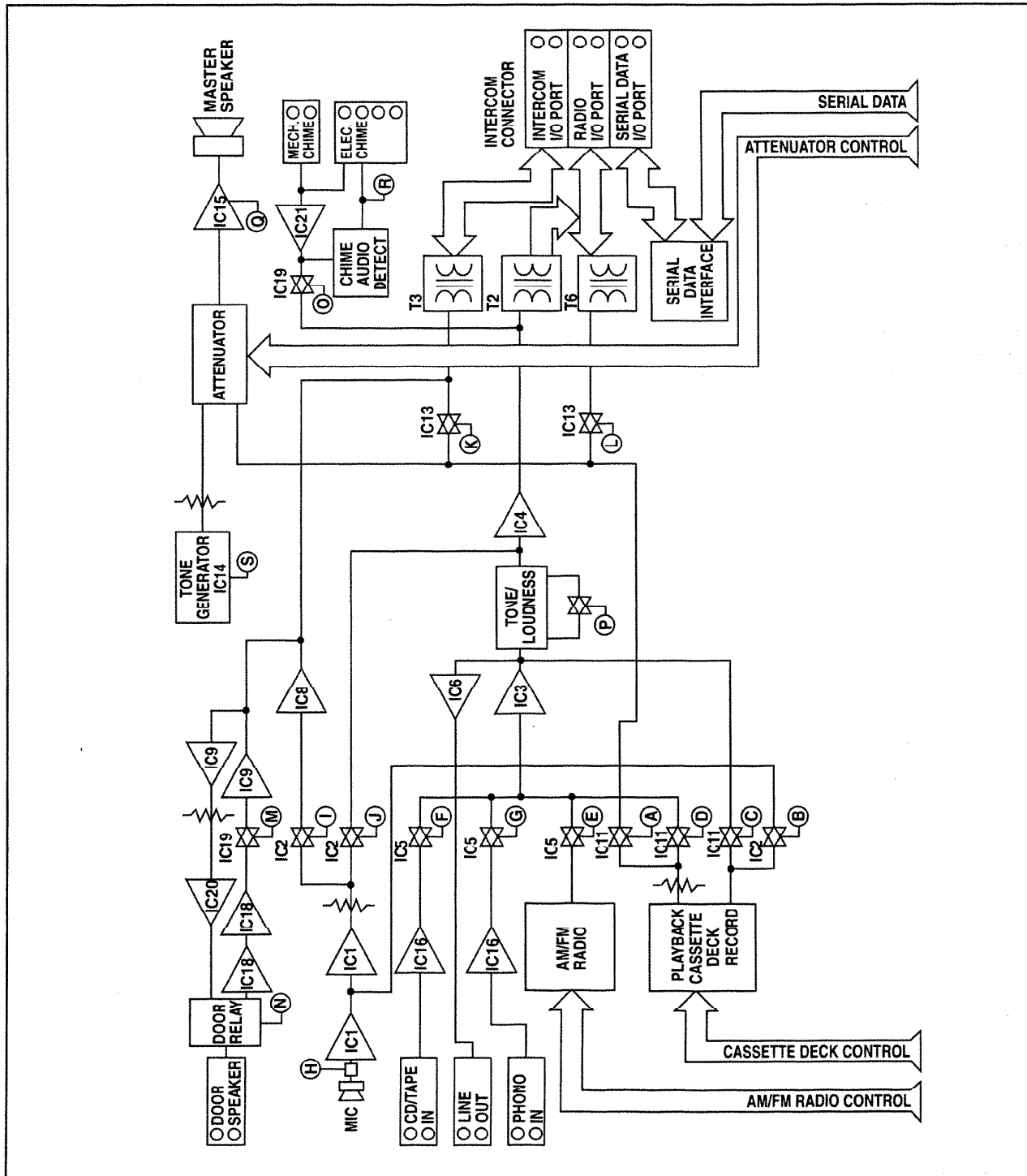
At the heart of the Master and Remote Stations is a microcomputer programmed to manage the various functions of each station. While both the Master and Remote Stations have the same microcomputer programmed to manage intercom and audio functions, the Master Station also has a microcomputer programmed to manage cassette and AM/FM radio functions.

Functions such as audio gate and LED status are directly controlled by the Remote Stations' microcomputer. The Master Station, on the other hand, incorporates registers to store the status of these devices which allow the microcomputer to perform other tasks. The registers and the devices that they control are illustrated in the Master Station's Block Diagram (pages 26-27). The circled letters in the Block Diagram on page 26 represent control lines that connect with the corresponding control lines in the Block diagram on page 27.



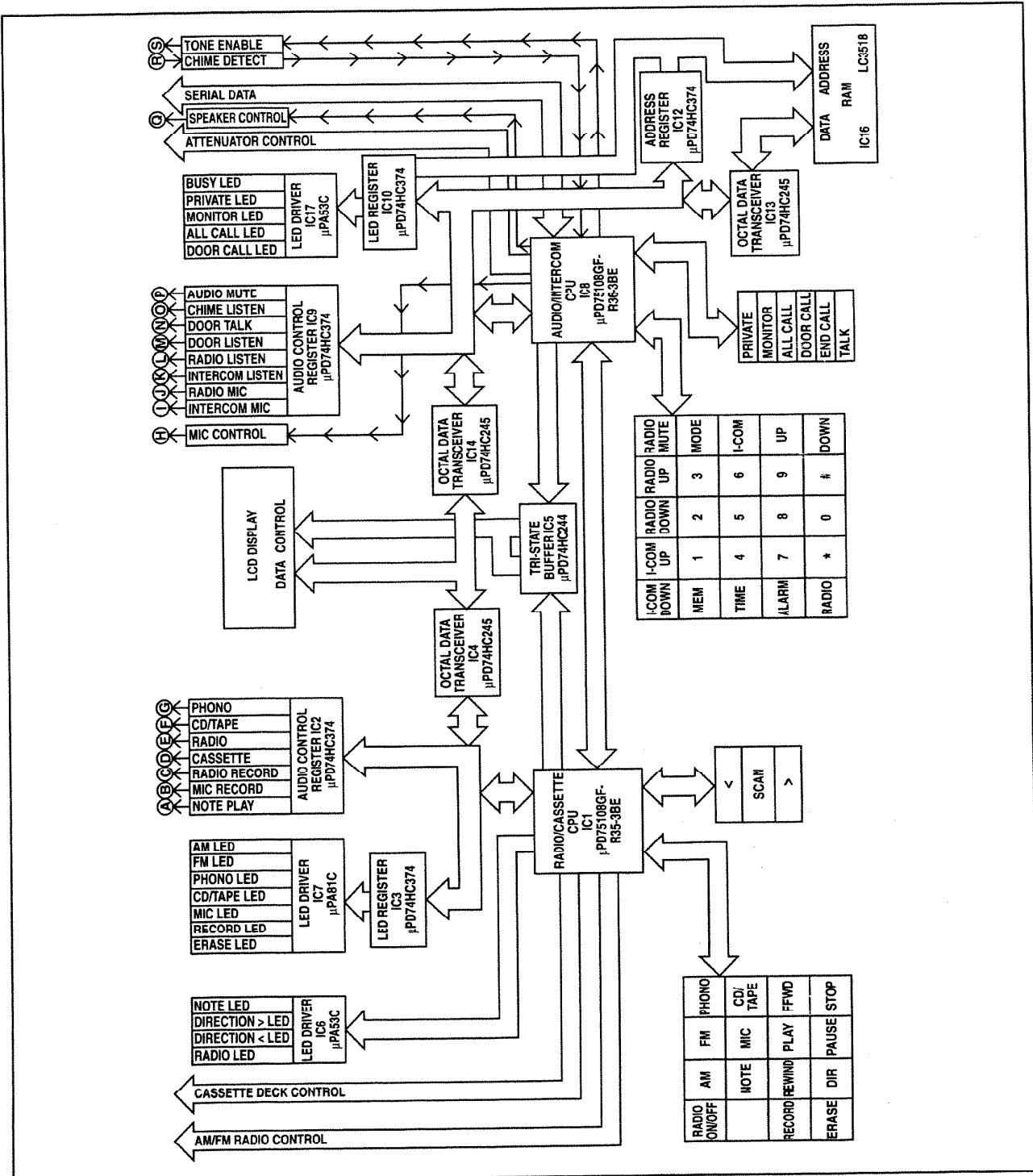
General Description

MASTER STATION BLOCK DIAGRAM



General Description

MASTER STATION BLOCK DIAGRAM



Circuit Description

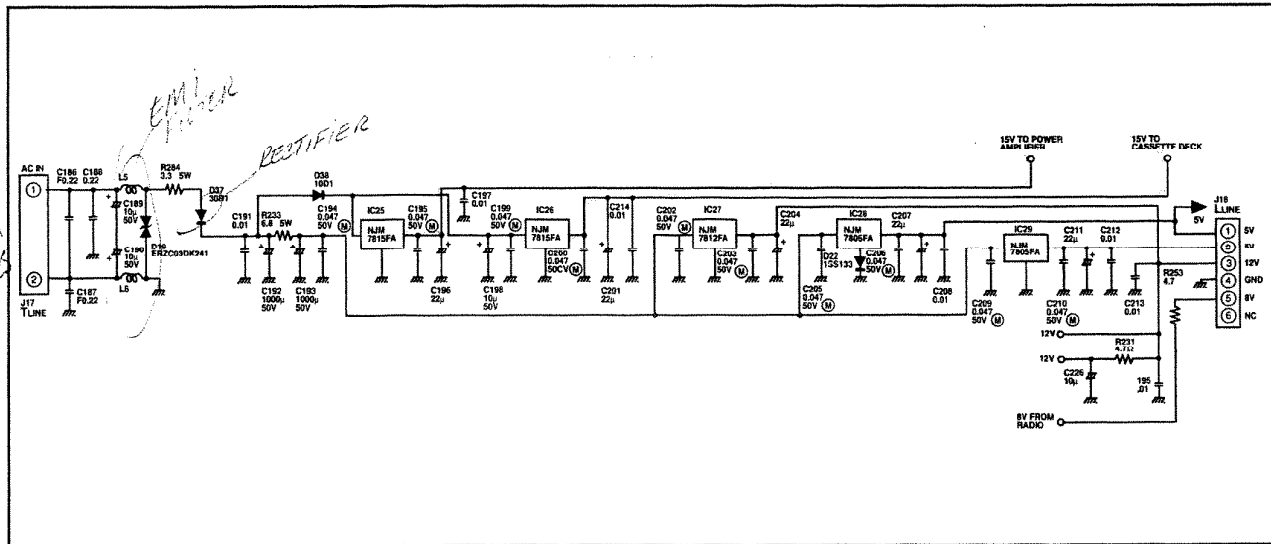
INTRODUCTION

The Master station has been divided into the following functional circuits. A schematic drawing, circuit description, and IC voltage chart has been provided for each circuit.

1. Master Station Power Supply
2. Remote Station Power Supply
3. Master Station Attenuator/Power Amplifier
4. AM/FM Radio
5. Cassette Deck
6. Tone/Loudness Control
7. Chime Input
8. Door Input/Output
9. Serial Data Interface
10. Intercom Audio Interface/Serial Data Interface Power Supply
11. Microphone Pre-Amplifier
12. Tone Generator
13. Reset
14. Battery Backup

NOTE:

- All voltages were measured between ground and the IC pins indicated.
- Voltage measurements were made with the system in the quiescent state after a * 8 # reset. AC line voltage was set at 120vAC.
- Any DC voltage lower than 100mV was considered 0 volts.
- A complete set of schematics is located in the Schematic/PC Board section of this manual.



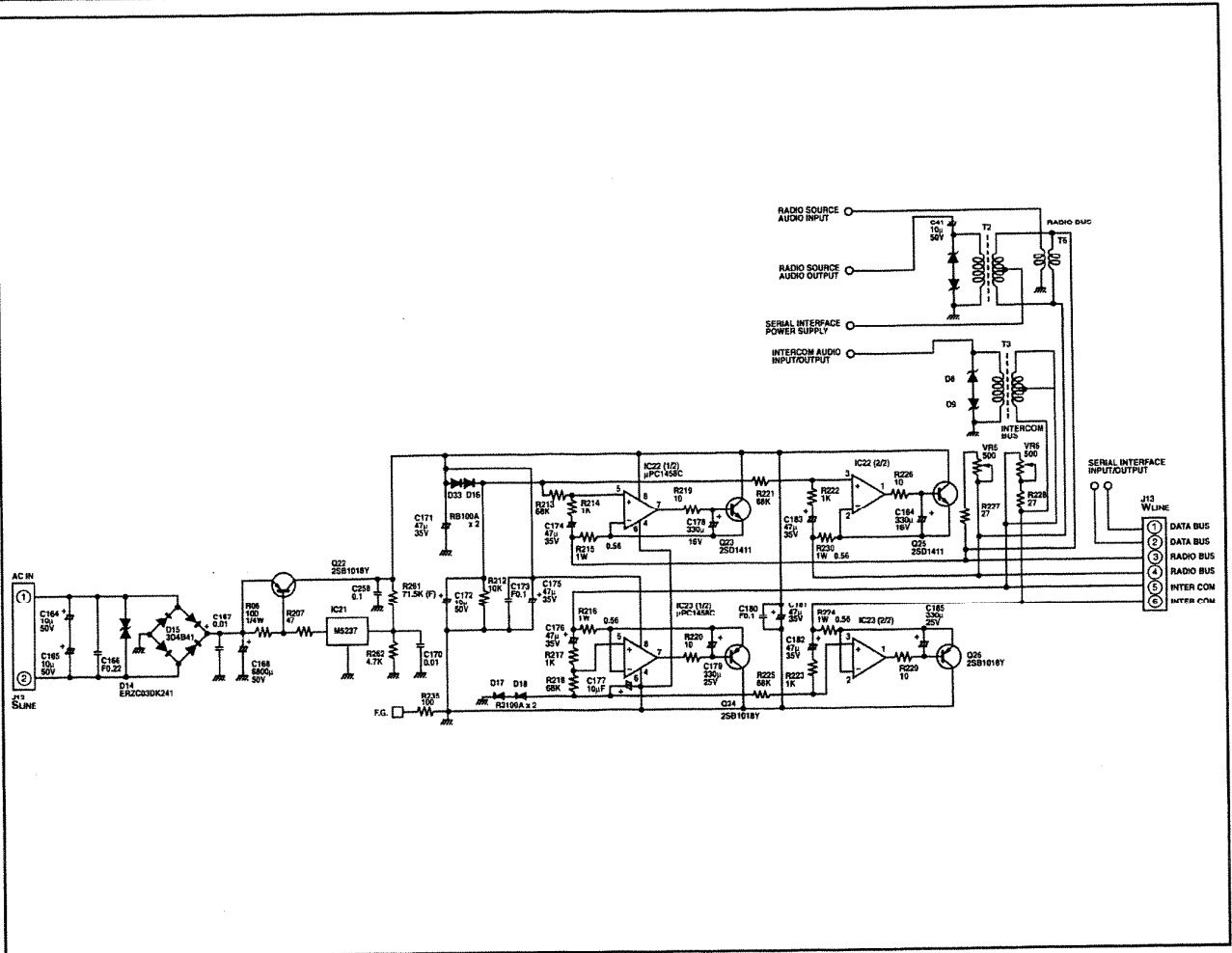
MASTER STATION'S POWER SUPPLY (Refer to Main PC Board Schematic page 64)

AC from the NuTone 401T transformer enters the Master Station's power supply through connector J17. The AC passes through an EMI filter and surge protection circuit before being rectified by D37. The rectified voltage is filtered and supplied to the voltage regulators which provide the various supply voltages required by the Master Station.

- IC25 provides 15V to the Power Amplifier Circuit
- IC26 provides 15V to the Cassette Deck Circuit
- IC27 provides 12V to the Audio Circuits
- IC28 provides 5.6V to the Digital Circuits
- IC29 provides 5V to the Display Circuit

QUIESCENT DC VOLTAGE					
PIN	IC25	IC26	IC27	IC28	IC29
1	25V	25V	24V	24V	24V
2	0	0	0	.6V	0
3	15V	15V	12V	5.6V	5V

Circuit Description



REMOTE STATION'S MAIN POWER SUPPLY (Refer to Main PC Board Schematic page 64)

AC for the Remote Station's power supply enters the master station through connector J12. The AC is then rectified by D15 and regulated by Q22 and IC21.

The regulated voltage is supplied to both sides of the radio-source audio bus through series pass transistors. An error amplifier connected to the base and emitter of each pass transistor monitors the transistor's output voltage and compares it with a reference voltage. The difference between these voltages generates an error voltage on the output of the error amplifier. This voltage is applied to the pass transistor's base thus regulating the output of the pass transistor and providing it with a low DC impedance. Capacitors connected to the base of the pass transistors and to the reference voltage input of the error amplifiers couples audio into these devices thus providing the circuit with a high audio frequency impedance.

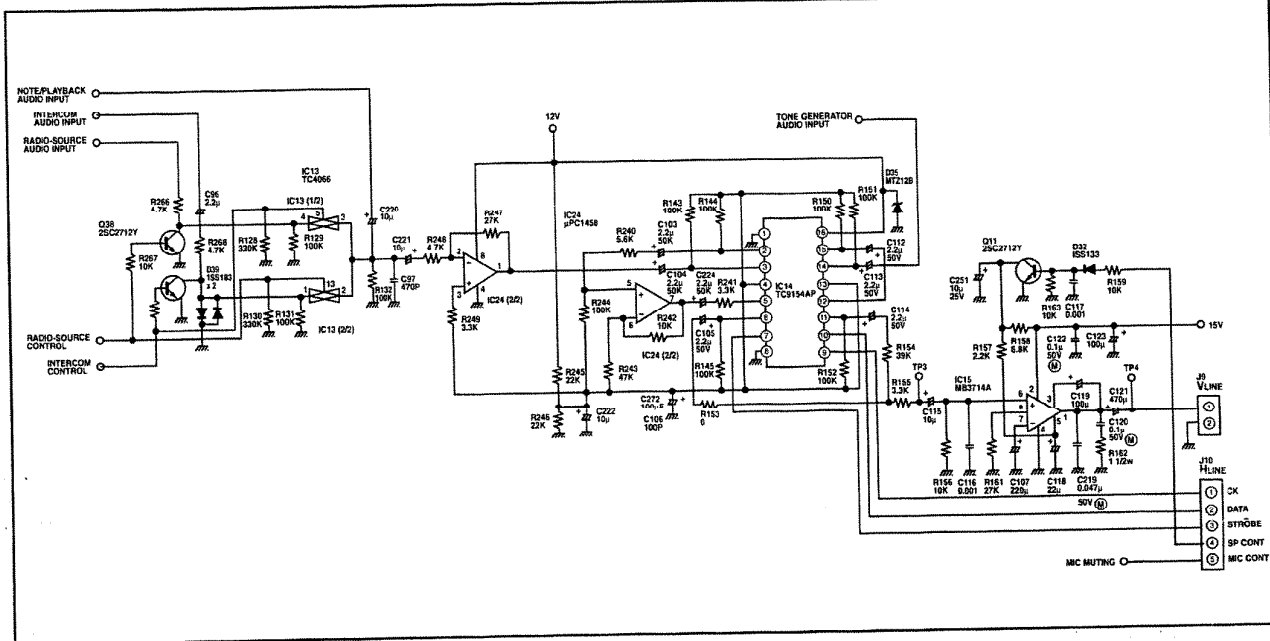
The power supply voltage is received from the intercom audio bus in the same manner.

QUIESCENT DC VOLTAGE*

PIN	IC21	IC22	IC23
1	35.2V	19.8V	19.9V
2	0	19.2V	1.3V
3	1.3V	19.9V	0
4		0	0
5		19.9V	0
6		19.2V	1.3V
7		19.8V	19.9V
8		20.4V	20.4V

* Measured with 1 remote connected to master station

Circuit Description



ATTENUATOR AND POWER AMPLIFIER (Refer to Main PC Board Schematic page 64)

The attenuator and power amplifier provide signal adjustment and final amplification for master station audio.

Radio-Source or intercom audio is selected as the input to the Attenuator/Power Amp Circuit by applying a high logic level to the appropriate pin of IC13. This control signal is also applied to the base of the transistor connected to the non-selected audio input of IC13. This transistor shunts the non-selected audio to ground thus eliminating audio bleed through from non-selected audio source.

Note Audio from the cassette deck is applied to the input of the Attenuator/Power Amp Circuit directly bypassing the Tone Control and Radio Bus Circuits. Note Audio is selected by applying a high logic level to pin 6 of IC11 in the Cassette Circuit.

The selected input audio is buffered by Amp No. 1 in IC24 before it is applied to the Attenuator IC14.

IC14 is a dual channel attenuator that provides 30dB of attenuation in 16 steps. The left channel of the attenuator controls the radio-source and intercom audio level. The right channel controls the tone generator's audio level.

Data regarding channel and degree of attenuation is entered into IC14 through the Data (10) Clock (9) and Strobe (7) pins from the Audio/Intercom Microcomputer IC8.

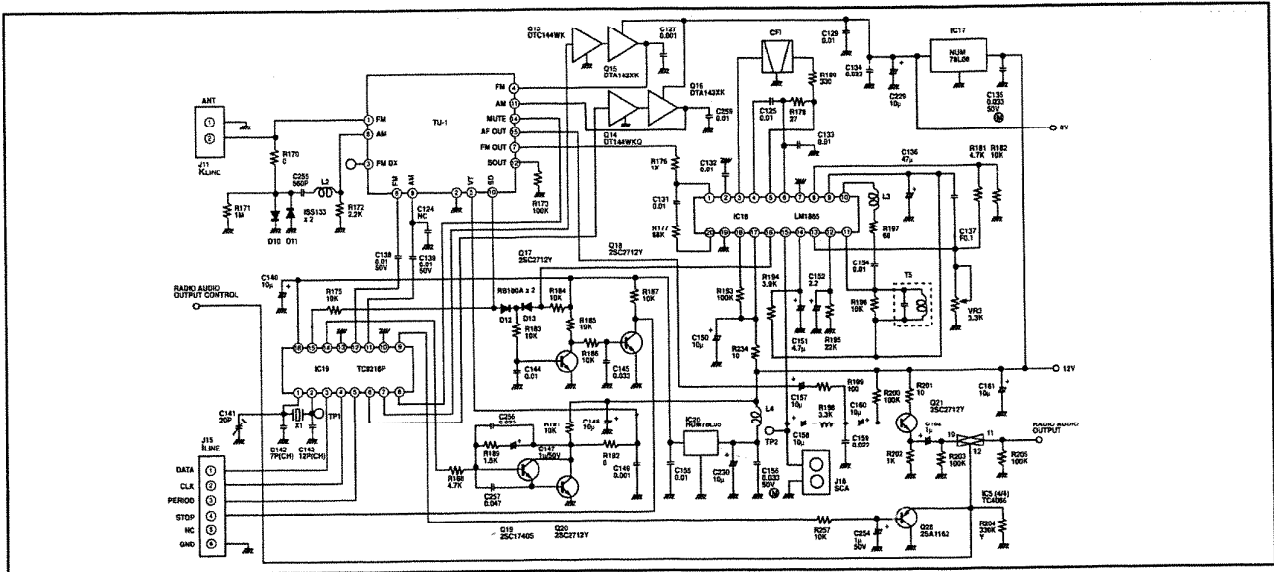
Amplifier No. 2 in IC24 is used as a buffer between the left channel's 10dB per step attenuator and its 2dB per step attenuator. The right channel does not require a buffer.

After being level adjusted by the attenuator, the selected audio is applied to the input of the master station's power amplifier IC15 which has a gain of 52dB. IC15 contains an internal muting circuit controlled by the Audio/Intercom Microcomputer IC8 via Q11. Applying a high logic level to the base of Q11 disables the Mute function. Removing the high logic level activates the Mute function.

QUIESCENT DC VOLTAGE

PIN	IC13	IC14	IC15	IC24
1	0	0	6.6V	5.8V
2	0	5.8V	15V	5.8V
3	0	5.8V	14.4V	5.8V
4	0	5.8V	0	0
5	5.5V	5.8V	.170V	5.8V
6	0	5.8V	0	5.8V
7	0	0	1V	5.8V
8	0	0	1V	11.6V
9	0	0		
10	0	0		
11	0	5.8V		
12	0	5.8V		
13	0	5.8V		
14	0	5.8V		
15	5.6V	5.8V		
16	0	11.6V		

Circuit Description



AM/FM RADIO (Refer to Main PC Board Schematic page 64)

The central component in the AM/FM Radio circuit is Tuner TU-1. The Phase Lock Loop IC19 controls TU-1 in accord with serial data received via the data clock and period lines from the Radio/Cassette Microcomputer IC1.

TU-1 is divided into AM and FM sections. A high logic level on pin 6 of IC19 applies power to the AM section through transistors Q14 and Q16. A high logic level on pin 7 of IC19 applies power to the FM section through transistors Q13 and Q15.

The radio signal enters TU-1 through the antenna inputs (pin 1 for FM and pin 8 for AM.) Inside TU-1 the radio signal is tuned, amplified, level adjusted, and mixed with the selected band's local oscillator thereby developing the band's intermediate frequency. At this stage a portion of the local oscillator's signal is fed to IC19 (pin 12 FM, pin 11 AM) where it is divided and compared with the reference oscillator. The difference between the divided local oscillator's frequency and the reference oscillator's frequency exits IC19 via pin 14 in the form of an error pulse. This pulse is applied to a low pass filter consisting of Q19 and Q20 where it is converted into a DC voltage and applied to pin 5 of TU-1. The DC voltage is then used to tune the RF amplifiers and local oscillators within TU-1. Changing the division rate of the local oscillator's frequency before it is compared with the reference oscillator's frequency in IC19 initiates radio tuning.

After being converted into an intermediate frequency, the AM signal is amplified, level adjusted, and converted into audio before it exits TU-1 from pin 15.

The FM IF signal exits TU-1 from pin 7 and is applied to IC18 where it is amplified, level adjusted, and converted into audio. The FM audio signal exits IC18 from pin 15.

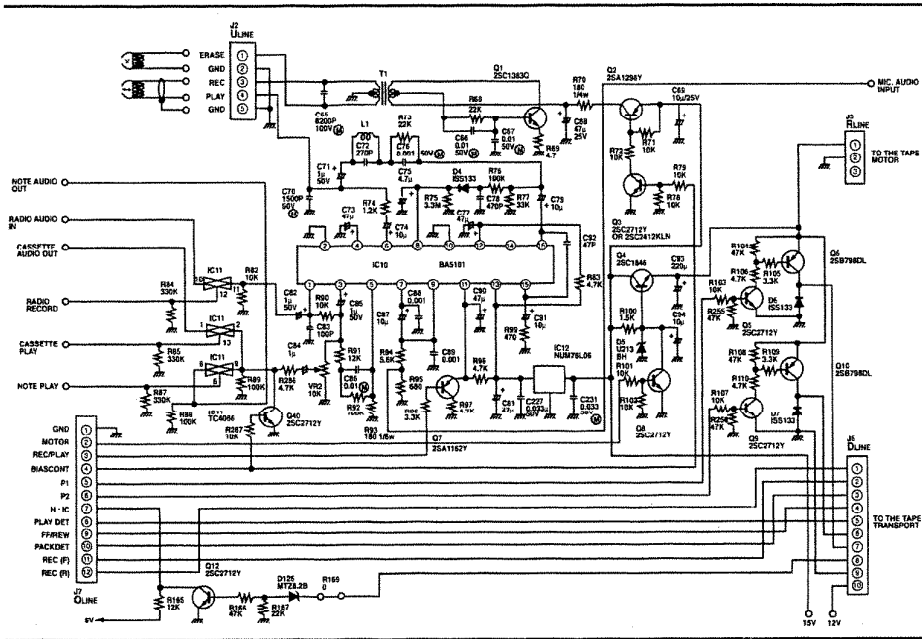
The radio audio then passes through a low pass filter and buffer (Q21) before being applied to the radio listen gate in IC5.

A strong station stop signal is generated by the AM and FM section whenever a strong station is received. In both the AM and FM circuits, a normally high strong station stop line is pulled low during station tuning. When a strong station is detected or station tuning has stopped, the line goes high. The AM stop signal originates from pin 10 of TU-1 and is applied to D12. The FM stop signal originates from pin 16 of IC18 and is applied to D13. Both signals are level adjusted by Q17 and Q18 before being supplied to the Radio/Cassette Microcomputer IC1.

NOTE: Care should be taken when measuring voltages on the pins of IC18. A short between pins could permanently damage the device.

QUIESCENT DC VOLTAGE				
PIN	IC17	IC18	IC19	IC20
1	11.3V	.7V	2.5V	11.3V
2	0	4.3V	2.5V	0
3	7.9V	1.2V	5V	4.9V
4		2.2V	5V	
5		2.2V	5V	
6		2.2V	.9V	
7		0	.9V	
8		.02V	.9V	
9		5.7V	0	
10		4.2V	0	
11		5.7V	0	
12		.9V	2.5V	
13		0	0	
14		5.9V	0	
15		4.5V	0	
16		.17V	4.9V	
17		10.9V		
18		10.8V		
19		0		
20		.7V		

Circuit Description



QUIESCENT DC VOLTAGE		
PIN	IC10	J7
1	0	0
2	0	4.9V
3	2.3V	0
4	.5V	0
5	0	0
6	.5V	0
7	.5V	0/5.6V
8	0	5.6V
9	0	5.6V
10	0	5.6V
11	2V	5.6V
12	5.9V	5.6V
13	5.9V	
14	0	
15	.4V	
16	.9V	

CASSETTE DECK (Refer to Main PC Board Schematic page 64)

The central component of the cassette deck circuitry is IC10. It is utilized in both the Record and Playback modes. In the record mode audio enters IC10 through pin 7 (mic recording) or pin 1 (radio/source recording.) It is amplified, level adjusted, and exits IC10 through pin 16. The audio then passes through an EQ network and notch filter before being applied to the Record/Playback head. A bias oscillator connected to the opposite side of the Record/Playback head provides the necessary biasing for the recording. A portion of the bias oscillator is also applied to the Erase Head.

During playback, audio from the Record/Playback head is applied to pin 6 of IC10. The audio is amplified, equalized, and leaves IC10 through pin 3 where it is connected to the Note and Cassette Audio gates through the Playback Audio Trimpot VR2.

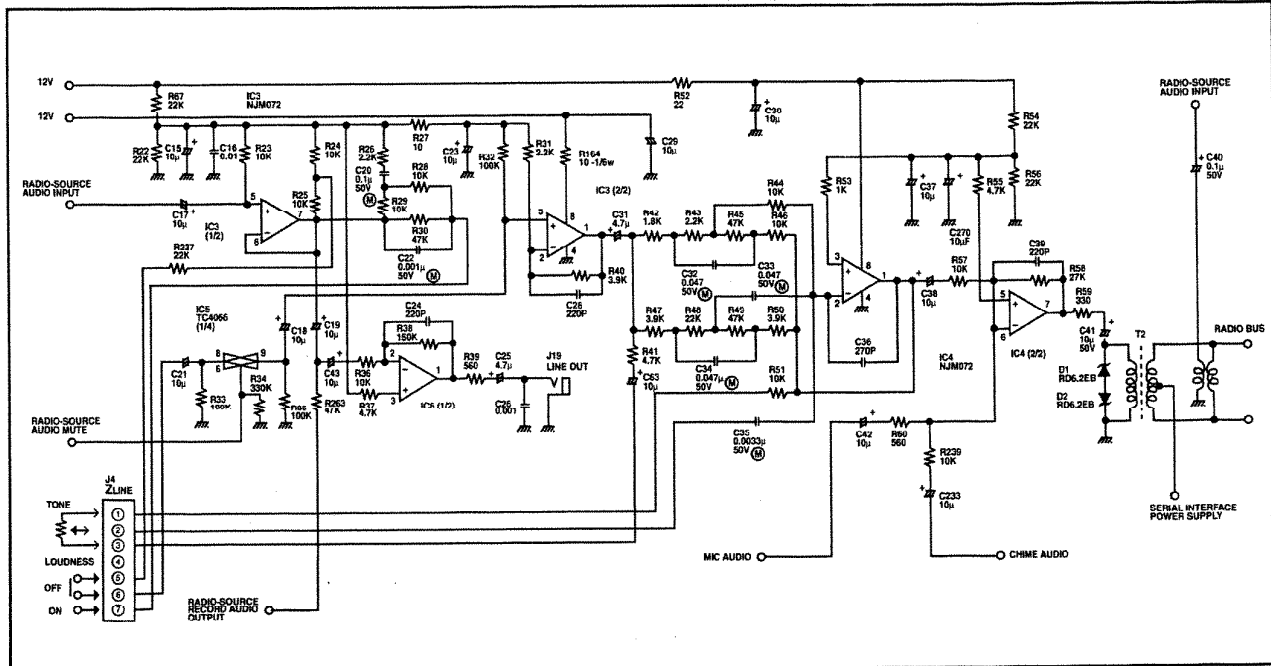
Cassette deck control is managed by the Radio/Cassette Microcomputer IC1. Connector J7 on the Main PC Board contains most of the control and feedback lines used by IC1 to control the cassette deck. The following is a description of those lines.

- Pin 1:** **GND.** Ground.
- Pin 2:** **MOTOR.** Tape transport motor control. A low logic level activates the tape transport motor through Q8 and Q4.
- Pin 3:** **PLAY/RECORD.** Play or Record mode selection of IC10. A high logic level activates the Record mode through Q7.
- Pin 4:** **BIASCONT.** Bias Oscillator control. A high logic level activates the bias oscillator through Q2 and Q3.

- Pin 5:** **P1.** Tape transport Play/Record solenoid control. Duration of the pulse applied to the solenoid determines tape direction.
- Pin 6:** **P2.** Tape transport Fast Forward/Rewind solenoid control. Duration of pulse applied to the solenoid determines tape direction.
- Pin 7:** **H-IC.** Reel positioning sensor. Provides 2 pulses for each 360° rotation of the reel located on the right side of the tape transport.
- Pin 8:** **PLAY DET.** Play detection normally at a high logic level changes to a low logic level when the Record/Play head is engaged.
- Pin 9:** **FF/REW.** Fast Forward/Rewind detection normally at a high logic level changes to a low logic level when Fast Forward or Rewind is engaged.
- Pin 10:** **PACKDET.** Cassette tape detection normally at a high logic level changes to a low logic level when a cassette tape is placed in the tape transport.
- Pin 11:** **REC (F) >.** Record prevention knockout detection.
- Pin 12:** **REC (R) <.** The logic level is low when knockouts are in place and high when they have been removed.

NOTE: If the microcomputer detects an error in the cassette deck's operation, the microcomputer will disable the cassette deck's motor and keyboard. This condition will be indicated by the flashing of both direction LEDs. The error indication can be disabled by pressing the direction key; however, it will return if the error is not corrected.

Circuit Description



TONE/LOUDNESS CONTROL (Refer to Main PC Board Schematic page 64)

Radio-source audio enters the Tone Control circuit through a buffer amplifier consisting of the No. 1 amplifier in IC3. The audio from the buffer is applied to the following circuits:

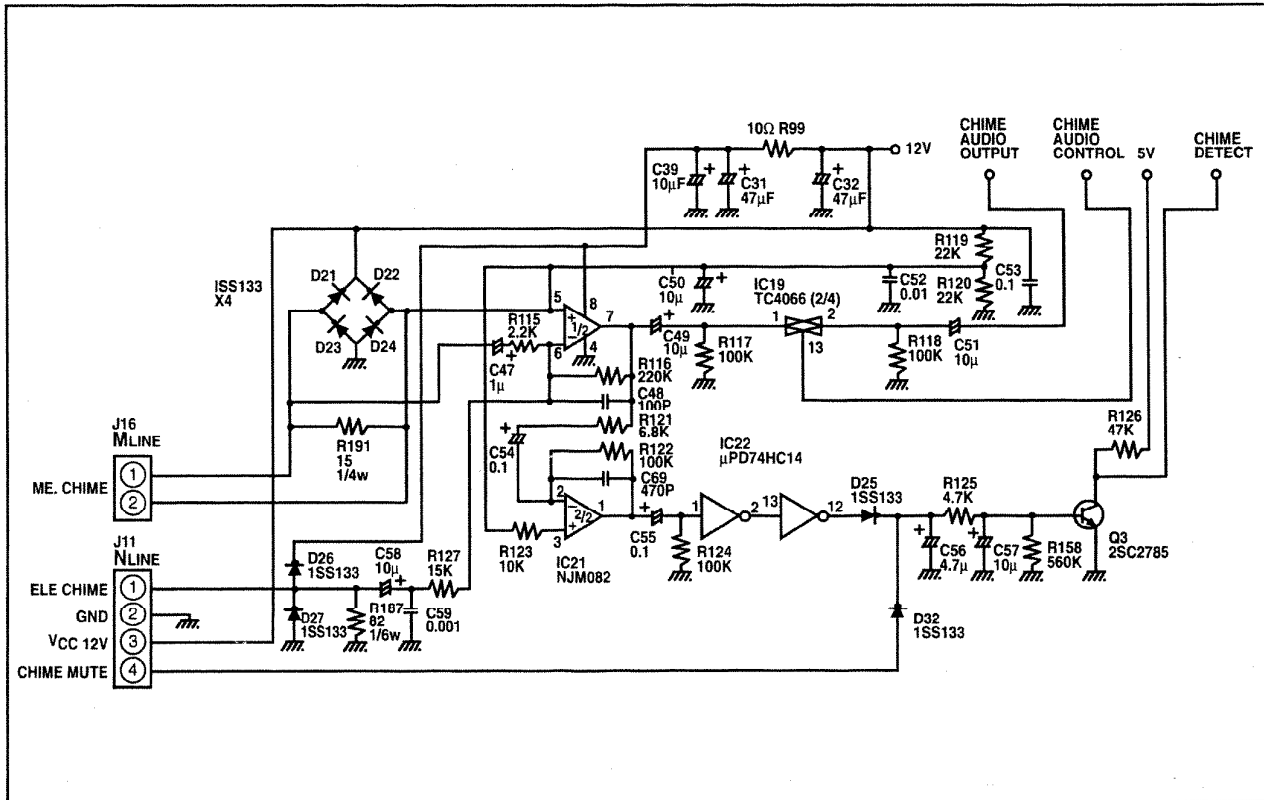
- Line Output Amplifier:** Comprised of the No. 1 amplifier in IC6. The line output amplifier provides low level audio to the line output connector.
- Cassette Deck Radio-Source Audio Record Output:** Provides unequalized radio-source audio to the cassette deck for recording.
- Loudness Filter Bypass Attenuator:** Selected when the loudness switch is in the OFF position. The bypass attenuator compensates for the gain reduction incurred by the loudness filter.
- Loudness Filter:** Selected when the loudness switch is in the ON position. The loudness filter compensates for the loss of bass and treble response the human ear has when listening to audio at low volume levels.

The audio from the loudness circuit is applied to the system audio mute gate consisting of the No. 3 audio gate in IC5. The system audio mute gate mutes the Radio-source audio throughout the system whenever the chime is activated. After passing through the system audio mute gate, the audio is applied to the tone control's pre-amplifier consisting of the No. 2 amplifier in IC3. The output from the pre-amplifier is supplied to the tone control's filter and main amplifier consisting of the No. 1 amplifier in IC4. The output from the tone control's main amplifier is applied to the radio bus driver amplifier comprised of the No. 2 amplifier in IC4. Chime audio and microphone audio during monitor is also applied to the input of the radio bus driver amplifier which connects to the radio bus through audio Transformer T2.

QUIESCENT DC VOLTAGE

PIN	IC3	IC4	IC5	IC6
1	5.6V	5.6V	0	5.6V
2	5.6V	5.6V	0	5.6V
3	5.6V	5.6V	0	5.6V
4	0	0	0	0
5	5.6V	5.6V	0	5.6V
6	5.6V	5.6V	5.5V	5.6V
7	5.6V	5.6V	0	5.6V
8	11.6V	11.2V	0	11.2V
9			0	
10			0	
11			0	
12			0	
13			0	
14			5.6V	

Circuit Description



CHIME INPUT (Refer to Control PC Board Schematic 2/2 page 62)

Audio from the electronic chime and electro-mechanical chime enters the circuit through J11 and J16. The chime audio is amplified by the No. 1 Amplifier in IC21 and sent to the chime audio listen gate in IC19.

Chime audio is permitted to pass through the chime audio listen gate when the Audio/Intercom Microcomputer IC8 detects a low logic level on its chime mute line. When this condition occurs, the microcomputer mutes the radio-source audio and activates the chime audio listen gate. Chime audio passes through the chime audio listen gate and is applied to the radio bus driver amplifier on the Main PC Board. The chime audio is then transmitted to all stations in the system over the radio bus.

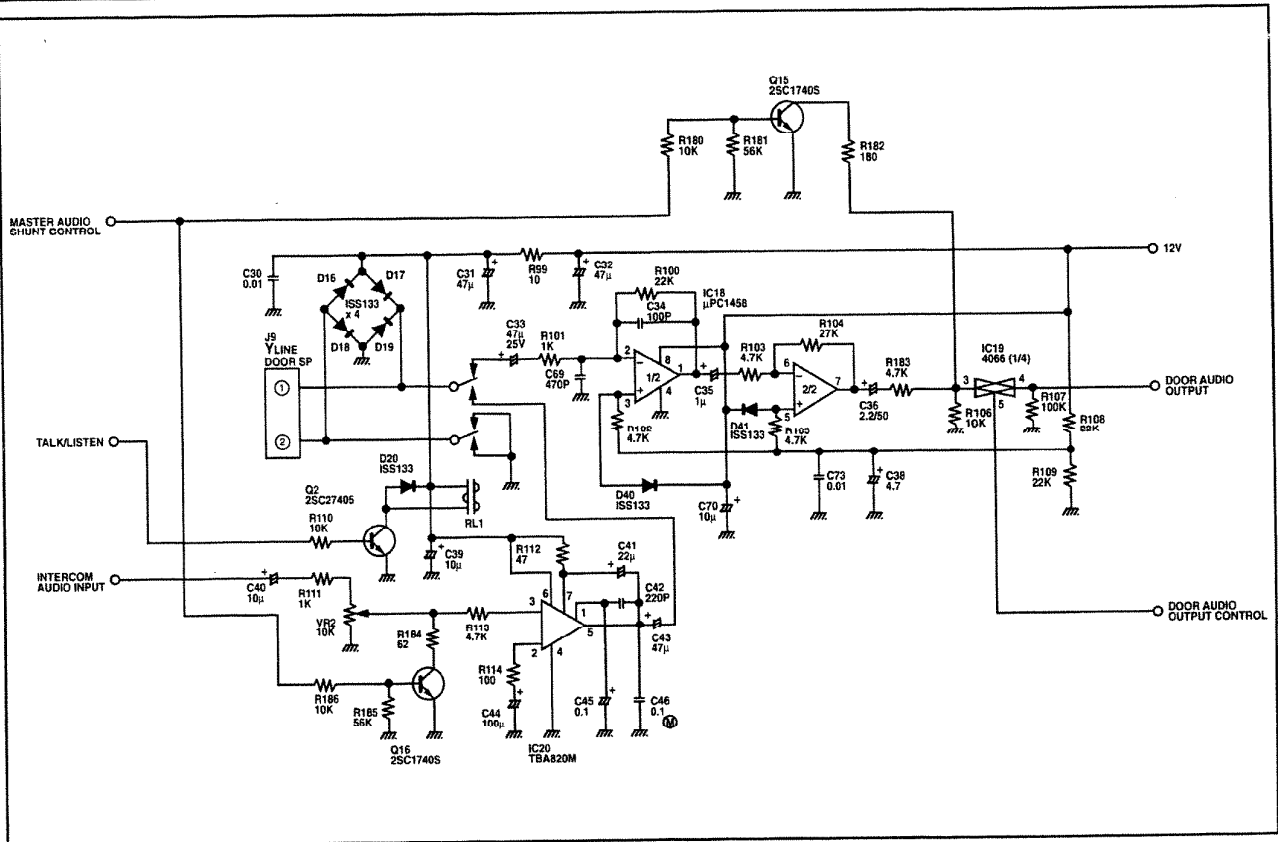
The microcomputer's chime mute line is pulled low by applying a high logic level to the base of transistor Q3. The NuTone IA-28 and IA-29 chime modules which connect to the electronic chime input connector internally generate the signal required to turn on transistor Q3. Chimes connected to the electro-mechanical chime input, however, rely on a chime audio detection circuit to generate the required signal. Comprised of the No. 2 amplifier in IC21 and the No. 1 and No. 6 schmitt trigger inverters in IC22, the detection circuit generates a mute signal using the chime audio received from the No. 1 amplifier in IC21. The mute signal is applied to the base of transistor Q3, thus initiating the chime audio listen mode described above.

Both chime inputs have been protected from lightning by diode clamps. D26 and D27 protect the electronic chime audio input. D21 through D24 protect the electro-mechanical chime audio input.

QUIESCENT DC VOLTAGE

PIN	IC19	IC21	IC22
1	0	5.8V	0
2	0	5.8V	5.6V
3	0	5.8V	0
4	0	0	5.6V
5	0	5.8V	0
6	0	5.8V	5.6V
7	0	5.8V	0
8	0		5.6V
9	0		0
10	0		5.6V
11	0		0
12	0		0
13	0		5.6V
14	5.6V		5.6V

Circuit Description



DOOR INPUT/OUTPUT (Refer to Control PC Board Schematic 2/2 page 62)

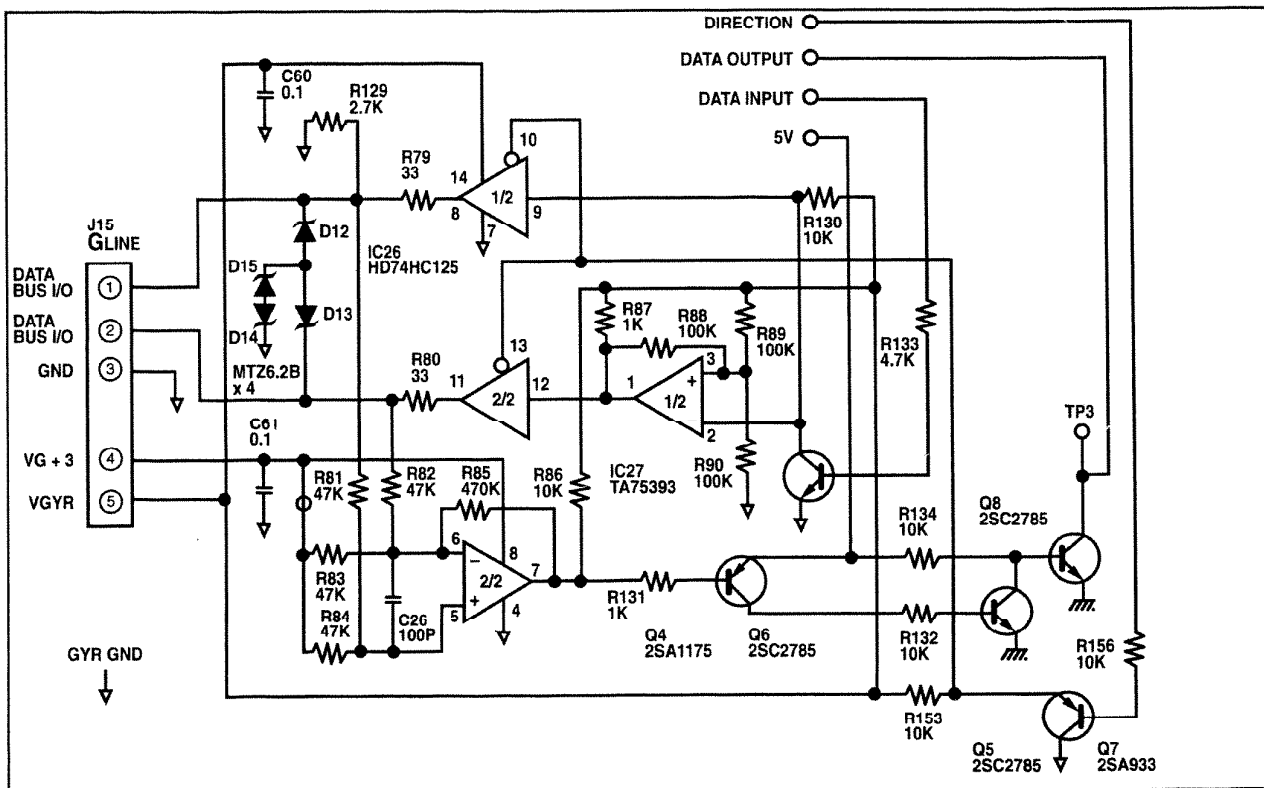
When a Door Call is activated, the door audio enters the Master Station through the Door Speaker terminals located on the Control PC Board. The door audio is applied to the input of the door speaker preamplifier via Door Relay RL1. The two-stage door speaker preamplifier consists of the No. 1 and No. 2 amps in IC18. Activation of a Door Call applies a high logic level to pin 5 of IC19 which couples the output of the door speaker preamplifier to the input of the intercom audio interface circuit located on the Main PC Board.

Activating a Door Talk command removes the high logic level applied to pin 5 of IC19 and applies five volts to the base of Q2 which switches the door relay to the Talk mode. Audio from the intercom audio interface circuit is applied to the Door Output Audio Trimpot VR2 before being supplied to the Door Speaker Power Amplifier IC20. The audio output from IC20 is then supplied to the door speaker via the Door Relay RL1.

Since communication between the door and the master is direct and unaffected by intercom bus loading, the input and output audio levels of the door circuit need to be reduced when communicating with the master station. This is accomplished by activating Q15 and Q16 which install resistive shunts to the door preamplifier's output and the door power amplifier's input. Q15 and Q16 are activated when the door call is initiated at the master station.

QUIESCENT DC VOLTAGE			
PIN	IC18	IC19	IC20
1	5.8V	0	.6V
2	5.8V	0	.5V
3	5.8V	0	0
4	0	0	0
5	5.8V	0	5.6V
6	5.8V	0	11.6V
7	5.8V	0	11.5V
8	11.6V	0	7.2V
9		0	
10		0	
11		0	
12		0	
13		0	
14		5.6V	

Circuit Description



SERIAL DATA INTERFACE (Refer to Control PC Board Schematic 2/2 page 62)

The microcomputer within each station communicates with the other stations through the black wires via a serial data interface circuit. The data transmitted by the serial data interface circuit is asynchronous and has a baud rate of 1,000 bits per second. A typical command transmission is 32 bits long and lasts for 32 milliseconds. The data is transmitted inversely by the interface over the black pair of wires; that is, the data on the black wire is the opposite logic level of the data on the black/white wire. The description that follows pertains to the master station's serial data interface circuit. The remote station's interface functions in a similar manner.

Transmit Data: A high logic level applied to the base of Q7 from the Audio/Intercom Microcomputer IC8 pulls the control pins low to the No. 1 and No. 2 buffers in IC26. This causes the output of the buffers to switch from a high impedance state to an active state where the output follows the input. Command data from the microcomputer is inverted by Q6 and applied to the input of the No. 1 buffer in IC26 which transmits the data to the black/white wire. The inverted data from Q6 is also applied to the inverting input of the No. 1 amplifier in IC27. This inverts the data again before supplying it to the No. 2 buffer in IC26 which transmits the data to the black wire. After the data transmission has been completed, the high logic level applied to Q7 is removed returning the buffers' control lines to a high logic level thus switching the buffers' outputs from an active state to a high impedance state.

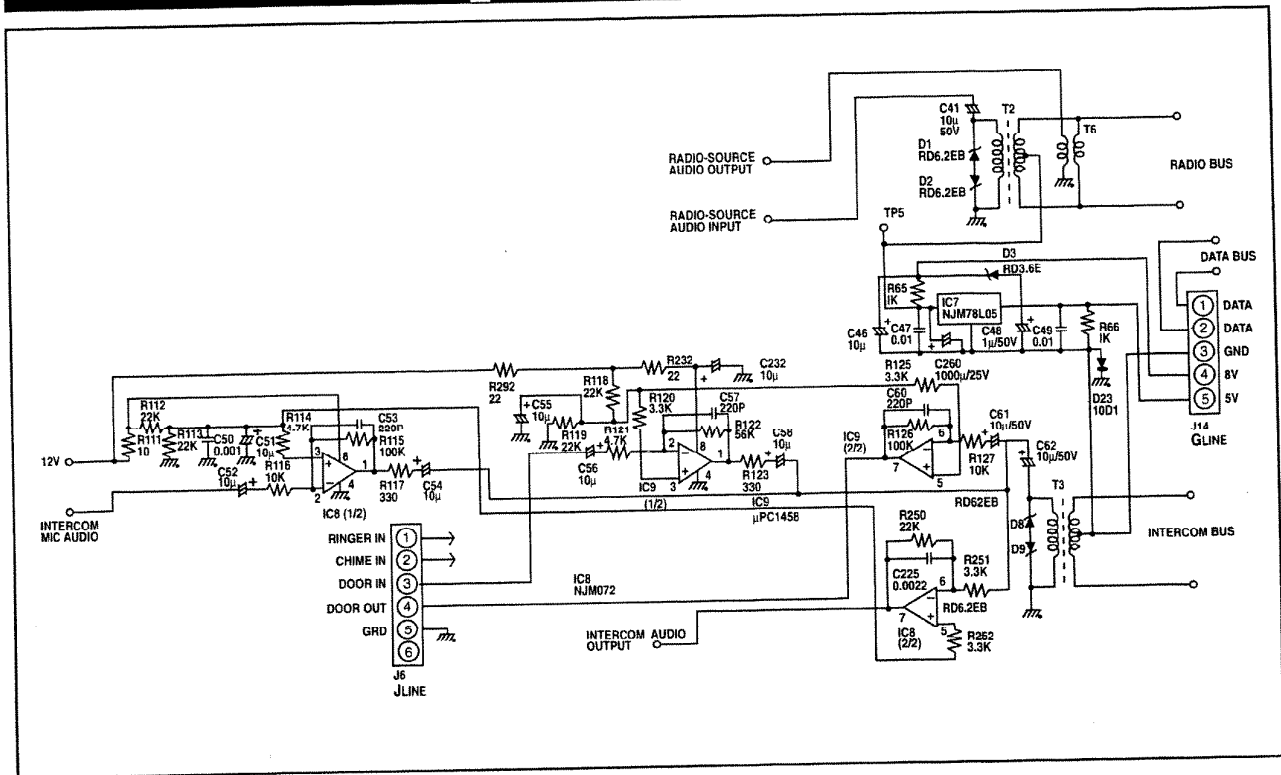
Receive Data: The data from the black pair of wires is applied to the inputs of the No. 2 amplifier in IC27. The difference between the voltages applied to the amplifier's inputs is developed on its output and fed to Q4, Q5 and Q8 where it is level adjusted and inverted before being applied to the Audio/Intercom microcomputer.

QUIESCENT DC VOLTAGE*

PIN	IC26	IC27
1	.7V	6.4V
2	.7V	.7V
3	.7V	4.5V
4	.7V	.7V
5	.7V	5.6V
6	.7V	7.8V
7	.7V	.9V
8	1.5V	9.8V
9	.7V	
10	5.6V	
11	6.9V	
12	6.4V	
13	5.6V	
14	6.4V	

* Measured with one remote connected

Circuit Description



INTERCOM AUDIO INTERFACE/SERIAL DATA

INTERFACE POWER SUPPLY (Refer to Main PC Board Schematic page 64)

Door and Master Station intercom audio is transmitted and received by the intercom audio interface circuit.

Receiving Audio

Audio from the intercom bus is supplied through transformer T3 to the input of the door intercom pre-amplifier and to the input of the master station intercom pre-amplifier.

Consisting of the No. 2 amplifier in IC9, the door intercom pre-amplifier provides intercom audio to the door input/output circuit through connector J6. The master station intercom pre-amplifier, consisting of the No. 1 amplifier in IC8, provides intercom audio to the master station's attenuator and power amplifier circuits.

Transmitting Audio

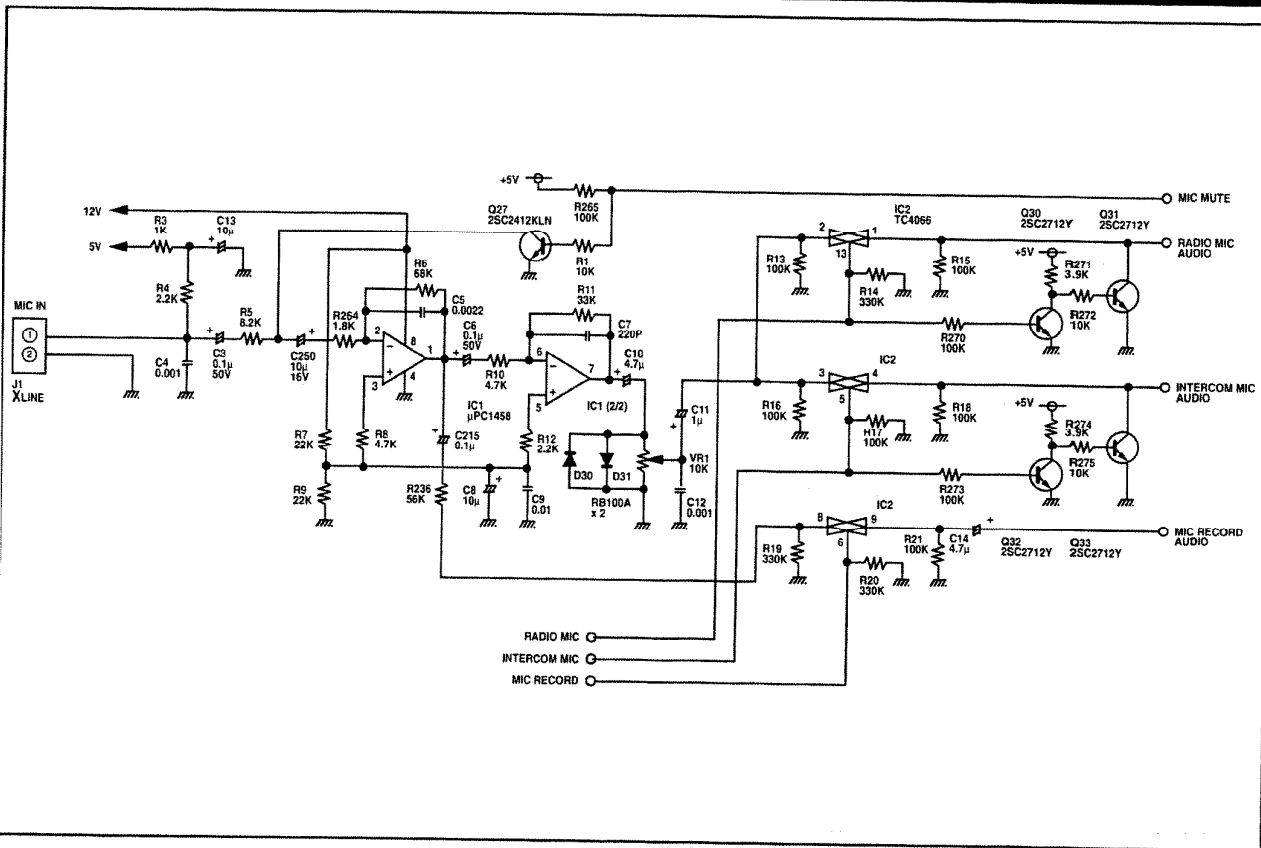
Audio from the door input/output circuit is supplied through connector J6 to the door intercom bus driver circuit consisting of the No. 1 amplifier in IC9. The master station microphone pre-amplifier supplies audio to the master station intercom bus driver circuit consisting of the No. 2 amplifier in IC8. The output from both driver circuits is coupled to the intercom bus through transformer T3.

QUIESCENT DC VOLTAGE			
PIN	IC7	IC8	IC9
1	18.2V	5.8V	5.8V
2	.7V	5.8V	5.8V
3	6.6V	5.8V	5.8V
4		0	0
5		5.8V	5.8V
6		5.8V	5.8V
7		5.8V	5.8V
8		11.6V	11.6V

Serial Data Interface Power Supply

The power supply for the serial data interface circuit is also shown in the schematic above. Power is received from the radio bus and intercom bus by the center tap on each of the audio transformers. The voltage from the transformers is regulated by IC7 which provides a 5-volt output. An 8-volt supply is also provided by Zener Diode D3. The 5-volt and 8-volt supplies are applied to the serial data interface circuit through connector J14.

Circuit Description



MICROPHONE PRE-AMPLIFIER (Refer to Main PC Board Schematic page 64)

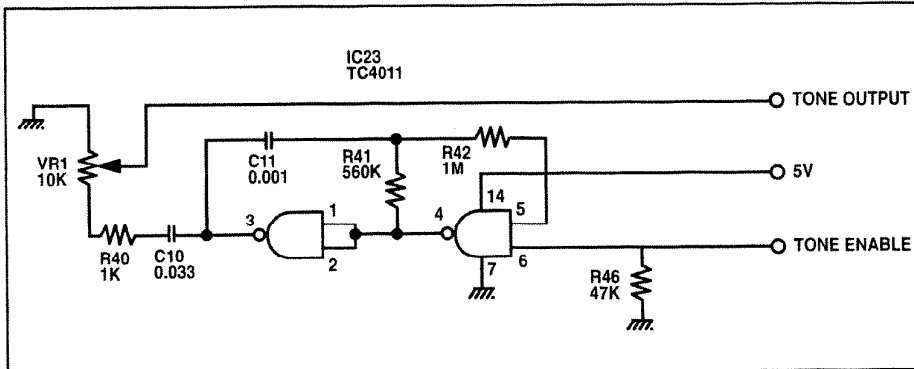
The microphone connects to the Master Station's Main PC Board through connector J1. A five-volt bias voltage is supplied through J1 to the output of the microphone. The output audio from the microphone is coupled to the first stage of the microphone preamplifier consisting of the No. 1 amp in IC1. Microphone audio from the first stage is coupled through IC2 to the cassette deck where it is used for mic recording. This audio path is selected when a high logic level is applied to pin 6 of IC2.

Monitor and intercom communications require additional amplification. This is provided by the No. 2 amp in IC1. The audio output from this amplifier is held below 7 volt by a diode limiter installed across the microphone volume trimpot VR1. The mic audio is then routed to the radio bus by applying a high logic level to the radio talk gate (pin 13 IC2) or to the intercom bus by applying a high logic level to the intercom talk gate (pin 5 IC2).

Transistor shunts have been installed on the input and outputs of the microphone preamplifier circuit to prevent microphone audio leakage to the non-selected audio output.

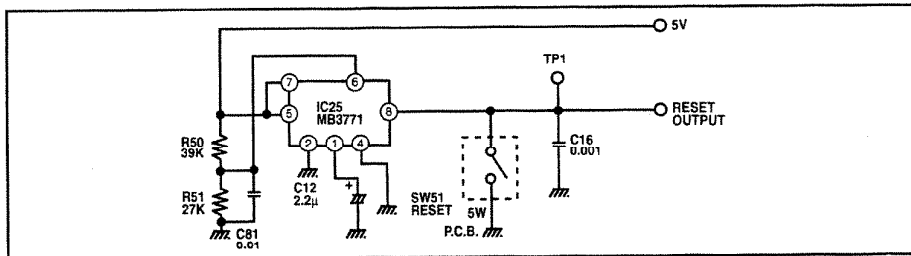
QUIESCENT DC VOLTAGE		
PIN	IC1	IC2
1	5.6V	0
2	5.6V	0
3	5.6V	0
4	0	0
5	5.6V	0
6	5.6V	0
7	5.6V	0
8	11.6V	0
9		0
10		0
11		0
12		0
13		0
14		5.6V

Circuit Description



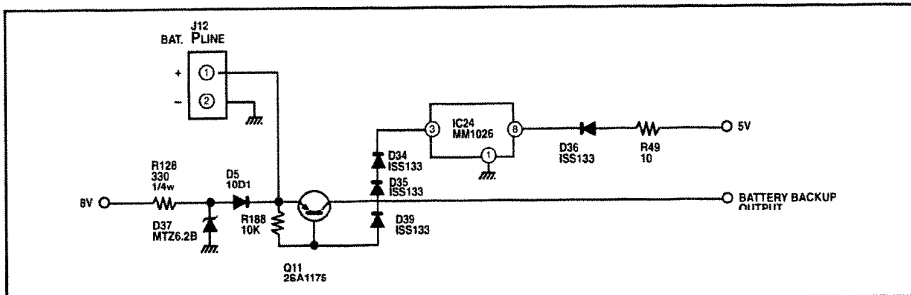
TONE GENERATOR (Refer to Control PC Board Schematic 2/2 page 62)

The tone generator is comprised of 2 NAND gates connected to form an oscillator. A high logic level from the audio/intercom microcomputer applied to the tone enable input activates the oscillator. The output tone from the oscillator is applied to the volume attenuator IC14 through the ringer volume trimpot VR1.



RESET (Refer to Control PC Board Schematic 2/2 page 62)

IC25 in the reset circuit monitors the 5V supply and compares it to an internally developed reference voltage. When the 5V supply drops below 2.7 volts, a reset signal is sent to the microcomputers to clear any incorrect data stored during the low voltage condition.



BATTERY BACKUP (Refer to Control PC Board Schematic 2/2 page 62)

The main component of the battery backup circuit is IC24. Its function is to monitor the 5V supply and activate the backup battery when the supply voltage falls below 3 volts. IC24 activates the backup battery by pulling pin 3 low, thus forward biasing the emitter-base junction of Q11. The backup supply voltage from the collector of Q11 is then supplied to the RAM and both microcomputers. When main power is reinstated, Q11 is turned off and a charge voltage is supplied to the battery through R128, D37 and D5.

QUIESCENT DC VOLTAGE

PIN	IC23
1	5.6V
2	5.6V
3	0
4	5.6V
5	4.8V
6	0
7	0
8	0
9	0
10	5.6V
11	5.6V
12	0
13	0
14	5.6V

QUIESCENT DC VOLTAGE

PIN	IC25
1	1.6V
2	0
3	0
4	0
5	5V
6	2V
7	5V
8	5V

QUIESCENT DC VOLTAGE

PIN	IC24
1	0
2	0
3	5V/0
4	0
5	0
6	5V
7	2V
8	5V

Troubleshooting

INTERCOM TROUBLESHOOTING

A properly functioning master station is essential to intercom communication, and it should be the first station checked when a problem with intercom communication exists. Checking the master station is best accomplished by connecting a remote station to the master station via a short piece of NuTone IW-6 cable and performing the operation checkout procedure on page 11 of this manual. If the problem still exists during the operational checkout, steps should be taken to localize the problem to specific C Boards on the master station. If, however, the problem is not present during the one station operational checkout, system troubleshooting will be required.

SYSTEM TROUBLESHOOTING

The objective of system troubleshooting is to localize the problem to a specific station or cable run. This is accomplished by connecting individual cable runs or stations to the master station one at a time and checking for proper operation after each one is installed. The location of the problem will be identified when the addition of a cable run or stations causes improper operation.

IMPORTANT: Always remove the main power from the system when connecting or disconnecting remote stations. Failure to do so may result in permanent damage to the system.

The following information is provided to assist the technician in localizing intercom problems.

PROBLEMS CAUSED BY MISWIRING

PROBLEM	MISWIRING						
	BLACK-BLACK/WHITE			RED-RED/WHITE		ORANGE-ORANGE/WHITE	
	SHORT	REVERSED	OPEN	SHORT	OPEN	SHORT	OPEN
No communication	●		●				
Sporadic communication	●						
No communication, busy led remains on after end call		●					
No function from remote station					●		●
No radio/source audio				●			
No intercom audio						●	
Weak radio/source audio				●			
Weak intercom audio						●	

MASTER STATION'S VOLTAGE BETWEEN ROUGH-IN GROUND AND INTERCOM CONNECTOR'S TERMINALS. NO REMOTE STATIONS CONNECTED

BLACK/WHITE	BLACK	RED/WHITE	RED	ORANGE/WHITE	ORANGE
1V	6.9V	19V	19V	.7V	.7V

JTE: Allow 10% tolerance for voltage and resistance measurements.

MASTER STATION'S RESISTANCE BETWEEN INTERCOM CONNECTOR'S TERMINALS. RADIO INTERCOM TRIMPOT ADJUSTED TO MAX. NO REMOTES.

BLACK-BLACK/WHITE TERMINALS	RED-RED/WHITE TERMINALS	ORANGE-ORANGE/WHITE TERMINALS
188K Ω	30 Ω	58 Ω

Troubleshooting

REMOTE STATION RESISTANCE BETWEEN TERMINALS

BLACK-BLACK/WHITE TERMINALS	RED-RED/WHITE TERMINALS	ORANGE-ORANGE/WHITE TERMINALS
188K Ω	64 Ω	64 Ω

SERVICING THE NUTONE IM-5006 RADIO INTERCOM SYSTEM

PC BOARD REPLACEMENT

Defective PC board replacement is the recommended method for correcting problems within the NuTone IM-5006 System. Problems can usually be localized to a specific PC Board by symptom observation and DC voltage measurement.

Replacing defective PC Boards is also the most practical approach to field repair the IM-5006 system.

COMPONENT LEVEL REPAIR

The success of component level repair will depend largely on the experience of the technician and the tools available to him or her. The technician must be familiar with surface mount components and the proper soldering techniques required for these components. The technician should also be familiar with the schematics and the circuit descriptions contained within this manual. It is assumed throughout this manual that the technician is informed on the proper use of a multimeter and oscilloscope.

NOTE: Before undertaking component level repair, the technician should be advised that NuTone does not supply board level components for the IM-5006 System; however individual PC Boards are available.

TROUBLESHOOTING

Whether the selected repair approach is PC Board replacement or component level repair, the first step in troubleshooting the IM-5006 Radio Intercom is symptom observation; that is, identifying the operations or functions that are inconsistent with normal operation.

Often a malfunctioning circuit will exhibit many symptoms. Finding the common circuit associated with the symptoms will usually indicate the problem area. For instance, if the AM/FM radio and the cassette deck are not functioning, the problem will most likely exist in the circuit associated with the Radio/Cassette Microcomputer since it is common to both the radio and cassette circuits. Once the problem has been localized to a particular circuit by symptom observation, the PC Board containing the circuit can be replaced or the problem can be isolated to a specific component.

After the repairs have been made to the system, a complete operational checkout should be performed to confirm the system is functioning correctly.

The following Troubleshooting Guide provides possible solutions to problems which may be encountered with the IM-5006 Radio Intercom System.

IM-5006 TROUBLESHOOTING GUIDE

PROBLEM	MEASURE/CHECK	CORRECT/RESULT	IF NOT REPLACE
1. Master station functions. No function from remote stations	1a. Check IW-6 connections at master and remote stations	1a. Should be properly installed	
	1b. Check the AC voltage on the 4011 transformers with the power supply leads from the master station disconnected	1b. A minimum of 24vAC should be measured on the secondary of the transformers	1b. Transformer
	1c. With both power supply leads connected measure the voltage between ground and the red and red/white screws of the 6-pin intercom connector J13 with no remote stations connected	1c. Should measure 19v approximately	1c. Main PC Board

Troubleshooting

PROBLEM	MEASURE/CHECK	CORRECT/RESULT	IF NOT REPLACE
1. Master station functions. No function from remote stations (continued)	1d. With both power supply leads connected measure the voltage between ground and the red and red/white screw terminals of the 6-pin intercom connector J13 with all remote stations connected.	1d. Should measure between 19v and 18v	1d. Isolate the problem area by removing remote speaker or cable runs, from the system until the correct voltage is measured. IMPORTANT: Always remove the main power from the system when connecting or disconnecting remote stations. Failure to do so may result in permanent damage to the system.
2. Master station not functioning. Remote stations function, however cannot preform intercom communication	2a. Check the AC voltage on the 401T transformers with the power supply leads from the master station disconnected	2a. A minimum of 24vAC should be measured on the secondary of the transformers	2a. Transformer
	2b. Measure the voltage on the pins of connector J18 located on the Main PC Board under the heat sink with the plug disconnected	2b. Should measure approximately: Pin J18 1 5v 2 5v 3 12v 4 0 5 8v 6 0	2b. Main PC Board
	2c. Measure the voltage on the pins of connector J18 located on Main PC Board under the heat sink with the plug connected	2c. Should measure approximately: Pin J18 1 5v 2 5v 3 12v 4 0 5 8v 6 0	2c. Control PC Board
3. No radio-source audio from the master station. Remote stations ok	3a. Check blue jumper wire between audio transformer T6 and IC24 (on units with serial number higher than 2110000)	3a. Should be properly installed	
	3b. Check connectors J5 and J10 on Main PC Board	3b. Should be properly installed	
	3c. Check connector J7 and J13 on Control PC Board	3c. Should be properly installed	
	3d. Measure the voltage on pin 4 of J10 Main PC Board	3d. Should measure approximately 5v	3d. Control PC Board
	3e. Measure the voltage on pin 2 of J5 Main PC Board	3e. Should measure approximately 5v	3d. Control PC Board. If correct replace Main PC Board

Troubleshooting

PROBLEM	MEASURE/CHECK	CORRECT/RESULT	IF NOT REPLACE
4. No chime audio from electronic chime module. All other functions ok. Radio mutes at all stations when chime is activated.	4a. Check connector J6 on Control PC Board	4a. Should be properly installed	
	4b. Check connector J6 on Main PC Board	4b. Should be properly installed	
	4c. Measure the voltage on pins 5, 6 and 7 of IC21 on Control PC Board	4c. Voltage on all 3 pins should measure approximately 5.8v	4c. Control PC Board
	4d. Measure the Voltage on Pins 1, 2 and 3 of IC21 on Main PC Board	4c. Voltage on all 3 pins should measure approximately 5.8v	4c. Main PC Board
5. Display does not light	5a. Check connector J10 on Control PC Board	5a. Should be properly installed	
	5b. Check display cable located above the cassette deck, look for pinched or cut wires	5b. No pinched or cut wire should be found	5b. Repair wires or replace Display PC Board
	5c. Measure the voltage on pin 2 of J10 on Control PC Board	5c. Should measure approximately 5v	5c. If correct replace Display PC Board. If incorrect go to next step
	5d. Measure the voltage on pin 2 of J10 on Control PC Board with plug disconnected	5d. Should measure approximately 5v	5d. If correct replace Display PC Board. If incorrect go to next step
	5e. Measure the voltage on pin 1 of the connector J18 located on the main PC Board under the heat sink with the plug disconnected	5e. Should measure approximately 5v	5d. If correct replace Control PC Board. If incorrect replace Main PC Board
6. Display has scramble characters	6a. Check connector J10 on Control PC Board	6a. Should be properly installed	
	6b. Check display cable located above the cassette deck, look for pinched or cut wires	6b. No pinched or cut wires should be found	6b. Repair wire or replace Display PC Board
7. Display has scramble characters when intercom station names are recalled from memory	7. Recall stored intercom station names by pressing the intercom key	7. The display should not have scrambled characters	7. Replace Control PC Board
8. Volume will not change at master station. All other functions ok	8. Check connector J10 on the Main PC Board and connectors J13 on the Control PC Board	8. Should be properly installed	8. If properly installed replace Main PC Board

Troubleshooting

PROBLEM	MEASURE/CHECK	CORRECT/RESULT	IF NOT REPLACE
9. Cassette deck will not record from any audio source. Record LED lights and transport moves, however no audio is recorded	9a. Check connectors J2 and J7 on Control PC Board	9a. Should be properly installed	
	9b. Check connectors J7, J2 and J5 on Main PC Board	9b. Should be properly installed	
	9c. Measure voltage on J7 pin 3 Main PC Board during radio record	9c. Should measure approximately 5v	9c. Control PC Board
	9d. Measure voltage on J7 pin 4 Main PC Board during radio record	9d. Should measure approximately 5v	9c. Control PC Board
	9e. Unplug J2 on Main PC Board and measure the voltage on pin 2 during radio record	9e. Audio should measure approximately 2VP-P	9e. Master Main PC Board
	9f. Unplug J2 on Main PC Board and measure the voltage on pin 3 during radio record	9f. Should measure approximately 55VP-P	9f. Master Main PC Board
	9g. Unplug J2 on Main PC Board and measure the resistance between pins 2 and 3 on the plug	9g. Should measure approximately 450Ω	9g. Cassette Deck
10. No playback audio from cassette deck	10a. Check tape playback volume trimpot VR2 for proper adjustment	10a. Should be at max	
	10b. Check connector J7, J2 and J5 on Main PC Board	10b. Should be properly installed	
	10c. Check connector J2 and J7 on Control PC Board	10c. Should be properly installed	
	10d. Measure voltage on pin 9 of J5 Main PC Board during tape play	10d. Should measure approximately 5.6v	10d. Control PC Board
	10e. Measure voltage on pin 3 of J7 Main PC Board during tape play	10e. Should measure 0VDC	10e. Control PC Board
	10f. Unplug J2 on Main PC Board and measure the resistance between pin 2 and 3 on the plug	10f. Should measure approximately 450Ω	10f. Cassette Deck
	10g. Measure the voltage on pin 2 of IC11 during tape playback	10g. Should measure approximately 100mvP-P	10g. Main PC Board

Troubleshooting

PROBLEM	MEASURE/CHECK	CORRECT/RESULT	IF NOT REPLACE
11. Cassette deck continuously changes direction when play is engaged	11a. Check connectors J7 and J8 on Main PC Board	11a. Should be properly installed	
	11b. Check connector J2 on Control PC Board	11b. Should be properly installed	
	11c. Check connector on top of tape transport	11c. Should be properly installed	
	11d. Measure the voltage on pin 8 of J8 on Main PC Board while rotating the right reel in the cassette compartment by hand	11d. Voltage should change between 0V and 12V as the reel is turned	11d. Cassette Deck
	11e. Measure the voltage on pin 7 of J7 on Main PC Board while rotating the right reel in the cassette compartment by hand	11d. Voltage should change between 0V and 5V as the reel is turned	11d. Main PC Board
12. Both direction LED's flash and cassette deck keys inoperable	12a. Check connectors J7 and J8 on Main PC Board	12a. Should be properly installed	
	12b. Check connectors J2 on Control PC Board	12b. Should be properly installed	
	12c. Check connector on the top of tape transport	12c. Should be properly installed	
	12d. Clean tape transport of any foreign material. Replace belts	12d. If condition persists	12d. Cassette Deck
13. Cassette deck's motor continuously runs	13a. Check connector J7 on Main PC Board	13a. Should be properly installed	
	13b. Check connector J2 on Control PC Board	13b. Should be properly installed	
	13c. Check voltage on pin 2 of J7 on Main PC Board after pressing the stop key	13c. Should measure approximately 5v	13c. If correct replace Main PC Board. If incorrect replace Control PC Board

Component Lead Identification

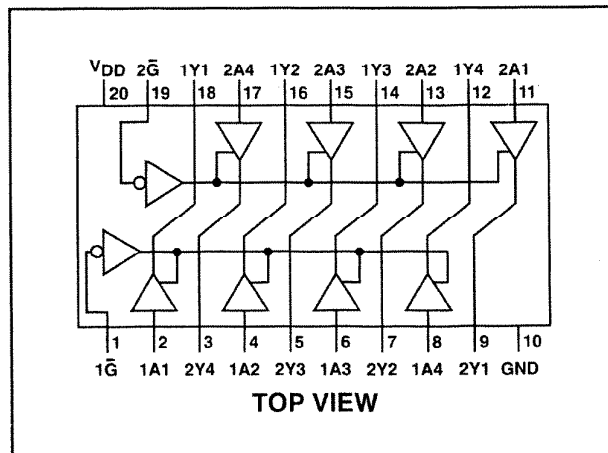
SCHEMATIC NO. IC5 – CONTROL PC BOARD

Part Number: 74HC244
Description: Octal Tri-State Buffer

TRUTH TABLE

1 \bar{G}	1A	1Y	2 \bar{G}	2A	2Y
L	L	L	L	L	L
L	H	H	L	H	H
H	L	Z	H	L	Z
H	H	Z	H	H	Z

H = High level, L = low level, Z = high impedance



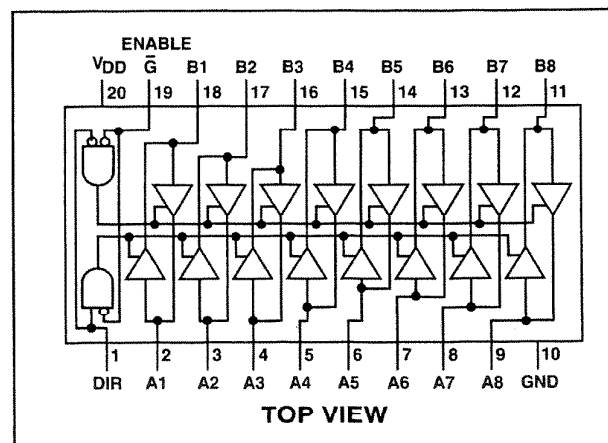
SCHEMATIC NO. IC4, 13, 14 – CONTROL PC BOARD

Part Number: 74HC245
Description: Octal Tri-State Transceiver

TRUTH TABLE

CONTROL INPUTS		OPERATION
\bar{G}	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

H = High level, L = low level, X = irrelevant



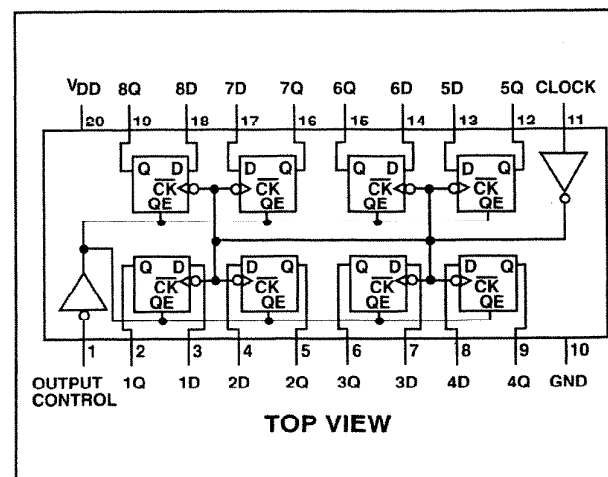
SCHEMATIC NO. IC2, 3, 9, 10, 12 – CONTROL PC BOARD

Part Number: 74HC374
Description: Octal D-Flip-Flop

TRUTH TABLE

OUTPUT CONTROL	CLOCK	DATA	OUTPUT
L	↑	H	H
L	↑	L	L
L	L	X	Q ₀
H	X	X	Z

H = High level, L = low level, X = don't care
↑ = transition from low-to-high, Z = high impedance state,
Q₀ = the level of the output before steady state input conditions were established



Component Lead Identification

SCHEMATIC NO.

IC26 – CONTROL PC BOARD

IC2 – REMOTE MAIN PC BOARD

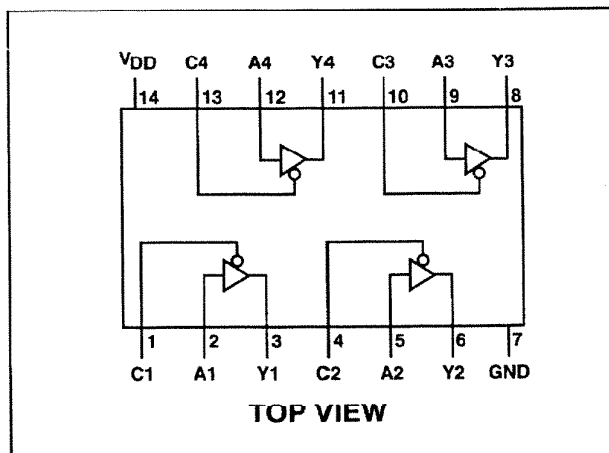
Part Number: 74HC125

Description: Tri-State Buffer

TRUTH TABLE

INPUTS		OUTPUT Y
A	C	
H	L	H
L	L	L
X	H	Z

Z = high impedance state



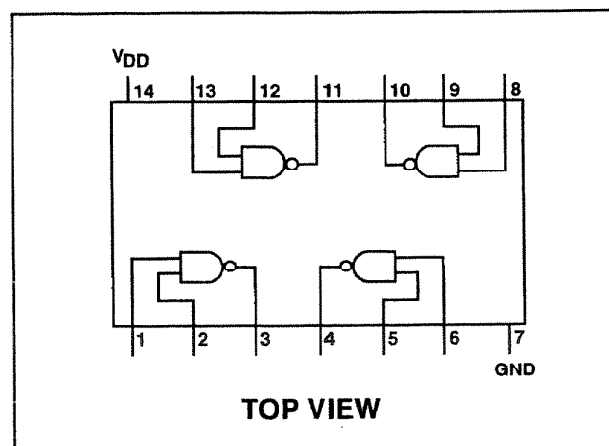
SCHEMATIC NO.

IC23 – CONTROL PC BOARD

IC4 – REMOTE MAIN PC BOARD

Part Number: TC4011

Description: NAND Gate

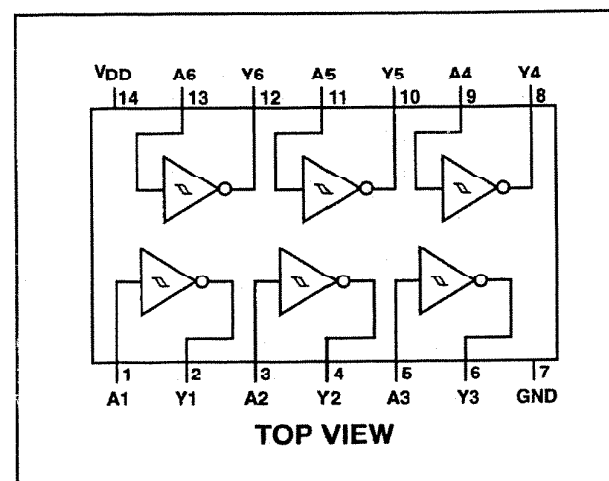


SCHEMATIC NO.

IC22 – CONTROL PC BOARD

Part Number: 74HC14

Description: Inverting Schmitt Trigger



Component Lead Identification

SCHEMATIC NO. IC16 – CONTROL PC BOARD

Part Number: LC3518BML-15

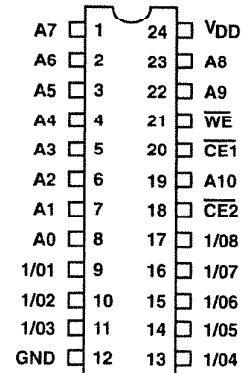
Description: 2048 Words x 8 bits static RAM

FUNCTION TABLE

MODE	CE2	CE1	WE	I/O
Read Cycle	L	L	H	Data Output
Write Cycle	L	L	L	Data Input
Nonselect	X	H	X	High Impedance
Nonselect	H	X	X	High Impedance

X: H or L

TOP VIEW

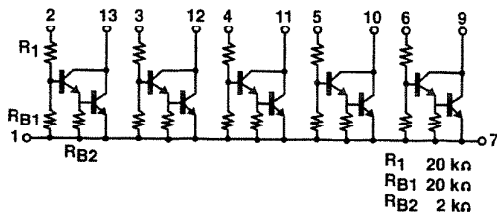


SCHEMATIC NO. IC6,17 – CONTROL PC BOARD

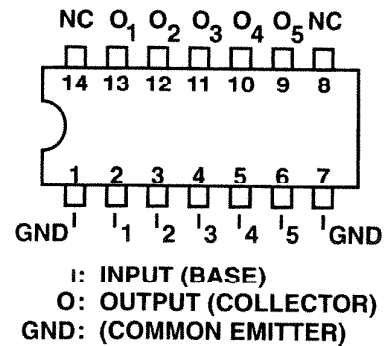
Part Number: μ PA53C

Description: LED Driver Transistor Array

EQUIVALENT CIRCUIT



TOP VIEW

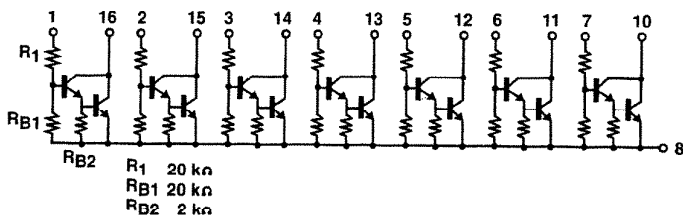


SCHEMATIC NO. IC7 – CONTROL PC BOARD

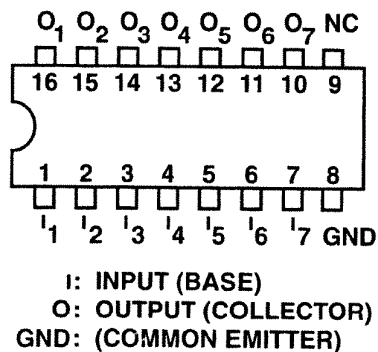
Part Number: μ PA81C

Description: LED Driver Transistor Array

EQUIVALENT CIRCUIT



TOP VIEW

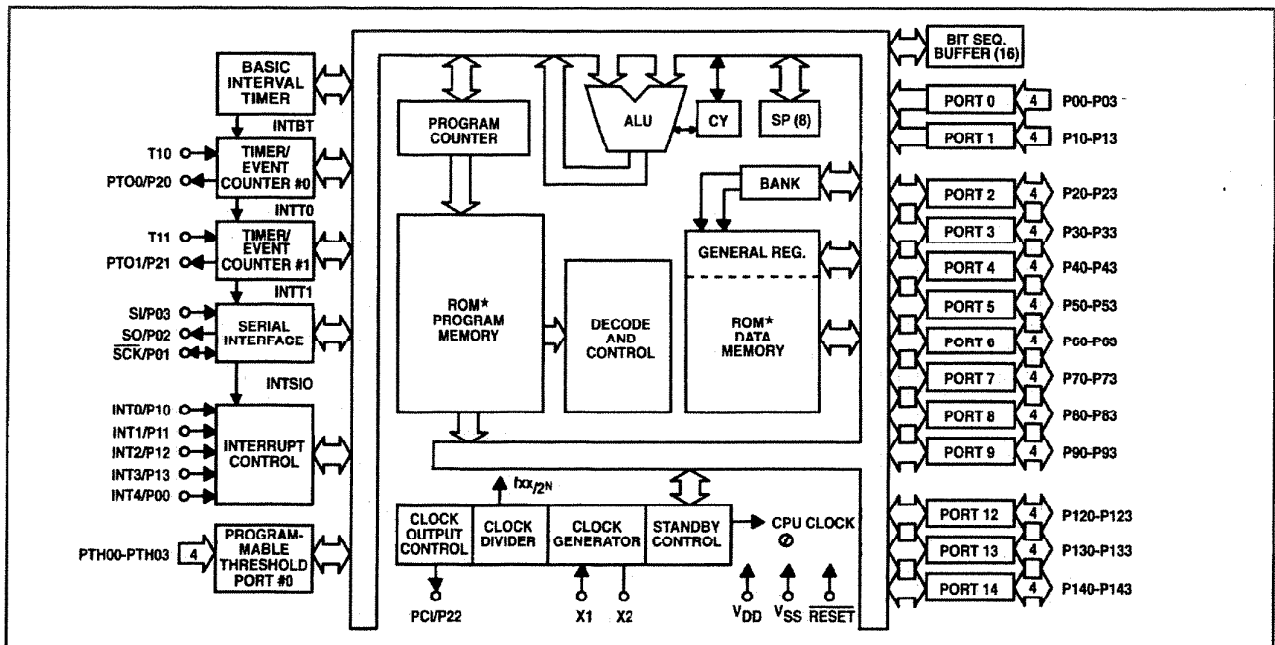
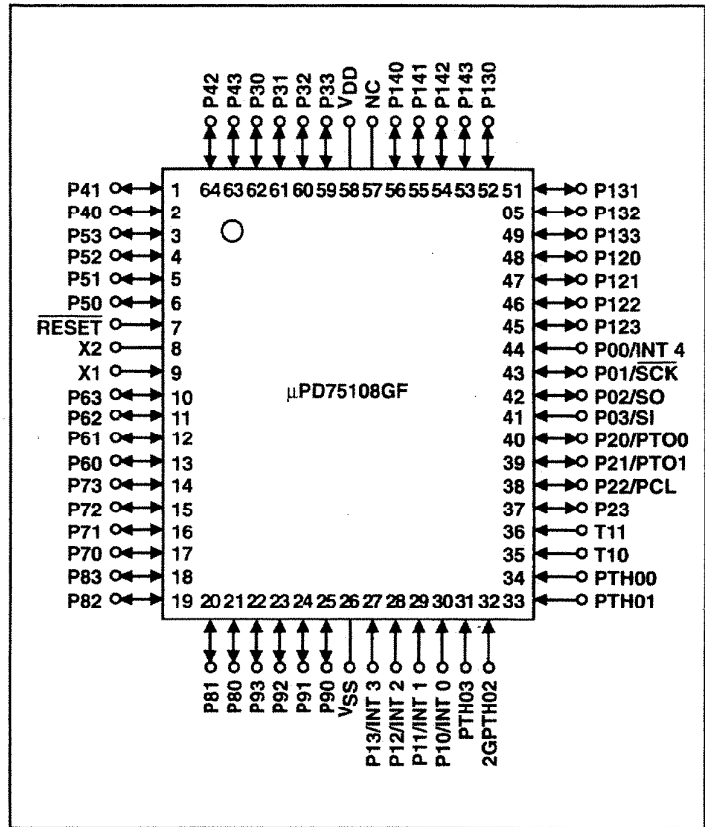


Component Lead Identification

SCHEMATIC NO.
IC1, 8 – CONTROL PC BOARD
IC1 – REMOTE MAIN PC BOARD

Part Number: μ PD75108GF-R35-3BE
 μ PD75108GF-R36-3BE

Description: Microcomputer



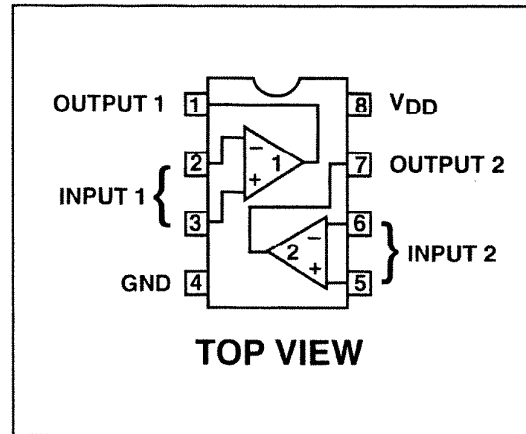
Component Lead Identification

SCHEMATIC NO.

(NJM082CP) IC21 – CONTROL PC BOARD
 (TA7593AP) IC27 – CONTROL PC BOARD
 IC3 – REMOTE MAIN PC BOARD
 (μ PC1458C) IC1, 9, 16, 22, 23, 24 – MAIN PC BOARD
 IC18 – CONTROL PC BOARD
 IC8, 9, 13 – REMOTE MAIN PC BOARD
 (NJM072D) IC3, 4, 6, 8 – MAIN PC BOARD

Part Number: NJM082CP TA7593AP FROM
 μ PC1458C NJM072D

Description: NJM082CP – Dual JFET Op-Amp
 TA7593AP – Dual Voltage Comparator
 μ PC1458C – Dual Op-Amp
 μ JM072D – Dual JFET Op-Amp



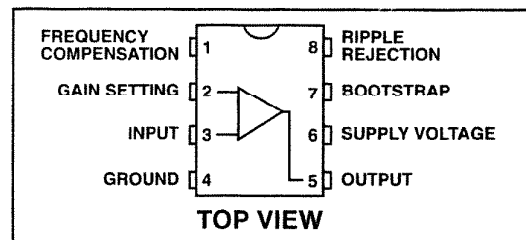
SCHEMATIC NO.

IC20 – CONTROL PC BOARD

Part Number: TBA820M

Description: 1.2 Watt Audio Amplifier

TRANSIENTS

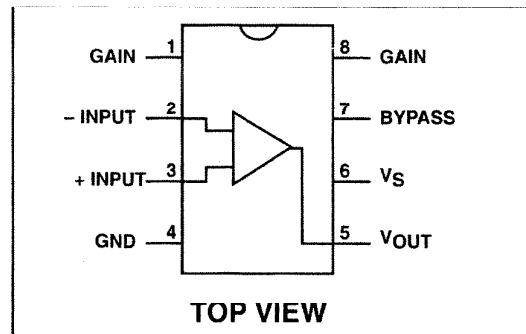


SCHEMATIC NO.

IC11 – REMOTE MAIN PC BOARD

Part Number: NJM386D

Description: Low Voltage Audio Power Amplifier

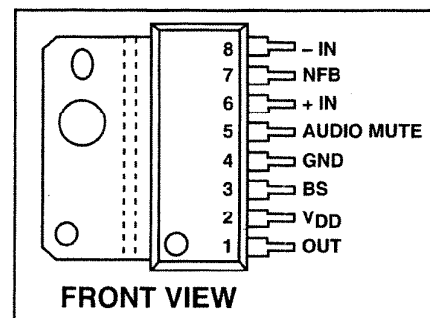
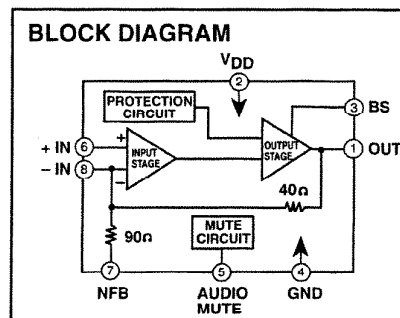


SCHEMATIC NO.

IC15 – MAIN PC BOARD

Part Number: MB3714A

Description: 6 Watt Audio Power Amplifier



Component Lead Identification

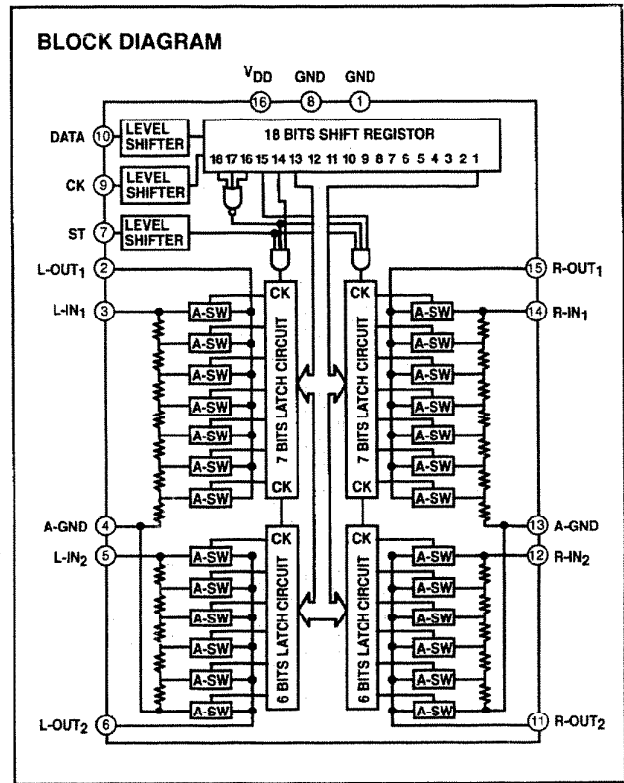
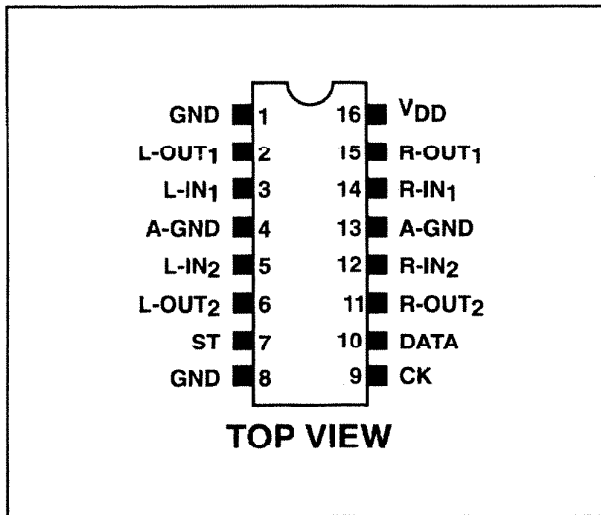
SCHEMATIC NO.

IC14 – MAIN PC BOARD

IC10 – REMOTE MAIN PC BOARD

Part Number: TC9154AP

Description: Dual Channel Electronic Volume Attenuator

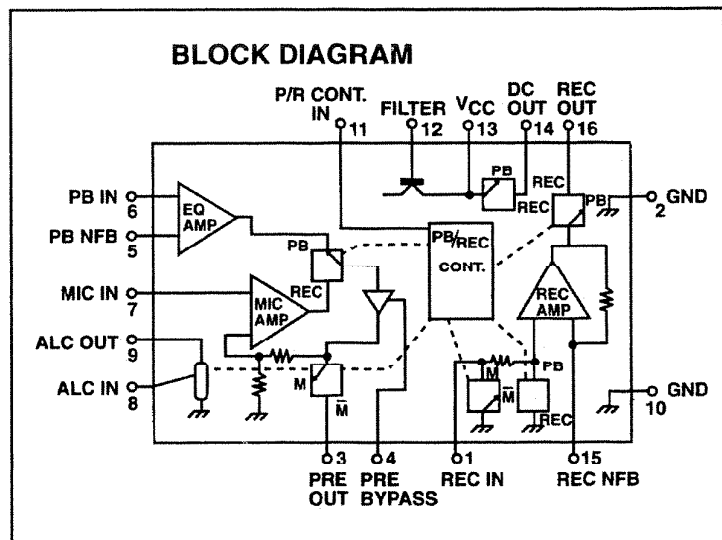
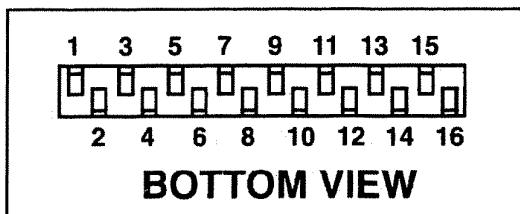
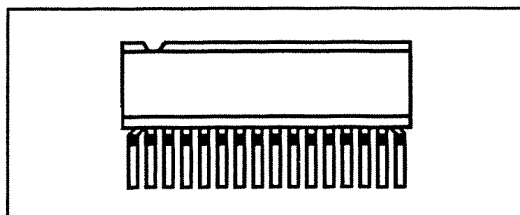


SCHEMATIC NO.

IC10 – MAIN PC BOARD

Part Number: BA5101

Description: Tape Record/Playback Amp

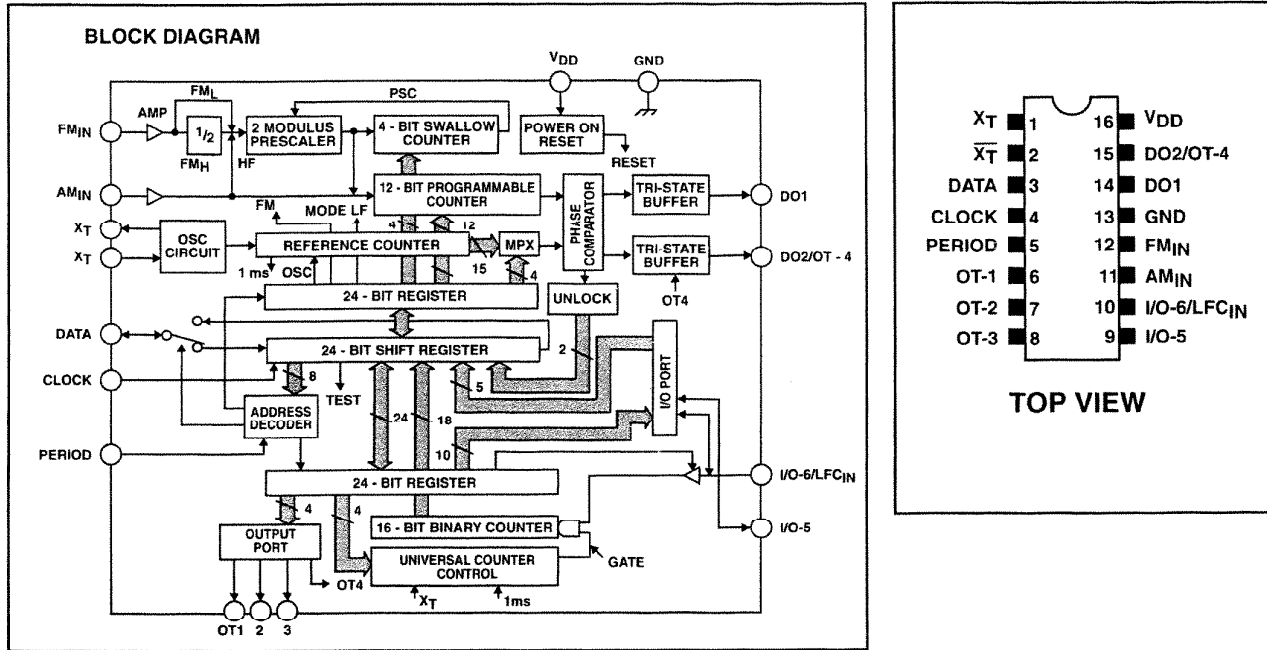


Component Lead Identification

SCHEMATIC NO.
IC19 – MAIN PC BOARD

Part Number: TC9216

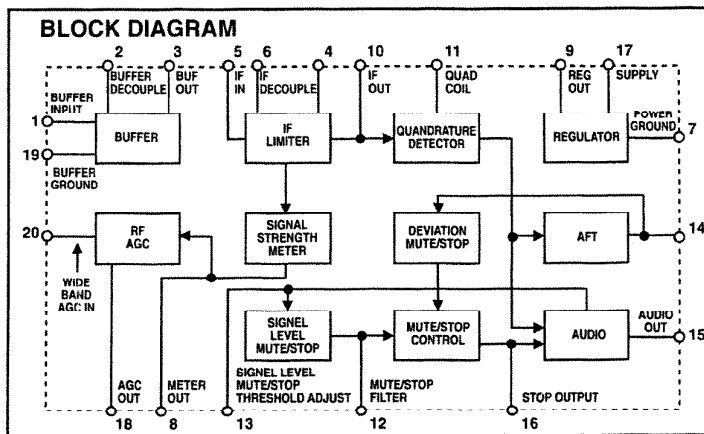
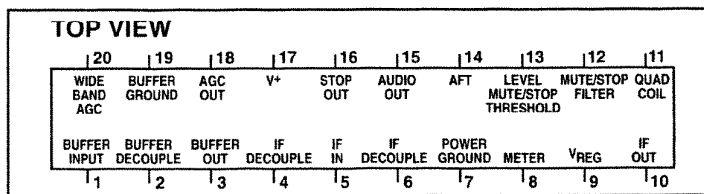
Description: Phase Locked Loop with Prescaler



SCHEMATIC NO.
IC18 – MAIN PC BOARD

Part Number: LM1865

Description: Advance FM IF System



Component Lead Identification

SCHEMATIC NO.

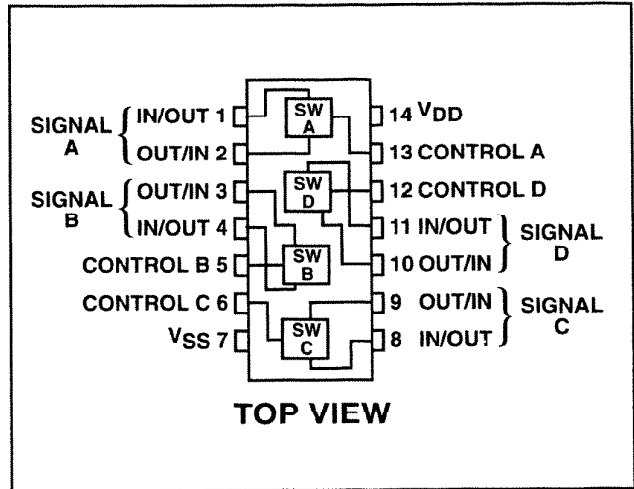
IC2, 5, 11, 13 – MAIN PC BOARD

IC18 – CONTROL PC BOARD

IC18 – REMOTE MAIN PC BOARD

Part Number: TC4066

Description: Bi Lateral Switch



SCHEMATIC NO.

(NJM78L05) IC7, 20 – MAIN PC BOARD

IC6 – REMOTE MAIN PC BOARD

(NJM78L06) IC12 – MAIN PC BOARD

(NJM78L08) IC17 – MAIN PC BOARD

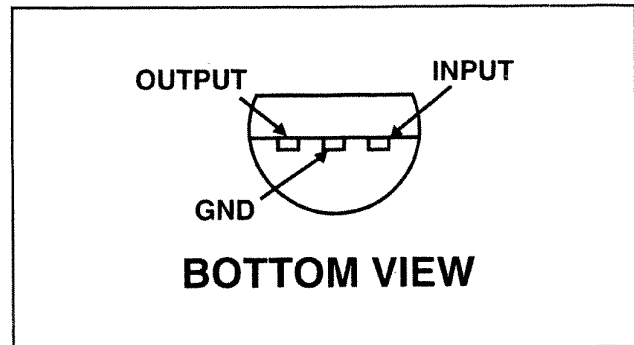
IC5 – REMOTE MAIN PC BOARD

Part Number: NJM78L05

NJM78L06

NJM78L08

Description: Positive Voltage Regulator



SCHEMATIC NO.

(NJM7815) IC25, 26 – MAIN PC BOARD

(NJM7812) IC27 – MAIN PC BOARD

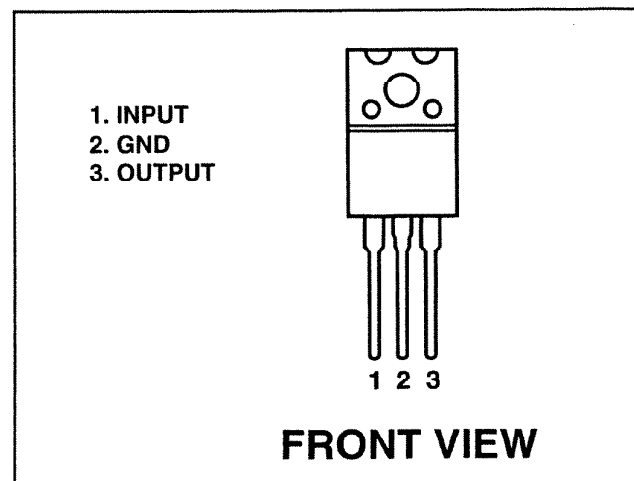
(NJM7805) IC28, 29 – MAIN PC BOARD

Part Number: NJM7815

NJM7812

NJM7805

Description: Positive Voltage Regulator

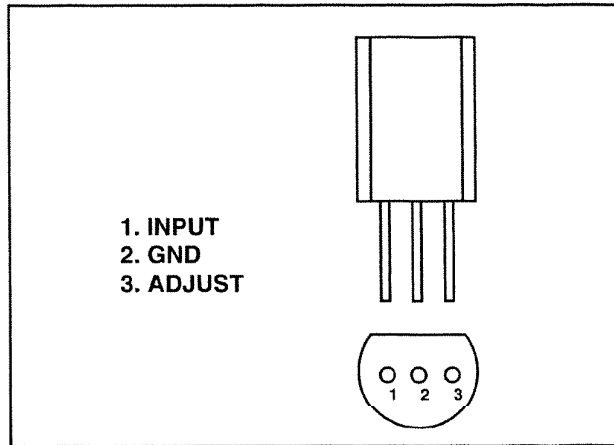


Component Lead Identification

SCHEMATIC NO. IC21 – MAIN PC BOARD

Part Number: M5237L

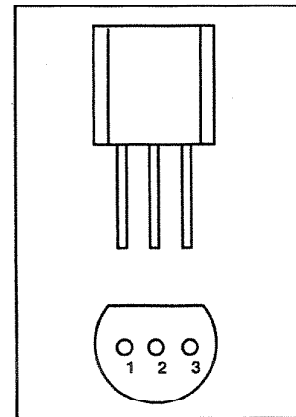
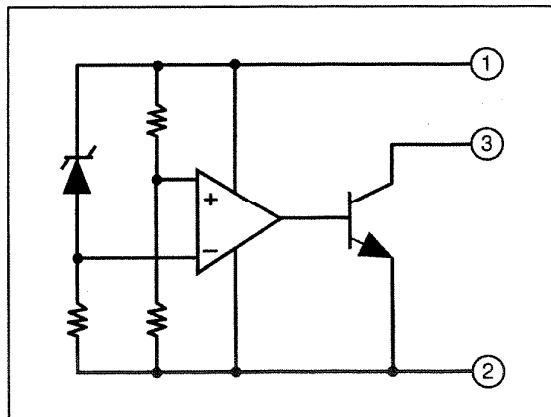
Description: Adjustable, Positive Voltage Regulator



SCHEMATIC NO. IC12 – REMOTE MAIN PC BOARD

Part Number: PST520D

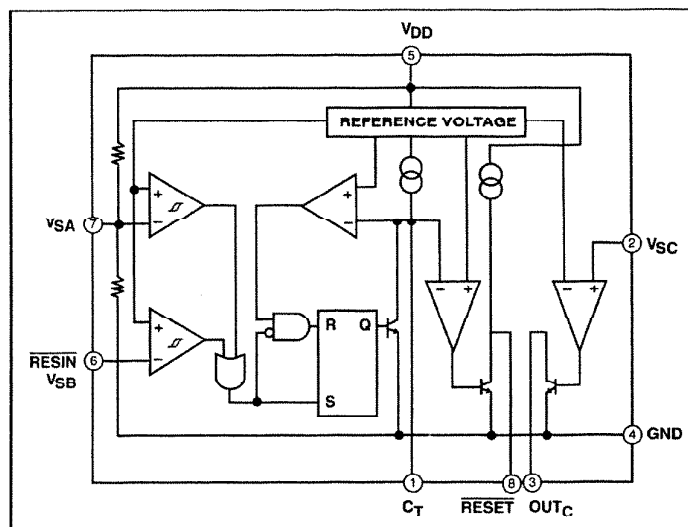
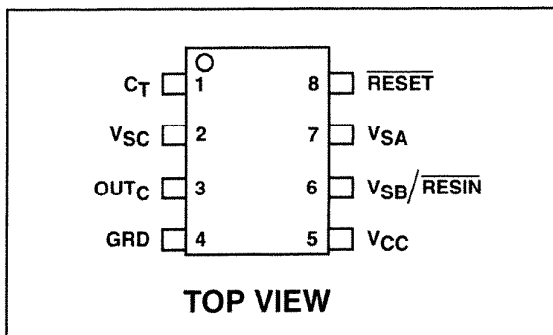
Description: Power Supply Monitor (System Reset)



SCHEMATIC NO. IC25 – CONTROL PC BOARD

Part Number: MB9771

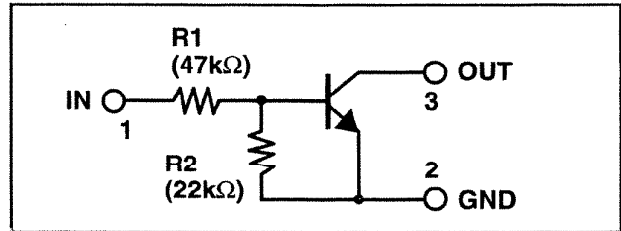
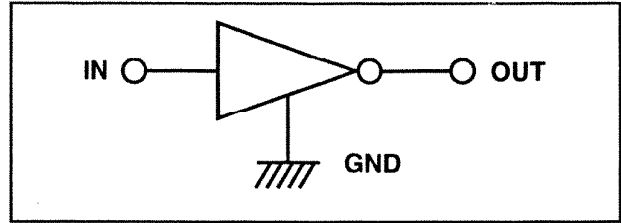
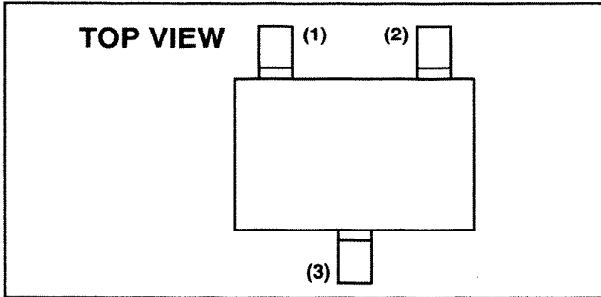
Description: Power Supply Monitor (System Reset)



Component Lead Identification

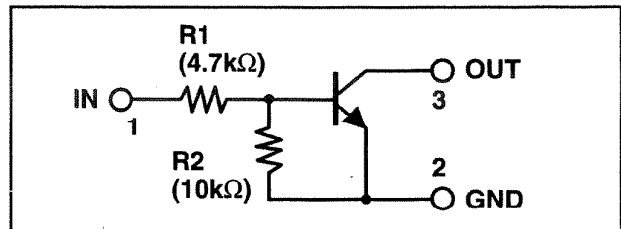
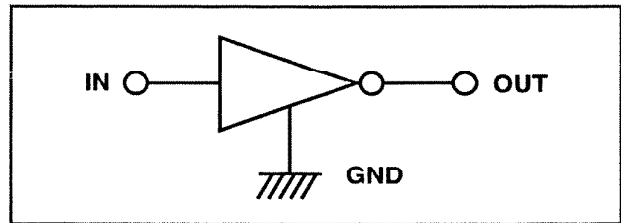
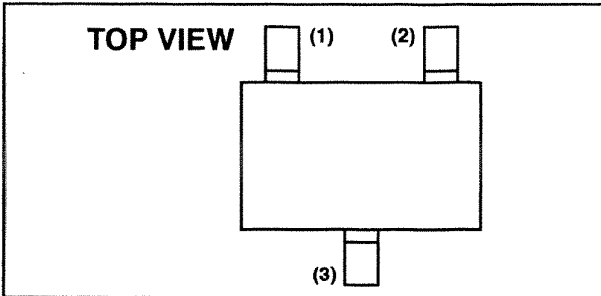
SCHEMATIC NO.
Q13, 14 – MAIN PC BOARD

Part Number: DTC144
Description: Digital Transistor



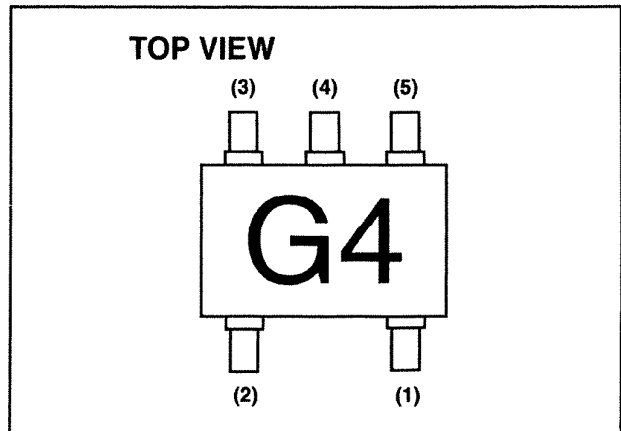
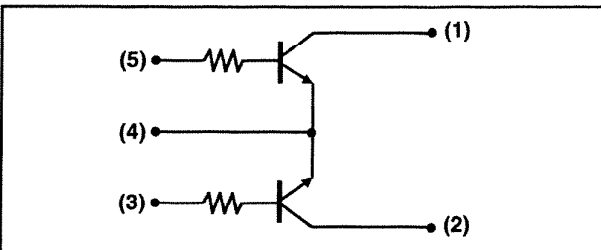
SCHEMATIC NO.
Q15, 16 – MAIN PC BOARD

Part Number: DTA143
Description: Digital Transistor



SCHEMATIC NO.
Q10 – REMOTE MAIN PC BOARD

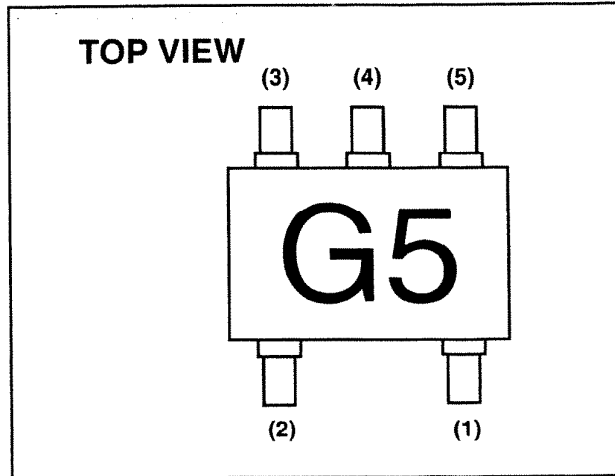
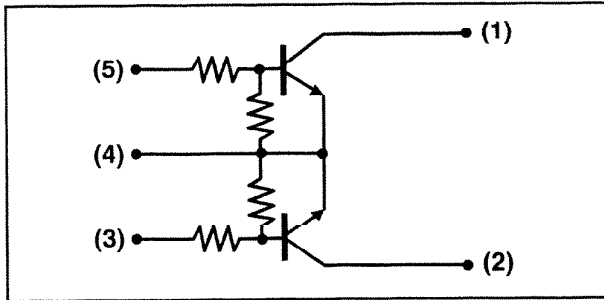
Part Number: FMG5
Description: Dual NPN Transistors



Component Lead Identification

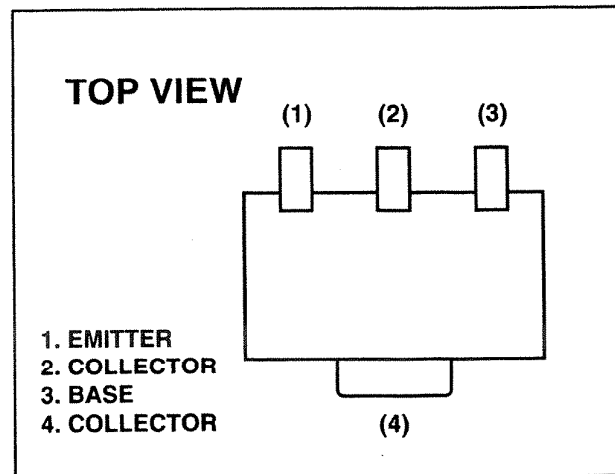
SCHEMATIC NO.
Q11 – REMOTE MAIN PC BOARD

Part Number: FMG4
Description: Dual NPN Transistor



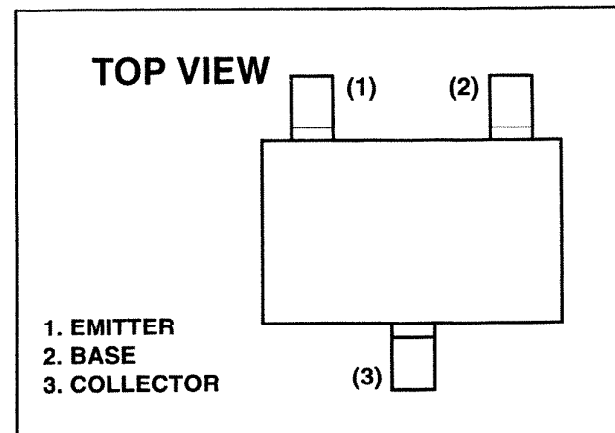
SCHEMATIC NO.
Q6, Q10 – MAIN PC BOARD

Part Number: ZSB1132
Description: PNP Power Transistor



SCHEMATIC NO.
(2CS2412) Q3, 5, 8, 9, 11, 12, 17, 18, 20,
21, 27 – MAIN PC BOARD
(2SA1037) Q7 – MAIN PC BOARD

Part Number: 2SC2412
 2SA1037
Description: 2SC2412 NPN Transistor
 2SA1037 PNP Transistor



Component Lead Identification.

SCHEMATIC NO.

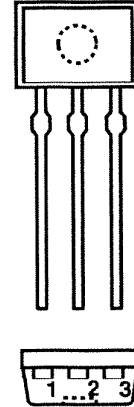
(2SC1740) Q2, 3, 5, 6, 8, 10, 15, 16, 17 –
CONTROL PC BOARD
Q1, 4, 5 REMOTE MAIN PC BOARD
Q19 MAIN PC BOARD
(2SA9335) Q4, 7, 9, 11 REMOTE
MAIN PC BOARD

Part Number: 2SC1740
2SA9335

Description: 2SC1740 NPN Transistor
2SA9335 PNP Transistor

FRONT VIEW

1. EMITTER
2. COLLECTOR
3. BASE



SCHEMATIC NO.

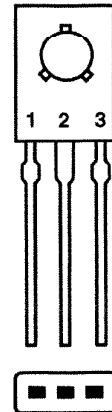
Q4 – MAIN PC BOARD

Part Number: 2SC1846

Description: NPN Power Transistor

FRONT VIEW

1. EMITTER
2. COLLECTOR
3. BASE



SCHEMATIC NO.

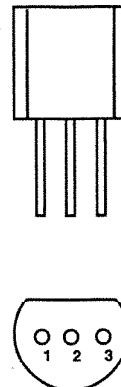
Q3 – REMOTE MAIN PC BOARD

Part Number: 2SK161

Description: Field Effect Transistor

FRONT VIEW

1. DRAIN
2. GATE
3. SOURCE

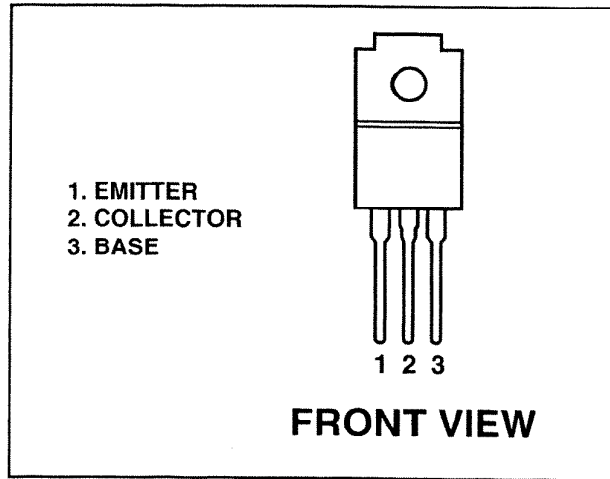


Component Lead Identification

SCHEMATIC NO.
(2SB1290) Q22, 24, 26 – MAIN PC BOARD
(2SD1833) Q23, 25 MAIN PC BOARD

Part Number: 2SAB1290
2SD1833

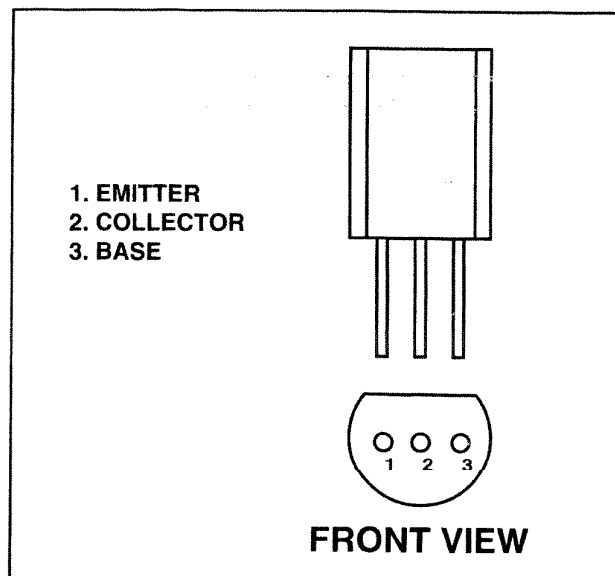
Description: 2SB1290 PNP Power Transistor
2SD1833 NPN Power Transistor

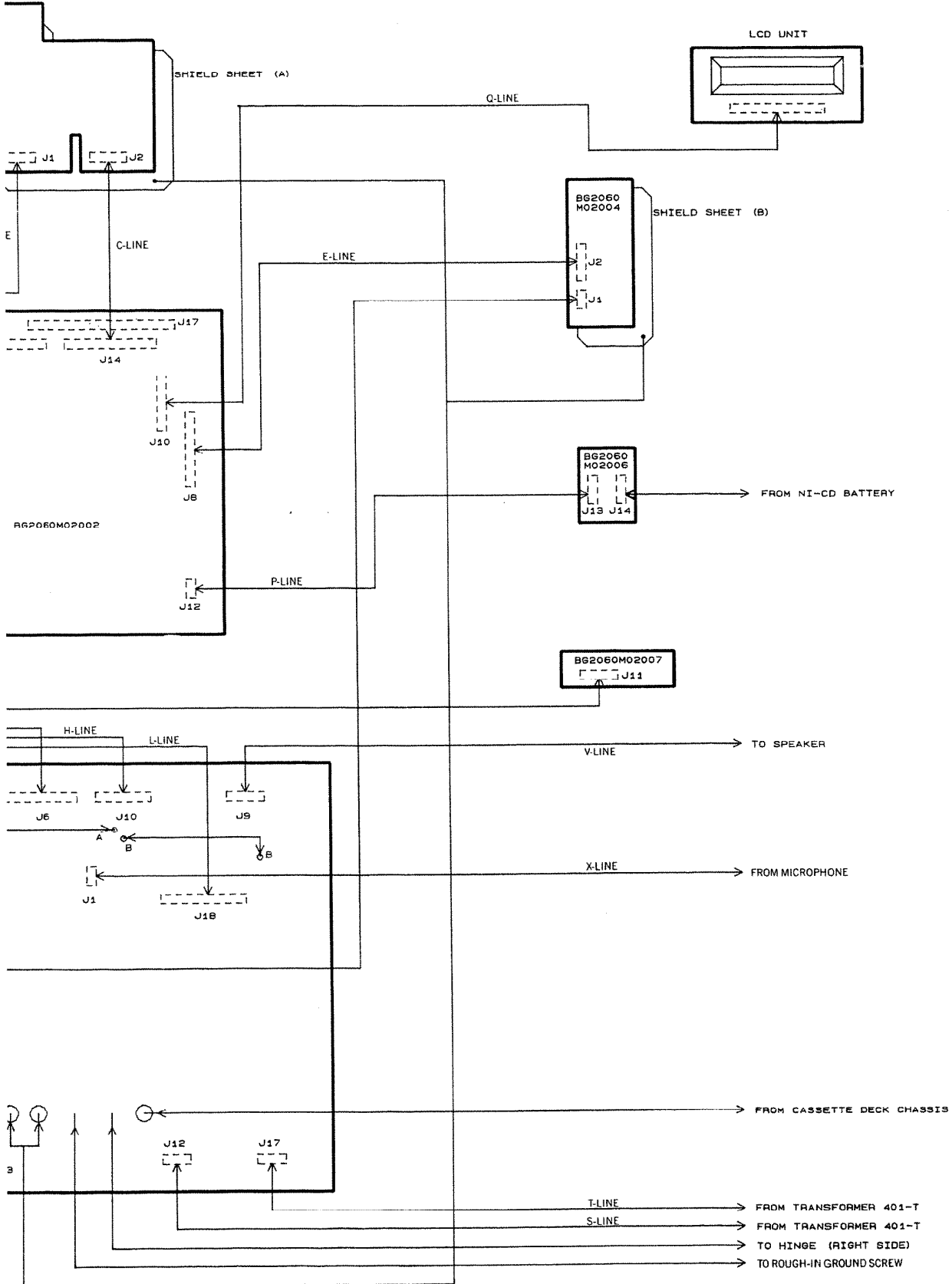


SCHEMATIC NO.
Q1 – MAIN PC BOARD

Part Number: 2SC1383

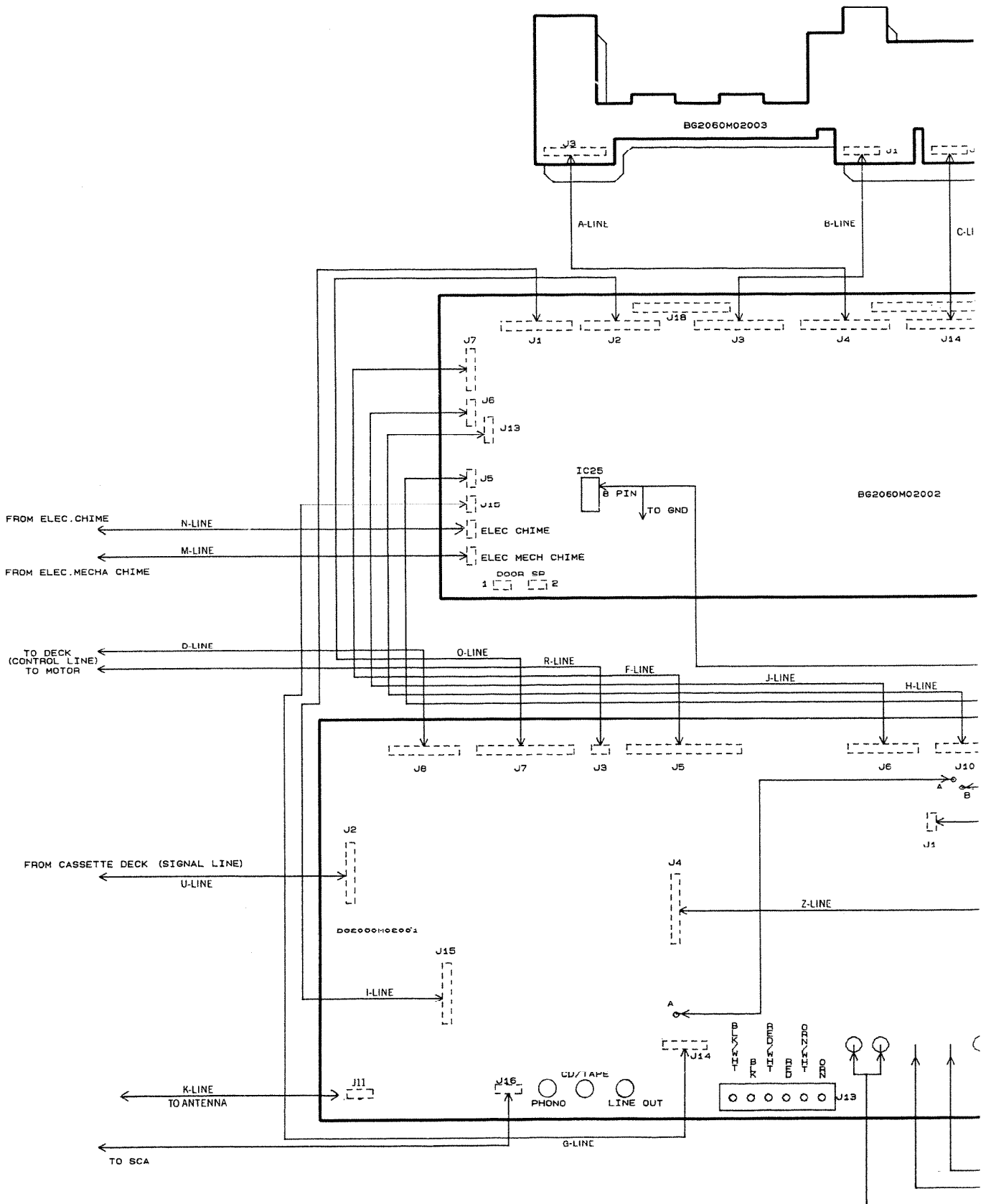
Description: NPN Transistor





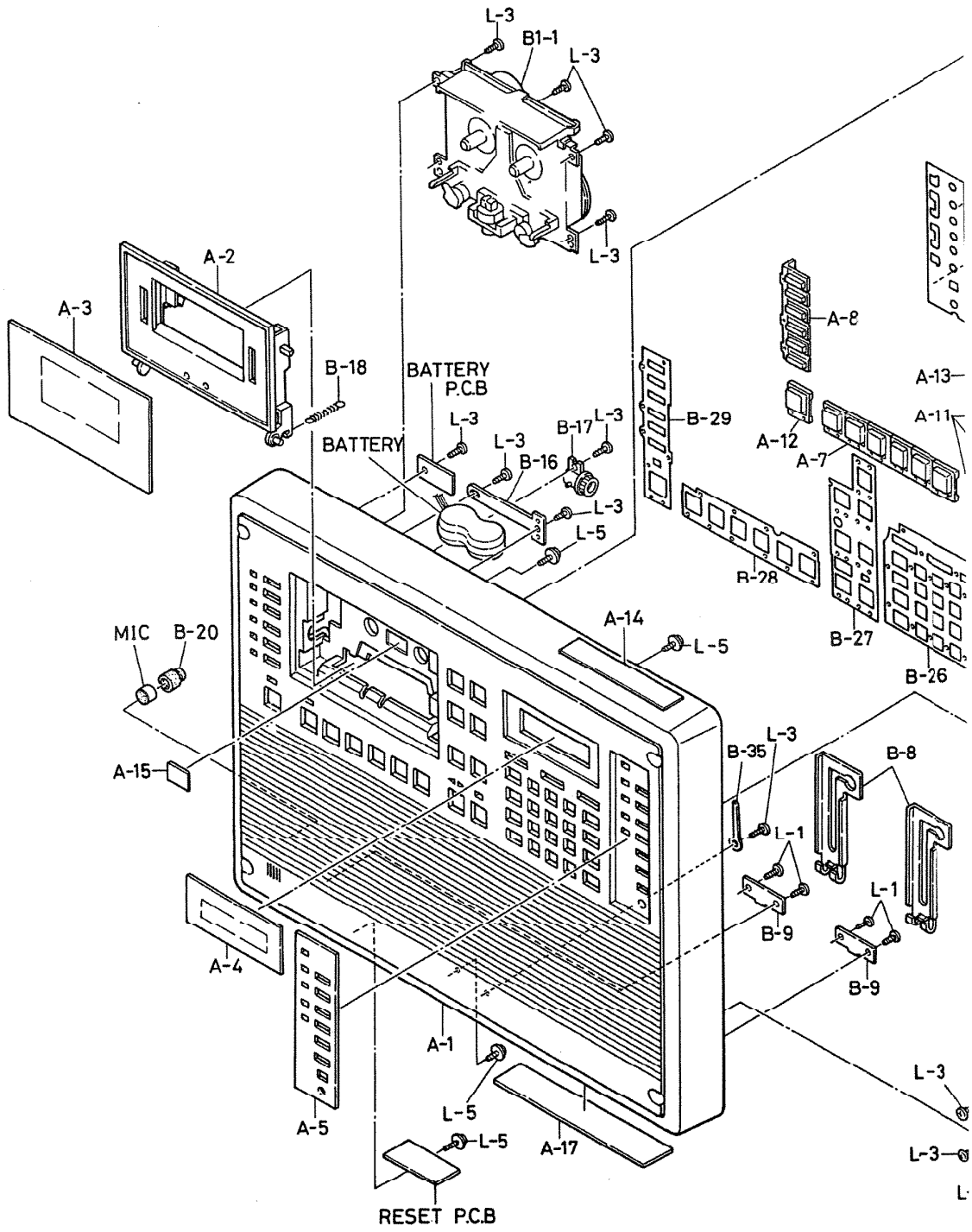
MASTER STATION: INTERCONNECTION DIAGRAM

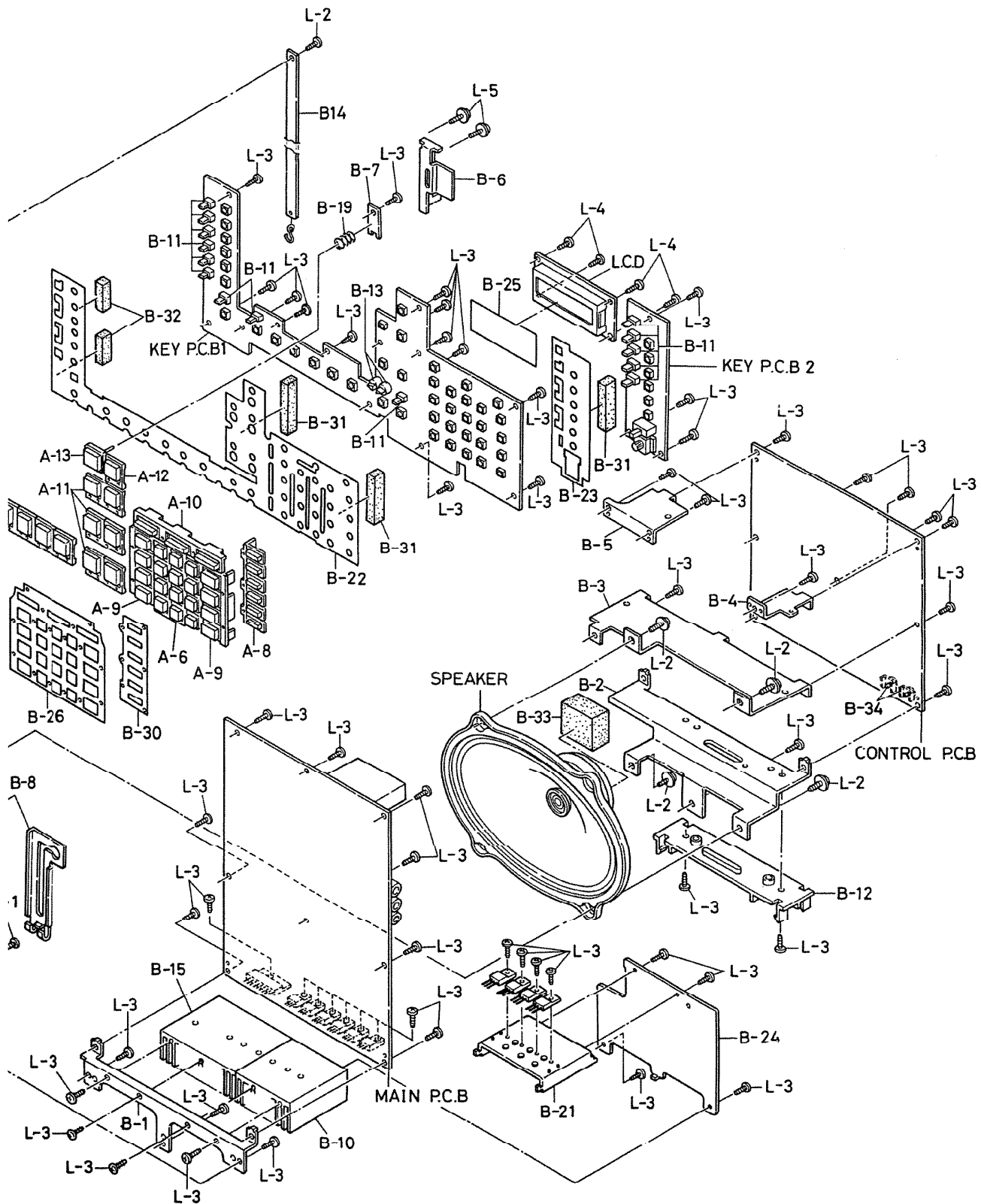
Interconnection Diagram

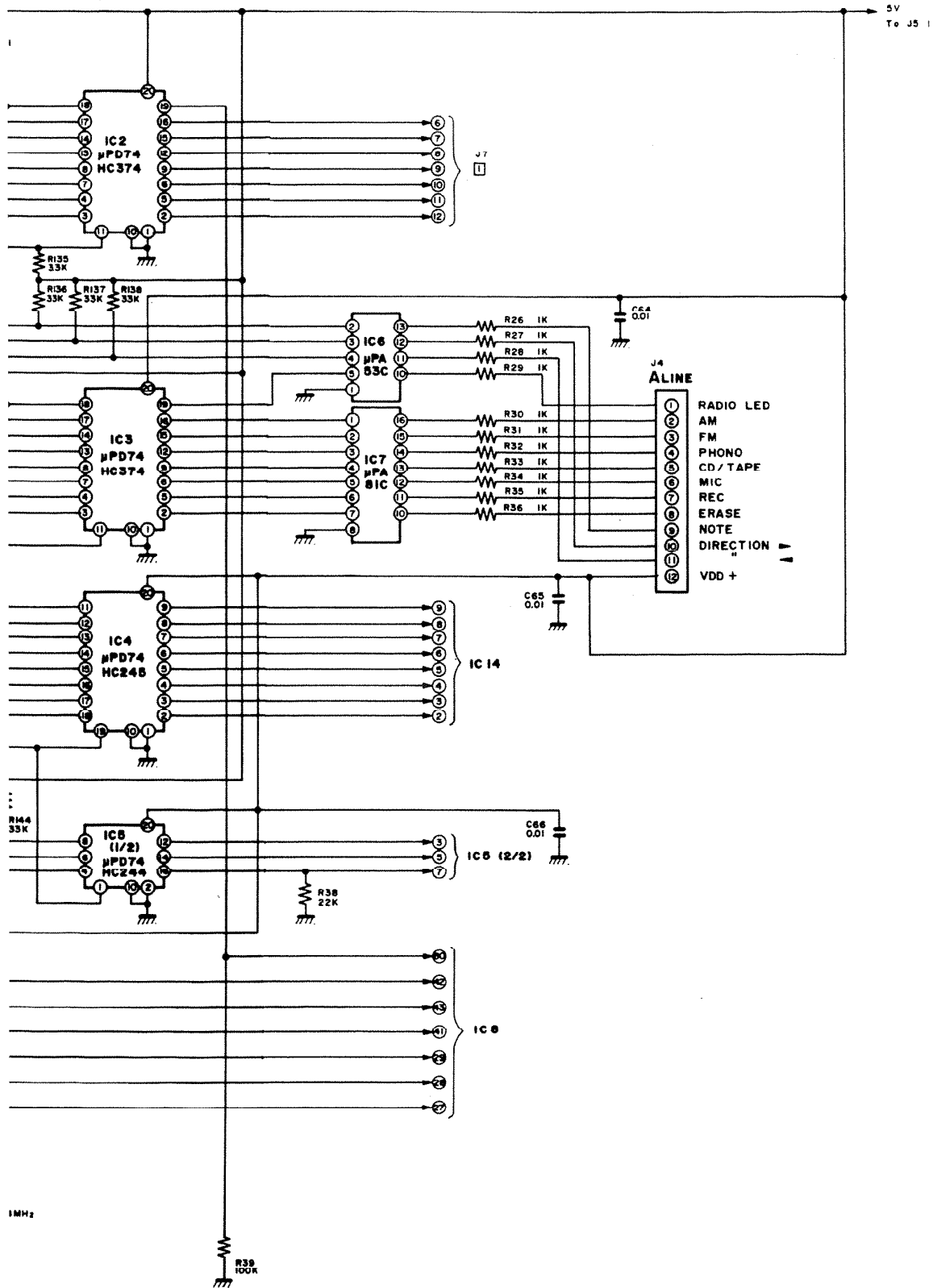


Exploded View

MASTER STATION: EXPLODED VIEW

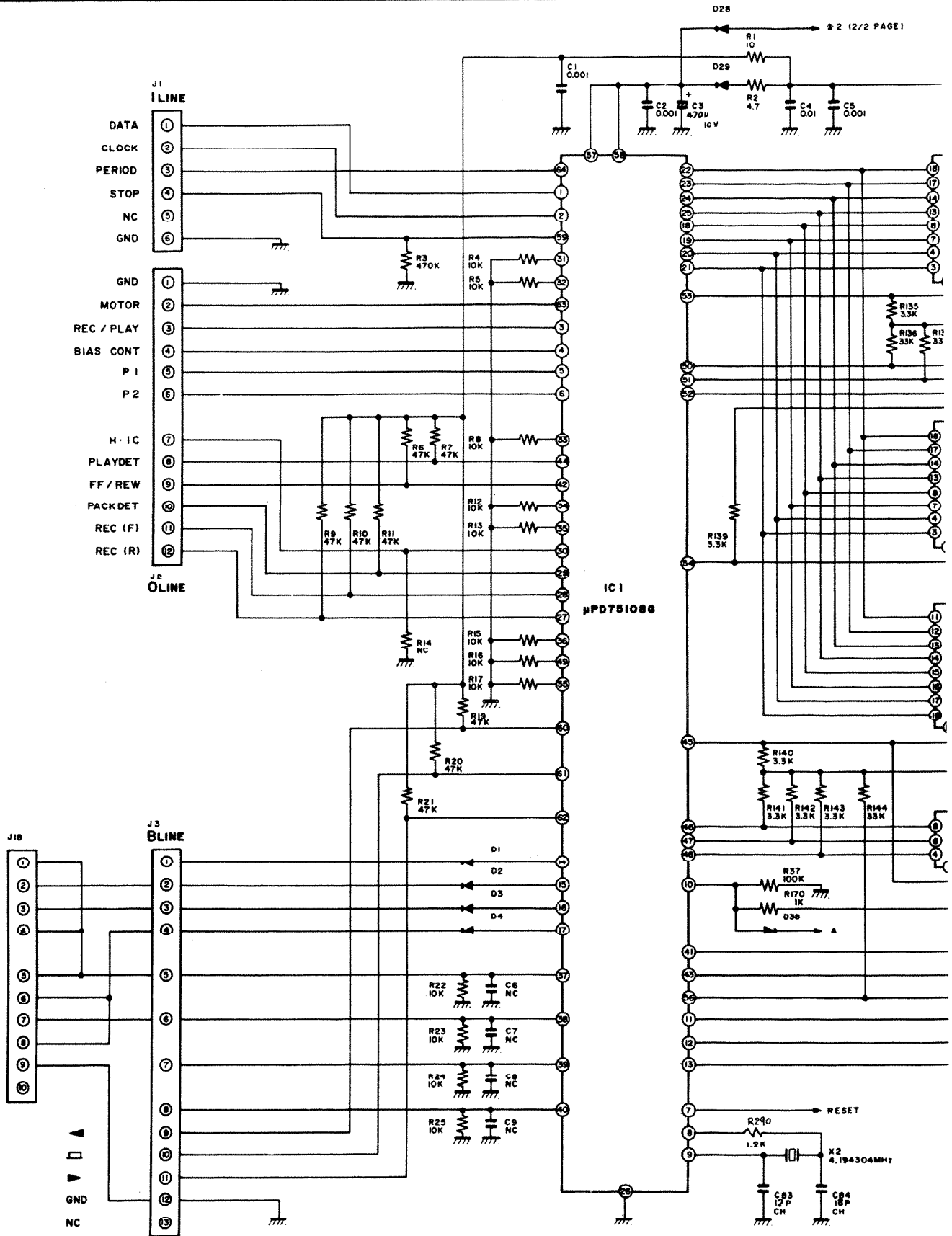






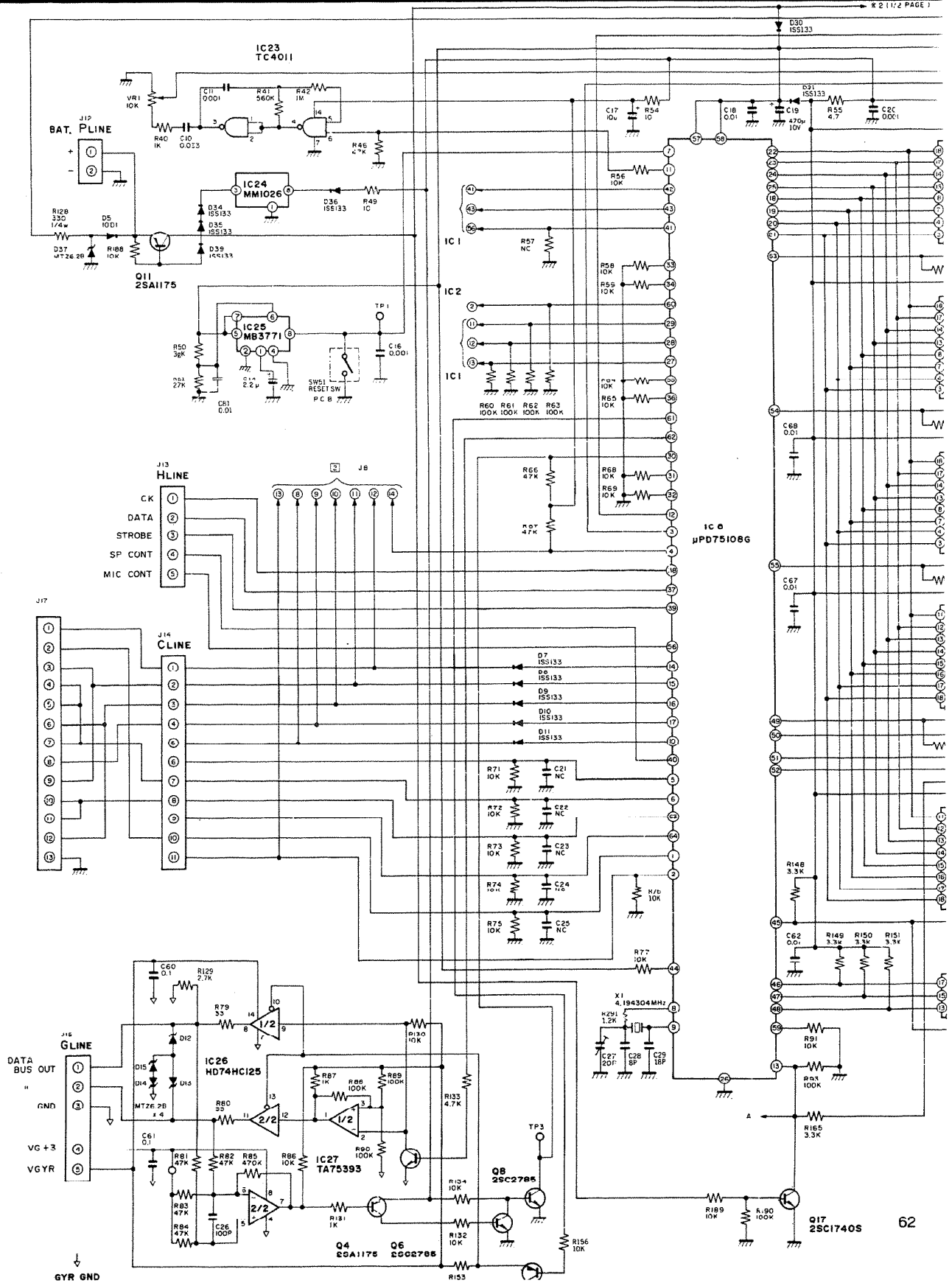
MASTER STATION: CONTROL PC BOARD SCHEMATIC
(1 of 2)

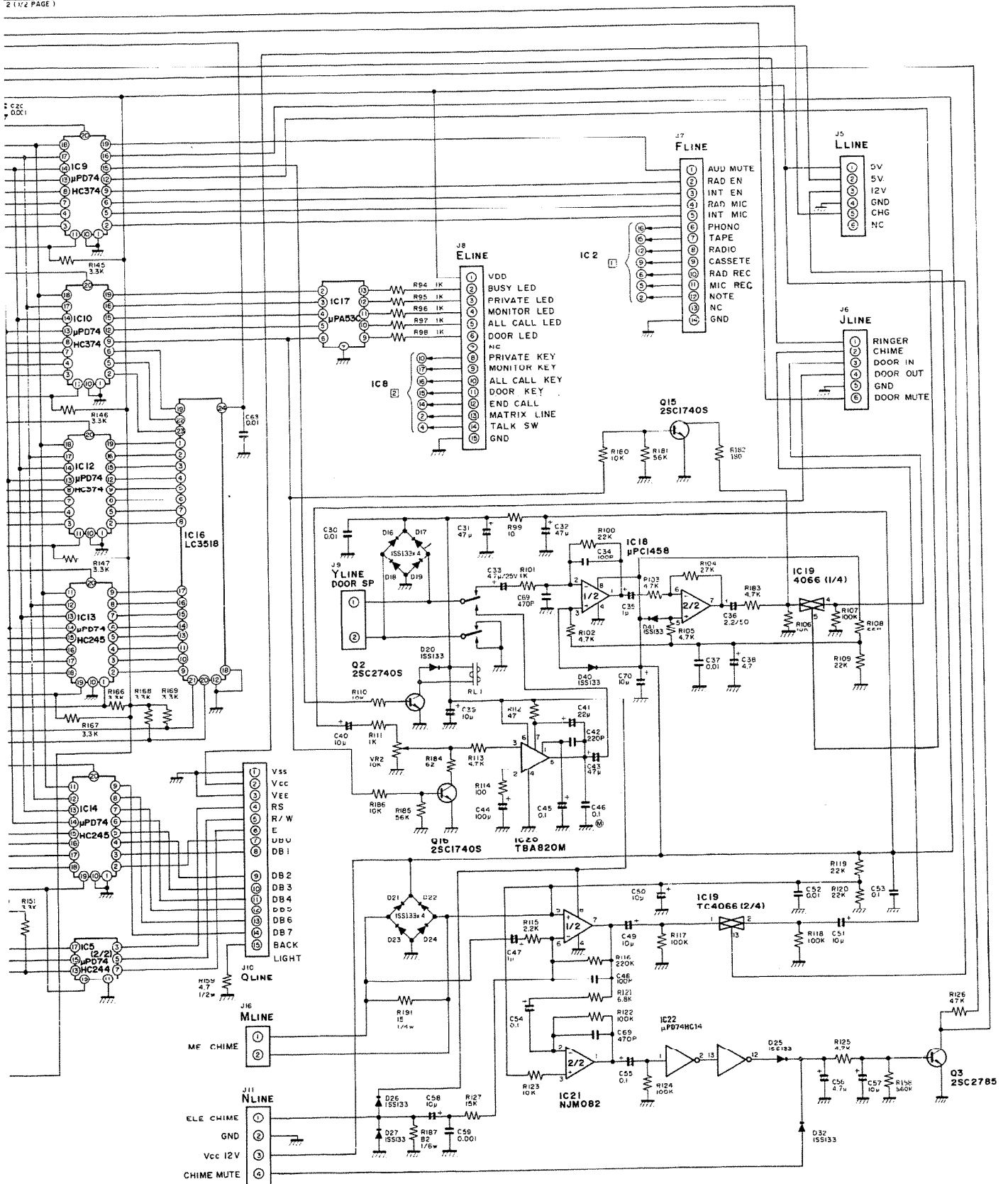
Schematic Diagrams/PC Boards



Schematic Diagrams/PC Boards

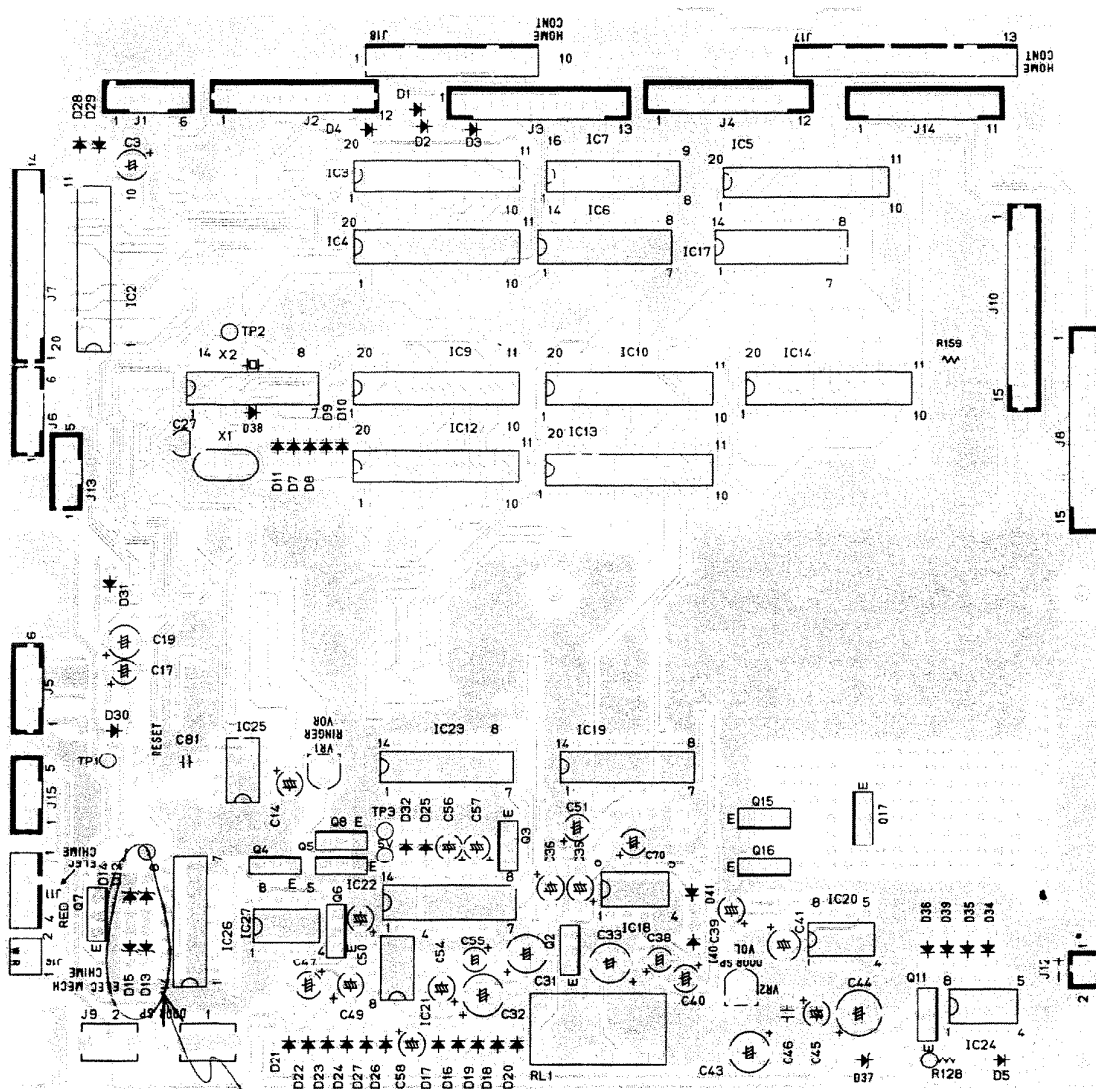
MASTER STATION: CONTROL PC BOARD SCHEMATIC (2 OF 2)





Schematic Diagrams/PC Boards

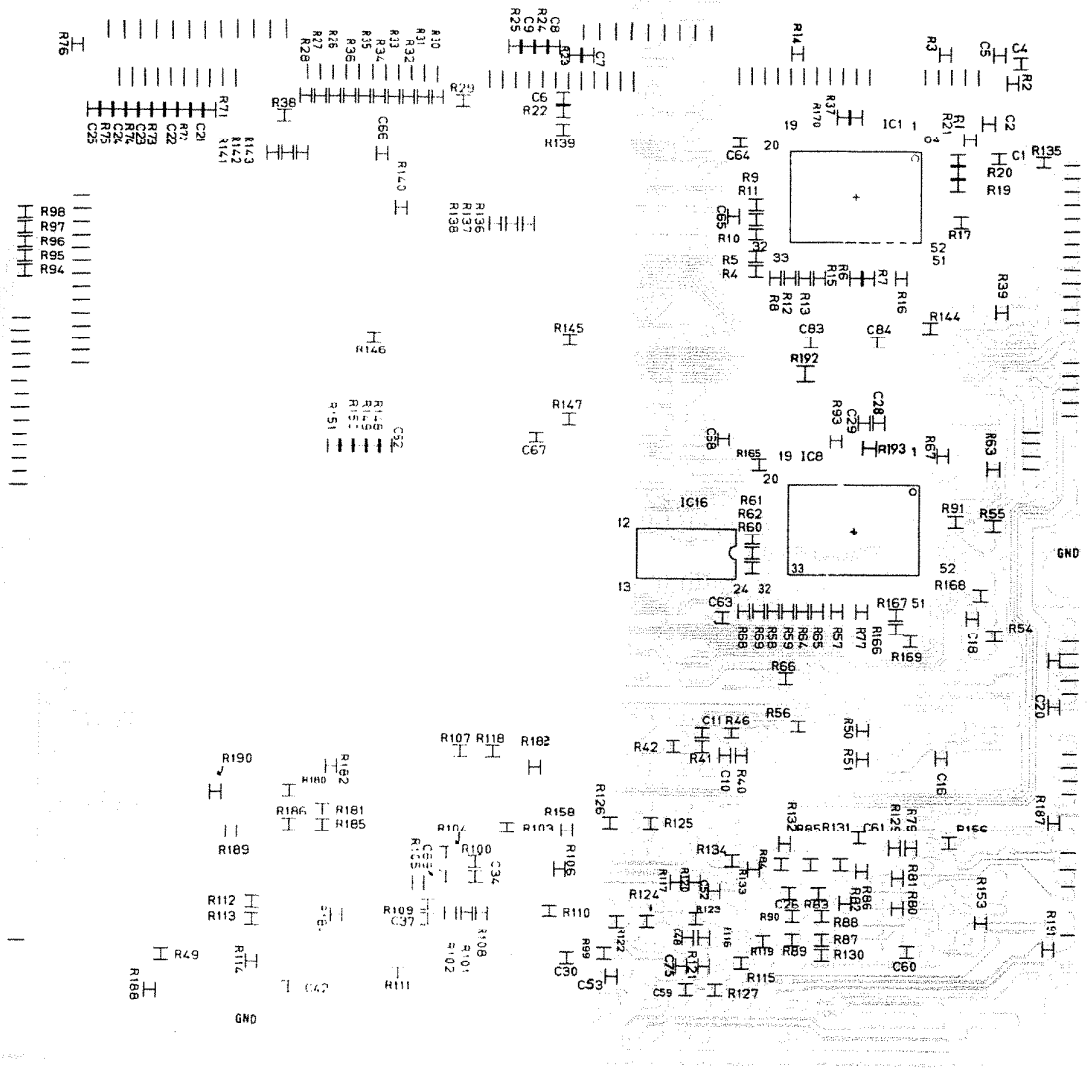
Top Control PCB



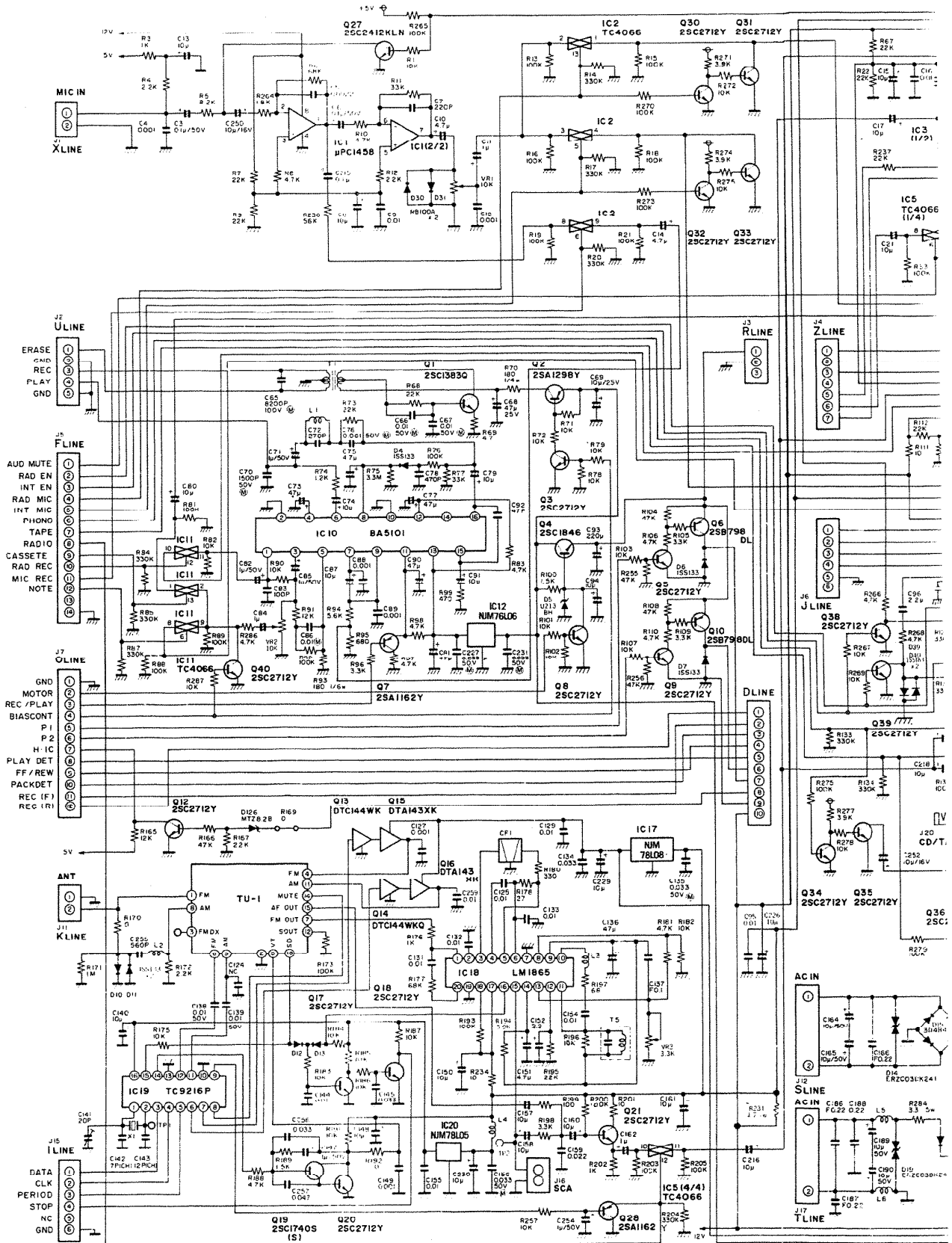
**D12 - 14 CAN BE
REPLACED WITH MOV'S
TO PREVENT DAMAGE FROM
TRANSIENTS**

Bottom Control PCB

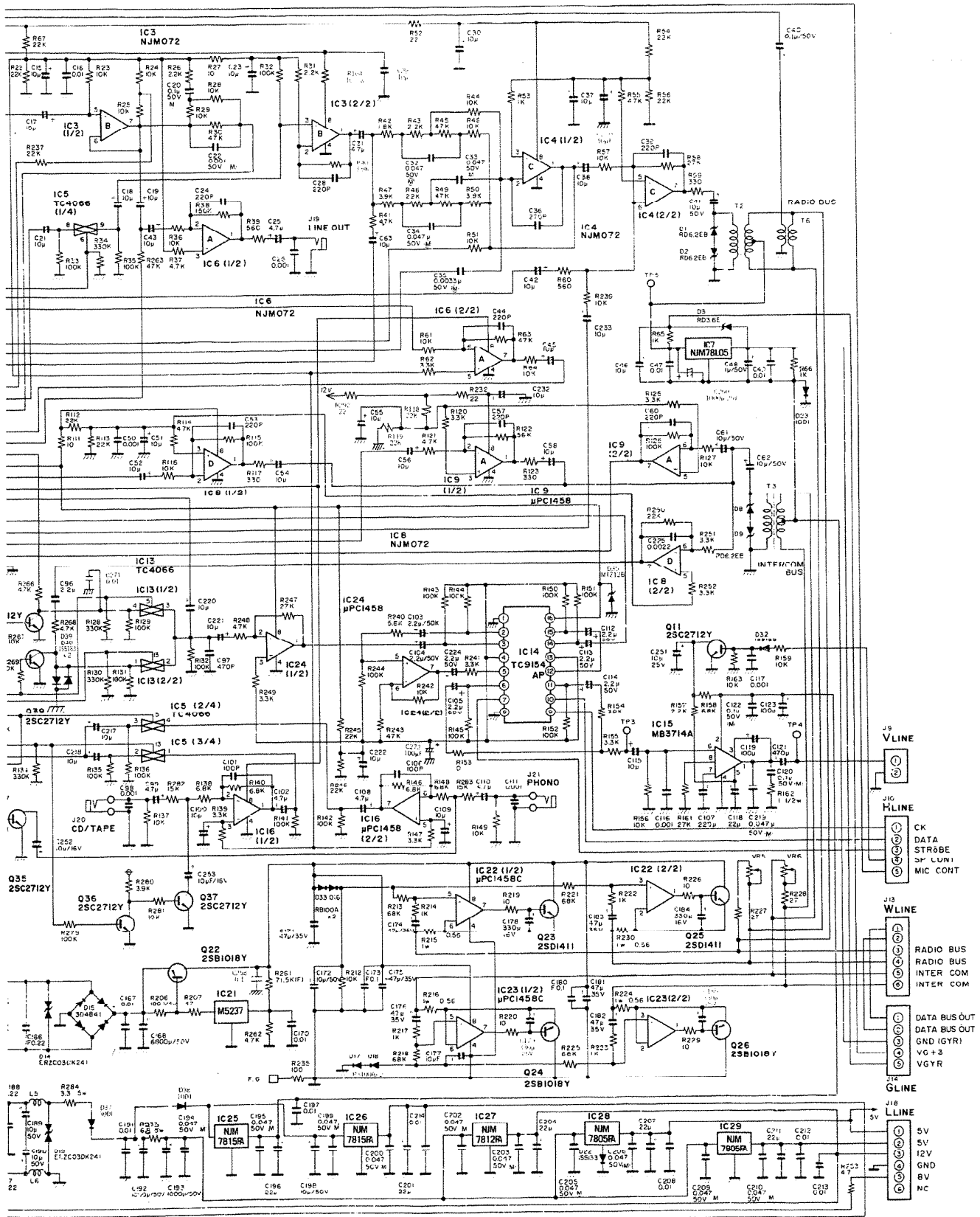
MASTER STATION: CONTROL PC BOARD FOIL PATTERN



Schematic Diagrams/PC Boards



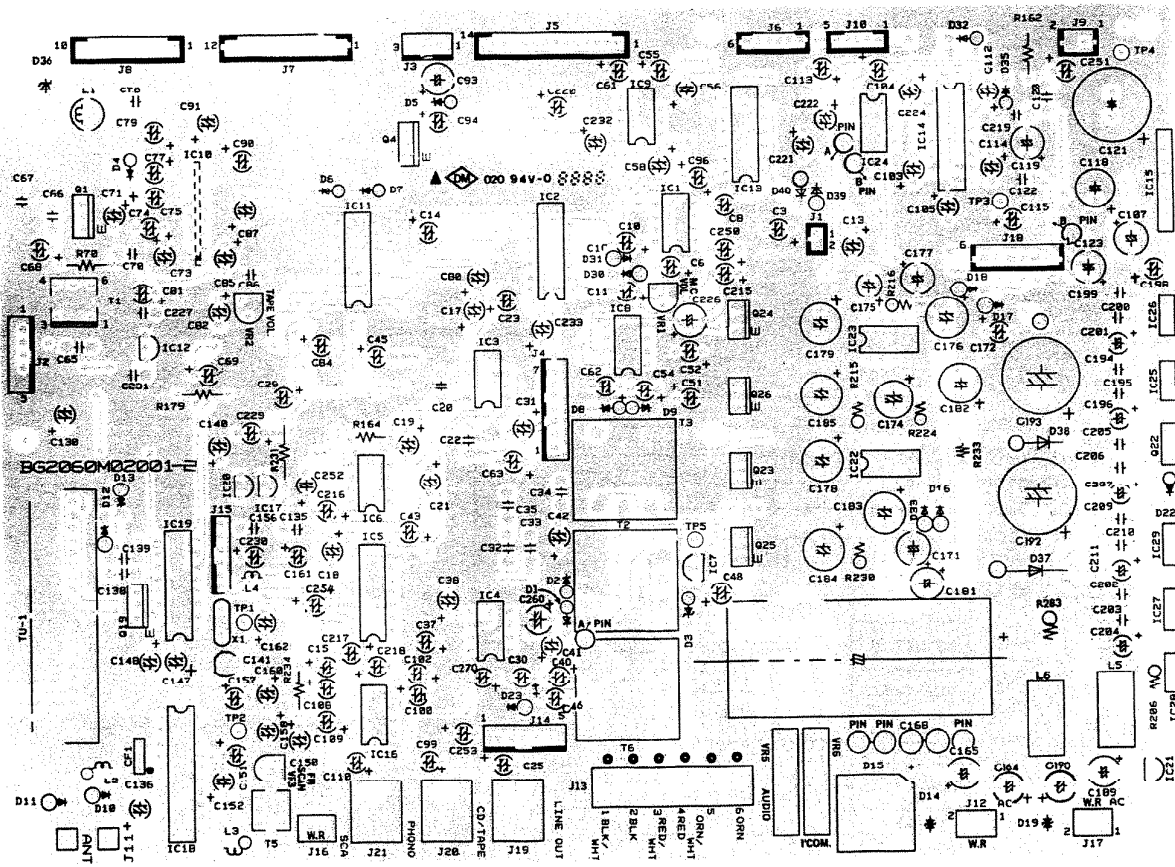
Schematic Diagrams/PC Boards



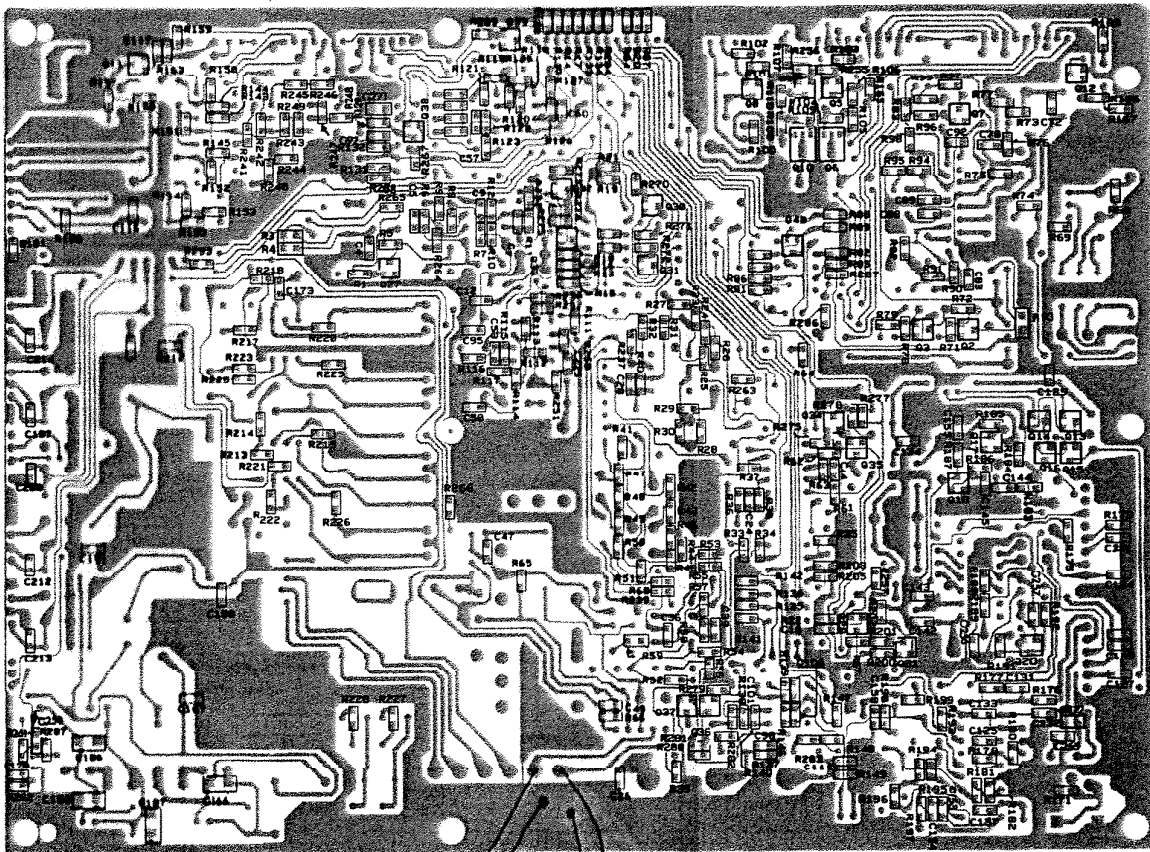
- J9 VLINE
- J10 HLINE
- ① CK
- ② DATA
- ③ STRØBE
- ④ LUM1
- ⑤ MIC CONT
- J13 WLINE
- ① RADIO BUS
- ② RADIO COM
- ③ INTER COM
- ④ INTER COM
- J14 GLINE
- ① DATA BUS OUT
- ② DATA BUS IN
- ③ VG +3
- ④ VGYR
- J18 LLINE
- ① 5V
- ② 5V
- ③ 12V
- ④ GND
- ⑤ 8V
- ⑥ NC

Schematic Diagrams/PC Boards

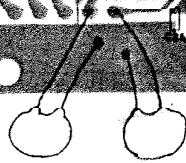
Top - Main P.C. Board



Bottom - Main P.C. Board



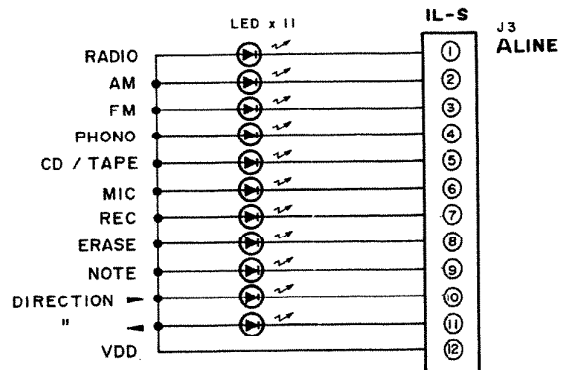
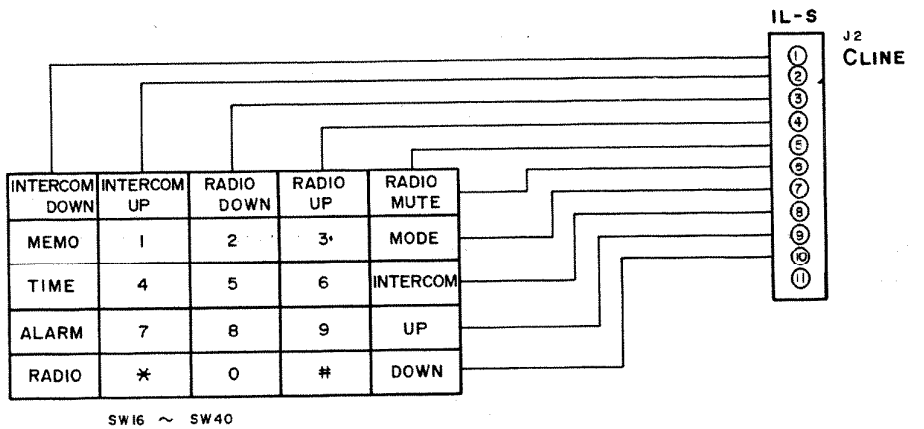
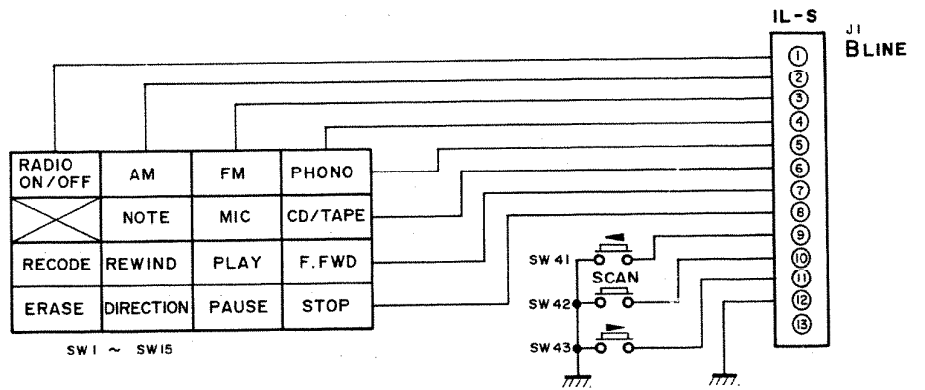
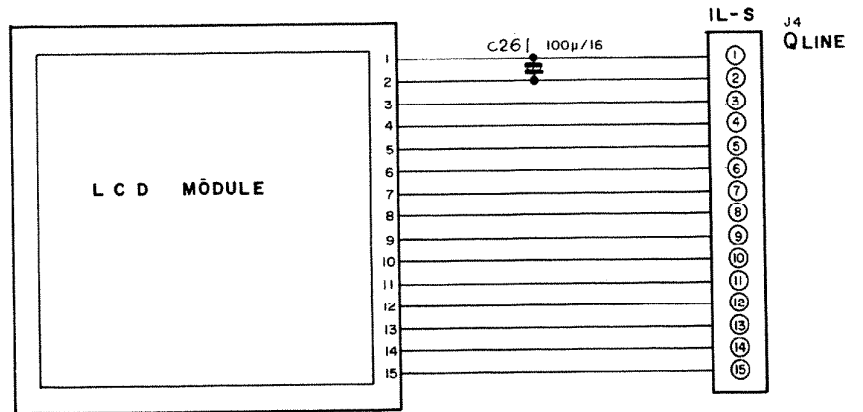
**MASTER STATION: MAIN PC BOARD
FOIL PATTERN**

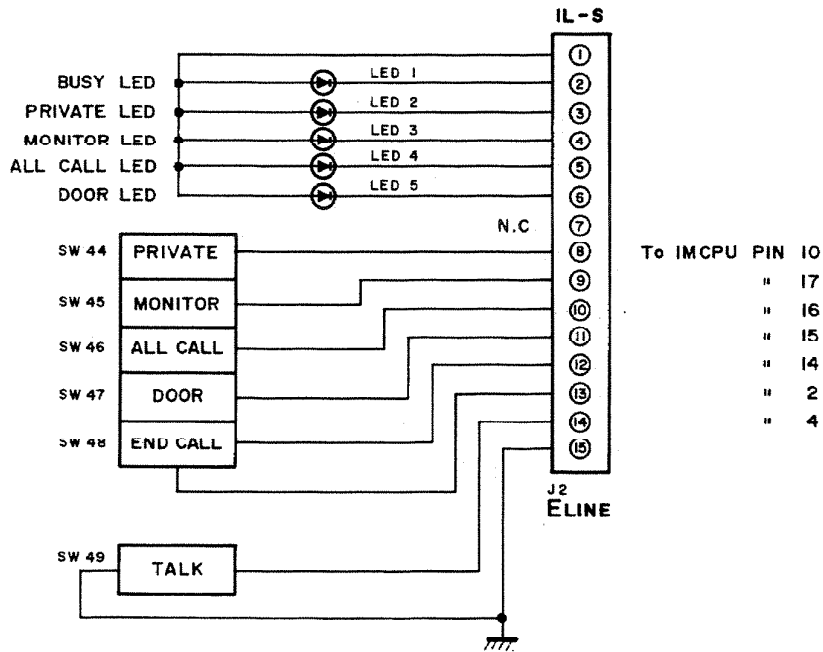
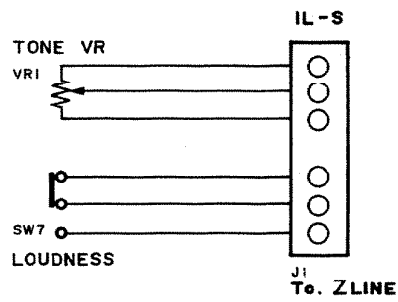


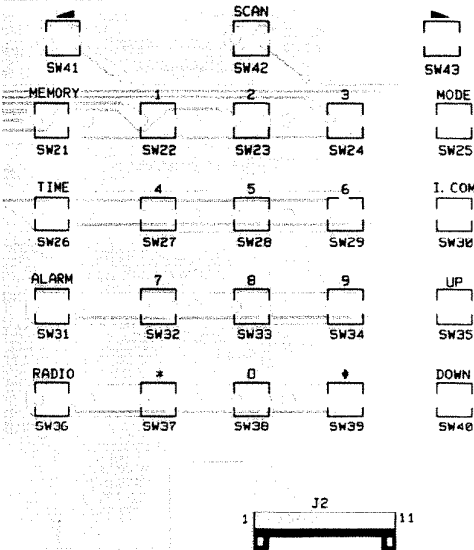
**MOV'S
TO PREVENT DAMAGE FROM
TRANSIENTS**

Schematic Diagrams/PC Boards

MASTER STATION: MAIN/INTERCOM KEYBOARDS AND LCD DISPLAY SCHEMATIC

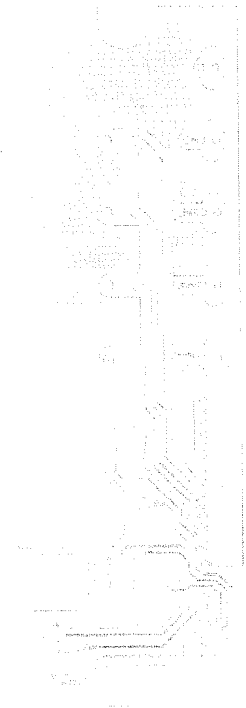
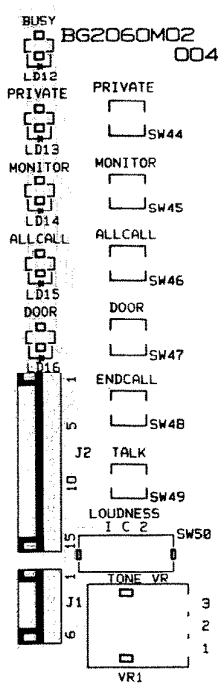






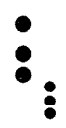
INTERCOM KEYBOARD
PC BOARD (TOP)

INTERCOM KEYBOARD
PC BOARD (BOTTOM)



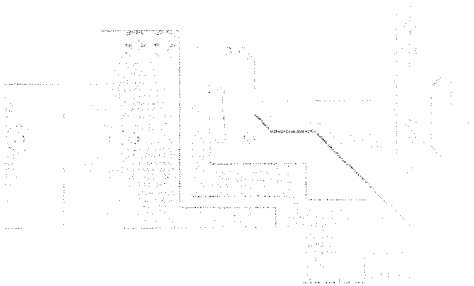
RESET SWITCH
PC BOARD (TOP)

RESET SWITCH
PC BOARD (BOTTOM)



BATTERY CONNECTOR
PC BOARD (TOP)

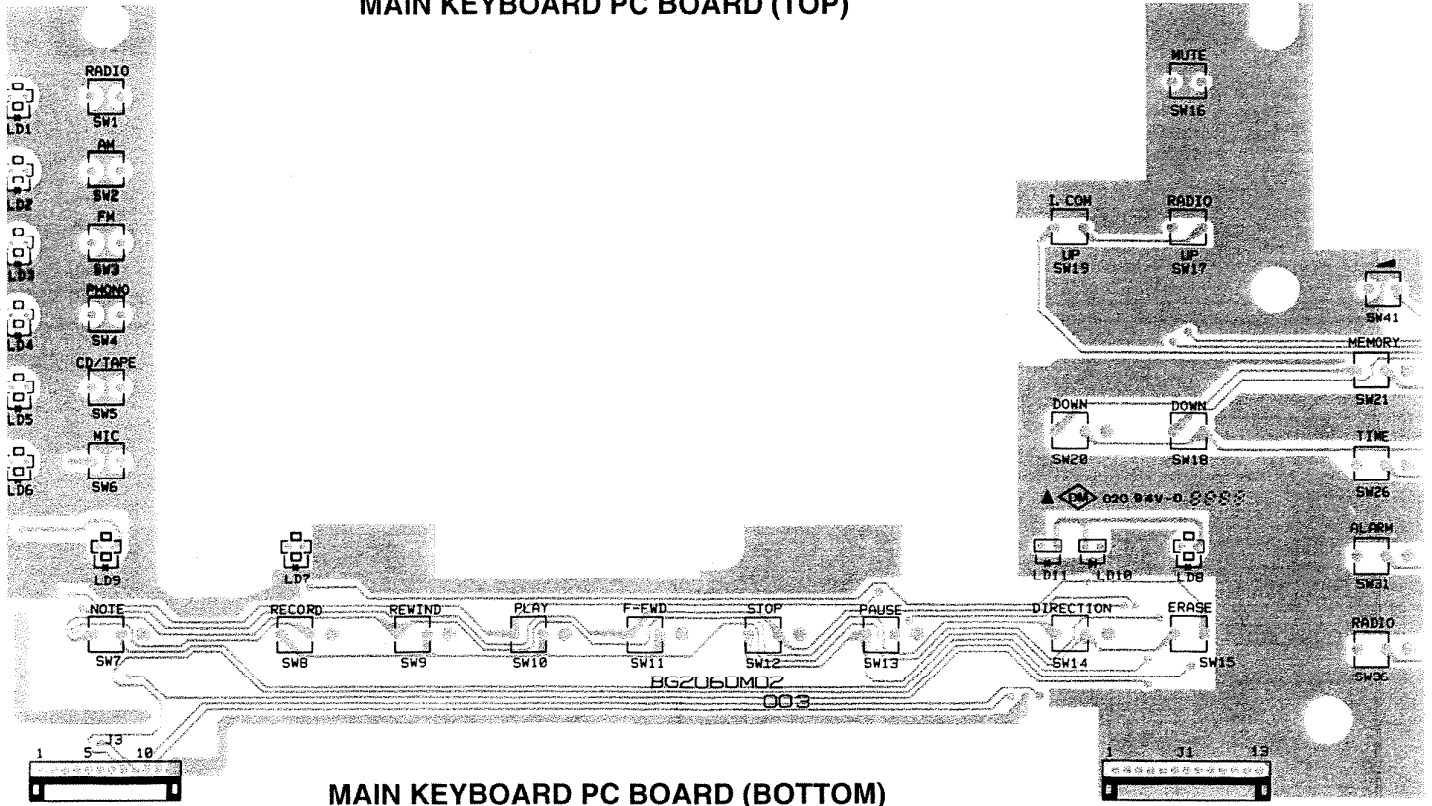
BATTERY CONNECTOR
PC BOARD (BOTTOM)



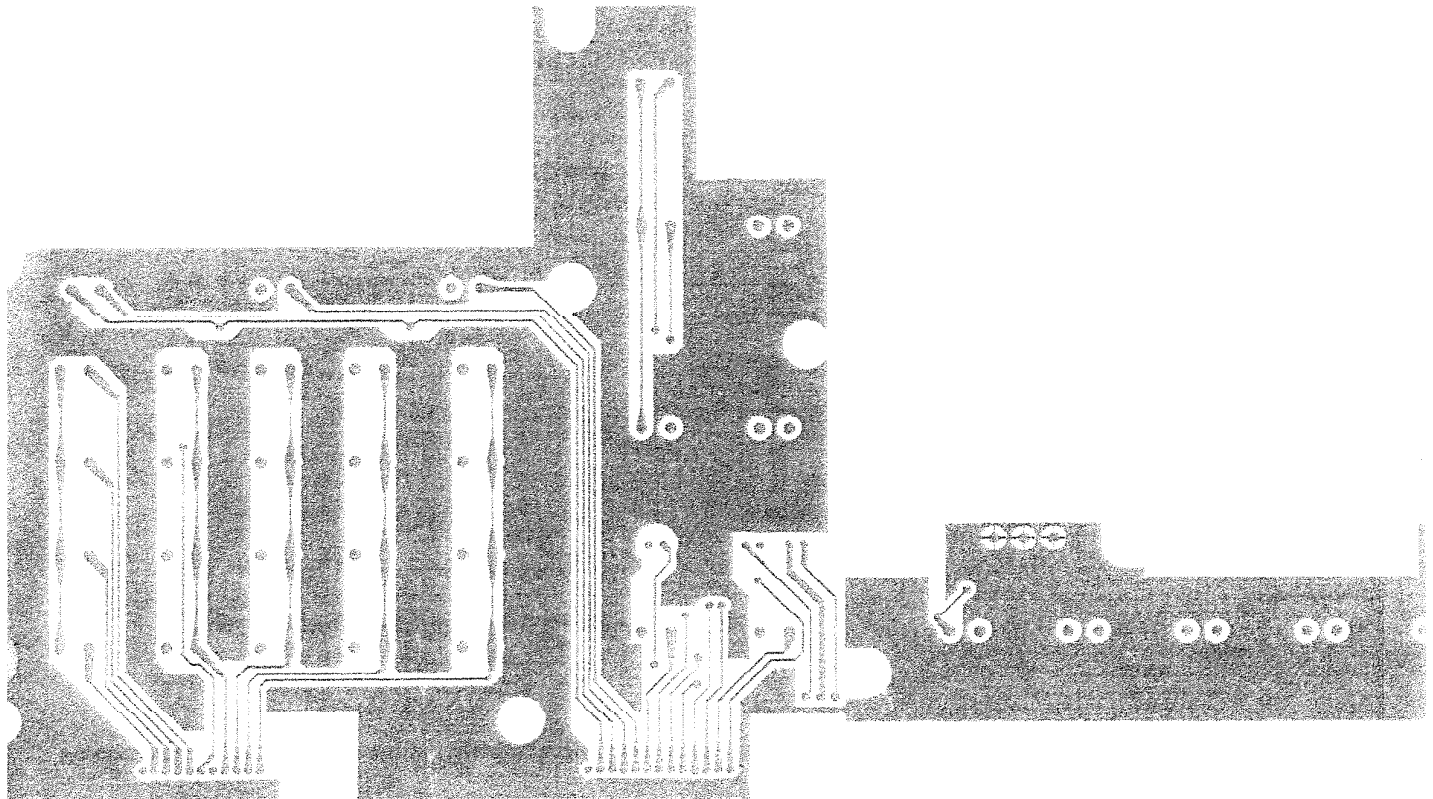
**MASTER STATION: MAIN/INTERCOM KEYBOARDS BATTERY CONNECTOR
AND RESET SWITCH PC BOARD FOIL PATTERN**

Schematic Diagrams/PC Boards

MAIN KEYBOARD PC BOARD (TOP)

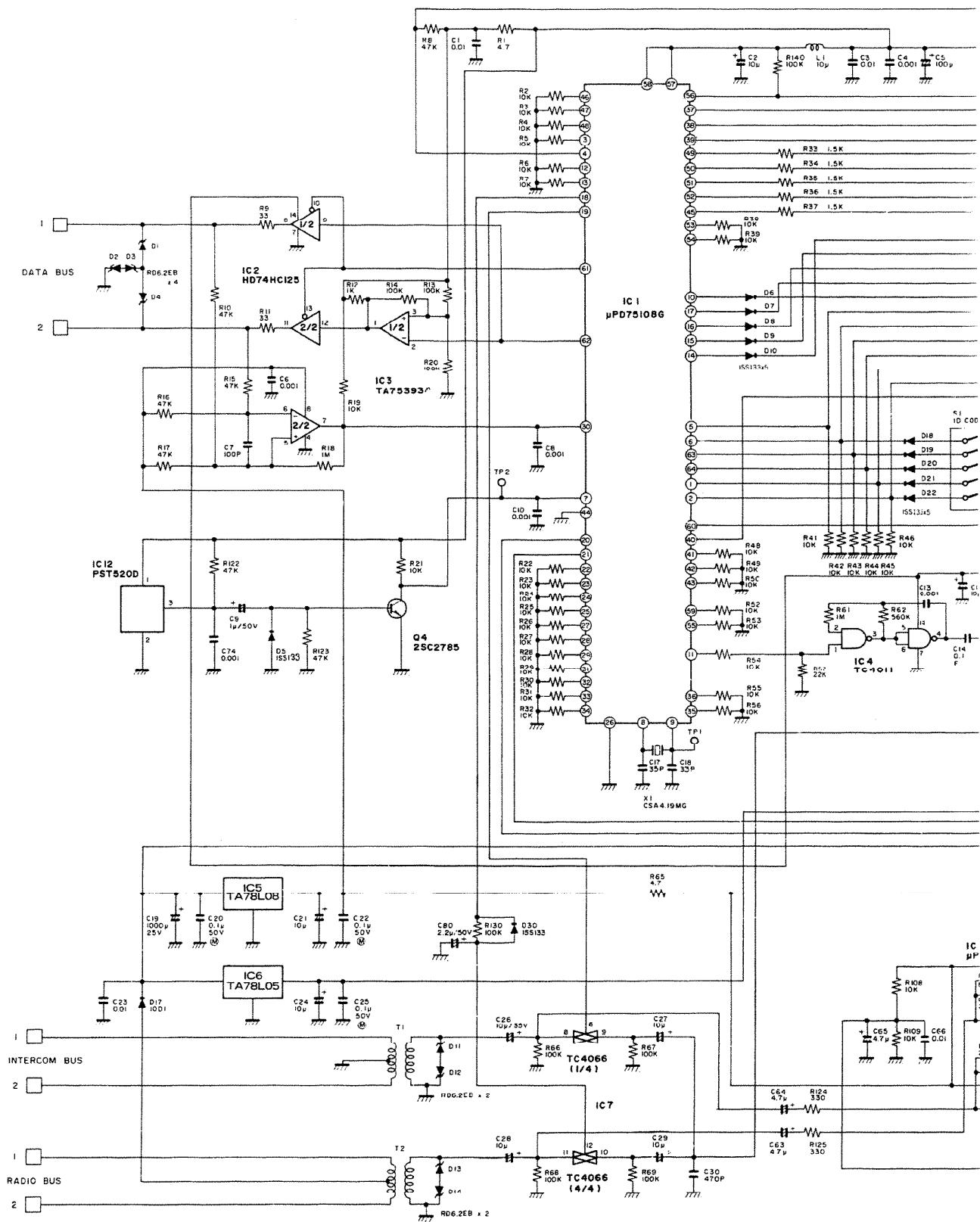


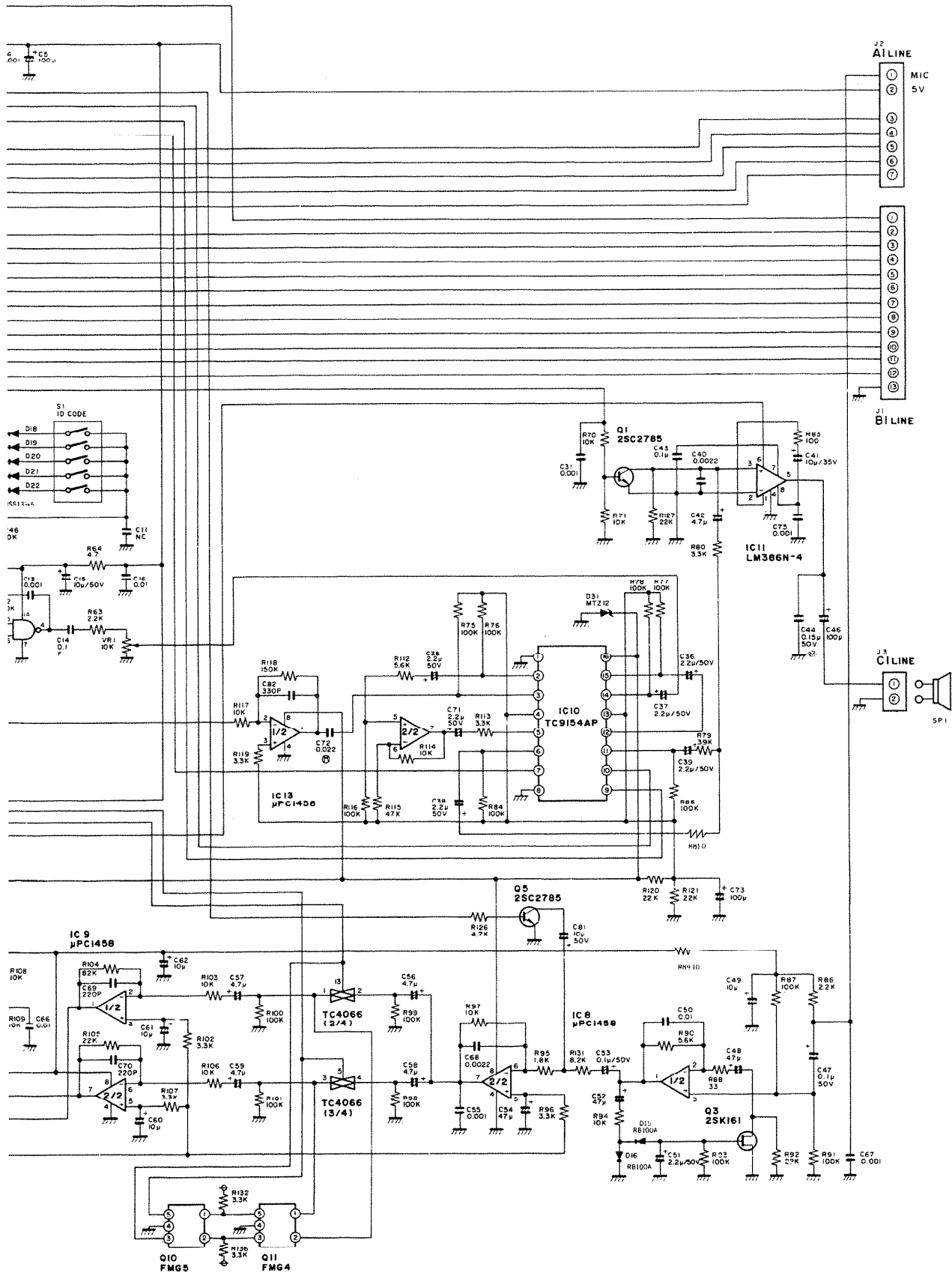
MAIN KEYBOARD PC BOARD (BOTTOM)



Schematic Diagrams/PC Boards

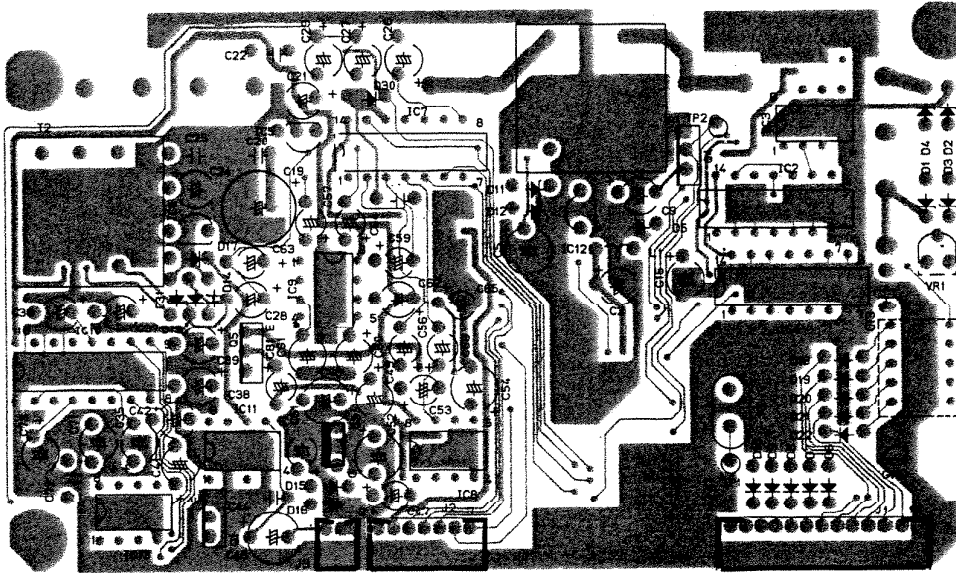
REMOTE STATION: MAIN PC BOARD SCHEMATIC



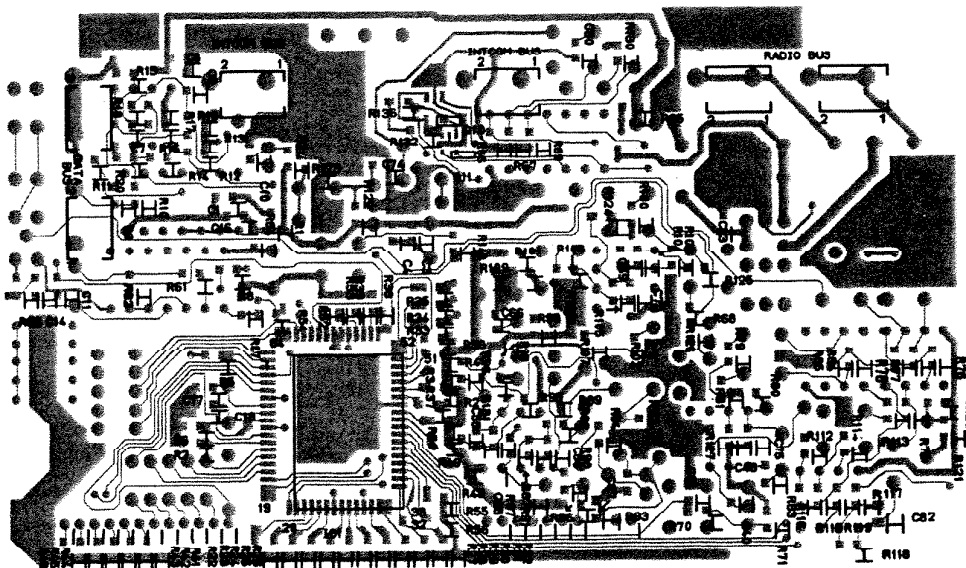


Schematic Diagrams/PC Boards

Remote Main PC Board - Top



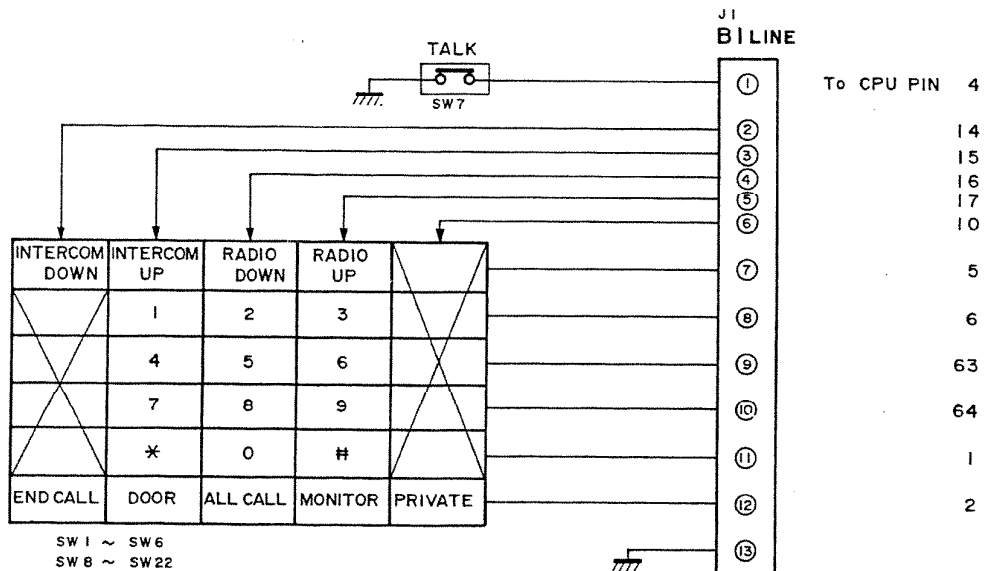
Remote Main PC Board - Bottom



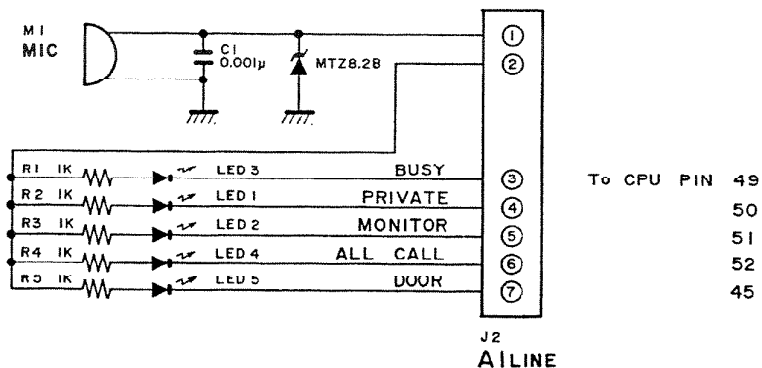
REMOTE STATION: MAIN PC BOARDS FOIL PATTERN

Schematic Diagrams/PC Boards

REMOTE STATION: KEYBOARD SCHEMATIC

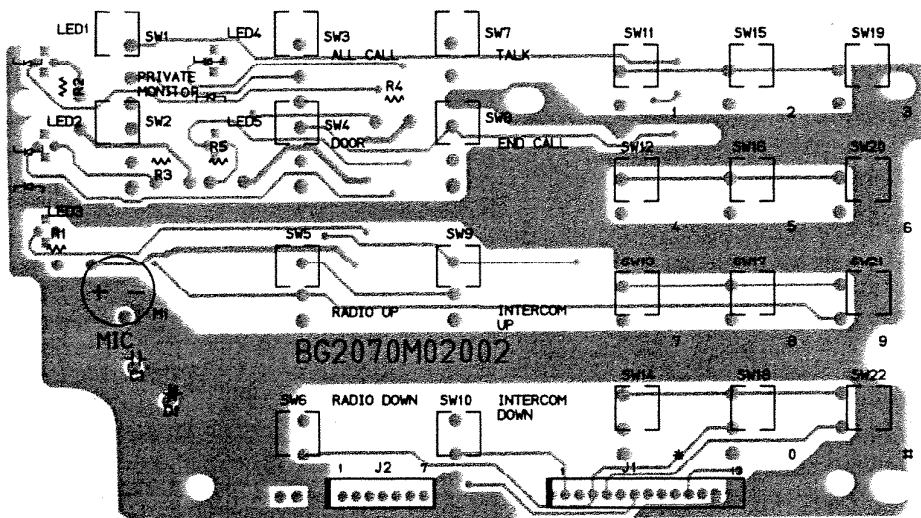


- SW 1 PRIVATE
2 MONITOR
3 ALL CALL
4 DOOR
5 RADIO UP
6 RADIO DOWN
- 7 TALK
8 END CALL
9 INTERCOM UP
10 INTERCOM DOWN
- 11 1
12 4
13 7
14 *
- 15 2
16 5
17 8
18 0
- 19 3
20 6
21 9
22 #

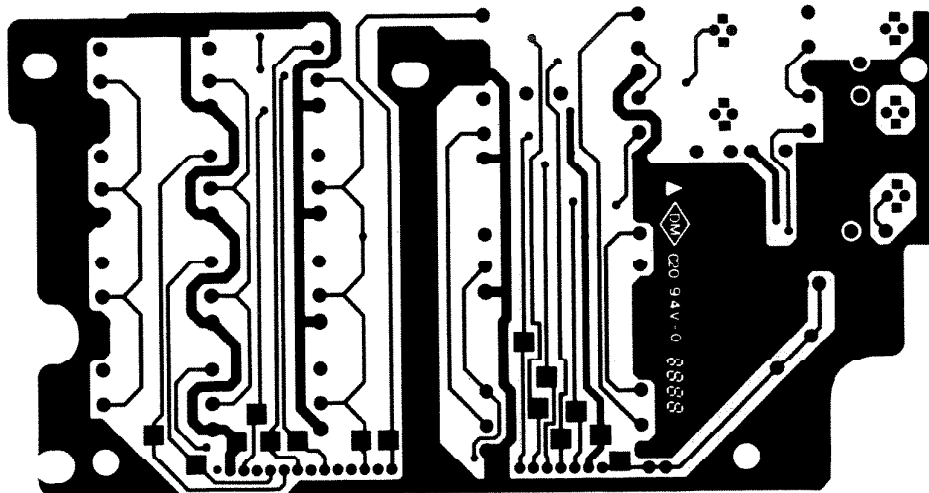


Schematic Diagrams/PC Boards

Remote Keyboard PCB - Top



Remote Keyboard PCB - Bottom



REMOTE STATION: KEYBOARD
FOIL PATTERN

Replacement Parts

MODEL IM-5006 RADIO INTERCOM MASTER UNIT

SCHEMATIC SYMBOL	NUTONE PART NO.	DESCRIPTION
A-1	9931A-000	Front Panel
A-4	9913A-000	LCD Window
A-5	9912A-000	Inlay
A-6	9980A-000	Key Top Dial (number keys)
A-7	9922A-000	Key Top Dial (cassette keys)
A-8	9918A-000	Key Top Dial (intercom, source keys)
A-9	9923A-000	Key Top Dial (function keys)
A-10	9924A-000	Key Top Dial (tuning keys)
A-11	9919A-000	Key Top Dial (volume keys)
A-12	9920A-000	Key Top Dial (mute, note keys)
A-13	9921A-000	Eject Button
B-19	9974A-000	Spring Eject Button
B-25	99142A-000	Cassette Door Assembly (includes window)
B-17	9973A-000	Damper – Cassette Door
B-18	9972A-000	Spring – Cassette Door
	9930A-000	Cassette Deck Assembly
	9979A-000	Cassette Belt Set
	9926A-000	Main PC Board Assembly
	9925A-000	Control PC Board Assembly
	9961A-000	Battery PC Board Assembly
	9916A-000	Main Key PC Board Assembly
	9917A-000	Intercom Key PC Board Assembly
	9915A-000	LCD Module
	9927A-000	Speaker
	9928A-000	Battery Ni-Cad 4.8v
	9839A-000	Hardware Bag Assembly (includes mounting bracket and screws)
	43914-000	Installation Instructions
	43915-000	Homeowners Manual

MODEL IS-515 SERIES 5" INSIDE SPEAKER

SCHEMATIC SYMBOL	NUTONE PART NO.	DESCRIPTION
	9940A-000	Panel and Key Pad Assembly (walnut)
	9948A-000	Panel and Key Pad Assembly (adobe)
	9952A-000	Panel and Key Pad Assembly (white)
	9941A-000	Key Top Dial # (walnut) (number keys)
	9949A-000	Key Top Dial # (adobe) (number keys)
	9980A-000	Key Top Dial # (white) (number keys)
	9943A-000	Key Top (walnut) (intercom keys)
	9951A-000	Key Top (adobe) (intercom keys)
	9953A-000	Key Top (white) (intercom keys)
	9944A-000	Key PC Board Assembly
	9945A-000	Main PC Board Assembly
	9946A-000	PC Board Cover
	9947A-000	Speaker
	43964-000	Installation Instructions
	8072A-000	Directory Card
	42930-000	Hardware Bag Assembly (includes (2) #8 x 2½ PH FIL HD "A" ant. copper screws)
	42931-000	Hardware Bag Assembly (includes (2) #8 x 2½ PH FIL HD "A" bright nickel screws)

Replacement Parts

MODEL IS-518 SERIES 8" INSIDE SPEAKER

SCHEMATIC SYMBOL	NUTONE PART NO.	DESCRIPTION
	9954A-000	Panel and Key Pad Assembly (walnut)
	9955A-000	Panel and Key Pad Assembly (adobe)
	9956A-000	Panel and Key Pad Assembly (white)
	9941A-000	Key Top Dial # (walnut) (number keys)
	9949A-000	Key Top Dial # (adobe) (number keys)
	9980A-000	Key Top Dial # (white) (number keys)
	9943A-000	Key Top (walnut) (intercom keys)
	9951A-000	Key Top (adobe) (intercom keys)
	9953A-000	Key Top (white) (intercom keys)
	9944A-000	Key PC Board Assembly
	9945A-000	Main PC Board Assembly
	9946A-000	PC Board Cover
	9957A-000	Speaker
	43965-000	Installation Instructions
	8072A-000	Directory Card
	9983A-000	Hardware Bag Assembly (includes (4) #8 x 2½ PH FIL HD "A" ant. copper screws)
	9839A-000	Hardware Bag Assembly (Includes (4) #8 x 2½ PH FIL HD "A" bright nickel screws)

MODELS IC-502L & IC-502WH REMOTE CONTROL

SCHEMATIC SYMBOL	NUTONE PART NO.	DESCRIPTION
	9968A-000	Panel and Key Pad Assembly (adobe)
	9969A-000	Panel and Key Pad Assembly (white)
	9951A-000	Key Top (adobe) (intercom keys)
	9953A-000	Key Top (white) (intercom keys)
	9949A-000	Key Top Dial # (adobe) (number keys)
	9980A-000	Key Top Dial # (white) (number keys)
	9944A-000	Key PC Board Assembly
	9967A-000	Main PC Board Assembly
	9964A-000	PC Board Cover
	43963-000	Installation Instructions
	8072A-000	Directory Card
	42931-000	Hardware Bag Assembly (includes (2) #8 x 2½ PH FIL HD "A" bright nickel screws)

Replacement Parts

MODEL IC-502LW OUTSIDE REMOTE CONTROL

SCHEMATIC SYMBOL	NUTONE PART NO.	DESCRIPTION
	9965A-000	Panel and Key Top Membrane Assembly: Panel Key Top Membrane
	9960A-000	Key PC Board Assembly (humi sealed)
	9963A-000	Main PC Board Assembly (humi sealed)
	9964A-000	PC Board Cover
	8072A-000	Directory Card
	43963-000	Installation Instructions
	42931-000	Hardware Bag Assembly (includes (2) #8 x 2½ PH FIL HD "A" bright nickel screws)

MODEL IS-519 5" OUTSIDE SPEAKER

SCHEMATIC SYMBOL	NUTONE PART NO.	DESCRIPTION
	9958A-000	Panel and Key Top Membrane Assembly: Panel Key Top Membrane
	9960A-000	Key PC Board Assembly (humi sealed)
	0254B-000	Main PC Board Assembly (humi sealed)
	9946A-000	PC Board Cover
	5916A-000	Speaker (weather proof)
	9984A-000	Gasket
	43964-000	Installation Instructions
	42931-000	Hardware Bag Assembly (includes (2) #8 x 2½ PH FIL HD "A" bright nickel screws)