RM-220

2-CHANNEL REMOTE STATION

INSTRUCTION
and
SERVICE MANUAL

945 Camelia St. Berkeley, California 94710 510-527-6666

Clear-Com 810193

8/24/94 REV. A

Clear-Com Systems

RM-220 2-Channel Remote Station

Instruction Manual

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Clear-Com Systems
945 Camelia St.
Berkeley, Ca. 94710
U.S.A

While Clear-Com makes every attempt to maintain the accuracy of the information contained in its product manuals, that information is subject to change without notice.

CLEAR-COM LIMITED WARRANTY

Clear-Com products are warranted to be free from defects in materials and workmanship for a period of one year from the date of sale.

Clear-Com's sole obligation during the warranty period is to provide, without charge, the parts and labor necessary to remedy covered defects appearing in products returned prepaid to Clear-Com, 945 Camelia St., Berkeley, Ca. 94710-1484, U.S.A.

This warranty does not cover any defect, malfunction or failure caused beyond the control of Clear-Com, including unreasonable or negligent operation, abuse, accident, failure to follow instructions in the Manual, defective or improper associated equipment, attempts at modification and repair not authorized by Clear-Com, and shipping damage. Products with their serial numbers removed or defaced are not covered by this warranty.

To obtain warranty service, follow the procedures described below in "Procedures for Returns" and "Shipping to Manufacturer for Repair or Adjustment."

This warranty is the sole and exclusive express warranty given with respect to Clear-Com products. It is the responsibility of the user to determine before purchase that this product is suitable for the user's intended purpose.

Any and all implied warranties, including the implied warranty of merchantability are limited to the duration of this express limited warranty. Neither Clear-Com nor the dealer who sells Clear-Com products is liable for incidental or consequential damages of any kind.

Return Shipping Instructions

Procedures for returns:

--If repair is necessary, contact the dealer where the unit was purchased.

--If repair through the dealer is not possible, contact the Clear-Com Customer Service Department, located at the factory, as directed below. They will issue a Return Authorization Number (RMA).

--Do not return any equipment to the factory without first obtaining a Return Authorization Number.

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–Be prepared to provide your company's name, address, phone number, name of person to contact regarding the repair, type and quantity of the equipment, description of the defect, and the equipment serial number(s).

Questions regarding returns for repair should be directed to:

Customer Service Department
Clear-Com Intercom Systems
945 Camelia Street
Berkeley, California 94710-1484
Telephone: (510) 527-6666
Fax: (510) 527-6699

Shipping to Manufacturer for Repair or Adjustment

All shipments of Clear-Com equipment must be prepaid via United Parcel Service or the best available shipper. The equipment should be shipped in the original packing container; however, if the original container is not available, use a suitable container that is rigid and of adequate size. If a substitute container is used, the equipment should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material. A detailed description of the problem or work to be done should be included. All shipments should be directed to the attention of the Customer Service Department and must include the Return Authorization Number.

Upon completion of repairs, equipment will be returned collect via United Parcel Service or other specified shipper.

NOTICE ABOUT SPECIFICATIONS

Performance specifications included in this manual are design-center specifications and are included for customer guidance and to facilitate system installation. Actual operating performance may vary.

BEFORE YOU BEGIN . . .

To get the most out of the RM-220 Main Station, read this manual carefully. It will answer questions you might have about the operation and service of the components in the system. Included is a Troubleshooting Section that provides causes and possible solutions to problems you might have with system and component operation. Clear-Com's Customer Service Department is available to answer questions not covered in this manual.

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THE CLEAR-COM CONCEPT

Clear-Com is a closed-circuit intercom system that consistently provides high-clarity communication in high-noise and low-noise environments. A basic system consists of a single- or multi-channel power supply or main station connected to various single- or multi-channel remote stations, such as beltpacks and loudspeaker stations.

Clear-Com manufactures a wide variety of both portable and fixed-installation units. All are compatible with each other. Clear-Com intercom systems can also interface with other communication systems and devices.

Clear-Com stations are interconnected with two-conductor, shielded microphone cable, using 3-pin XLR connectors. One wire carries the DC power (28-30 volts) from a main station or power supply to all remote stations, and the other wire carries 2-way (duplex) audio information. The shield acts as a common ground. One termination (per channel) is needed throughout the intercom network, and is usually located in the main station or power supply.

Clear-Com is a distributed amplifier system; each main and remote station houses its own mic preamplifier, headset or speaker power amplifier, and signaling circuitry. Low-impedance mic input lines (200 Ohms) and specially designed circuitry make Clear-Com channels virtually immune to RFI and dimmer noise.

Clear-Com main stations, power supplies and certain remote stations each have an auxiliary program input with its own volume control, which allows an external audio source to be fed to the intercom system.

Visual Signal Circuitry (CALL Lights), a standard feature on most main and remote stations, allows the user to attract the attention of operators who have removed their headsets.

Depending upon the type of main and remote stations selected and assuming that enough DC power is available, a maximum number of remote stations from 10 (all speaker stations) to 30 (all headset stations) can be distributed along a mile of wire. Remote stations bridge the intercom line at a very high impedance (>10 KOhms), and place a minimum load on the line. The audio level always remains constant, and does not fluctuate as stations leave and join the network.

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DESCRIPTION

The "PL-Pro" RM-220 is one of a series of professional intercom stations specifically designed for the broadcast industry. This 2 channel, one rack space station is ideal for ENG and EFP trucks, production studio consoles, and small TV facilities. The station can be tailored to your needs through it's programmable "Talk" button options. The RM-220 is compatible with all Clear-Com Party-Line intercoms,

The station also incorporates a single channel program interrupt system (IFB) in the station. When activated, one or more stations can interrupt the program to a talent with Clear-Con's wired or wireless talent receivers. Direct connection to Clear-Com's IFB system is easily accomplished through a 1/4 inch phone jack on the rear panel intended to directly connect to a Clear-Com MA-4.

The RM-220 remote speaker/ headset station allows selectable two channel talking and/or listening on a Clear-Com Intercom System. The operator can communicate on either of the channels separately or on both at once. Illuminated dual action talk buttons are electronic momentary or latching. The latching feature may be disabled if desired. Also the talk buttons can be remote controlled for footswitch or other use. Monitoring activity is possible through the speaker or headset or both at once.

The RM-220 features Visual Call Signaling to attract the attention of operators who have removed their headsets or turned off their speakers.

This station accepts dynamic headsets. The station accepts two different lengths of plug-in gooseneck microphones, 9" and 18", to allow for different operating locations/positions.

The station's speaker can be turned on or off by a convenient front panel switch when private conversation via the headset is desired. A "speaker dipping" circuit will give you an additional amount of acoustic output before feedback. This feature helps to reduce feedback when stations are placed in close proximity to each other. The station accepts a balanced Program input for monitoring external audio in the headset or speaker. Individual sidetone controls for each channel allows the operator to vary the level of his/her own voice as heard in the headset/speaker.

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"Studio Announce" allows control of a paging speaker in a studio. A front panel button activates this function and an associated relay.

The RM-220 installs in a standard 19" equipment rack, using only one rack space. The station provides two 3-pin, XLR connectors for Input and loop-through on each channel.

TECHNICAL SPECIFICATIONS:

CONTROL SYSTEM:

CMOS Digital Logic and Signal Switching

HEADSET MICROPHONE PRE-AMP:

Dynamic Headset Input Impedance ——— - 1 KOhms
Input Level ——— - 55 dBv* nominal
Frequency Response: ——— 250 Hz to 12 KHz, contoured for intelligibility.
Gain from Headset to Intercom Line: ——— +41 dB

PANEL MICROPHONE PRE-AMP:

Input Level ——— 45 dBv* nominal
Frequency Response: ——— 250 Hz to 12 KHz, contoured for intelligibility.
Gain from Panel Mic to Intercom Line: ——— +31 dB (adjustable)

SPEAKER AMPLIFIER:

Load Impedance: ——— 16 Ohms
Output Level: ——— at least 4 watts
Distortion: ——— <0.2% THD at 1 KHz
Frequency Response: ——— 200-18KHz +/-2dB

HEADPHONE AMPLIFIER:

Load Impedance: ——— greater than 50 Ohms
Output Level: ——— at least +20 dBv* across 600 ohm
Distortion: ——— <0.2% THD at 1 KHz
Frequency Response: ——— 200-18KHz +/-2dB
Gain from Intercom Line: ——— +37 dB

PROGRAM INPUT:

Input Level Ref.: ——— -10 dBv*
Input Impedance: ——— >40 KOhms
Frequency Response: ——— 150 Hz to 15 KHz

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INTERCOM LINE DRIVE/RECEIVE CIRCUITS:

Impedance, Output Load: ——— > 10 KOhms (200Hz - 10 KHz)
Level, Line (200 ohm load): ——— -9 dBv* (nominal) +5dBv (max before clip)
Sidetone Null Capability: ——— > 25 dB (200Hz - 10 KHz)
Crosstalk, Station Induced Ch. to Ch.: ——— >60 dB
Noise, SN Ratio in Listen Channels: ——— >60 dB

LINE LEVEL OUTPUTS:

SA (Announce)
- Type ——— Balanced
- Impedance ——— 600 ohms
- Level ——— 0 dBv

IFB/HOT MIC:
- Type ——— Unbalanced
- Impedance ——— 600 ohms
- Level ——— 0 dBv

STANDARD CLEAR-COM SYSTEM SPECIFICATIONS:

Usable Line Quality: ——— > 100 Stations
Total Line Length on One Channel ——— > 5000 feet

CONNECTORS:

Intercom: ——— 4 XLR-3 (2-CH A, 2-CH B)
Accessory ——— DB-15F
- Program Input
- SA output
- Foot Switch Logic Inputs

IFB/HOT MIC. ——— 1/4 inch Phone Jack

POWER REQUIREMENTS:

Source ——— Intercom Line
Voltage ——— 20 - 30 VDC
Current ——— 65 mA idle, 120 mA average

PHYSICAL SPECIFICATIONS:

Dimensions: ——— 19"W x 1.75"H x 7..0D (483mm x 44.5mm x 178mm)
Weight: ——— 3.6 lbs (1.6 Kg)
Operating Temperature Range: ——— 32-122° F (0-50° C)

* - 0dBv = 0.775 volts RMS.

(Specifications subject to change without notice.)

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INSTALLATION

This section discusses the installation of the RM-220 in an intercom system. Typical applications, overall installation theory, and detail of each connector, and adjustment of the RM-220 are discussed.

INSTALLATION OVERVIEW

This section describes the Clear-Com concept in intercom line interconnection. The following subjects are discussed:

- Intercom Line Connection
- Line Termination
- Station Powering
- Cable Considerations

Intercom Line Connection:

The RM-220 provides a male and female XLR-3 connector for each intercom line that are "looped through".

Line Termination:

The fundamental concept of Clear-Com Party-Line intercom is that all stations provide high impedance current sourced signals into a single common system termination. The line drivers in a station have a source impedance greater than 10 KOhms.

The receive or "listen" section of stations contain a 'hybrid null' circuit that attempts to reject (null) any "talk" signal being sent by that station on that channel. The 'hybrid null' circuit depends on a known impedance on the intercom line to accomplish this. Variations in impedance on the line upset the 'null'.

CAUTION: All Clear-Com Intercom lines must be terminated. Care must be taken not to fail to terminate or to 'double' terminate a line. All unused intercom inputs must be terminated to keep the line drive circuits stable.

The RM-220 does not provide termination on the intercom line. Clear-Com main stations and power supplies provide switch selectable termination networks on all intercom output lines. It is up to the user to determine where the termination will be provided. An unterminated line will cause excessive levels, possible oscillation of line drivers, and sever unbalance of hybrid null networks. A double or multiple terminated line will cause low levels and sever unbalance of hybrid null circuits.

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The termination of an intercom line (or channel) is a 220 Ohm resistor in series with a 4.7 KOhm that is paralleled with a 10 uF capacitor.

Station Powering:

The RM-220 needs +20 to +30 volts between pins 1 and 2 of the intercom connectors. Typical Clear-Com systems are powered by a Main Station or a Power Supply.

Clear-Com power supplies can be paralleled to increase the number of REMOTE STATIONS that can be operated in a system.

Cable Considerations:

The Clear-Com intercom line is intended to run on a shielded twisted pair of cable per channel of intercom. One conductor carries full duplex ("two-way") audio, the other conductor carries the DC power for remote stations. The shield is used for ground return for audio and power. When choosing interconnect cable, keep the following considerations in mind:

1 DC resistance of the ground or common conductor affects crosstalk. For runs longer than 500 feet do not use wire smaller than 20 gauge.

2 The capacitance of the interconnect cable affects system frequency response and sidetone stability. Total capacitance should not be greater than 0.25 uF.

Portable Installation Cable: Practical cable for portable system interconnections is flexible, two-conductor, shielded microphone cable. For runs less than 500 feet a cable made of 24 gauge wire is acceptable. For runs longer than 500 feet use a 20 gauge cable or larger.

Permanent installation Cable: Vinyl-jacketed shielded pair is the cable of choice for permanent installations. Use a low-capacitance 20 gauge wire for short runs (under 500 feet) and 18 gauge cable for runs greater than 500 feet. Placing the cable in conduit is recommended but not necessary.

Multi-pair cable that is individually shielded is acceptable for use in multi-channel systems. For cross-talk considerations the shields must be tied together on both ends of the cable to produce the lowest possible DC path for ground return.

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DESCRIPTION OF CONNECTORS

Headset Connector (Front Panel)

NOTE ABOUT HEADSETS: The following is a description of a recommended headset.

Mic Type —— Dynamic
Impedance – 150-250 Ohms
Output ——— -55dB
Headphone – Dynamic
Impedance — 50-2000 Ohms

Wiring: Pin 1 – mic common
Pin 2 – mic hot
Pin 3 – headphone common
Pin 4 – headphone hot

Panel Mic Connector (Front Panel)

Clear-Com provides two plug-in panel microphones for use on the RM-220. The GM-9 is 9 inches long and GM-18 is 18 inches long. The microphone is of the electret type. The microphone has a builtin 1/4 inch phone jack for a connector. A mating receptical is mounted on the RM-220.

To install a GM-9 or GM-18 panel mount microphone use the following steps:

1 Check the set screw in the mic mounting flange to make sure it is clear of the threads in the bushing.
2 Screw the microphone into the bushing hand tight.
3 Set the set screw on top of the bushing to lock the mic in place.

Intercom Line Connectors (Rear Panel, XLR-3 2 male & 2 female)

The RM-220 has a male and female pair of XLR-3 connectors for each intercom line. The male-female pair of connectors are wired parallel and intended for loop-thuough connection.

The pinout of the Intercom Connectors is as follows:

- Pin 1 — Ground (Shield)
- Pin 2 — Power (+20 to +30 VDC)
- Pin 3 — Audio

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IFB/HOT Mic (Rear panel, 1/4 inch Phone Jack)

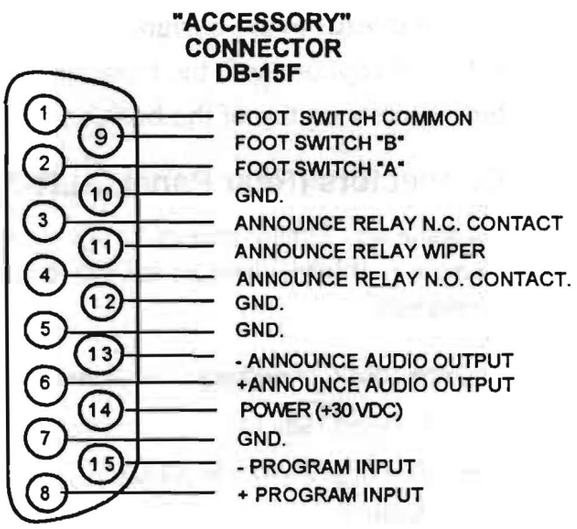
A 1/4 inch phone jack marked IFB/HOT Mic provides a 0 dB output signal from the selected microphone. This output is intended to work with Clear-Com's MA-4 IFB control panel. A control signal into this connector from the MA-4 cause all active Talks from the station to cease and only send an output to this output.

The pin description of the connector is as follows:

- Tip — Microphone Audio Output
- Ring — Control Signal (>15 VDC)
- Sleeve — Ground (Shield)

ACCESSORY (Rear Panel, DB-15F)

The Accessory DB-15F connector on the rear panel provides Program Input, Announce Audio Output, Announce Relay Contacts, and Foot Switch inputs for activating a Talk on either channel. The pin assignment of the connector is as follows:



Viewed from the rear of the connector

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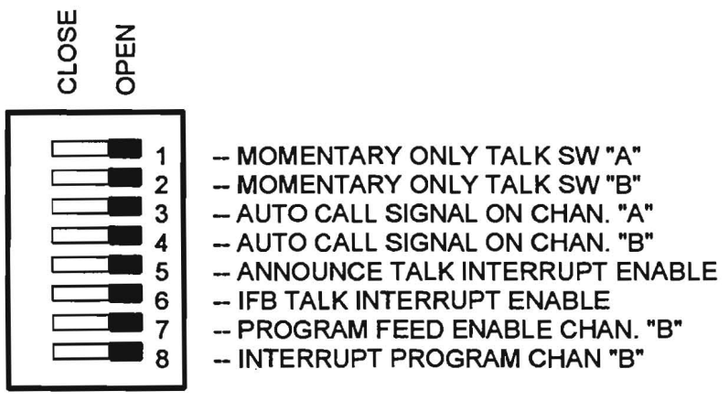
DESCRIPTION OF OPTIONS AND ADJUSTMENTS

Dip Switch Option Switches (Rear Panel)

Eight dip switches on the rear panel enable various options in the station.

- Momentary only action only on the TALK switches.
- Automatically send a CALL signal when a TALK is active.
- Interrupt any active TALKs when the ANNOUNCE button is pressed.
- Interrupt any active TALKs when the IFB circuit is activated.
- Feed PROGRAM audio to Chan. "B" and disable the monitoring of PROGRAM with the front panel control marked PROGRAM.
- Interrupt the PROGRAM feed to Chan. "B" when a CALL signal is present on Chan. "B".

The RM-220 is shipped from the factory with all dip switches in the OPEN position. To enable a function place that dip switch in the CLOSE position.



Mute Level Adjust (Rear Panel)

When a TALK button is pressed the listen level in the Speaker will "MUTE" or "DIP" to a lower level that is set by the MUTE LEVEL control. To disable the function, turn the control fully clock-wise. The maximum DIP is approximately 10 dB in the full counter-clock-wise position.

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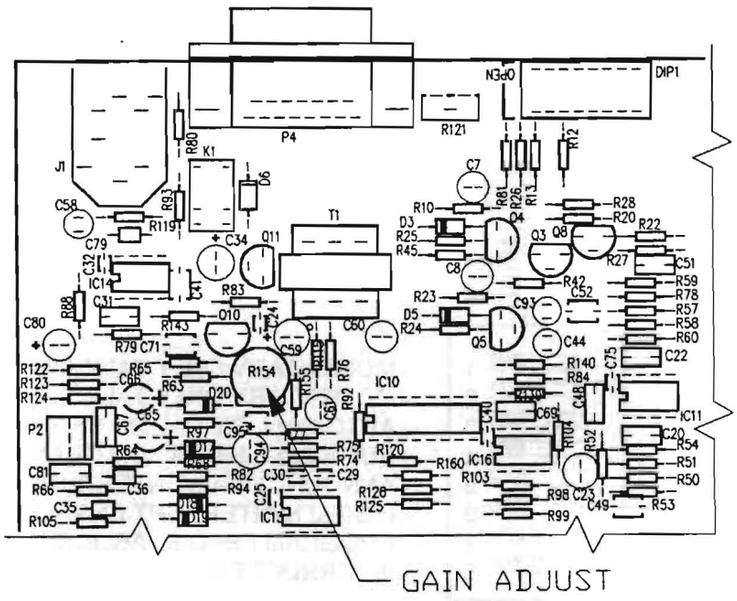
Panel Mic Level Adjustment (Internal)

The microphone preamplifier for the Panel Microphone has an internal gain adjustment control. This gain can be adjusted for different operating conditions. As shipped from the factory the control is set to minimum gain such that the panel microphone and a headset microphone have the same volume when worked at about 2 inches.

To adjust the panel microphone gain, remove the top cover of the unit and adjust R154 on the right side of the printed circuit board. Refer to the illustration below.



Location of Panel Mic Gain Adjust Control R154

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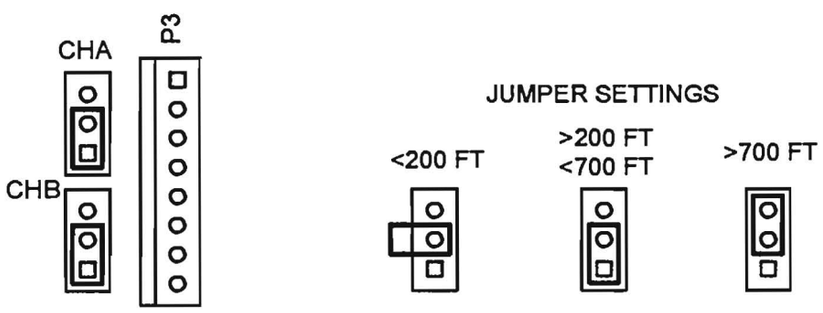
Intercom Line Length Compensation (Internal)

The receive circuits of the intercom channels have been optimized for a Intercom Line length between 200 and 700 feet (60 and 200 meters). The capacitance of the intercom line must be compensated for in the receive circuits if a good sidetone null is to be achieved. When using a speaker a good sidetone null is necessary to achieve a usable listening level.

A set of jumpers has been provided for compensating for lines shorter than 200 feet or longer than 700 feet. Each intercom channel has its own jumper.

To change the setting of the Line Length Compensation Jumpers, remove the cover of the unit and move the jumper for the appropriate channel. The jumpers are next to P3 about in the middle of the board. Refer the illustration below for jumper selection. Set each channel for the setting appropriate for it.



Line Length Compensation Jumper Settings

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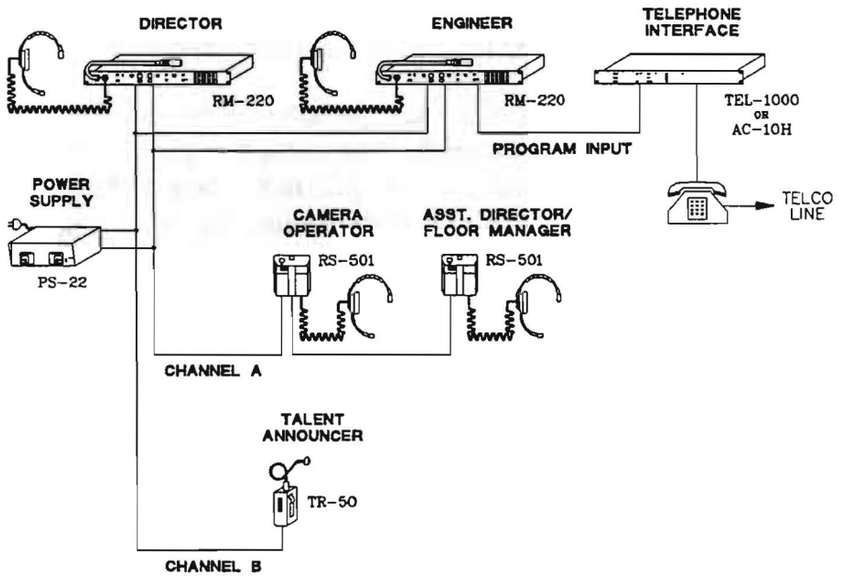
TYPICAL SYSTEM APPLICATIONS

ENG/ EFP Truck

The following block diagram describes a typical ENG/EFP Truck installation.



Typical ENG/EFP Truck Installation

The system has two 2 channel RM-220 rack mount stations. The system is powered from a 1 amp Clear-Com power supply that also provides the terminations for both channels.

Channel B is connected to Talent Recievers for announcers.

A telephone line interface is connected to the Program input of station #2 that provides a program feed from the studio via a dial-up telephone line. Its dip switch options are set to insert program on channel B and interrupt the program when a call signal is present on channel B. The option dip switches for placing a Call signal on channel B is set on both RM-220s. Now, either RM-220 will interrupt the program feed to the announcer when a Talk is initiated from it to the announcers.

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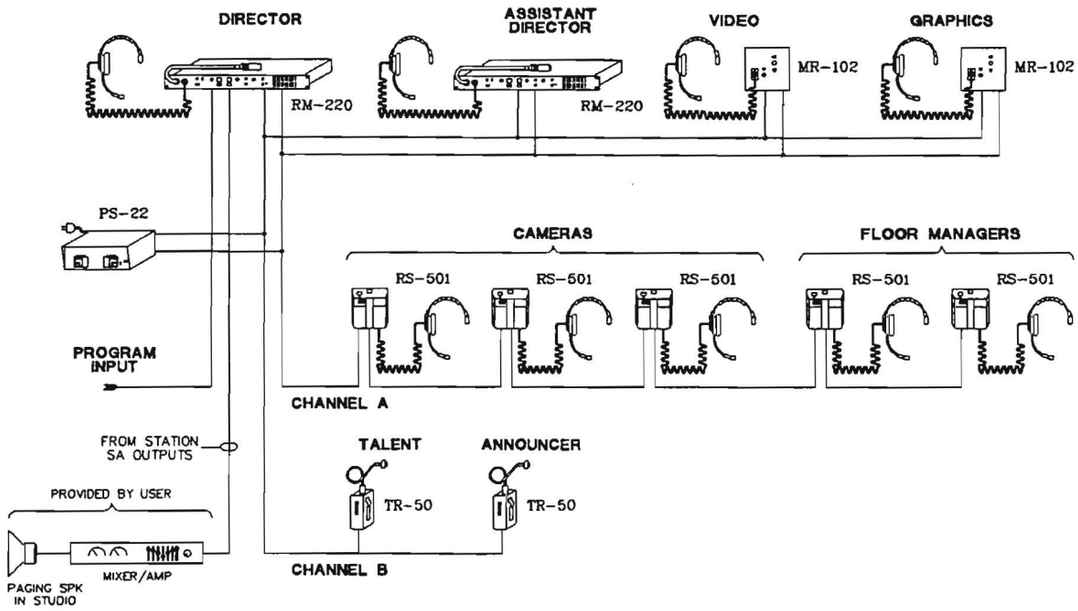
Cable/School Television Studio

The following block diagram describes a typical Cable or School Television Studio installation.



Typical Cable or School Television Studio Installation

The system has several 2 channel RM-220 rack mount stations and several wall mount 2 channel stations. The system is powered from a 1 amp Clear-Com power supply that also provides the terminations for both channels.

A line of single channel beltpacks is connected to channel A. The beltpacks are used for the cameras and floor managers. Normal communication between all parties is on channel A.

Channel B is connected to Talent Receivers for announcers. Program that is to feed the announcers is connected to the first RM-220. Its dip switch options are set to insert program on channel B and interrupt the program when a call signal is present on channel B. The option dip switches for placing a Call signal on channel B is set on both RM-220s. Now, either RM-220 will interrupt the program feed to the announcer when a Talk is initiated from it to the announcers.

A PA amplifier is connected to the ANNOUNCE output of the first RM-220 such that the operator of that station could talk directly to everyone in the studio.

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ACTUAL APPLICATIONS

This section describes detail instructions for various types of applications. A block diagram such as those in the previous section describing an ENG/EFP Truck and a Cable/School Television Studio should be developed for your application. The following sub-topics in this section describe in detail each of the major application types that might be encountered. The sub-topics in this section are:

- Intercom Line Wiring
- Program Input
- Internal IFB Operation
- External IFB (MA-4 and PIC-4000 Connection)
- PA Feed to StudioOutput
- Remote Control of TALK Switches
- Inadequate Side-Tone Adjustment

Intercom Line Wiring

The Intercom Line wiring has several purposes in the Clear-Com system.

- Interconnection of the audio intercom signal between stations.
- Delivery of DC power for remote stations such as the RM-220 to operate from.
- Termination of the intercom audio line external to remote stations.

Interconnect the intercom lines of stations and power supplies using a shielded twisted pair cable with XLR 3 pin connectors the same as used for balanced microphones. Refer to the Installation Overview section of this manual on page 9 for more information.

The RM-220 has a male and female pair of XLR-3 connectors for each intercom line. The male-female pair of connectors are wired parallel and intended for loop-thuough connection.

The pinout of the Intercom Connectors are as follows:

- Pin 1 — Ground (Shield)
- Pin 2 — Power (+20 to +30 VDC)
- Pin 3 — Audio

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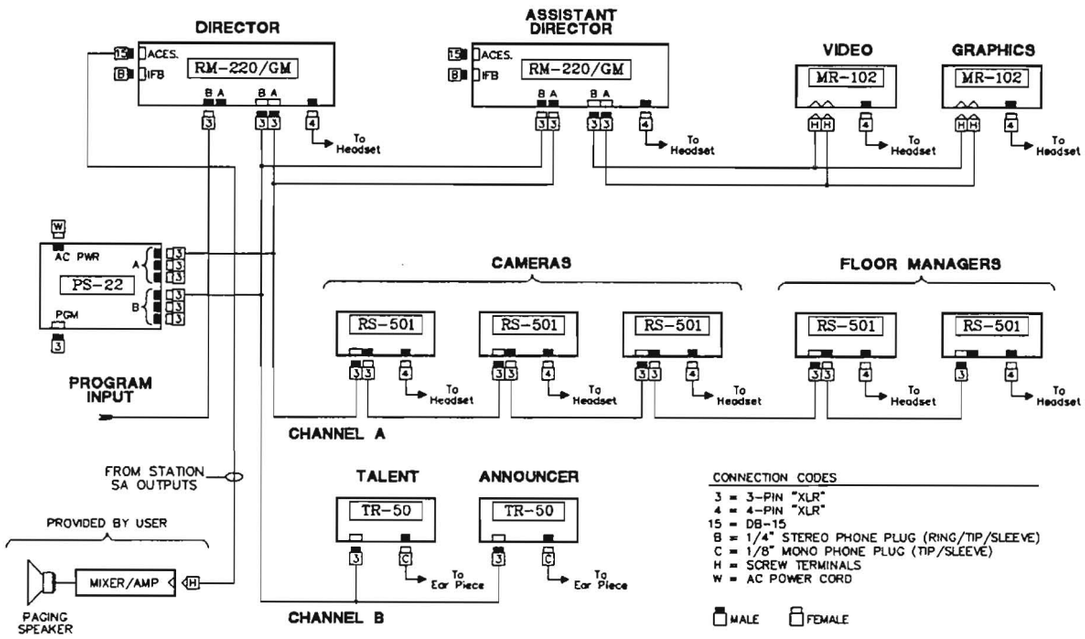
The following application shows the practical interconnection of the intercom lines in the block diagram of the Cable/School Television Studio shown on page 17.



Interconnecting a Small Cable/School Television Studio

The entire system is wired using male/female microphone cables looped-through each station except for the MR-102s. The MR-102 has screw terminals for the intercom lines. The PS-22 provides the DC power for the system and the line termination switches must be turned ON.

CAUTION: All Clear-Com Intercom lines must be terminated. Care must be taken not to fail to terminate or to 'double' terminate a line. All unused intercom inputs must be terminated to keep the line drive circuits stable. The RM-220 does not provide termination on the intercom line.

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Program Input

There are to different purposes for the Program Input; monitoring program in the speaker and headphone or feeding the Channel B intercom line with program material.

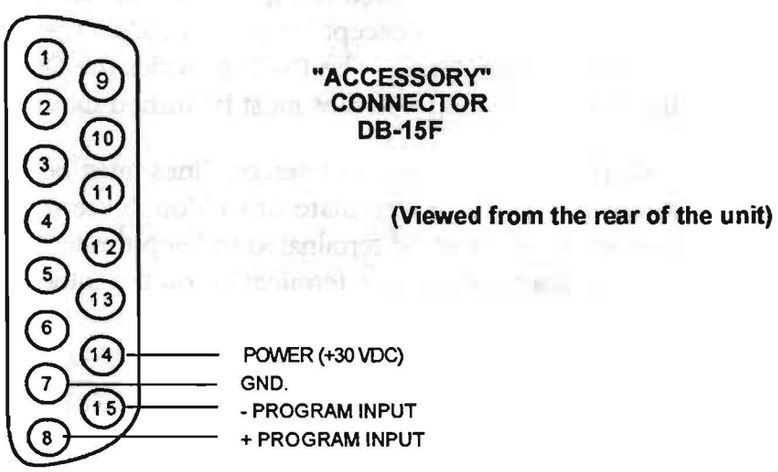
Monitoring Program: To monitor Program in the headphone or speaker:

- Connect the Program source to the proper pins on the DB-15.
- Make sure that DIP switches 7 & 8 are set to the OPEN position.
- Set the front panel control marked Program for the desired volume.

Feeding Channel B Intercom Line: To feed the B channel with program material:

- Connect the Program source to the proper pins on the DB-15.
- Set DIP switch #7 to the CLOSE position.
- Set the Program Send Level control on the front panel just underneath the Ch. B Listen Control for the desired level on the Intercom line.
- If it is desired to interrupt this program feed when a CALL signal is present on the intercom line set DIP switch #8 to the Close position.

To Connect To The Program Input: The Program Input of the RM-220 is available in the DB-15 Accessory Connector on the rear panel. The input is electronically balanced with an input impedance of 10 KOhms. The nominal level should be 0dB +/- 10dB.



Connecting Program Sources

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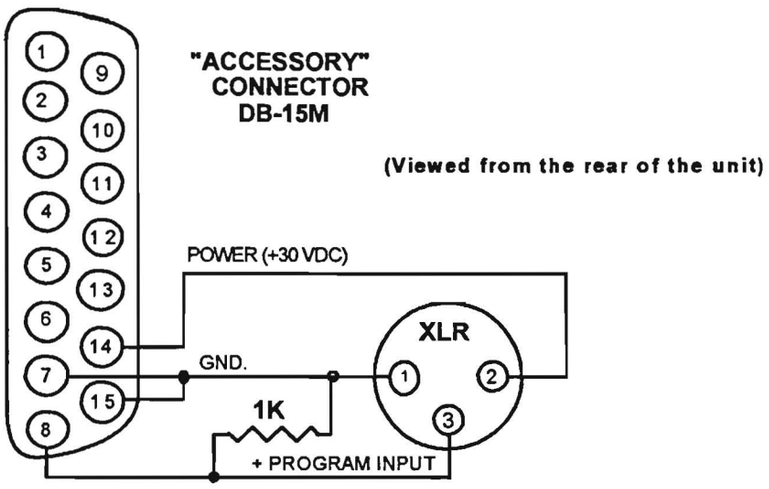
Connect a balanced input to pins 8 and 15 with the shield connected to pin 7.

To connect an unbalanced input connect the signal to pin 8 and connect the shield to pins 15 and 7.

Connecting Party-Line Products As Program Sources: If other Clear-Com products are to be used as a program source directly such as an AC-10H Telephone interface use the following interconnection cable.

Pin 14 of the DB-15 ACCESSORY connector provides +30 VDC to power the external device. Connecting pins 7 and 15 together unbalances the Program input. The output from the party line device is connected to pin 8 with a 1K ohm load to provide a partial termination.



Connecting Party-Line Products As Program Sources

Internal IFB Operation

To use Channel B as an IFB feed, connect the Program source to the Program input as mentioned in the previous section and set DIP switches #7 and #8 to the CLOSE position. The program will now be interrupted whenever there is a CALL signal present on Channel B. If there are multiple RM-220s in the system, the program should only be feed into one of the RM-220s.

To interrupt the IFB program automatically when a TALK on the B channel is active, set Dip Switch #4 to the CLOSE position. Set the same dip switch in any other RM-220 connected to the same channel if it is desired for them to interrupt the program.

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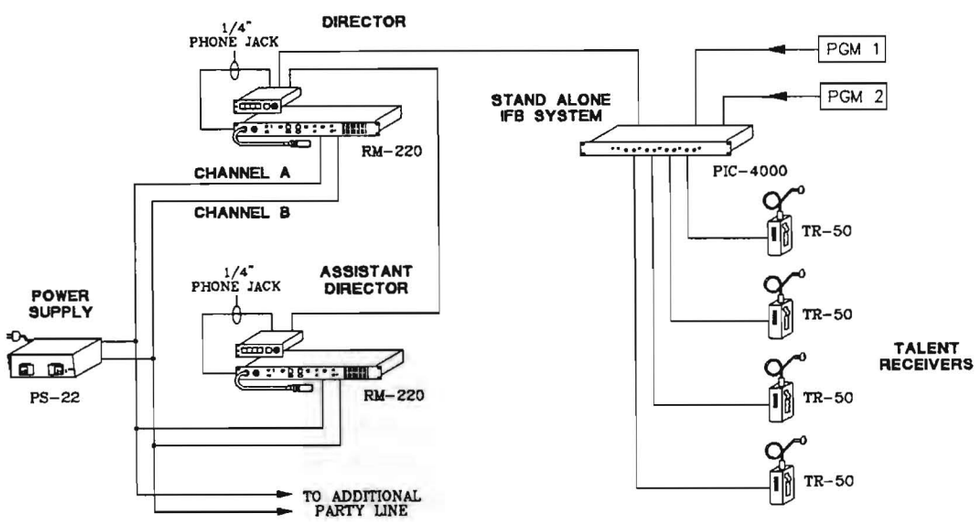
External IFB (MA-4 and PIC-4000 Connection)

Clear-Com provides a stand-alone IFB system called a PIC-4000. The PIC-4000 provides four interruptable IFB feeds from two program sources and located in a central location. The MA-4 is a four channel control head intended to work with the PIC-4000. A MA-4 is located at each location where program interrupt is to be initiated. Each MA-4 has its own panel mounted microphone which when mounted next to an intercom station with a panel mounted microphone causes panel congestion with two microphones at a single location.

The RM-220 has a 1/4 inch phone jack output on its rear panel intended to connect directly to a MA-4 and provide a microphone feed to the MA-4. The MA-4 can be ordered without a panel mounted microphone. When a button is pressed on the MA-4, a control signal will temporarily transfer the microphone in use on the RM-220 to the MA-4 muting any Talks active on the RM-220.

To connect the RM-220 to a MA-4, use a two wire shielded cable with 1/4 inch tip, ring, and sleeve jacks on each end. Connect the tip to the tip, the ring to the ring, and use the shield to connect the sleeve to the sleeve.



Typical External IFB System Using a PIC-4000 and MA-4 with a RM-220

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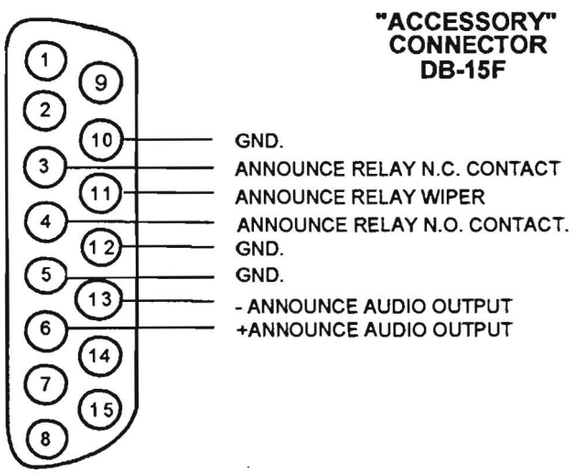
PA Feed to Studio Output

Pressing the button marked "Announce" on the front of the RM-220 temporarily disables activity of the station and places the output of the selected microphone on the ANNOUNCE AUDIO OUTPUT terminals of the ACCESSORY I/O DB-15 CONNECTOR on the rear panel of the station. Isolated relay contacts are also available for controlling some external device such as a PA amplifier to another room.

The audio output is 600 ohms impedance that is transformer balanced and isolated with a nominal output level of 0dB. To connect to the ANNOUNCE output, connect a shielded twisted pair cable to pins 6 and 13 of the ACCESSORY connector and use pin 5 for connection of the shield.

A relay is provided that activates when the ANNOUNCE button is pressed and its contacts are available on the ACCESSORY connector. The relay is rated for 2.0 Amps. of DC current at 24 VDC.



Connections for Announce Audio and Relay Outputss

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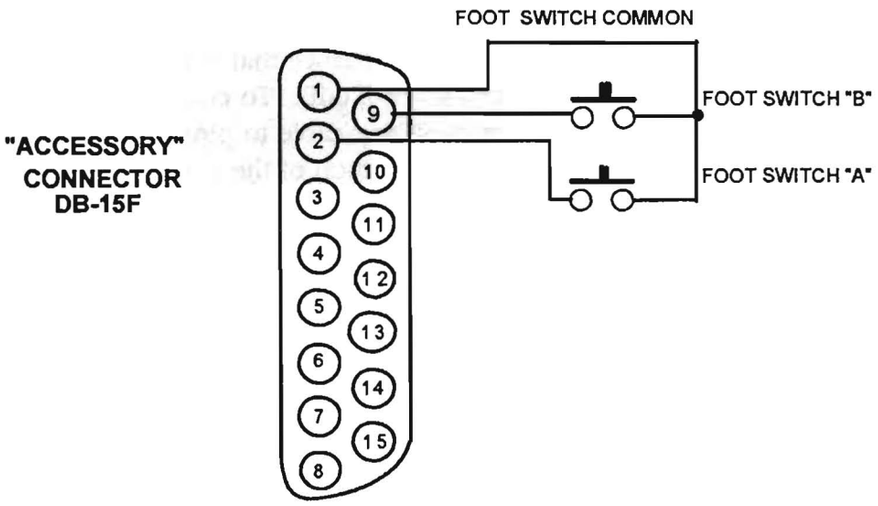
Remote Control of TALK Switches

The TALK switches of the RM-220 can be remote controlled with external contacts that are available on the ACCESSORY connector on the rear panel. A footswitch or remote pushbutton when wired to the ACCESSORY connector acts exactly the same as pushing a TALK switch on the front panel. Both latching and momentary actions are active.



Connection of External Talk Switches

Inadequate Side-Tone Adjustment

The receive circuits of the intercom channels have been optimized for a Intercom Line length between 200 and 700 feet (60 and 200 meters). The capacitance of the intercom line must be compensated for in the receive circuits if a good sidetone null is to be achieved. When using a speaker a good sidetone null is necessary to achieve a usable listening level.

A set of jumpers has been provided for compensating for lines shorter than 200 feet or longer than 700 feet. Each intercom channel has its own jumper. Refer to page 15 for changing these jumper for optimum operation.

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OPERATION

Normal operation of the RM-220 only requires access to the front panel controls. For intercom operation set the Listen Level controls for each channel to desired level and press the Talk switches when talking. If a headset is being used, set the sidetone control for the channel that is being talked to for the desired amount of sidetone in the earphone. If the Panel Mic and Speaker are being used, set the sidetone control for minimum feed-through to the speaker to prevent feedback.

The rest of this section is a detailed description of each control.

Talk Buttons

Each channel has its own illuminated "Talk" button for activating the microphone feed to a given channel. Mechanically the push-button is momentary in action, however electrically the button has dual action (momentary or latching) depending on how the button is pressed. The latching function can be defeated with a rear panel dip switch.

LATCHING: Pressing the button quickly will "toggle" the "talk" function, alternately turning it on or off.

MOMENTARY: Pressing the button for longer than 1/4 second will turn the button press into a momentary function such that when the button is released the "Talk" function will turn off. In any case the "Talk" function is activated all of the time the button is pressed.

TALK INDICATION: The "Talk" button will illuminate dimly indicating when a "Talk" is activated.

CALL INDICATION: The "Talk" button will flash brightly when a "Call" signal is received on that channel.

AUTO-CALL ON TALK: Each channel can be set to send a call signal when the "talk" function is active. This function is used to activate IFB circuits or any other "call" activated function available on other stations. A dip switch option on the rear panel activates this function.

SPEAKER MUTE FUNCTION: Pressing either "Talk" button will cause the output level of the speaker to reduce by an amount set by the rear panel Mute control. To disable the function, turn the Mute control fully clock-wise.

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Call Buttons

Each channel has its own "Call" button. Pressing the "Call" button at any time will send a "Call" signal on that channel regardless of the activation of the "Talk" circuit for that channel.

The "Talk" button for that channel will illuminate brightly while the "Call" button is pressed indicating the presence of a "Call" signal on the line.

Listen Level Controls

Each channel has a separate "Listen Level" control. Listening is always on and is not controlled by any logic. To listen to a channel, turn up the appropriate control. To not listen to a channel, turn the control completely off.

Side Tone Controls

Each channel has a "Side Tone" null control. This control is used to set the amount of the microphone that is heard in the earphone from that channel.

This control is a true hybrid null control and therefore is sensitive to changes in line loading. For headphone use it is best to find the 'null' for a given channel and then rotate the control clockwise to obtain the desired side tone level.

If the speaker and panel microphone are used together providing a possible acoustic feedback path it will be necessary to use an almost complete 'null' of the side tone control.

Program Send Level Control for Channel B

Channel B has a "Program Send Level" control that sets the amount of program being sent to that channel when the program is activated.

Speaker ON/OFF Switch

The switch marked Speaker ON/OFF is used to turn the speaker on and off.

Mic Select Switch

The Mic Select Switch enables the operator to select which microphone is active.

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Program Monitor Level Control

The "Program" volume control sets the amount of the program signal heard directly in the headphone or speaker. This control only affects what is heard in the headphone or speaker and does not affect "Program" feed to the intercom lines.

NOTE: If Program is being feed to the Channel B intercom line the program feed to the headphone and speaker is disabled.

Announce Button

The "Announce" button allows the operator to instantly use the microphone input to directly talk to a system external to the intercom such as a paging speaker/amplifier in another room. A dry set of relay contacts on the rear panel is also available that can be used to activate external switching as needed when the Announce button is pressed.

Pressing the Announce button momentarily disables any active "Talks". Active "Talk" circuits will be restored when the button is released. The "Talk" muting action can be defeated if desired by moving an internal jumper. (see section on internal options and adjustments)

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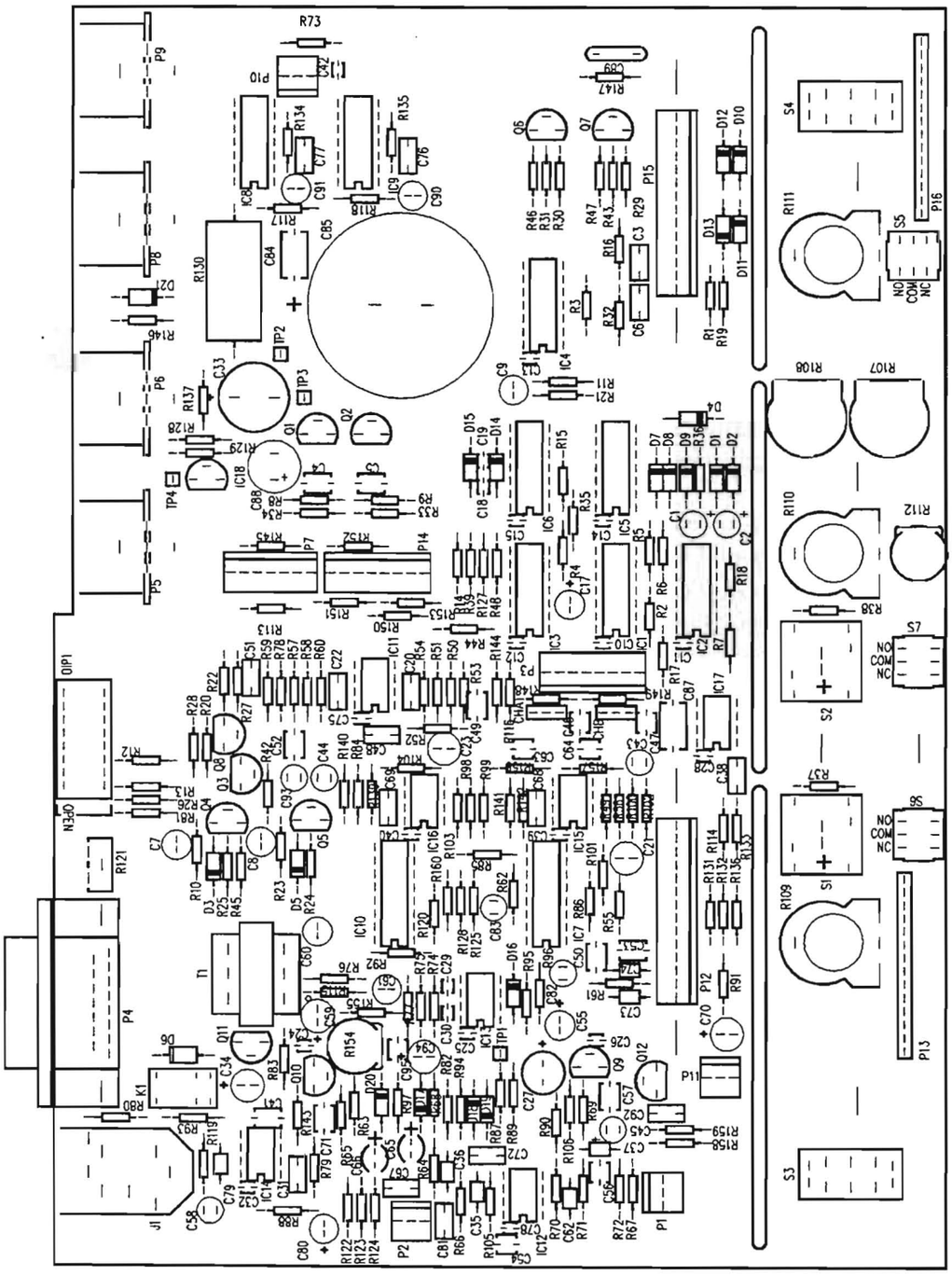

RM-220 Main PCB Assembly Drawing

Rev. A

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Bill of Materials for the RM-220

Miscellaneous

Device	Description	Part #	Designator
JACK	STEREO PC MOUNT 1/4 IN	210135	J1
JUMP JAX	SEALECTRO#0264810	210103	JP1 JP2
POT	50K LINEAR 25MM SHAFT	470070	R109 R110 R111
TRANSFORMER	600CT/600CT #TTC108	560018	T1
TRIMPOT	PIHER#PT10WH-50K	470059	R121
TRIMPOT	PIHER#PT10WV-50K	470038	R112
TRIMPOT	PIHER#PT-10V-5K	470022	R154
TRIMPOT	PIHER#PT-15V	470069	R107 R108
RELAY	SPDT 24V MINI PC ITT#SZ24	450004	K1
SWITCH, DIP	PIANO 8 POS.	510110	DIP1
SWITCH, PB	DPDT W/LONG PLUNGER	510107	S5
SWITCH, PB	DPDT W/SHORT PLUNGER	510106	S6 S7
SWITCH, PB	LOW PROFILE W/32V LAMP	510104	S1 S2
SWITCH, ROC.	DPDT, ROCKER	510111	S3 S4

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
39	pF	Ceramic Disc	50V	5%	150026	C20 C22
47	pF	Ceramic Disc	50V	10%	150041	C31 C38 C68 C69
100	pF	Ceramic Disc	50V	10%	150006	C24 C26 C29 C30
200	pF	Ceramic Disc	100V	5%	150063	C48 C51
470	pF	Ceramic Disc	50V	10%	150014	C36 C37 C73 C74 C79
680	pF	Ceramic Disc	50V	5%	150094	C62
0.001	uF	Ceramic Disc	30V	20%	150052	C35
0.0022	uF	Mylar	100V	5%	150045	C46 C47
0.0047	uF	Mylar	50V	5%	150114	C54 C56 C63 C64 C95
0.01	uF	Ceramic Disc	30V	20%	150012	C3 C6 C72 C76 C77 C81 C92
0.01	uF	Ceramic Disc	1400V	20%	150029	C89
0.022	uF	Mylar	100V	10%	150008	C4 C5 C41
0.047	uF	Metal Polyester	100V	2%	150123	C67
0.047	uF	Mylar	100V	5%	150131	C49 C50 C52 C53 C57 C71
0.1	uF	Monolithic	50V	10%	150035	C10 C11 C12 C13 C14 C15 C18 C19 C25 C28 C32 C39 C40 C42 C75 C78
0.22	uF	Mylar	100V	20%	150003	C84 C87
0.47	uF	Tantalum	35V	10%	150110	C7 C8 C65 C66

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Capacitors ... continued

Value		Type	Volts	Tol.	Part #	Designator
0.47	uF	Aluminum	50V		150151	C9 C60 C61
1	uF	Tantalum	35V	20%	150116	C45
1	uF	Aluminum	50V	10%	150002	C43 C44 C58 C82 C83 C90 C91 C93
2.2	uF	Aluminum	50V		150065	C59 C94
4.7	uF	Aluminum	50V		150087	C21 C23
10	uF	Aluminum	50V		150064	C1 C2
22	uF	Aluminum	35V	20%	150152	C17 C55 C80
47	uF	Aluminum	35V		150081	C34 C70
100	uF	Aluminum	35V		150136	C27
220	uF	Aluminum	35V		150021	C88
1000	uF	Aluminum	35V		150092	C33
10,000	uF	Aluminum	35V		150153	C85

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
2.2	OHM	1/4	Carbon Film	5%	410113	R73 R128 R129
10	OHM	1/4	Carbon Film	5%	410002	R147
22	OHM	1/4	Carbon Film	5%	410004	R37 R38 R91 R114
39	OHM	1/4	Carbon Film	5%	410008	R156 R157
47	OHM	1/4	Carbon Film	5%	410039	R46 R47 R67
50	OHM	5	Wire Wound	5%	410186	R130
82	OHM	1/4	Carbon Film	5%	410038	R106
100	OHM	1/4	Carbon Film	5%	410071	R83 R88
430	OHM	1/4	Carbon Film	5%	410106	R100 R113 R155
820	OHM	1/4	Carbon Film	5%	410096	R134 R135
1K	OHM	1/4	Carbon Film	5%	410010	R90
1.5K	OHM	1/4	Carbon Film	5%	410055	R87
1.8K	OHM	1/4	Carbon Film	5%	410035	R84
2K	OHM	1/4	Carbon Film	5%	410014	R10 R23 R55 R61 R120
4.7K	OHM	1/4	Carbon Film	5%	410013	R89 R124
6.2K	OHM	1/4	Carbon Film	5%	410137	R52 R78
6.81K	OHM	1/8	Carbon Film	1%	410063	R66 R71
7.5K	OHM	1/4	Carbon Film	5%	410171	R31 R43
8.2K	OHM	1/4	Carbon Film	5%	410037	R116
10K	OHM	1/4	Carbon Film	5%	410016	R17 R32 R62 R64 R79 R94 R115 R119 R122 R131 R133 R143
12K	OHM	1/4	Metal Film	1%	410140	R70 R85 R86 R105
15K	OHM	1/4	Carbon Film	5%	410017	R139 R141

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Resistors & Resistor Packs ... continued

Value	Power	Type	Tol.	Part #	Designator
20K OHM	1/4	Carbon Film	5%	410151	R49 R51 R56 R58 R98 R99 R125 R126
22K OHM	1/8	Metal Film	1%	410157	R72 R117 R118 R123
30K OHM	1/4	Carbon Film	5%	410090	R140 R142
39K OHM	1/4	Carbon Film	5%	410019	R132
39.2K OHM	1/8	Metal Film	1%	410111	R76 R77
47K OHM	1/4	Carbon Film	5%	410021	R5 R6 R7 R18 R29 R30 R95 R96 R127 R144 R160
47.5K OHM	1/8	Metal Film	1%	410105	R101 R102 R103 R104
100K OHM	1/4	Metal Film	1%	410148	R74 R75
100K OHM	1/4	Carbon Film	5%	410024	R1 R2 R3 R4 R12 R13 R14 R15 R16 R19 R21 R24 R25 R26 R27 R28 R33 R34 R35 R36 R44 R54 R60 R80 R81 R92 R136
120K OHM	1/4	Carbon Film	5%	410079	R53 R59
220K OHM	1/4	Carbon Film	5%	410028	R42 R45 R158 R159
330K OHM	1/4	Carbon Film	5%	410033	R63 R69
390K OHM	1/4	Carbon Film	5%	410029	R50 R57
470K OHM	1/4	Carbon Film	5%	410030	R8 R9 R11 R20 R22 R65 R68 R93
1M OHM	1/4	Carbon Film	5%	410058	R39 R48
10M OHM	1/4	Carbon Film	5%	410059	R82 R97

Diodes,Transistors, and Intergrated Circuits

Device	Description	Part #	Designator
1N4003	RECTIFIER, 1A 200PIV	480058	D6 D21
1N4148	SIGNAL DIODE, 10MA 75PIV	480000	D1 D2 D4 D7 D8 D9 D10 D11 D12 D13 D14 D15 D16 D17 D18 D19 D20
1N957B	DIODE, 6.8V ZENER 4W 5%	480026	D3 D5
2N5639	TRANSISTOR, JFET NCHAN	480069	Q9 Q10
4001	CMOS QUAD 2 INPUT NOR	480112	IC4 IC5
4011	CMOS QUAD 2 INPUT NAND	480111	IC6
4013	CMOS DUAL D TYPE FF	480171	IC2
4584B	CMOS HEX SCMITT TRIG	480090	IC1 IC3
78L15H	REGULATOR, NEG. 15V 100MA	480078	IC18
DG211	CMOS QUAD ANALOG SWITCH	480092	IC7 IC10
LM833N	OP AMP, DUAL LOW NOISE	480175	IC12 IC13 IC17
LM384	OP AMP, 4W POWER	480012	IC8 IC9
MPS-A13	TRANSISTOR, NPN 30V DARL	480004	Q1 Q2 Q3 Q6 Q7 Q8 Q11
MPS-A63	TRANSISTOR, PNP 30V DARL	480008	Q4 Q5
RC4559NB	OP AMP, DUAL 8 PIN DIP	480056	IC11 IC14 IC15 IC16

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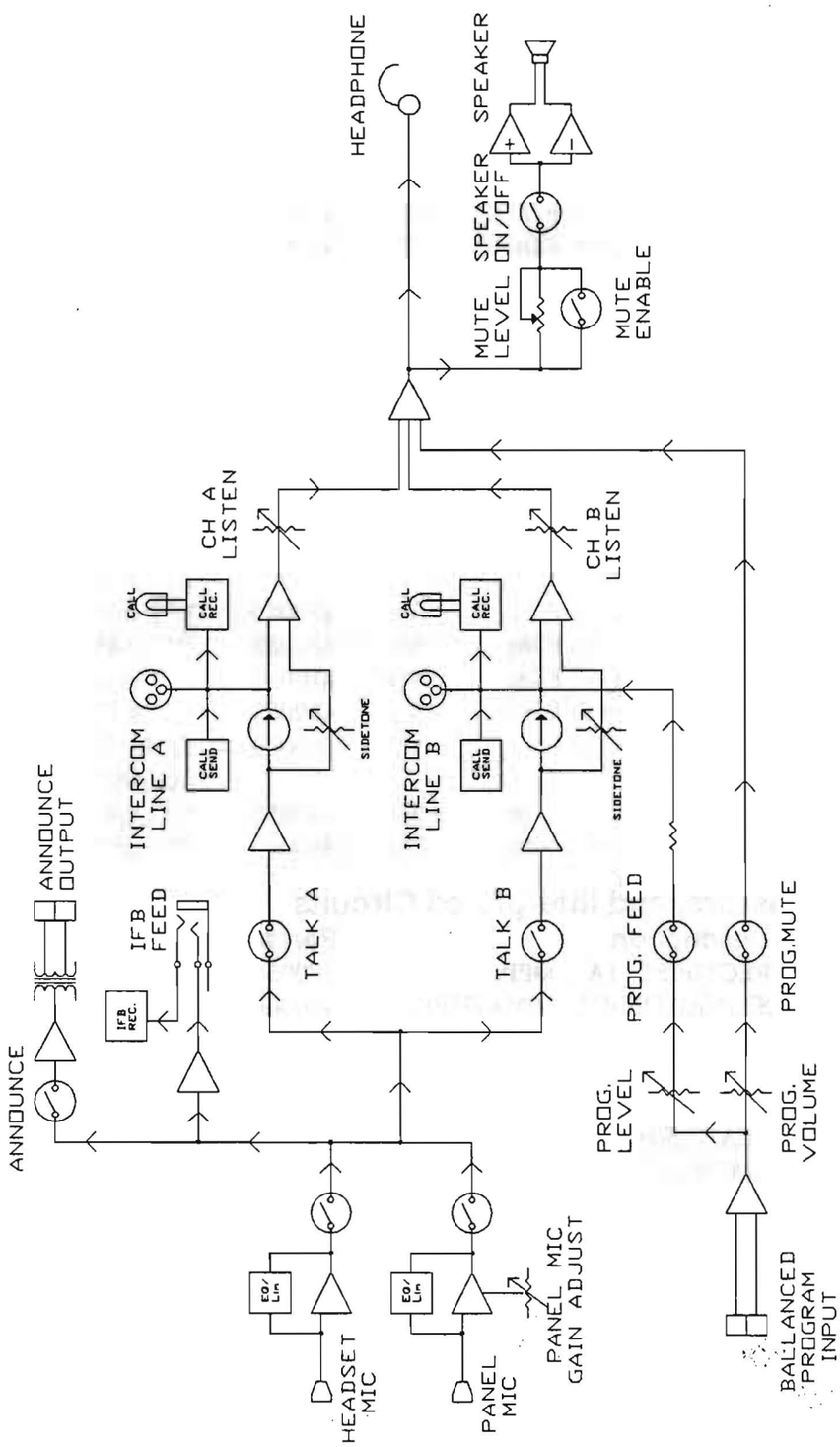

Audio Block Diagram for the RM-22

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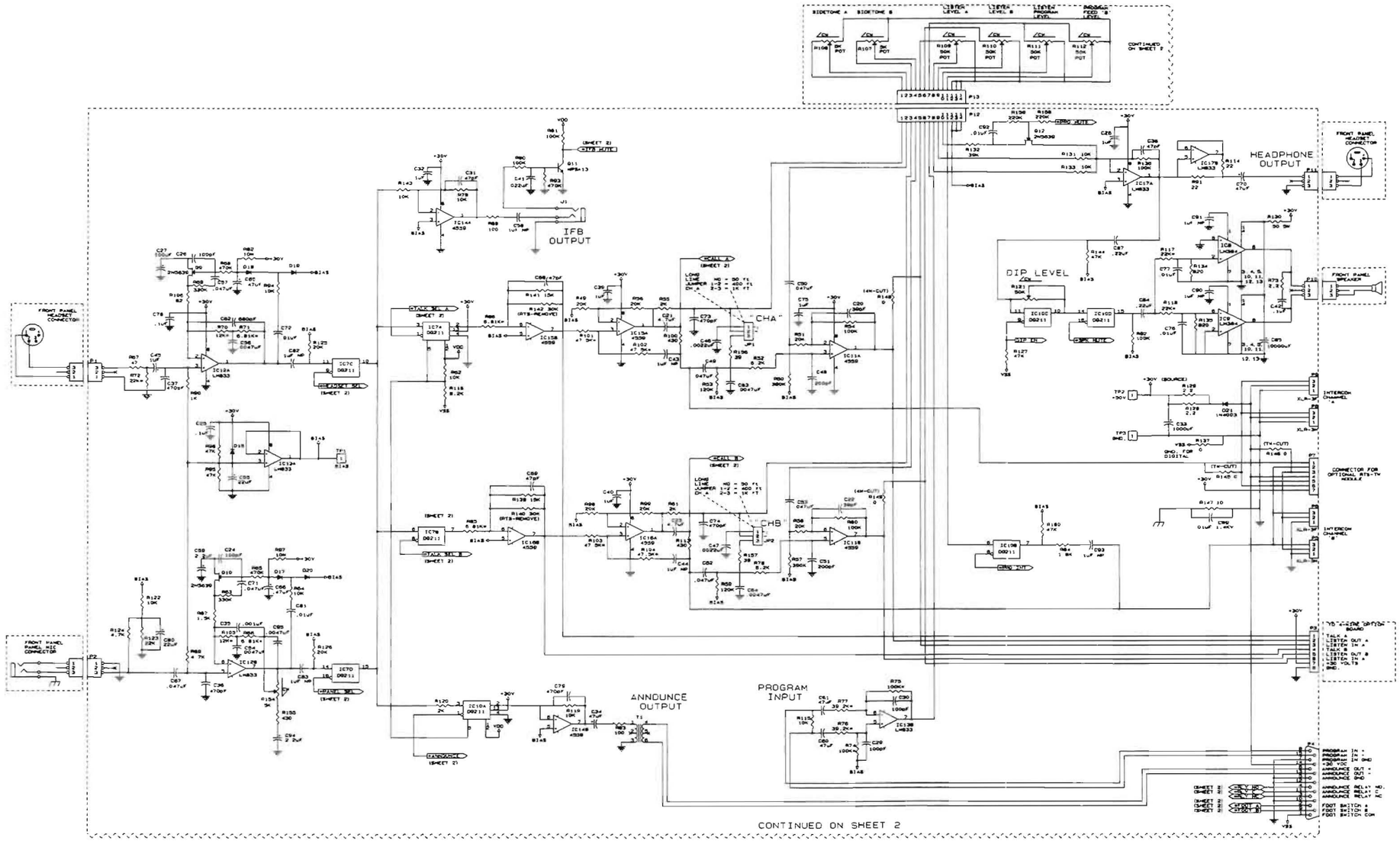

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTORS ARE 1/4W 5% LISTED IN OHMS
2. ALL CAPACITORS ARE LISTED IN MICROFARADS
3. ALL DIODES ARE 1N4148

Schematic Diagram Sheet 1 for the RM-220

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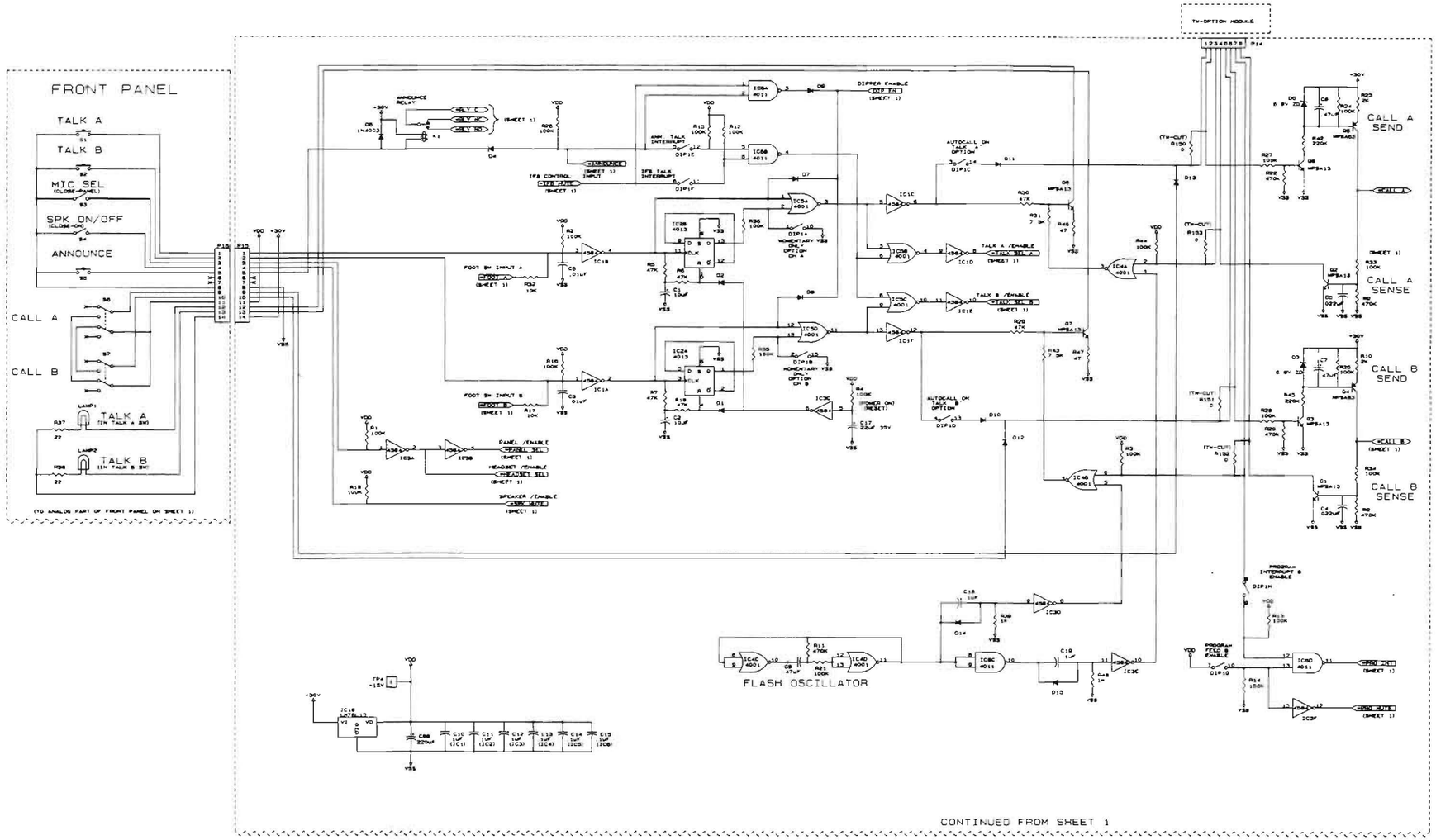

POWER & GND OF ICs

DEVICE	TYPE	+15VD PINS	GND PINS
IC1	4081	14	7
IC2	4013	14	7
IC3	4013	14	7
IC4	4001	14	7
IC5	4001	14	7
IC6	4011	14	7

Schematic Diagram Sheet 2 for the RM-220

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