

INTRODUCTION

Congratulations on choosing this Clear-Com product. Clear-Com was established in 1968 and remains the market leader in providing intercom for entertainment, educational, broadcast and industrial applications. The ruggedness and high build-quality of Clear-Com products is the industry standard. In fact, many of our original belt packs and main stations are still in daily use around the world.

The MS-232 Two-Channel Main Station is a powerful, yet user friendly unit that can serve as the heart of a Clear-Com system. We recommend that you read through this manual completely to better understand the functions of the MS-232. If you encounter a situation or have a question that this manual does not address, contact your dealer or call Clear-Com directly at the factory. Our applications support and service people are standing by to assist you. Thank you for selecting Clear-Com for your communications needs.

Description

The Clear-Com *PL-Pro*TM MS-232 is a two-channel, one rack space main station ideal for ENG and EFP trucks, production studio consoles, theatre, live performances, and small TV facilities. It features excellent speech intelligibility in all noise levels and can be tailored to your needs through its programmable options.

Selectable two-channel talking and/or listening allows the operator to communicate on either of the intercom channels separately or on both at once. The illuminated dual-action talk buttons are electronic momentary or latching. Monitoring can be done through the headset, the integral speaker, or both at once. The MS-232 offers both visual and audible call signaling to attract the attention of operators who have removed their headsets or turned off their speakers. The Remote Mic Kill (RMK) feature provides the ability to turn off all open mics on Series 500 belt packs.

The MS-232 can control a paging speaker for studio announcements. A front panel button activates this function and an associated relay. A balanced program input allows monitoring external audio using the headset or speaker.

This main station accepts dynamic headsets, such as the Clear-Com *PL-Pro*TM Series. Individual side-tone controls for each intercom channel allow the operator to vary the level of his/her own voice as heard in the headset and speaker. It also accepts Clear-Com gooseneck panel microphones.

The integral speaker can be turned on or off by a convenient front panel switch. An automatic speaker dipping circuit will lower the level of the speaker when the announce button, talk buttons or program interrupt are activated. This feature helps minimize feedback.

The MS-232 also incorporates a dual-channel program interrupt system (IFB). When activated, one or more stations can interrupt the program audio to another intercom station or a talent wearing Clear-Com's wired or wireless talent receivers. Clear-Com's stand-alone IFB system can also be connected to this station.

The MS-232 provides 30-Volt DC power to operate Clear-Com belt packs and remote stations. This power is distributed between the two channels, and will support up to 60 headset stations or 20 speaker stations. Clear-Com's new fail-safe design automatically shuts down the power to a channel when a short circuit or electronic overload is sensed on that channel. The other channel will continue to operate normally. Once the fault condition is removed, the MS-232's fail-safe circuit will restore power, even under full load conditions. LED indicators signal a short or overload on either channel.

The MS-232 will operate from any AC line voltage between 90 and 240 Volts AC at 50 or 60 Hz. The MS-232 installs in a standard 19" equipment rack, using only one rack space. The unitized aluminum chassis and extra-thick front panel with integral rack ears result in reduced size and a lighter weight package that maintains legendary Clear-Com ruggedness. Three 3-pin XLR connectors are provided for connection to each intercom channel.

The MS-232 is compatible with all Clear-Com Party-Line intercoms.

QUICK START

- 1 Unpack the unit and inspect for any damage that may have occurred in shipping. Connect the proper AC Mains cable.
- 2 Install the MS-232. (For additional information, refer to the Clear-Com *PL-Pro™* System Installation Manual.)
- 3 Connect the AC to the Mains circuit. Connect the intercom lines.
- 4 Set the two termination switches on the rear panel to **ON**.
- 5 Set the Option switches to the default (up) position.
- 6 Switch **POWER ON**. The green power light should be **ON** and the two red short lights should be **OFF**.
- 7 Set Listen Levels and Sidetones. (Refer to the Listen Level and Sidetone setting topics in the Operation section of this manual.)
- 8 The intercom system should now be operating properly.

Read the rest of this manual for further information.

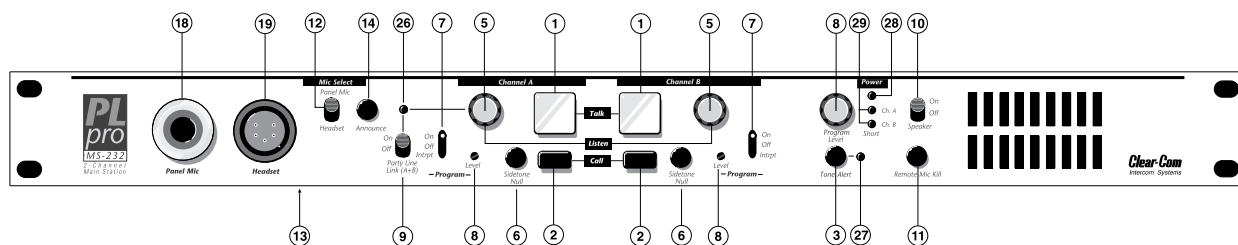
OPERATION

Normal operation of the MS-232 Main Station only requires access to the front panel controls. The controls located elsewhere on the unit are intended to be set-and-forget in nature. For intercom operation, set the Listen level controls for each channel to the desired level and press the Talk buttons when talking. If a headset is used, set the Sidetone control for each channel for the desired amount of sidetone in the earphone. If the Panel Mic and Speaker are being used, set the sidetone controls for minimum feed-through to the speaker to prevent feedback.

Front Panel

The controls, indicators, and connectors found on the MS-232 front panel are shown in the following figure and are described by the following text. The numbers in the left column refer to Figure 1.

Figure 1 - Front Panel



- 1 **Talk Buttons:** Each channel has an illuminated Talk button for activating the microphone feed to that channel. Each Talk button has a dual action (momentary or latching) depending upon how the button is pressed. If desired, the latching function for each channel can be defeated using the option switches on the rear panel. The following describes the various functions of these multi-purpose buttons.
 - ♦ **MOMENTARY:** Press and hold the Talk button while you are speaking. Release it when you are finished.

- ◆ **LATCHING:** Press the button quickly to latch the Talk function. Press the button again to turn off the Talk function.
- ◆ **TALK INDICATION:** The Talk button will illuminate dimly whenever the Talk function is activated.
- ◆ **CALL INDICATION:** The Talk button will flash brightly when a Call signal is received on that channel.
- ◆ **CALL ON TALK:** Each channel can optionally be set to send a Call signal whenever you press the Talk button. This function is used to activate program interrupts or any other Call-activated function available on other stations. Option switches on the rear panel will enable this function.
- ◆ **SPEAKER MUTE:** If the front panel speaker is turned on, pressing either Talk button will reduce the speaker output level to avoid feedback.

The Talk buttons can be labeled to indicate their function. To label the Talk buttons, use the following procedure:

- 1 Pull the Talk button straight off.
 - 2 Insert a small flat blade screwdriver into the slot between the cap and the body of the button and gently twist. This will remove the cap.
 - 3 Remove the square white diffuser from the cap.
 - 4 Insert a 1/2" X 1/2" square of thin paper with the needed description into the cap. Follow it up with the square white diffuser and press the cap onto the body of the button. Press the button back into the front panel.
- 2 **Call Buttons:** Each channel has its own Call button. Pressing a Call button will send a Call signal on that channel. All the call lights on that channel will flash. Call signals can also be sent while talking if required. The Talk button will flash while the Call button is pressed, indicating the presence of a Call signal on the line.
 - 3 **Tone Alert:** An audible tone alert can be enabled to sound when a Call signal is received on either channel. This can be useful when the operator's attention has been drawn away from the MS-232 indicator panel. Press the Tone Alert button to alternately enable or disable the audible tone alert. The green indicator next to this button is lit when the audible Tone Alert is enabled. When enabled, the Tone Alert will sound when a Call button on a beltpack or station is pressed. The Tone Alert will not sound if a Call signal is originated at the MS-232 station. The level can be adjusted by the control on the rear panel (4).
 - 5 **Listen Level Controls:** Each channel has a separate Listen level control. Turn these controls to set the listen level you need on each channel. Turn the control completely counter-clockwise to silence a channel.
 - 6 **Sidetone Controls:** Each channel has a Sidetone Null control. Sidetone is the level of your own voice that you hear while talking on the intercom. Setting a comfortable level of sidetone will ensure that the intercom line sounds alive and also helps you modulate your voice relative to other voices on the line.

Typically, different Sidetone Null settings are needed depending upon whether you are using the gooseneck panel microphone along with the speaker or not. Use one of the following procedures to correctly set the Sidetone level controls.

Sidetone Adjustment Procedure for Gooseneck Microphone with Speaker turned on:

- 1 Turn off the Party Line Link (A+B) switch.
- 2 Turn the Level control for Channel B all the way down. Set the Level control for Channel A to a comfortable level.

- 3 Press the Channel A Talk button and speak into the microphone while turning the Sidetone Null control for Channel A slowly back and forth. There should be a point where your voice (and any accompanying acoustic feedback) disappears. This is the null point.
- 4 Repeat this procedure for Channel B by turning the Channel A Level control down and adjusting the Channel B controls.

Sidetone Adjustment Procedure for Headset:

- 1 Turn off the Party Line Link (A+B) switch.
 - 2 Turn the Level control for Channel B all the way down. Set the Level control for Channel A to a comfortable level by having someone talk to you from another station.
 - 3 Press the Channel A Talk button and speak into the microphone while turning the Sidetone Null control for Channel A slowly back and forth until you hear your voice at a comfortable level in the headset.
 - 4 Repeat this procedure for Channel B by turning the Channel A Level control down and adjusting the Channel B controls.
- 7 **Program ON-OFF-INTRPT Switches:** The Program ON-OFF-INTRPT switches are used to manually or automatically control program audio feed into the intercom lines. The settings are as follows:
- ♦ ON: The channel will receive program audio when the switch is set to ON. The audio level for each channel can be adjusted with the Program Level trimpots as described in the following paragraph.
 - ♦ OFF: The channel will not receive program audio when the switch is set to OFF.
 - ♦ INTRPT: Pressing the Talk button will interrupt the program when this switch is set to INTRPT.
- 8 **Program Level Controls:** Adjust the Program Level controls to set the program audio level heard on the intercom. There are three Program Level controls. The Program Level knob to the left of the Speaker On-Off switch adjusts the level of program heard in the headset or panel speaker.

The program levels heard on each intercom channel line can be individually adjusted, but this is intended to be a one time setting made when the MS-232 is set up. This is done using the screwdriver level adjustment trimpots adjacent to the Program ON-OFF-INTRPT switches on Channels A and B. Set the Sidetone Null controls and the Program Level knob fully counter-clockwise when adjusting the individual channel Program Level trimpots. After the Program Level trimpots are properly adjusted, use the procedure listed in the **Sidetone Controls** section on this page to set the sidetone level.

NOTE: Do not force the trimpots past their stop points. This will damage them.

- 9 **Party Line Link (A+B) Switch:** The Party Line Link (A+B) switch is used to combine both intercom channels into one, for example, for rehearsals. When this switch is set to the ON position, the green lamp directly above the switch will light, and all of the stations on the B channel will be moved onto the A intercom line. This will allow communication between everyone on both channels at once.
- In this mode, the Channel B controls and switches will be inactive. Since the wiring for the B channel has been now added to the A channel, the Sidetone Null control for Channel A may require some readjustment.
- 10 **Speaker ON/OFF Switch:** The Speaker ON/OFF Switch turns the front panel speaker on or off. This switch does not affect whether the Tone Alert is heard through the speaker. The speaker volume will automatically dip whenever the panel or headset microphone is on.

- 11 **Remote Mic Kill Switch:** The Remote Mic Kill (RMK) switch will turn off the Talk function of every beltpack on channels A and B. If the Talk functions of a large number of beltpacks have inadvertently been left activated, incidental noise and talking can make it difficult or impossible to communicate on the party line intercom. The Remote Mic Kill switch can be pressed to quiet the line in this situation. Those needing to communicate can then set their Talk functions ON as needed.

NOTE: The Remote Mic Kill switch can only function if the MS-232 Main Station is powering all of the stations in the system. The switch momentarily interrupts power to the other beltpacks and stations in the system. If there are other power supplies or main stations in the system, then the Remote Mic Kill switch cannot interrupt power and therefore cannot work.

- 12 **Mic Select Switch:** Set the Mic Select switch to select whether the panel microphone or the headset microphone is active.
- 13 **Panel Mic Gain:** This control is located on the underside of the MS-232 chassis. It may be used to increase or decrease the sensitivity of the panel microphone. It has no effect on the sensitivity of the headset microphone. Use a small screwdriver to turn the control clockwise to increase sensitivity or counterclockwise to decrease sensitivity.
- 14 **Announce:** Press the Announce button to make stage or PA system announcements. It directs the audio from the selected headset or panel microphone to the Annc Out rear panel connector and activates the Announce Relay. Simultaneously, if the program audio feed to the Announce Output is enabled, it is interrupted by the announcement. Program audio feed to the Announce Output is selected by setting jumper JP2 on the Main board to the ON position. Optionally, pressing the Announce button can also disconnect the selected headset or panel microphone audio from the intercom line(s). This option is controlled by the Interrupt Announce option switch.
- 19 **Headset Connector:** The headset connector is located on the front panel. All Clear-Com headsets are recommended for use with the MS-232. The following is a description of the characteristics of a suitable headset:

Mic Type --- Dynamic; 150 to 250 ohms impedance; -55 dB output level
Headphone --- Dynamic; 50 to 2000 ohms impedance

The wiring of the headset is to be as follows:

Pin 1 --- Mic common
Pin 2 --- Mic hot
Pin 3 --- Headphone common
Pin 4 --- Headphone hot

The mic and headphone wiring in the headset cord must be individually shielded. **Do not connect Pins 1 and 3 together.** Headset extension cords or headset "Y" cables are not recommended because they will increase crosstalk between channels.

- 18 **Panel Mic Connector:** Clear-Com recommends the GM-9 and GM-18 plug-in panel microphones for use with the MS-232. The GM-9 is 9 inches long and the GM-18 is 18 inches long. The microphone is an electret type. The 1/4 inch phone jack on the microphone mates with the Panel Mic receptacle on the front panel of the MS-232.

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

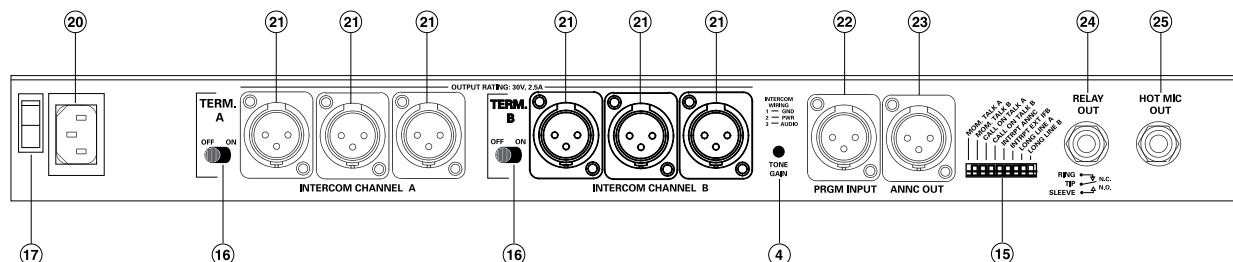
- 1 Check and unscrew the set screw in the mic mounting flange to make sure it is clear of the threads in the bushing.
- 2 Screw the microphone into the bushing hand tight.
- 3 Turn the set screw on top of the mic mounting flange clockwise to lock the microphone in place.

- 26 **Party Line Link (A+B) LED:** This green LED is lit when the Party Line Link (A+B) switch is ON, to provide a visual indication that party line Channels A and B are linked together.
- 27 **Tone Alert LED:** This green LED lights when the Tone Alert function is enabled. Tone Alert is an audible indication that a Call signal is active. Toggle the Tone Alert function ON or OFF using the Tone Alert button.
- 28 **Power LED:** This green LED lights when the MS-232 is receiving AC power and the power switch on the rear panel is turned on.
- 29 **Short LEDs:** There is one red LED for Channel A and one for Channel B. These LEDs light when the MS-232 senses a short or overload on the associated channel. When the fault is removed, the MS-232 will automatically reset and the LED will go out.

Rear Panel

The controls and connectors found on the MS-232 rear panel are shown in the following figure and briefly described by the following text. The numbers in the left column refer to Figure 2.

Figure 2 - Rear Panel



- 4 **Tone Alert Volume Control:** This control adjusts the volume of the Tone Alert sound. This is normally adjusted when the system is set up and there should be no need to adjust it in normal operation.
- 15 **Option Switches:** Eight Option switches are provided on the rear panel. They should be configured when the system is set up, but are not changed in normal operation. The default position of the switches is in the OFF (up) position. The function of each switch is as follows:
 - 1 MOM TALK A: Setting the Momentary Talk A switch to the ON position will disable the latching function of the Channel A Talk button. In this mode, the Talk button must always be held in continuously while the operator is talking on Channel A.
 - 2 MOM TALK B: Setting the Momentary Talk B switch to the ON position will disable the latching function of the Channel B Talk button. In this mode, the Talk button must always be held in continuously while the operator is talking on Channel B.
 - 3 CALL ON TALK A: If the Call On Talk A switch is set to the ON position, a Call signal will be placed on Channel A whenever the Talk function is activated. This can be used to activate any Call activated functions available on other stations.
 - 4 CALL ON TALK B: If the Call On Talk B switch is set to the ON position, a Call signal will be placed on Channel B whenever the Talk function is activated. This can be used to activate any Call activated functions available on other stations.
 - 5 INTRPT ANNC: If the Interrupt Announce switch is set to the ON position, pressing the Announce button will disconnect the microphone from the intercom line(s). This will allow announcements to be made without being heard over the intercom channels.
 - 6 INTRPT EXT IFB: When the Hot Mic output is connected to Clear-Com's IFB System and the Interrupt External IFB switch is set to the ON position, pressing a key on the IFB

System will disconnect the selected headset or panel microphone from the intercom line(s). This allows the MS-232 microphone to be used to cue talent without affecting intercom line communication.

- 7 **LONG LINE A:** If a long cable run on Channel A is unavoidable and approaches 1,000 feet or more, set the Long Line A option switch to the ON position. The ability to set a sidetone null on Channel A depends upon properly setting this switch.
- 8 **LONG LINE B:** If a long cable run on Channel B is unavoidable and approaches 1,000 feet or more, set the Long Line B option switch to the ON position. The ability to set a sidetone null on Channel B depends upon properly setting this switch.
- 16 **Termination Switches:** These switches provide switchable terminations for channels A and B. In most systems, both terminations on the MS-232 should be in the ON position (default setting). The fundamental concept of Clear-Com Party-Line intercom is that all channels are terminated in one location, preferably at a main station or power supply. The termination switches on the MS-232 rear panel should be set to the OFF position **only** if the channel is terminated by another main station or power supply in the system. **If there are no other main stations, power supplies, or other terminations on the line, set the rear panel switches labeled TERM A and TERM B to the ON position.**

NOTE: All intercom lines must be terminated only once, whether they are used or not. Never "double-terminate" a line.

- 17 **Power Switch:** The power switch can be used to turn AC power to the MS-232 on and off. When in the ON position, the Power LED on the front panel will be illuminated.
- 20 **AC Power Connection:** An IEC type 320 connector is provided to interface to the appropriate AC power cord to be used. Voltages from 90 to 240 VAC at 50 or 60 Hz are acceptable. The MS-232 will automatically adjust for the power applied, so there are no manual switches to set power line voltage or frequency.
- 21 **Intercom Line Connection:** The MS-232 contains three 3-pin male XLR connectors for each intercom line. These connectors are wired in parallel. Any single-channel station or channel of a multi-channel station connected on a line plugged into Channel A of the MS-232 will be "party-lined" with all the other stations on that channel. In a multi-channel system, the goal is to assign specific people to the correct group, i.e. the other people they need to be in contact with the most. This is particularly important when the party line users are on a single-channel beltpack or station; less so if they are on multi-channel stations. The pinout of the intercom connectors is as follows:
 - Pin 1 --- Ground (Shield)
 - Pin 2 --- Power (+30 VDC)
 - Pin 3 --- Audio
- 22 **Program Input:** A 3-pin XLR female connector provides the main program input to the station. Program can be fed to the headphone or speaker as well as to either or both of the intercom channels. The level to the speaker or headphone is controlled by the Program Level control. The Program ON-OFF-INTRPT switches control whether each intercom channel receives program audio. The program audio levels on each intercom channel can be adjusted using the individual Program Level trimpots. The Program Input accepts a balanced or unbalanced line-level audio signal from -20 dBv to +10 dBv. An option is to feed program audio to the Announce Output. This is selected by setting jumper JP2 on the Main board to the ON position. When this option is selected, a 0 dBv signal on the Program Input will produce a 0dBv signal on the Announce Output.

The pinout of the Program Input connector is as follows:

- Pin 1 --- Ground (Shield)
- Pin 2 --- + Signal
- Pin 3 --- - Signal

- 23 **Announce Out:** A 3-pin XLR male connector is provided as a feed to a studio PA amplifier. Pressing the Announce button on the front panel places the audio from the selected headset or panel microphone on the Annnc Out rear panel connector. Optionally, pressing the Announce button can also disconnect the selected headset or panel microphone from the intercom line(s). This option is controlled by the Interrupt Announce option switch. Simultaneously, if the program audio feed to the Announce Output is enabled, it is interrupted by the announcement. Program audio feed to the Announce Output is selected by setting jumper JP2 on the Main board to the ON position. The pinout of the Announce Out connector is as follows:

Pin 1 --- Ground (Shield)
Pin 2 --- - Signal
Pin 3 --- + Signal

The audio output is balanced and transformer isolated. It has a 600 ohm impedance and a nominal output level of 0 dBV. A shielded twisted pair cable should be used in the cable wired to this connector.

- 24 **Relay Out:** A dry set of relay contacts is provided through a 1/4 inch jack to activate external switching as needed when the Announce button is pressed. These contacts can be used to control an external device such as a PA amplifier to another room. The contacts are rated for 2.0 Amps at 24 VDC. The contacts are wired as follows:

Ring --- Normally Closed Contact
Tip --- Common Contact
Sleeve --- Normally Open Contact

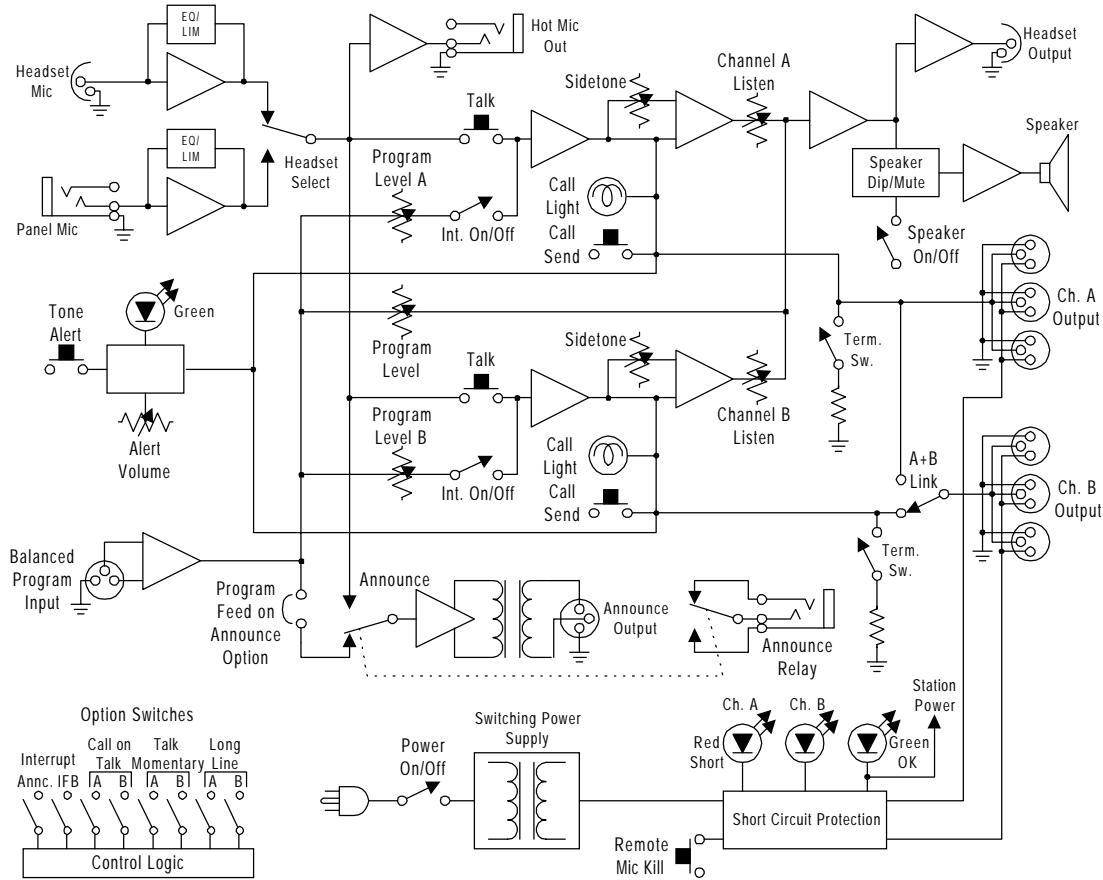
- 25 **Hot Mic Out / IFB System:** This connection is a 1/4 inch phone jack. It provides a 0 dBV output signal from the selected headset or panel microphone. This output is intended interface with the External Line In jack on Clear-Com's IFB System. The jack is wired as follows:

Ring --- Ext. IFB Control Signal Input
Tip --- Hot Mic Audio Output
Sleeve --- Ground (Shield)

MS-232 Block Diagram

The following is a block diagram of the MS-232:

Figure 3 - MS-232 Block Diagram



TROUBLESHOOTING

Problem: System does not operate. Green POWER LED is not illuminated and no SHORT LED's are illuminated

Cause 1: No AC power to the MS-232.

Solution 1: Make sure the power switch on the rear panel is turned ON. Check the AC connection and cable. Plug into a dependable AC source.

Cause 2: The MS-232 has an internal power supply failure.

Solution 2: Unit requires servicing.

Problem: System does not operate when power switch is turned on. Green POWER LED and red SHORT LED wink

Cause: Direct short on the intercom channel indicated by the red Short LED.

Solution: Remove the intercom line cables one at a time from that channel until the faulty line is located. Once the short is removed, the MS-232 will reset automatically and power will come back up within several seconds. Check for shorts between pins 1 and 2 or improper cable wiring.

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- Problem:** **Red SHORT LED illuminated**
Cause 1: Short or overload on that channel due to a shorted or miswired cable.
Solution 1: Remove the intercom line cables one at a time from the system until the faulty line is located. (The red Short LED will then turn off.) Check for shorts between pins 1 and 2 or improper cable wiring. Once the short is removed, the MS-232 will reset automatically and power will come back up within several seconds.
- Cause 2: Defective remote station.
Solution 2: Check the remote station and replace if necessary.
- Problem:** **Both red SHORT LEDs are illuminated**
Cause 1: System is overloaded.
Solution 1: Remove the intercom line cables one at a time from the system to help determine where the excess current requirements lie. Re-evaluate the system current needs.
- Cause 2: Short in multipair cable.
Solution 2: Remove the intercom line cables one at a time from system until the faulty line is located. Check for shorts between pins 1 and 2 or improper cable wiring.
- Problem:** **Hum or buzz in system**
Cause 1: Inductive pickup caused by close proximity of this main station or connected remote stations to power lines or transformers.
Solution 1: Relocate the offending unit.
- Cause 2: 10 Ohm chassis ground resistor is open.
Solution 2: Check the DC resistance for 10 Ohms between the chassis and pin 1 of any intercom connector.

If this condition occurs, it is because the system ground came into contact with something that was "HOT" with respect to the power supply earth ground. Carefully check the system ground and AC distribution in the area.

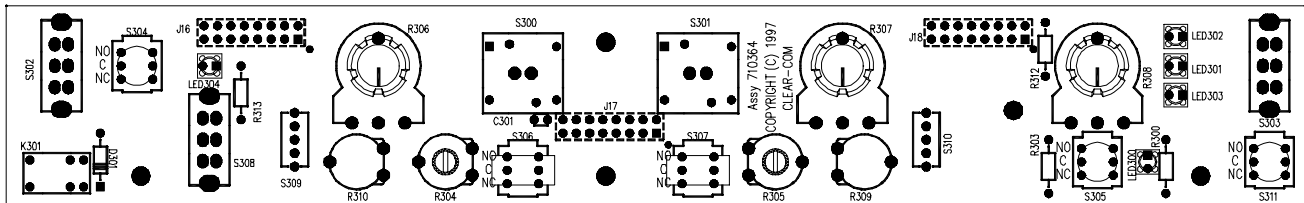
WARNING: THIS IS A POTENTIALLY DANGEROUS SITUATION. A SHOCK HAZARD MAY EXIST BETWEEN A REMOTE STATION HEADSET AND GROUND.

- Problem:** **System feedback (Acoustical)**
Cause 1: Listen Level control at this station or a remote station is set too high.
Solution 1: Adjust.
- Cause 2: Sidetone Null control at this station or a remote station is not adjusted correctly.
Solution 2: Adjust. Refer to the procedure in the Front Panel section of this manual.
- Cause 3: Channel unterminated.
Solution 3: Set the MS-232 termination switch for that channel to the ON position.
- Cause 4: A headset extension cord was used.
Solution 4: Headset extension cords are not recommended.
- Problem:** **Excessive crosstalk**
Cause 1: High DC resistance in ground return.
Solution 1: Use heavier cable; add additional conductor(s) to ground return.
- Cause 2: MULTI-CHANNEL cable pairs are not individually shielded.
Solution 2: Replace cable with individually shield pairs.
- Cause 3: Headset cables are not wired properly or shielded properly.
Solution 3: Correct wiring. Use headsets with properly shielded wiring.
- Problem:** **Program signal sounds distorted.**
Cause: Overload of Program Input circuit.
Solution: Reduce Program Input level or reduce the gain of the program signal at the source, such as an audio mixer.

- Problem:** Call signals do not function.
- Cause 1: Excessive DC loading of intercom line.
- Solution 1: Remove any audio transformers or other equipment which may be connected across the intercom line. If equipment other than Clear-Com intercom equipment must be connected to the intercom line, please contact Clear-Com application or service personnel for advice.
- Cause 2: Far too many terminations on the intercom line.
- Solution 2: Check all Main Stations and Power Supplies to make sure each intercom channel is terminated at only one point.

PARTS LISTS

Front Panel PCB Layout



Parts List for MS-232 Front Panel PCB and Chassis

Capacitors

Value	Type	Volts	Tol.	Part #	Designator
.1 uF	Monolithic	50V	10%	150035	C301

Resistors

Value	Power	Type	Tol.	Part #	Designator
4.7K OHM	1/4	Carbon Film	5%	410013	R300
10K OHM	1/4	Carbon Film	5%	410016	R312 R313
36K OHM	1/4	Carbon Film	5%	410163	R303

Diodes and Transistors

Device	Description	Part #	Designator
LED	RED, ROUND, FLAT TOP LED	390044	LED301 LED303
LED	GREEN, ROUND, FLAT TOP LED	390045	LED302 LED300 LED304
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D301

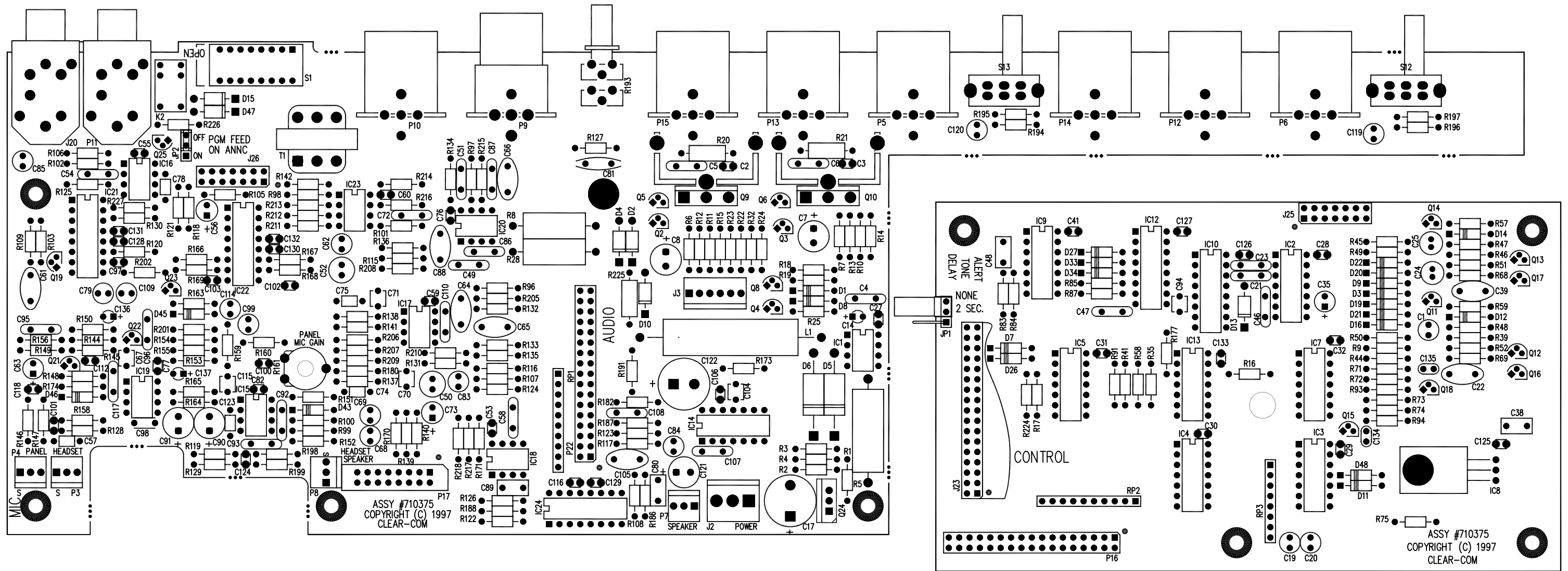
Miscellaneous

Device	Description	Part #	Designator
Button	FLAT TOP GREY KEYCAP	240064	S300 S301
Button	ROUND MINIATURE	240081	S304 S305 S311
Button	RECT. MINIATURE	240082	S306 S307
Knob	GREY INSERT 6X4.5MM HOLE .45DIA	240089	R306 R307 R308
Assembly	65 W 30 V SWITCHING POWER SUP.	400013	
Relay	SPDT 24V MINI PC RELAY	450004	K301
Pot	50K TRIM POT H MTG.	470018	R309 R310
Pot	5K TRIMPOT H MTG.	470063	R304 R305
Pot	50K 25MM FLATTED SHAFT	470070	R306 R307 R308
Switch	DPDT SLIDE SWITCH	510090	S302 S303 S308
Switch	PUSH BUTTON SWITCH W/32V LAMP	510104	S300 S301

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Miscellaneous (Continued)

Device	Description	Part #	Designator
Switch	DPDT MINIATURE	510107	S304 S305 S306 S307 C311
Switch	POWER SWITCH, SPST SNAP-IN	510119	
Switch	SPDT ON-OFF-ON	510120	S309 S310
Cord	IEC POWER CORD	610022	
Cable	POWER ENTRY HARNESS	740063	
Cable	DC POWER CABLE, MS-232 & PS-464	740064	
Cable	ASSY, CABLE, HEADSET, MS-232	740065	
Cable	ASSY, CABLE, PLUG-IN MIC, MS-232	740066	
Speaker	SPEAKER ASSY, MS-232	740067	
Cable	RIBBON, 3 CONN	770021	J16 J18
Cable	RIBBON, 16-PIN	770023	



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Parts List for MS-232 Audio / Logic PCBs

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
1	uF	Aluminum NP	50V	10%	150002	C1 C62 C68 C69 C79 C83 C84 C85 C109 C114
22	uF	Aluminum	16V		150010	C14 C136 C137
.01	uF	Ceramic Disc	30V	20%	150012	C4 C5 C6 C21 C23 C46 C47 C95 C96 C107 C108
470	pF	Ceramic Disc	50V	10%	150014	C57 C74 C75 C78 C92 C93 C123
39	pF	Ceramic Disc	50V	5%	150026	C51 C49
.01	uF	Ceramic Disc	1.4KV	20%	150029	C81
.22	uF	Monolithic	50V	10%	150034	C38 C48 C80 C89
.1	uF	Monolithic	50V	10%	150035	C2 C3 C27 C28 C29 C30 C31 C32 C41 C53 C55 C59 C60 C76 C77 C82 C97 C101 C102 C103 C106 C116 C124 C125 C126 C127 C128 C129 C130 C131 C132 C133 C134 C135 C122
220	uF	Aluminum	50V		150037	C122
47	pF	Ceramic Disc	50V	10%	150041	C54 C58 C72 C110
.0022	uF	Mylar	100V	5%	150045	C115
200	pF	Ceramic Disc	100V	5%	150063	C87 C86
10	uF	Aluminum	50V		150064	C35 C119 C120
2.2	uF	Aluminum NP	50V		150065	C19 C20 C99
47	uF	Aluminum	35V		150081	C56 C73
4.7	uF	Aluminum NP	50V		150087	C50 C52
1000	uF	Aluminum	35V		150092	C17
22	pF	Ceramic Disc	50V	10%	150098	C117
820	pF	Monolithic	50V	5%	150101	C112 C118
.0047	uF	Mylar	50V	5%	150114	C67 C70 C71 C94 C100 C104
1	uF	Tantalum	35V	20%	150116	C63
.01	uF	Metal Film	100V	2%	150122	C98
.047	uF	Mylar	100V	5%	150131	C22 C39 C61 C64 C65 C66 C88 C105
100	uF	Aluminum	35V		150136	C7 C8 C90 C91 C121
.47	uF	Aluminum NP	50V		150151	C24 C25

Resistors

Value		Power	Type	Tol.	Part #	Designator
10	OHM	1/4	Carbon Film	5%	410002	R127
22	OHM	1/4	Carbon Film	5%	410004	R107 R116 R199
220	OHM	1/4	Carbon Film	5%	410007	R75 R146 R159 R194 R196
39	OHM	1/4	Carbon Film	5%	410008	R72 R74 R137 R138
1K	OHM	1/4	Carbon Film	5%	410010	R6 R7 R10 R11 R22 R174 R198
4.7K	OHM	1/4	Carbon Film	5%	410013	R18 R32 R35 R58 R125 R128 R186 R195 R197
2K	OHM	1/4	Carbon Film	5%	410014	R39 R46 R98 R130 R180 R227
3.3K	OHM	1/4	Carbon Film	5%	410015	R19 R148 R153 R164
10K	OHM	1/4	Carbon Film	5%	410016	R24 R93 R94 R102 R118 R147 R151 R152 R158 R170 R177
15K	OHM	1/4	Carbon Film	5%	410017	R144
33K	OHM	1/4	Carbon Film	5%	410020	R2 R3 R4 R168 R169 R188
100K	OHM	1/4	Carbon Film	5%	410024	R47 R48 R49 R50 R51 R52 R97 R103 R108 R122 R124 R132 R226
68K	OHM	1/4	Carbon Film	5%	410025	R68 R69 R87
220K	OHM	1/4	Carbon Film	5%	410028	R57 R59 R84
470K	OHM	1/4	Carbon Film	5%	410030	R41 R44 R45 R91 R109 R133 R134 R149 R154 R155 R156
6.8K	OHM	1/4	Carbon Film	5%	410036	R145 R165 R171 R217 R218
680	OHM	1/4	Carbon Film	5%	410044	R150
5	OHM	5	Wirewound	10%	410051	R5

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Resistors (Continued)

Value	Power	Type	Tol.	Part #	Designator
120 OHM	1/4	Carbon Film	5%	410053	R105 R106
1M OHM	1/4	Carbon Film	5%	410058	R9 R16 R83 R85 R163
2.2K OHM	1/2	Carbon Film	5%	410068	R20 R21
820K OHM	1/4	Carbon Film	5%	410070	R23
.39 OHM	2	Carbon Film	5%	410073	R28
120K OHM	1/4	Carbon Film	5%	410079	R135 R136
43K OHM	1/4	Carbon Film	5%	410084	R25
20.0K OHM	1/4	Carbon Film	1%	410086	R12 R13 R117 R120 R121 R129 R139 R140 R182 R187 R201 R202 R205 R206 R207 R208 R212 R213 R215 R216
820 OHM	1/4	Carbon Film	5%	410096	R123
9.1K OHM	1/4	Carbon Film	5%	410100	R14 R15 R17 R119 R141 R142 R224
47.5K OHM	1/8	Metal Film	1%	410105	R99 R100 R126 R166 R167 R209 R210 R211 R214
430 OHM	1/4	Carbon Film	5%	410106	R1 R115 R131 R160
2.2 OHM	1/4	Carbon Film	5%	410113	R191 R173 R225
6.2K OHM	1/4	Carbon Film	5%	410137	R96 R101
60.4K OHM	1/4	Metal Film	1%	410164	R71 R73
1.5 OHM	1/4	Carbon Film	5%	410208	R225
100K OHM		X 9 SIP BUSSED		415002	RP1 RP2
220K OHM		X 4 SIP ISOLATED		415007	RP3

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D1 D3 D7 D8 D9 D11 D16 D19 D20 D21 D22 D26 D27 D33 D34 D43 D45 D46 D48
Transistor	MPS-A13 NPN 30V DARL	480004	Q11 Q14 Q15 Q16 Q17 Q18 Q19
Diode	1N5401 RECT 3A 100PIV	480005	D5 D6
Transistor	MPS-A63 PNP 30V DARL	480008	Q12 Q13
Diode	1N957B ZENER 6.8V .4W 5%	480026	D12 D14
Transistor	MPS-A55 PNP 60V	480050	Q2 Q3 Q4 Q5 Q6
Transistor	MPS-A05 NPN 60V	480052	Q8 Q23
Diode	1N4003 RECT 1A 200PIV	480058	D2 D4 D10 D13 D15 D47
Transistor	2N5639 JFET NCHAN 8V VGS	480069	Q25
Transistor	J174 JFET PCHAN 8V VGS	480079	Q21 Q22
Transistor	TIP41 NPN 40V 6A TO-220 POWER	480099	Q24
Transistor	TIP35C NPN 100V 25A TO-218	480228	Q9 Q10

Integrated Circuits

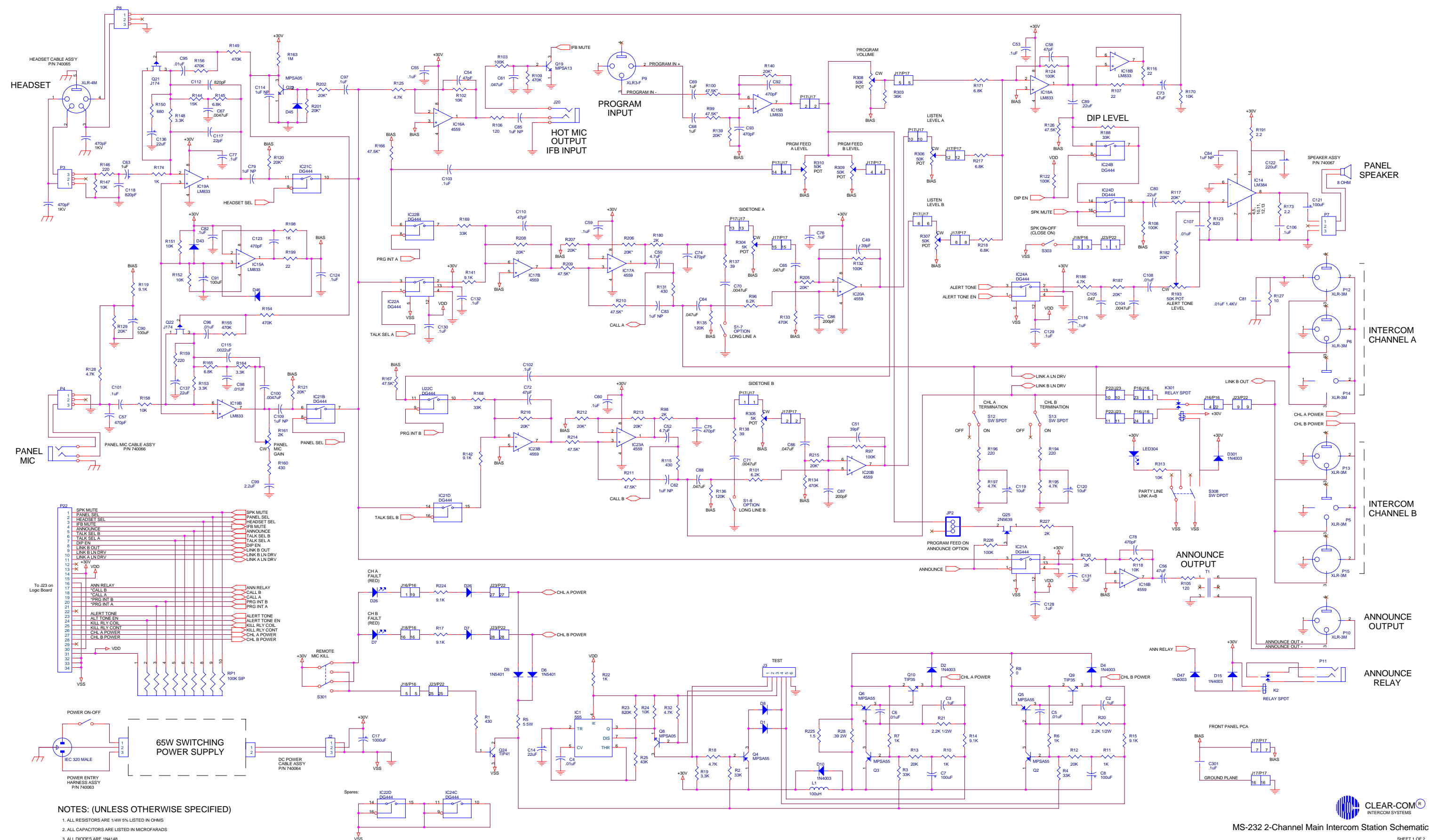
Device	Description	Part #	Designator
IC	LM384 POWER 4W AMP	480012	IC14
IC	555 TIMER	480017	IC1
IC	LM340-15 POS 15V REGULATOR	480024	IC8
IC	RC4559NB DUAL OP AMP	480056	IC16 IC17 IC20 IC23
IC	4071 CMOS QUAD 2 IN OR GATE	480081	IC7
IC	4584B CMOS HEX SCMITT TRIG	480090	IC2 IC9
IC	4040 CMOS 12 STAGE CONVERTER	480108	IC12
IC	4011 CMOS QUAD 2 IN NAND GATE	480111	IC5
IC	4001 CMOS QUAD 2 IN NOR GATE	480112	IC4
IC	4013 CMOS DUAL D TYPE FLIP FLOP	480171	IC3 IC13
IC	LM833N DUAL OP AMP	480175	IC15 IC18 IC19
IC	DG444 QUAD ANALOG SWITCH	480212	IC21 IC22 IC24
IC	4556 CMOS DUAL 1 OF 4 DECODER	480236	IC10

Clear-Com MS-232 Two-Channel Main Station

Miscellaneous

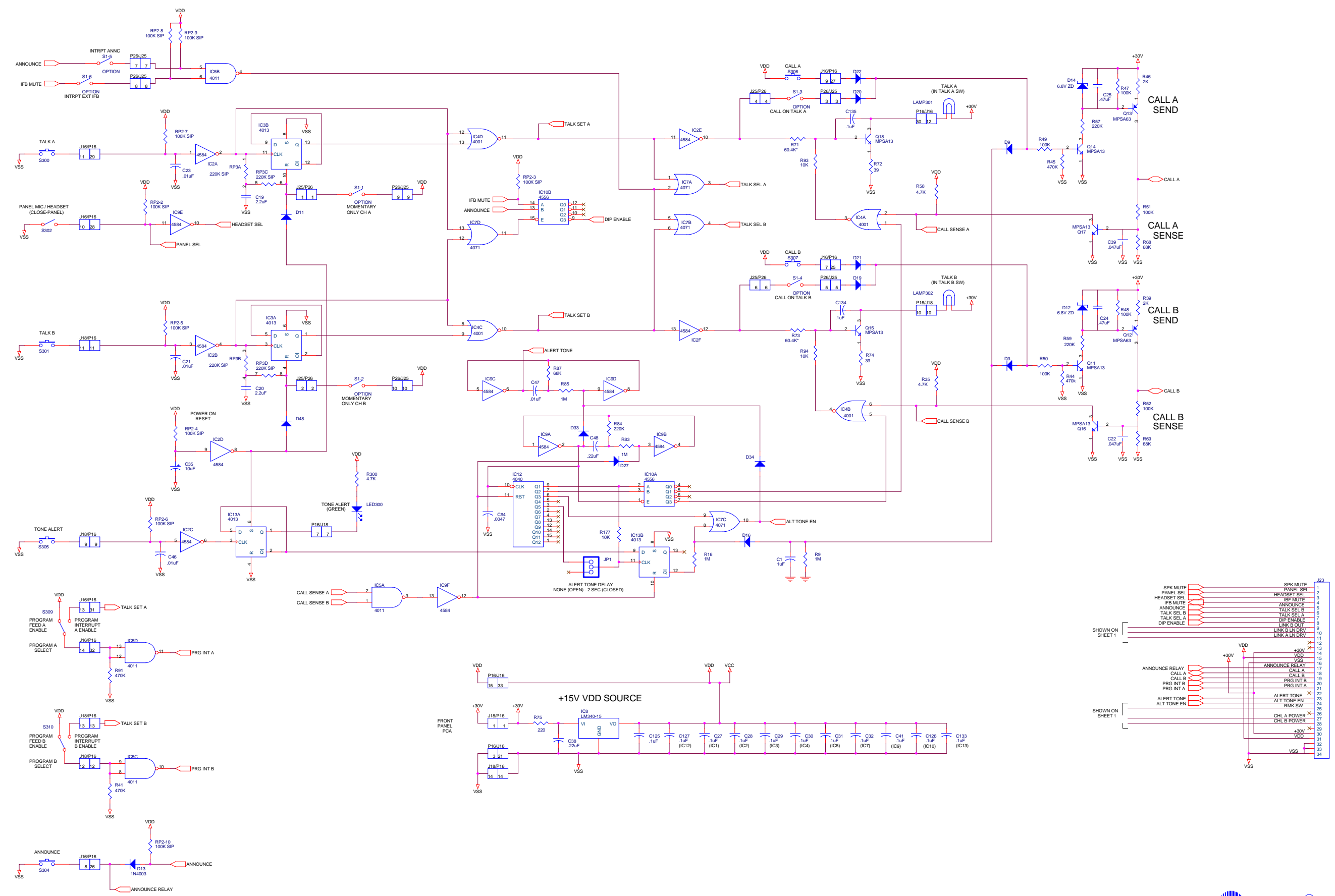
Device	Description	Part #	Designator
Inductor	100UH 2A	180010	L1
Connector	1/4 IN STEREO JACK	210135	P11 J20
Connector	HEADER MULTI-PIN	210217	J3(6) P1 P3(3) P4(3) P7(3) P8(3)
Connector	JUMP JACK .1IN	210226	JP1 JP2
Connector	HEADER .156IN PIN	210234	J2(3)
Connector	3 PIN MALE	210245	P5 P6 P10 P12 P13 P14 P15
Connector	3 PIN FEMALE	210246	P9
Connector	SINGLE ROW RT ANG HEADER	210253	JP1(3) JP2(3)
Connector	DUAL ROW HEADER 8 POS. .230IN	210276	P17
Connector	DUAL ROW HEADER 17 POS. .230IN	210279	P16 P22
Connector	DUAL ROW HEADER 7 POS. .320IN	210282	J25
Connector	7 POS DUAL ROW SOCKET .635 TALL	210349	J26
Relay	SPDT 24V MINI PC RELAY	450004	K2
Pot	2K TRIMPOT H MTG.	470029	R161
Pot	50K TRIMPOT	470059	R193
Switch	DIP SWITCH PIANO 8 POS.	510110	S1
Switch	DPDT R/A SLIDE SWITCH	510121	S12 S13
Transformer	600CT/600CT	560018	T1
Cable	34 PIN FLAT, 2 CONN.	770018	J23

Clear-Com MS-232 Two-Channel Main Station



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 1N148



SHOWN ON SHEET 1	J23	J24	J25	J26	J27	J28	J29	J30	J31	J32	J33	J34
SPK MUTE	SPK MUTE	SPK MUTE	SPK MUTE	SPK MUTE	SPK MUTE	SPK MUTE	SPK MUTE	SPK MUTE	SPK MUTE	SPK MUTE	SPK MUTE	SPK MUTE
PANEL SEL	PANEL SEL	PANEL SEL	PANEL SEL	PANEL SEL	PANEL SEL	PANEL SEL	PANEL SEL	PANEL SEL	PANEL SEL	PANEL SEL	PANEL SEL	PANEL SEL
HEADSET SEL	HEADSET SEL	HEADSET SEL	HEADSET SEL	HEADSET SEL	HEADSET SEL	HEADSET SEL	HEADSET SEL	HEADSET SEL	HEADSET SEL	HEADSET SEL	HEADSET SEL	HEADSET SEL
IFB MUTE	IFB MUTE	IFB MUTE	IFB MUTE	IFB MUTE	IFB MUTE	IFB MUTE	IFB MUTE	IFB MUTE	IFB MUTE	IFB MUTE	IFB MUTE	IFB MUTE
ANNOUNCE	ANNOUNCE	ANNOUNCE	ANNOUNCE	ANNOUNCE	ANNOUNCE	ANNOUNCE	ANNOUNCE	ANNOUNCE	ANNOUNCE	ANNOUNCE	ANNOUNCE	ANNOUNCE
TALK SEL A	TALK SEL A	TALK SEL A	TALK SEL A	TALK SEL A	TALK SEL A	TALK SEL A	TALK SEL A	TALK SEL A	TALK SEL A	TALK SEL A	TALK SEL A	TALK SEL A
TALK SEL B	TALK SEL B	TALK SEL B	TALK SEL B	TALK SEL B	TALK SEL B	TALK SEL B	TALK SEL B	TALK SEL B	TALK SEL B	TALK SEL B	TALK SEL B	TALK SEL B
DIP ENABLE	DIP ENABLE	DIP ENABLE	DIP ENABLE	DIP ENABLE	DIP ENABLE	DIP ENABLE	DIP ENABLE	DIP ENABLE	DIP ENABLE	DIP ENABLE	DIP ENABLE	DIP ENABLE
LINK S OUT	LINK S OUT	LINK S OUT	LINK S OUT	LINK S OUT	LINK S OUT	LINK S OUT	LINK S OUT	LINK S OUT	LINK S OUT	LINK S OUT	LINK S OUT	LINK S OUT
LINK A LN DRV	LINK A LN DRV	LINK A LN DRV	LINK A LN DRV	LINK A LN DRV	LINK A LN DRV	LINK A LN DRV	LINK A LN DRV	LINK A LN DRV	LINK A LN DRV	LINK A LN DRV	LINK A LN DRV	LINK A LN DRV
LINK B LN DRV	LINK B LN DRV	LINK B LN DRV	LINK B LN DRV	LINK B LN DRV	LINK B LN DRV	LINK B LN DRV	LINK B LN DRV	LINK B LN DRV	LINK B LN DRV	LINK B LN DRV	LINK B LN DRV	LINK B LN DRV
CALL A	CALL A	CALL A	CALL A	CALL A	CALL A	CALL A	CALL A	CALL A	CALL A	CALL A	CALL A	CALL A
CALL B	CALL B	CALL B	CALL B	CALL B	CALL B	CALL B	CALL B	CALL B	CALL B	CALL B	CALL B	CALL B
PRG INT B	PRG INT B	PRG INT B	PRG INT B	PRG INT B	PRG INT B	PRG INT B	PRG INT B	PRG INT B	PRG INT B	PRG INT B	PRG INT B	PRG INT B
PRG INT A	PRG INT A	PRG INT A	PRG INT A	PRG INT A	PRG INT A	PRG INT A	PRG INT A	PRG INT A	PRG INT A	PRG INT A	PRG INT A	PRG INT A
ALERT TONE	ALERT TONE	ALERT TONE	ALERT TONE	ALERT TONE	ALERT TONE	ALERT TONE	ALERT TONE	ALERT TONE	ALERT TONE	ALERT TONE	ALERT TONE	ALERT TONE
ALT TONE EN	ALT TONE EN	ALT TONE EN	ALT TONE EN	ALT TONE EN	ALT TONE EN	ALT TONE EN	ALT TONE EN	ALT TONE EN	ALT TONE EN	ALT TONE EN	ALT TONE EN	ALT TONE EN
CHL A POWER	CHL A POWER	CHL A POWER	CHL A POWER	CHL A POWER	CHL A POWER	CHL A POWER	CHL A POWER	CHL A POWER	CHL A POWER	CHL A POWER	CHL A POWER	CHL A POWER
CHL B POWER	CHL B POWER	CHL B POWER	CHL B POWER	CHL B POWER	CHL B POWER	CHL B POWER	CHL B POWER	CHL B POWER	CHL B POWER	CHL B POWER	CHL B POWER	CHL B POWER
VDD	VDD	VDD	VDD	VDD	VDD	VDD	VDD	VDD	VDD	VDD	VDD	VDD
+30V	+30V	+30V	+30V	+30V	+30V	+30V	+30V	+30V	+30V	+30V	+30V	+30V
VSS	VSS	VSS	VSS	VSS	VSS	VSS	VSS	VSS	VSS	VSS	VSS	VSS

CLEAR-COM LIMITED WARRANTY

The Clear-Com 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.

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.

For your own records fill in the information below:

* Model No. _____	* Serial No. _____	
Date Purchased _____		
Purchased from (dealer) _____		
Address _____		
City _____	State _____	Zip _____

Factory Service

All equipment returned for repair must be accompanied by documentation stating your return address, telephone number and date of purchase, along with a description of the problem.

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

Send equipment to be repaired to:

**Customer Service Department
Clear-Com Intercom Systems
4065 Hollis St.
Emeryville, CA 94608-3505
Telephone: (510) 496-6666
Telefax: (510) 496-6699**

Warranty Repairs - If in warranty, no charge will be made for the repairs. Equipment being returned for warranty repair must be sent prepaid and will be returned prepaid.

Non-Warranty Repair - Equipment that is not under warranty must be sent prepaid to Clear-Com. If requested, an estimate of repair costs will be issued prior to service. Once your approval for repair, and repair of equipment is completed, the equipment will be shipped freight collect from the factory to the customer.

TECHNICAL SPECIFICATIONS

HEADSET MICROPHONE PRE-AMP

Input Type: Dynamic
Impedance: 1K Ω
Input Level: -55 dBV nominal; -10 dBV max.
Gain from headset mic to intercom line: +41 dB

PANEL MICROPHONE PRE-AMP

Input Type: Electret
Input Level: -45 dBV nominal
Gain from panel mic to intercom line: +31 dB

PRE-AMP RESPONSE CURVE

Frequency Response: 250 Hz - 12 KHz, contoured for intelligibility
Limiter Range: 20 dB

HEADPHONE/SPEAKER AMPLIFIER

Load Impedance Range: 50 Ω - 2 K Ω
Output Level: at least +20 dBV across 600 Ω
Distortion: < 0.2% THD @ 1 KHz
Frequency Response: 200 Hz - 18 KHz, \pm 2 dB
Gain from intercom line: +37 dB
Power Output: 110 dB SPL

PROGRAM AMPLIFIER

(Transformerless, balanced differential input)
Input Level: -20 dBV
Input Impedance: > 100 K Ω
Frequency Response: 150 Hz - 18 KHz, \pm 2 dB

TERMINATION IMPEDANCE

Impedance: 200 Ω , switchable

POWER SUPPLY

Type: Switching, with overcurrent limiting and reset circuitry
Output Voltage: 30 volts DC
Output Current: 2 amps peak, 1.75 amps max, distributed over both channels
Short Circuit Reset Time: < 15 sec.
Hum & Noise: < -80 dBv

STATION CAPACITY

Capacity: Maximum of 60 headset stations or 20 speaker stations, distributed over both channels

REAR PANEL CONNECTORS

Intercom: (6) XLR-3M (3 per channel)
Announce Out: (1) XLR-3M (Audio)
Announce Relay: (1) 1/4" Phone Jack (Relay)
Program: (1) XLR-3F
Hot Mic / IFB Interface: (1) 1/4" Phone Jack
AC Power: IEC 320 Connector

REAR PANEL CONTROLS

(2) Termination On-Off switches; (8) Option switches; (1) Power switch; (1) Tone Alert Volume control

FRONT PANEL CONNECTORS

Panel Mic: (1) 1/4" panel mounting jack
Headset: (1) XLR-5F

FRONT PANEL CONTROLS & INDICATORS

(1) Panel / Headset Mic switch; (1) Announce button; (1) Party Line Link switch; (2) Program On-Off-Interrupt switches; (3) Program Level controls; (2) Listen controls; (2) Sidetone Null controls; (2) Talk buttons; (2) Call buttons; (1) Tone Alert button; (1) RMK button; (1) Speaker On-Off switch
(2) Short LEDs; (1) Power on LED; (1) Party Line Link LED; (1) Tone Alert LED

POWER REQUIREMENTS

90 - 240 VAC, 50 - 60 Hz, 60 VA

ENVIRONMENTAL

32 - 122° F (0 - 50° C)

DIMENSIONS

19" W x 1.75" H x 6.5" D (483 mm x 44 mm x 165 mm)

WEIGHT

5.0 lbs. (2.75 kg)

NOTICE ABOUT SPECIFICATIONS

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. 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.