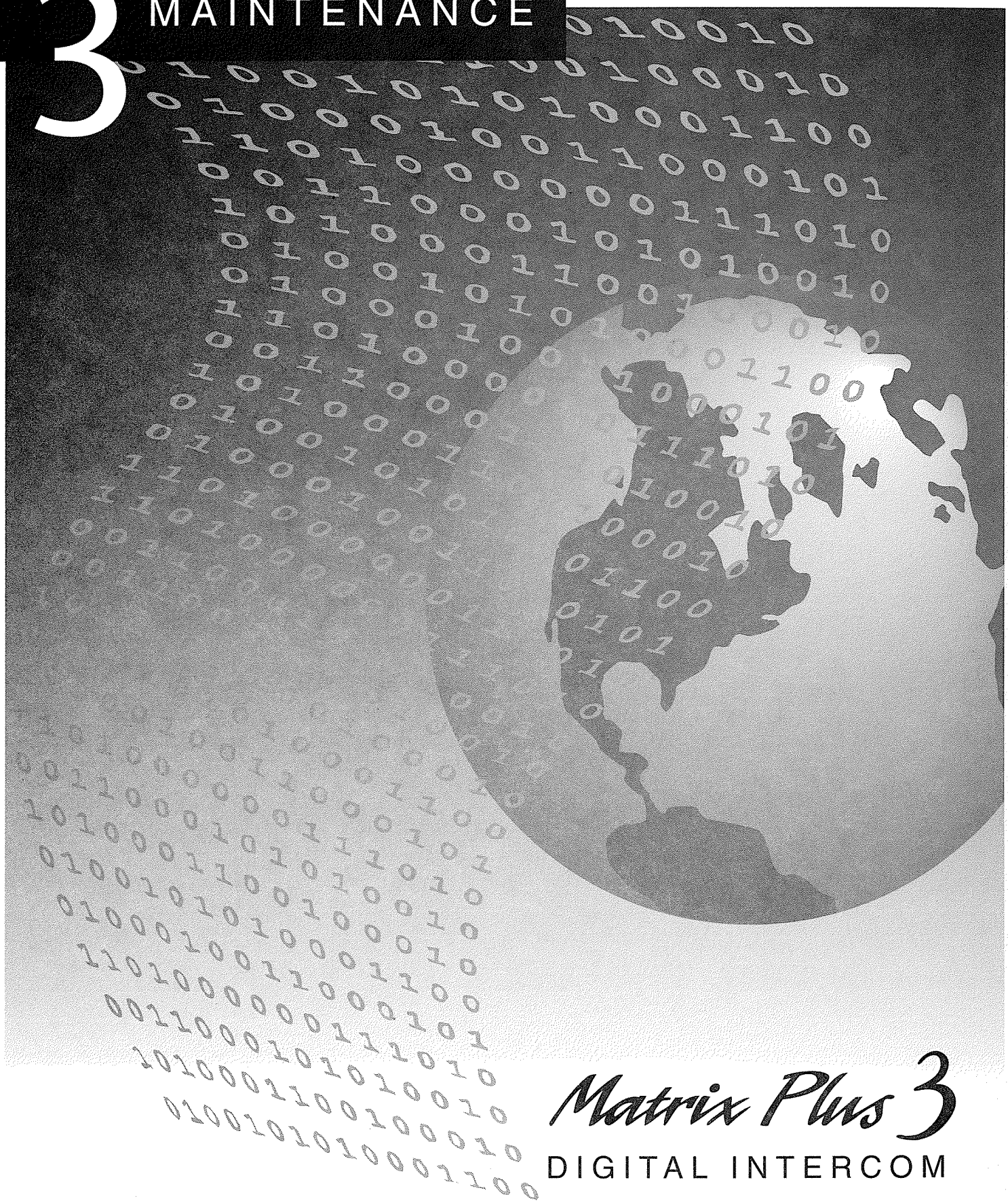
3 MAINTENANCE



Matrix Plus 3

DIGITAL INTERCOM

Matrix Plus 3 System

Volume III

Maintenance Manual

Clear-Com Part #810219, Rev. J

Matrix Plus 3 System Maintenance Manual

Clear-Com Systems

4065 Hollis Street

Emeryville, California 94608-3505

U.S.A.

Congratulations on your purchase of a Matrix Plus 3 Intercom System. The Matrix Plus 3 System includes sophisticated hardware and software components that can be configured in many different ways. The four-volume set of the Matrix Plus 3 System Manuals will guide you through installation, operation, and troubleshooting/ maintenance of your system.

Four-Volume Set Description

This is **Volume III — Maintenance Manual** — This manual includes troubleshooting and maintenance information on the Matrix Plus 3 System. The Maintenance Manual also provides schematics and bills of materials for each Matrix Plus 3 System hardware component. Technical personnel will use the maintenance manual for locating solutions to common problems encountered in using the Matrix Plus 3 System.

Volume I — The *Matrix Plus 3 System Operation* manual describes the use of the Matrix Plus 3 System. In the operation manual, intercom station operators and other Matrix Plus 3 System users will find detailed instructions on the use of the Matrix Plus 3 System components, including the PGM-WIN configuration program.

Volume II — The *Matrix Plus 3 System Installation* manual describes how to install a Matrix Plus 3 System and includes the specifications of each Matrix Plus 3 System component. Technical personnel will use the installation manual when installing the Matrix Plus 3 System.

Volume IV — The *PGM-WIN System Configuration* manual describes the operation of the configuration program. Intercom station operators and other Matrix Plus 3 System users will find detailed instructions on the use of the Matrix Plus 3 System configuration program. For installation and maintenance of the configuration program refer to the Configuration chapter in the *Matrix Plus 3 System Installation* and the *Matrix Plus 3 System Maintenance* manuals.

All of these manuals are written for beginning users of Matrix Plus 3 Systems, however some experience with basic intercom systems is assumed. To use the PGM-WIN configuration program, you must have some familiarity with your IBM-PC or compatible computer and the WIN-95 or WINDOWS NT Operating System. External devices that are not supplied with your Matrix Plus 3 System are not covered in this manual. External devices include external party-line

intercom systems, audio devices, and other hardware connected to the matrix through 4-wire connections or Matrix Plus 3 System Interface Modules.

How Each Manual Is Divided

Each of the manual volumes is divided into chapters and sections except for the *PGM-WIN System Configuration* manual. Chapters are marked by divider tabs labeled with the name of the chapter. The chapter titles are Contents, Overview, Stations, Configuration, Frames, Matrix Cards, Interfaces, and Index. Chapters that are subdivided have their titles on white divider tabs.

Page numbering begins at page "1" for each chapter. With the exception of the Contents and Index chapters (which use Roman numerals), each page is referred to by its chapter letter, section number, and page number. For example, the first page of the section on the ICS-2002 Intercom Station is found on page "S1-1." "S1-1" stands for Station chapter, section 1, page 1."

To locate this page, turn to the chapter divider tab labeled "Stations," and then turn to the next divider tab labeled "ICS-2002/1802."

Customer Service Department

The Matrix Plus Customer Service Department is available to answer questions not covered in this manual.

Clear-Com Customer Service Department

Clear-Com Intercom Systems

4065 Hollis St.

Emeryville, CA 94608-3505

Telephone: (510) 496-6666

Fax: (510) 496-6610

E-mail: service@clearcom.com

Warranty and Repairs

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, 4065 Hollis St., Emeryville, CA 94608-3505, 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 in "Repairs" on page iii and "Shipping Instructions" on page iv.

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.

Repairs

Through your Dealer

If repair of Matrix Plus System hardware products is necessary, contact the dealer where the unit was purchased.

Through the Factory

If repair through the dealer is not possible, contact the Clear-Com Customer Service Department at the address listed under "Customer Service Department" on page ii.

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).

If return of the product to the factory is authorized, the Clear-Com Customer Service Department will issue you a Return Authorization ("RA") Number. Do not return any equipment to the factory without first obtaining a RA Number.

Shipping Instructions

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. 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. All shipments should be directed to the attention of the Customer Service Department and must include the RA Number.

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

Software License Agreement

Clear-Com Intercom Systems ("Clear-Com") provides this software program and firmware for the Matrix Plus System and licenses its use. You assume responsibility for the selection of the program and firmware to achieve your intended results, and for the installation and use of, and results obtained from, the program.

"Program" in this agreement refers to the PGM-WIN configuration program computer software. "Firmware" in this agreement refers to the operating software stored in ROMs throughout the Matrix Plus System.

License

The computer program and firmware contains confidential information pertaining to Clear-Com. You may not modify, reverse compile, rent, lease, or distribute the computer program or firmware, or any copy, in whole or in part.

You may use the program only on a single machine. You may copy the program into any machine-readable form for backup purposes in support of your use of the program on the single machine.

You may transfer the computer program, firmware, and license to another party if the other party agrees to accept the terms and conditions of this agreement. If you transfer the program, you must at the same time either transfer all copies (whether in printed or machine-readable form) to the same party, or destroy any copies not transferred. Clear-Com grants a license to such other party under this agreement and the other party will accept such license by its initial use of the program. If you transfer possession of any copy of the program and firmware in whole or in part to another party, your license is automatically terminated.

Termination

The license is effective until terminated. You may terminate it at any time by destroying the program, together with all copies. You also will terminate upon conditions set forth elsewhere in this agreement or if you fail to comply with any of the terms or conditions of this agreement. You agree upon such termination to destroy the program together with all copies.

Limited Warranty

Clear-Com warrants that the Matrix Plus 3 software, firmware, and the accompanying media will perform substantially in accordance with the specifications set forth in the accompanying documentation. Clear-Com does not warrant that the functions contained in the program will meet your requirements or that the operation of the program will be uninterrupted or error-free.

Limited Remedies

If the Clear-Com software, firmware, or media fails to perform as warranted, Clear-Com will replace it within the warranty period. Clear-Com will at its sole descression also endeavor to fix any software/firmware problems as stated in "Limited Warranty" on page v. In no event will Clear-Com be liable to you for any lost profits, lost savings, or other incidental or consequential damages arising from use of, or inability to use, any program, even if Clear-Com or an authorized Clear-Com representative has been advised of the possibility of such damages, or for any claim by any other party.

Some states and provinces do not allow the limitation or exclusion of liability for incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Clear-Com's liability to you for actual damages for any cause whatsoever, and regardless of the form of the action, will be limited to the money paid for the program and firmware that caused the damages or that is the subject matter of, or is directly related to, the cause of the action.

General

Any attempt to rent, lease, or sublicense the program; or (except as expressly provided in this agreement) to transfer any of the rights, duties, or obligations under this agreement is void.

The agreement will be construed under the laws of the State of California, except for that body of laws dealing with the conflict of laws. If any provision of this agreement shall be held by a court of competent jurisdiction to be contrary to law, that provision will be enforced to the maximum extent permissible, and the remaining provisions of the agreement shall remain in full force and effect.

Notice Regarding 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.

Introduction

This chapter discusses the following subjects:

- Basic Theory of Operation
- Reliability
- Recommended Spare Parts
- System Troubleshooting Guide

CAUTION: Servicing Instructions Are For Use By Qualified Personnel Only. To Reduce The Risk Of Electric Shock, Do Not Perform Any Servicing Other Than That Contained In The Operating Instructions Unless You Are Qualified To Do So. Refer All Servicing To Qualified Service Personnel.

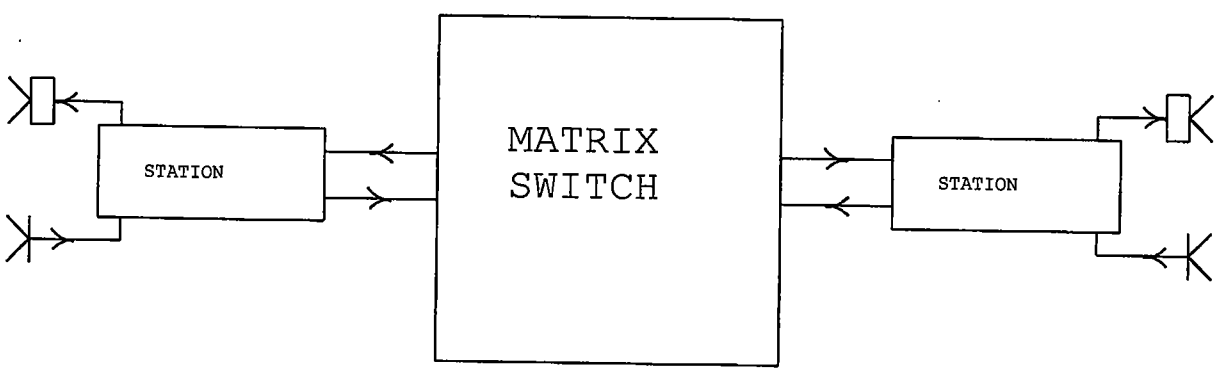
Basic Theory Of Operation

This section discusses the fundamental theories behind the operation of the Matrix Plus 3 System. The following subjects are discussed:

- Matrix Intercom Concept
- A Digital Matrix Switch
- Internal Frame Communication
- Physical Partitioning of the System
- Configuration Storage

Matrix Intercom Concept

A matrix intercom is compromised of a central switching box with multiple intercom stations or interfaces connected directly to it. Each station is connected with a separate 2-pair (Talk and Listen) audio circuit and a 2-pair RS-422 data circuit. The central switching box has enough switching and mix hardware such that each output to a station can be the sum of all other inputs.



A Digital Matrix Switch

The Matrix Plus 3 system utilizes digital switching and mixing technology known as Distributed Digital Signal Processing (DDSP). The input audio from each station or port is digitized and placed in a time slot on a digital data bus. A block of digital switching and summing hardware is available for each output to a station or interface.

System microprocessors instruct the DDSP circuitry to sum all of the input channels for a particular output channel. Also, while the particular input is being summed into the output it is also multiplied by a constant that represents the variable level desired for that input to the particular channel.

After the signal processing is completed for a particular output channel, the digital word is converted to an analog signal to be sent to the station or interface.

The digital sample rate is 32 K Samples/Sec. The time between each sample is divided into 256 time slots. Each audio input is placed in one of these time slots depending on its port number in the system. The illustration below explains the concept further.

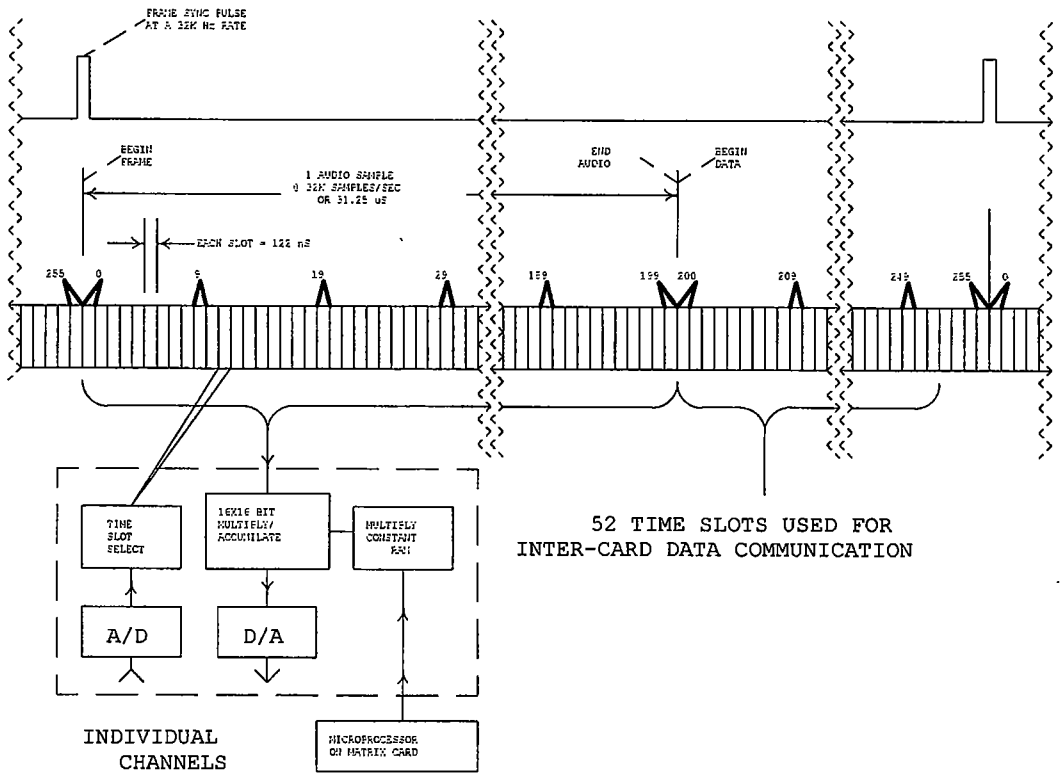


Figure O-1. Block Diagram of Digital Time Slot Concept

Internal Frame Communication

A Matrix Plus 3 system features a maximum of 200 ports; therefore it uses only 200 of the 256 slots available between each audio sample. 52 of the 56 remaining slots are used as a system of "outgoing mailboxes" that enable communication between the frame cards: one for each matrix card, and one for the CONFIG-1 card. Each card in the system has hardware in the form of a FPGA (Field Programmable Gate Array) that buffers and handles this communication for each micro-processor on each card. The effective data rate is 1 M Bit/Sec. Refer to the illustration on the previous page.

This type of scheme allows each microprocessor in the system to communicate directly with each other processor in the system. It is possible for one microprocessor to have multiple conversations at the same time allowing a much higher effective through-put than the basic rate of 1 M Bit/Sec.

Physical Partitioning of the System

The Matrix Plus 3 card frame that houses the matrix system has 27 card slots (27 for SYS-200 or 11 for COM-72). The first slot in the frame contains a CLOCK-1 card that has circuitry to produce the timing signals necessary to keep all of the cards in the system operating in sync together. The second slot contains the CONFIG-1 card that stores the system configuration, communicates to the external PC computer, and directly connects to accessory interfaces (RLY-6 and GPI-6 interface modules). The remaining slots are available for Matrix cards.

Each matrix card contains the switching circuitry necessary to support 8 stations or interfaces. The top connector on the rear of the cards connects to a mother board that has the digital data bus and delivers DC power to all of the cards. The connector for each slot on this motherboard has 5 pins dedicated to providing a unique 5 bit address to the card plugged into the slot. The CLOCK-1, CONFIG-1 and Matrix cards must be plugged into their proper slots to function. The cards will not function if they are plugged into any slot except for the one they were intended for. They will not, however, be damaged or damage the system if they are put into incorrect slots.

The bottom connector on the rear of the Matrix cards provides the port connections for the eight channels of that card. The matrix cards plug in directly to the rear panel assemblies that contain the RJ-45 modular port connectors on the rear panel of the frame. The bottom connector on the rear of the CONFIG-1 card provides connection to the rear panel for the external PC Computer, the Accessory Interfaces, and the Alarm I/O connector.

Configuration Storage

Matrix Plus 3 frame cards feature redundant configuration storage memory. The CONFIG-1 card stores the current system configuration and three others in its battery-backed RAM; each matrix card has its own memory which stores as much of the current configuration as applies to the card's eight ports. As a result, the CONFIG-1 card can be removed from the frame with no effect on the frame's operation whatsoever. If you replace the CONFIG-1 card with a CONFIG-1 that does not have the current configuration stored in its RAM, the new card will download the configuration from the matrix cards; however, if you want to change the system configuration, do so using the configuration software—the other three configurations will not be stored on the new card. Each matrix card's memory is volatile—that is, if it loses power momentarily, it will reset to its default configuration (all party lines).

Reliability

High reliability is one of the primary design objectives of the Matrix Plus 3 System. During the product's design phase, numerous prototype failures were analyzed in great detail; as a result, Clear-Com has created a design that will minimize the effect of component failures. The following aspects of the design are discussed:

- Dual Redundant Power Supplies
- Dual Redundant System Clock Sources
- "Hot Patch" Capability
- Component Isolation
- Automatic System Reconfiguration

Dual Redundant Power Supplies

Both the SYS-200 and the COM-72 matrix frame are provided with two redundant sets of power-supplies, each with its own separate mains AC power connection. The Matrix Plus 3 System can operate normally on just one supply—if one mains AC supply or one power-supply module fails, the system will continue operating. Each power supply is provided with a set of alarm relay contacts that will close if any power supply output fails. The relay contacts can be wired to an alarm at a remote location that will alert operators to the failure of all or part of the power supply system.

Dual Redundant System Clock Sources

A single clock source is required for the timing of the digital signals on the digital motherboard of the frame. If this clock source fails the system would fail. The Matrix Plus 3 system includes a "main"and a "backup clock source. The CONFIG-1 board's microprocessor monitors the system clock and if there is a failure, the backup clock source on the CONFIG-1 card will be switched on allowing uninterrupted operation of the system. A system failure alarm will be issued warning of the operation on the back-up clock system.

"Hot Patch" Capability

All Matrix Plus 3 frame cards, interface modules, and power supplies have "hot patch" and "self-initalizing" capability—that is, they can be installed or removed from the system while the power is on without damage to either the system or themselves. Overall system operation will not be disturbed by the insertion and removal of components, and the system's microprocessors will smoothly incorporate any newly added device.

Component Isolation

The CONFIG-1 is the central storage for the operating configurations, but the matrix cards are not dependent upon it for them to operate completely. Each matrix card stores the portion of the configuration it needs. Each matrix card also communicates directly to all other matrix cards without the benefit of the CONFIG-1 card. The CONFIG-1 card does not need to have a redundant back-up because it is not necessary for intercom operation of the machine.

If one MTX card malfunctions, it will only affect the eight intercom stations or interfaces connected to that card's ports (with rare exceptions). In all cases, if you replace the faulty card, you will remove all effects that it has on other components in the system.

Automatic System Reconfiguration

If any intercom station in the system is removed and another installed in its place, the Matrix Plus 3 System will automatically send the original station's configuration to the replacement station within seconds of the replacement being connected, even if the replacement is a different type. This is possible because the complete configuration of each station is stored in the microprocessor of the MTX card that supports the station's matrix port, and the microprocessor's software is advanced enough to configure for each type of station.

If an MTX card is removed from the matrix frame, and another of the same type is installed in its place, the CONFIG-1 Card will automatically send it the complete configuration for the eight stations and/or interfaces that are supported by the MTX card slot; the MTX card will in turn automatically send the configuration to its stations and/or interfaces.

If a CONFIG-1 is replaced for any reason while the system is operating, the current configuration will remain in the microprocessors in the frame's MTX cards. The new CONFIG-1 will upload all legitimate configurations from the MTX's microprocessors before resuming operations. All talk paths will be maintained.

Recommended Spare Parts

To keep system downtime during repairs to a minimum, keep a set of fully operational spare parts at your site. A minimum list is as follows:

- 1 CONFIG-1 master controller card
- 1 MTX crosspoint card of each type used
- 1 PSU-101 System Power Supply
- 1 Each of every Intercom Station type that has been installed in the system
- 1 of each interface type used
- 1 of each matrix frame power supply module used

System Troubleshooting

The following section is an overall guide to troubleshooting the system as a whole. The use of reset switches is discussed. A list of symptoms and possible solutions for troubleshooting the overall system is also presented. Each individual chapter for each product will also contain a list of symptoms and possible solutions.

If you are unable to solve your problem, call the factory at the number listed under the heading "Customer Support" in the "Contents" Chapter of this Maintenance Manual.

Reset Switches

All microprocessor-based components of the Matrix Plus 3 system feature local microprocessor reset switches on the front of the unit that will restart that microprocessor's program.

The CONFIG-1 Controller Card features two reset buttons: one for resetting all MTX cards in the matrix frame simultaneously, and another for resetting the CONFIG-1 card itself. Each MTX card has its own reset button that will reset that card's microprocessor only.

Each intercom station has a reset button that is accessible through a small unmarked hole on the front panel; push the button with a small screwdriver or piece of wire. Refer to each individual station's chapter for locations of the reset button.

Troubleshooting

The following section is a list of symptoms of problems and possible solutions.

1. The entire system seems to be operating except for one MTX card.
    - Reset the card. Only that card and any stations connected to it will be affected.
    - Replace the card.

2. The stations appear to operate, but the "Frame Data" LEDs on the MTX cards are not blinking regularly, indicating that the frame is not communicating with the MTX cards.
    - Reset the CONFIG-1 card.
    - Replace the CONFIG-1 card.

3. Several components in the system are operating incorrectly, and neither of the above solutions solve the problem.

- Reset both the CONFIG-1 and all MTX cards by pushing both reset buttons on the CONFIG-1. This has the same effect as unplugging and reconnecting mains AC power to the matrix frame.
- Check that all of the system firmware has compatible versions: look at the configuration program's "Firmware Version" report to verify that the revision level of all components in the system is consistent. This report is part of the Event Log. To display this report, the computer must be connected to the frame.
- If the report shows any components that are not the current revision.

4. The configuration information in the CONFIG-1's battery-backed memory is lost—all ports have default names with the prefix "@".

- The CONFIG-1 cannot find any configuration information and is using its "default" configuration. The CONFIG-1 looks for configuration information in the battery-backed RAM. Check that the Battery Disconnect jumper is placed properly—if it is not in place, the battery-backed RAM will lose its configuration information any time that power is removed from it.

5. The CONFIG-1 card is acting strangely (i.e., resetting itself intermittently).

- If you have disconnected the battery, make sure that the Battery Disconnect jumper has been placed across the set of pins toward the rear of the CONFIG-1 card; this grounds the battery monitoring circuit as required for correct operation.
- Check that the Battery Disconnect jumper is placed across its own set of jumper pins, connecting the pair that is closest to the front of the card.

6. The Matrix Plus 3 System's configuration is hopelessly corrupted.

   - Download a saved copy of the configuration from the PC.
   - If the configuration is faulty, the configuration in the RAM could be unrecoverable. In that case, restart the RAM on the CONFIG-1 with the following procedure:

     1. Remove the CONFIG-1 from the frame.

     2. Remove the Battery Disconnect jumper, place in the OFF position for five seconds, then place it back in the ON position. This will clear all of the RAM memory.

     3. Put the CONFIG-1 back in the frame and push both reset buttons. This will place a default configuration in the RAM: 12 party-lines will be established and assigned to the first 12 keys of every station. This simple configuration serves as an easy test of the system's hardware: if the system works in this configuration, it must be assumed that the fault is in the configuration that you were using.

   - If the above steps do not work, replace the CONFIG-1.

7. The matrix is dead—no LED indicators are lit.

   - Check the AC mains power to the matrix frame.
   - If AC mains power is present, check the power supply LEDs in the matrix card frame.

8. Interfaces in IMF-3 Interface Frame are not functioning properly.

   - Check connections between the IMF-3 and the PSU-101, including ground.
   - Check connections between the IMF-3 and the Matrix Card Frame.

9. The Alarm LED is flashing and the "Clock Fault" LED is on solid or flashing.

   - A solid on "Clock Fault" LED condition indicates that one of the signals of the primary clock system on the CLOCK-1 card is non-functional and the system is operating on the backup clock system on the CONFIG-1 card. The CLOCK-1 card should be replaced.
   - A blinking "Clock Fault" Led indicates that something is wrong with the secondary clock system on the CONFIG-1 board. The CONFIG-1 card should be replaced.

10. The Alarm LED is flashing and the "Temp Fault" LED is on. The "Temp Fault" LED indicates that the temperature as measured on the CONFIG-1 card is greater than 125 degrees F (50 degrees C).

- Check the operation of the cooling fans and their filters on a SYS-200 frame for proper operation.
- For a COM-72 frame check that there is adequate ventilation above and below the frame.

11. The Alarm LED is flashing and one of the "Power" LEDs on any of the MTX cards is flashing or not on.

- A flashing "Power " LED on a MTX card indicates that one of the analog power supplies on the MTX card is out of specification. The MTX card should be replaced.
- Flashing LEDs on all of the MTX cards indicates that both of the analog power supplies behind the lower door are non-functional.
- A "Power" LED that is not on indicates that the "digital" 5 volt power supply is not functional on that MTX card.

12. (SYS-200) The Alarm LED is flashing and the "Power Supply Fault" LED is on.

- Open the lower door of the frame and inspect the six green LEDs on the power supply modules. One of these LEDs should be off indicating a failure of that power supply module. Replace the power supply module in question.

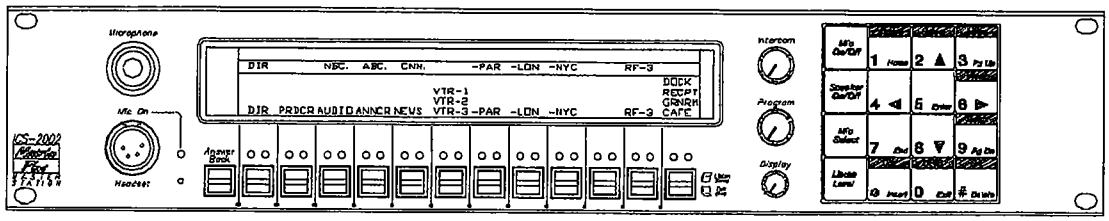
13. (COM-72) The Alarm LED is flashing and one of the six LEDs on the front of the power modules is off.

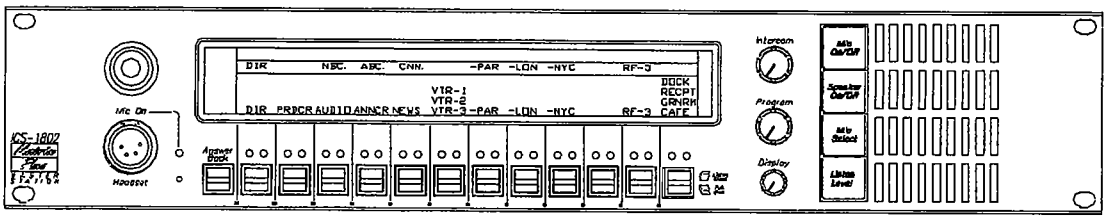
- Replace that power module.

14. The Alarm LED is flashing and none of the above secondary indications are present.

- If an external alarm circuit is connected to the External Alarm Inputs of the CONFIG-1 card, check that possible fault condition.
- Check the Event Log in the Configuration Program for the nature of the fault.

STATIONS





Matrix Plus 3 System ICS-2002/ICS-1802

MASTER INTERCOM STATIONS

Introduction

This section provides station microprocessor resetting instructions, Maintenance menu use, troubleshooting guidelines, schematics, assembly drawings, and component lists for the following products:

- ICS-2002 Master Intercom Station
- ICS-1802 Master Intercom Station
- OPT-100 Auxiliary Audio Input/Output Option
- XP-12 10-Selector Expansion Panel
- XPL-12 10-Selector Display Expansion Panel
- XP-22 20-Selector Expansion Panel
- XPL-22 20-Selector Display Expansion Panel
- AP-22 Assignment Panel.

The ICS-1802 is identical to the ICS-2002, except that the ICS-2002 has 12 multifunction buttons. As a result, local programmability and DTMF dialing are not available on the ICS-1802.

A jumper on the front panel PCB of both stations, which is placed in different positions depending on the model, enables the configuration program to identify the model.

Station Reset

The station's microprocessor has a reset button located in an unmarked hole just below the green "Mic On" LED on the left side of the unit's front panel. If the station is acting erratically, try resetting it by:

1. inserting a small screwdriver or a stiff piece of wire (such as a bent paper clip) into the hole and pushing the reset button

or

2. unplugging the station from AC power and reconnecting.

Maintenance Menu (ICS-2002 only)

The ICS-2002's Maintenance menu includes several functions to aid in testing installation and isolating problems. To access the Maintenance menu:

1. Push the "Menu" button on the station's keypad.
2. Press and hold the "Menu" button for 1 sec. to bring up the hidden menus. Because the Maintenance menu is a hidden menu, it might require a password if the system operator has assigned one.
3. Select "Maintenance Menu."
4. Select one of the following functions:
   - Version Information
   - Send Tone To Matrix
   - Activate Matrix Loopback.

Each letter will also appear in the label area above a selector key.

Version Information

This function displays the installed software's version number and copyright information.

Send Tone to Matrix

This function sends a tone to the matrix, which is useful for tracing signal paths through the system. To check a talk path to a specific station:

1. Activate a talk path to the station.
2. Send the tone (internally generated by the station).

Activate Matrix Loopback

This function returns the station's audio via the matrix frame. This is accomplished by connecting a crosspoint between the station's incoming audio and the station's path for outgoing audio from the matrix. This provides a check for the audio paths between the station and the matrix frame. This function also checks that the communication between the station and the matrix frame is working correctly; the loop can be completed only if the station is communicating with the matrix frame.

Troubleshooting

When experiencing the symptoms listed below, attempt the following solutions in the order outlined. The solutions are listed in order of difficulty with the first being the most simple and easy. For troubleshooting guidelines for the entire system, see the Overview chapter of this manual.

- **The station's LCD display and all front-panel indicators fail to light.**

1. Check mains AC power into the station.
2. Ensure the external power supply is properly connected to the station.
3. Replace the station.

- **The LCD display is blank.**

1. Verify that the back light has not been disabled through the configuration program.
2. Adjust the "Display" control on the front panel.
3. Reset the station.
4. Replace the station.

- **The display shows unexpected characters.**

1. Power the station off and turn it back on.
2. Reset the station's matrix card in matrix frame.
3. Replace the station.

- **The electro-luminescent back light of the LCD display is off.**

1. Activate any talk or listen function.
2. Check the station's Configuration menu to be sure the Panel Light setting is on.
3. Replace the station.

- **The LED indicator above a selector key does not light when the key is pressed.**

1. Ensure the selector key has a label assigned to it (the LED indicator will not light without an assigned label).
2. Reset the station.
3. Replace the station.

- **Keypad button functions do not operate, or the station beeps when a button is pressed (affected buttons could include "Assign" Keys, "Station," "Dial," "Menus," and "Swap Window").**

1. Ensure the function has not been inhibited from the configuration program of the station's local Configuration menu.
2. Reset the station.
3. Replace the station.

- **The station appears to activate talk paths, but other stations can't hear the station operator.**

1. Check "Mic On/Off" and "Panel Mic" buttons to ensure the intended microphone is selected and on.
2. If the correct microphone is turned on, ensure the station audio has not been muted externally through the logic inputs.
3. Make sure the station has not been defined as a nearby station.
4. Activate the Matrix Loopback mode from the station's Maintenance menu to check the audio paths to the matrix.
5. Enable eavesdropping on the station.
6. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
7. Reset the station.
8. Replace the station.

- **The display says waiting for system connection and all red LEDs flash slowly.**

1. Wait 60 sec. If the matrix frame has just been powered up, it is possible it is still downloading the configuration to the Matrix cards.
2. Ensure the cable connecting the station to the matrix is plugged in at both ends.
3. Check the integrity of the RS-422 data paths, especially the polarity.

4. Check the configuration program to ensure the station has been assigned the correct port type (ICS-2002 Intercom Station).
5. Confirm the Matrix card type matches the station.
6. Reset the station's Matrix card in the Matrix frame.
7. Replace the station's Matrix card in the Matrix frame.
8. Reset the station.
9. Replace the station.

- **No audio from the station's speaker.**

1. Ensure the "Intercom" knob on the station's front panel is turned up.
2. Ensure the "Speaker On/Off" button is on.
3. Check whether audio can be heard in a headphone.
4. Check the configuration program and the station's logic inputs to ensure the speaker has not been software disabled.
5. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
6. Reset the station's Matrix card in the Matrix frame.
7. Replace the station's Matrix card in the Matrix frame.
8. Reset the station.
9. Replace the station.

- **The operator cannot hear another station's page or call signal tones.**

1. Adjust the "Page Volume" control of the station using the configuration program (refer to the *PGM-WIN System Configuration Manual*).
2. Check the station's configuration to see if page override is enabled.

- **Announce tones (eavesdropping indication, change tones, etc.) aren't heard at the station.**

1. Check the station's Configuration menu to see if the monitoring tones and change tones are enabled.

- **No speaker audio from the external program feed.**

1. Check the "Program" knob on the station's front panel.
2. Check the program source.
3. Reset the station.
4. Replace the station.

- **The headphone isn't receiving audio from the external program feed.**

1. If the external program feed is audible in the speaker, check the station's configuration program to ensure the program was not disabled for the second earphone feed.
2. Replace the station.

- **The configuration computer incorrectly identifies the station type.**

1. Compare the position of the station's front-panel PCB ID jumper against its assembly drawing to see if the jumper is in the correct position.

- **Accessory panels do not function.**

1. Check the accessory panel's connection on the station's rear panel.
2. Ensure the external AC power transformers are correctly connected to the accessory panels.
3. Check the configuration program to ensure the correct number of selectors are configured.

Miscellaneous Bill of Materials for the ICS-2002/1802

Description	Part #	Designator
CABLE, 26 PIN 3 IN. RIBBON CABLE	730078	
CABLE, 34 PIN RIBBON	730181	
CONNECTOR, FILTRD AC LINE W/FUSE	210176	
DISPLAY, LCD ASSY	710294	
EPROM, ICS-2002 PROGRAM	710412	
FUSE, 1/2A SLO-BLO 20MM	520030	
KNOB, SMALL	240080	
KNOB, LARGE	240076	
SPEAKER 2 1/2 in. 8 OHM 3.5W	500103	
POWER CORD	610022	
TRANSFORMER, POWER	560025	

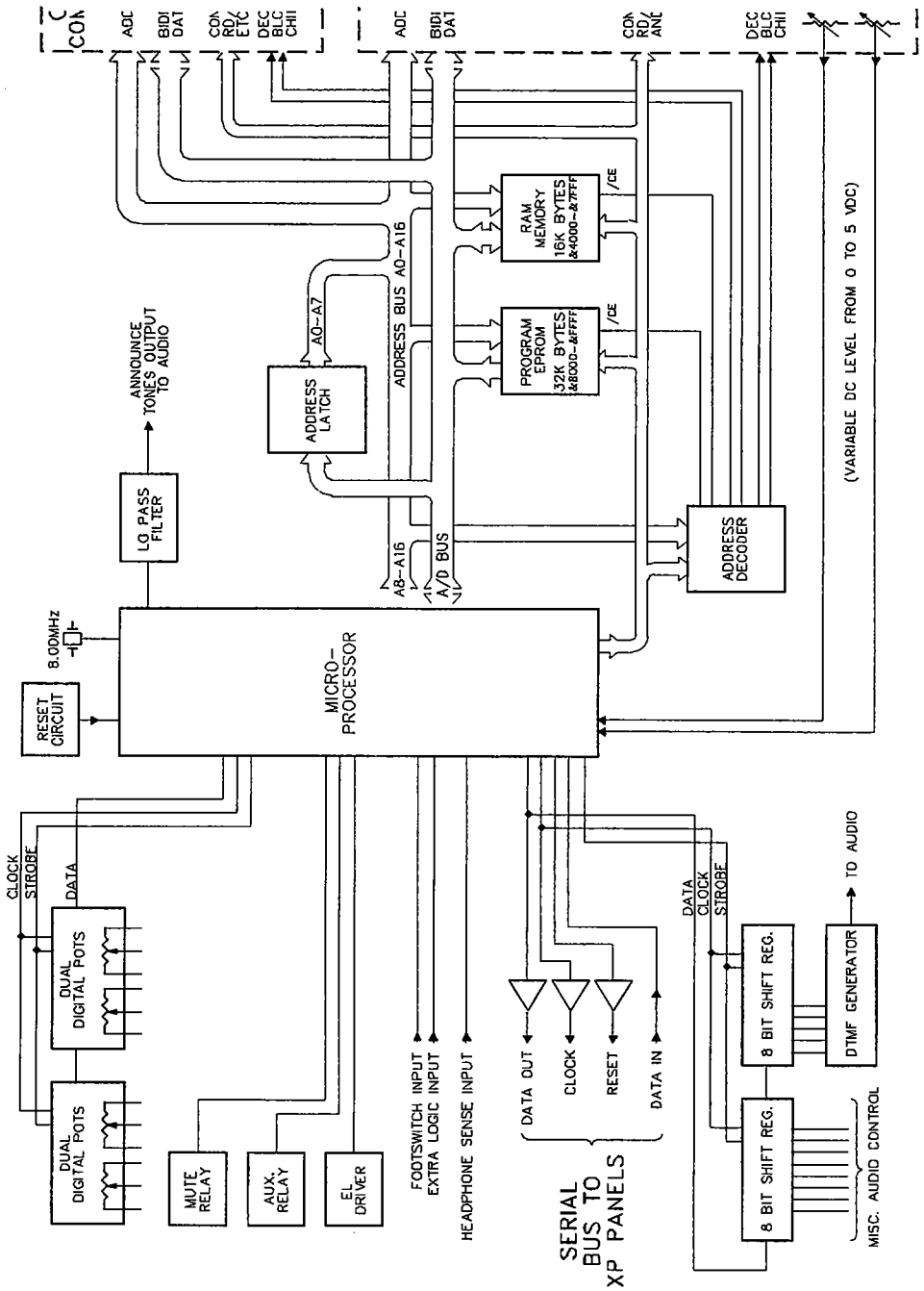


FIGURE S1-1: Digital Block Diagram—ICS-2002 Main PCB

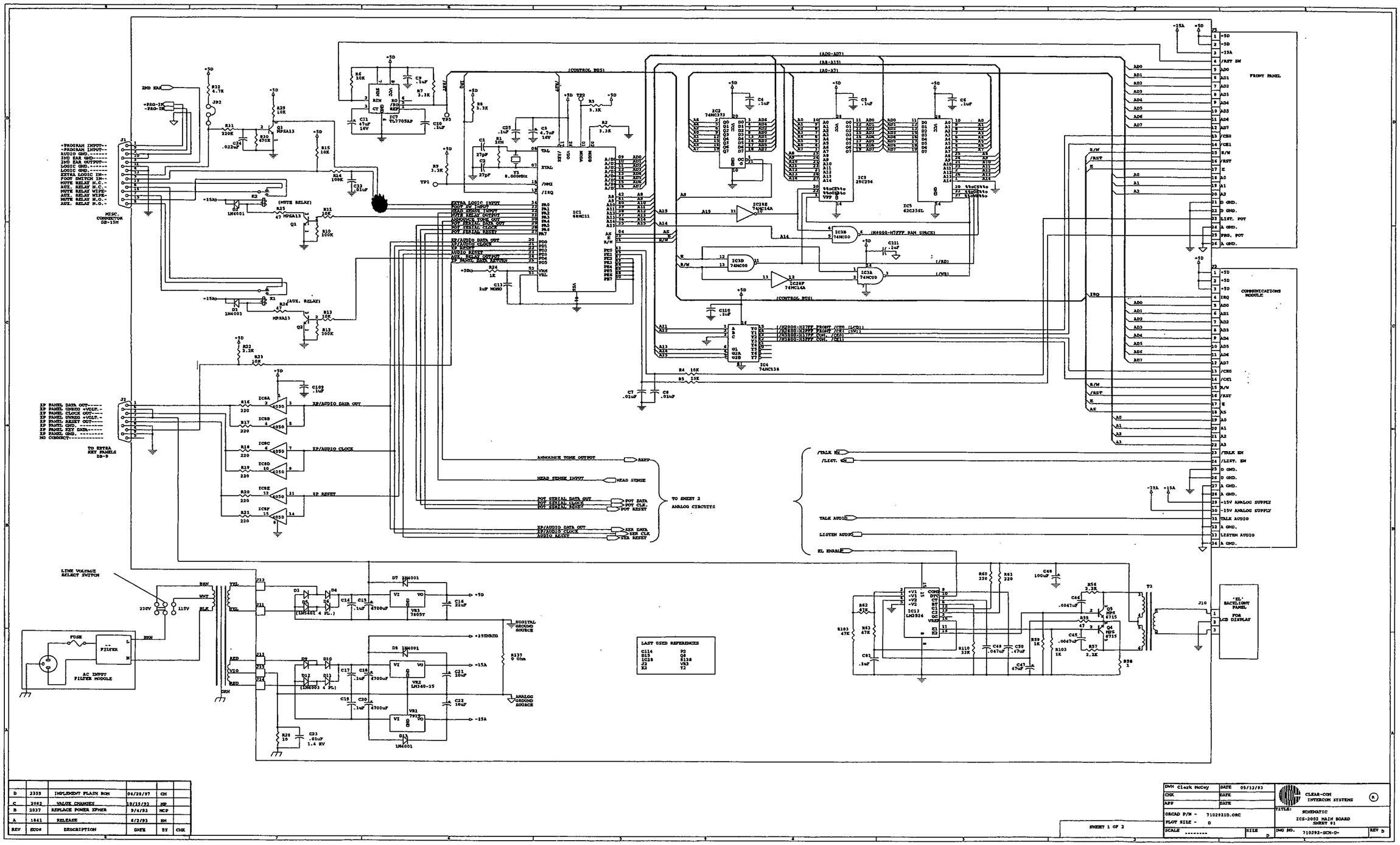


FIGURE S1-2: ICS-2002 Main PCB Sheet 1 of 2 Rev. D

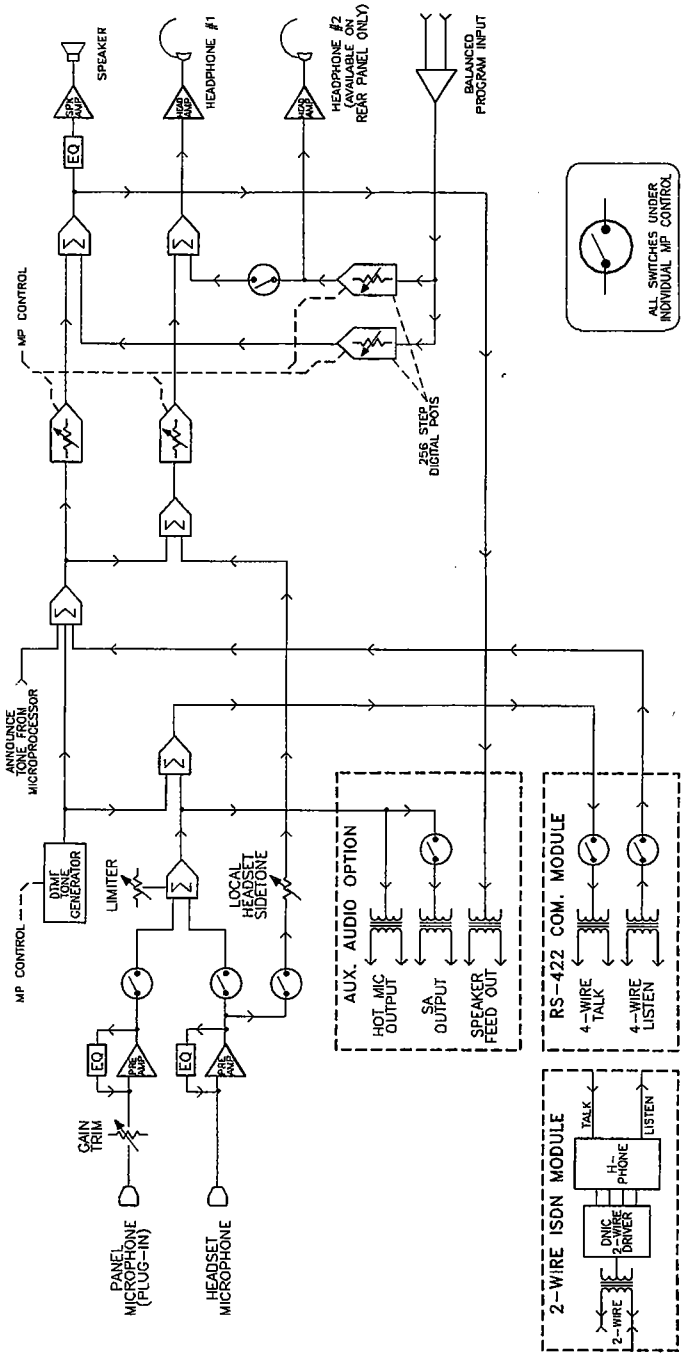


FIGURE S1-3: Analog Block diagram—ICS-2002 Main PCB

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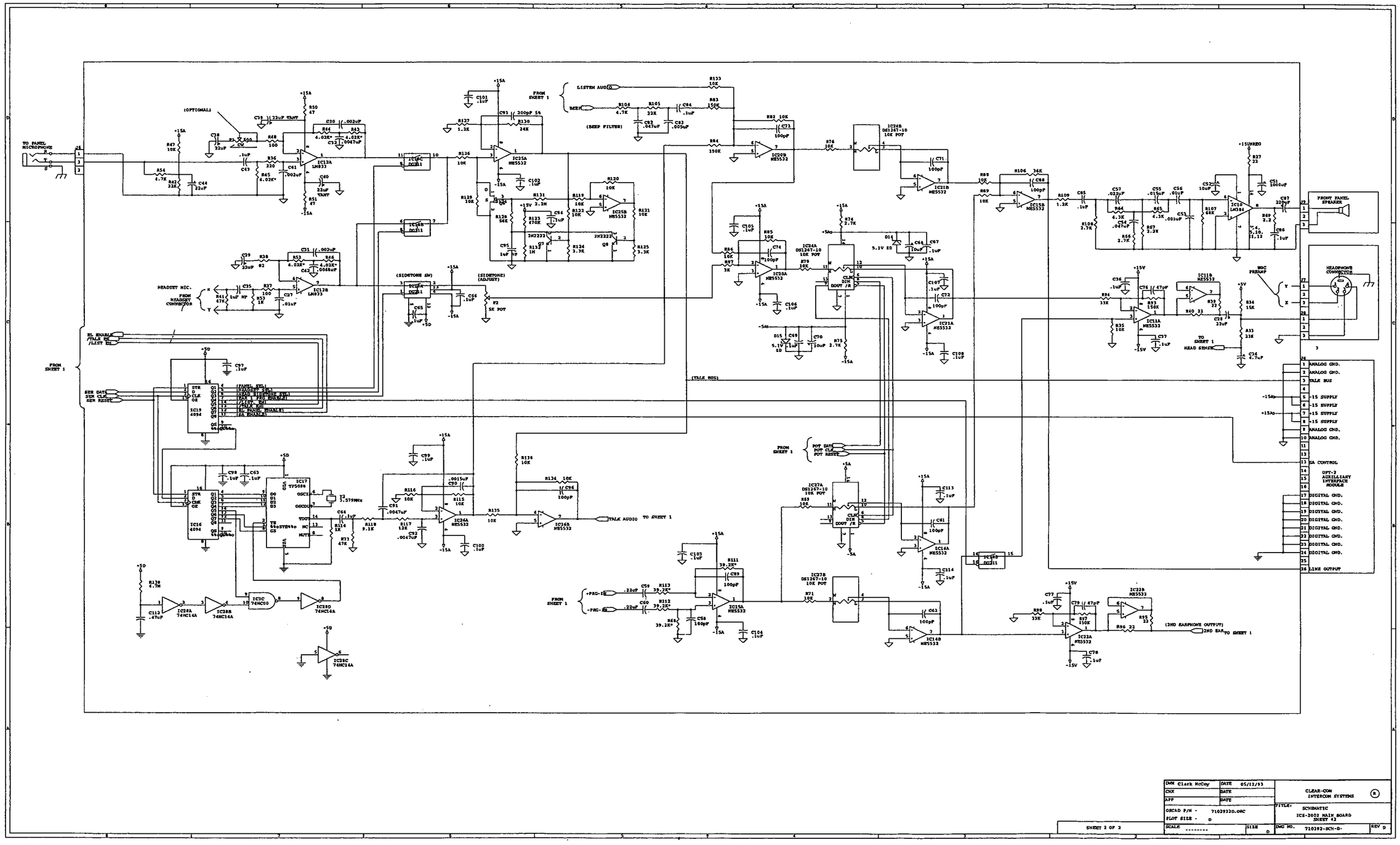

FIGURE S1-4: ICS-2002 Main PCB Sheet 2 of 2 Rev. D

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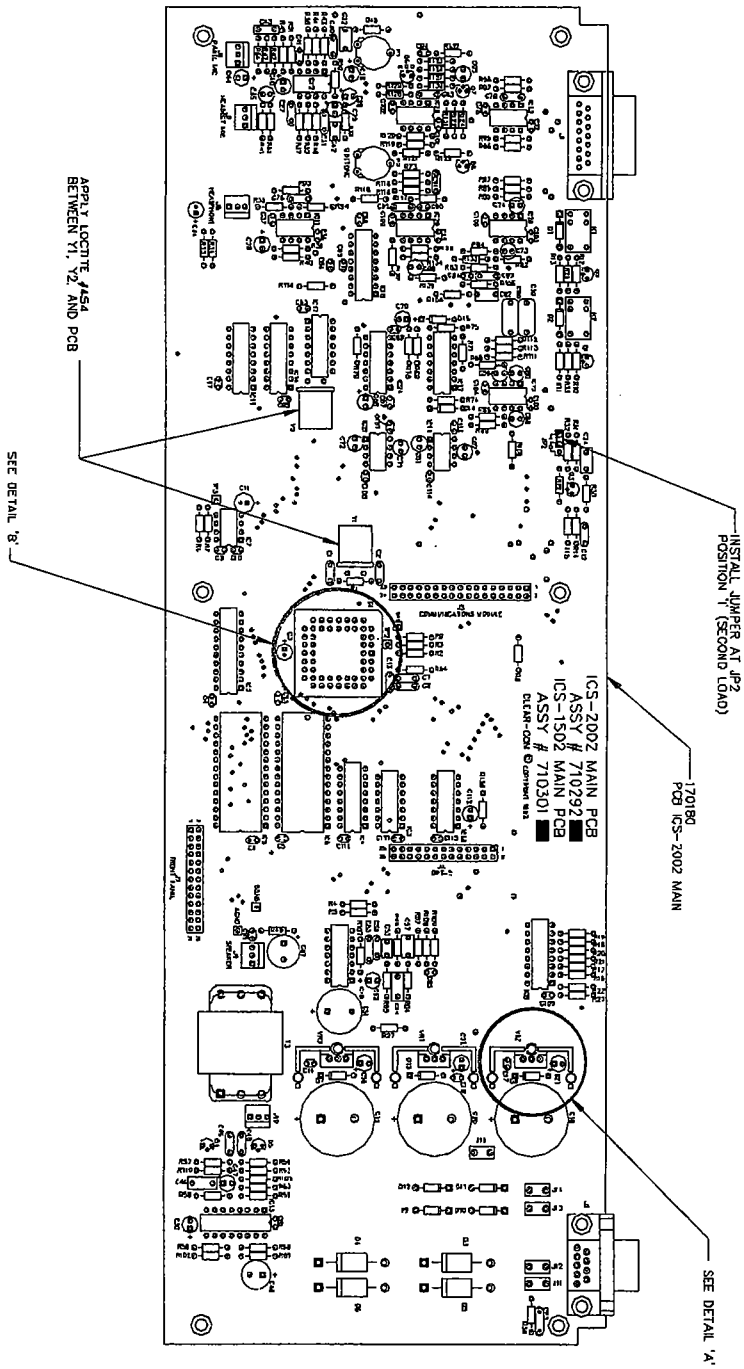

FIGURE S1-5: Assembly Drawing—ICS-2002 Main PCB Rev. D

Bill of Materials for the ICS-2002 Main PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
27	pF	Ceramic Disc	50	5%	150071	C1 C2
47	pF	Ceramic Disc	50	10%	150041	C76 C79
100	pF	Ceramic Disc	50	10%	150006	C58 C61 C62 C71 C72 C73 C74 C88 C89 C96
200	pF	Ceramic Disc	100	5%	150063	C93
0.001	uF	Ceramic Disc	30	20%	150052	C53
0.0015	uF	Monolithic	50	10%	150125	C90
0.0022	uF	Mylar	100		5%	150045C30 C31 C41
0.0047	uF	Ceramic Disc	50	10%	150016	C45 C46 C83
0.0047	uF	Mylar	50	5%	150114	C32 C91 C92
6800	pF	Ceramic Disc	50	5%	150057	C42
0.01	uF	Ceramic Disc	30	20%	150012	C7 C8 C12 C27 C56
0.01	uF	Ceramic Disc	1400	20%	150029	C23
0.015	uF	Metal Polyester	50	5%	150093	C55
0.022	uF	Mylar	100	10%	150008	C24 C57
0.047	uF	Monolithic	50	10%	150111	C49
0.047	uF	Metal Polyester	50	10%	150005	C54 C82
0.1	uF	Monolithic	50	10%	150035	C4 C5 C6 C9 C10 C14 C17 C19 C25 C36 C37 C63 C64 C65 C66 C67 C69 C77 C78 C81 C84 C85 C86 C94 C97 C98 C99 C100 C101 C102 C103 C104 C105 C106 C107 C108 C109 C110 C111 C113 C114 C115
0.1	uF	Monolithic	100	10%	150085	C43
0.22	uF	Mylar	100	20%	150003	C59 C60
0.47	uF	Tantalum	35	10%	150110	C50 C112
1	uF	Ceramic Disc	50	10%	150073	C13
1	uF	Aluminum	50	10%	150002	C35 C95
4.7	uF	Aluminum	16	10%	150141	C3 C34

10	uF	Aluminum	50		150064	C21 C22 C44 C52 C68 C70
22	uF	Aluminum	16		150010	C16 C28 C29 C38
22	uF	Tantalum	16		150032	C39 C40
47	uF	Aluminum	16	20%	150143	C11 C47
100	uF	Aluminum	35		150136	C48
220	uF	Aluminum	35		150021	C87
1000	uF	Aluminum	35		150092	C51
4700	uF	Aluminum	25	20%	150126	C15 C18 C20

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
1	OHM	1/4	Carbon Film	5%	410139	R58
2.2	OHM	1/4	Carbon Film	5%	410113	R49
10	OHM	1/4	Carbon Film	5%	410002	R28
22	OHM	1/4	Carbon Film	5%	410004	R27 R39 R40 R95 R96
47	OHM	1/4	Carbon Film	5%	410039	R25 R26 R50 R51 R55
82	OHM	1/4	Carbon Film	5%	410038	R38
100	OHM	1/4	Carbon Film	5%	410071	R37 R48
220	OHM	1/4	Carbon Film	5%	410007	R16 R17 R18 R19 R20 R21 R36 R60 R61
1K	OHM	1/4	Carbon Film	5%	410010	R24 R53 R59 R102 R114
1.2K	OHM	1/4	Carbon Film	5%	410041	R109 R127
2.2K	OHM	1/4	Carbon Film	5%	410011	R22 R56 R57 R67
2.7K	OHM	1/4	Carbon Film	5%	410040	R66 R74 R75 R108
3.0K	OHM	1/4	Carbon Film	5%	410104	R87
3.3K	OHM	1/4	Carbon Film	5%	410015	R2 R3 R7 R8 R9 R124 R125
4.02K	OHM	1/8	Metal Film	1%	410155	R43 R44 R45 R46 R52
4.3K	OHM	1/4	Carbon Film	5%	410158	R64 R65
4.7K	OHM	1/4	Carbon Film	5%	410013	R32 R54 R104
9.1K	OHM	1/4	Carbon Film	5%	410100	R118
10K	OHM	1/4	Carbon Film	5%	410016	R4 R5 R6 R11 R13 R15 R23 R29 R35 R47 R69

						R71 R76 R79 R82 R83 R85 R86 R88 R89 R115 R116 R119 R120 R121 R122 R126 R129 R133 R134 R135 R136
12K	OHM	1/4	Carbon Film	5%	410031	R117
15K	OHM	1/4	Carbon Film	5%	410017	R34
22K	OHM	1/4	Carbon Film	5%	410018	R33 R42 R105
24K	OHM	1/4	Carbon Film	5%	410083	R130
33K	OHM	1/4	Carbon Film	5%	410020	R94 R98 R110
36K	OHM	1/4	Carbon Film	5%	410163	R106
39.2K	OHM	1/8	Metal Film	1%	410111	R68 R111 R112 R113
47K	OHM	1/4	Carbon Film	5%	410021	R41 R62 R63 R73 R103
56K	OHM	1/4	Carbon Film	5%	410023	R128
68K	OHM	1/4	Carbon Film	5%	410025	R107
100K	OHM	1/4	Carbon Film	5%	410024	R10 R12 R14
150K	OHM	1/4	Carbon Film	5%	410026	R84 R93 R97
220K	OHM	1/4	Carbon Film	5%	410028	R31
470K	OHM	1/4	Carbon Film	5%	410030	R30 R123
1M	OHM	1/4	Carbon Film	5%	410058	R132
2.2M	OHM	1/4	Carbon Film	5%	410153	R131
4.7M	OHM	1/4	Carbon Film	5%	410077	R138
10M	OHM	1/4	Carbon Film	5%	410059	R1

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4001 RECT 1A 50PIV	480001	D1 D2 D7 D8 D13
Diode	1N4003 RECT 1A 200PIV	480058	D9 D10 D11 D12
Diode	1N5231B ZENER 5.1V 5%	480038	D14 D15
Diode	1N5401 RECT 3A 100PIV	480005	D3 D4 D5 D6
Transistor	2N2222 NPN 30V	480006	Q7 Q8
Transistor	J174 JFET PCHAN 8V VGS	480079	Q6
Transistor	MPS-A13 NPN 30V DARL	480004	Q1 Q2 Q3
Transistor	MPS6715 NPN 40V 1W	480095	Q4 Q5

Integrated Circuits

Device	Description	Part #	Designator
Analog Switch	DG211CJ CMOS QUAD SWITCH	480092	IC18
Digital IC	DS1267-10 DUAL 10K POT	480195	IC24 IC27

Digital IC	TL7705AP RESET IC	480134	IC7
Digital IC	TP 5088 DTMF GENERATOR	480196	IC17
Logic Chip	4050B CMOS HEX BUFFER	480077	IC8
Logic Chip	4094B CMOS SHIFT REGISTER	480107	IC16 IC19
Logic Chip	74HC00 CMOS QUAD NAND	480157	IC3
Logic Chip	74HC138 CMOS 3 TO 8 DECODE	480120	IC4
Logic Chip	74HC14 CMOS HEX INVERTER	480199	IC28
Logic Chip	74HC373 CMOS OCTAL D LATCH	480142	IC2
Microprocessor	68HC11AOFN CMOS MCU	480132	IC1
Op Amp	LM384 POWER 4W OP AMP	480012	IC10
Op Amp	LM833N DUAL 8 PIN DIP	480175	IC12
Op Amp	NE5532 DUAL OP AMP	480070	IC11 IC14 IC15 IC20 IC21 C22 IC25 IC26
Memory IC	GM76C256L CMOS RAM 32K X 8	480183	IC5
Regulator	7805T POS 5V REG. TO220 PKG	480083	VR3
Regulator	7915 NEG 15V 1.5A REG. IC	480149	VR1
Regulator	LM340-15 POS 15V REGULATOR	480024	VR2
Regulator	LM3524 REG PW MOD IC	480150	IC13

Miscellaneous

Device	Description	Part #	Designator
Connector	DB-9F RT ANG PC MTG	210186	J2
Connector	DB-15F RT ANG PC MTG CON	210187	J1
Crystal	3.579545MHz CRYSTAL	230001	Y2
Crystal	8.000MHz CRYSTAL	230003	Y1
Pot	500 OHM TRIM POT	470060	P1
Pot	5K TRIM POT.	470022	P2
Relay	SPDT 12V RELAY ITT#SZ12	450006	K1 K2
Transformer	XFORMER, 110 TO 12V 70mA	560022	T3

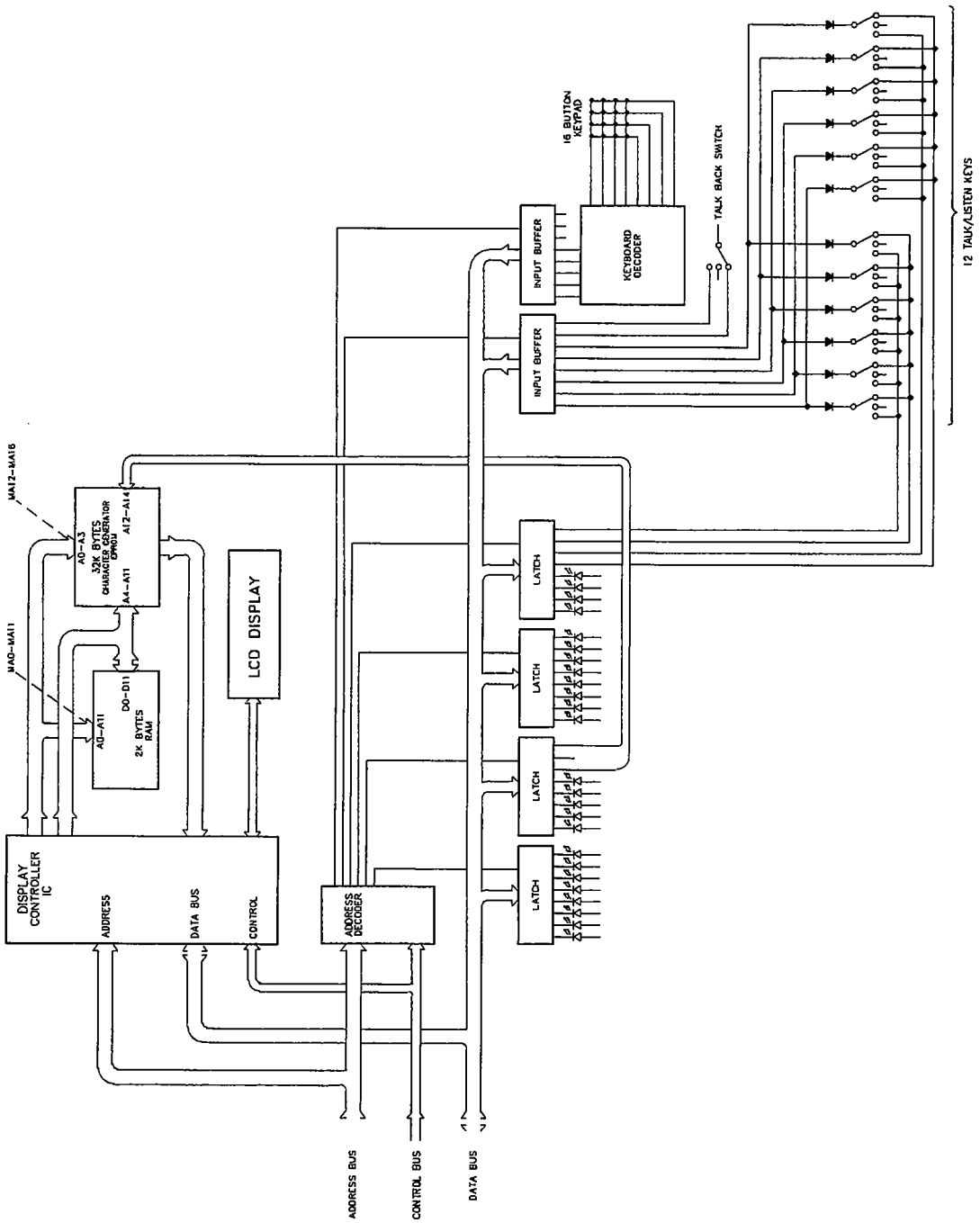

FIGURE S1-6: Block diagram—ICS-2002 Front Panel PCB

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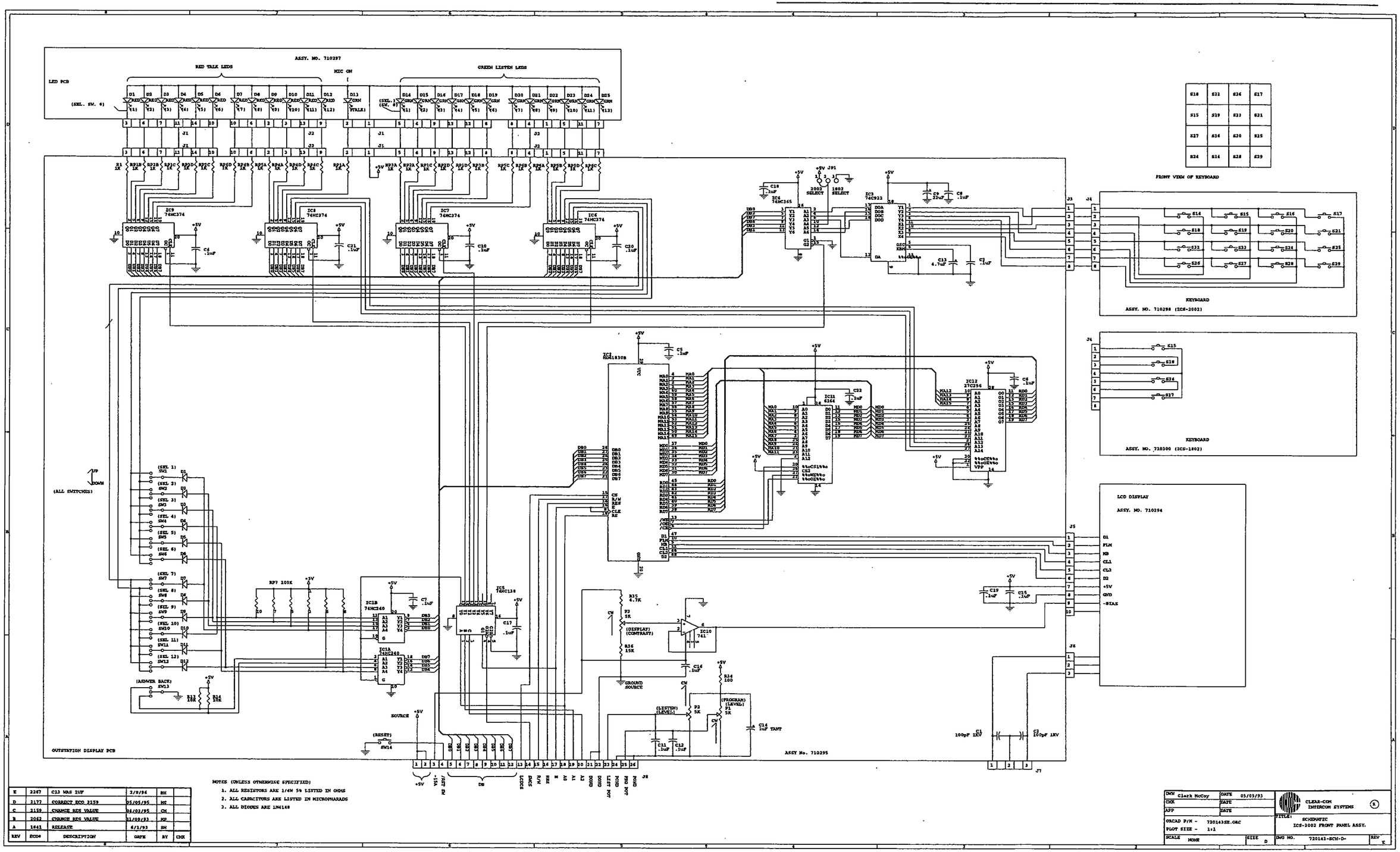

FIGURE S1-7: ICS-2002 Front Panel PCB Schematic Sheet Rev. E

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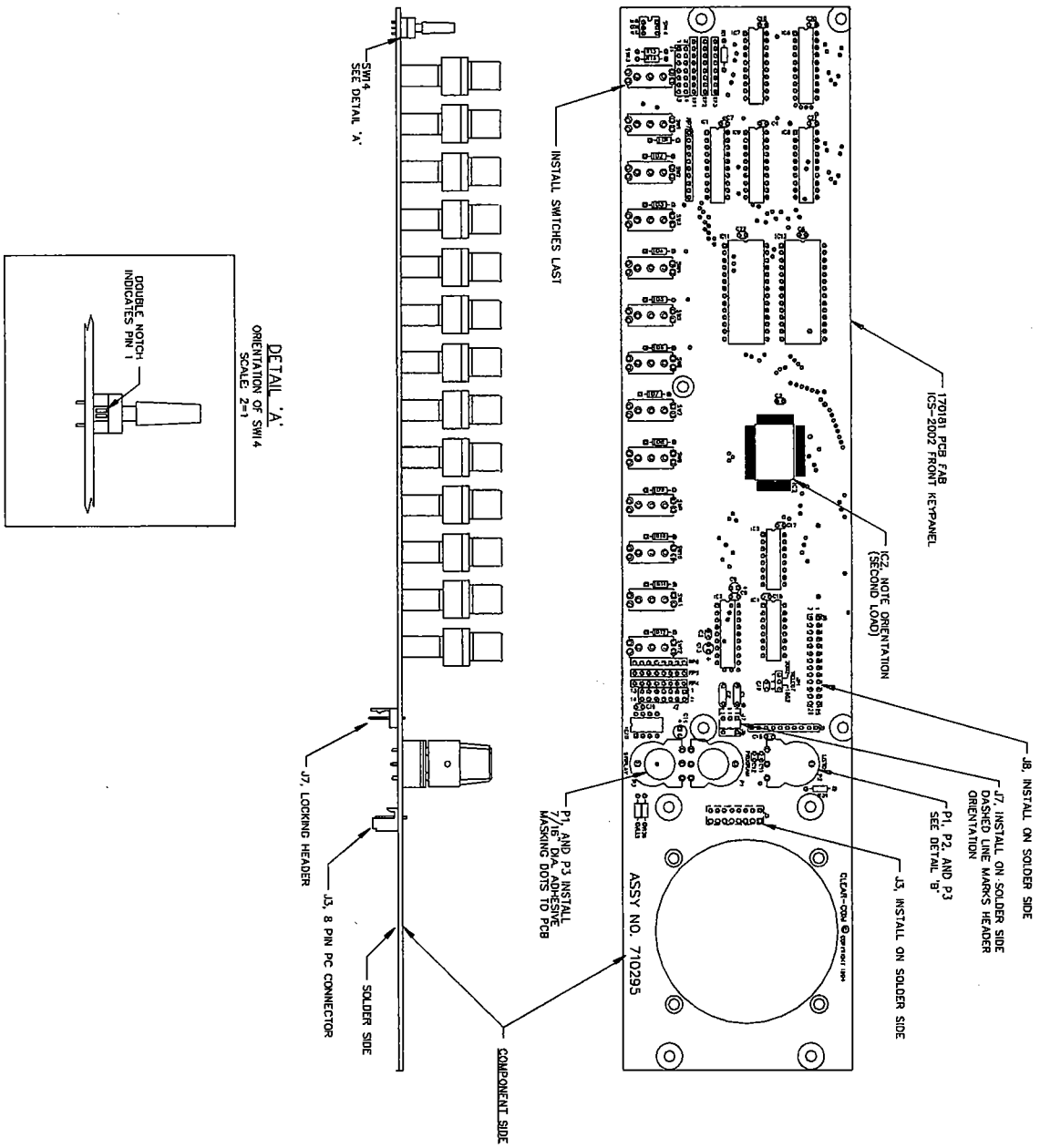

FIGURE S1-8: Assembly Drawing—ICS-2002 Front Panel PCB Rev. C

Bill of Materials for the ICS-2002 Front Panel

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
100	pF	Ceramic Disc	1000	20%	150048	C1 C2
0.1	uF	Monolithic	50	10%	150035	C3 C4 C5 C6 C7 C8 C10 C11 C12 C15 C16 C17 C18 C19 C20 C21 C22
1	uF	Tantalum	35	20%	150116	C13 C14
22	uF	Tantalum	16		150032	C9

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
100	OHM	1/4	Carbon Film	5%	410071	R34
1K	OHM		X 8 SIP bussed		415006	RP1 RP2 RP3 RP4 RP5 RP6
5.1K	OHM	1/4	Carbon Film	5%	410138	R35
10K	OHM	1/4	Carbon Film	5%	410016	R13 R14
20K	OHM	1/4	Carbon Film	5%	410151	R36
100K	OHM		X 9 SIP Bussed		415002	RP1

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12

Integrated Circuits

Device	Description	Part #	Designator
Display Driver	HD61830B LCD CONTROLLER	480119	IC2
Logic Chi	74C922 CMOS I6 KEY ENCODER	480122	IC3
Logic Chip	74HC138 CMOS 3 TO 8 DECODE	480120	IC5
Logic Chip	74HC240 CMOS INV BUFFER	480121	IC1
Logic Chip	74HC365 CMOS HEX BUFFER	480123	IC4
Logic Chip	74HC374 CMOS OCTAL D FF	480143	IC6 IC7 IC8 IC9
Op Amp	LM741 IC OP AMP 8-PIN DIP	480018	IC10
ROM/RAM	6264 CMOS 8K X 8 STATIC RAM	480117	IC11

Miscellaneous

Device	Description	Part #	Designator
	K LINEAR POT 25MM	470067	P3
	5K LINEAR POT 30MM	470068	P1 P2
	SWITCH, PUSHBUTTON	510102	SW14
	ICS-2002 CHAR. GEN EPROM	710296	IC12 IC12
	SWITCH, 3PST	510080	SW1 SW2 SW3 SW4 SW5 SW6 SW7 SW8 SW9 SW10 SW11 SW12 SW13
LED	LED, ROUND GREEN FLAT TOP	390045	D13 D14 D15 D16 D17 D18 D19 D20 D21 D22 D23 D24 D25 D25
LED	LED, ROUND RED FLAT TOP	390044	D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12
	KEYCAP, SET OF 12	240071	
	KEYCAP, SET OF 4	240072	
	PUSH BUTTON SWITCH	510082	S14 S15 S16 S17 S18 S19 S20 S21 S22 S23 S24 S25 S26 S27 S28 S29 S29

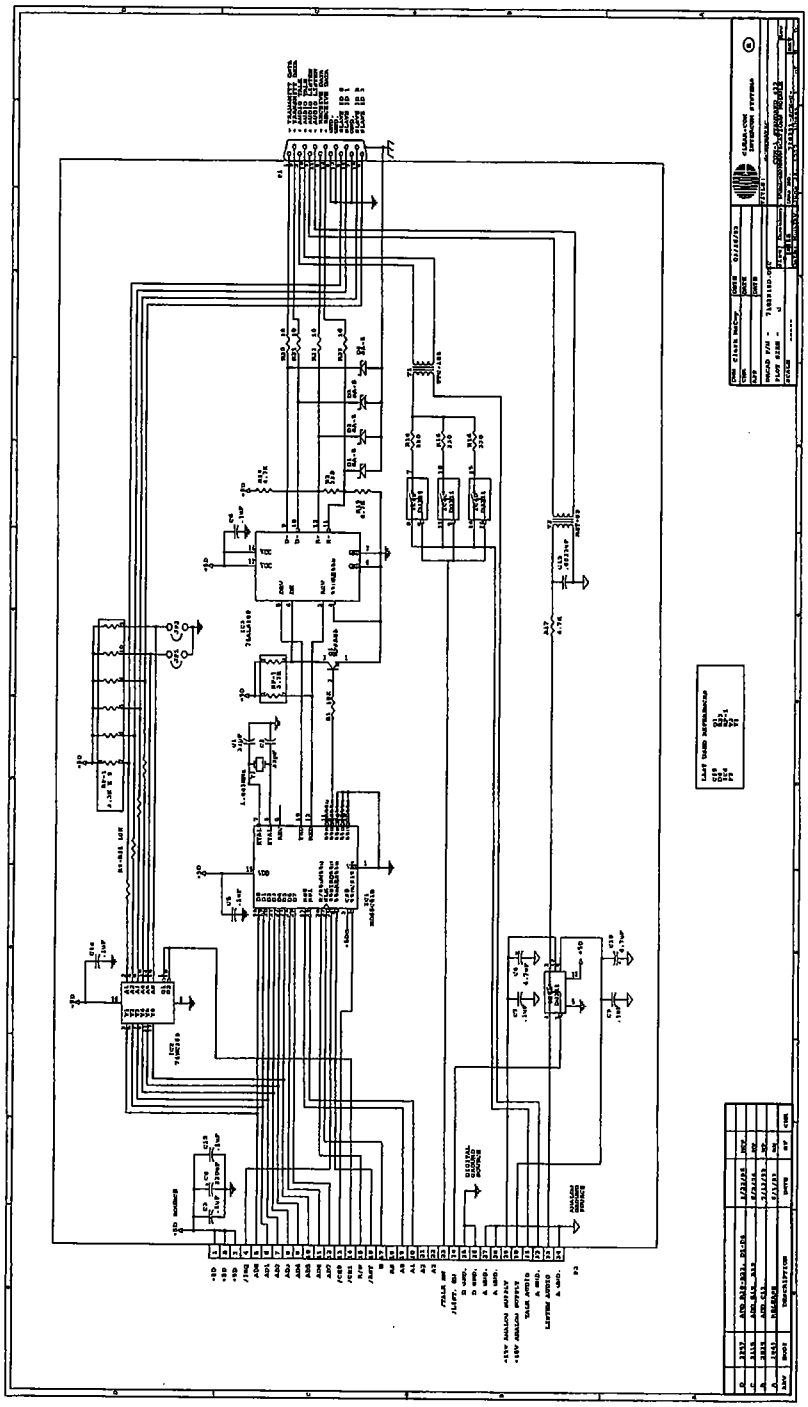

FIGURE S1-9: COM-1 Communications Module Schematic Rev. A

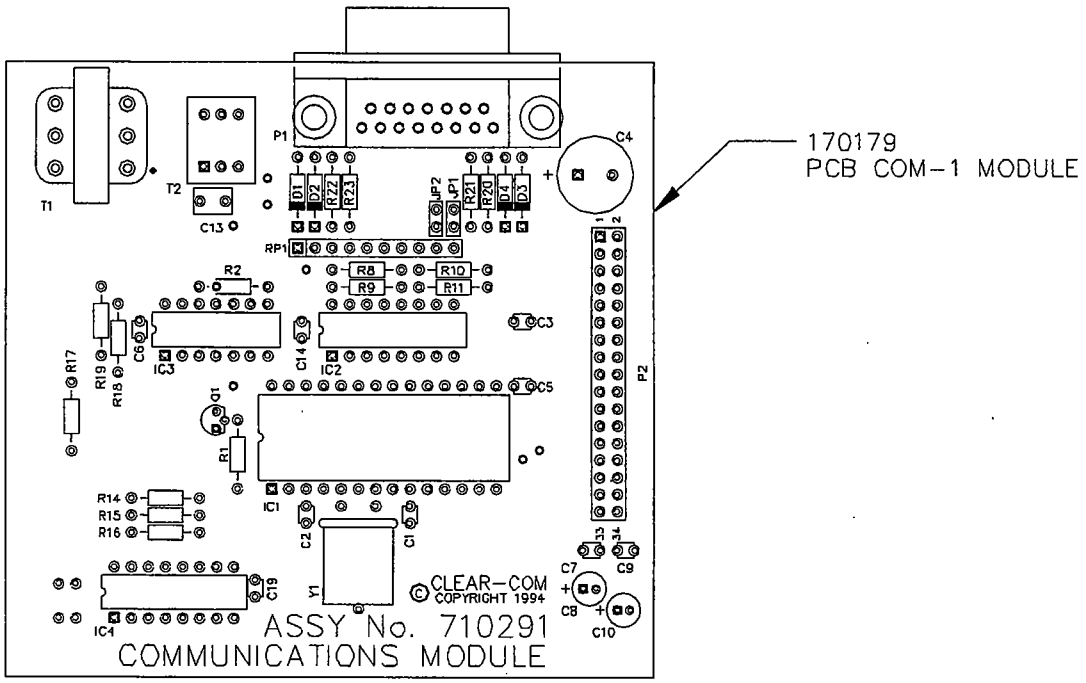

FIGURE S1-10: Assembly Drawing—COM-1 Communications Module Rev. D

Bill of Materials for the COM-1 Communication Module

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
33	pF	Monolithic	50	10%	150128	C1 C2
0.1	uF	Monolithic	50	10%	150035	C3 C5 C6 C7 C9 C14 C19
4.7	uF	Aluminum	16	10%	150141	C8 C10
220	uF	Aluminum	35		150021	C4

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
330	OHM	1/4	Carbon Film	5%	410061	R2 R14 R15 R16
3.3K	OHM	1/4	Carbon Film	5%	415000	RP-1
4.7K	OHM	1/4	Carbon Film	5%	410013	R17
10K	OHM	1/4	Carbon Film	5%	410016	R1 R8 R9 R10 R11

Diodes and Transistors

Device	Description	Part #	Designator
Transistor	MPS-A05 NPN 60V	480052	Q1

Integrated Circuits

Device	Description	Part #	Designator
Analog Switch	DG211CJ CMOS QUAD	480092	IC4
Interface Chip	75ALS180 RS-422 TRANCEIVER	480187	IC3
Logic Chip	65SC51 SERIAL ADAPTER IC	480197	IC1
Logic Chip	74HC365 CMOS HEX BUFFER	480123	IC2

Miscellaneous

Device	Description	Part #	Designator
Connector	DB-15M RT ANG PC MTG CON	210188	P1
Crystal	1.843MHZ CRYSTAL	230002	Y1
Transformer	AUDIO 10K:10K	560034	T2
Transformer	XFORMER, AUDIO 600CT/600CT	560018	T1

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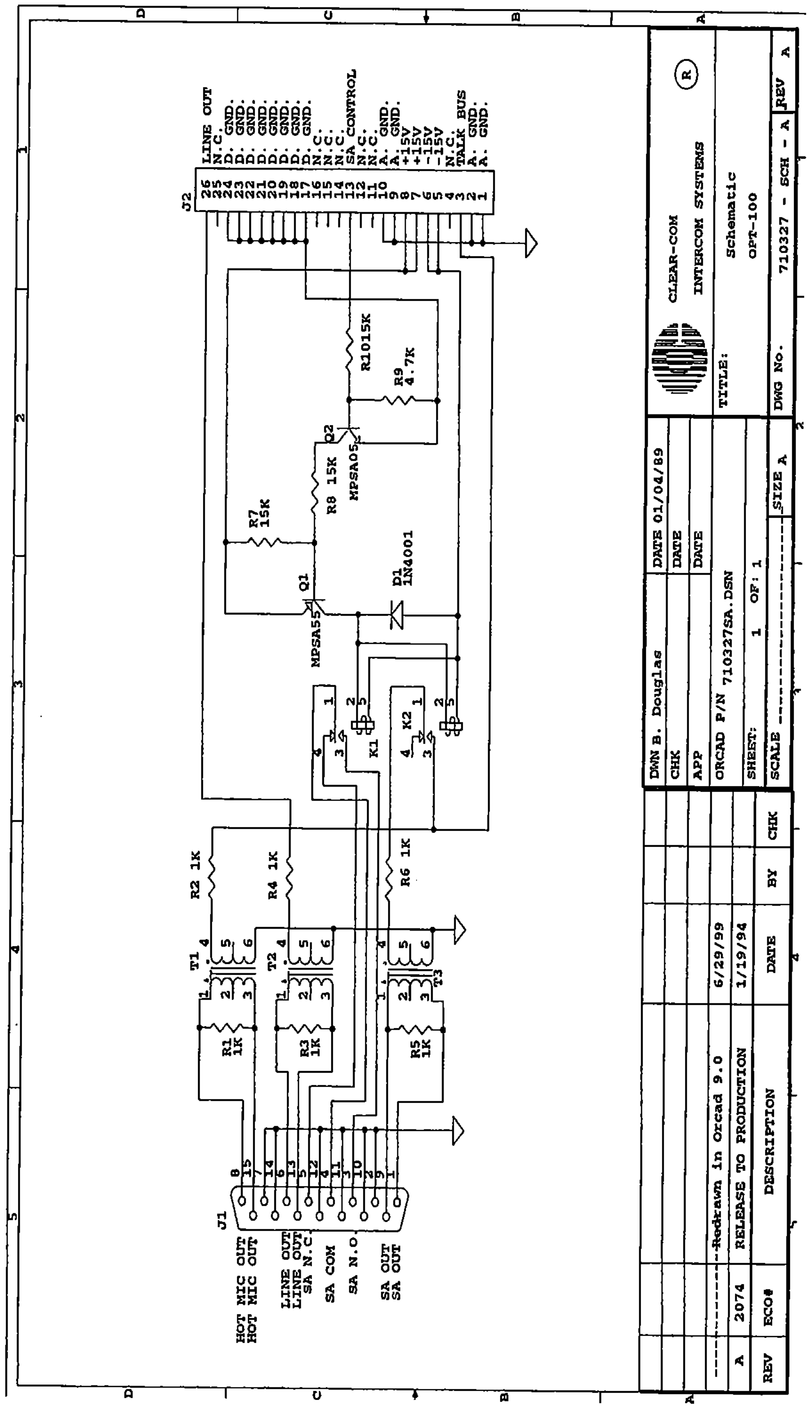


FIGURE S1-11: OPT-100 (Aux Audio Option) Schematic Rev. A

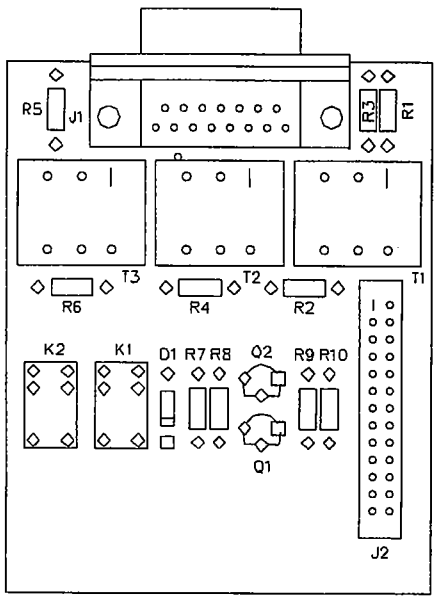


FIGURE S1-12: Assembly Drawing—OPT-100 Module
Rev. A

Bill of Materials for the OPT-100 Module

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
1K	OHM	1/4	Carbon Film	5%	410010	R1 R2 R3 R4 R5 R6
4.7K	OHM	1/4	Carbon Film	5%	410013	R9
15K	OHM	1/4	Carbon Film	5%	410017	R7 R8 R10

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4001 RECT 1A 50PIV	480001	D1
Transistor	MPS-A05 NPN 60V	480052	Q2
Transistor	MPS-A55 PNP 60V	480050	Q1

Miscellaneous

Device	Description	Part #	Designator
Connector	db-15fRT ANG PC MTG	210187	J1
Relay	SPDT 24V MINI PC RELAY	450004	K1 K2
Transformer	AUDIO, 600CT/600CT	560018	

Accessory Panels

There are three types of accessory panels:

- XP-12/22 Expansion Key Panels
- XPL-12/22 Expansion Key Panels with Electronic Labels
- AP-22 Assignment Panels.

Because so much of the circuitry is common to the various panels, and the ICS-52/92 intercom station, the common schematics, assembly drawings, and bills of materials are not duplicated. Instead, the following sections describe which parts are used in each and only the unique components are shown.

XP-12

The XP-12 schematic, Figure S1-13 on page S1-36, shows two PC boards, #710308 and #710253. The Figure S1-14 on page S1-37 shows assembly drawings for each boards.

XP-22

The XP-22 is actually two XP-12 circuits packaged together. Figure S1-15 on page S1-39 shows the interconnection between the two circuits. For details of the circuits, see the XP-12 documentation.

XPL-12

The XPL-12 schematic, Figure S1-17 on page S1-42, shows two PC boards, #710343 and #710344, which are also used in the ICS-92 intercom station. See the ICS-92 for circuit details. The schematic also references the PSU assembly #710349, for which the assembly drawing and BOM are shown.

XPL-22

The XPL-22 is actually two XPL-12 circuits packaged together. Figure S1-19 on page S1-45 shows the interconnection between the circuits. For details, see the XPL-12 documentation.

AP-22

The AP-22 schematic, Figure S1-20 on page S1-46, shows the same PSU and display PCB units as the XPL-12. Figure S1-21 on page S1-47 shows the assembly drawing for the AP-22.

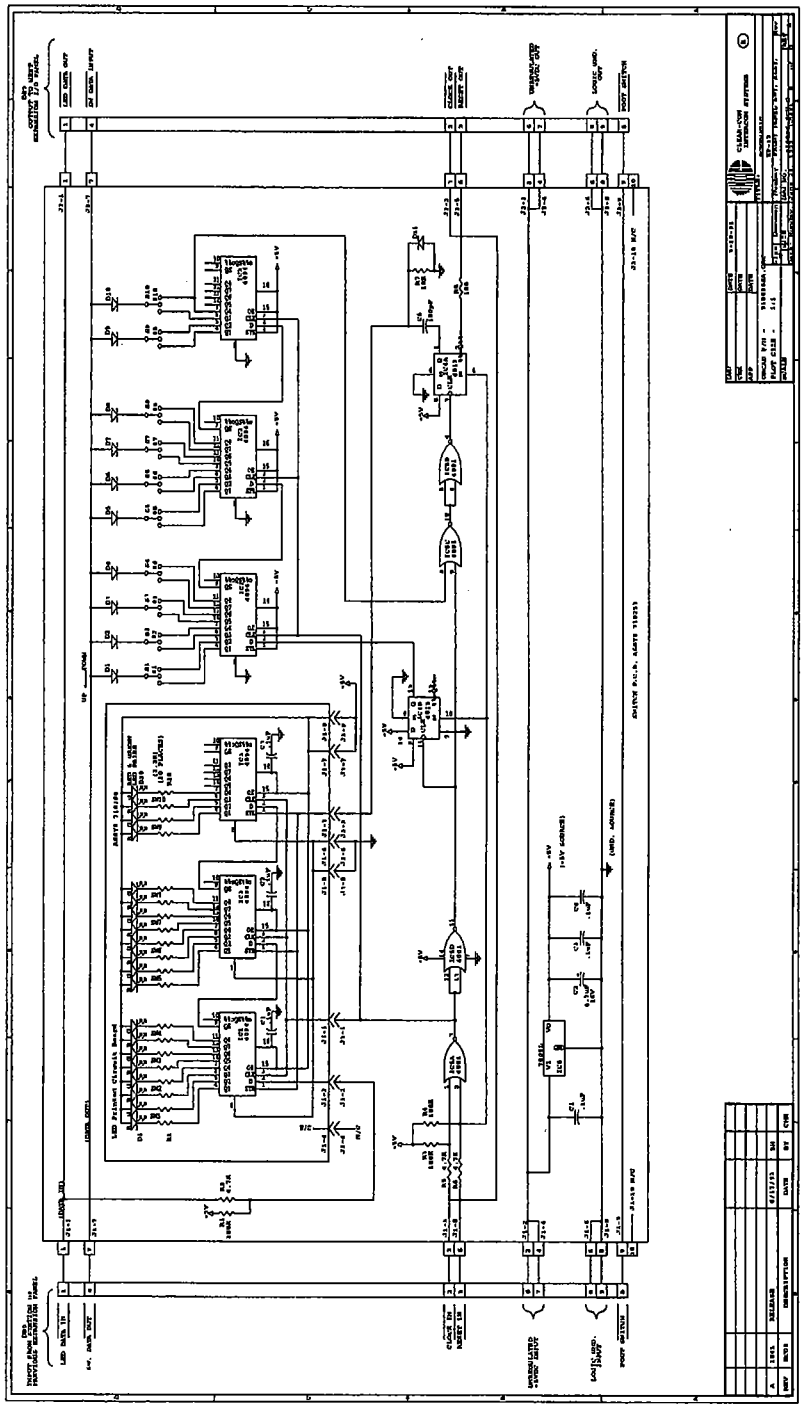


FIGURE S1-13: XP-12 (10-Selector Expansion Panel) Schematic Rev. A

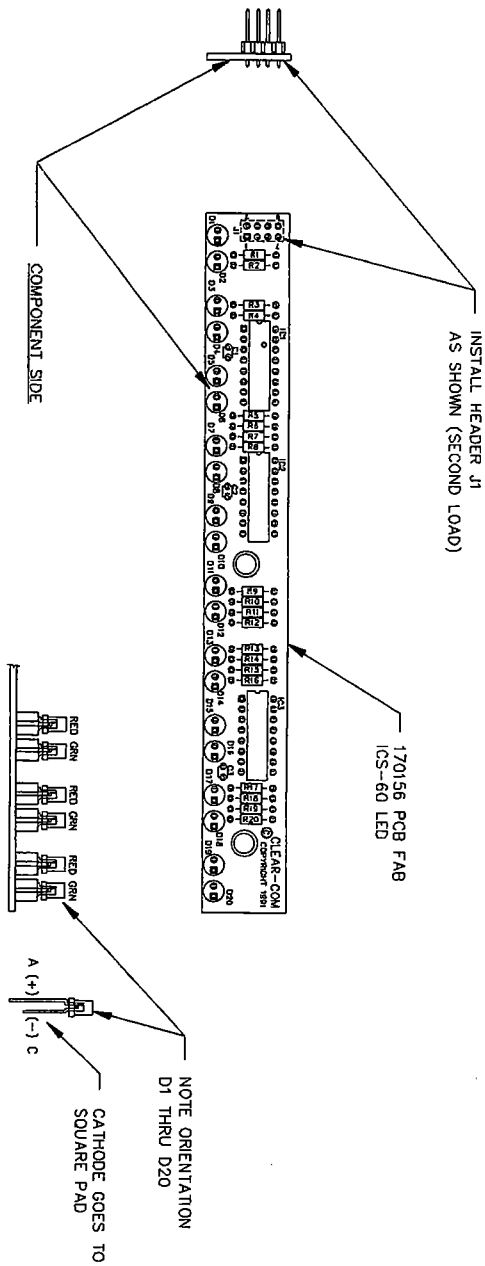


FIGURE S1-14: Assembly Drawing—XP-12 (10-Selector Expansion Panel) Rev. A

Bill of Materials for the XP-12 PCB

Capacitors

Value	Type	Volts	Tol.	Part #	Designator
.1 uF	Monolithic			150035	C1 C2 C3

Resistors & Resistor Packs

Value	Power	Type	Tol.	Part #	Designator
1K OHM	1/4	Carbon Film	5%	410010	R1-R20(20)

Diodes and Transistors

Device	Description	Part #	Designator
CMOS IC	4094B CMOS SHIFT REGISTER	480107	IC1 IC2 IC3
LED	RED, ROUND, FLAT TOP	390044	D1 D3 D5 D7 D9 D11 D13 D15 D19
LED	GREEN, ROUND, FLAT TOP	390045	D2 D4 D6 D8 D10 D12 D14 D16 D18 D20 S8 S9 S10

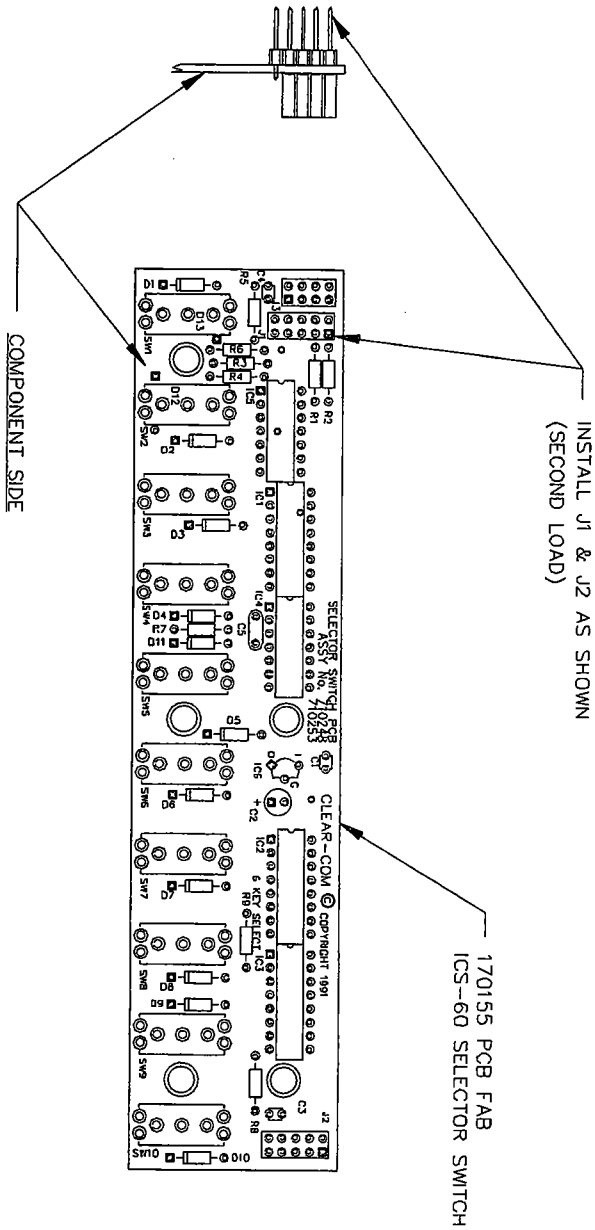


FIGURE S1-15: Assembly Drawing—XP-22 (20-Selector Expansion Panel) Rev. D

Bill of Materials for the XP-22 PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.001	uF	Ceramic	30	20%	150052	C5
.1	uF	Monolythic	50	10%	150035	C1 C3 C4
4.7	uF	Aluminum NP	50		150087	C2

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
100	OHMS	1/4W	Carbon Film	5%	410071	R8
4.7K	OHMS	1/4W	Carbon Film	5%	410013	R2 R5 R6
10K	OHMS	1/4W	Carbon Film	5%	410016	R7
100K	OHMS	1/4W	Carbon Film	5%	410024	R1 R3 R4

Diodes and Transistors

Device	Description	Part #	Designator
CMOS IC	4094B SHIFT REGISTER	480107	IC1 IC2 IC3
CMOS IC	4001 QUAD 2 INPUT NOR GATE	480112	IC5
CMOS IC	4013 DUAL D TYPE FLIP FLOP	480171	IC4
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11
Regulator	7805L POS 5V TO-92 PKG	480088	IC6

Miscellaneous

Device	Description	Part #	Designator
Switch	SP3T MOM-OFF-MOM PC MTG	510080	S1 S2 S3 S4 S5 S6 S7

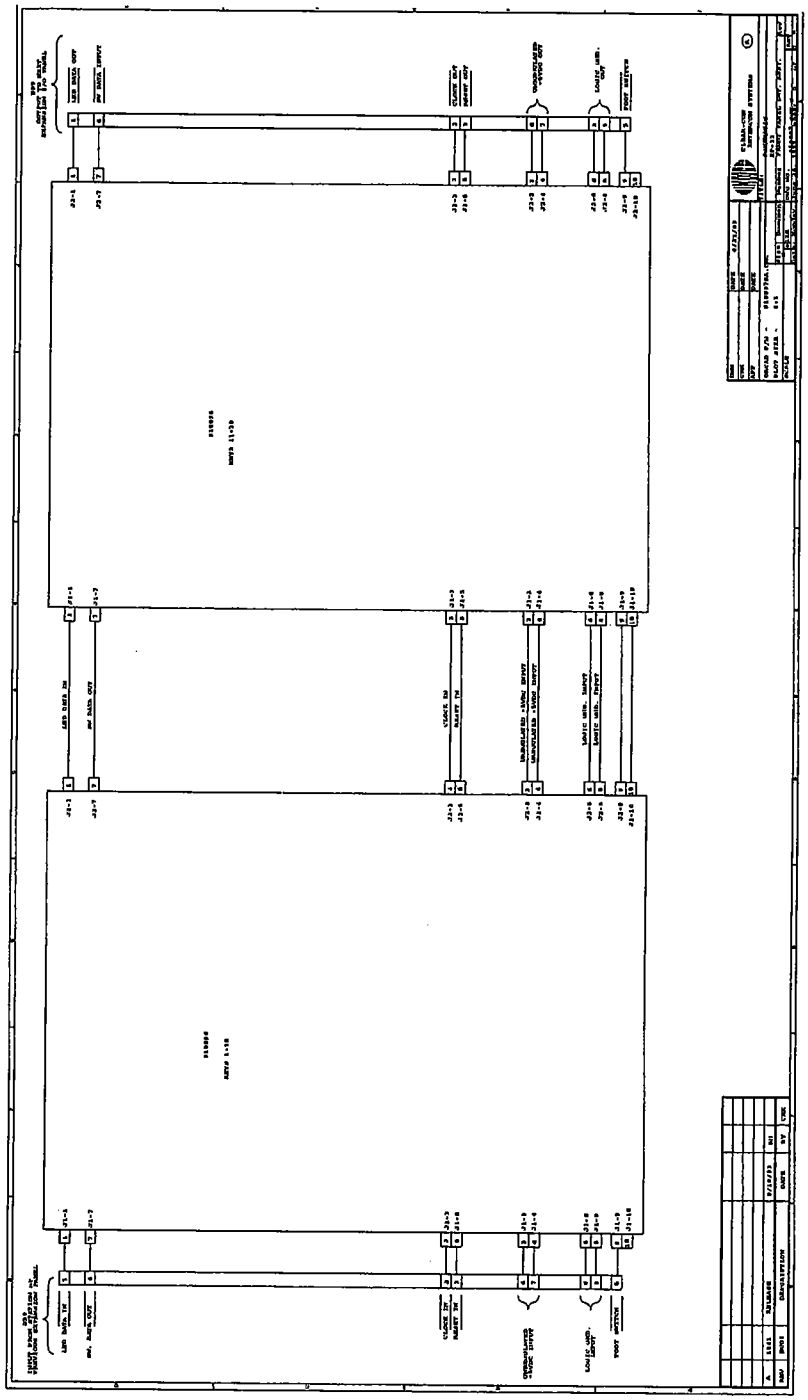


FIGURE S1-16: XP-22 (20-Selector Expansion Panel) Schematic Rev. A

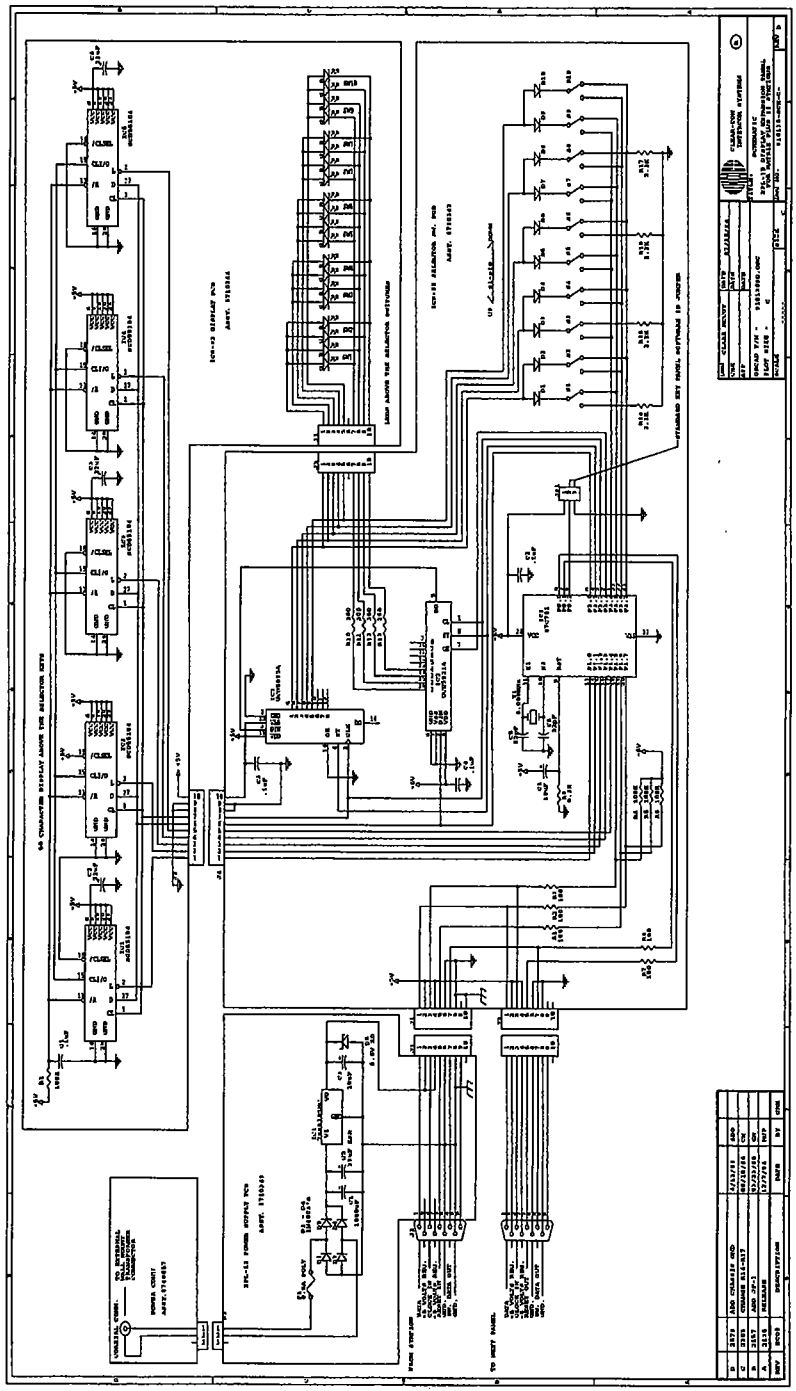


FIGURE S1-17: XPL-12 (10-Selector Panel w/ Electronic Labels) Schematic Rev. B

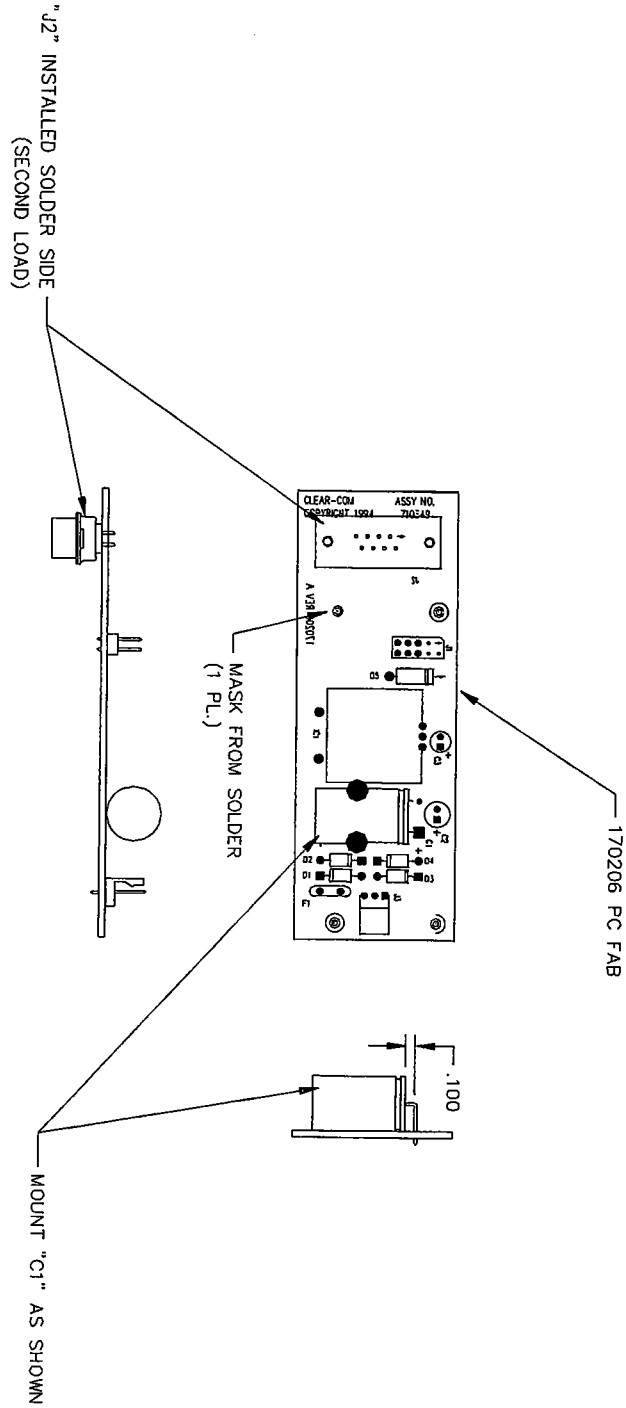


FIGURE S1-18: Assembly Drawing—XPL-12 (10-Selector Panel w/ Electronic Labels) Rev. B

Bill of Materials for the XPL-12 PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
10	uF	Aluminum	50		150064	C3
33	uF	Alu. LOW ESR	35	20%	150130	C2
1000	uF	Aluminum	35		150092	C1

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4003 RECT 1A 200PIV	480058	D1 D2 D3 D4
Diode	1N5339 ZENER 5.6V 5W	480182	D5
Regulator	78SR105HC POS 5V 1A	480206	IC1

Miscellaneous

Device	Description	Part #	Designator
Connector	9 PIN (M) D TYPE SOLDER PINS	210310	J2
Fuse	0.90A POLY SWITCH	520036	F1

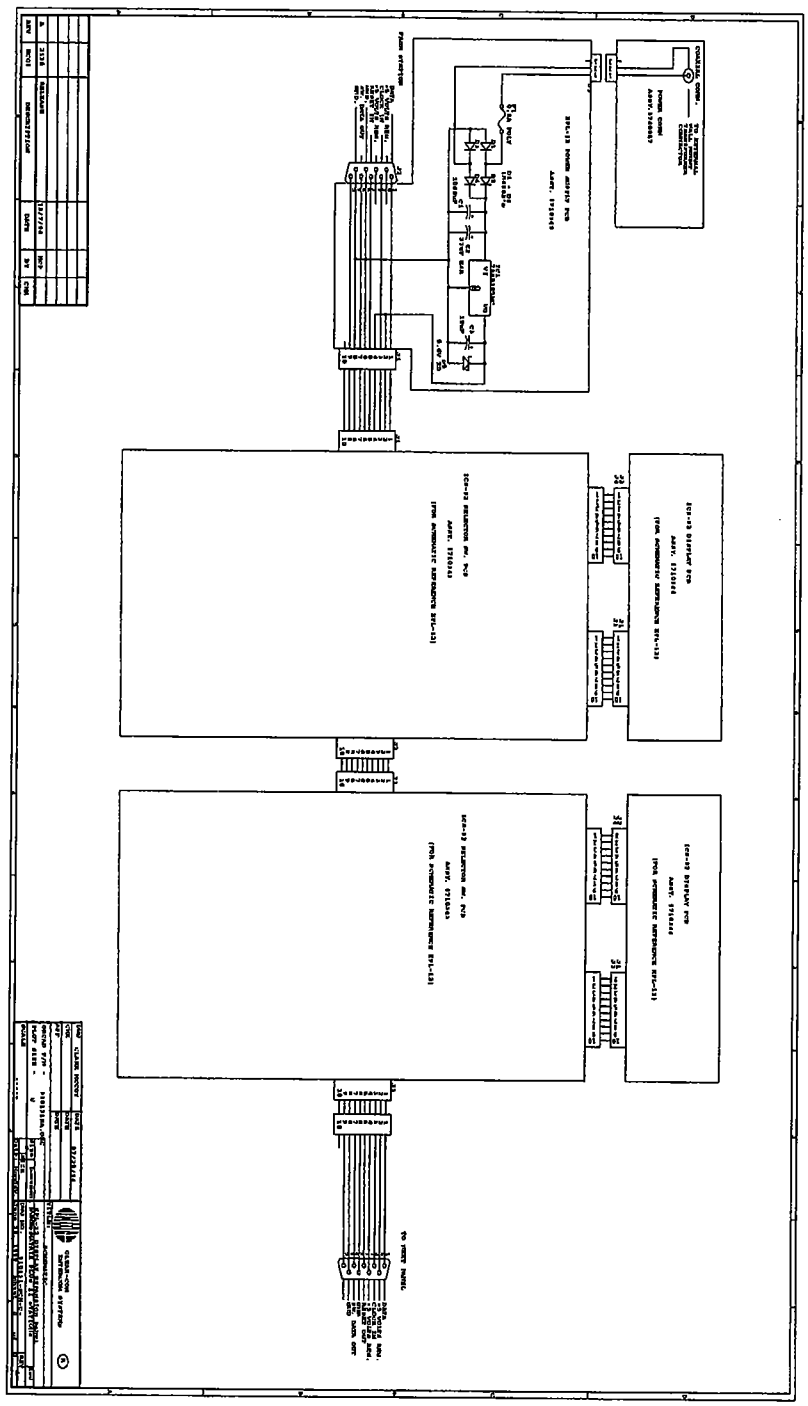


FIGURE S1-19: XPL-22 (20-Selector Panel w/ Electronic Labels) Schematic Rev. A

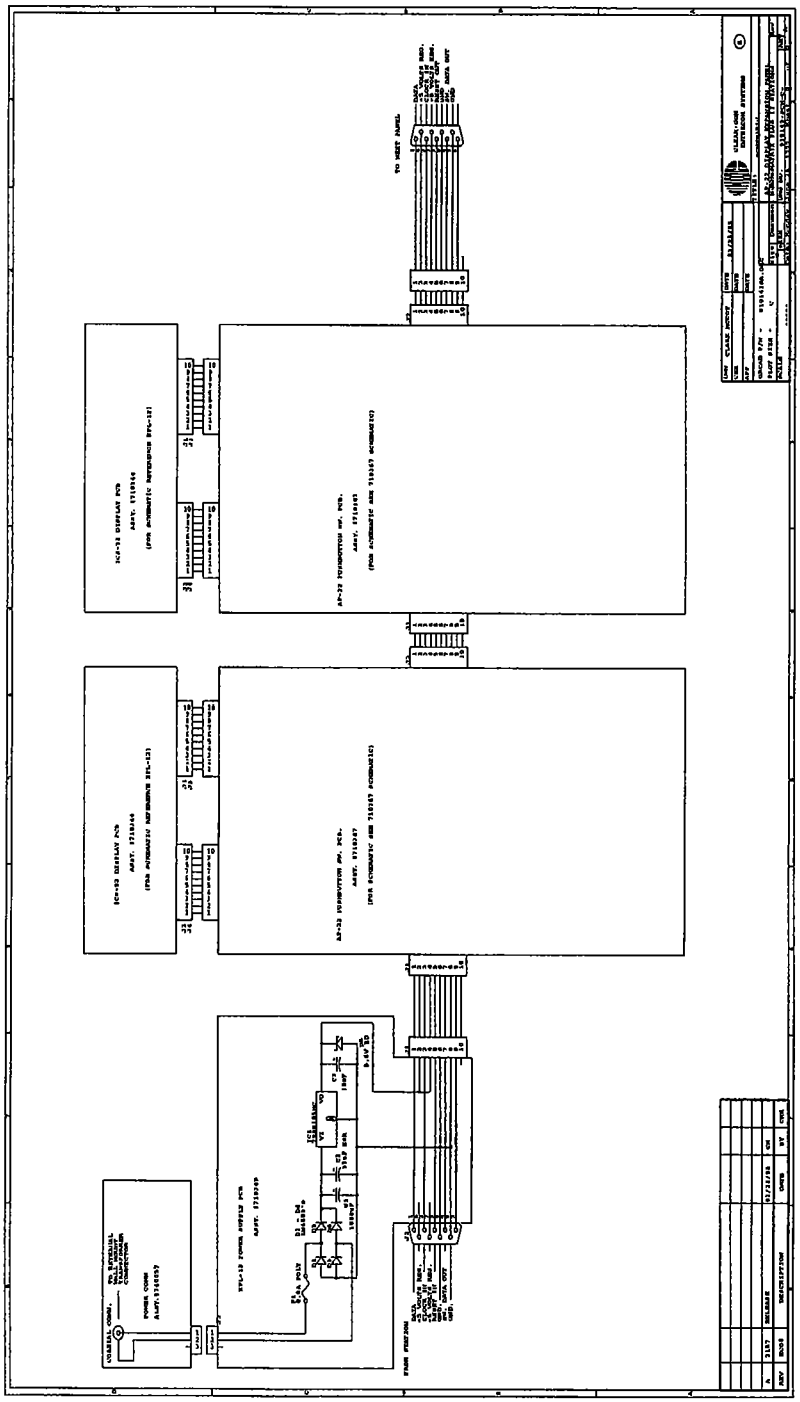


FIGURE S1-20: AP-22 (IFB Assignment Panel)
Schematic Rev. A

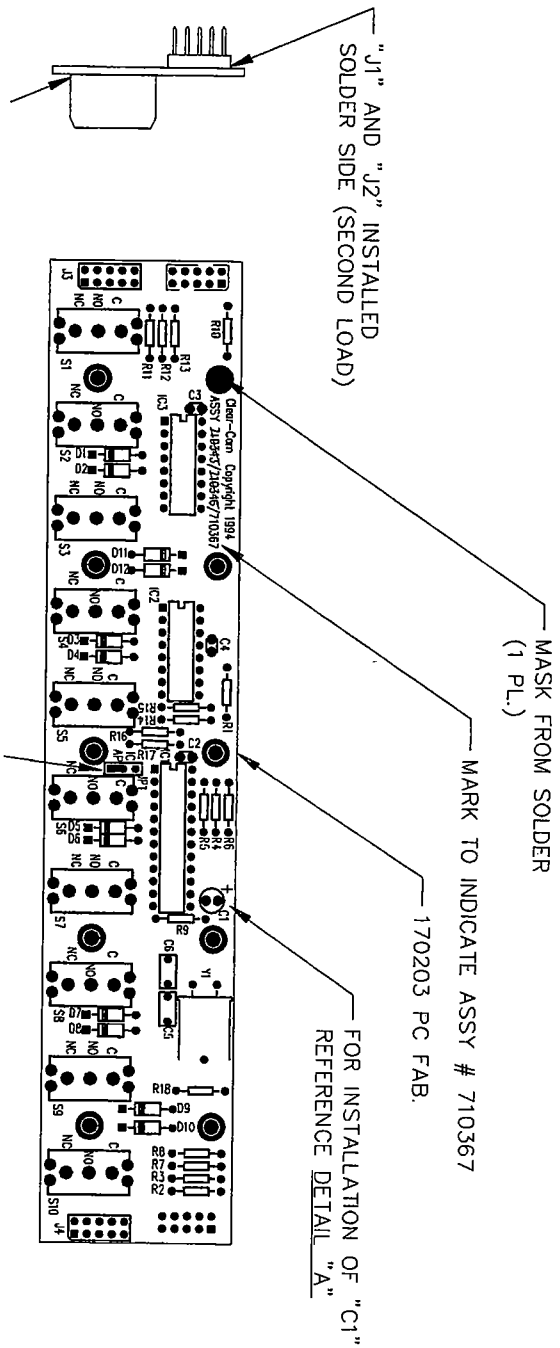


FIGURE S1-21: Assembly Drawing—AP-22 (IFB Assignment Panel) Rev. B

Bill of Materials for the AP-22 PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.1	uF	Monolithic	50	10%	150035	C2 C3 C4
10	uF	Aluminum NP	50		150064	C1
22	pF	Ceramic	50	10%	150098	C5 C6

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
100	OHMS	1/4W	Carbon Film	5%	410071	R1 R2 R3 R7 R8
4.7K	OHMS	1/4W	Carbon Film	5%	410013	R14 R15 R16 R17
100K	OHMS	1/4W	Carbon Film	5%	410024	R4 R5 R6
8.2K	OHMS	1/4W	Carbon Film	5%	410037	R9
200	OHMS	1/4W	Carbon Film	5%	410072	R10 R11 R12 R13

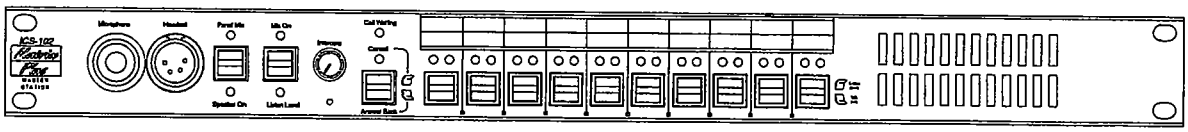
Diodes and Transistors

Device	Description	Part #	Designator
CMOS IC	UCN5821A SHIFT REGISTER	480164	IC2
CMOS IC	UCN5895 SHIFT REGISTER	480210	IC3
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D1 D2 D3 D4 D5 D6 D7 D8 D9 D10
Microprocessor	87C751 CMOS MCV	480209	IC1

Miscellaneous

Device	Description	Part #	Designator
Switch	SPDT MOMENTARY PC MTG	510115	S1 S2 S3 S4 S5 S6 S7 S8 S9 S10
Crystal	8.000MHz PARALLEL CRYSTAL	230003	Y1

ICS-1502



Matrix Plus 3 System **ICS-102/102T**

MASTER INTERCOM STATIONS

Introduction

This section provides station microprocessor resetting instructions, troubleshooting guidelines, schematics, assembly drawings, and component lists for the ICS-102/ICS-102T intercom station. XP, XPL, and AP Accessory Panel; the OPT-100; and the COM-1 communications module information are in the "ICS-2002/ICS-1802" section of this manual.

The station operates at 14 VAC, supplied from an external transformer. Transformers can be ordered for either 117 VAC or 220 VAC.

Station Reset

The station's microprocessor has a reset button located in an unmarked hole just below the "Intercoms" knob on the left side of the unit's front panel. If the station is acting erratically, try resetting it by:

1. inserting a small screwdriver or a stiff piece of wire (such as a bent paper clip) into the hole and pushing the reset button

or

2. unplugging the station from AC power and reconnecting.

Troubleshooting

When experiencing the symptoms listed below, attempt the following solutions in the order outlined. The solutions are listed in order of difficulty with the first being the most simple and easy. For troubleshooting guidelines for the entire system, see the Overview chapter of this manual.

- **The station's LEDs and push-button lights fail to light.**

1. Check mains AC power into the station.
2. Ensure the external power supply is properly connected to the station.
3. Replace the station.

- **The LED indicator above a selector key does not light when the key is pressed.**

1. Ensure the selector key has a label assigned to it (the LED indicator will not light without an assigned label).
2. Reset the station.
3. Replace the station.

- **The station appears to activate talk paths, but other stations can't hear the station operator.**

1. Check "Mic On/Off" and "Panel Mic" buttons to ensure the intended microphone is selected and on.
2. If the correct microphone is turned on, ensure the station audio has not been muted externally through the logic inputs.
3. Make sure the station has not been defined as a nearby station.
4. Activate the Matrix Loopback mode from the station's Maintenance menu to check the audio paths to the matrix.
5. Enable eavesdropping on the station.
6. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
7. Reset the station.
8. Replace the station.

- **The station is inoperative and all red LEDs flash slowly.**

1. Wait 60 sec. If the matrix frame has just been powered up, it is possible it is still downloading the configuration to the Matrix cards.
2. Ensure the cable connecting the station to the matrix is plugged in at both ends.
3. Check the integrity of the data paths, especially the polarity for stations using a COM-10 communication module.
4. Check the configuration program to ensure the station has been assigned the correct port type.
5. Confirm the matrix card type matches the station. Stations with COM-10 communication modules should have an MTX-

A8 or MVX-A8. Stations with COM-20 communication modules should have an MTX-D8 or MVX-D8.

6. Reset the station's matrix card in the Matrix frame.
7. Replace the station's matrix card in the Matrix frame.
8. Reset the station.
9. Replace the station.

- **No audio from the station's speaker.**

1. Ensure the Intercom knob on the station's front panel is turned up.
2. Ensure the Speaker On/Off button is on.
3. Check whether audio can be heard in a headphone.
4. Use the configuration computer or an ICS-2002 station's programming feature to test the integrity of the station's audio path by temporarily setting a forced listen to it.
5. Reset the station's matrix card in the Matrix frame.
6. Replace the station's matrix card in the Matrix frame.
7. Reset the station.
8. Replace the station.

- **The operator cannot hear another station's page or call signal tones.**

1. Adjust the "Page Volume" control of the station using the configuration program (refer to the *PGM-WIN System Configuration Manual*).
2. Check the station's configuration to see if page override is enabled.

- **Announce tones (eavesdropping indication, change tones, etc.) aren't heard at the station.**

1. Adjust the station's "Page Volume" control in the configuration program (refer to the *PGM-WIN System Configuration Manual*).
2. Check the station's Configuration menu to see if page override is enabled.

- **Accessory panel keys do not function.**

1. Check the accessory panel's connection on the station's rear panel.
2. Ensure the external AC power transformers are correctly connected to the accessory panels.
3. Check the configuration program to ensure the correct number of keys are configured.

Miscellaneous Bill of Materials for the ICS-102/102T

Device	Description	Part #
CABLE	10-PIN FLAT CABLE	770001
CABLE	16-PIN FLAT CABLE	770008
CABLE	34-PIN FLAT CABLE	730181
CLAMP	CABLE CLAMP, 3/16IN PLASTIC	640054
FLASH ROM	ICS-102 PROGRAM	710416
SPEAKER	41 X 71MM, SMALL MAGNET	500138
TRANSFORMER	POWER PLUG-IN 117/14VAC	400008
TRANSFORMER	POWER PLUG-IN 220/14VAC	400011

ICS-102 DIGITAL BLOCK DIAGRAM

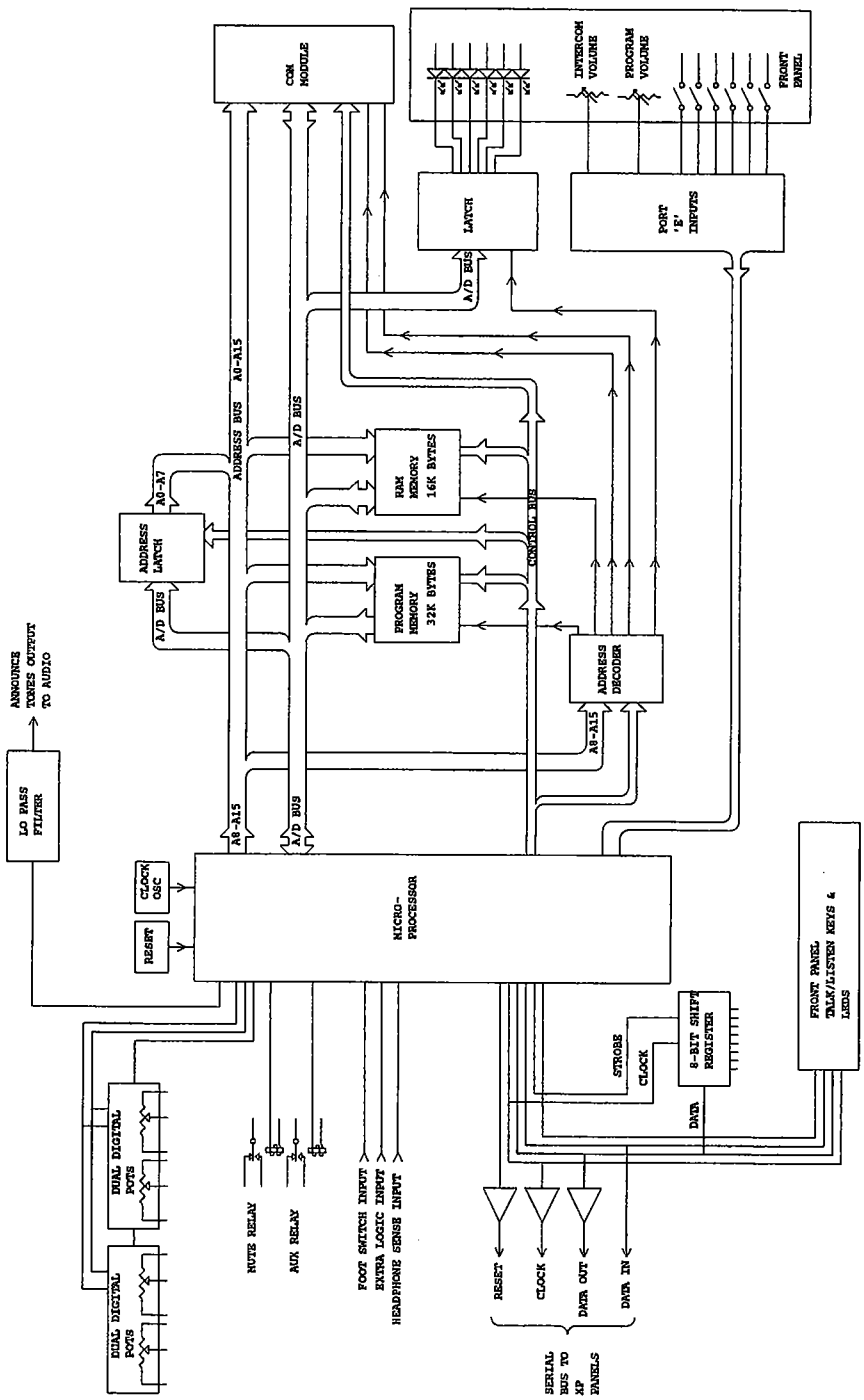


FIGURE S3-1: Digital Block Diagram—ICS-102/102T Main PCB

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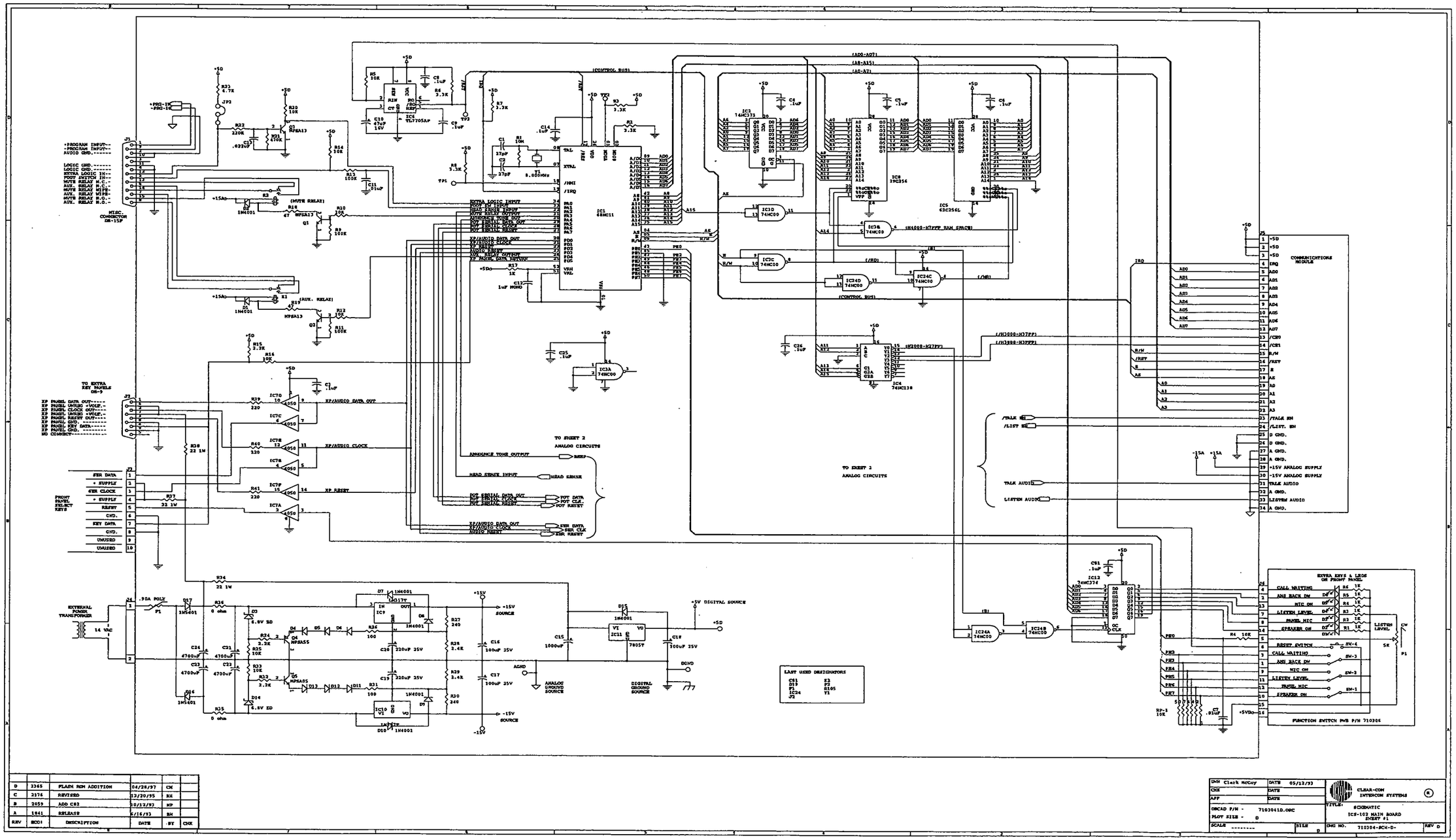

FIGURE S3-2: Schematic—ICS-102/ICS-102T Main PCB Sheet 1 Rev. D

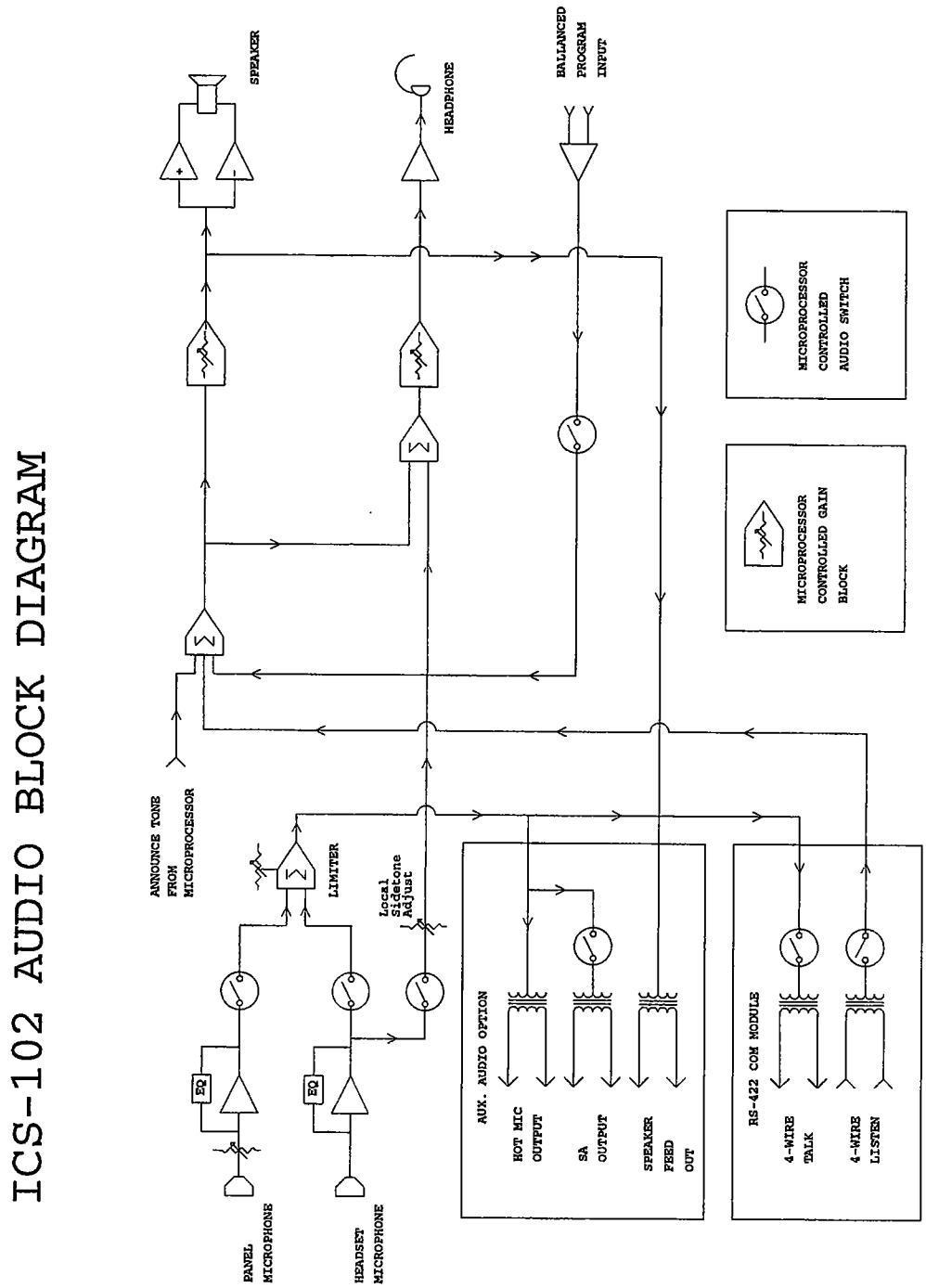

FIGURE S3-3: Audio Block Diagram—ICS-102 Main PCB Rev. A

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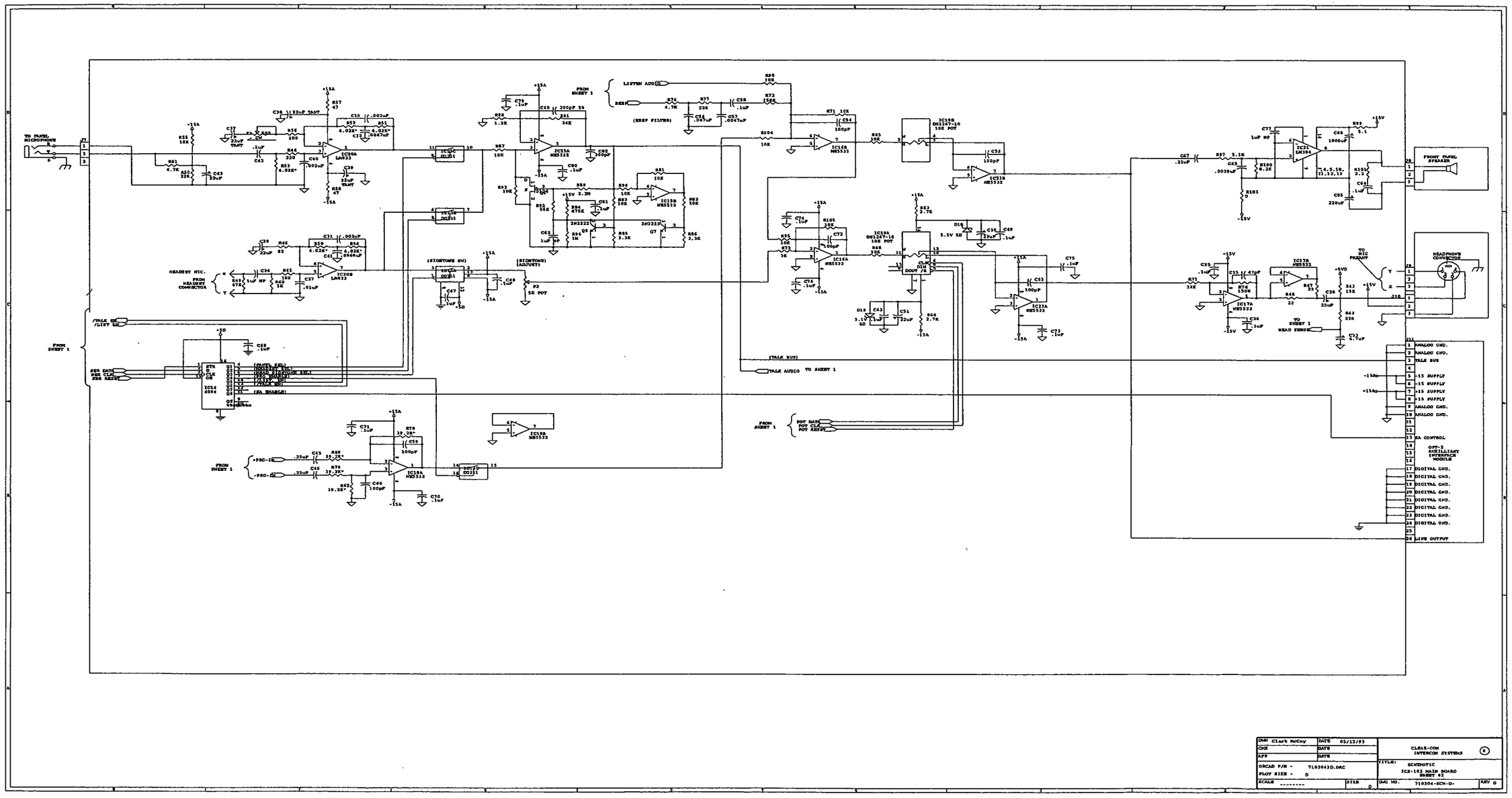


FIGURE S3-4: Schematic—ICS-102/102T Main PCB Sheet 2 Rev. D

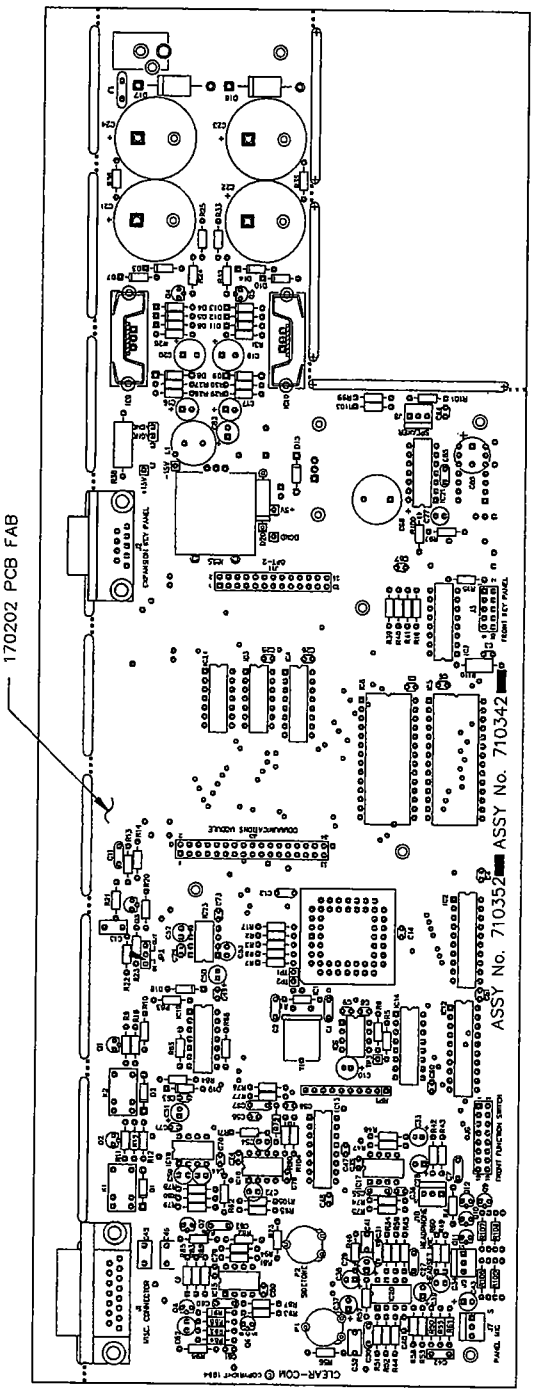


FIGURE S3-5: Assembly Drawing—ICS-102/102T Main PCB Rev. E

Bill of Materials for ICS-102/102T Main PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
27	PF	CERAMIC	50	5%	150071	C1 C2
47	PF	CERAMIC	50	10%	150041	C55
100	PF	CERAMIC	50	10%	150006	C44 C52 C53 C54 C59 C72
200	PF	CERAMIC	100	5%	150063	C60 C82
6800	PF	CERAMIC	50	5%	150057	C41
.001	UF	CERAMIC	30	20%	150052	C65 C66
.0022	UF	MYLAR	100	5%	150045	C30 C31 C40
.0047	UF	MYLAR	50	5%	150114	C32
.0047	UF	CERAMIC	50	10%	150016	C57
.01	UF	CERAMIC	30	20%	150012	C7 C11 C27
.022	UF	MYLAR	100	10%	150008	C13
.047	UF	MONO	50	10%	150111	C56
.1	UF	MONO	50	10%	150035	C9 C14 C25 C26 C35 C36 C47 C48 C49 C58 C61 C63 C3 C4 C5 C6 C8 C76 C79 C80 C81 C64 C67 C69 C70 C71 C73 C74 C75
.1	UF	MONO	100	10%	150085	C42
.22	UF	MYLAR	100	20%	150003	C45 C46
1	UF	CERAMIC	50	10%	150073	C12 C18
1	UF	ALUMINUM NP	50	10%	150002	C3 C62 C77 C78
2.2	UF	ALUMINUM NP	50		150065	C33
22	UF	TANT.	16		150032	C38 C39
22	UF	ALUMINUM	16	20%	150142	C28 C29 C37 C43 C50 C51
33	UF	ALU LOW ESR	35	20%	150130	C84 C83
47	UF	ALUMINUM	16	20%	150143	C10
100	UF	ALUMINUM	25	20%	150099	C16 C17
220	UF	ALUMINUM	25		150137	C19 C20
1000	UF	ALUMINUM	35		150092	C68
4700	UF	ALUMINUM	25		150139	C21 C22 C23 C24

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
1	OHM	1/4W	CARBON FILM	5%	410139	R99 R103
2.2	OHMS	1/4W	CARBON FILM	5%	410113	R101
22	OHMS	1/4W	CARBON FILM	5%	410004	R47 R48
22	OHMS	1W	CARBON FILM	5%	410174	R38
47	OHMS	1/4W	CARBON FILM	5%	410039	R18 R19 R57 R58
82	OHMS	1/4W	CARBON FILM	5%	410038	R46
100	OHMS	1/4W	CARBON FILM	5%	410071	R26 R31 R45 R56
220	OHMS	1/4W	CARBON FILM	5%	410007	R39 R40 R41 R44
240	OHMS	1/4W	CARBON FILM	5%	410060	R27 R30
5	OHMS		TRIM POT		470060	P1
1K	OHMS	1/4W	CARBON FILM	5%	410010	R17 R60
1.2	OHMS	1/4W	CARBON FILM	5%	410041	R88
2.2K	OHMS	1/4W	CARBON FILM	5%	410011	R15 R24 R32
2.4K	OHMS	1/4W	CARBON FILM	5%	410103	R28 R29
2.7K	OHMS	1/4W	CARBON FILM	5%	410040	R63 R64
3.0K	OHMS	1/4W	CARBON FILM	5%	410104	R73
3.3K	OHMS	1/4W	CARBON FILM	5%	410015	R2 R3 R6 R7 R8 R85 R86
4.02K	OHMS	1/8W	METAL FILM	1%	410155	R51 R52 R53 R54 R59
4.7K	OHMS	1/4W	CARBON FILM	5%	410013	R23 R61 R76
5K	OHMS		TRIM POT		470022	P2
8.2K	OHMS	1/4W	CARBON FILM	5%	410037	R100 R102
10K	OHMS	1/4W	CARBON FILM	5%	410016	R4 R5 R10 R12 R14 R16 R20 R25 R33 R55 R65 R68 R71 R81 R82 R83 R87 R90 R93 R94 R95 R104 R105
1	OHM X 9		R-PACK		415001	RP1
15K	OHMS	1/4W	CARBON FILM	5%	410017	R43
22K	OHMS	1/4W	CARBON FILM	5%	410018	R42 R50 R77 R97 R98 R106 R107 R108 R109
24K	OHMS	1/4W	CARBON FILM	5%	410083	R91
33K	OHMS	1/4W	CARBON FILM	5%	410020	R75
39.2K	OHMS	1/8W	METAL FILM	1%	410111	R62 R78 R79 R80
47K	OHMS	1/4W	CARBON FILM	5%	410021	R49
56K	OHMS	1/4W	CARBON FILM	5%	410023	R92

100K	OHMS	1/4W	CARBON FILM	5%	410024	R9 R11 R13
150K	OHMS	1/4W	CARBON FILM	5%	410026	R72 R74
220K	OHMS	1/4W	CARBON FILM	5%	410028	R22
470K	OHMS	1/4W	CARBON FILM	5%	410030	R21 R84
1M	OHM	1/4W	CARBON FILM	5%	410058	R96
2.2M	OHMS	1/4W	CARBON FILM	5%	410153	R89
10M	OHMS	1/4W	CARBON FILM	5%	410059	R1

Diodes and Transistors

Device	Description	Part #	Designator
DIODE	1N957B ZENER 6.8V .4W 5%	480026	D3 D14
DIODE	1N4003 RECT 1A 200PIV	480058	D1 D2 D7 D8 D9 D10 D15
DIODE	1N4148 SIGNAL 10MA 75PIV	480000	D4 D5 D6 D11 D12 D13
DIODE	1N5231B ZENER 5.1V .5W 5%	480038	D18 D19
DIODE	1N5339 ZENER 5.6V 5W	480182	D20
DIODE	1N5401 RECT 3A 100PIV	480005	D16 D17
TRANSISTOR	2N2222 NPN 30V	480006	Q7 Q8 Q9 Q10 Q11 Q12
TRANSISTOR	J174 JFET PCHAN 8V VGS	480079	Q6
TRANSISTOR	MPS-A05 NPN 60V	480052	Q5
TRANSISTOR	MPS-A13 NPN 30V DARL	480004	Q1 Q2 Q3
TRANSISTOR	MPS-A55 PNP 60V	480050	Q4

Integrated Circuits

Device	Description	Part #	Designator
4050B	CMOS HEX BUFFER	480077	IC7
4094B	CMOS 8 BIT SHIFT REGISTER	480107	IC14
68HC11A	CMOS MCU 52 PIN PLCC FP	480132	IC1
4HC00	CMOS QUAD NAND	480157	IC3 IC24
74HC138	CMOS 3 TO 8 LINE DECODER	480120	IC4
74HC373	CMOS OCTAL D LATCH	480142	IC2
74HC374	CMOS OCTAL D FL/FLOP	480143	IC12
DG211CJ	CMOS QUAD ANALOG SWITCH	480092	IC13
GM76C256L	CMOS SRAM 32K X 8 100NS	480183	IC5
DS1267-10	DIGITAL POT, DUAL 10K	480195	IC19
LM384	OPAMP, POWER 4W	480012	IC21 IC22
LM833N	OPAMP, DUAL LO NOISE	480175	IC20
NE5532	OPAMP, DUAL LO NOISE	480070	IC15 IC16 IC17 IC18 IC23

78SR105HC	REGULATOR, 5V SWITCHER 1A	480206	IC25
LM317T	REGULATOR, POS ADJ 1.5A	480167	IC9
LM337T	REGULATOR, NEG ADJ 1.5A	480177	IC10
TL7705AP	RESET SUPERVISOR IC	480134	IC6

Miscellaneous

Device	Description	Part #	Designator
CONNECTOR	2.1MM CO-AX PC MTG POWER	210213	J4
CONNECTOR	DB-9F RT ANG PC MTG	210186	J2
CONNECTOR	DB-15F RT ANG PC MTG	210187	J1
CRYSTAL	8.000MHZ PARALLEL CRYSTAL	230003	Y1
FUSE	0.90A POLY SWITCH	520036	F1
JUMP JACK	JUMP JAX	210103	JP2
RELAY	SPDT 12V PC RELAY ITT#SZ12	450006	K1 K2

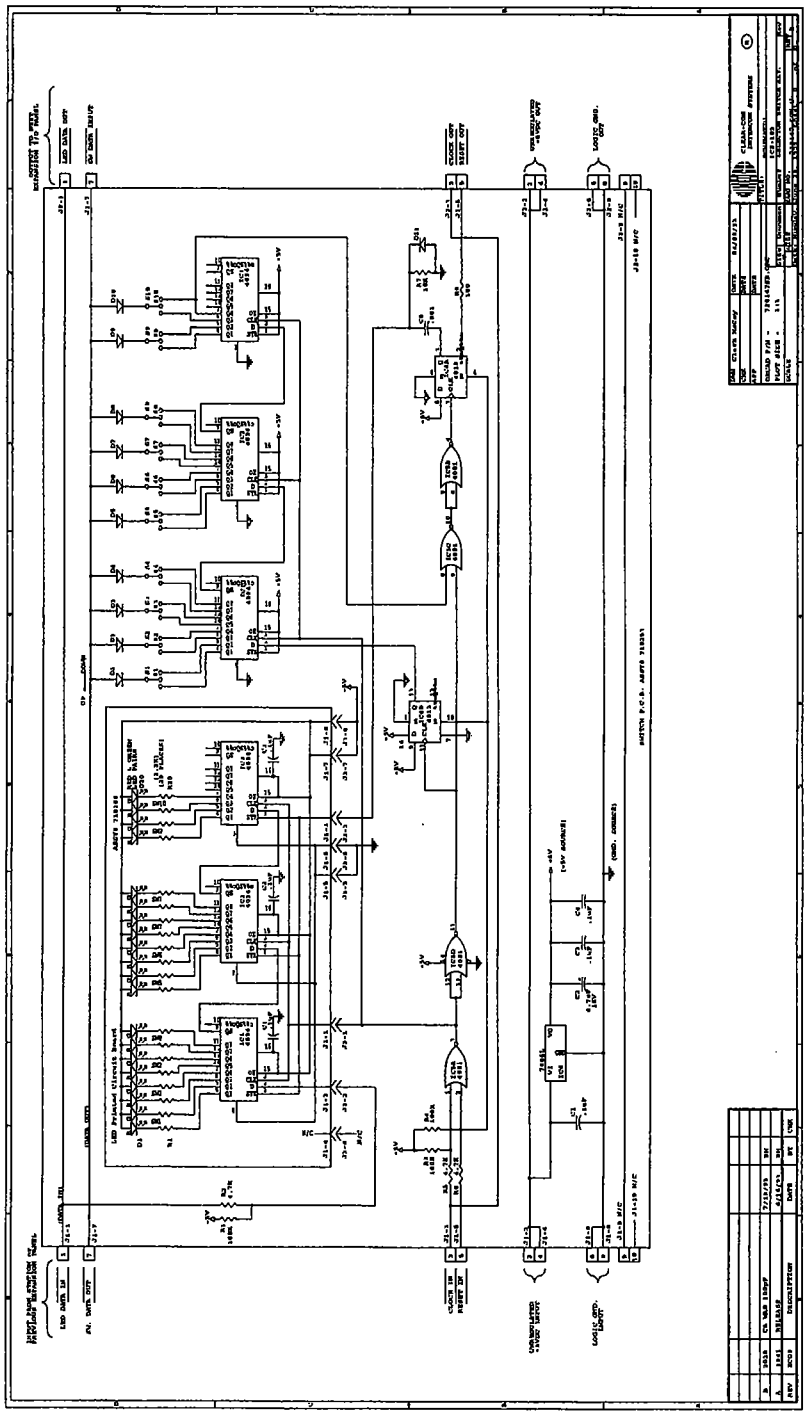


FIGURE S3-6: Schematic—ICS-102/ICS-102T Selector Switch PCB Rev. B

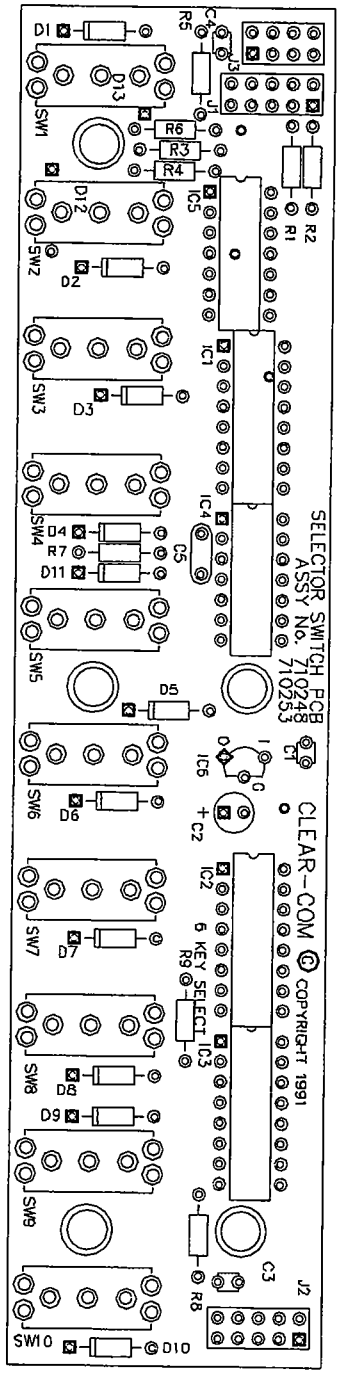


FIGURE S3-7: Assembly Drawing—ICS-102/ICS-102T
Selector Switch PCB Rev. D

Bill of Materials for ICS-102 Selector Switch PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
0.001	uF	Ceramic Disc	30	20%	150052	C5
0.1	uF	Monolithic	50	10%	150035	C1 C3 C4
4.7	uF	Aluminum	50		150087	C2

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
100	OHM	1/4	Carbon Film	5%	410071	R8
4.7K	OHM	1/4	Carbon Film	5%	410013	R2 R5 R6
10K	OHM	1/4	Carbon Film	5%	410016	R7
100K	OHM	1/4	Carbon Film	5%	410024	R1 R3 R4

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11

Integrated Circuits

Device	Description	Part #	Designator
Logic Chip	4001 CMOS 4 2 IN NOR GATE	480112	IC5
Logic Chip	4013 CMOS DUAL D FF	480171	IC4
Logic Chip	4094B CMOS SHIFT REGISTER	480107	IC1 IC2 IC3
Regulator	7805L POS 5V REG. TO-92 PKG	480088	IC6

Miscellaneous

Device	Description	Part #	Designator
SWITCH	SP3T MOM-OFF-MOM PC MTG	510080	S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S10

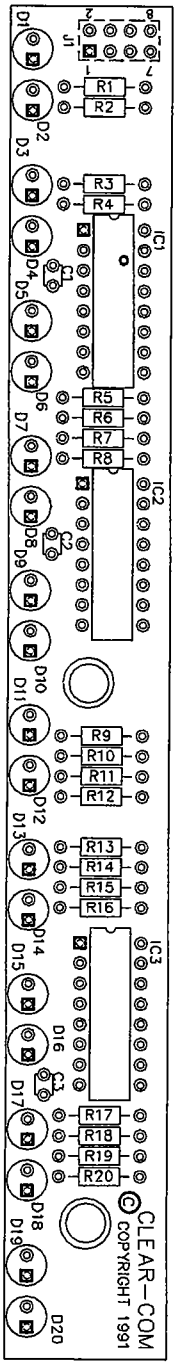


FIGURE S3-8: Assembly Drawing—ICS-102/102T Selector Switch LED PCB Rev. A

Bill of Materials for ICS-102/102T Selector Switch LED PCB

Capacitors

Value	Type	Volts	Tol.	Part #	Designator
0.1 uF	Monolithic	50	10%	150035	C1 C2 C3

Resistors & Resistor Packs

Value	Power	Type	Tol.	Part #	Designator
1K OHM	1/4	Carbon Film	5%	410010	R1-R20(20)

Integrated Circuits

Device	Description	Part #	Designator
Logic Chip	4094B CMOS SHIFT REGISTER	480107	IC1 IC2 IC3

Miscellaneous

Device	Description	Part #	Designator
LED	GREEN, ROUND, FLAT TOP LED	390045	D2 D4 D6 D8 D10 D12 D14 D16 D18 D20
LED	RED, ROUND, FLAT TOP LED	390044	D1 D3 D5 D7 D9 D11 D13 D15 D19

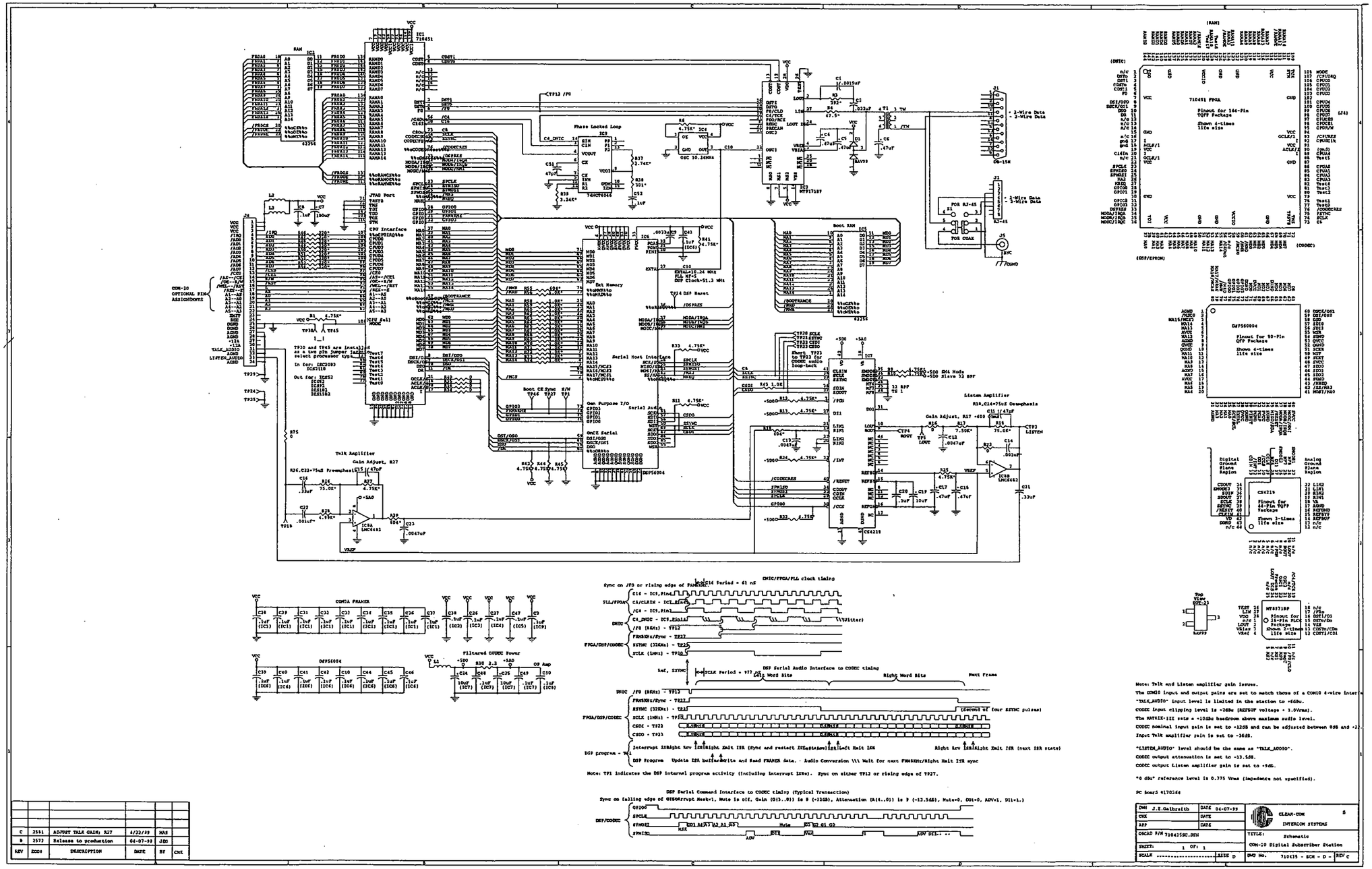


FIGURE S3-9: Schematic—COM-20 Communication PCB Rev. C

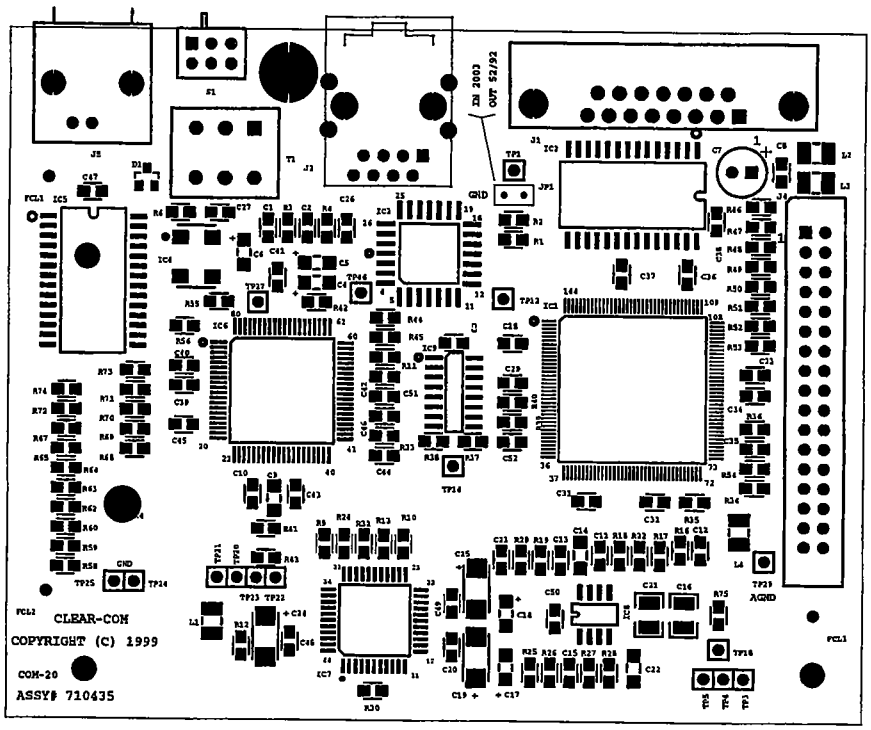


FIGURE S3-10: Assembly Drawing—COM-20 Communication PCB Rev. A

Bill of Materials for COM-20 Communication PCB

Capacitors

Value	Type	Volts	Tol.	Part #	Designator
.001 uF	Ceramic Disc SMD	50V	1%	151001	C14 C22
.00 33	Ceramic Disc SMD	50V	5%	151002	C9
47 pF	Ceramic Disc SMD	50V	5%	151120	C11 C15 C51
.0015 uF	Ceramic Disc SMD	50V	5%	151138	C1
.0047 uF	Ceramic Disc SMD	50V	10%	151156	C12 C13 C23
.022 uF	Ceramic Disc SMD	50V	10%	151164	C2
.1 uF	Ceramic Disc SMD	50V	10%	151172	C3 C8 C10 C20 C26 C27 C28 C29 C31 C32 C33 C34 C35 C36 C37 C38 C39 C40 C41 C42 C43 C44 C45 C46 C47 C48 C49 C50 C52

.33	uF	Ceramic Disc SMD	25V	10%	151178	C16 C21
.47	uF	Tantalum SMD	35V	10%	151184	C4 C5 C6 C17 C18
10	uF	Tantalum SMD	25V	10%	151192	C19 C24 C25
100	uF	Aluminum	16V	20%	150155	C7

Resistors

Value		Power	Type	Tol.	Part #	Designator
0	OHM	1/10	SMD		411100	R16 R22 R34 R35 R36 R40 R75
2.2	OHM	1/10	SMD	5%	411181	R30
47.5	OHM	1/10	SMD	1%	411262	R4
221	OHM	1/10	SMD	1%	411326	R46 R47 R48 R49 R50 R51 R52 R53 R54
301	OHM	1/10	SMD	1%	411339	R38
392	OHM	1/10	SMD	1%	411350	R3
604	OHM	1/10	SMD	1%	411368	R29 R19 R55
1.00K	OHM	1/10	SMD	1%	411389	R43 56 R58 R59 R60 R62 R63R64 R65 R67 R68 R70 R71 R72R73 R74 R69
2.74K	OHM	1/10	SMD	1%	411431	R37
3.24K	OHM	1/10	SMD	1%	411438	R39
4.75K	OHM	1/10	SMD	1%	411454	R1 R6 R9 R10 R11 R12 R13 R24 R25 R32
4.75K	OHM	1/10	SMD	1%	411454	R33 R41 R42 R44 R45 R27
4.99K	OHM	1/10	SMD	1%	411456	R28
7.50K	OHM	1/IO	SMD	1%	411473	R17
75.0K	OHM	1/10	SMD	1%	411569	R26 R18

Diodes and Transistors

Device	Description	Part #	Designator
Diode	BAV99 DUAL DIODE... SMD	481033	D1

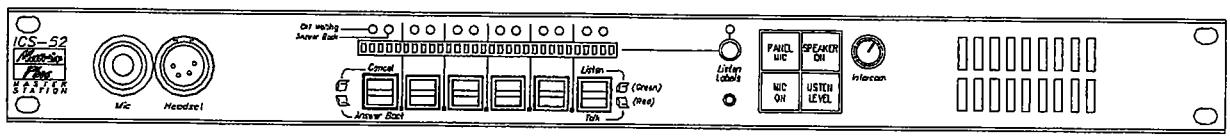
Integrated Circuits

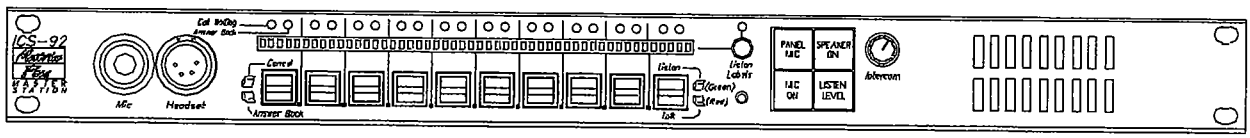
Device	Description	Part #	Designator
62256	CMOS SRAM 32K X 8	481047	IC2 IC5
6482	DUAL CMOS OPAMP RAIL/RAIL	481022	IC8
0.24MHZ	CRYSTAL CLOCK OSCILLATOR	231004	IC4
4218	16-BIT 2 CHANNEL CODEC	481041	IC7
74HCT4046A	CMOS PHASE LOCK LOOP...SOIC16	481045	IC9

MT9171AP	DIGITAL NETWORK INT.	481046	IC3
56004	24-BIT DSP 40MHZ	481071	IC6
IFPGA	DNIC FRAMER, COM 20	710451	IC1

Miscellaneous

Device	Description	Part #	Designator
Connector	JUMP JAX	210103	JP1
Connector	HEADER MULTI PIN HEADER((PER)PIN)	210112	JP1(2)
Connector	15 PIN (M) RT ANG PC MTG D TYPE CON	210188	J1
Connector	DUAL ROW HEADER 17 POS. .230IN	210279	J4
Connector	RJ-45 RT ANG MOD CON 1-PORT SHIELDED	210335	J2
Connector	BNC RT ANGLE PC MNT W/THREAD BUSH	210354	J5
Inductor	FERRITE EMI SUPPRESSOR 400MA	181001	L1 L2 L3
Switch	DPDT MICRO-SUBMINIATURE SWITCH	510124	S1
Transformer	2745B 2:1 PULSE TRANSFORMER	560023	T1





Matrix Plus 3 System **ICS-92/92T/ICS-52/52T**

MASTER INTERCOM STATIONS

Introduction

This section provides station microprocessor resetting instructions, troubleshooting guidelines, schematics, assembly drawings, and component lists for the ISC-92/92T and ICS-52/52T intercom stations. XP, XPL, and AP Accessory Panel; the OPT-100; and the COM-1 communications module information are in the "ICS-2002/ICS-1802" section of this manual.

These stations operate at 14 VAC, supplied from an external transformer. Transformers can be ordered for either 117 VAC or 220 VAC.

Station Reset

The station's microprocessor has a reset button located in an unmarked hole just below the "Listen Labels" button on the right side of the unit's front panel. If the station is acting erratically, try resetting it by:

1. inserting a small screwdriver or a stiff piece of wire (such as a bent paper clip) into the hole and pushing the reset button

or

2. unplugging the station from AC power and reconnecting.

Troubleshooting

When experiencing the symptoms listed below, attempt the following solutions in the order outlined. The solutions are listed in order of difficulty with the first being the most simple and easy. For troubleshooting guidelines for the entire system, see the Overview chapter of this manual.

- **The station's LEDs and push-button lights fail to light.**

1. Check mains AC power into the station.
2. Ensure the external power supply is properly connected to the station.
3. Replace the station.

- **The LED indicator above a selector key does not light when the key is pressed.**

1. Ensure the selector key has a label assigned to it (the LED indicator will not light without an assigned label).
2. Reset the station.
3. Replace the station.

- **The station appears to activate talk paths, but other stations can't hear the station operator.**

1. Check Mic On/Off and Panel Mic buttons to ensure the intended microphone is selected and on.
2. If the correct microphone is turned on, ensure the station audio has not been muted externally through the logic inputs.
3. Make sure the station has not been defined as a nearby station.
4. Enable Eavesdropping on the station.
5. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
6. Reset the station.
7. Replace the station.

- **The station is inoperative and all red LEDs flash slowly.**

1. Wait 60 sec. If the matrix frame has just been powered up, it is possible it is still downloading the configuration to the Matrix cards.
2. Ensure the cable connecting the station to the matrix is plugged in at both ends.
3. Check the integrity of the data paths, especially the polarity for stations using a COM-10 communication module.
4. Check the configuration program to ensure the station has been assigned the correct port type.
5. Confirm the matrix card type matches the station. Stations with COM-10 communication modules should have an MTX-A8 or MVX-A8. Stations with COM-20 communication modules should have an MTX-D8 or MVX-D8.
6. Reset the station's matrix card in the Matrix frame.

7. Replace the station's matrix card in the Matrix frame.
8. Reset the station.
9. Replace the station.

- **No audio from the station's speaker.**

1. Ensure the 'Intercom" knob on the station's front panel is turned up.
2. Ensure the "Speaker On/Off" button is on.
3. Check whether audio can be heard in a headphone.
4. Check the configuration program and the station's logic inputs to ensure the speaker has not been software disabled.
5. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
6. Reset the station's Matrix card in the Matrix frame.
7. Replace the station's Matrix card in the Matrix frame.
8. Reset the station.
9. Replace the station.

- **The operator cannot hear another station's page or call signal tones.**

1. Adjust the "Page Volume" control of the station using the configuration program (refer to the *PGM-WIN System Configuration Manual*).
2. Check the station's configuration to see if page override is enabled.

- **Announce tones (eavesdropping indication, change tones, etc.) aren't heard at the station.**

1. Check the station's Configuration menu to see if the monitoring tones and change tones are enabled.

- **Accessory panel keys do not function.**

1. Check the accessory panel's connection on the station's rear panel.
2. Ensure the external AC power transformers are correctly connected to the accessory panels.

3. Check the configuration program to ensure the correct number of keys are configured.

Miscellaneous Bill of Materials for the ICS-92/92T/52/52T

Device	Description	Part #
CABLE	10-PIN FLAT CABLE	770011
CABLE	16-PIN FLAT CABLE (SPLIT	770010
CABLE	34-PIN FLAT CABLE	730181
CLAMP	CABLE CLAMP, 3/16IN PLASTIC	640054
FLASH ROM	ICS-92 PROGRAM	710414
SPEAKER	41 X 71MM, SMALL MAGNET	500138
TRANSFORMER	POWER PLUG-IN 117/14VAC	400008
TRANSFORMER	POWER PLUG-IN 220/14VAC	400011

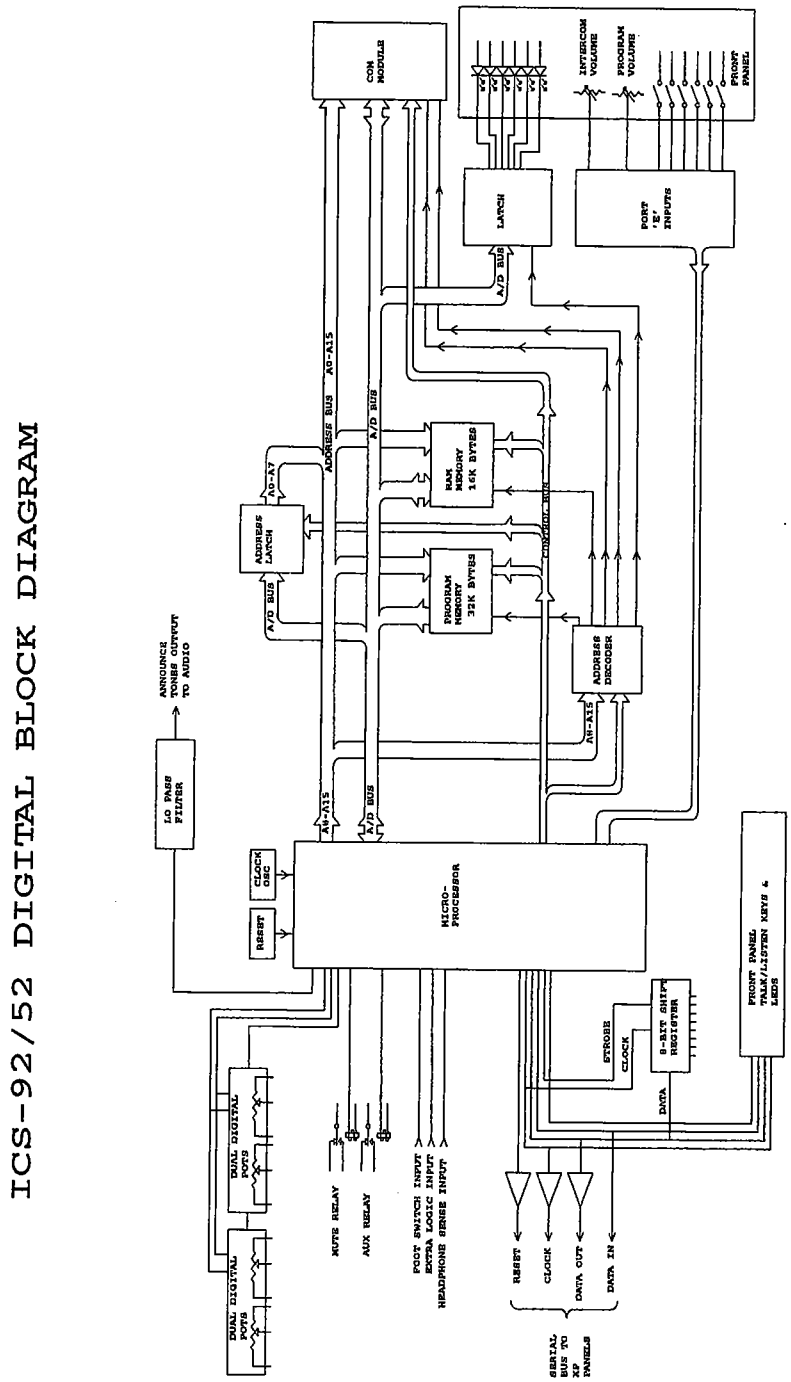


FIGURE S4-1: Digital Block Diagram—ICS-92/92T/ ICS-52/52T Main PCB

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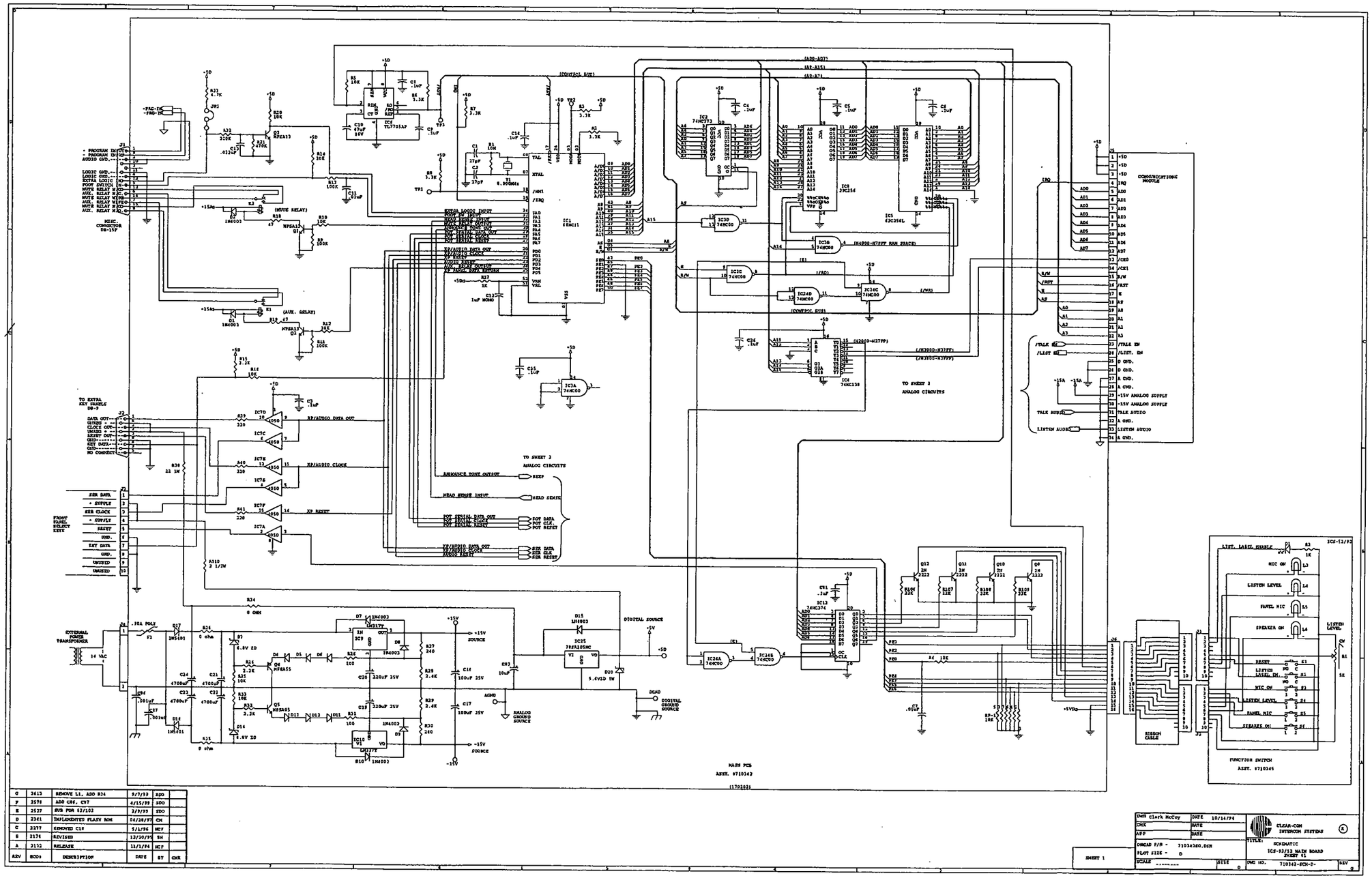

REV	ECO#	DESCRIPTION	DATE	BY	CHK
G	3413	REMOVE L1, ADD R34	9/7/99	RDO	
F	3578	ADD C86, C87	6/15/99	SDO	
E	3527	SUB FOR 92/102	2/9/99	SDO	
D	2341	IMPLEMENTED FLASH ROM	06/28/97	CM	
C	2297	REMOVED C18	5/1/96	MCF	
B	2176	REVISED	12/20/95	BH	
A	2132	RELEASE	11/1/94	MCF	

FIGURE S4-2: Schematic—ICS-92/92T/ICS-52/52T Main PCB Sheet 1 Rev. G

ICS-92/52 AUDIO BLOCK DIAGRAM

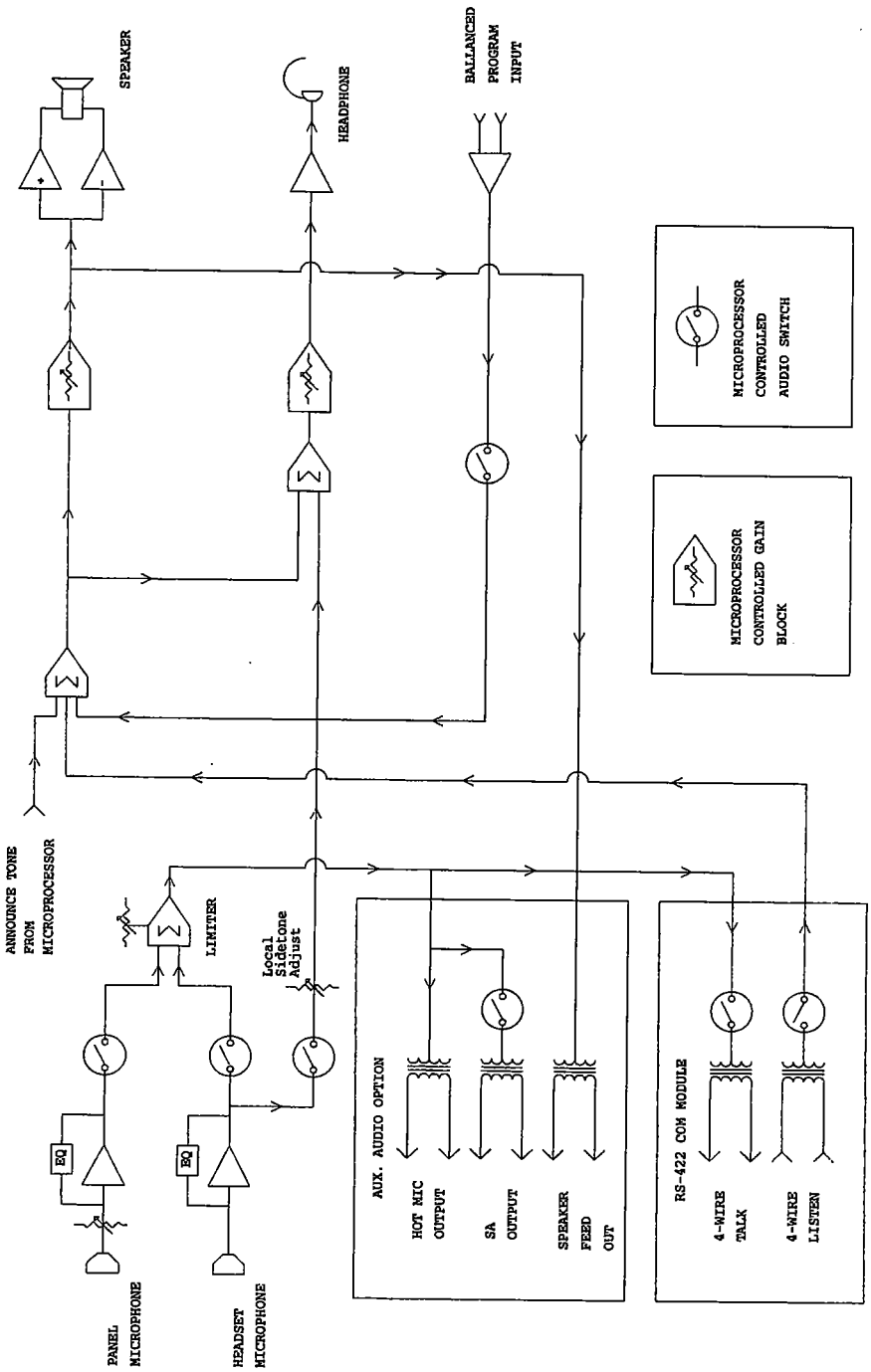

FIGURE S4-3: Audio Block Diagram—ICS-92/ICS-52 Main PCB

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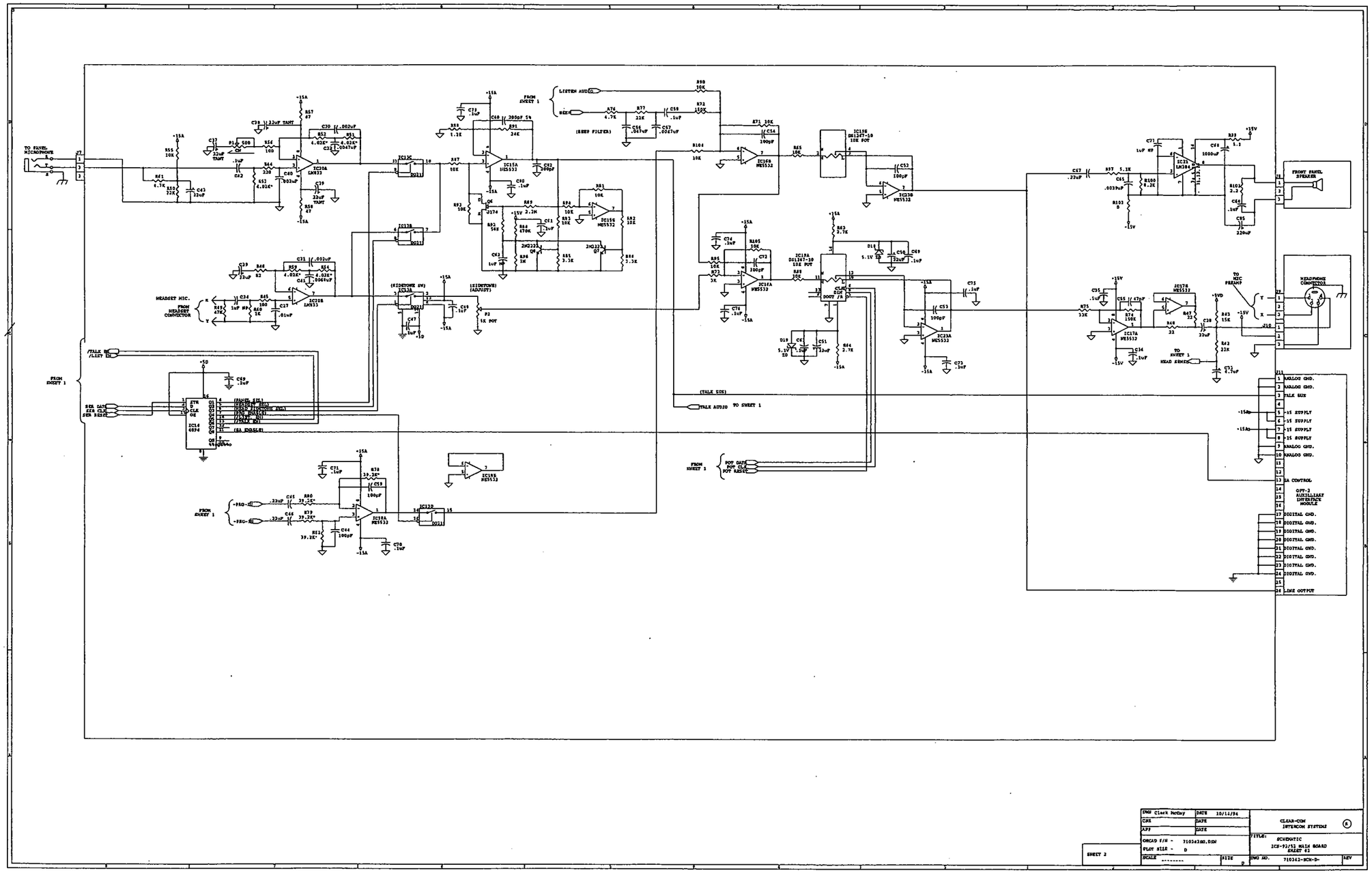


FIGURE S4-4: Schematic—ICS-92/92T/ICS-52/52T Main PCB Sheet 2 Rev. G

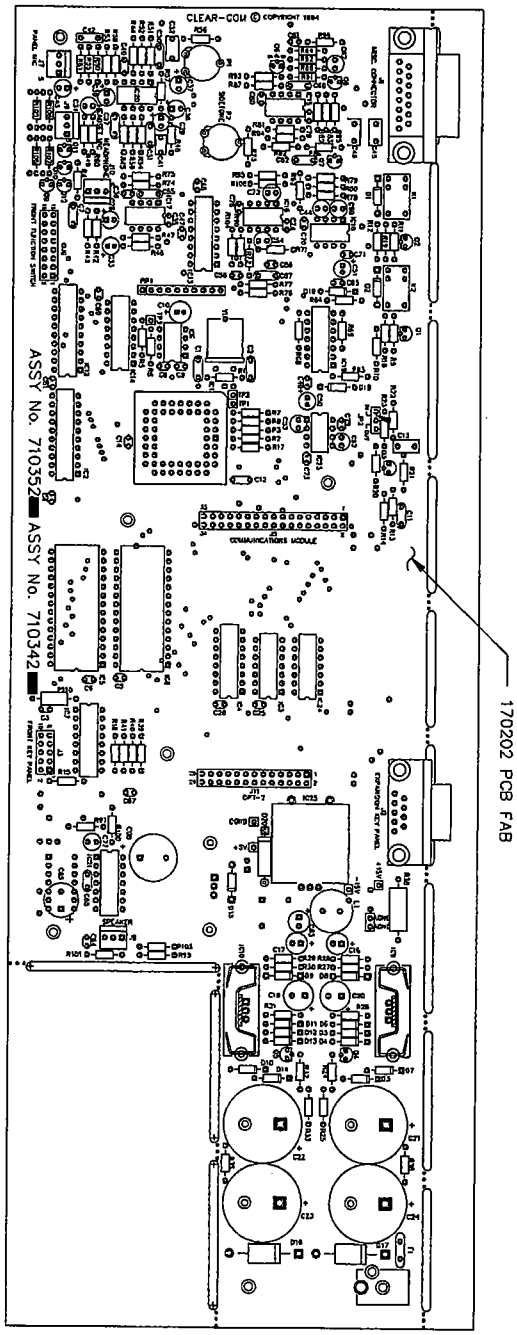


FIGURE S4-5: Assembly Drawing—ICS-92/92T/ICS-52/52T Main PCB Rev. E

Bill of Materials for ICS-92/92T Main PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
27	PF	CERAMIC	50	5%	150071	C1 C2
47	PF	CERAMIC	50	10%	150041	C55
100	PF	CERAMIC	50	10%	150006	C44 C52 C53 C54 C59 C72
200	PF	CERAMIC	100	5%	150063	C60 C82
6800	PF	CERAMIC	50	5%	150057	C41
.001	UF	CERAMIC	30	20%	150052	C65 C66
.0022	UF	MYLAR	100	5%	150045	C30 C31 C40
.0047	UF	MYLAR	50	5%	150114	C32
.0047	UF	CERAMIC	50	10%	150016	C57
.01	UF	CERAMIC	30	20%	150012	C7 C11 C27
.022	UF	MYLAR	100	10%	150008	C13
.047	UF	MONO	50	10%	150111	C56
.1	UF	MONO	50	10%	150035	C9 C14 C25 C26 C35 C36 C47 C48 C49 C58 C61 C63 C3 C4 C5 C6 C8 C76 C79 C80 C81 C64 C67 C69 C70 C71 C73 C74 C75
.1	UF	MONO	100	10%	150085	C42
.22	UF	MYLAR	100	20%	150003	C45 C46
1	UF	CERAMIC	50	10%	150073	C12 C18
1	UF	ALUMINUM NP	50	10%	150002	C3 C62 C77 C78
2.2	UF	ALUMINUM NP	50		150065	C33
22	UF	TANT.	16		150032	C38 C39
22	UF	ALUMINUM	16	20%	150142	C28 C29 C37 C43 C50 C51
33	UF	ALU LOW ESR	35	20%	150130	C84 C83
47	UF	ALUMINUM	16	20%	150143	C10
100	UF	ALUMINUM	25	20%	150099	C16 C17
220	UF	ALUMINUM	25		150137	C19 C20
1000	UF	ALUMINUM	35		150092	C68
4700	UF	ALUMINUM	25		150139	C21 C22 C23 C24

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
1	OHM	1/4W	CARBON FILM	5%	410139	R99 R103
2.2	OHMS	1/4W	CARBON FILM	5%	410113	R101
22	OHMS	1/4W	CARBON FILM	5%	410004	R47 R48
22	OHMS	1W	CARBON FILM	5%	410174	R38
47	OHMS	1/4W	CARBON FILM	5%	410039	R18 R19 R57 R58
82	OHMS	1/4W	CARBON FILM	5%	410038	R46
100	OHMS	1/4W	CARBON FILM	5%	410071	R26 R31 R45 R56
220	OHMS	1/4W	CARBON FILM	5%	410007	R39 R40 R41 R44
240	OHMS	1/4W	CARBON FILM	5%	410060	R27 R30
5	OHMS		TRIM POT		470060	P1
1K	OHMS	1/4W	CARBON FILM	5%	410010	R17 R60
1.2	OHMS	1/4W	CARBON FILM	5%	410041	R88
2.2K	OHMS	1/4W	CARBON FILM	5%	410011	R15 R24 R32
2.4K	OHMS	1/4W	CARBON FILM	5%	410103	R28 R29
2.7K	OHMS	1/4W	CARBON FILM	5%	410040	R63 R64
3.0K	OHMS	1/4W	CARBON FILM	5%	410104	R73
3.3K	OHMS	1/4W	CARBON FILM	5%	410015	R2 R3 R6 R7 R8 R85 R86
4.02K	OHMS	1/8W	METAL FILM	1%	410155	R51 R52 R53 R54 R59
4.7K	OHMS	1/4W	CARBON FILM	5%	410013	R23 R61 R76
5K	OHMS		TRIM POT		470022	P2
8.2K	OHMS	1/4W	CARBON FILM	5%	410037	R100 R102
10K	OHMS	1/4W	CARBON FILM	5%	410016	R4 R5 R10 R12 R14 R16 R20 R25 R33 R55 R65 R68 R71 R81 R82 R83 R87 R90 R93 R94 R95 R104 R105
1	OHM X 9		R-PACK		415001	RP1
15K	OHMS	1/4W	CARBON FILM	5%	410017	R43
22K	OHMS	1/4W	CARBON FILM	5%	410018	R42 R50 R77 R97 R98 R106 R107 R108 R109
24K	OHMS	1/4W	CARBON FILM	5%	410083	R91
33K	OHMS	1/4W	CARBON FILM	5%	410020	R75
39.2K	OHMS	1/8W	METAL FILM	1%	410111	R62 R78 R79 R80
47K	OHMS	1/4W	CARBON FILM	5%	410021	R49
56K	OHMS	1/4W	CARBON FILM	5%	410023	R92

100K	OHMS	1/4W	CARBON FILM	5%	410024	R9 R11 R13
150K	OHMS	1/4W	CARBON FILM	5%	410026	R72 R74
220K	OHMS	1/4W	CARBON FILM	5%	410028	R22
470K	OHMS	1/4W	CARBON FILM	5%	410030	R21 R84
1M	OHM	1/4W	CARBON FILM	5%	410058	R96
2.2M	OHMS	1/4W	CARBON FILM	5%	410153	R89
10M	OHMS	1/4W	CARBON FILM	5%	410059	R1

Diodes and Transistors

Device	Description	Part #	Designator
DIODE	1N957B ZENER 6.8V .4W 5%	480026	D3 D14
DIODE	1N4003 RECT 1A 200PIV	480058	D1 D2 D7 D8 D9 D10 D15
DIODE	1N4148 SIGNAL 10MA 75PIV	480000	D4 D5 D6 D11 D12 D13
DIODE	1N5231B ZENER 5.1V .5W 5%	480038	D18 D19
DIODE	1N5339 ZENER 5.6V 5W	480182	D20
DIODE	1N5401 RECT 3A 100PIV	480005	D16 D17
TRANSISTOR	2N2222 NPN 30V	480006	Q7 Q8 Q9 Q10 Q11 Q12
TRANSISTOR	J174 JFET PCHAN 8V VGS	480079	Q6
TRANSISTOR	MPS-A05 NPN 60V	480052	Q5
TRANSISTOR	MPS-A13 NPN 30V DARL	480004	Q1 Q2 Q3
TRANSISTOR	MPS-A55 PNP 60V	480050	Q4

Integrated Circuits

Device	Description	Part #	Designator
4050B	CMOS HEX BUFFER	480077	IC7
4094B	CMOS 8 BIT SHIFT REGISTER	480107	IC14
68HC11A	CMOS MCU 52 PIN PLCC FP	480132	IC1
4HC00	CMOS QUAD NAND	480157	IC3 IC24
74HC138	CMOS 3 TO 8 LINE DECODER	480120	IC4
74HC373	CMOS OCTAL D LATCH	480142	IC2
74HC374	CMOS OCTAL D FL/FLOP	480143	IC12
DG211CJ	CMOS QUAD ANALOG SWITCH	480092	IC13
GM76C256L	CMOS SRAM 32K X 8 100NS	480183	IC5
DS1267-10	DIGITAL POT, DUAL 10K	480195	IC19
LM384	OPAMP, POWER 4W	480012	IC21 IC22
LM833N	OPAMP, DUAL LO NOISE	480175	IC20
NE5532	OPAMP, DUAL LO NOISE	480070	IC15 IC16 IC17 IC18 IC23

78SR105HC	REGULATOR, 5V SWITCHER 1A	480206	IC25
LM317T	REGULATOR, POS ADJ 1.5A	480167	IC9
LM337T	REGULATOR, NEG ADJ 1.5A	480177	IC10
TL7705AP	RESET SUPERVISOR IC	480134	IC6

Miscellaneous

Device	Description	Part #	Designator
CONNECTOR	2.1MM CO-AX PC MTG POWER	210213	J4
CONNECTOR	DB-9F RT ANG PC MTG	210186	J2
CONNECTOR	DB-15F RT ANG PC MTG	210187	J1
CRYSTAL	8.000MHZ PARALLEL CRYSTAL	230003	Y1
FUSE	0.90A POLY SWITCH	520036	F1
JUMP JACK	JUMP JAX	210103	JP2
RELAY	SPDT 12V PC RELAY ITT#SZ12	450006	K1 K2

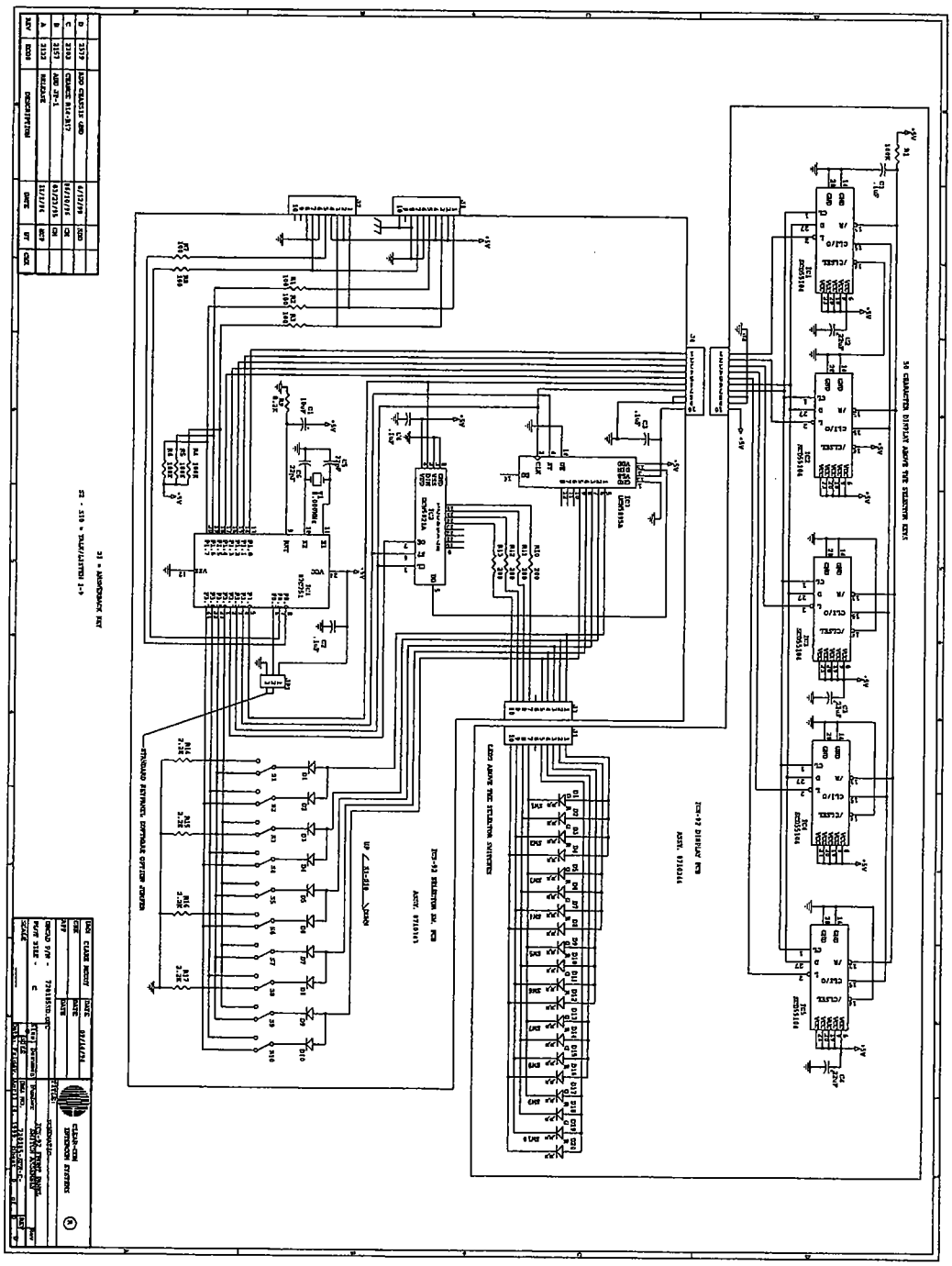


FIGURE S4-6: Schematic—ICS-92/92T Selector Switch Assembly Rev. D

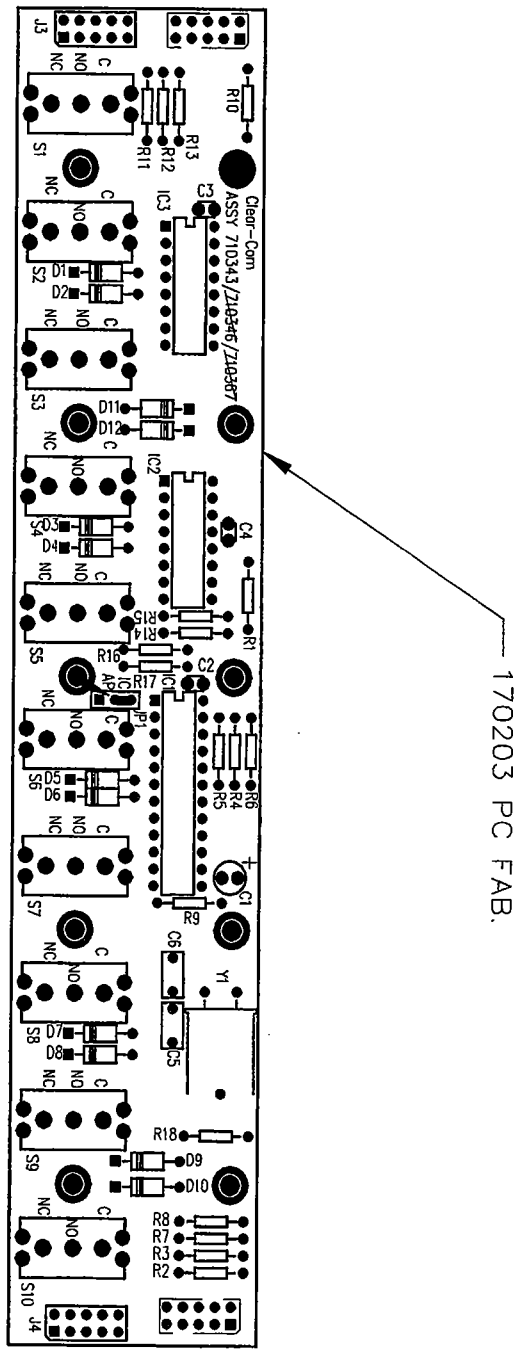


FIGURE S4-7: Assembly Drawing—ICS-92/92T Selector Switch PCB Rev. D

Bill of Materials for ICS-92/92T Selector Switch PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
22	PF	CERAMIC	50	10%	150098	C5 C6
1	UF	MONO	50	10%	150035	C2 C3 C4
10	UF	ALUMINUM	50		150064	C1

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
0	OHM		JUMPER		600000	R18
1	OHMS	1/4W	CARBON FILM	5%	410071	R1 R2 R3 R7 R8
200	OHMS	1/4W	CARBON FILM	5%	410072	R10 R11 R12 R13
4.7K	OHMS	1/4W	CARBON FILM	5%	410013	R14 R15 R16 R17
8.2K	OHMS	1/4W	CARBON FILM	5%	410037	R9
100K	OHMS	1/4W	CARBON FILM	5%	410024	R4 R5 R6

Diodes and Transistors

Device	Description	Part #	Designator
DIODE	1N4148 SIGNAL 10MA 75PIV	480000	D1 D2 D3 D4 D5 D6 D7 D8 D9 D10

Integrated Circuits

Device	Description	Part #	Designator
710353	PROGRAMED MICRO P,87C751	710353	IC1
UCN5821A	CMOS 8 BIT SHFT REG I SINK	480164	IC2
UCN5895	CMOS 8 BIT SHFT REG I SOURCE	480210	IC3

Miscellaneous

Device	Description	Part #	Designator
CRYSTAL	8.000MHZ PARALLEL HC-49U	230003	Y1
SWITCH	SP3T MOM-OFF-MOM PC MTG	510080	S1-S10

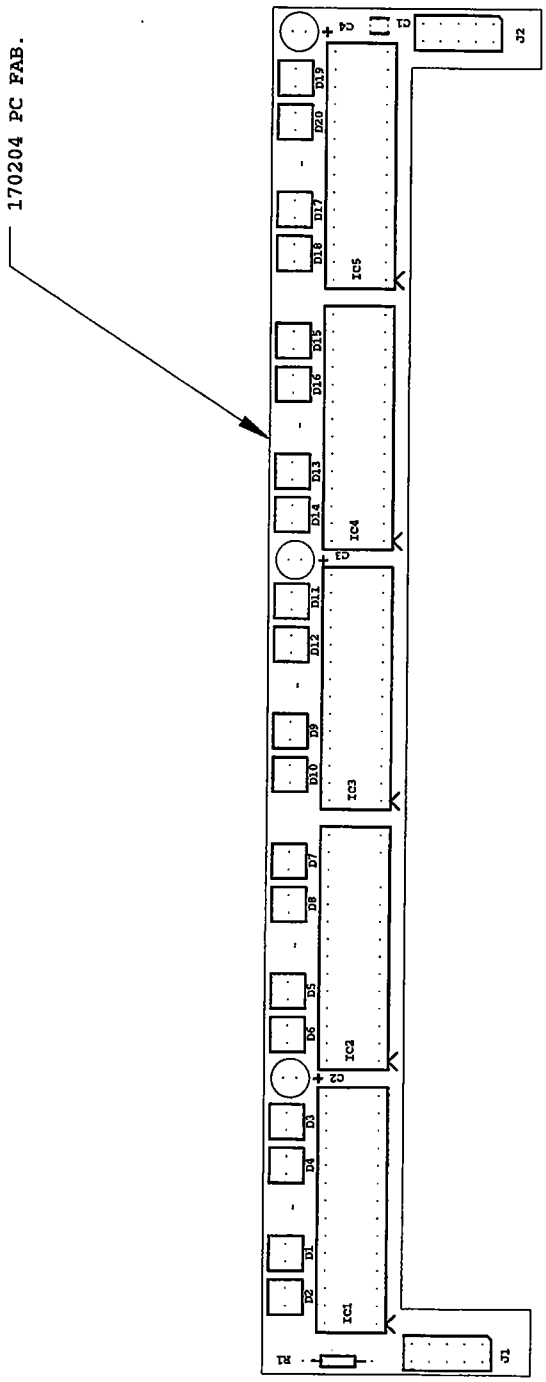


FIGURE S4-8: Assembly Drawing—ICS-92/92T Display PCB Rev. A

Bill of Materials for ICS-92/92T Display PCB

Capacitors

Value	Type	Volts	Tol.	Part #	Designator
.1 UF	MON	50	10%	150035	C1
22 UF	TAN	16		150032	C2 C3 C4

Resistors & Resistor Packs

Value	Power	Type	Tol.	Part #	Designator
100K OHMS	1/4W	CARBON FILM	5%	410024	R1

Diodes and Transistors

Device	Description	Part #	Designator
LED	GREEN, ROUND, FLAT TOP LED	390045	D1 D3 D5 D7 D9 D11 D13 D15 D17 D19
LED	RED, ROUND, FLAT TOP LED	390044	D2 D4 D6 D8 D10 D12 D14 D16 D18 D20

Integrated Circuits

Device	Description	Part #	Designator
DISPLAY	10 CHARACTER LED DISPLAY	390050	IC1 IC2 IC3 IC4 IC5

Miscellaneous

Device	Description	Part #	Designator
LENS	TWO COLOR DISPLAY LENS	250694	

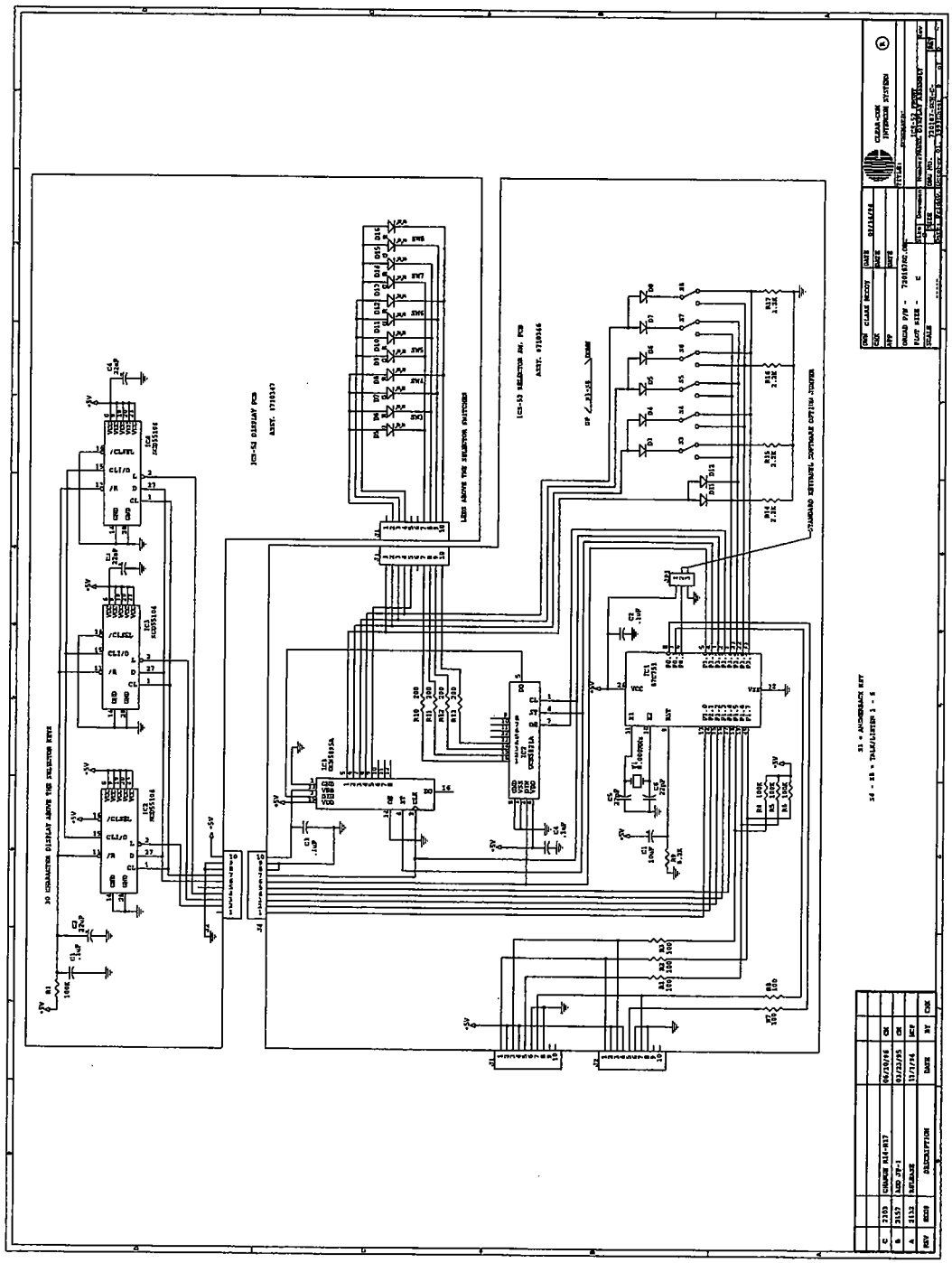


FIGURE S4-9: Schematic—ICS-52/52T Selector Switch Assembly Rev. C

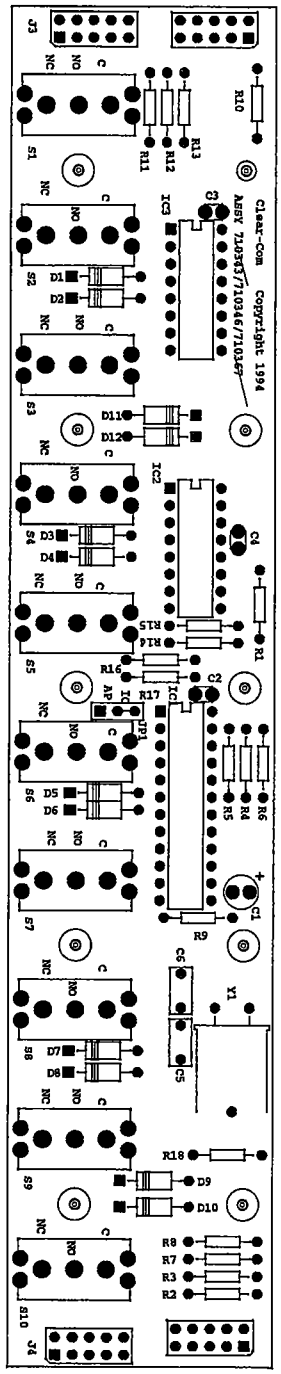


FIGURE S4-10: Assembly drawing—ICS-52/52T Selector Switch PCB Rev. C

Bill of Materials for ICS-52/52T Selector Switch PCB

Capacitors

Value	Type	Volts	Tol.	Part #	Designator
22PF	CERAMIC	50	10%	150098	C5 C6
1UF	MONO	50	10%	150035	C2 C3 C4
10UF	ALUMINUM	50		150064	C1

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
0	OHM		JUMPER		600000	R18
100	OHMS	1/4W	CARBON FILM	5%	410071	R1 R2 R3 R7 R8
200	OHMS	1/4W	CARBON FILM	5%	410072	R10 R11 R12 R13
4.7	OHMS	1/4W	CARBON FILM	5%	410013	R14 R15 R16 R17
8.2K	OHMS	1/4W	CARBON FILM	5%	410037	R9
100K	OHMS	1/4W	CARBON FILM	5%	410024	R4 R5 R6

Diodes and Transistors

Device	Description	Part #	Designator
DIODE	1N4148 SIGNAL 10MA 75PIV	480000	D3 D4 D5 D6 D7 D8

Integrated Circuits

Device	Description	Part #	Designator
710353	PROGRAMED MICRO P,87C751	710353	IC1
UCN5821A	CMOS 8 BIT SHFT REG I SINK	480164	IC2
UCN5895	CMOS 8 BIT SHFT REG I SOURCE	480210	IC3

Miscellaneous

Device	Description	Part #	Designator
CRYSTAL	8.000MHZ PARALLEL HC-49U	230003	Y1
SWITCH	SP3T MOM-OFF-MOM PC MTG	510080	S3-S8

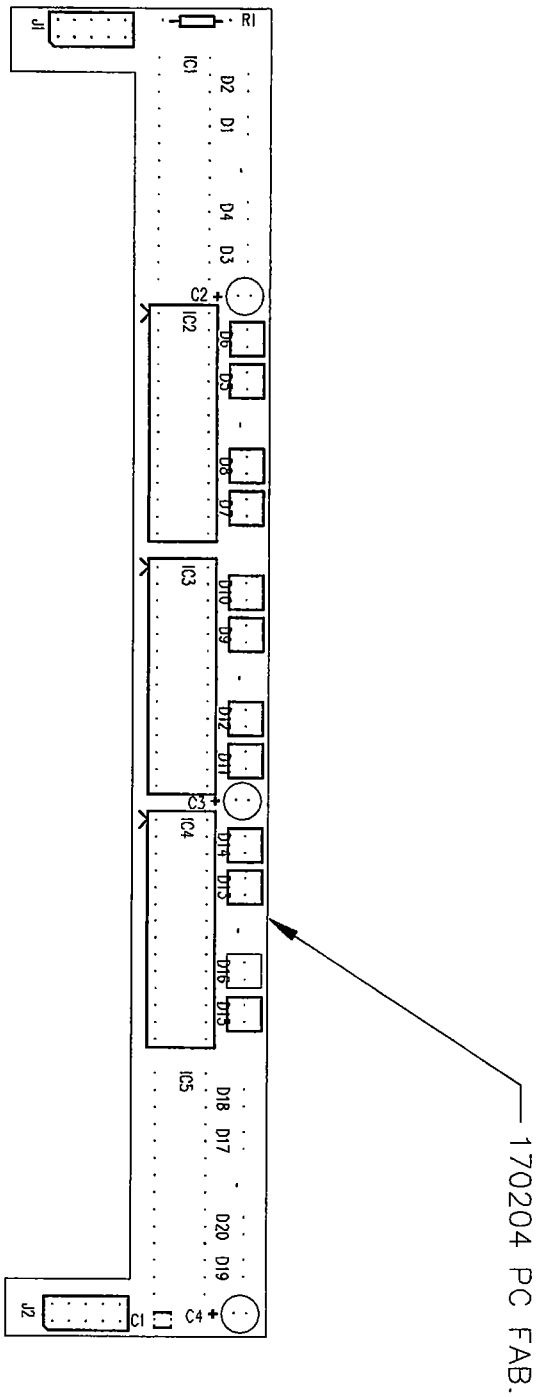


FIGURE S4-11: Assembly Drawing—ICS-52/52T Selector Switch LED PCB Rev. A

Bill of Materials for ICS-52/52T Display PCB

Capacitors

Value	Type	Volts	Tol.	Part #	Designator
.1UF	MON	50	10%	150035	C1
22UF	TAN	16		150032	C2 C3 C4

Resistors & Resistor Packs

Value	Power	Type	Tol.	Part #	Designator
100K OHMS	1/4W	CARBON FILM	5%	410024	R1

Diodes and Transistors

Device	Description	Part #	Designator
LED	GREEN, ROUND, FLAT TOP LED	390045	D5 D7 D9 D11 D13 D15
LED	RED, ROUND, FLAT TOP LED	390044	D6 D8 D10 D12 D14 D16

Integrated Circuits

Device	Description	Part #	Designator
DISPLAY	10 CHARACTER LED DISPLAY	390050	IC2 IC3 IC4

Miscellaneous

Device	Description	Part #	Designator
LENS	TWO COLOR DISPLAY LENS	250694	

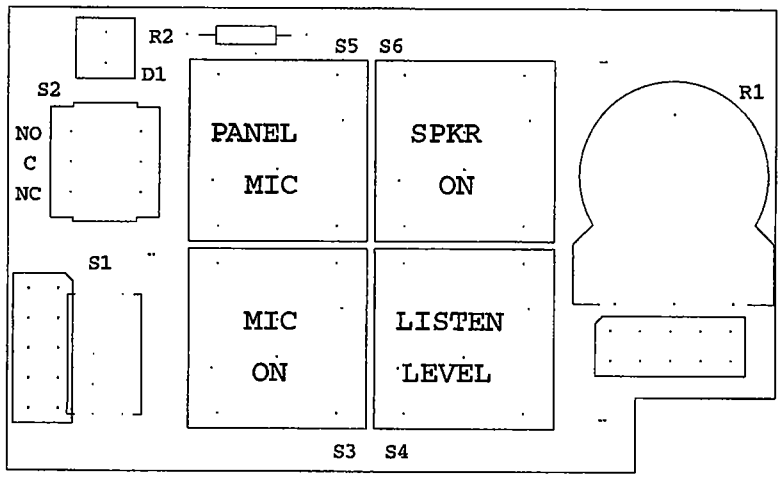


FIGURE S4-12: Assembly Drawing—ICS-92/92T Function Switch PCB Rev. C

Bill of Materials for ICS-92/ICS-92T Function Switch PCB

Resistors & Resistor Packs

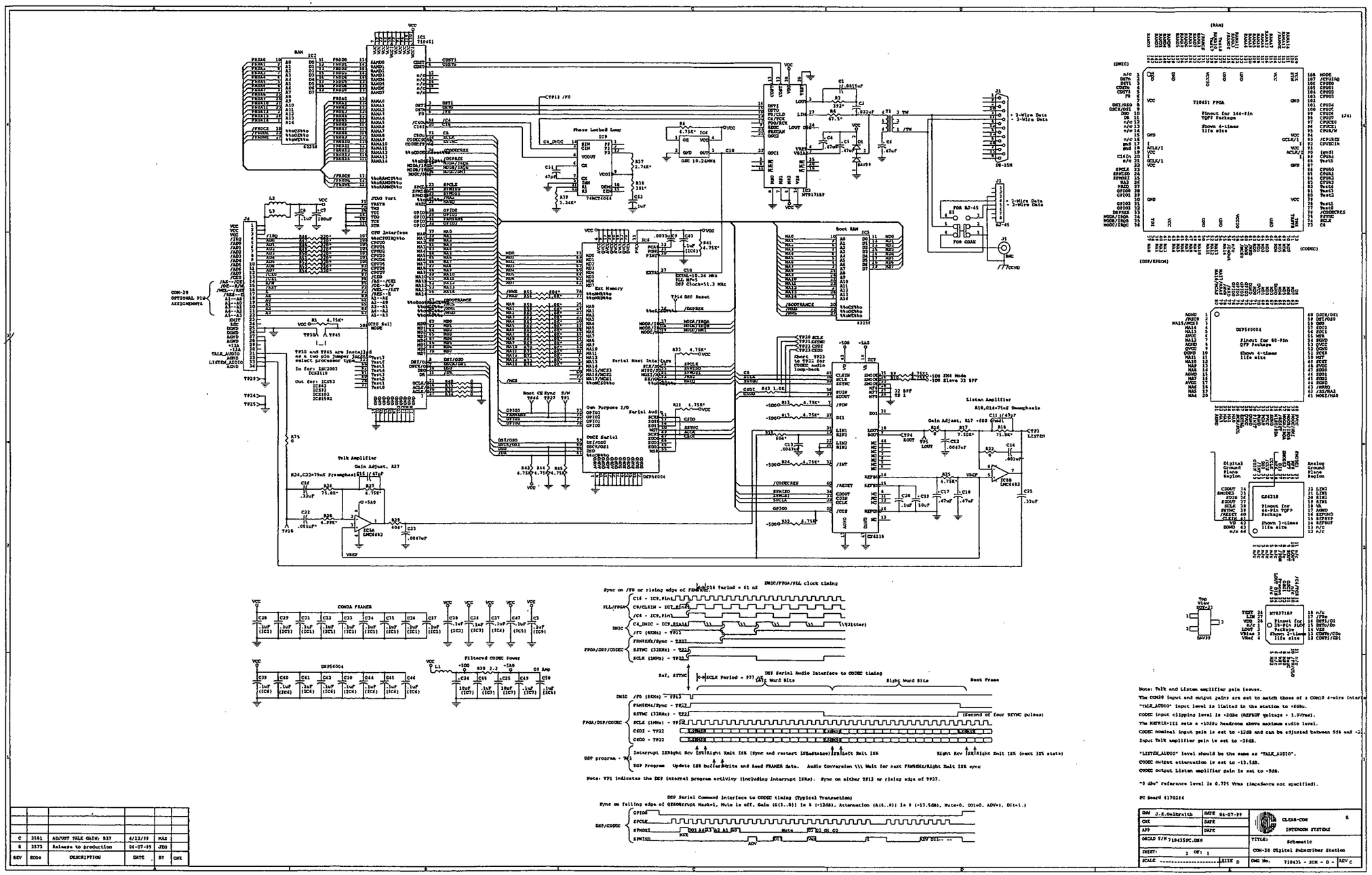
Value		Power	Type	Tol.	Part #	Designator
1K	OHMS	1/4W	CARBON FILM	5%	410010	R2
5K	OHMS		POT PC MOUNT		470072	R1

Diodes and Transistors

Device	Description	Part #	Designator
LED	GREEN, ROUND, FLAT TOP	390045	D1

Miscellaneous

Device	Description	Part #	Designator
SWITCH	PUSHBUTTON SWITCH	510089	S1
SWITCH	PUSHBUTTON, DPDT	510107	S2
SWITCH	PUSHBUTTON SWITCH W LAMP	510108	S3 S4 S5 S6



REV	ECO#	DESCRIPTION	DATE	BY	CHK
C	3161	ADJUST TALK GAIN; R37	4/12/99	MAK	
B	3573	Release to production	04-07-99	JEG	

FIGURE S4-13: Schematic—COM-20 Communications PCB Rev. C

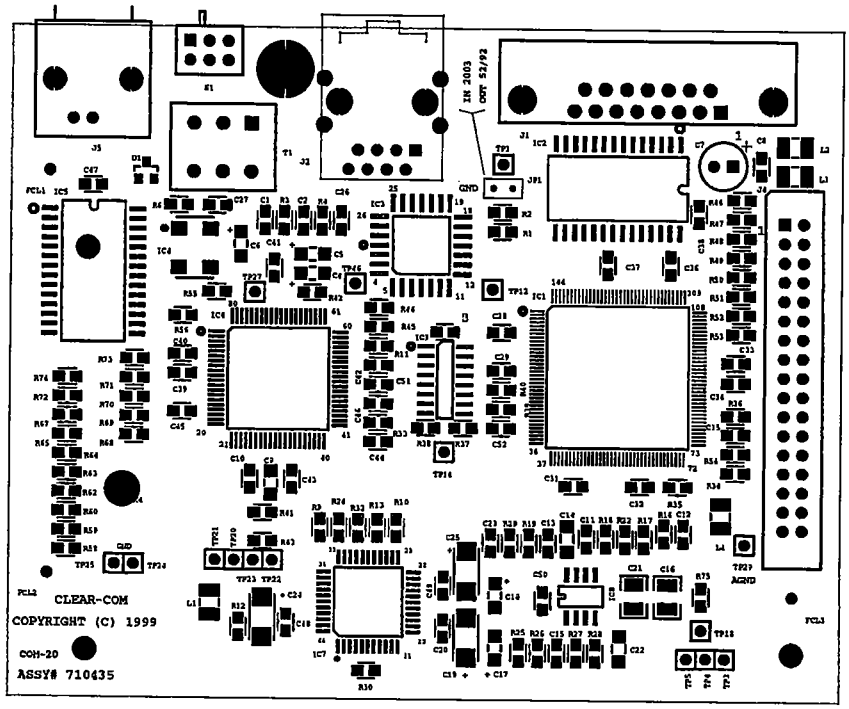


FIGURE S4-14: Assembly Drawing—COM-20 Communication PCB Rev. A

Bill of Materials for COM-20 Communication PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.001	uF	Ceramic Disc SMD	50V	1%	151001	C14 C22
.00	33	Ceramic Disc SMD	50V	5%	151002	C9
47	pF	Ceramic Disc SMD	50V	5%	151120	C11 C15 C51
.0015	uF	Ceramic Disc SMD	50V	5%	151138	C1
.0047	uF	Ceramic Disc SMD	50V	10%	151156	C12 C13 C23
.022	uF	Ceramic Disc SMD	50V	10%	151164	C2
.1	uF	Ceramic Disc SMD	50V	10%	151172	C3 C8 C10 C20 C26 C27 C28 C29 C31 C32 C33 C34 C35 C36 C37 C38 C39 C40 C41 C42 C43 C44 C45 C46 C47 C48 C49 C50 C52

.33	uF	Ceramic Disc SMD	25V	10%	151178	C16 C21
.47	uF	Tantalum SMD	35V	10%	151184	C4 C5 C6 C17 C18
10	uF	Tantalum SMD	25V	10%	151192	C19 C24 C25
100	uF	Aluminum	16V	20%	150155	C7

Resistors

Value		Power	Type	Tol.	Part #	Designator
0	OHM	1/10	SMD		411100	R16 R22 R34 R35 R36 R40 R75
2.2	OHM	1/10	SMD	5%	411181	R30
47.5	OHM	1/10	SMD	1%	411262	R4
221	OHM	1/10	SMD	1%	411326	R46 R47 R48 R49 R50 R51 R52 R53 R54
301	OHM	1/10	SMD	1%	411339	R38
392	OHM	1/10	SMD	1%	411350	R3
604	OHM	1/10	SMD	1%	411368	R29 R19 R55
1.00K	OHM	1/10	SMD	1%	411389	R43 56 R58 R59 R60 R62 R63R64 R65 R67 R68 R70 R71 R72R73 R74 R69
2.74K	OHM	1/10	SMD	1%	411431	R37
3.24K	OHM	1/10	SMD	1%	411438	R39
4.75K	OHM	1/10	SMD	1%	411454	R1 R6 R9 R10 R11 R12 R13 R24 R25 R32
4.75K	OHM	1/10	SMD	1%	411454	R33 R41 R42 R44 R45 R27
4.99K	OHM	1/10	SMD	1%	411456	R28
7.50K	OHM	1/IO	SMD	1%	411473	R17
75.0K	OHM	1/10	SMD	1%	411569	R26 R18

Diodes and Transistors

Device	Description	Part #	Designator
Diode	BAV99 DUAL DIODE... SMD	481033	D1

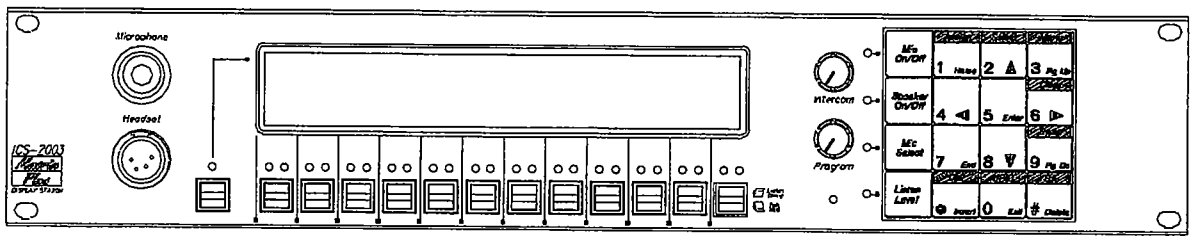
Integrated Circuits

Device	Description	Part #	Designator
62256	CMOS SRAM 32K X 8	481047	IC2 IC5
6482	DUAL CMOS OPAMP RAIL/RAIL	481022	IC8
0.24MHZ	CRYSTAL CLOCK OSCILLATOR	231004	IC4
4218	16-BIT 2 CHANNEL CODEC	481041	IC7
74HCT4046A	CMOS PHASE LOCK LOOP...SOIC16	481045	IC9

MT9171AP	DIGITAL NETWORK INT.	481046	IC3
56004	24-BIT DSP 40MHZ	481071	IC6
IFPGA	DNIC FRAMER, COM 20	710451	IC1

Miscellaneous

Device	Description	Part #	Designator
Connector	JUMP JAX	210103	JP1
Connector	HEADER MULTI PIN HEADER((PER)PIN)	210112	JP1(2)
Connector	15 PIN (M) RT ANG PC MTG D TYPE CON	210188	J1
Connector	DUAL ROW HEADER 17 POS. .230IN	210279	J4
Connector	RJ-45 RT ANG MOD CON 1-PORT SHIELDED	210335	J2
Connector	BNC RT ANGLE PC MNT W/THREAD BUSH	210354	J5
Inductor	FERRITE EMI SUPPRESSOR 400MA	181001	L1 L2 L3
Switch	DPDT MICRO-SUBMINIATURE SWITCH	510124	S1
Transformer	2745B 2:1 PULSE TRANSFORMER	560023	T1



Matrix Plus 3 System

ICS-2003/2003T

MASTER INTERCOM STATIONS

Introduction

This section provides station microprocessor resetting instructions, Maintenance menu use, troubleshooting guidelines, schematics, assembly drawings, and component lists. For operation information, see the *Matrix Plus 3 Operation Manual;* for installation information, see the *Matrix Plus 3 Installation Manual;* and for programming information, see the *PGM-WIN System Configuration Manual.*

Station Reset

The station's microprocessor has a reset button located in an unmarked hole just below the program volume knob on the right side of the unit's front panel. If the station is acting erratically, try resetting it by:

1. inserting a small screwdriver or a stiff piece of wire (such as a bent paper clip) into the hole and pushing the reset button

or

2. unplugging the station from AC power and reconnecting.

Maintenance Menu

The station's Maintenance menu includes several functions to aid in testing installation and isolating problems. To access the Maintenance menu:

1. Push the "Menu" button on the station's keypad.
2. Select "Maintenance Menu."
3. Select one of the following options:
   - Version Information
   - Send Tone To Matrix
   - Activate Matrix Loopback.

Version Information

This function displays the installed software's version number and copyright information.

Send Tone to Matrix

This function sends a tone to the matrix, which is useful for tracing signal paths through the system. To check a talk path to a specific station:

1. Activate a talk path to the station.
2. Send the tone (internally generated by the station).

Activate Matrix Loopback

This function returns the station's audio via the matrix frame. This is accomplished by connecting a crosspoint between the station's incoming audio and the station's path for outgoing audio from the matrix. This provides a check for the audio paths between the station and the matrix frame. This function also checks that the communication between the station and the matrix frame is working correctly; the loop can be completed only if the station is communicating with the matrix frame.

Troubleshooting

When experiencing the symptoms listed below, attempt the following solutions in the order outlined. The solutions are listed in order of difficulty with the first being the most simple and easy. For troubleshooting guidelines for the entire system, see the "Overview" chapter of this manual.

- **The station's display and all front-panel indicators fail to light.**

1. Check mains AC power into the station.
2. Ensure the external power supply is properly connected to the station.
3. Replace the station.

- **The display shows unexpected characters.**

1. Power the station off and turn it back on.
2. Reset the station's matrix card in the matrix frame.
3. Replace the station.

- **The LED indicator above a selector does not light when the selector is pressed.**

1. Ensure the selector has a label assigned to it (the LED indicator will not light without an assigned label).

2. Reset the station.
3. Replace the station.

- **Keypad button functions do not operate, or the station beeps when a button is pressed (affected buttons could include "Assign," "Station," "Dial," "Menu," and "Swap").**

1. Ensure the function has not been inhibited from the configuration program of the station's local Configuration menu.
2. Reset the station.
3. Replace the station.

- **The station appears to activate talk paths, but other stations can't hear the station operator.**

1. Check "Mic On/Off" and "Panel Mic" buttons to ensure the intended microphone is selected and on.
2. If the correct microphone is turned on, ensure the station audio has not been muted externally through the logic inputs.
3. Make sure the station has not been defined as a nearby station.
4. Activate the Matrix Loopback mode from the station's Maintenance menu to check the audio paths to the matrix.
5. Enable eavesdropping on the station.
6. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
7. Reset the station.
8. Replace the station.

- **The station is inoperative and all red LEDs flash slowly.**

1. Wait 60 sec. If the matrix frame has just been powered up, it is possible it is still downloading the configuration to the Matrix cards.
2. Ensure the cable connecting the station to the matrix is plugged in at both ends.
3. Check the integrity of the data paths, especially the polarity for stations using a COM-10 communication module.

4. Check the configuration program to ensure the station has been assigned the correct port type.
5. Confirm the matrix card type matches the station. Stations with COM-10 communication modules should have an MTX-A8 or MVX-A8. Stations with COM-20 communication modules should have an MTX-D8 or MVX-D8.
6. Reset the station's matrix card in the Matrix frame.
7. Replace the station's matrix card in the Matrix frame.
8. Reset the station.
9. Replace the station.

- **No audio from the station's speaker.**

1. Ensure the 'Intercom" knob on the station's front panel is turned up.
2. Ensure the "Speaker On/Off" button is on.
3. Check whether audio can be heard in a headphone.
4. Check the configuration program and the station's logic inputs to ensure the speaker has not been software disabled.
5. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
6. Reset the station's Matrix card in the Matrix frame.
7. Replace the station's Matrix card in the Matrix frame.
8. Reset the station.
9. Replace the station.

- **The operator cannot hear another station's page or call signal tones.**

1. Adjust the "Page Volume" control of the station using the configuration program (refer to the *PGM-WIN System Configuration Manual*).
2. Check the station's configuration to see if page override is enabled.

- **Announce tones (eavesdropping indication, change tones, etc.) aren't heard at the station.**

1. Check the station's Configuration menu to see if the monitoring tones and change tones are enabled.

- **No speaker audio from the external program feed.**

1. Check the "Program" knob on the station's front panel.
2. Check the program source.
3. Reset the station.
4. Replace the station.

- **The headphone isn't receiving audio from the external program feed.**

1. If the external program feed is audible in the speaker, check the station's configuration program to ensure the program was not disabled for the second earphone feed.
2. Replace the station.

- **Accessory panels do not function.**

1. Check the accessory panel's connection on the station's rear panel.
2. Ensure the external AC power transformers are correctly connected to the accessory panels.
3. Check the configuration program to ensure the correct number of selectors are configured.

Miscellaneous Bill of Materials for the ICS-2003/2003T

Device	Description	Part #	Designator
CABLE	26 Pin 3 in Ribbon	730078	
CABLE	34 Pin Ribbon	730181	
CABLE	20 Pin Ribbon, 2mm connectors	730208	
DISPLAY	60 x 480 Pixel EL Display	390056	
SPEAKER	2 1/2 in. 8 OHM 3.5W	500103	
CORD	Power	610022	
POWER SUPPLY	+5, +12, & -12 V	760050	

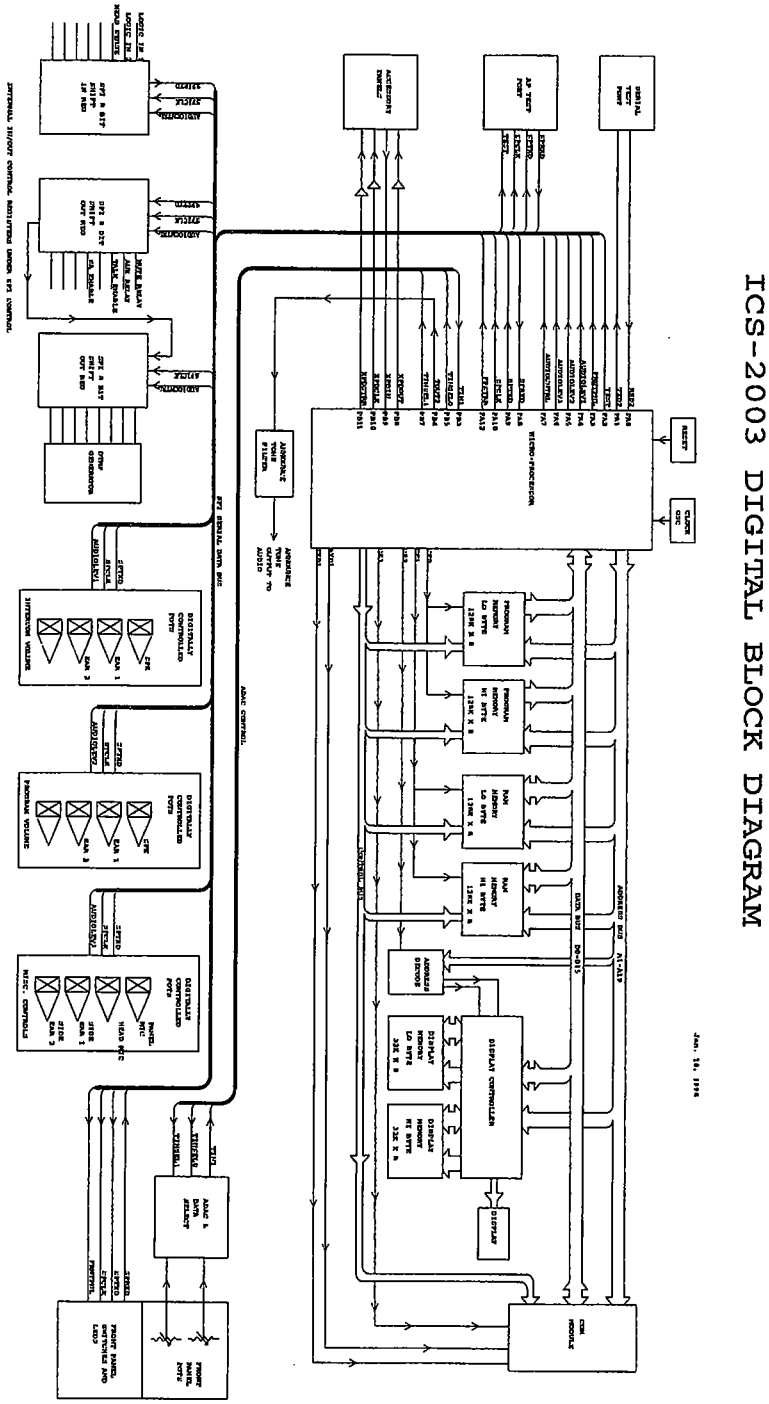


FIGURE S5-1: Digital Block Diagram—ICS-2003 Main PCB

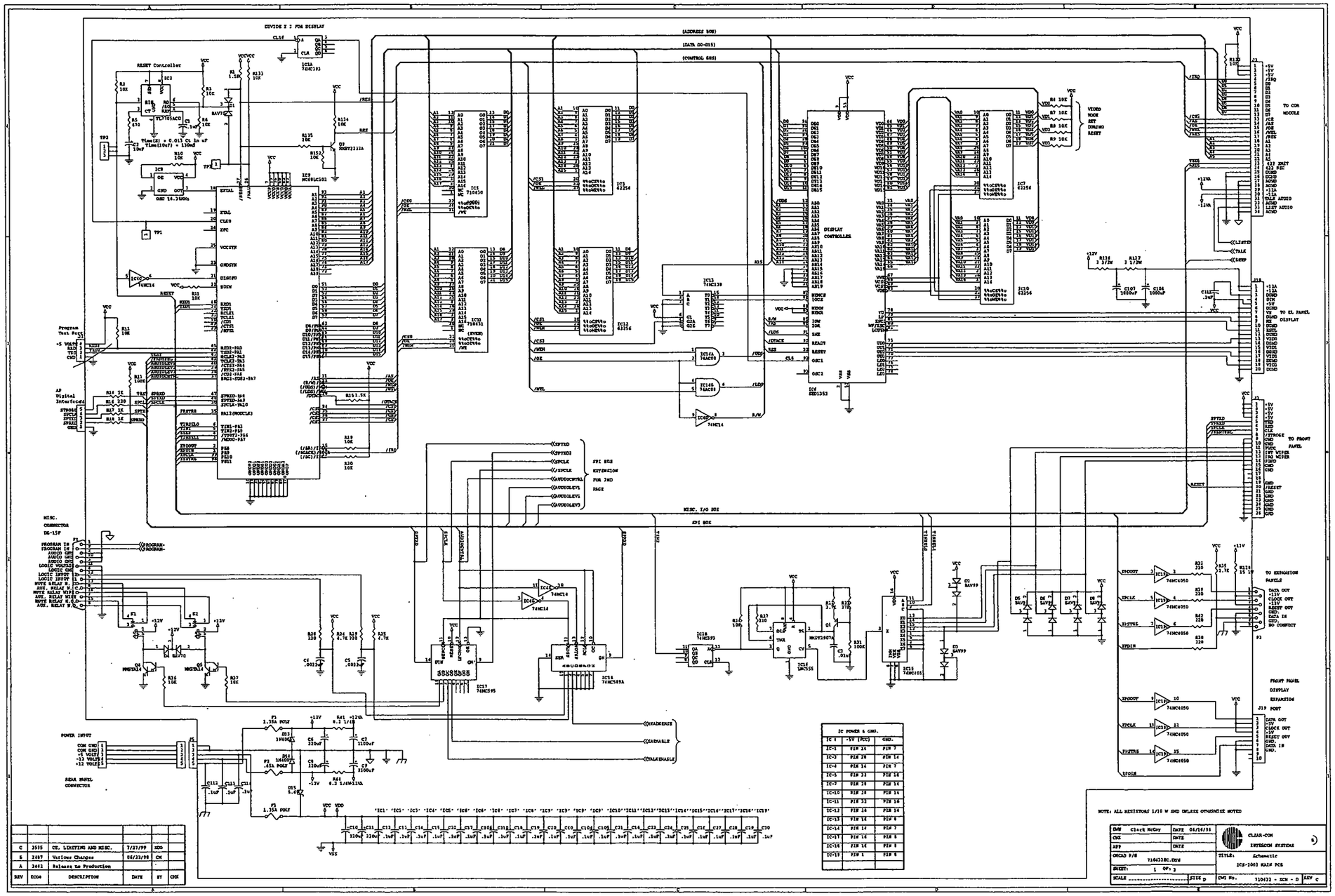


FIGURE S5-2: ICS-2003 Main PCB Sheet 1 of 2 Rev. C

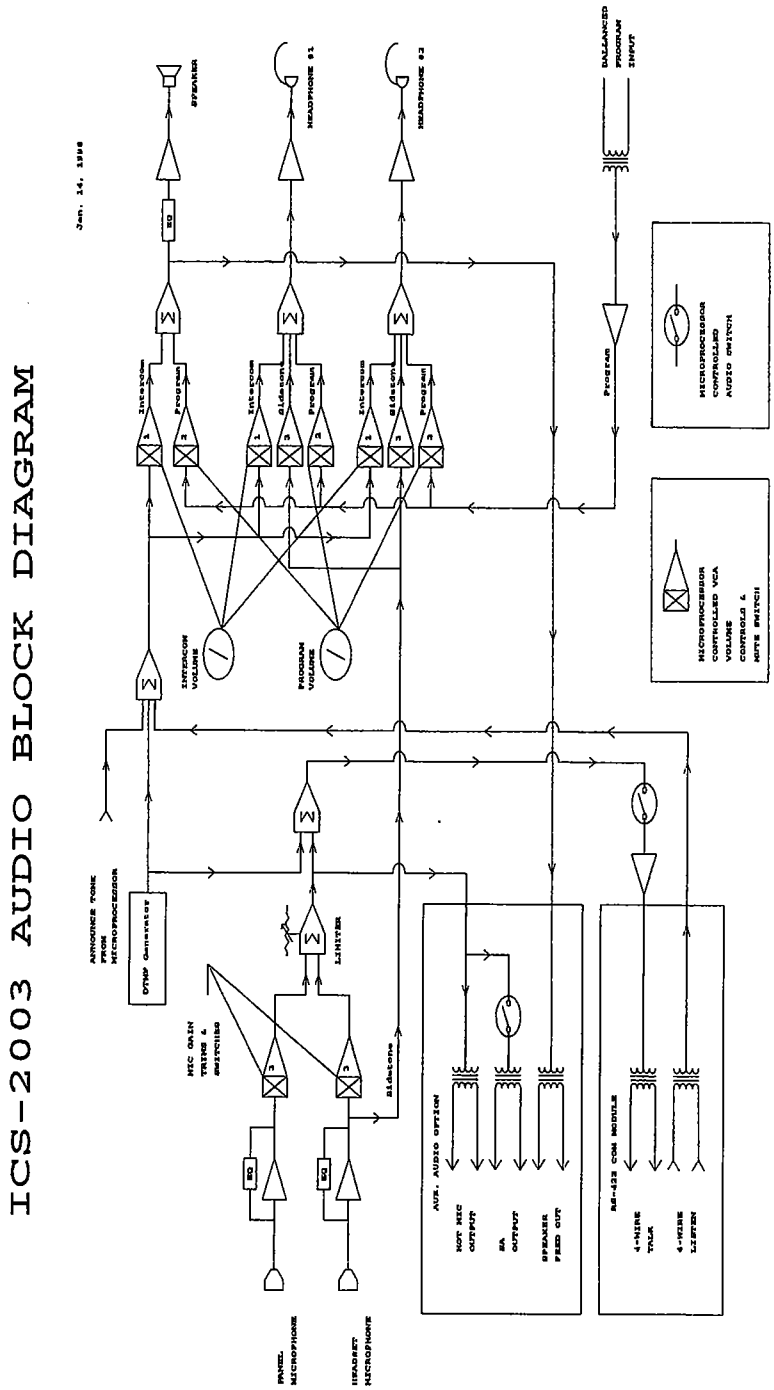


FIGURE S5-3: Analog Block diagram—ICS-2003 Main PCB

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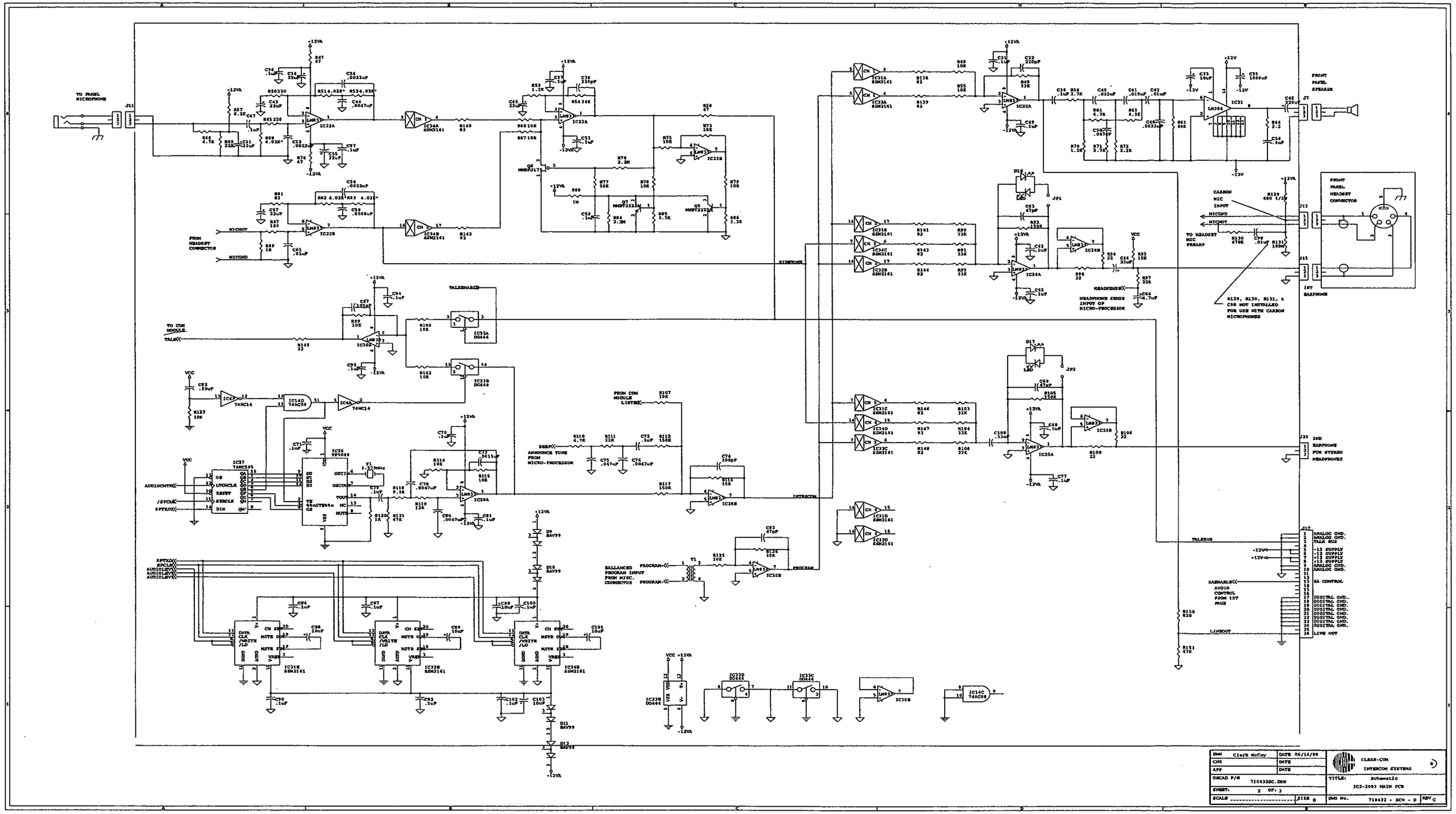

FIGURE S5-4: ICS-2003 Main PCB Sheet 2 of 2 Rev. C

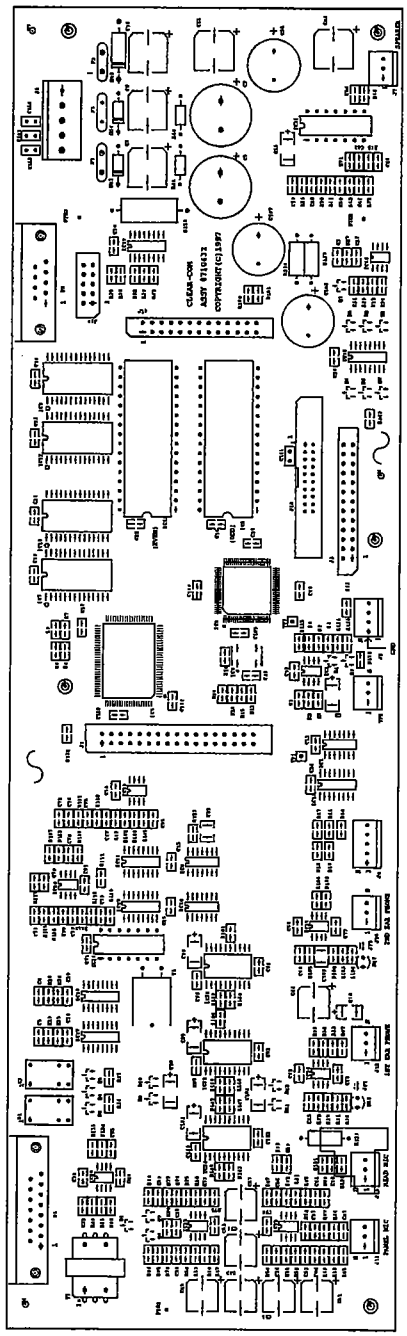

FIGURE S5-5: Assembly Drawing—ICS-2003 Main PCB Rev. C

Bill of Materials for the ICS-2003/2003T Main PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
47	pF	Ceramic Disc SMD	50	5%	151120	C63 C69 C83
100	pF	Ceramic Disc SMD	50	5%	151124	C67 C74
220	pF	Ceramic Disc SMD	50	5%	151128	C32 C38
.0015	uF	Ceramic Disc SMD	50	5%	151138	C73
.0022	uF	Ceramic Disc SMD	50	10%	151152	C4 C5 C36 C52 C56
.0033	uF	Ceramic Disc SMD	50	10%	151154	C48
.0047	uF	Ceramic Disc SMD	50	10%	151156	C44 C76 C78 C80
.0068	uF	Ceramic Disc SMD	50	10%	151158	C58
.01	uF	Ceramic Disc SMD	50	10%	151160	C3 C42 C61 C98
.015	uF	Ceramic Disc SMD	50	10%	151162	C41
.022	uF	Ceramic Disc SMD	50	10%	151164	C40
.047	uF	Ceramic Disc SMD	50	10%	151168	C75 C50
.1	uF	Ceramic Disc SMD	50	10%	151172	C1 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C37 C39 C47 C49 C53 C54 C59 C60 C62 C65 C68 C70 C71 C72 C77 C79 C81 C86 C87 C90 C92 C94 C95 C96 C97 C100 C102 C104 C105 C106 C110
.33	uF	Ceramic Disc SMD	25	10%	151178	C82 C109
4.7	uF	Tantalum SMD	16	10%	151189	C66
10	uF	Tantalum SMD	25	10%	151192	C2 C33 C88 C89 C C101 C103
22	uF	Aluminum SMD	50	20%	151200	C34 C43 C45 C51 C55 C57 C64
220	uF	Aluminum SMD	25	10%	151204	C6 C8 C10 C11 C46
1000	uF	Aluminum	35		150092	C35 C107 C108
2200	uF	Aluminum	25		150120	C7 C9

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
2	OHM	1/2	Carbon Film	5%	410173	R136 R137
2.2	OHM	1/10	SMD	5%	411181	R64
8.2	OHM	1/4	Carbon Film	5%	410166	R41 R44
15	OHM	1	Carbon Film	5%	410214	R128
22.1	OHM	1/10	SMD	1%	411230	R94 R96 R106 R109 R145
47.5	OHM	1/10	SMD	1%	411262	R47 R58 R74
82.5	OHM	1/10	SMD	1%	411285	R81 R138 R139 R140 R141 R142 R143 R144 R146 R147 R148
100	OHM	1/10	SMD	1%	411293	R87
221	OHM	1/10	SMD	1%	411326	R16 R27 R28 R29 R30 R32 R39 R42 R50 R65
475	OHM	1/10	SMD	1%	411358	R5 R151
680	OHM	1/2	Carbon Film	5%	410165	R129
825	OHM	1/10	SMD	1%	411381	R150
1.00K	OHM	1/10	SMD	1%	411389	R14 R17 R18 R89 R120
1.21K	OHM	1/10	SMD	1%	41139	R53 R70
1.50K	OHM	1/10	SMD	1%	411406	R15
2.21K	OHM	1/10	SMD	1%	411422	R72
2.74K	OHM	1/10	SMD	1%	411431	R22 R35 R56 R71
3.32K	OHM	1/10	SMD	1%	411439	R85 R86
4.02K	OHM	1/10	SMD	1%	411447	R51 R52 R68 R82 R83
4.32K	OHM	1/10	SMD	1%	411450	R61 R62
4.75K	OHM	1/10	SMD	1%	411454	R24 R25 R66 R110
8.25K	OHM	1/10	SMD	1%	411477	R57
9.09K	OHM	1/10	SMD	1%	411481	R118
10.0K	OHM	1/10	SMD	1%	411485	R1 R2 R3 R4 R6 R7 R8 R9 R10 R11 R12 R19 R20 R26 R36 R37 R48 R55 R60 R67 R73 R75 R78 R79 R99 R100 R102 R107 R114 R115 R116 R123 R124

					R125 R132 R133 R134 R135
12.1K OHM	1/10	SMD	1%	411493	R119
15.0K OHM	1/10	SMD	1%	411502	R93
22.1K OHM	1/10	SMD	1%	411518	R69 R97 R111
23.7K OHM	1/10	SMD	1%	411521	R54
27.4K OHM	1/10	SMD	1%	411527	R23
33.2K OHM	1/10	SMD	1%	411535	R49 R90 R91 R95 R103 R104 R108
47.5K OHM	1/10	SMD	1%	411550	R121
56.2K OHM	1/10	SMD	1%	411557	R77
68.1K OHM	1/10	SMD	1%	411565	R63
100K OHM	1/10	SMD	1%	411581	R13 R31
150K OHM	1/10	SMD	1%	411598	R92 R105 R112 R117 R130
1.0M OHM	1/10	SMD	5%	411677	R84
1.2M OHM	1/10	SMD	5%	411685	R80
2.2M OHM	1/10	SMD	5%	411710	R76

Diodes and Transistors

Device	Description	Part #	Designator
Diode	BAV70 Dual Diode Com Cath	481019	D1 D4
Diode	BAV99 Dual Diode Series SMD	481033	D2 D3 D5 D6 D7 D8 D9 D10 D11 D12
Transistor	2222A NPN 40V 600ma SMD	481026	Q7 Q8 Q9
Transistor	2907A PNP 60V 600ma SMD	481027	Q1
Transistor	J175 P-Ch JFET SMD	481056	Q6
Transistor	MPSA14 NPN 30V 300ma SMD	481038	Q4 Q5

Integrated Circuits

Device	Description	Part #	Designator
Analog IC	555 CMOS TIMER SMD	481051	IC16
Analog IC	LM384 POWER 4W OP AMP	480012	IC21
Analog IC	LM833 Dual Opamp SMD	481023	IC20 IC22 IC23 IC24 IC25 IC28 IC30
Analog IC	SSM2161 4-Ch Volume Ctn. SMD	481055	IC31 IC32 IC34
Analog SW	DG444 Quad SPST Analog SW	481050	IC33
DTMF Gen.	TP 5088 DTMF GEN.	480196	IC26
Logic IC	74AC08 Quad 2-IN AND Gate	481053	IC14
Logic IC	74HC14 Hex Schmitt Trig Invert	481052	IC4
Logic IC	74HC138 CMOS 3-8 Decoder	481059	IC13

Logic IC	74HC393 Dual 4 Bit Bin Cnt	481058	IC1
Logic IC	74HC589 Par IN/SER Out SMD	481054	IC18
Logic IC	74HC595 SerIN/PAROut SMD	481036	IC17 IC27
Logic IC	74HC4050 Hex Buf SMD	481057	IC19
Logic IC	74HC4051 8-CH Mux SMD	481001	IC15
Micro. P	68LC302 Micro Cont SMD	481049	IC9
ROM Mem.	EPROM ASSY, ODD, ICS-2003	710430	IC5
ROM Mem.	EPROM ASSY, EVEN, ICS-2003	710431	IC11
Regulator	7705 Supply Supervisor SMD	481018	IC2
RAM Mem.	62256 CMOS SRAM 32K X 8	481047	IC3 IC7 IC10 IC12
Video Cont.	SED1353 LCD Graphics Control	481060	IC6

Miscellaneous

Device	Description	Part #	Designator
Clock Osc.	16.384MHZ OSC. SMD	231002	IC8
Connector	DB-9F RT ANG PC MTG	210186	P2
Connector	DB-15F RT ANG PC MTG	210187	P1
Connector	32 PIN IC DIP SOCKET .600	210324	IC5 IC11
Connector	2 X 10 2MM HEADER	210356	J18
Crystal	3.579545MHZ PARALLEL	230001	Y1
Fuse	0.65A POLYFUSE	520043	F2
Fuse	1.35A POLYFUSE	520044	F1 F3
Relay	SPDT 12V MINI PC	450006	K1 K2
Transformer	10K-10K Audio Xformer	560020	T1

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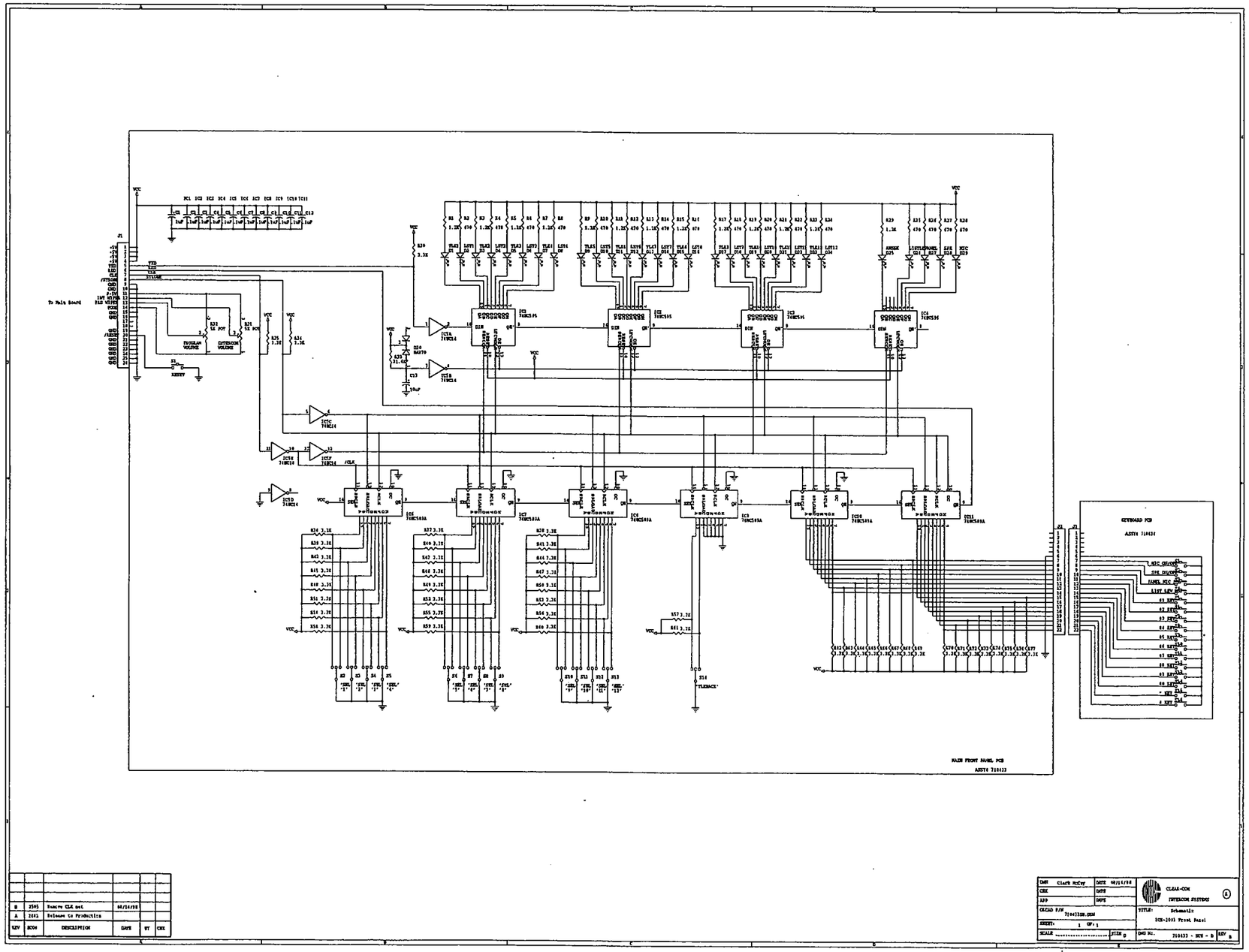


FIGURE S5-6: Schematic—ICS-2003 Front Panel PCB Rev. B

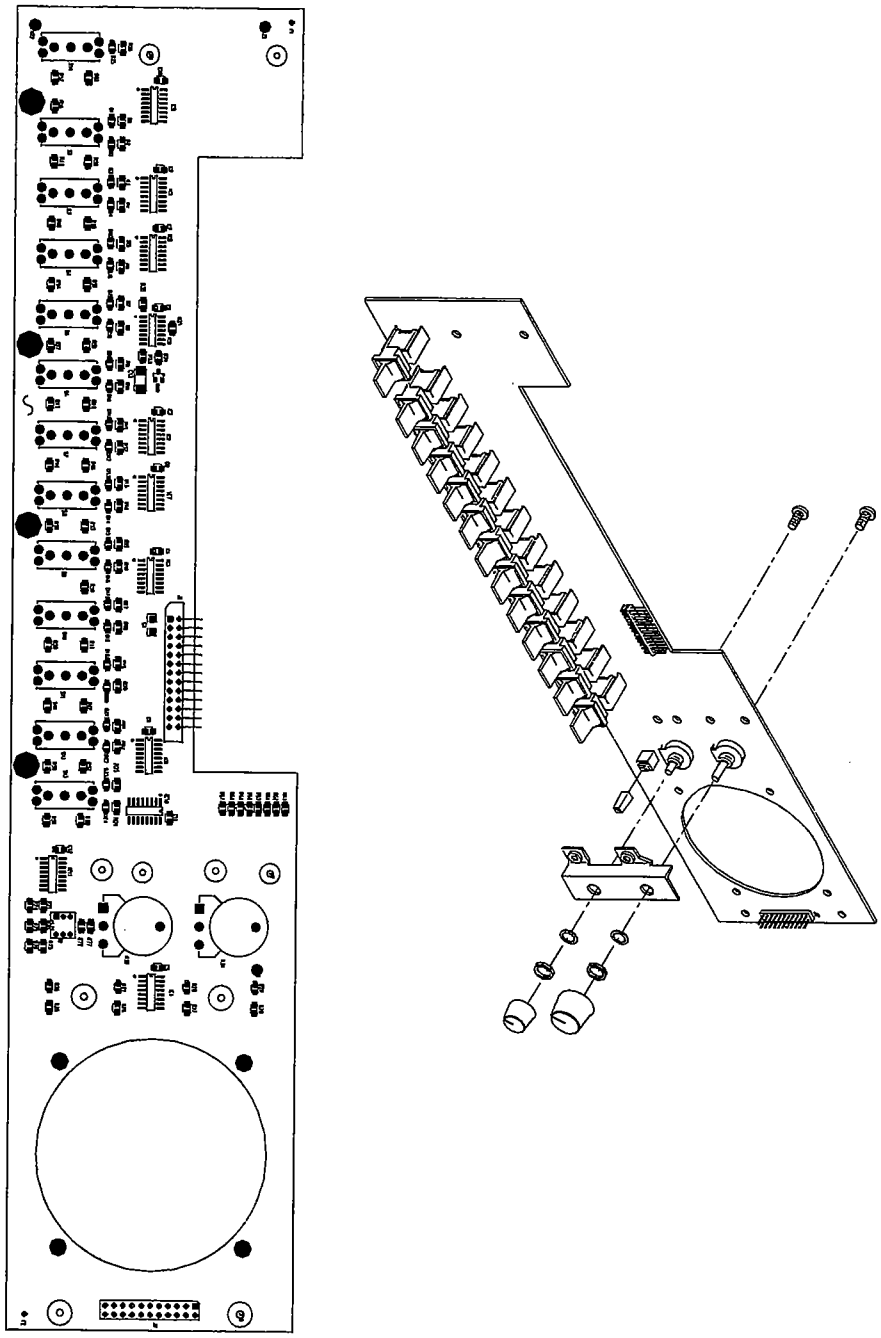


FIGURE S5-7: Assembly Drawing—ICS-2003 Front Panel PCB Rev. B

Bill of Materials for the ICS-2003/2003T Front Panel PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.1	uF	Ceramic Disc SMD	50	10%	151172	C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12
1	uF	Tantalum SMD	16	10%	151185	C1
10	uF	Tantalum SMD	25	10%	151192	C13

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
475	OHM	1/10	SMD	1%	411358	R2 R4 R6 R8 R10 R12 R14 R16 R18 R20 R22 R24 R25 R26 R27 R28
1.21K	OHM	1/10	SMD	1%	411397	R1 R3 R5 R7 R9 R11 R13 R15 R17 R19 R21 R23 R29
3.24K	OHM	1/10	SMD	1%	411438	R30 R34 R35 R36 R37 R38 R39 R40 R41 R42 R43 R44 R45 R46 R47 R48 R49 R50 R51 R52 R53 R54 R55 R56 R57 R58 R59 R60 R61 R62 R63 R64 R65 R66 R67 R68 R69 R70 R71 R72 R73 R74 R75 R76 R77
31.6K	OHM	1/10	SMD	1%	411533	R33

Diodes and Transistors

Device	Description	Part #	Designator
Diode	BAV70 Dual, Com. Cath. SOT23	481019	D30
LED	Red 5ma LED SMD 0805	391001	D1 D3 D5 D7 D9 D11 D13 D15 D17 D19 D21 D23 D25

LED	Green 5ma SMD 0805	391002	D2 D4 D6 D8 D10 D12 D14 D16 D18 D20 D22 D24 D26 D27 D28 D29

Integrated Circuits

Device	Description	Part #	Designator
Logic IC	74HC14 Hex Schmitt Trig S0IC16	481052	IC5
Logic IC	74HC589 Par IN/SER Out SMD	481054	IC6 IC7 IC8 IC9 IC10 C11
Logic IC	74HC595 SerIN/PAROut SMD	481036	IC1 IC2 IC3 IC4

Miscellaneous

Device	Description	Part #	Designator
Knob	Grey Insert .61 Dia.	240076	R32
Knob	Grey Insert .45 Dia.	240077	R31
Pot	5K	470081	R32
Pot	5K	470082	R31
Switch	SP3T MOM-OFF-MOM PC Mtg	510080	S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14
Switch	DPDT Mom. Push-button Switch	510102	S1

Miscellaneous Keyboard Parts

Device	Description	Part #	Designator
Connector	11 Pos Dual Row Socket	210362	J1
Keycap	SET OF 12, Keyboard	240071	
Keycap	SET OF 4, Keyboard	240072	
Switch	Push-button, Keyboard	510082	S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 S16

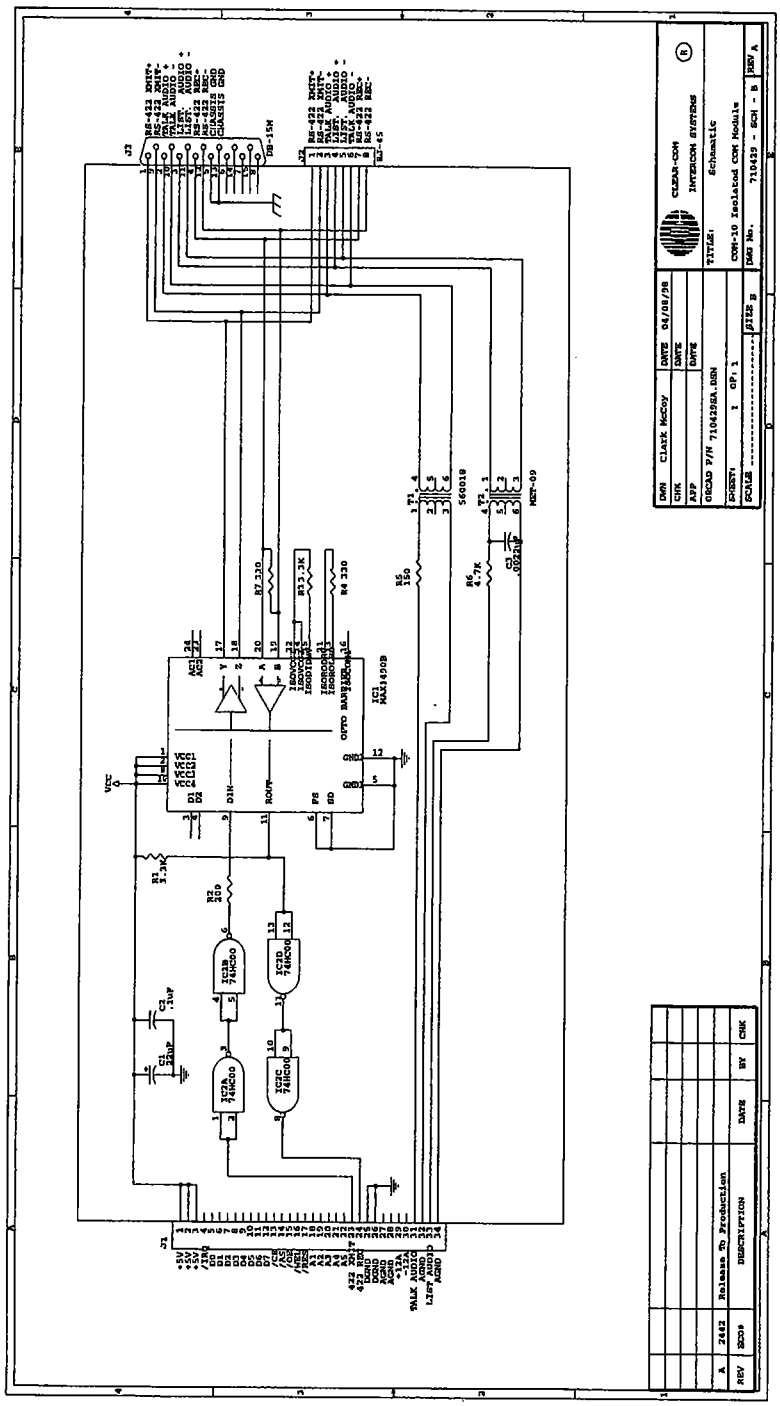


FIGURE S5-8: COM-10 Communications Module Schematic Rev. A

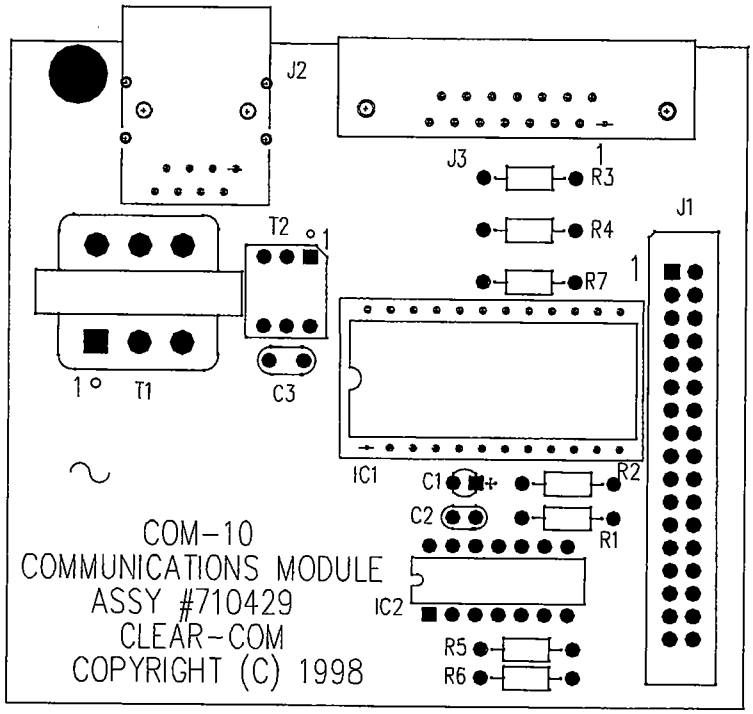


FIGURE S5-9: Assembly Drawing - COM-10 Communications Module Rev. A

Bill of Materials for the ICS-2003/ICS-2003T COM-10 PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
22	uF	Tantalum	16		150032	C1
.1	uF	Monolithic	50	10%	150035	C2
.0022	uF	Mylar	100	5%	150045	C3

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
150	OHM	1/4	Carbon Film	5%	410006	R5
200	OHM	1/4	Carbon Film	5%	410072	R2
330	OHM	1/4	Carbon Film	5%	410061	R4
4.7K	OHM	1/4	Carbon Film	5%	410013	R6
3.3K	OHM	1/4	Carbon Film	5%	410015	R3 R1

Integrated Circuits

Device	Description	Part #	Designator
Interface IC	1490B Isolated RS422 Interface	480242	IC1
Logic IC	74HC00 Quad NAND	480157	IC2

Miscellaneous

Device	Description	Part #	Designator
Connector	DB-15M Rt Ang PC Mtg	210188	J3
Connector	RJ-45 Rt Ang	210335	J2
Transformer	600CT/600CT	560018	T1
Transformer	10K:10K	560034	T2

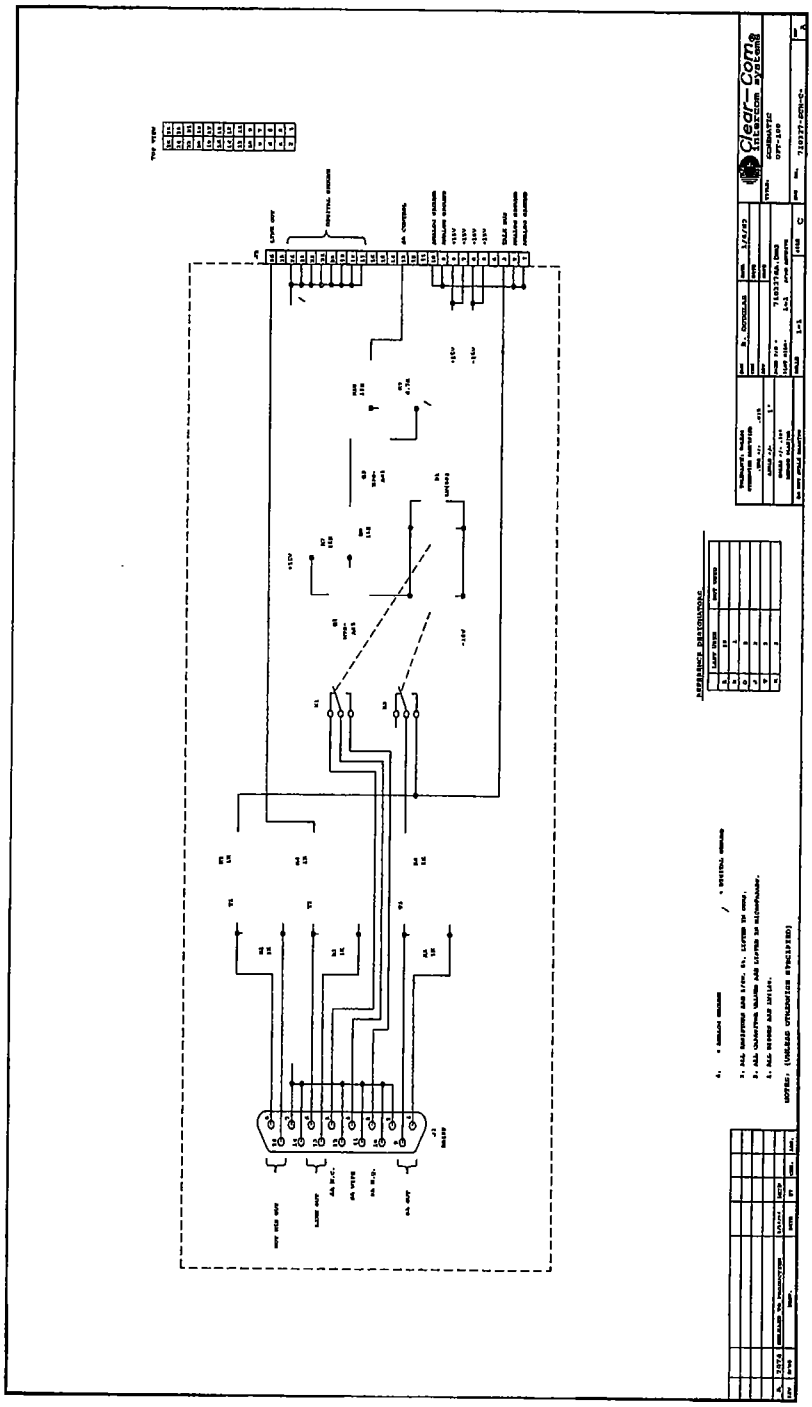


FIGURE S5-10: Schematic—OPT-100 (Aux Audio Option) Rev. A

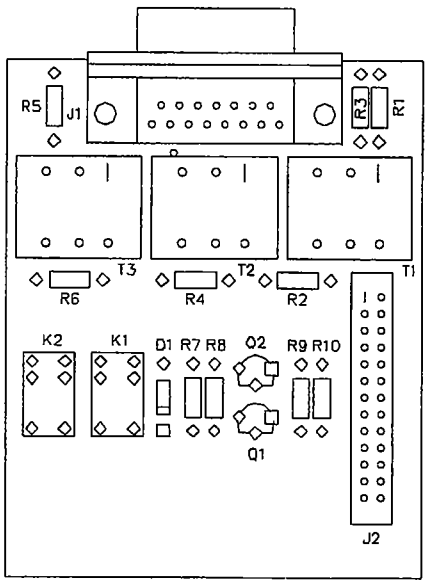


FIGURE S5-11: Assembly Drawing—OPT-100 Module
Rev. A

Bill of Materials for the OPT-100 PCB

Resistors & Resistor Packs

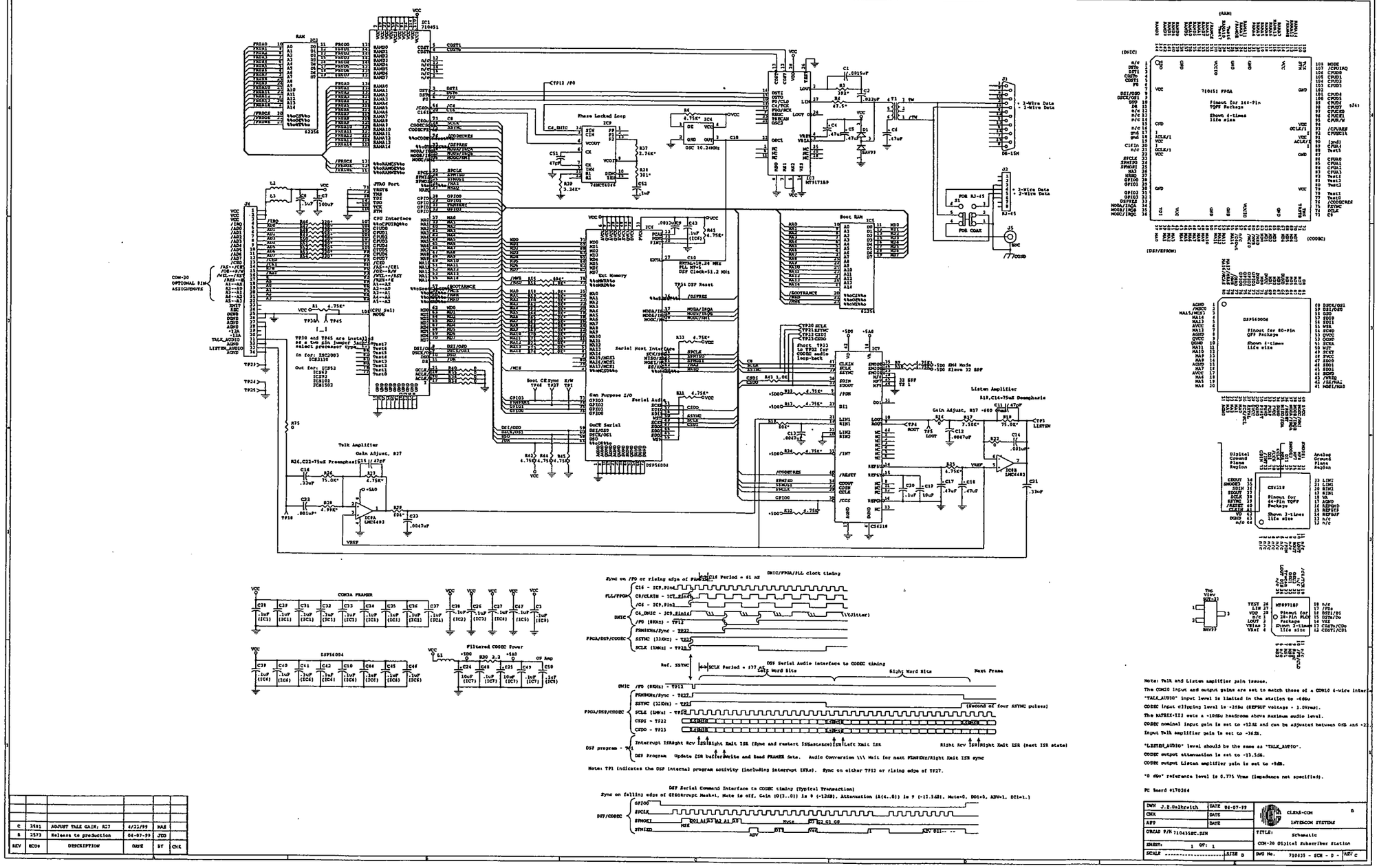
Value		Power	Type	Tol.	Part #	Designator
1K	OHM	1/4	Carbon Film	5%	410010	R1 R2 R3 R4 R5 R6
4.7K	OHM	1/4	Carbon Film	5%	410013	R9
15K	OHM	1/4	Carbon Film	5%	410017	R7 R8 R10

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4001 RECT 1A 50PIV	480001	D1
Transistor	MPS-A05 NPN 60V	480052	Q2
Transistor	MPS-A55 PNP 60V	480050	Q1

Miscellaneous

Device	Description	Part #	Designator
Connector	db-15fRT ANG PC MTG	210187	J1
Relay	SPDT 24V MINI PC RELAY	450004	K1 K2
Transformer	AUDIO, 600CT/600CT	560018	



REV	ECO#	DESCRIPTION	DATE	BY	CHK
C	3691	ADJUST TALK GAIN; R27	4/22/99	MAS	
B	2573	Release to production	04-07-99	JTD	

FIGURE S5-12: Schematic—COM-20 Communication PCB Rev. C

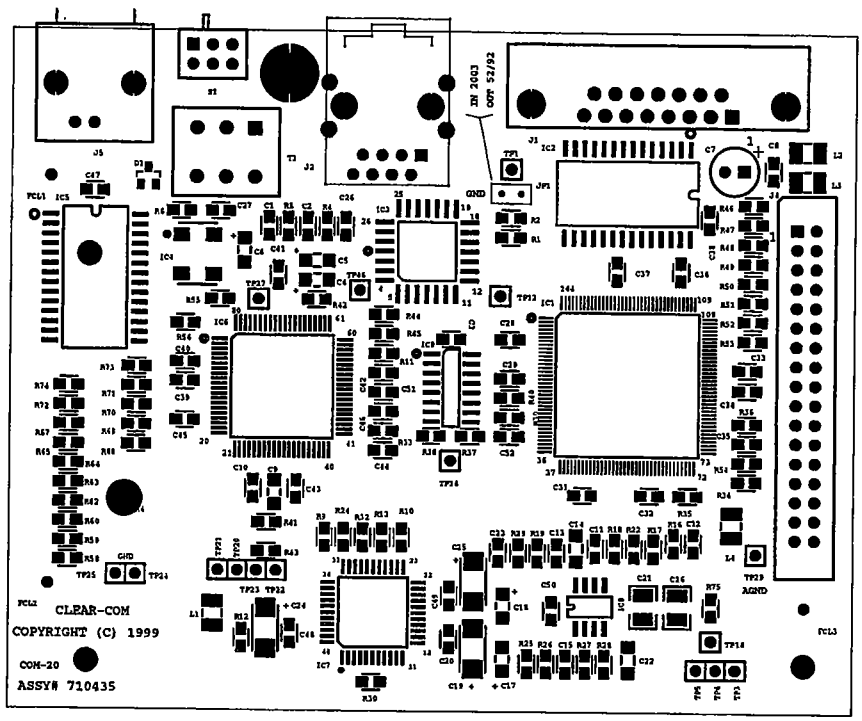


FIGURE S5-13: Assembly Drawing—COM-20 Communication PCB Rev. C

Bill of Materials for COM-20 Communication PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.001	uF	Ceramic Disc SMD	50V	1%	151001	C14 C22
.00	33	Ceramic Disc SMD	50V	5%	151002	C9
47	pF	Ceramic Disc SMD	50V	5%	151120	C11 C15 C51
.0015	uF	Ceramic Disc SMD	50V	5%	151138	C1
.0047	uF	Ceramic Disc SMD	50V	10%	151156	C12 C13 C23
.022	uF	Ceramic Disc SMD	50V	10%	151164	C2
.1	uF	Ceramic Disc SMD	50V	10%	151172	C3 C8 C10 C20 C26 C27 C28 C29 C31 C32 C33 C34 C35 C36 C37 C38 C39 C40 C41 C42 C43 C44 C45 C46 C47 C48 C49 C50 C52

.33	uF	Ceramic Disc SMD	25V	10%	151178	C16 C21
.47	uF	Tantalum SMD	35V	10%	151184	C4 C5 C6 C17 C18
10	uF	Tantalum SMD	25V	10%	151192	C19 C24 C25
100	uF	Aluminum	16V	20%	150155	C7

Resistors

Value		Power	Type	Tol.	Part #	Designator
0	OHM	1/10	SMD		411100	R16 R22 R34 R35 R36 R40 R75
2.2	OHM	1/10	SMD	5%	411181	R30
47.5	OHM	1/10	SMD	1%	411262	R4
221	OHM	1/10	SMD	1%	411326	R46 R47 R48 R49 R50 R51 R52 R53 R54
301	OHM	1/10	SMD	1%	411339	R38
392	OHM	1/10	SMD	1%	411350	R3
604	OHM	1/10	SMD	1%	411368	R29 R19 R55
1.00K	OHM	1/10	SMD	1%	411389	R43 56 R58 R59 R60 R62 R63R64 R65 R67 R68 R70 R71 R72R73 R74 R69
2.74K	OHM	1/10	SMD	1%	411431	R37
3.24K	OHM	1/10	SMD	1%	411438	R39
4.75K	OHM	1/10	SMD	1%	411454	R1 R6 R9 R10 R11 R12 R13 R24 R25 R32
4.75K	OHM	1/10	SMD	1%	411454	R33 R41 R42 R44 R45 R27
4.99K	OHM	1/10	SMD	1%	411456	R28
7.50K	OHM	1/IO	SMD	1%	411473	R17
75.0K	OHM	1/10	SMD	1%	411569	R26 R18

Diodes and Transistors

Device	Description	Part #	Designator
Diode	BAV99 DUAL DIODE... SMD	481033	D1

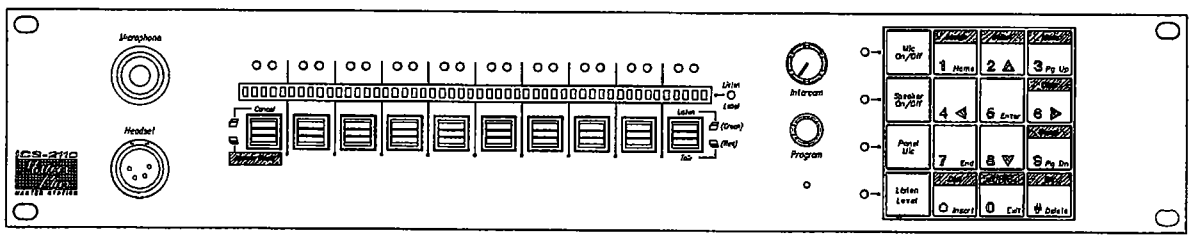
Integrated Circuits

Device	Description	Part #	Designator
62256	CMOS SRAM 32K X 8	481047	IC2 IC5
6482	DUAL CMOS OPAMP RAIL/RAIL	481022	IC8
0.24MHZ	CRYSTAL CLOCK OSCILLATOR	231004	IC4
4218	16-BIT 2 CHANNEL CODEC	481041	IC7
74HCT4046A	CMOS PHASE LOCK LOOP...SOIC16	481045	IC9

MT9171AP	DIGITAL NETWORK INT.	481046	IC3
56004	24-BIT DSP 40MHZ	481071	IC6
IFPGA	DNIC FRAMER, COM 20	710451	IC1

Miscellaneous

Device	Description	Part #	Designator
Connector	JUMP JAX	210103	JP1
Connector	HEADER MULTI PIN HEADER((PER)PIN)	210112	JP1(2)
Connector	15 PIN (M) RT ANG PC MTG D TYPE CON	210188	J1
Connector	DUAL ROW HEADER 17 POS. .230IN	210279	J4
Connector	RJ-45 RT ANG MOD CON 1-PORT SHIELDED	210335	J2
Connector	BNC RT ANGLE PC MNT W/THREAD BUSH	210354	J5
Inductor	FERRITE EMI SUPPRESSOR 400MA	181001	L1 L2 L3
Switch	DPDT MICRO-SUBMINIATURE SWITCH	510124	S1
Transformer	2745B 2:1 PULSE TRANSFORMER	560023	T1



Matrix Plus 3 System

ICS-2110/2110T

MASTER INTERCOM STATIONS

Introduction

This section provides station microprocessor resetting instructions, troubleshooting guidelines, schematics, assembly drawings, and components lists. For operation information, see the *Matrix Plus 3 Operation Manual;* for installation information, see the *Matrix Plus 3 Installation Manual;* and for programming information, see the *PGM-WIN System Configuration Manual.*

Station Reset

The station's microprocessor has a reset button located in an unmarked hole just below the green "Mic On" LED on the left side of the unit's front panel. If the station is acting erratically, try resetting it by:

1. inserting a small screwdriver or a stiff piece of wire (such as a bent paper clip) into the hole and pushing the reset button

or

2. unplugging the station from AC power and reconnecting.

Troubleshooting

When experiencing the symptoms listed below, attempt the following solutions in the order outlined. The solutions are listed in order of difficulty with the first being the most simple and easy. For troubleshooting guidelines for the entire system, see the "Overview" chapter of this manual.

- **The station's display and all front-panel indicators fail to light.**

1. Check mains AC power into the station.
2. Ensure the external power supply is properly connected to the station.
3. Replace the station.

- **The display shows unexpected characters.**

1. Power the station off and turn it back on.

2. Reset the station's matrix card in the matrix frame.
3. Replace the station.

- **The LED indicator above a selector does not light when the selector is pressed.**

1. Ensure the selector has a label assigned to it (the LED indicator will not light without an assigned label).
2. Reset the station.
3. Replace the station.

- **Keypad button functions do not operate, or the station beeps when a button is pressed (affected buttons could include "Assign," "Station," "Dial," "Menu," and "Swap").**

1. Ensure the function has not been inhibited from the configuration program of the station's local Configuration menu.
2. Reset the station.
3. Replace the station.

- **The station appears to activate talk paths, but other stations can't hear the station operator.**

1. Check "Mic On/Off" and "Panel Mic" buttons to ensure the intended microphone is selected and on.
2. If the correct microphone is turned on, ensure the station audio has not been muted externally through the logic inputs.
3. Make sure the station has not been defined as a nearby station.
4. Enable eavesdropping on the station.
5. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
6. Reset the station.
7. Replace the station.

- **The station is inoperative and all red LEDs flash slowly.**

1. Wait 60 sec. If the matrix frame has just been powered up, it is possible it is still downloading the configuration to the Matrix cards.

2. Ensure the cable connecting the station to the matrix is plugged in at both ends.
3. Check the integrity of the data paths, especially the polarity for stations using a COM-10 communication module.
4. Check the configuration program to ensure the station has been assigned the correct port type.
5. Confirm the matrix card type matches the station. Stations with COM-10 communication modules should have an MTX-A8 or MVX-A8. Stations with COM-20 communication modules should have an MTX-D8 or MVX-D8.
6. Reset the station's matrix card in the Matrix frame.
7. Replace the station's matrix card in the Matrix frame.
8. Reset the station.
9. Replace the station.

- **No audio from the station's speaker.**

1. Ensure the "Intercom" knob on the station's front panel is turned up.
2. Ensure the "Speaker On/Off" button is on.
3. Check whether audio can be heard in a headphone.
4. Check the configuration program and the station's logic inputs to ensure the speaker has not been software disabled.
5. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
6. Reset the station's Matrix card in the Matrix frame.
7. Replace the station's Matrix card in the Matrix frame.
8. Reset the station.
9. Replace the station.

- **The operator cannot hear another station's page or call signal tones.**

1. Adjust the "Page Volume" control of the station using the configuration program (refer to the *PGM-WIN System Configuration Manual*).

2. Check the station's configuration to see if page override is enabled.

- **Announce tones (eavesdropping indication, change tones, etc.) aren't heard at the station.**

1. Check the station's Configuration menu to see if the monitoring tones and change tones are enabled.

- **No speaker audio from the external program feed.**

1. Check the Program knob on the station's front panel.
2. Check the program source.
3. Reset the station.
4. Replace the station.

- **The headphone isn't receiving audio from the external program feed.**

1. If the external program feed is audible in the speaker, check the station's configuration program to ensure the program was not disabled for the second earphone feed.
2. Replace the station.

- **Accessory panels do not function.**

1. Check the accessory panel's connection on the station's rear panel.
2. Ensure the external AC power transformers are correctly connected to the accessory panels.
3. Check the configuration program to ensure the correct number of selectors are configured.

Schematics

See the ICS-2003 section of this manual for all schematics except for the front panel schematics (see Figure S6-1 on page S6-5 and Figure S6-2 on page S6-6).

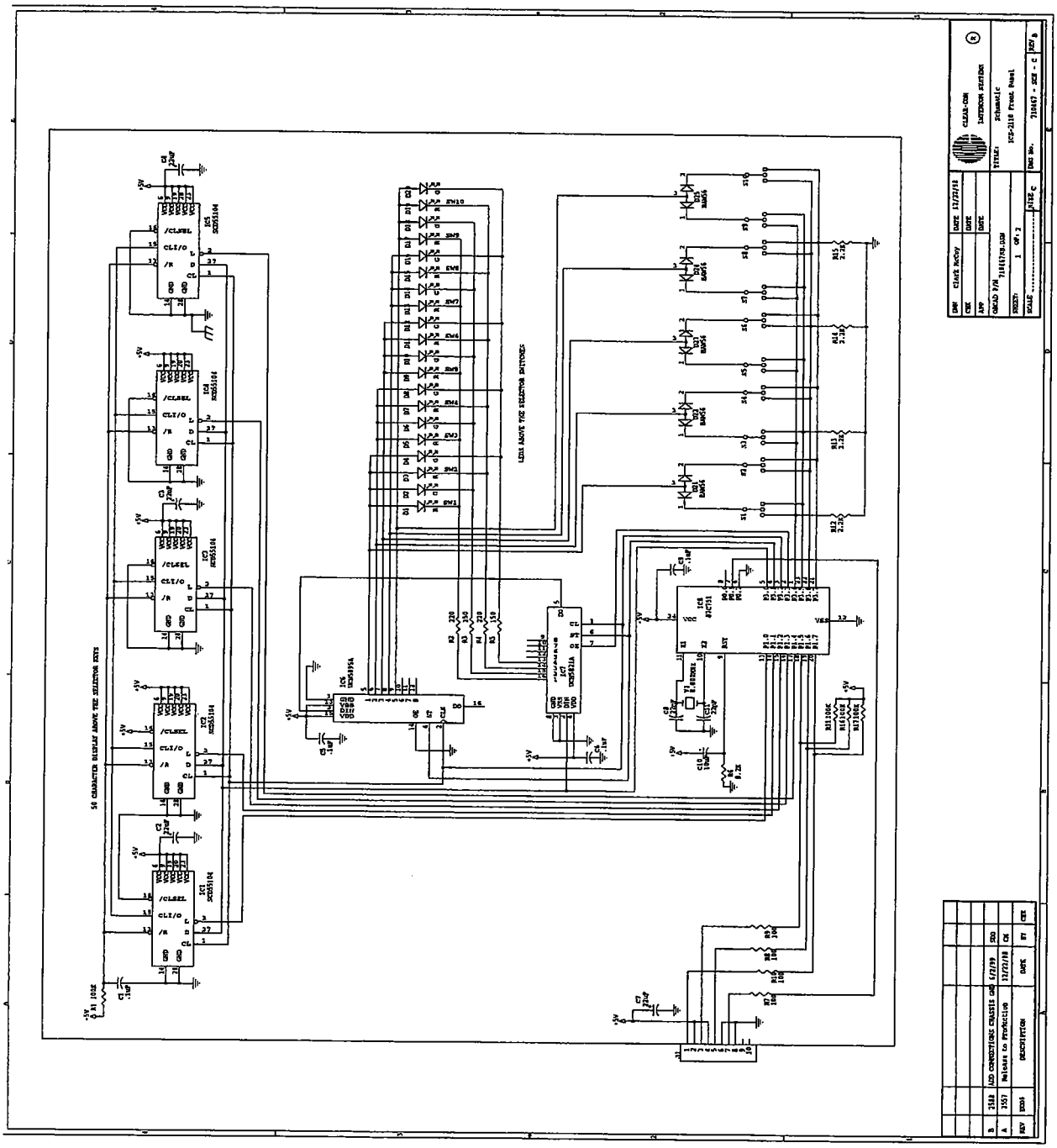


FIGURE S6-1: Front Panel Schematic, page 1 of 2

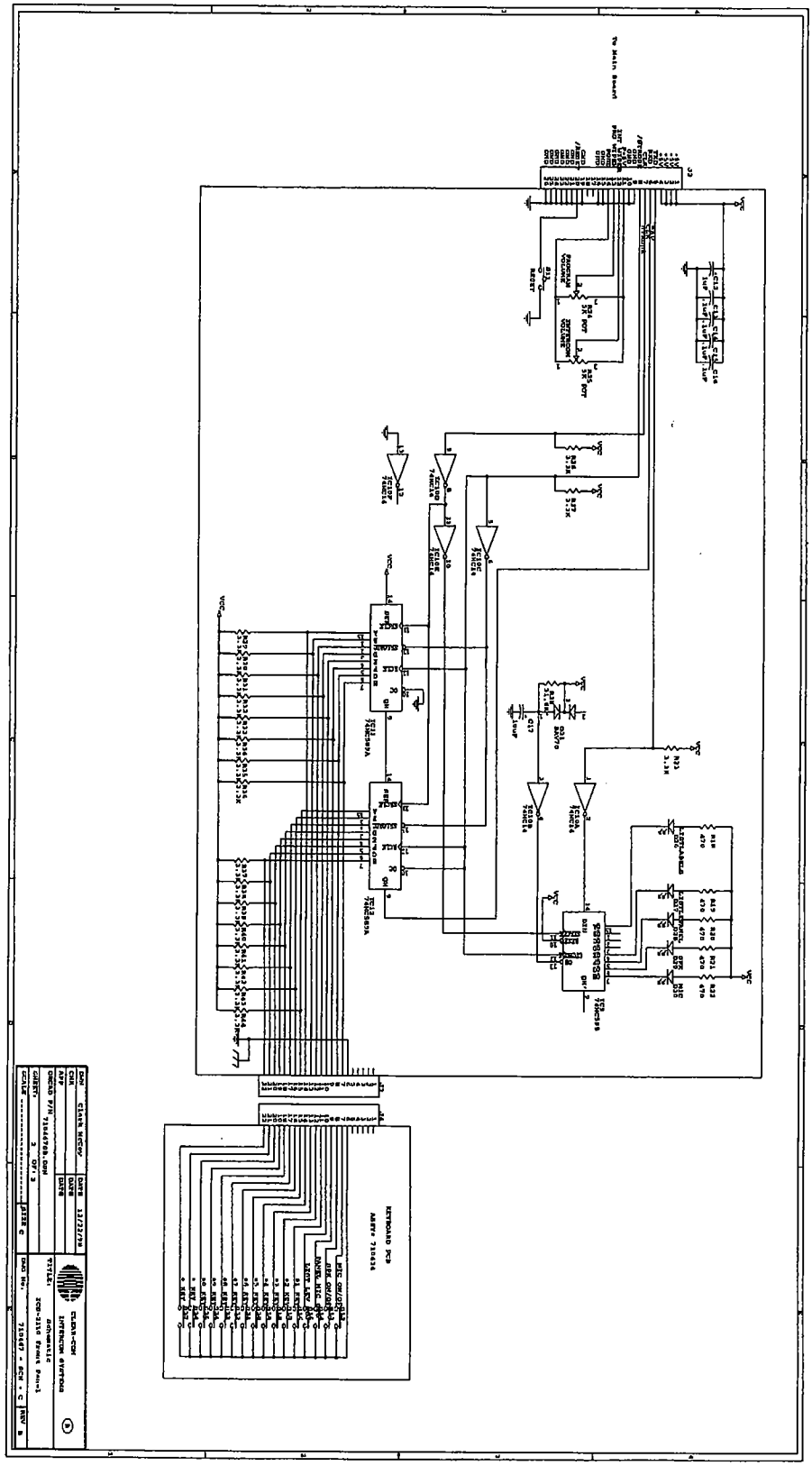


FIGURE S6-2: Front Panel Schematic, page 2 of 2

Assembly Drawings

See the ICS-2003 section of this manual for all assembly drawings except for the front panel assembly drawing, Figure S6-3 on page S6-7.

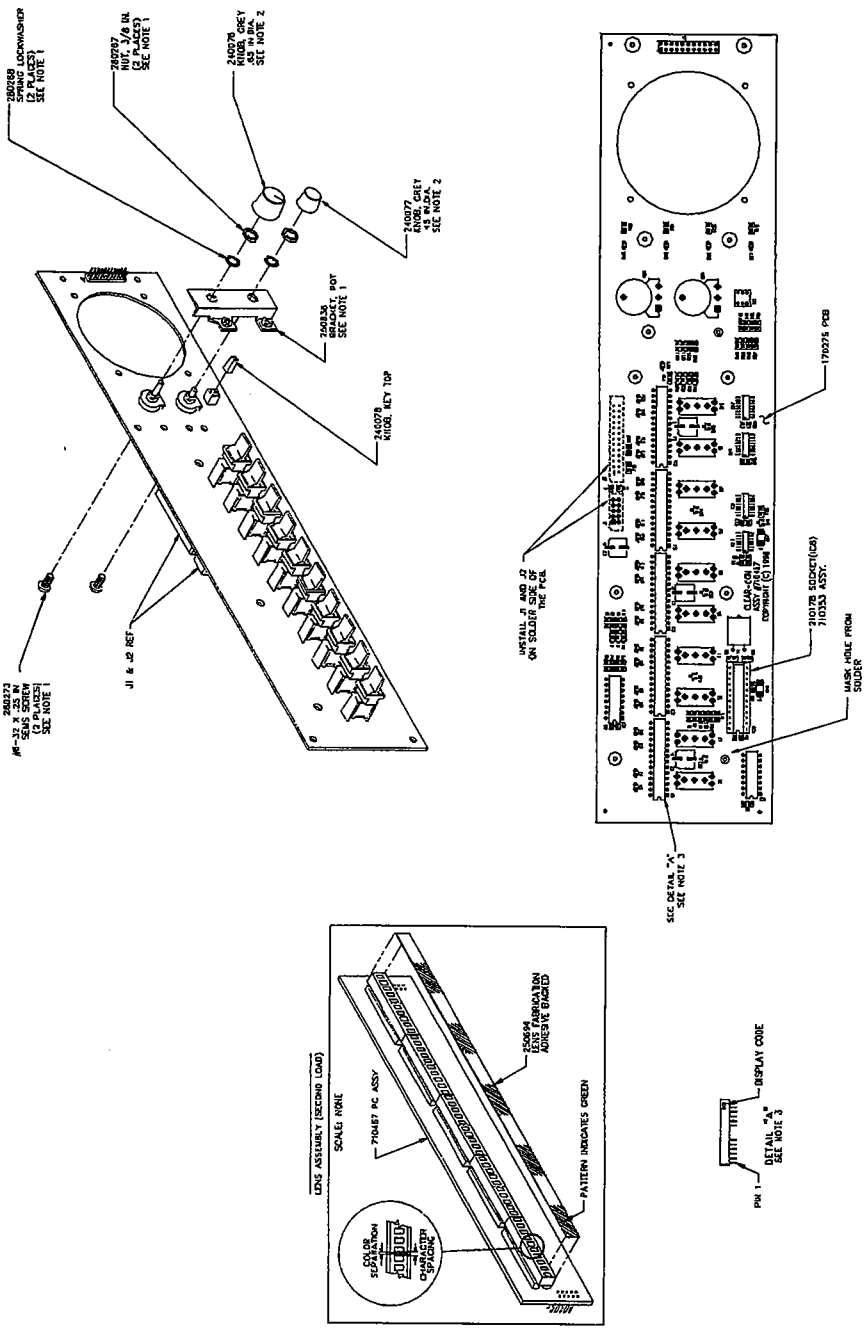


FIGURE S6-3: Front Panel Assembly Drawing

Bill of Materials

See the ICS-2003 section of this manual for all bill of materials except for the front panel bill of materials.

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
22	pF	Ceramic Disc SMD	50V	5%	151116	C8 C11
.1	uF	Ceramic Disc SMD	50V	10%	151172	C1 C5 C6 C9 C13 C14 C15 C16
1	uF	Tantalum SMD	16V	10%	151185	C12
10	uF	Tantalum SMD	25V	10%	151192	C10 C17
22	uF	Aluminum SMD	50V	20%	151200	C2 C3 C4 C7

Resistors

Value		Power	Type	Tol.	Part #	Designator
100	OHM	1/10	SMD	1%	411293	R7 R8 R9 R10
150	OHM	1/10	SMD	1%	411310	R3 R5
221	OHM	1/10	SMD	1%	411326	R2 R4
475	OHM	1/10	SMD	1%	411358	R18 R19 R20 R21 R22
2.21K	OHM	1/10	SMD	1%	411422	R12 R13 R14 R15
3.32K	OHM	1/10	SMD	1%	411439	R23 R26 R27 R29 R30 R31 R32 R33 R34 R35 R36 R37 R38 R39 R40 R41 R42 R43 R44
8.25K	OHM	1/10	SMD	1%	411477	R6
31.6K	OHM	1/10	SMD	1%	411533	R28
100K	OHM	1/10	SMD	1%	411581	R1 R11 R16 R17

Diodes and Transistors

Device	Description	Part #	Designator
Diode	DUAL, COM CATH, BAV70 SMD	481019	D31
Diode	DUAL, COM ANOD, BAW56 SMD	481020	D21 D22 D23 D24 D25

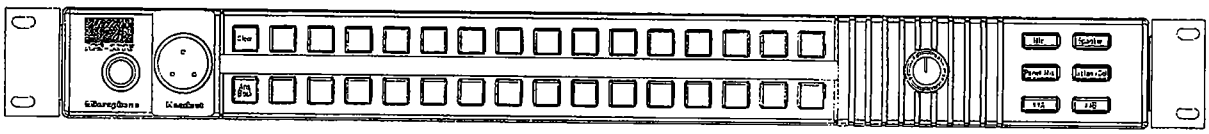
Integrated Circuits

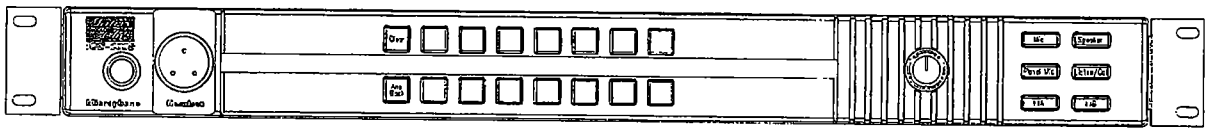
Device	Description	Part #	Designator
IC	74HC14 HEX SCHMITT TRIG INVERT	481052	IC10
IC	74HC589 PAR.IN/SER.OUT LATCH	481054	IC11 IC12

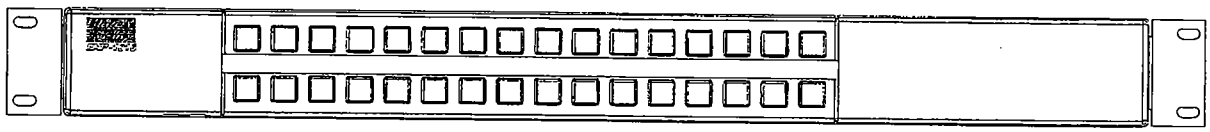
IC	74HC595 SER.IN/PAR.OUT LATCH	481036	IC9
IC	MICRO P, FRONT PANEL CONTROL	710353	IC8
IC	SCD55104 LED DISPLAY	390050	IC1 IC2 IC3 IC4 IC5
IC	UCN5895 8 BIT SHFT REG PULL UP	480210	IC6
IC	UCN5821A SHIFT REG SINK	480164	IC7

Miscellaneous

Device	Description	Part #	Designator
Crystal	8.000MHz PARALLEL CRYSTAL	230003	Y1
Knob	KNOB .61 DIA	240076	R24
Knob	KNOB .45 DIA	240077	R25
LED	LED SMD 0805 RED SMD	391001	D1 IC
Socket	28 PIN ELEVATED DIP SOCKET	210364	IC1 IC2 IC3 IC4 IC5
Switch	SP3T MOM-OFF-MOM PC MTG	510080	S1 S2 S3 S4 S5 S6 S7 S8 S9 10
Switch	DPDT MOM.	510102	S11







Matrix Plus 3 System ICS-1016/ICS-1008/EXP-1016

MASTER INTERCOM STATIONS

Introduction

This section provides station microprocessor resetting instructions, troubleshooting guidelines, assembly drawings, schematics, and component lists.

Station Reset

If the station is acting erratically, try resetting it by unplugging the station from AC power and reconnecting or by simultaneously pressing the "Mic," "Speaker," and up and down arrow buttons.

Troubleshooting

When experiencing the symptoms listed below, attempt the following solutions in the order outlined. The solutions are listed in order of difficulty with the first being the most simple and easy. For troubleshooting guidelines for the entire system, see the "Overview" chapter of this manual.

- **The station's front-panel indicators fail to light.**

1. Check mains AC power into the station.
2. Ensure the external power supply is properly connected to the station.
3. Replace the station.

- **The LED behind the talk/listen button does not light when the key is pressed.**

1. Ensure the button has a label assigned to it (the LED indicator will not light without an assigned label).
2. Reset the station.
3. Replace the station.

- **The station appears to activate talk paths, but other stations can't hear the station operator.**

1. Check "Mic On/Off" and "Panel Mic" buttons to ensure the intended microphone is selected and on.
2. If the correct microphone is turned on, ensure the station audio has not been muted externally through the logic inputs.
3. Make sure the station has not been defined as a nearby station.

4. Enable eavesdropping on the station.
5. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
6. Reset the station.
7. Replace the station.

- **No audio from the station's speaker.**

1. Ensure the "Intercom" knob on the station's front panel is turned up.
2. Ensure the "Speaker" button is on.
3. Check whether audio can be heard in a headphone.
4. Test the integrity of the station's audio path by temporarily setting a forced listen to it.
5. Reset the station's matrix card in the Matrix frame.
6. Replace the station's matrix card in the Matrix frame.
7. Reset the station.
8. Replace the station.

- **The operator cannot hear another station's page.**

1. Adjust the station's rear-panel "Page" control.
2. Check the station's configuration to see if the page override inhibit is set.

- **Announce tones (call signal tones, eavesdropping indication, etc.) aren't heard at the station.**

1. Adjust the station's rear-panel "Page" control.
2. Check the station's configuration to see if page override is set.

- **Accessory panel keys do not function.**

1. Check the accessory panel's connection on the station's rear panel.
2. Check the configuration program to ensure the correct number of accessory keys has been configured.

Servicing

Figure S7-1 on page S7-3 illustrates the steps required to disassemble an ICS-1016/ICS-1008 or EXP-1016 for servicing. The disassembly steps are:

1. Remove the unit from the rack.
2. Remove both screws from each side that are holding the rack ears in place.
3. Remove the rack ears.
4. Remove the four screws holding the PCB in place.
5. Remove the three screws holding the front panel in place.

Note: Do not disconnect any wiring unless a component is to be replaced.

To reassemble an ICS-1016/ICS-1008 or EXP-1016, reverse the above steps.

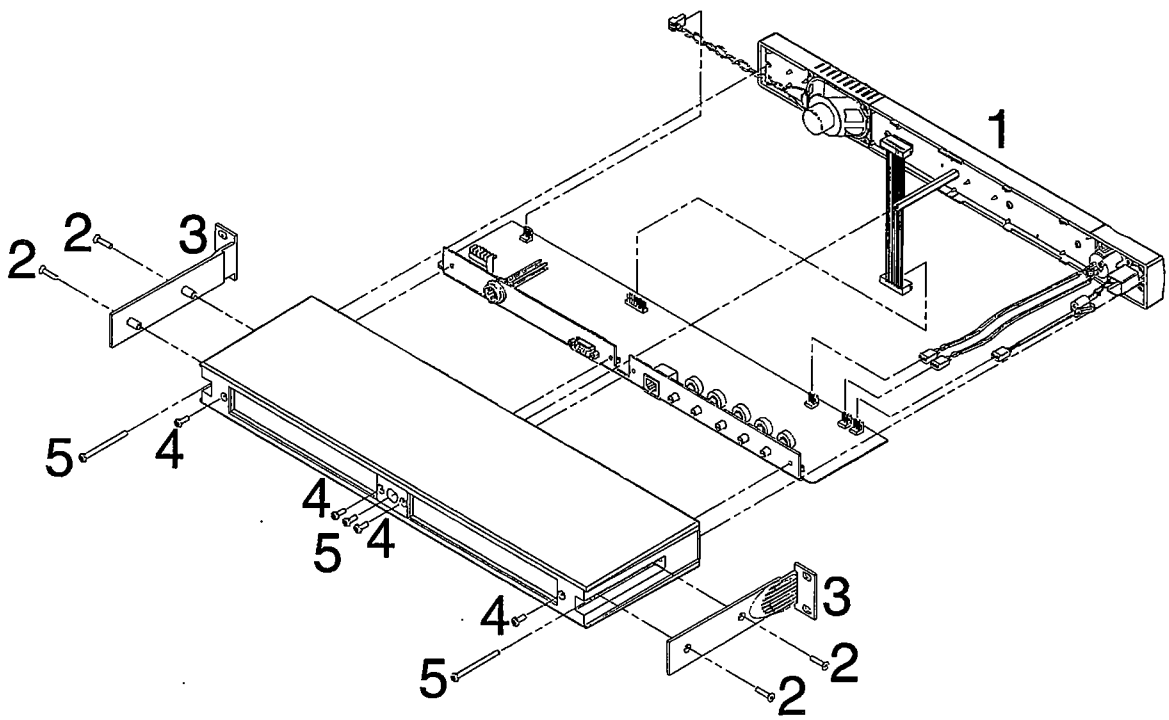


FIGURE S7-1: Station/Expansion Panel Assembly and Disassembly for Service

Bill of Materials for ICS-1016

Miscellaneous

Device	Description	Part#	Designator
Cable	Ribbon, 16 Position Dual Row	730101	
Connector	4 Pin XLR Male Flush Mount	210286	
Connector	Phone Jack, 1/4"	210050	
Cover	Designator Strip, ICS-1016	250902	
Knob	Grey Insert	240076	
Nut	M10 X .75 Spanner Panel Nut	280359	
Power Sup.	ICS-1016 Assembly	760051	
Speaker	Small Magnet	500138	

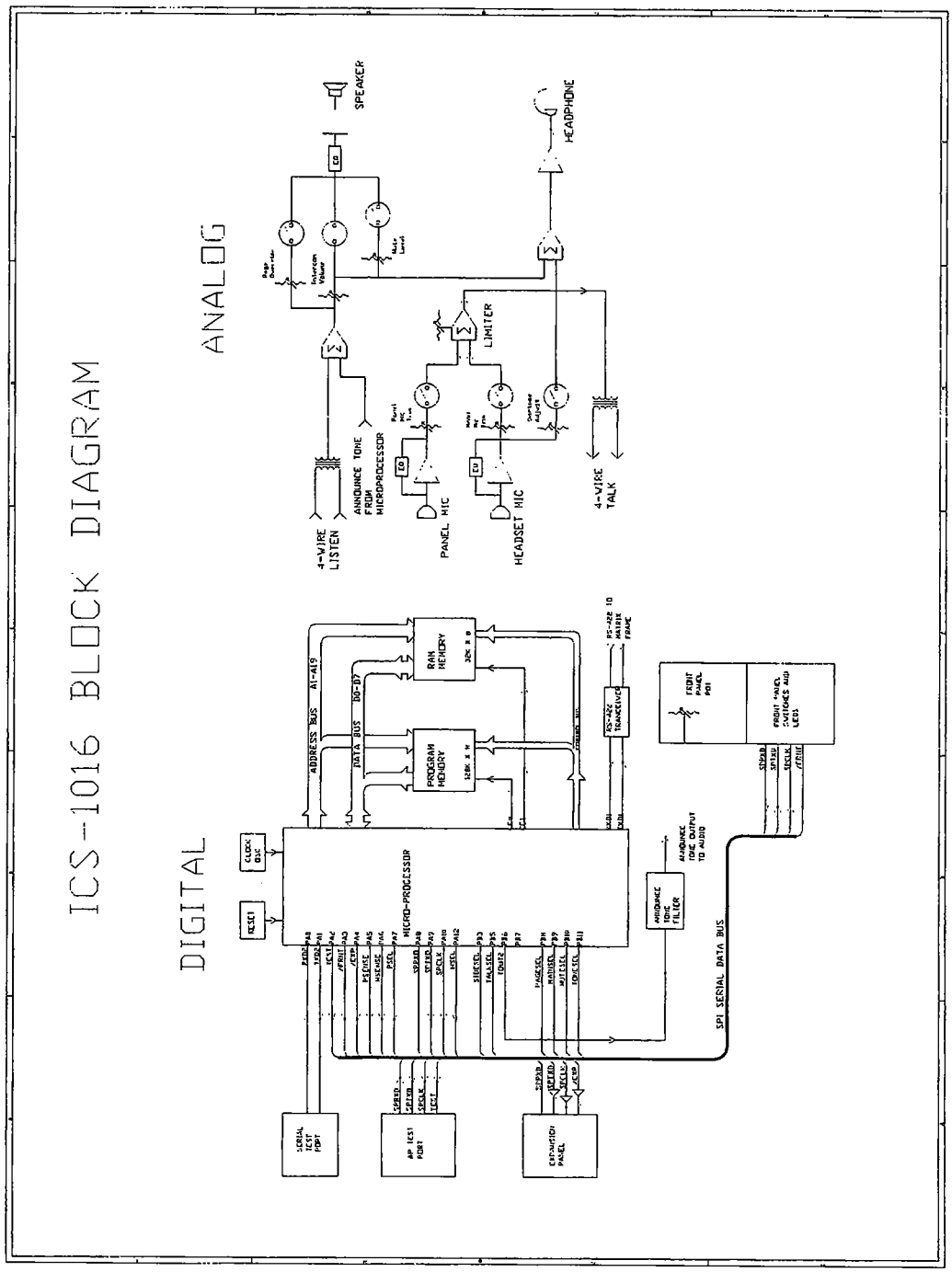


FIGURE S7-2: Block Diagrams—ICS-1016/ICS-1008 Main PCB

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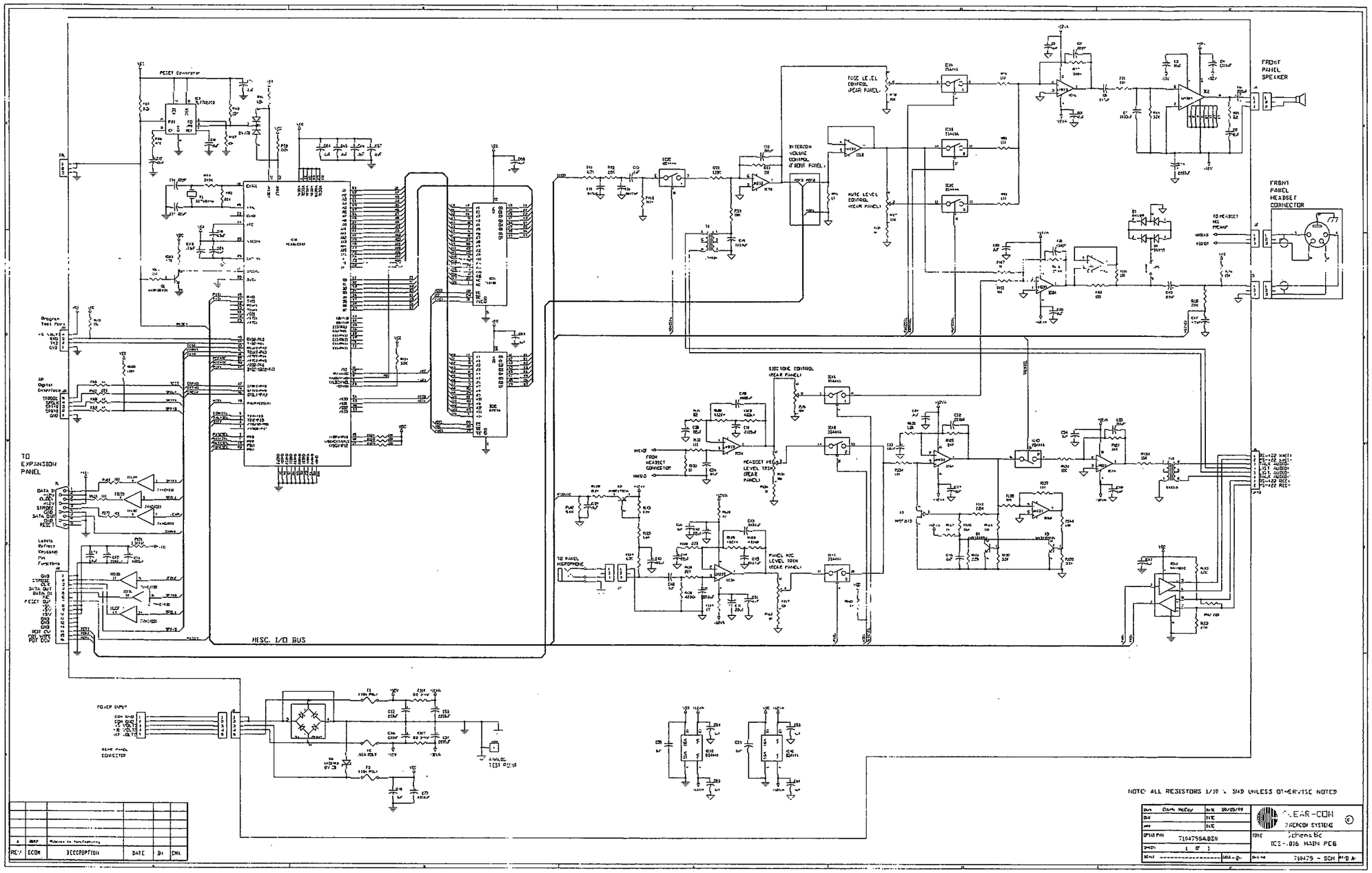


FIGURE S7-3: ICS-1016/ICS-1008 Main PCB Schematic

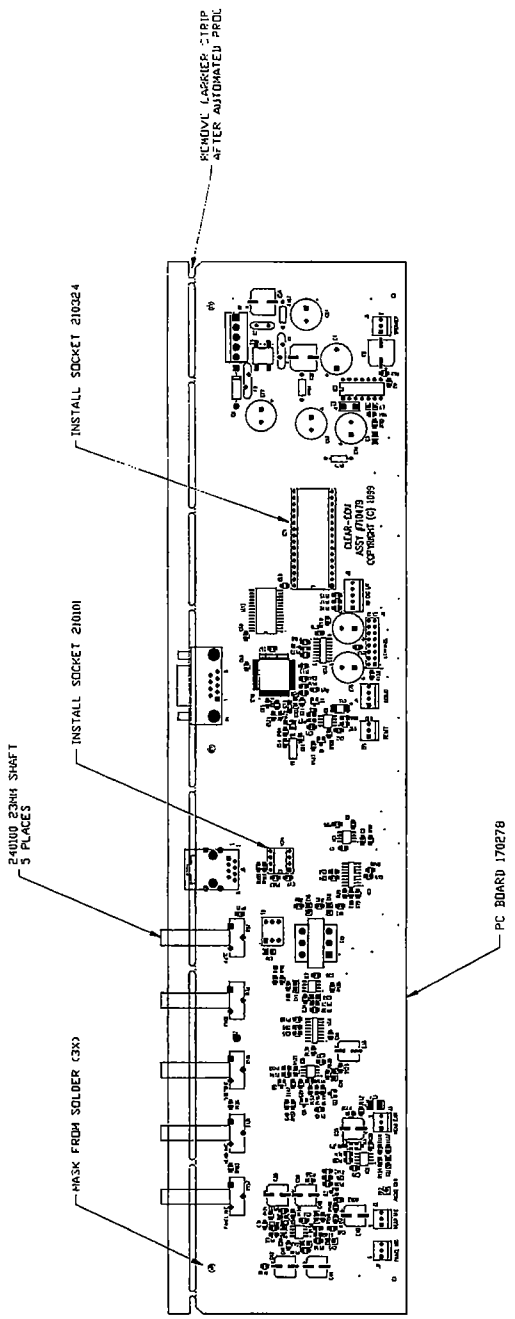


FIGURE S7-5: Assembly Drawing—ICS-1016/ICS-1008 Main PCB Rev. A

Bill of Materials for ICS-1016 Main PCB Assembly

Capacitors

Value		Type	Volts	Tol.	Part#	Designator
22	pF	Ceramic Disc SMD	50V	5%	151116	C2 C14 C17
47	pF	Ceramic Disc SMD	50V	5%	151120	C21
100	pF	Ceramic Disc SMD	50V	5%	151124	C11 C33
220	pF	Ceramic Disc SMD	50V	5%	151128	C32
.0022	uF	Ceramic Disc SMD	50V	10%	151152	C19 C28 C43 C49
.0033	uF	Ceramic Disc SMD	50V	10%	151154	C7
.0047	uF	Ceramic Disc SMD	50V	10%	151156	C16 C45
.0068	uF	Ceramic Disc SMD	50V	10%	151158	C31
.01	uF	Ceramic Disc SMD	50V	10%	151160	C36 C23
.047	uF	Ceramic Disc SMD	50V	10%	151168	C15 C5
.1	uF	Ceramic Disc SMD	50V	10%	151172	C1 C8 C9 C10 C13 C20 C24 C26 C29 C34 C37 C38 C39 C41 C46 C47 C48 C51 C54 C55 C58 C59 C60 C61 C64 C65 C66 C67 C68 C69 C70 C71 C73
.15	uF	Ceramic Disc SMD	50V	10%	151174	C18
4.7	uF	Tantalum SMD	16V	10%	151189	C27
10	uF	Tantalum SMD	25V	10%	151192	C12 C3
22	uF	Aluminum SMD	50V	20%	151200	C25 C30 C35 C42 C44 C50
100	uF	Aluminum SMD	25V	10%	151203	C40
220	uF	Aluminum SMD	25V	10%	151204	C6 C52 C56
1000	uF	Aluminum	35V		150092	C4
2200	uF	Aluminum	16V	20%	150164	C53 C57 C74 C75 C76 C77

Resistors

Value		Power	Type	Tol.	Part#	Designator
1	OHM	1/4	CF	5%	410139	R171
2.2	OHM	1/10	SMD	5%	411181	R85
8.2	OHM	1/4	CF	5%	410166	R164 R167
47.5	OHM	1/10	SMD	1%	411262	R159 R140
82.5	OHM	1/10	SMD	1%	411285	R121
100	OHM	1/10	SMD	1%	411293	R108 R111 R130 R168

						R169 R170
150	OHM	1/10	SMD	1%	411310	R135
221	OHM	1/10	SMD	1%	411326	R117 R148 R156 R161
475	OHM	1/10	SMD	1%	411358	R86 R165
1.00K	OHM	1/10	SMD	1%	411389	R96 R101 R115 R118 R119 R133 R136 R162
1.21K	OHM	1/10	SMD	1%	411397	R125 R84
1.50K	OHM	1/10	SMD	1%	411406	R114 R81
2.21K	OHM	1/10	SMD	1%	411422	R82 R88
3.32K	OHM	1/10	SMD	1%	411439	R153 R152
4.02K	OHM	1/10	SMD	1%	411447	R122 R123 R149 R150 R158
4.75K	OHM	1/10	SMD	1%	411454	R91 R103 R142 R154 R155 R163
8.25K	OHM	1/10	SMD	1%	411477	R139 R143
10.0K	OHM	1/10	SMD	1%	411485	R79 R83 R87 R89 R90 R98 R99 R107 R109 R110 R113 R124 R127 R128 R129 R132 R134 R137 R138 R144 R146 R160
15.0K	OHM	1/10	SMD	1%	411502	R106
22.1K	OHM	1/10	SMD	1%	411518	R92 R112
23.7K	OHM	1/10	SMD	1%	411521	R126
33.2K	OHM	1/10	SMD	1%	411535	R80
56.2K	OHM	1/10	SMD	1%	411557	R145
100K	OHM	1/10	SMD	1%	411581	R120
150K	OHM	1/10	SMD	1%	411598	R93 R104 R166
332K	OHM	1/10	SMD	1%	411631	R77 R94
1.0M	OHM	1/10	SMD	5%	411677	R147
2.2M	OHM	1/10	SMD	5%	411710	R151 R141
20M	OHM	1/8	SMD	5%	411775	R95

Diodes and Transistors

Device	Description	Part#	Designator
Diode	1N5340 ZENER 6.0V 5W	480243	D6
Diode	BAV70 DUAL COMMON CATHODE SMD	481019	D1
Diode	BAV99 DUAL DIODE SMD	481033	D3 D2
Diode	DF04S RECT BRIDGE 1A 400V SMD	481040	D4
Transistor	2222A NPN 40V 600MA SMD	481026	Q1 Q4 Q5
Transistor	2907A PNP 60V 600MA SMD	481027	Q2

Transistor	J175 P-CHANNEL JFET SMD	481056	Q3

Integrated Circuits

Device	Description	Part#	Designator
IC	488E RS-422 XCVR PROTECTED	480231	IC14
IC	62256 CMOS SRAM 32K X 8 SMD	481047	IC12
IC	74HC4050 CMOS HEX BUFFER SMD	481057	IC13
IC	7705 RESET SUPERVISOR IC SMD	481018	IC9
IC	833 DUAL OPAMP SMD	481023	IC1 IC5 IC6 IC7 IC8
IC	DG444 QUAD SPST CMOS ANALOG SW	481050	IC4 IC3
IC	EPROM ASSY., ICS-1016	710481	IC11
IC	LM384 POWER 4W OP AMP 14 PIN	480012	IC2

Miscellaneous

Device	Description	Part#	Designator
Connector	8 PIN DIP SOCKET	210101	IC14
Connector	9 PIN (F) RT ANG PC MTG D TYPE CON	210186	P1
Connector	32 PIN DIP SOCKET .600	210324	IC11
Connector	RJ-45 RT ANG SHIELDED	210335	J6
Crystal	32.768 KHZ XTAL	230006	Y1
Fuse	0.65A POLYFUSE	520043	F2
Fuse	1.35A POLYFUSE	520044	F3 F1
M-CNTRLR	68LC302 HCMOS 16.67MHZ SMD	481049	1C10
Shaft	FOR PT15 Trimpot	240100	R78 R97 R116 R131 R157
Transformer	600CT/600CT PAN MAGNETICS #TTC108	560018	T10
Transformer	10K:10K MINIATURE TRANSFORMER	560034	T9
Trimpot	10K PIHER PT15NB-10K	470023	R78 R97 R116 R131 R157

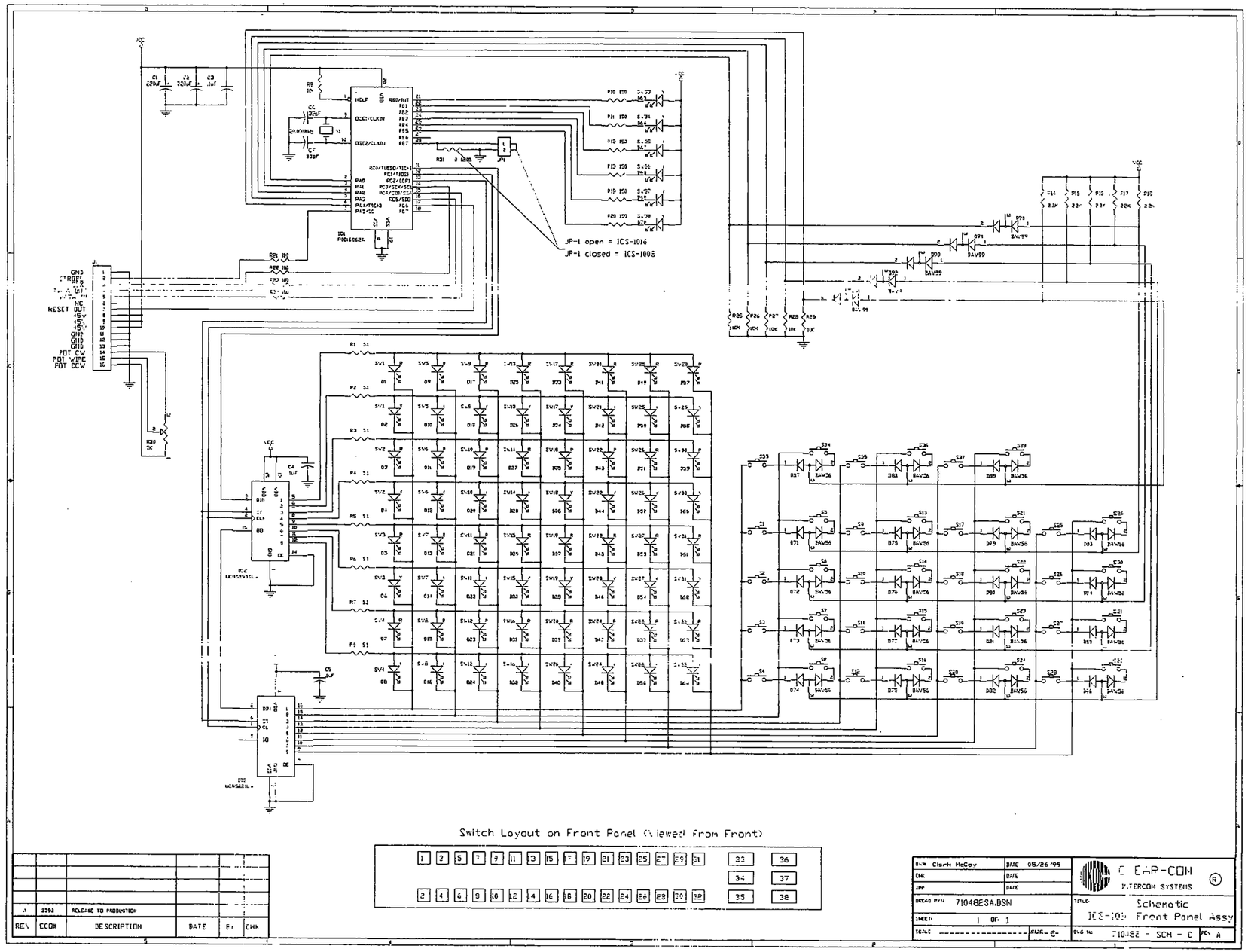


FIGURE S7-5: ICS-1016/ICS-1008/EXP-1016 Front Panel PCB Schematic

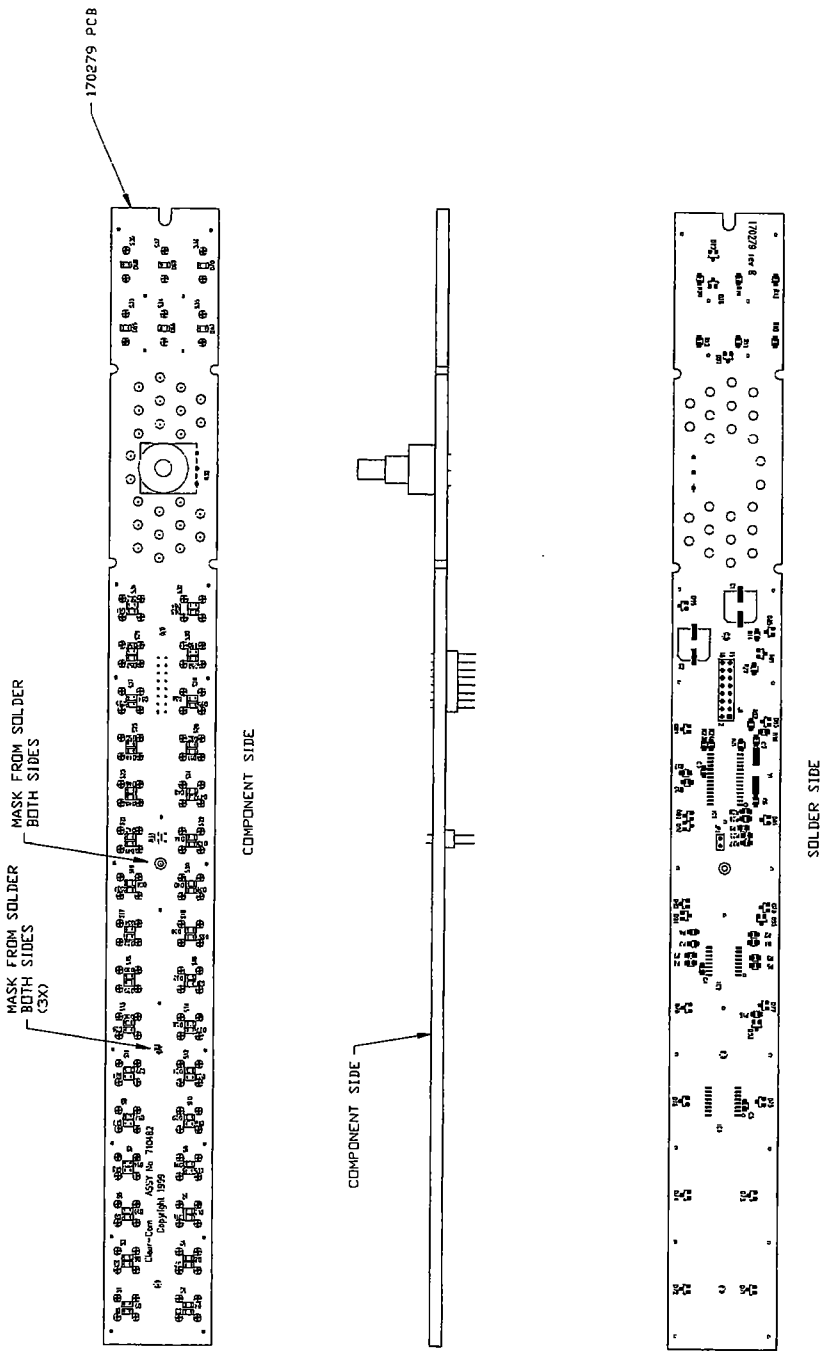


FIGURE S7-7: Assembly Drawing—ICS-1016/ICS-1008/ EXP-1016 Front Panel PCB Rev. A

Bill of Materials for ICS-1016 Front Panel PCB Assembly

Capacitors

Value		Type	Volts	Tol.	Part#	Designator
33	pF	Ceramic Disc SMD	50V	5%	151118	C6 C7
.1	uF	Ceramic Disc SMD	50V	10%	151172	C3 C4 C5
220	uF	Aluminum SMD	25V	10%	151204	C1 C2

Resistors

Value		Power	Type	Tol.	Part#	Designator
5.1	OHM	1/1O	SMD	5%	411190	R1 R2 R3 R4 R5 R6 R7 R8
100	OHM	1/10	SMD	1%	411293	R21 R22 R23 R24
150	OHM	1/10	SMD	1%	411310	R10 R11 R12 R13 R19 R20
2.21K	OHM	1/10	SMD	1%	411422	R14 R15 R16 R17 R18
10.0K	OHM	1/10	SMD	1%	411485	R9 R25 R26 R27 R28 R29

Diodes and Transistors

Device	Description	Part#	Designator
Diode	BAW56 Dual Diode Common Anode SMD	481020	D71 D72 D73 D74 D75 D76D77 D78 D79 D80 D81 D82 D83 D84 D85 D86 D87 D88D89 D90
Diode	BAV99 Dual Diode SMD	481033	D91 D92 D93 D94 D95
LED	RED SMD 0805	391001	D1 D3 D5 D7 D9 D11 D13 D15 D17 D19 D21 D23 D25 D27 D29 D31 D33 D35 D37 D39 D4 D43 D45 D47 D49 D51 D53 D55 D57 D59 D61 D63
LED	YELLOW SMD 0805	391003	D2 D4 D6 D8 D10 D12 D14 D16 D18 D20 D22 D24 D26 D28 D30 D32 D34

D36 D38 D40 D42
D44 D46 D48 D50
D52 D54 D56 D58
D60 D62 D64 D65
D66 D67 D68 D69
D70

Integrated Circuits

Device	Description	Part#	Designator
IC	5821 OCTAL LATCHED SINK DRIVER SMD	481072	IC3
IC	5895 OCTAL LATCHED SOURCE DRIVER SMD	481073	IC2

Miscellaneous

Device	Description	Part#	Designator
Crystal	20.000MHZ Parallel SMD	231005	Y1
Pot	5K	470081	R30
Microprocessor	Microchip PIC16C62A	710483	IC1

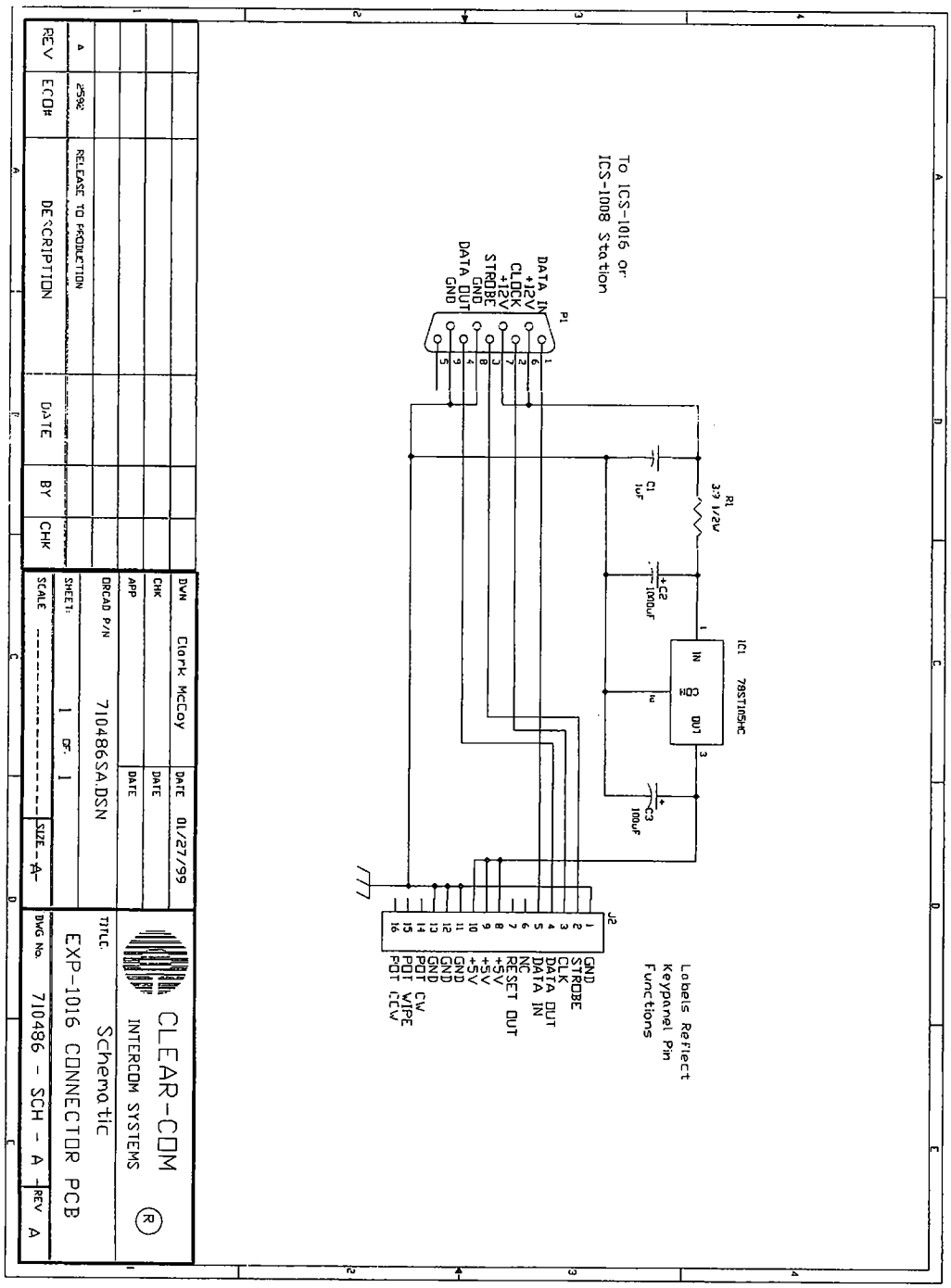


FIGURE S7-8: Schematic—EXP-1016 Main PCB

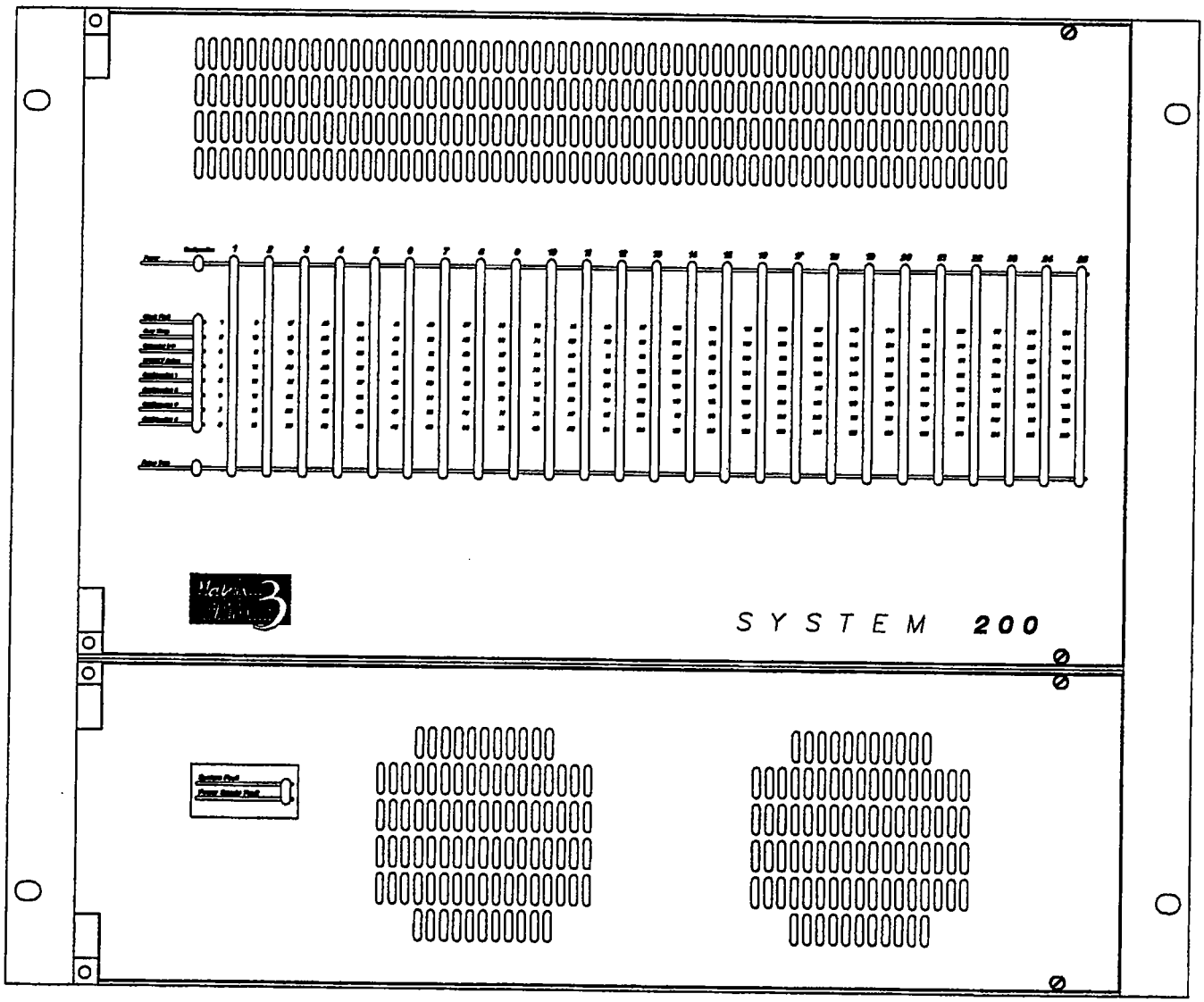
Bill of Materials for EXP-1016 Main PCB Assembly

Miscellaneous

Device	Description	Part #	Designator
.1 uF	Monolithic, 100V, 10%	150085	C1
1000 uF	Aluminum, 35V	150092	C2
100 uF	Aluminum, 16V, 20%	150155	C3
Connector	9-PIN (M) D TYPE CONN RT. ANGLE PCB MTG.	210343	P1
3.9 OHM1/2	Carbon Comp, 5%	410185	R1
IC	78ST105 5V 1.5A 3 TERM SWITCHER	480232	IC1

FRAMES

CONFIGURATION



Matrix Plus 3 System SYS-200

SYSTEM CARD FRAME 200x200 - 25 SLOT

Introduction

This Chapter provides a description of the frame, trouble shooting guidelines, routine maintenance recommendations, and schematic diagrams, assembly drawings, and Bills of Materials for the SYS-200 Card Frame.

Description

The SYS-200 Card Frame houses the programmable hardware that enables the Matrix Plus 3 System to support up to 200 ports, allowing you to build a 200 x 200 matrix system. A basic SYS-200 frame includes the following:

- A card frame that holds up to 25 matrix cards.
- A CONFIG-1 card with battery-backed RAM that stores the configurations and communicates with an external configuration computer.
- A CLOCK-1 System Clock card.
- Four power supplies, two for digital circuits and two for analog circuits providing full redundancy.
- An alarm card that reports system hardware failures.
- Connectors on the rear panel that support connections to a configuration computer, I/O accessories, alarm I/O, and eight RJ-45 connectors to support one matrix card.

To complete the system you may have also ordered additional items, such as:

- Up to 25 MTX cards, each capable of supporting eight ports.
- One to four RP rear panels, each RP panel provides RJ-45 connectors for six matrix cards.
- An extender card is available for operating frame cards outside the frame for servicing. Refer to page F!-10 for a complete description.

From a system software point of view the SYS-200 and the COM-72 frames are identical except for the number of Matrix card the frame will support.

Rear Panel Connectors

The rear panels of the SYS-200 feature connectors that allow you to connect to intercom stations and interfaces, to the computer running the configuration software, and to other separate Matrix Plus 3 systems, in addition to mains AC power connectors.

Depending on how many rear connector panels are ordered, blank panels will be installed to fill the rear panel. Rear connector panels can be installed in the field by the user when expansion is required.

Rear panel RP-56 provides 48 RJ-45 connectors, adding to the 8 that are already in the frame, providing a total capacity of 56 ports. Rear panel RP-104 adds another 48 ports taking the total port count to 104. RP-152 and RP-200 are used to expand the system to 152 ports and 200 ports respectively. These panels are electrically identical but they have different silk-screen markings for the ports they relate to.

Power Supplies

The SYS-200 frame features plug in power supplies. Two complete sets of power supplies are standard in the frame. Each set of power supplies is capable of operating the entire frame by it self.

The matrix cards and other circuitry in the SYS-200 frame require three different 15 volt DC power supplies. A fully populated frame requires a 150 Watt supply for the digital circuitry and a 110 Watt dual +/- supply for the analog circuitry. The SYS-200 features a second set of these power supplies as standard to provide full power redundancy. This second set of power supplies has a separate power entry module on the rear panel for AC mains. If the AC mains for each set of power supplies is supplied from different AC sources then complete power redundancy will be achieved.

Normally, the SYS-200 is shipped with smaller power supplies unless the system is configured at the time of shipment with more than 13 matrix cards. If the system has 13 or less matrix cards the system will ship with PS-D104s and PS-A104s. The PS-D104 is a 65 Watt digital supply whereas the PS-A104 is a 65 Watt +/- analog supply. The "104" in the name indicates how many ports the power supplies will support. For larger systems PS-D200s and PS-A200s are used. **CAUTION:** If your system is originally shipped with 13 or less matrix cards and you expand the system, contact Clear-Com's service department for an upgrade to the larger supplies.

Front Panel Controls and Indicators

The front panel of the System-200 is divided by two doors. The large top door covers the card frame portion that contains the Matrix Cards, Configuration, and System Clock Card. The lower door covers the power supply section of the frame. The following sections describe the user controls and indicators in each of these sections.

Top Door

The active circuitry for the matrix frame is contained in the printed circuit cards located behind this door. The CONFIG-1 Card and Matrix Cards each have LED indicators that are visible through windows in the door. The CLOCK-1 card has two LEDs on it that are not visible through the door. Opening the door reveals that there are push-buttons switches on the Matrix and CONFIG-1 cards.

The CLOCK-1 system clock card is always mounted in the first slot of the frame. There is a metal bracket that holds it in place as there is so little circuitry that it is unlikely that it will be removed very often.

The CONFIG-1 card is always plugged into the second slot. The CONFIG-1 card will only function in the second slot. If a CONFIG-1 card is plugged into another slot it will not function, nor will it impede the normal operation of the frame.

Matrix Cards are to be plugged in the next 25 slots. The port assignment of a given card is determined by the card connector on the mother board that the card is plugged into. There are ID jumpers on the motherboard connector telling a matrix card what port numbers it is servicing.

The functions of the indicators and switches of all of the boards are described in the following paragraphs.

CLOCK-1 Card

The clock card has two green LEDS labeled D1 and D2.

- **The upper LED:** indicates whether the clock card has power.
- **The lower LED:** indicates status of the Primary Clock Group signals which are driven at all times by the CLOCK-1 card.

  Normally the CLOCK-1 card will drive the lower LED ON continuously, indicating that all signals in the Primary Clock Group are fully functional and in use.

  A blinking LED indicates that the system has detected a fault in one or more signals in the Primary Clock Group, and the CLOCK-1 card needs immediate attention.

  A continuous OFF condition indicates that the signals in the Primary Clock Group are all good, but temporarily are not being used by the system.

  Unless the LED is continuously ON, the Clock Fault LED on the adjacent CONFIG-1 card should be continuously ON.

CONFIG-1 Card

The CONFIG-1 card has ten indicator LEDS and three push button switches. The LEDs are visible through the front door. The push button switches are only accessable with the door open.

The following paragraphs are a description of each push-button and LED in top to bottom order as they are seen on the board.

- **POWER LED "Green":** This green LED is on solid when the DC power on the CONFIG-1 is within specifications.
- **GLOBAL RESET Push-button:** Pressing and releasing this button will cause ALL of the matrix cards in the frame to reset, however the CONFIG card will not reset.
- **LOCAL RESET Push-button:** Pressing and releasing this button will cause a reset of only the CONFIG card. To reset the entire frame at one time, press and release both the GLOBAL and LOCAL reset buttons together at the same time.
- **CLOCK FAULT LED "Red":** The LED marked CLK FAULT indicates status of the Secondary Clock Group signals driven by the CONFIG -1 card. These signals are only used by the system in the case of a fault detected in the Primary Clock Group (CLOCK-1 Card).

Normally the CLK FAULT LED remains continuously OFF, indicating that all signals in the Secondary Clock Group are fully functional but not in use.

A blinking LED indicates that the system has detected a fault in one or more of the signals in the Secondary Clock Group, and the CONFIG -1 card needs immediate attention.

A continuous ON condition in the CLK FAULT LED indicates that the signals in the Secondary Clock Group are all good, and that the system is using them.

If a clock system fault is detected the CONFIG-1 card will also cause a general system alarm.

- **OVER TEMP LED "Red":** This red LED when on, indicates that the temperature as measured on the CONFIG-1 card is out of safe operating range. Safe operating range is between 0 and 50 degrees C (32 and 125 degrees F).

  If an over temperature condition is detected the CONFIG-1 card will also cause a general system alarm.

- **COMPUTER I/O LED "Yellow":** This yellow LED is on any time there is active communication to or from the Configuration Computer.

- **GPI/RLY ACTIVE LED "Yellow":** This yellow LED indicates that one or more GPI-6 or RLY-6 interfaces connected to the Matrix Frame are communicating with the CONFIG-1 card.

- **CONFIGURATION 1 LED "Green":** If this green LED is on solid the system is operating on the 1st configuration stored in memory. If this LED is flashing it a warning that the system is about to switch over to this configuration. Refer to the description of the CPU CONFIG push-button for a discussion of the flashing function.

- **CONFIGURATION 2 LED "Green":** If this green LED is on solid the system is operating on the 2nd configuration stored in memory. If this LED is flashing it a warning that the system is about to switch over to this configuration.

- **CONFIGURATION 3 LED "Green":** If this green LED is on solid the system is operating on the 3rd configuration stored in memory. If this LED is flashing it a warning that the system is about to switch over to this configuration.

- **CONFIGURATION 4 LED "Green":** If this green LED is on solid the system is operating on the 4th configuration stored in memory. If

this LED is flashing it a warning that the system is about to switch over to this configuration.

- **CONFIG SELECT Push-button:** This button is used to manually switch from one configuration to another at the frame. It is also possible to switch configurations from the Configuration Computer and an ICS-2002 station in the system. A valid configuration must be stored in the desired new configuration. The only way to setup a configuration is to download a configuration from the Configuration Computer.

  To change configurations, repeatedly press and release the CONFIG SELECT push-button. Each time the button is released the next Configuration LED will begin to flash indicating what configuration is setup to transfer to. The LED for the current configuration will stay on solid. Once the desired LED is flashing pressing and holding the button for 5 seconds will cause the newly selected configuration to be downloaded into all of the matrix cards and stations in the system. If an LED is flashing and the button is not pressed within 5 seconds the flashing will discontinue and the system will continue operate from the original configuration.

- **FRAME DATA LED "Yellow":** This yellow LED indicates communication activity from this card to some other card in the system. The CONFIG card will send regular communication to cause this LED to blink regular. This blinking activity indicates that those cards are indeed communicating on the data bus.

MTX Cards

The MTX cards each have ten indicator LEDS and one push button switch. The LEDs are visible through the front door. The Reset switch is only accessable with the door open.

The following paragraphs are a description of each push-button and LED in top to bottom order as they are seen on the board.

- **POWER LED "Green":** This green LED is on solid when the DC power on the MTX card is within specifications. If it is flashing then one of the two analog power supplies on the board are out of specification. If the LED is out, the digital power supply on the board is off.

  A flashing LED will be reported to the CONFIG-1 card and cause a system failure ALARM.

- **LOCAL RESET Push-button:** Pressing and releasing this button will cause a reset of only that MTX card.

- **CHANNEL ACTIVE (Green):** The next eight green LEDs are activity indicators for each of the eight ports on this matrix card. On the front panel each LED is numbered with its port number for the frame. This overall port number corresponds to the RJ-45 number on the rear panel for that port.

  If a station is connected to the port, the LED will be on solid when the station has reported in and is fully functional.

  If an interface is connected the port, the card will sense what type of interface it is and the LED will be on solid.

  When a TALK label is first activated on a port, its LED will flash for 3 seconds to indicate activity on that port.

- **FRAME DATA LED:** This yellow LED indicates communication activity from this card to some other card in the system. The CONFIG-1 card will send regular communication to cause this LED to blink regular. This blinking activity indicates that those cards are indeed communicating on the data bus.

Lower Door

The lower door covers the Power Supplies and Alarm card for the system. Opening this door provides access to the ALARM Card, the Power Supplies, and cooling fans for maintenance.

Alarm Card

The SYS-200's alarm card has two red indicator LEDS that are visible through holes in the Lower Door. The Alarm Card also has a sonic alarm which will emit a high-pitched beep whenever there is a system fault and a set of relay contacts will provide the ability to have an external indicator. There is a Reset push-button for the audible alarm and relay on front edge of the card that is available with the door open. Resetting the audible alarm and relay does not reset the actual alarm condition which will only reset when the cause of the alarm is removed.

The red SYSTEM FAULT Led will be flashing if the system has sensed a fault from a number of different causes. The following is a list of all of the possible causes:

1. Power supply fault: If any one of the four power supply modules has a failure it will be reported. The POWER SUPPLY FAULT LED will be on solid to indicate this condition. Each of the power supply modules has an indicator LED or LEDs to report the condition of the individual supplies on that module.
   CAUTION: If a power supply is physically removed it will not be reported as a failure.
2. The CONFIG-1 card being removed from the frame or becoming non-functional will cause an alarm.
3. A clock system fault will cause an alarm and will be indicated by a solid or flashing LED on the CONFIG-1 card.
4. An out of range temperature condition will cause an alarm and will be indicated by the OVER TEMP LED on the CONFIG-1 card.
5. If any of the power sense circuits in any of the matrix cards senses a failure which will cause a flashing or off indication on that card's Power Sense LED and cause an alarm.

6 There is an external Alarm input to the CONFIG-1 card that will also cause an alarm condition. There is no indication on the front of the frame that this is the cause of the alarm. The typical use of this input would be to monitor the alarm circuits of a PSU-101 or other power supply which has its own indicators.

All fault conditions are recorded in the system event log in the CONFIG-1 card's battery-backed ram memory.

POWER SUPPLY LEDS: If the "Power Supply Fault" LED on the lower door is lit, open the power-supply compartment door and look at the supplies themselves. The digital supplies (PS-D104 or PS-D200) each have one LED indicating that the power supply is on. The analog supplies (PS-A104 or PS-A200) each have two LEDs, the top is for the '+' supply and bottom LED is for the '-' supply. If any LED is dimmed, the voltage on its output is below its specification; if any LED is not lit at all, its output is dead.

Trouble Shooting Guidelines

The Matrix Plus 3 system is a large complex interconnection of many microprocessor controlled devices. Clear-Com has provided complete schematics for all parts of the system. Because of the complexity, Clear-Com recommends that trouble shooting be limited to identifying the "bad" circuit board, module, or station and swap it out for a known good one. If possible, return the faulty unit to Clear-Com for repair.

The SYS-200 Frame is a housing for the Matrix System. The actual matrix system is distributed between the CLOCK-1, CONFIG-1, and MTX matrix cards within the frame. The SYS-200 frame also contains the necessary power supplies for the cards contained in it. If all of the cards, alarm card, and power supply modules are removed there are no active electronics left in the frame.

EXTDR-1 Frame Card Extender Board

Matrix Plus 3 has a special card extender assembly (EXTDR-1) designed specifically for the MTX-A8, CONFIG-1, and CLOCK-1 matrix cards. The digital communication bus will not operate through a passive extender card. To purchase an EXTDR-1 contact the Sales or Service departments.

A schematic for the EXTDR-1 is provided in the last part of this chapter.

The board contains the necessary circuitry to connect a frame card to the Digital Mother Board in the frame. The analog side of the board is passive but a jumper field is provided between all pins to allow monitoring or breaking connections to the RJ-45 rear panels.

Schematics and BOMs Provided in This Chapter

Schematics

For information on the CONFIG-1 or MTX cards refer to their chapters in this manual. The CLOCK-1 card, the Alarm card, and Power Supply modules are described later in this chapter. The following schematic drawings are provided in this chapter:

1. Overall Schematic of the SYS-200 Frame. This schematic contains the power components for the frame that include the Power Supply Mother Board, the Alarm PCB, the PS-A104, the PS-D104, and the Rear Connector Panel.
2. The Digital Mother Board
3. The RP-56 RJ-45 Rear Connector Panel. The RP-104, RP-152, and RP-200 have identical wiring. The only difference in these panels is the silkscreen of the channel numbers on the rear panel.
4. The PS-D200 150 Watt Digital Power Supply
5. The PS-A200 110 Watt Analog Power Supply
6. The CLOCK-1 System Clock PCB.

For documentation on the MTX-A8 Matrix Card and the CONFIG-1 Configuration Card, each of these items have their own chapters in this manual.

Bills of Materials

The Bills of Material provided in this chapter have been edited to show only those parts that might need field replacement. For items not covered in these BOMs please contact the Service Department. The Following BOMs are provided:

1. CLOCK-1 BOM
2. ALARM Card BOM
3. An overall Miscellaneous BOM

Routine Maintenance Recommendations

The System-200 has cooling fans and a Lithium battery for NVM (Non-Volitile Memory) ram storage that do require routine maintenance. The following paragraphs cover these subjects.

Servicing Cooling Components

The lower door of the frame has two cooling fans mounted on the inside of the door. Inside the mounting bracket for each fan there is an air filter. This filter should be cleaned at least once every three months and replace once a year or more often in dusty conditions.

Because the frame has moving air in it, the entire frame should be cleaned at least once a year. To clean the card frame, the frame should be shut down, all cards removed, and use compressed air to remove any dust buildups in the frame. All cards should be cleaned with a brush to remove any dust buildup. **Caution: Care should be taken to not induce a static discharge in the cards during this cleaning process.**

Lithium Battery Maintenance

The CONFIG-1 features a lithium battery that provides back-up power for its processor's internal RAM. This RAM stores the system's configurations, up to a maximum of four. The battery should be disconnected before performing any service on the board, including battery replacement. The battery should be replaced every five years as a preventive maintenance measure. To disconnect the battery, remove the battery disconnect jumper and put it on the unconnected pair of pins on the header. The board will operate with the battery disconnected, but remember that if the system's power is cut, all operating parameters will be lost.

CAUTION

Lithium batteries can overheat or explode if they are shorted. When you handle the CONFIG-1 board or the loose battery, DO NOT touch any external electrical conductors to the battery's terminals or to the circuits that the terminals are connected to!

Whenever you are servicing the battery, make sure that the jumper on JP1 is connecting the common to either the ON or the OFF pin. If the common is left floating, the CONFIG-1 may behave unpredictably (for example, the microprocessor may reset itself intermittently).

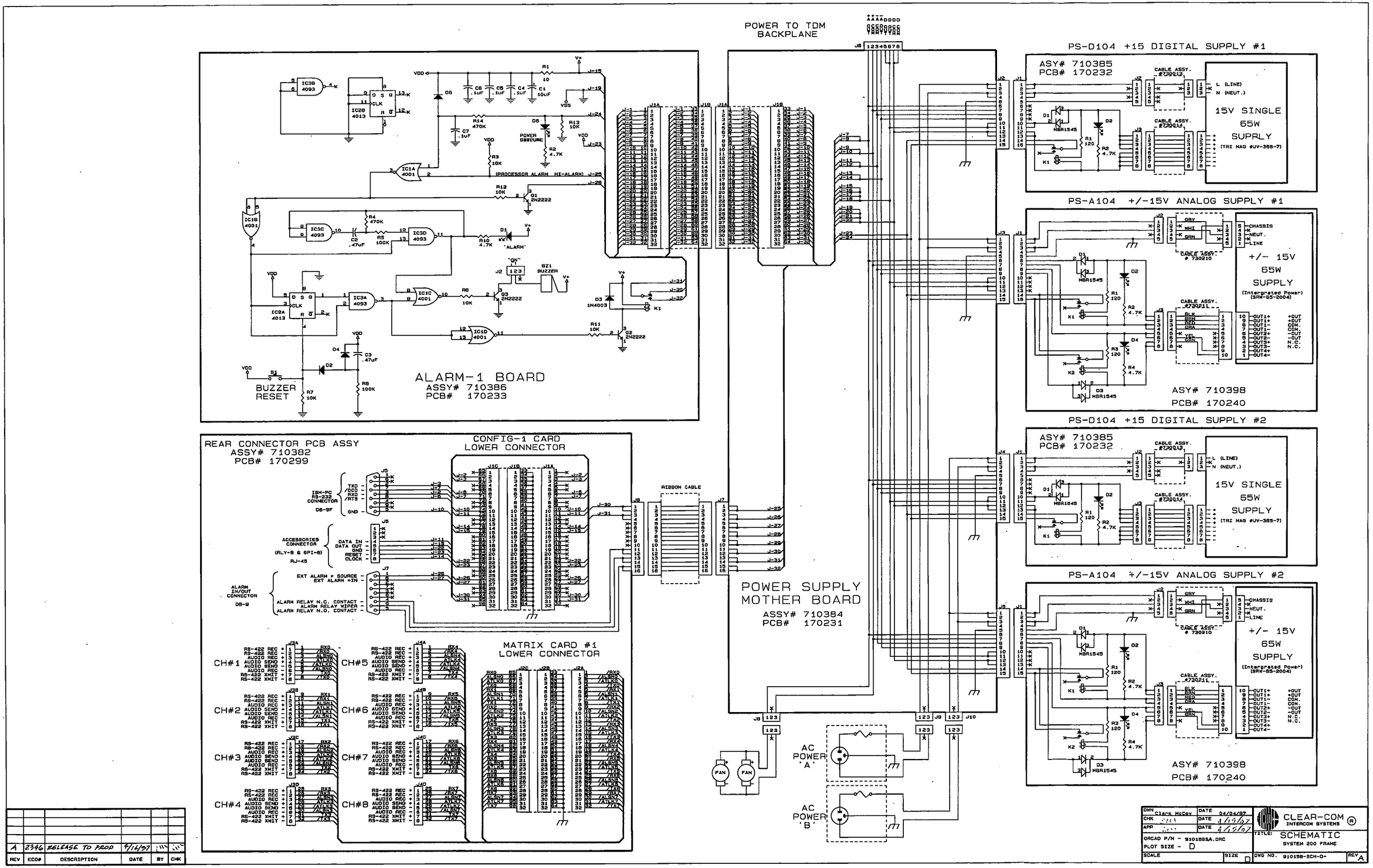


FIGURE F1-3 Schematic, Overall - SYS-200 Frame, Rev. A

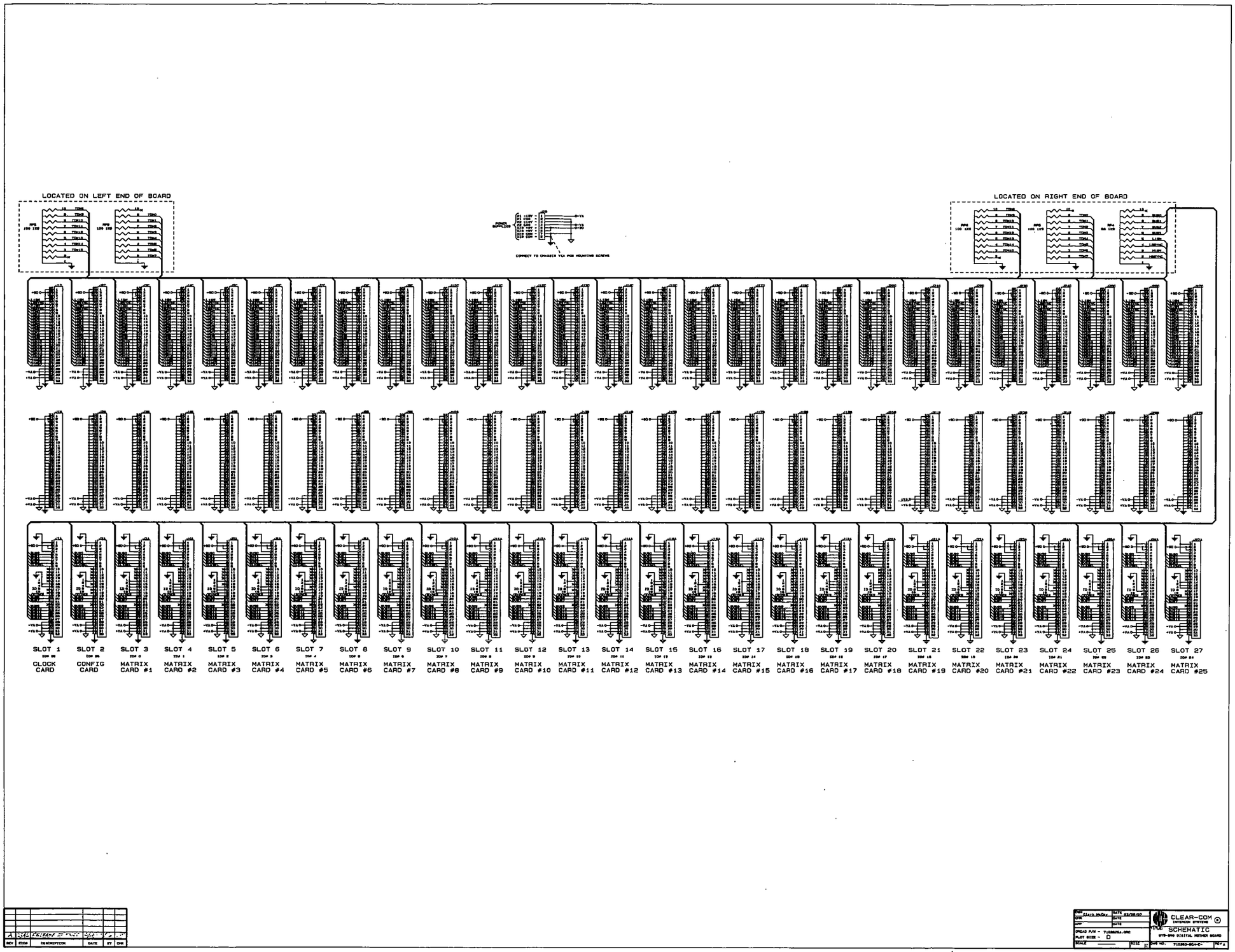
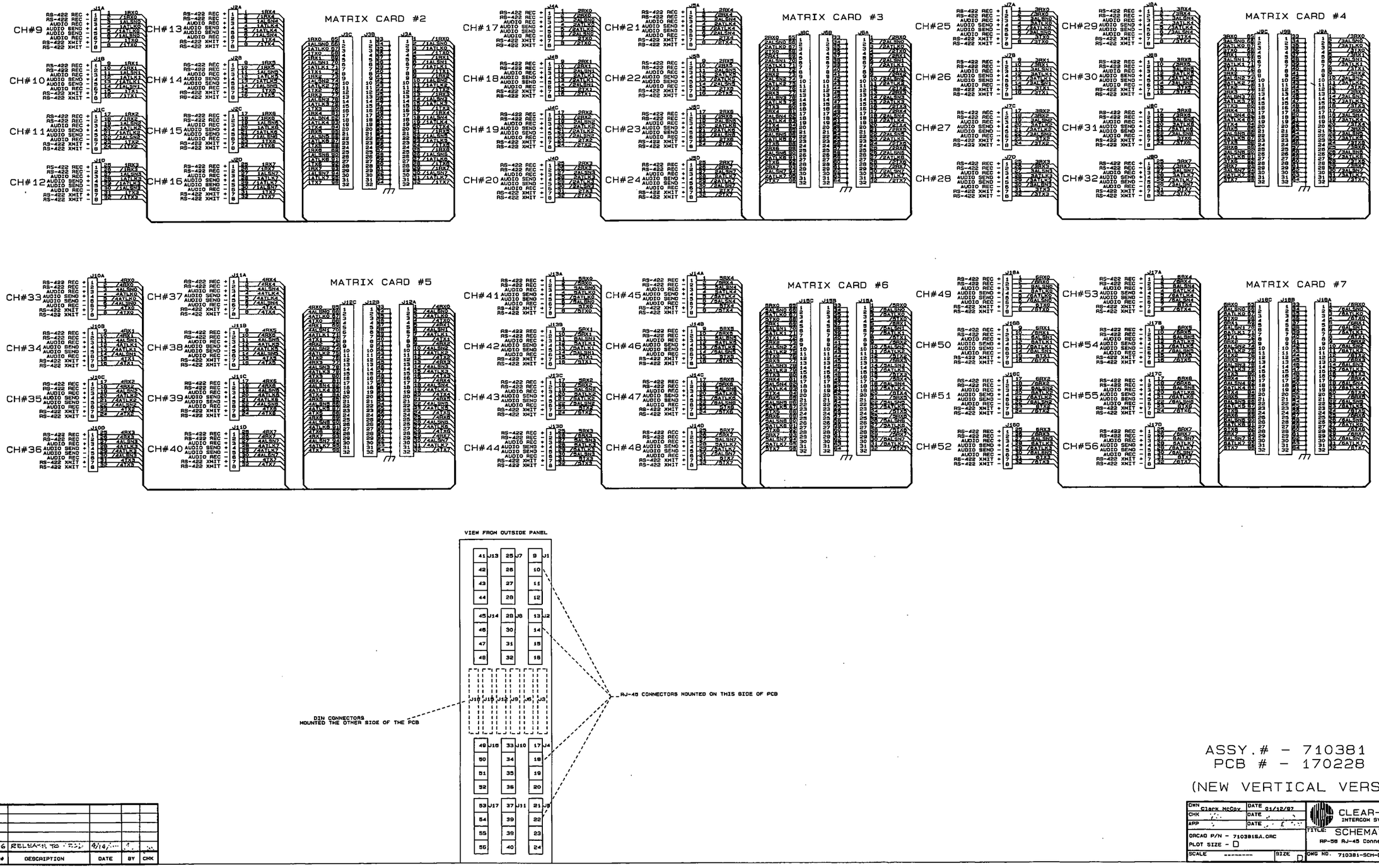


FIGURE F1-4 Schematic - SYS-200 Frame, Digital Motherboard, Rev. A



REV	ECO#	DESCRIPTION	DATE	BY	CHK
A	2546	RELEASED TO PROD	4/14/...	...	...

ASSY.# - 710381
PCB # - 170228

(NEW VERTICAL VERSION)

DWN Clark McCoy	DATE 01/12/97	CLEAR-COM® INTERCOM SYSTEMS	
CHK	DATE	TITLE: SCHEMATIC	
APP	DATE	RP-56 RJ-45 Connector PCB	
ORCAD P/N - 710381SA.ORC			
PLOT SIZE - D			
SCALE --------	SIZE D	DWG NO. 710381-SCH-D-	REV A

FIGURE F1-5 Schematic - RP-56 RJ-45 Connector PCB, Rev. A

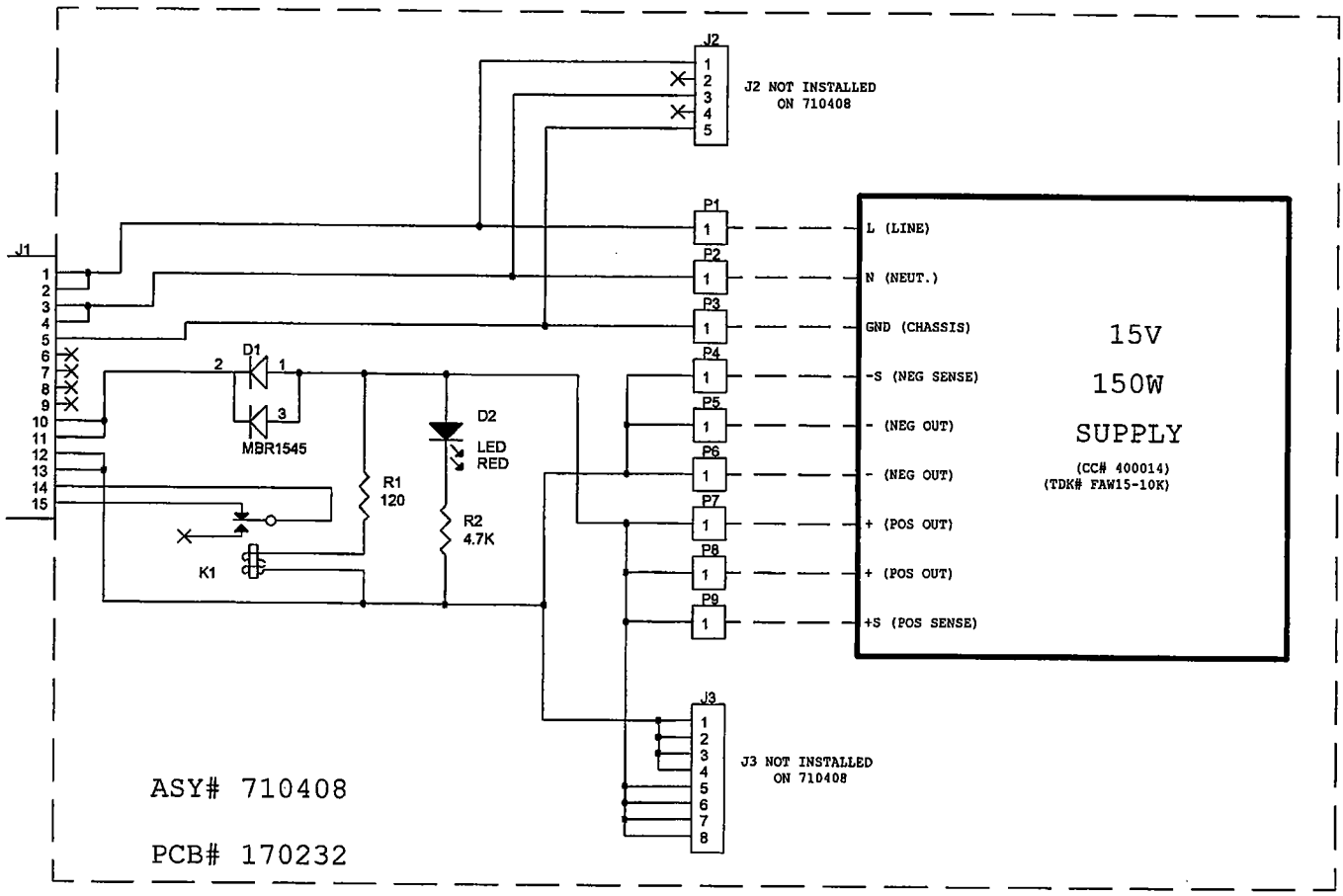


FIGURE F1-6 Schematic - PS-D200 150 Watt Digital Power Supply, Rev. A

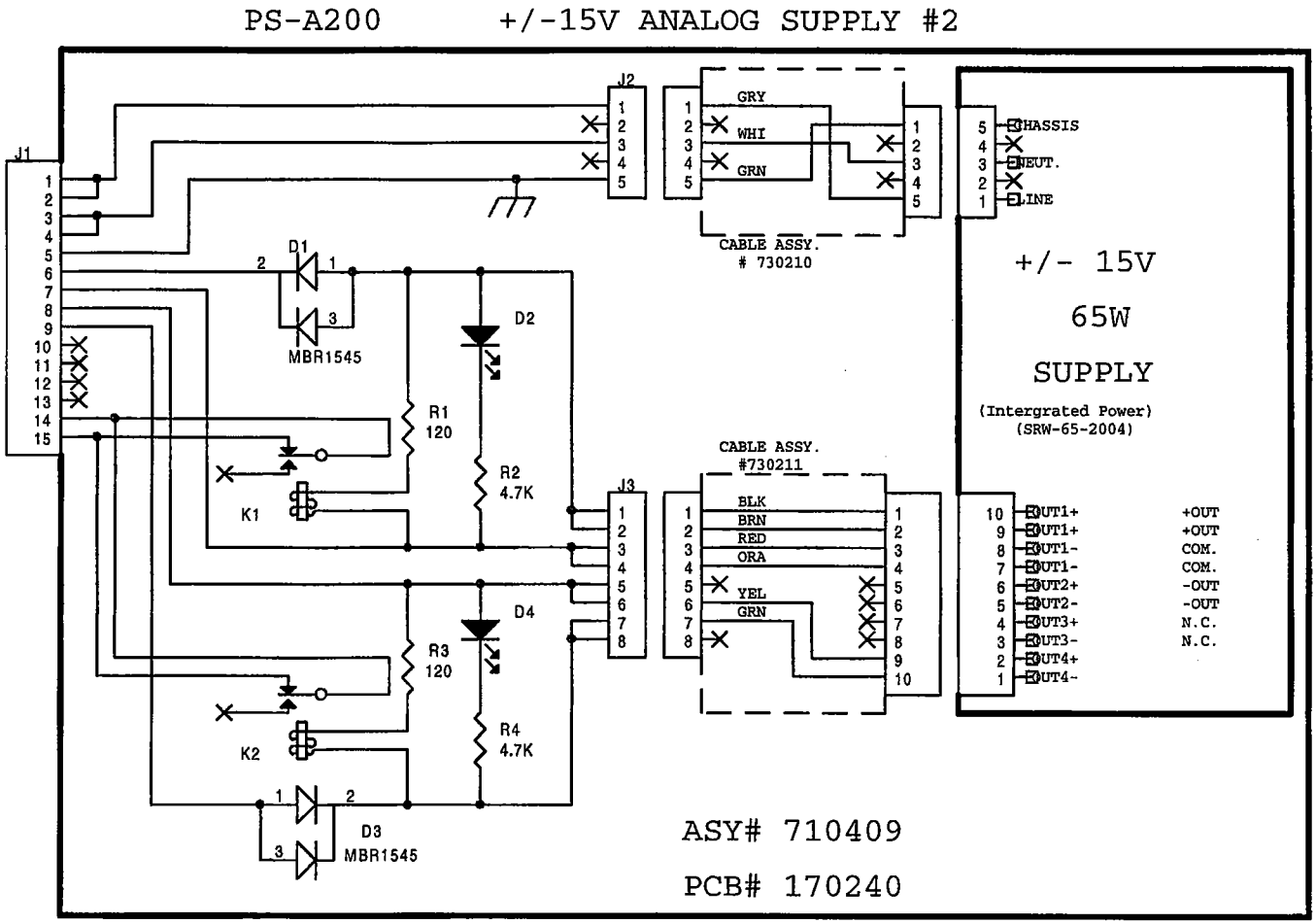


FIGURE F1-7 Schematic - PS-A200 110 Watt Analog Power Supply, Rev. A

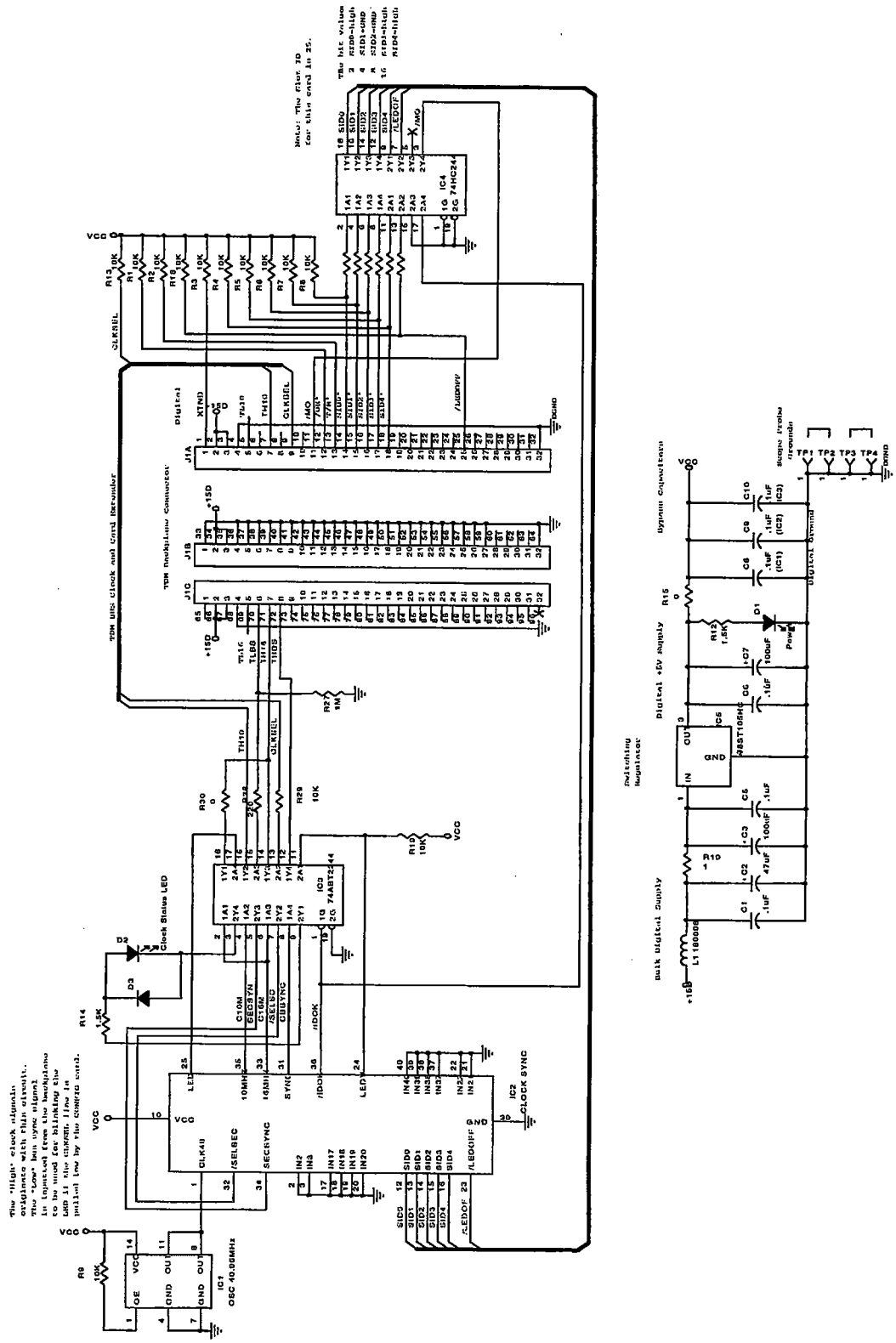


FIGURE F1-8 Schematic - CLOCK-1 System Clock PCB, Rev. A

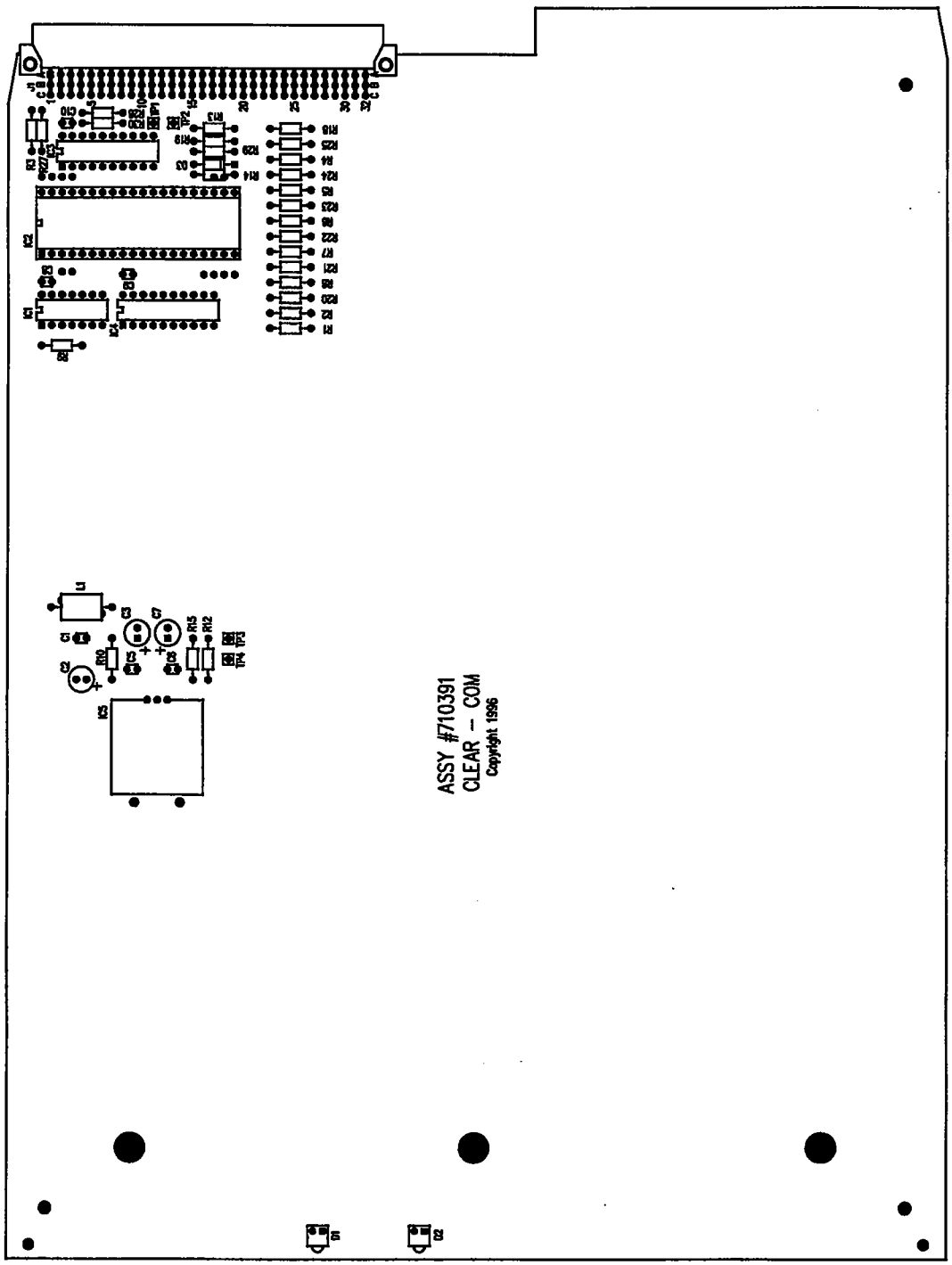


FIGURE F1-9 CLOCK-1 Assembly Drawing, Rev. A

Bill of Materials for the CLOCK-1 Card

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.1	uF	Monolythic	50V	10%	150035	C1,C5,C6,C8,C9,C10
47	uF	Alu. Small	35V		150081	C2
100	uF	Alu.	16V	20%	150155	C7,C3

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
1	Ohm	1/4W	Carbon Film	5%	410139	R10
220	Ohm	1/4W	Carbon Film	5%	410007	R28
10K	Ohm	1/4W	Carbon Film	5%	410016	R1-R9,R13,R18-R25,R29
1.5K	Ohm	1/4W	Carbon Film	5%	410055	R12,R14
1M	Ohm	1/4W	Carbon Film	5%	410058	R27

Diodes

Device	Description	Part #	Designator
Diode	1N4148 Signal 10mA 75PIV	480000	D3
Led	T1 Rt Angle PC Mt. 5mA Green	390028	D1,D2

Integrated Circuits

Device	Description	PN	Designator
Oscillator	40.960 MHz Crystal Clock	230007	IC1
Digital IC	74ABT2244 Octal Buffer/Driver	480235	IC3
Digital IC	74HC244 Octal 3 State Buffer	480141	IC4
Regulator	78ST105 5V 1.5A Switching	480232	IC5
Digital IC	PLD, CLOCK-1 Logic	710392	IC2

Miscellaneous

Device	Description	Part #	Designator
Inductor	Ferrite HI-Q Wideband Choke	180008	L1

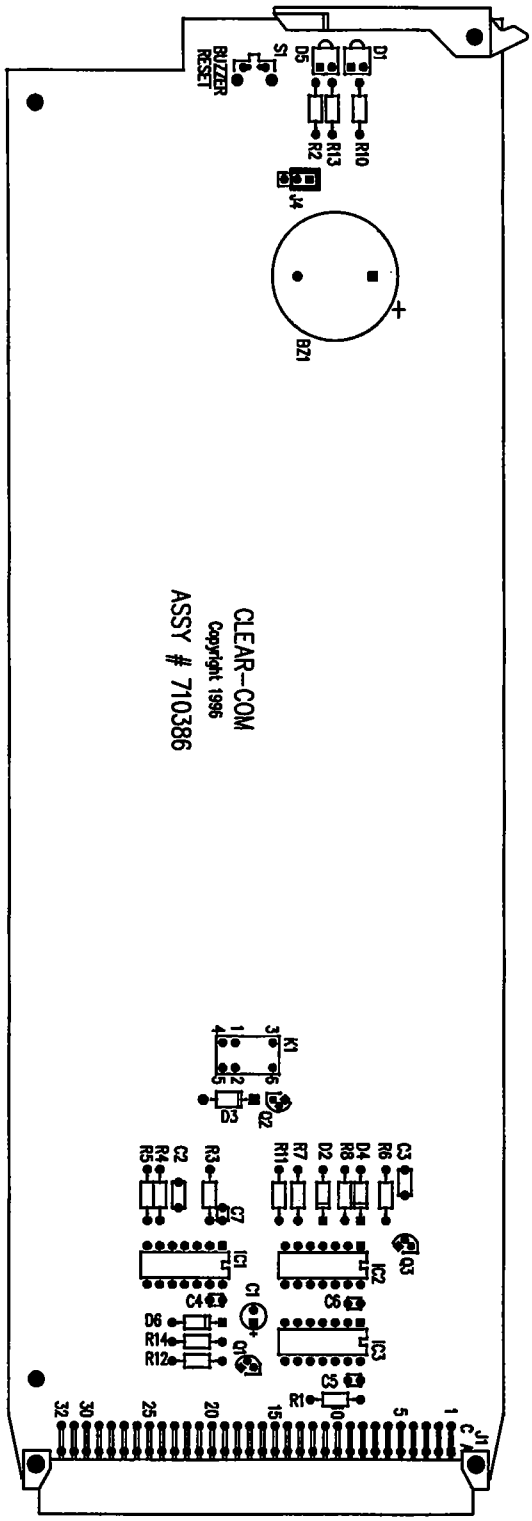


FIGURE F1-10 ALARM PCB Assembly Drawing, Rev. A

Bill of Materials for the Alarm PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.1	uF	Monolythic	50V	10%	150035	C4,C5,C6,C7
.47	uF	Monolythic	50V		150043	C2,C3
10	uF	Alu. Radial	50V		150064	C1

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
10	Ohm	1/4W	Carbon Film	5%	410002	R1
4.7 K	Ohm	1/4W	Carbon Film	5%	410013	R2,R10
10 K	Ohm	1/4W	Carbon Film	5%	410016	R3,R6,R7,R11,R12,R13
100 K	Ohm	1/4W	Carbon Film	5%	410024	R5,R8
470 K	Ohm	1/4W	Carbon Film	5%	410030	R4,R14

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4003 Rect. 1A 200PIV	480058	D3
Diode	1N4148 Signal 10MA 75PIV	480000	D2,D4,D6
Led	T1 RT ANG 5mA Red	390027	D1,D5
Transistor	2N2222A NPN 30V	480006	Q1,Q2,Q3

Integrated Circuits

Device	Description	PN	Designator
Digital IC	4001 Quad 2 In NOR Gate	480112	IC1
Digital IC	4013 Dual D Flip Flop	480171	IC2
Digital IC	4093 Quad 2 In NAND Schmitt	480211	IC3

Miscellaneous

Device	Description	Part #	Designator
Buzzer	Piezo Alert 3.7KHZ 3-20VDC	500130	BZ1
Switch	Switch, Pushbutton SPST PC Mt.	510099	S1
Relay	SPDT 12V Mini PC Relay	450006	K1

Miscellaneous SYS-200 Frame Parts

Device	Description	Part #
Connector	DB-9F Wire Wrap	210333
Connector	Power Entry Module	210320
Connector	RJ-45 1-Port Shielded	210334
Connector	RJ-45 4-Port Shielded	210330
Fan	12 VDC, SYS-200	140037
Filter, Fan	Filter material	140033
Fuse	4A 20mm Fast Blow Fuse	520032
PCB Assy	Alarm Board, SYS-200	710386
PCB Assy	CLOCK-1	710391
PCB Assy	CONFIG-1	710388
PCB Assy	PS-A104 Power Supply Board	710398
PCB Assy	PS-D104 Power Supply Board	710385
Power Cord	AC Power Cord	610022
PCB Assy	SYS-200 PS Mother Board	710384
Recitifier	MBR1545 Schottky 45V/15A	480154
Resistors, Bussed	100 Ohm x 9 (Dig. Mother Board)	415011
Resistors, Bussed	56 Ohm x 9 (Dig. Mother Board)	415012

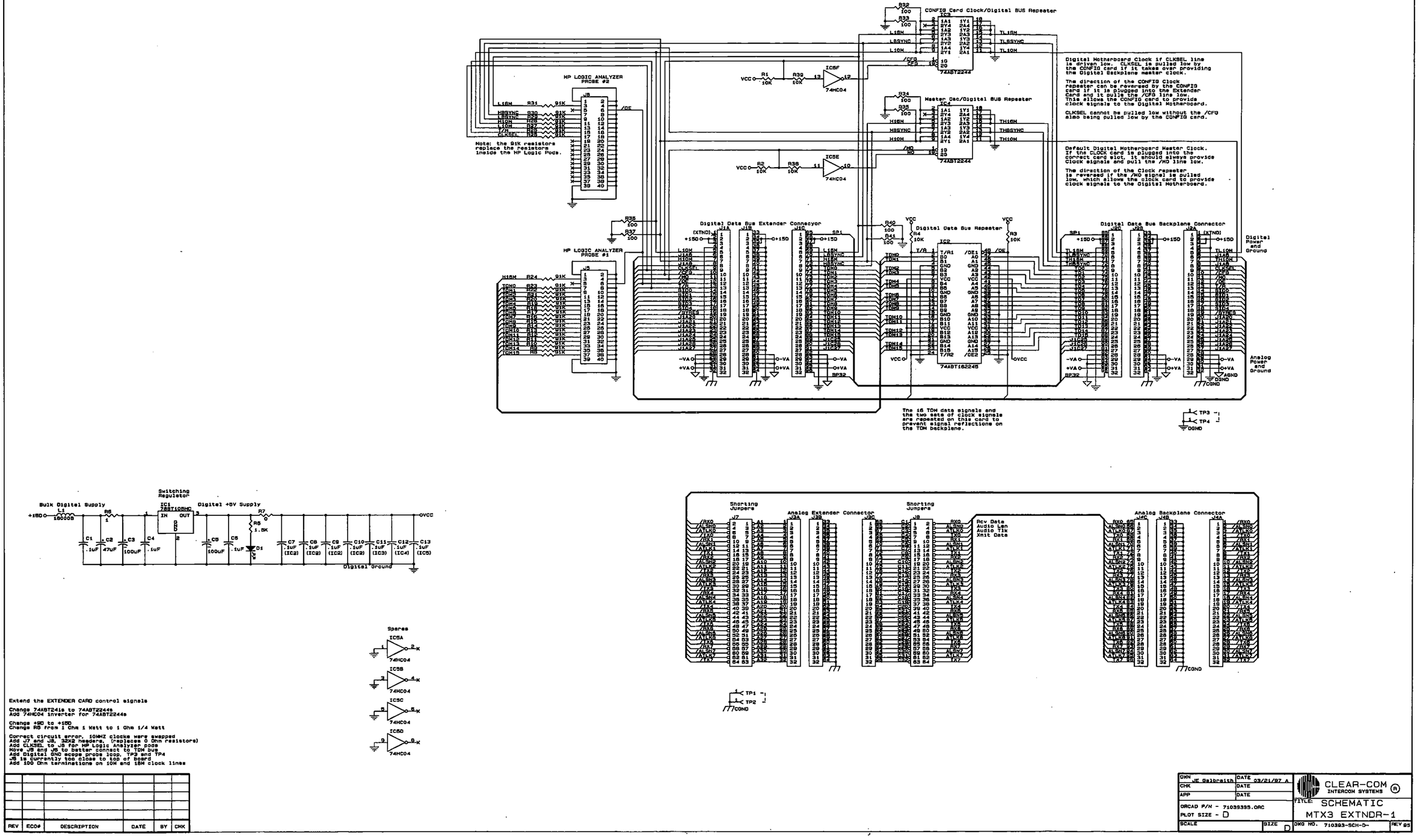
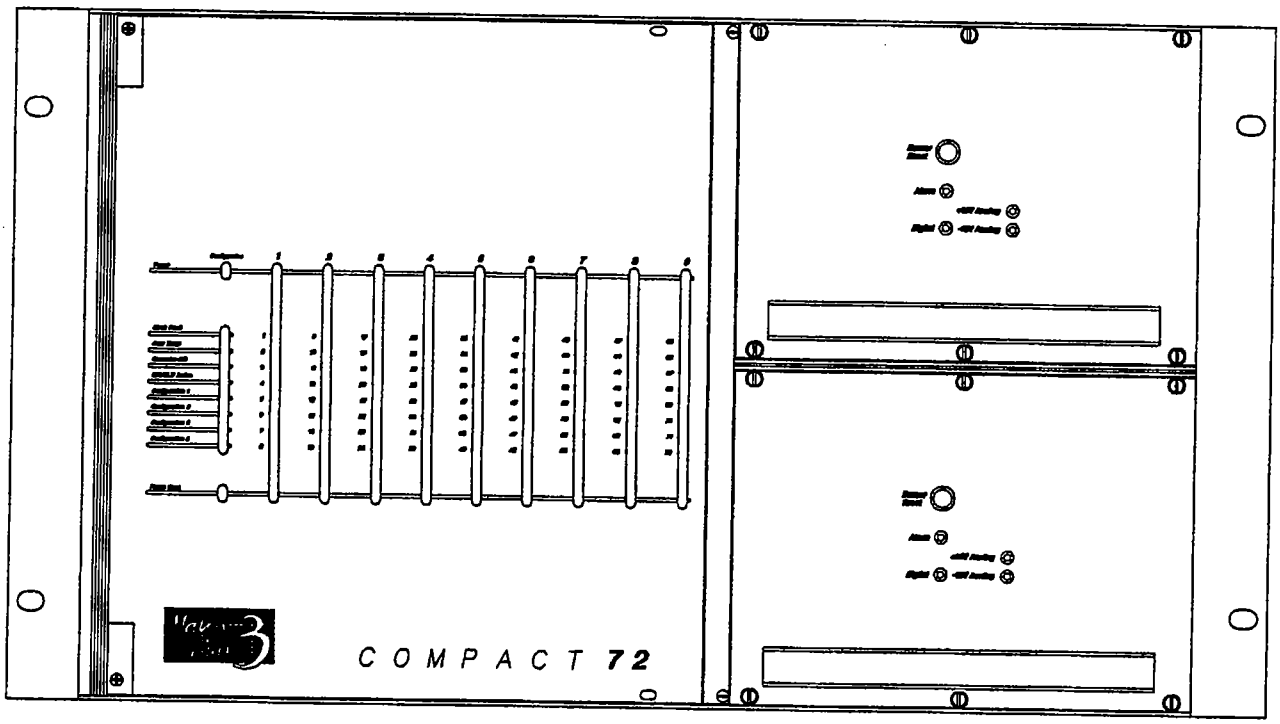


FIGURE F1-11 Schematic - EXTDR-1 Extender PCB, Rev. A



Matrix Plus 3 System COM-72
COMPACT CARD FRAME 72x72 - 9 SLOT

Introduction

This Chapter provides a description of the frame, trouble shooting guidelines, routine maintenance recommendations, and schematic diagrams, assembly drawings, and Bills of Materials for the COM-72 Card Frame.

Description

The COM-72 Card Frame houses the programmable hardware that enables the Matrix Plus 3 System to support up to 72 ports, allowing you to build a 72 x 72 matrix system. A basic COM-72 frame includes the following:

- A card frame that holds up to 9 matrix cards.
- A CONFIG-1 card with battery-backed RAM that stores the configurations and communicates with an external configuration computer.
- A CLOCK-1 System Clock card.
- Four power supplies, two for digital circuits and two for analog circuits providing full redundancy.
- An alarm card that reports system hardware failures.
- Connectors on the rear panel that support connections to a configuration computer, I/O accessories, alarm I/O, and seventy-two RJ-45 connectors to support nine matrix cards.

To complete the system you may have also ordered additional items, such as:

- Up to 9 MTX cards, each capable of supporting eight ports.
- An extender card is available for operating frame cards outside the frame for servicing. Refer to page F1-10 for a complete description.

From a system software point of view the COM-72 and the SYS-200 frames are identical except for the number of Matrix cards the frame will support.

Rear Panel Connectors

The rear panels of the COM-72 feature connectors that allow you to connect to intercom stations and interfaces, to the computer running the configuration software, and to other separate Matrix Plus 3 systems, in addition to mains AC power connectors.

Power Supplies

The COM-72 frame features plug in power supplies. Two complete sets of power supplies are standard in the frame. Each set of power supplies is capable of operating the entire frame by itself.

The matrix cards and other circuitry in the COM-72 frame require three different 15 volt DC power supplies. A fully populated frame requires a 65 Watt supply for the digital circuitry and a 65 Watt dual +/- supply for the analog circuitry. The COM-72 features a second set of these power supplies as standard to provide full power redundancy. This second set of power supplies has a separate power entry module on the rear panel for AC mains. If the AC mains for each set of power supplies is supplied from different AC sources then complete power redundancy will be achieved.

Front Panel Controls and Indicators

The front panel of the COM-72 is divided in two sections. The left portion of the frame has a door that covers the card frame portion that contains the Matrix Cards, Configuration, and System Clock Card. The right portion of the frame contains the two modular power supplies. Each module contains the three power supplies necessary to operate the frame. The following sections describe the user controls and indicators in each of these sections.

Left Door

The active circuitry for the matrix frame is contained in the printed circuit cards located behind this door. The CONFIG-1 Card and Matrix Cards each have LED indicators that are visible through windows in the door. The CLOCK-1 card has two LEDs on it that are not visible through the door. Opening the door reveals that there are push-buttons switches on the Matrix and CONFIG-1 cards.

The CLOCK-1 system clock card is always mounted in the first slot of the frame. There is a metal bracket that holds it in place as there is so little circuitry that it is unlikely that it will be removed very often.

The CONFIG-1 card is always plugged into the second slot. The CONFIG-1 card will only function in the second slot. If a CONFIG-1 card is plugged into another slot it will not function, nor will it impede the normal operation of the frame.

Matrix Cards are to be plugged in the next 9 slots. The port assignment of a given card is determined by the card connector on the mother board that the card is plugged into. There are ID jumpers on the motherboard connector telling a matrix card what port numbers it is servicing.

The functions of the indicators and switches of all of the boards are described in the following paragraphs.

CLOCK-1 Card

The clock card has two green LEDS labeled D1 and D2.

- **The upper LED:** indicates whether the clock card has power.
- **The lower LED:** indicates status of the Primary Clock Group signals which are driven at all times by the CLOCK-1 card.

  Normally the CLOCK-1 card will drive the lower LED ON continuously, indicating that all signals in the Primary Clock Group are fully functional and in use.

  A blinking LED indicates that the system has detected a fault in one or more signals in the Primary Clock Group, and the CLOCK-1 card needs immediate attention.

  A continuous OFF condition indicates that the signals in the Primary Clock Group are all good, but temporarily are not being used by the system.

  Unless the LED is continuously ON, the Clock Fault LED on the adjacent CONFIG-1 card should be continuously ON.

CONFIG-1 Card

The CONFIG-1 card has ten indicator LEDS and three push button switches. The LEDs are visible through the front door. The push button switches are only accessible with the door open.

The following paragraphs are a description of each push-button and LED in top to bottom order as they are seen on the board.

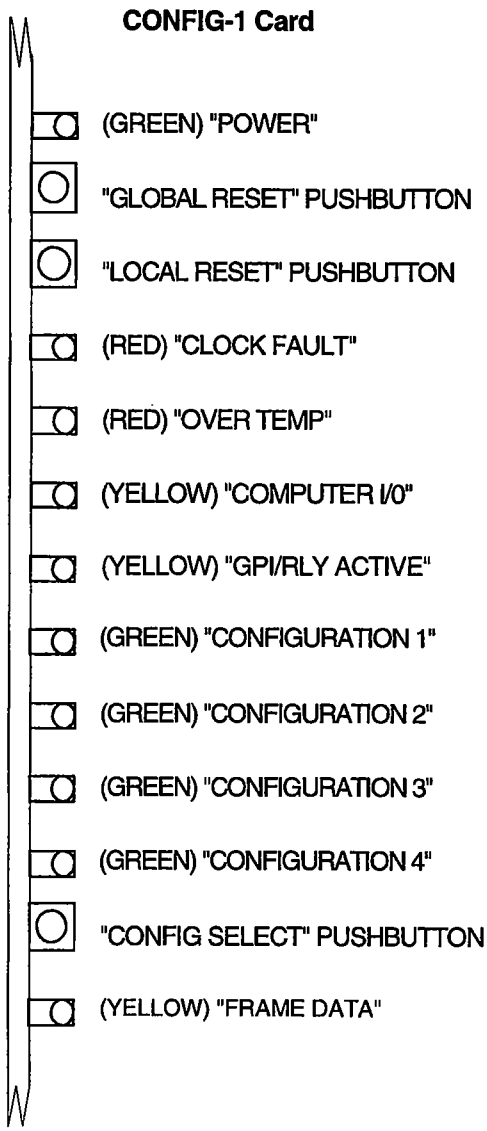


FIGURE F2-1 CONFIG-1 Card Buttons and Indicator

- **POWER LED "Green":** This green LED is on solid when the DC power on the CONFIG-1 is within specifications.
- **GLOBAL RESET Push-button:** Pressing and releasing this button will cause ALL of the matrix cards in the frame to reset, however the CONFIG card will not reset.
- **LOCAL RESET Push-button:** Pressing and releasing this button will cause a reset of only the CONFIG card. To reset the entire frame at one time, press and release both the GLOBAL and LOCAL reset buttons together at the same time.
- **CLOCK FAULT LED "Red":** The LED marked CLK FAULT indicates status of the Secondary Clock Group signals driven by the CONFIG -1 card. These signals are only used by the system in the case of a fault detected in the Primary Clock Group (CLOCK-1 Card).

  Normally the CLK FAULT LED remains continuously OFF, indicating that all signals in the Secondary Clock Group are fully functional but not in use.

  A blinking LED indicates that the system has detected a fault in one or more of the signals in the Secondary Clock Group, and the CONFIG -1 card needs immediate attention.

  A continuous ON condition in the CLK FAULT LED indicates that the signals in the Secondary Clock Group are all good, and that the system is using them.

  If a clock system fault is detected the CONFIG-1 card will also cause a general system alarm.
- **OVER TEMP LED "Red":** This red LED when on, indicates that the temperature as measured on the CONFIG-1 card is out of safe operating range. Safe operating range is between 0 and 50 degrees C (32 and 125 degrees F).

  If an over temperature condition is detected the CONFIG-1 card will also cause a general system alarm.
- **COMPUTER I/O LED "Yellow":** This yellow LED is on any time there is active communication to or from the Configuration Computer.
- **GPI/RLY ACTIVE LED "Yellow":** This yellow LED indicates that one or more GPI-6 or RLY-6 interfaces is connected to the Matrix Frame and the CONFIG-1 card is able to communicate with them.

- **CONFIGURATION 1 LED "Green":** If this green LED is on solid the system is operating on the 1st configuration stored in memory. If this LED is flashing it a warning that the system is about to switch over to this configuration. Refer to the description of the CONFIG SELECT push-button for a discussion of the flashing function.
- **CONFIGURATION 2 LED "Green":** If this green LED is on solid the system is operating on the 2nd configuration stored in memory. If this LED is flashing it a warning that the system is about to switch over to this configuration.
- **CONFIGURATION 3 LED "Green":** If this green LED is on solid the system is operating on the 3rd configuration stored in memory. If this LED is flashing it a warning that the system is about to switch over to this configuration.
- **CONFIGURATION 4 LED "Green":** If this green LED is on solid the system is operating on the 4th configuration stored in memory. If this LED is flashing it a warning that the system is about to switch over to this configuration.
- **CONFIG SELECT Push-button:** This button is used to manually switch from one configuration to another at the frame. It is also possible to switch configurations from the Configuration Computer and an ICS-2002 station in the system. A valid configuration must be stored in the desired new configuration. The only way to setup a configuration is to download a configuration from the Configuration Computer.

  To change configurations, repeatedly press and release the CONFIG SELECT push-button. Each time the button is released the next Configuration LED will begin to flash indicating what configuration is setup to transfer to. The LED for the current configuration will stay on solid. Once the desired LED is flashing pressing and holding the button for 5 seconds will cause the newly selected configuration to be downloaded into all of the matrix cards and stations in the system. If an LED is flashing and the button is not pressed within 5 seconds the flashing will discontinue and the system will continue operate from the original configuration.
- **FRAME DATA LED "Yellow":** This yellow LED indicates communication activity from this card to some other card in the system. The CONFIG card will send regular communication to cause this LED to blink regular. This blinking activity indicates that those cards are indeed communicating on the data bus.

MTX Cards

The MTX cards each have ten indicator LEDS and one push button switch. The LEDs are visible through the front door. The Reset switch is only accessible with the door open.

The following paragraphs are a description of each push-button and LED in top to bottom order as they are seen on the board.

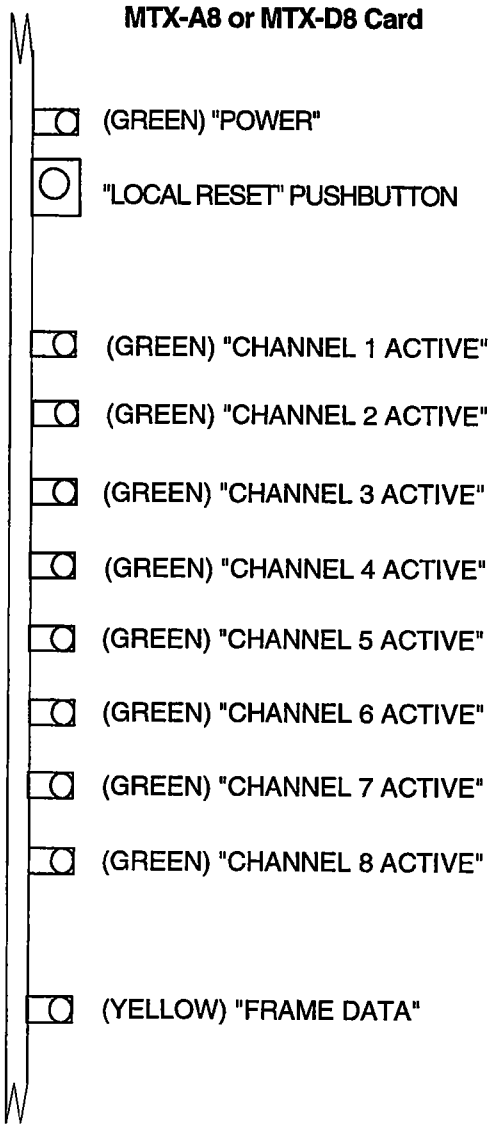


FIGURE F2-2 MTX Card Buttons and Indicators

- **POWER LED "Green":** This green LED is on solid when the DC power on the MTX card is within specifications. If it is flashing then one of the two analog power supplies on the board are out of specification. If the LED is out, the digital power supply on the board is off.

  A flashing LED will be reported to the CONFIG-1 card and cause a system failure ALARM.

- **LOCAL RESET Push-button:** Pressing and releasing this button will cause a reset of only that MTX card.

- **CHANNEL ACTIVE (Green):** The next eight green LEDs are activity indicators for each of the eight ports on this matrix card. On the front panel each LED is numbered with its port number for the frame. This overall port number corresponds to the RJ-45 number on the rear panel for that port.

  If a station is connected to the port, the LED will be on solid when the station has reported in and is fully functional.

  If an interface is connected the port, the card will sense what type of interface it is and the LED will be on solid.

  When a TALK label is first activated on a port, its LED will flash for 3 seconds to indicate activity on that port.

- **FRAME DATA LED:** This yellow LED indicates communication activity from this card to some other card in the system. The CONFIG-1 card will send regular communication to cause this LED to blink regular. This blinking activity indicates that those cards are indeed communicating on the data bus.

Power Supply Modules

The right side of the frame has two separate power supply modules that are capable of powering the entire frame separately. Together, the two modules provide 100% power redundancy.

The power supply modules are removable from the front of the frame and are "hot-patchable". To remove a power module loosen the six captive screws holding the module in place and pull on the handle provided.

Each of the modules are identical, however the Alarm circuitry contained in the module is only active in the top unit.

Alarm Circuitry

The alarm circuitry in the top module has four red indicator LEDs. A sonic alarm inside the module will emit a high-pitched beep whenever there is a system fault and a set of relay contacts will provide the ability to have an external indicator. There is a Reset push-button for the audible alarm and relay on the front of the module. Resetting the audible alarm and relay does not reset the actual alarm condition which will only reset when the cause of the alarm is removed.

The red SYSTEM FAULT Led will be flashing if the system has sensed a fault from a number of different causes. The following is a list of all of the possible causes:

1. Power Supply fault: If any one of the six power supplies in the two modules has a failure it will be reported. Each of these supplies has an LED on the front panel of the module to indicate the presence of power.
2. The CONFIG-1 card being removed from the frame or becoming non-functional will cause an alarm.
3. A clock system fault will cause an alarm and will be indicated by a solid or flashing LED on the CONFIG-1 card.
4. An out of range temperature condition will cause an alarm and will be indicated by the OVER TEMP LED on the CONFIG-1 card.
5. If any of the power sense circuits in any of the matrix cards senses a failure which will cause a flashing or off indication on that card's Power Sense LED and cause an alarm.

6 There is an external Alarm input to the CONFIG-1 card that will also cause an alarm condition. There is no indication on the front of the frame that this is the cause of the alarm. The typical use of this input would be to monitor the alarm circuits of a PSU-101 or other power supply which has its own indicators.

All fault conditions are recorded in the system event log in the CONFIG-1 card's battery-backed ram memory.

Trouble Shooting Guidelines

The Matrix Plus 3 system is a large complex interconnection of many microprocessor controlled devices. Clear-Com has provided complete schematics for all parts of the system. Because of the complexity, Clear-Com recommends that trouble shooting be limited to identifying the "bad" circuit board, module, or station and swap it out for a known good one. If possible, return the faulty unit to Clear-Com for repair.

The COM-72 Frame is a housing for the Matrix System. The actual matrix system is distributed between the CLOCK-1, CONFIG-1, and MTX matrix cards within the frame. The COM-72 frame also contains the necessary power supplies for the cards contained in it. If all of the cards and power supply modules are removed there are no active electronics left in the frame.

EXTDR-1 Frame Card Extender Board (Optional)

Matrix Plus 3 has a special card extender assembly (EXTDR-1) designed specifically for the MTX, CONFIG-1, and CLOCK-1 matrix cards. The digital communication bus will not operate through a passive extender card. To purchase an EXTDR-1 contact the Sales or Service departments.

A schematic for the EXTDR-1 is provided in the SYS-200 chapter.

The board contains the necessary circuitry to connect a frame card to the Digital Mother Board in the frame. The analog side of the board is passive but a jumper field is provided between all pins to allow monitoring or breaking connections to the RJ-45 rear panels.

Schematics and BOMs Provided in This Chapter

Schematics

For information on the CONFIG-1 or MTX-A8 cards refer to their chapters in this manual. The Power Supply modules are described later in this chapter. The following schematic drawings are provided in this chapter:

1 Overall Schematic of the COM-72 frame. This schematic contains the power components for the frame that include the Power Supply Mother Board, the Power Supply Modules.

2 The Digital Mother Board

3 The Rear Connector Panel.

For documentation on the CLOCK-1 System Clock PCB refer to SYS-200 Chapter.

For documentation on the MTX Matrix Card and the CONFIG-1 Configuration Card, each of these items have their own chapters in this manual.

BOMs

The Bills of Material provided in this chapter have been edited to show only those parts that might need field replacement. For items not covered in these BOMs please contact the Service Department.

Routine Maintenance Recommendations

The COM-72 a Lithium battery for NVM (Non-Volatile Memory) ram storage that does require routine maintenance.

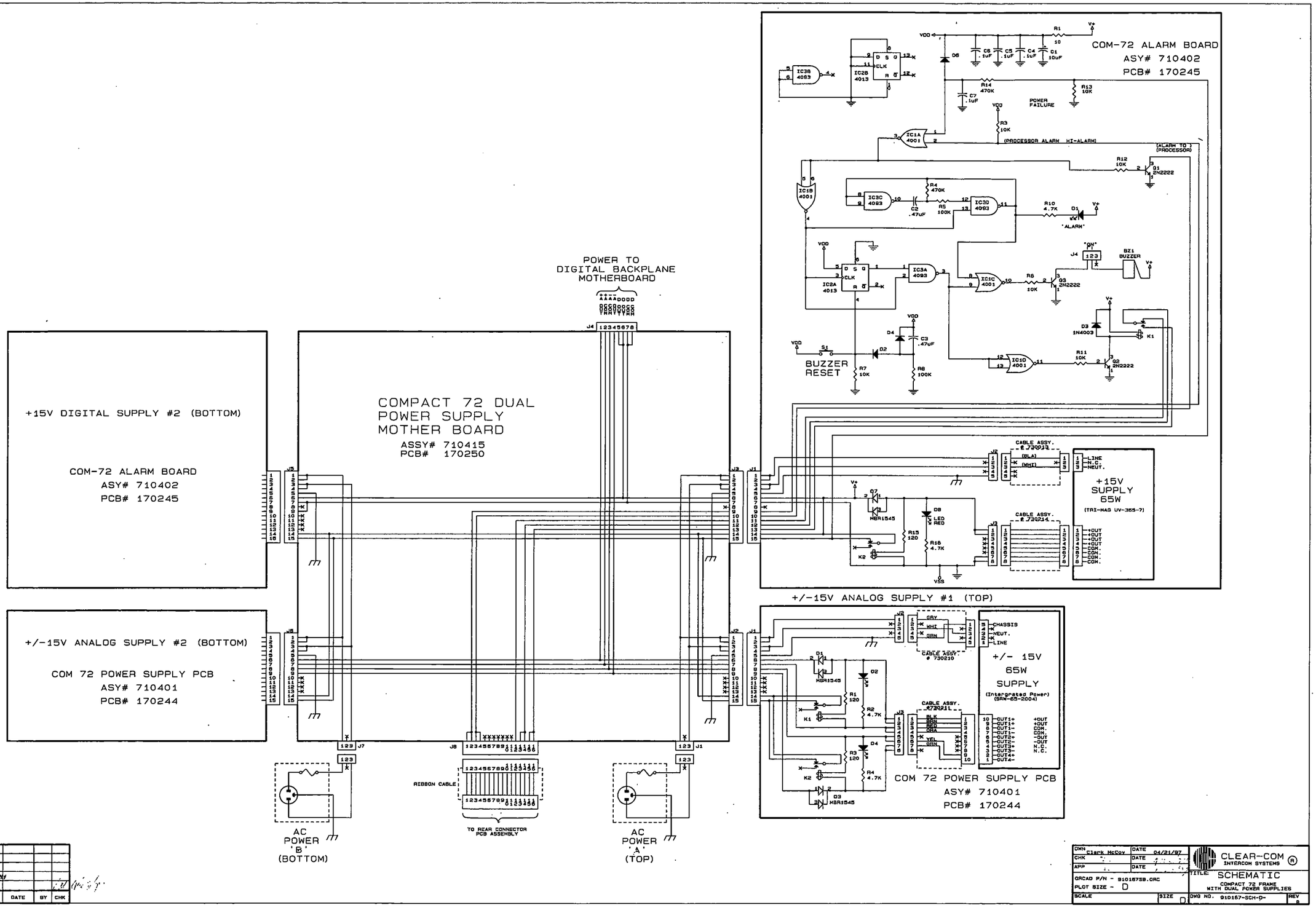
The CONFIG-1 features a lithium battery that provides back-up power for its processor's internal RAM. This RAM stores the system's configurations, up to a maximum of four. The battery should be disconnected before performing any service on the board, including battery replacement. The battery should be replaced every five years as a preventive maintenance measure. To disconnect the battery, remove the battery disconnect jumper and put it on the unconnected pair of pins on the header. The board will operate with the battery disconnected, but remember that if the system's power is cut:

- All operating parameters will be lost.
- The RAM will lose the configurations.

CAUTION

Lithium batteries can overheat or explode if they are shorted. When you handle the CONFIG-1 board or the loose battery, DO NOT touch any external electrical conductors to the battery's terminals or to the circuits that the terminals are connected to!

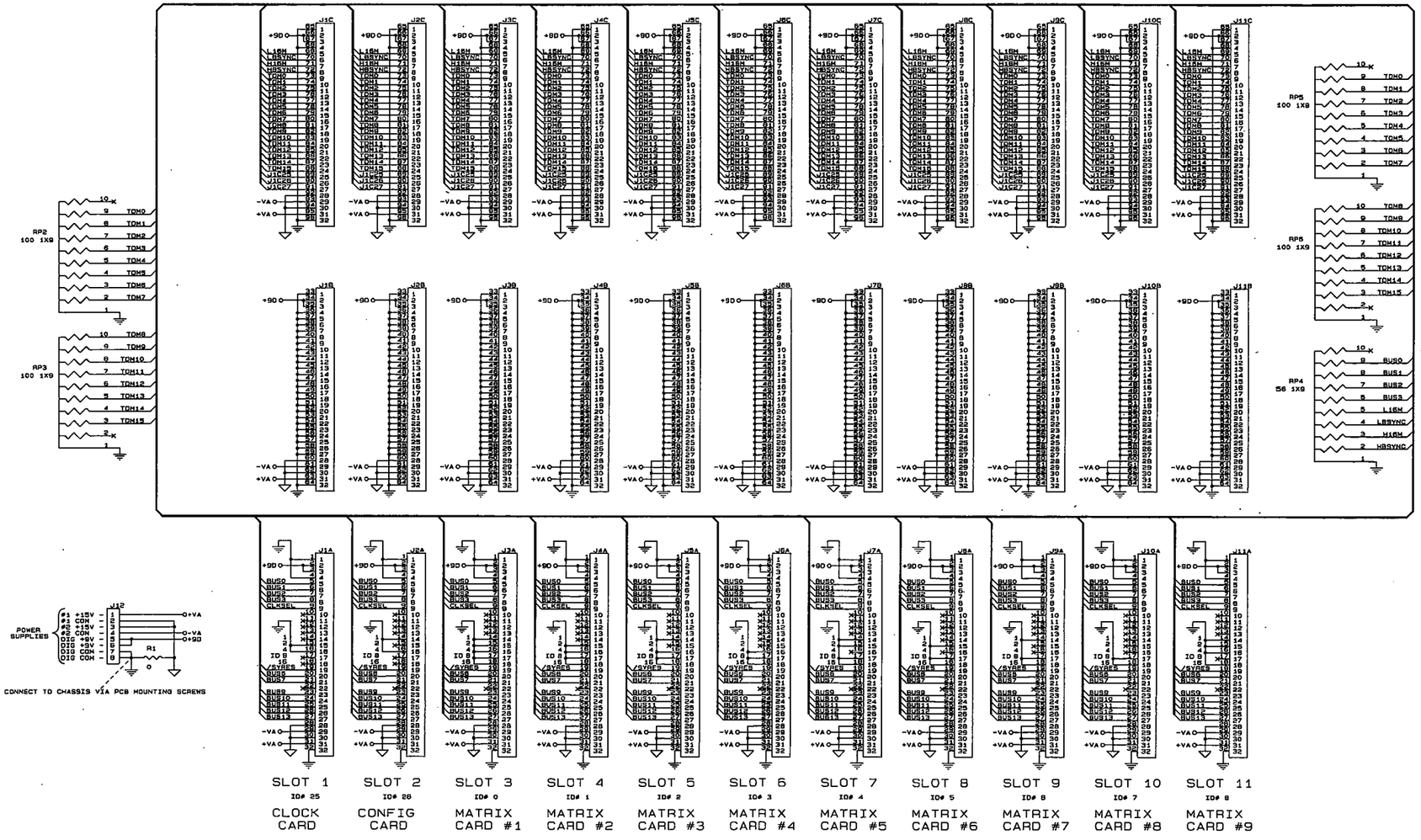
Whenever you are servicing the battery, make sure that the jumper on JP1 is connecting the common to either the ON or the OFF pin. If the common is left floating, the CONFIG-1 may behave unpredictably (for example, the microprocessor may reset itself intermittently).



REV	ECO#	DESCRIPTION	DATE	BY	CHK
B	2347	REPLACEMENT/2ND PWR SUPPLY			
A	2347	RELEASE TO PRODUCTION			

DWN Clark McCoy	DATE 04/21/97	CLEAR-COM INTERCOM SYSTEMS	
CHK	DATE		
APP	DATE	TITLE: SCHEMATIC	
ORCAD P/N - 910167SB.ORC		COMPACT 72 FRAME WITH DUAL POWER SUPPLIES	
PLOT SIZE - D			
SCALE	SIZE D	DWG NO. 910167-SCH-D-	REV B

FIGURE F2-3 Schematic, Overall - COM-72 Frame, Rev. B

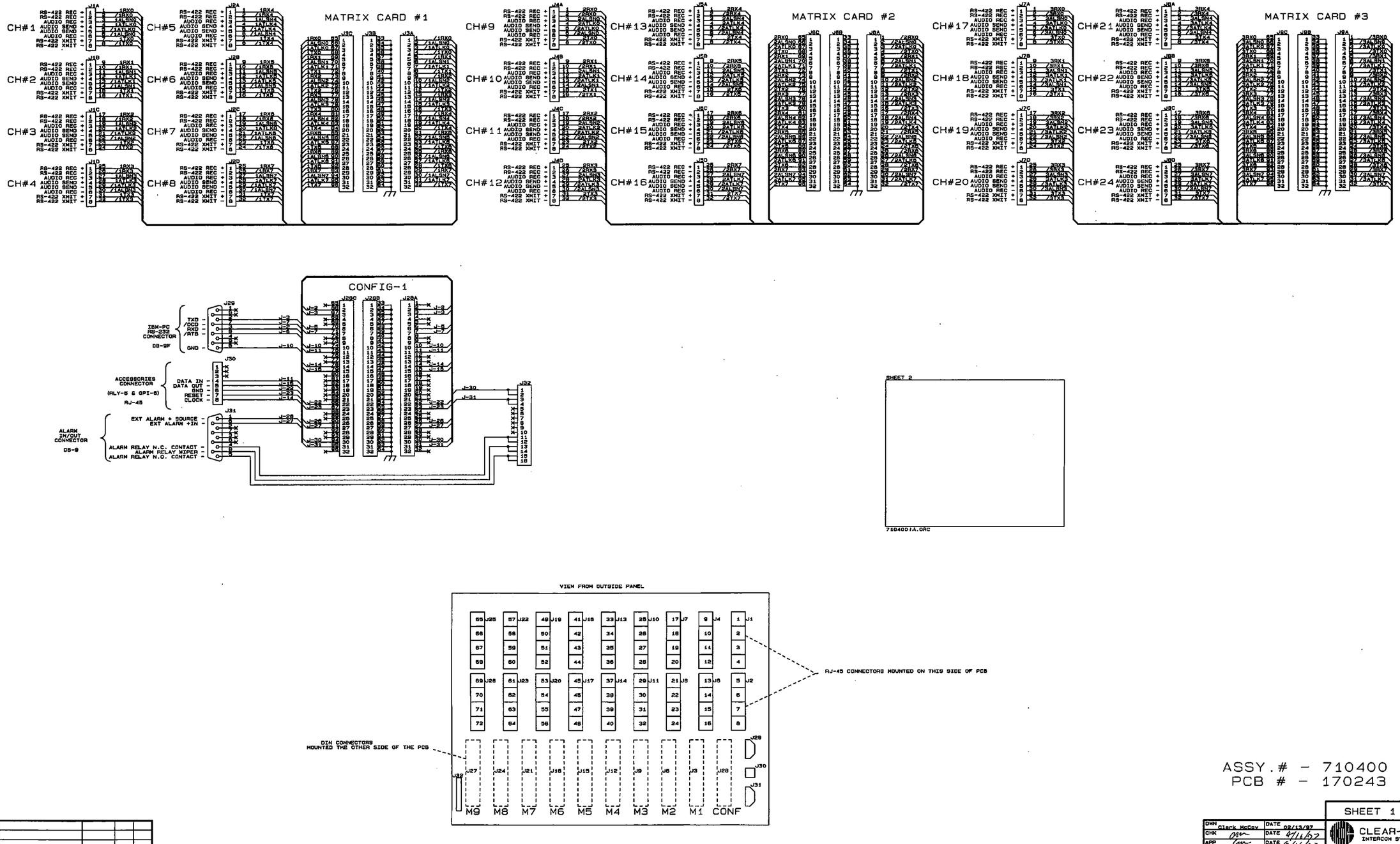


PCB ASSY# 710399
PCB# 170252

REV	ECO#	DESCRIPTION	DATE	BY	CHK

DWN Clark McCoy	DATE 03/04/97	CLEAR-COM INTERCOM SYSTEMS
CHK	DATE	TITLE: SCHEMATIC
APP	DATE	COMPACT-72 TDM MOTHER BOARD
ORCAD P/N - 710399SA.ORC		
PLOT SIZE - D		
SCALE	SIZE D	DWG NO. 710399-SCH-D- REV A

FIGURE F2-4 Schematic - COM-72 Frame, Digital Motherboard, Rev. A



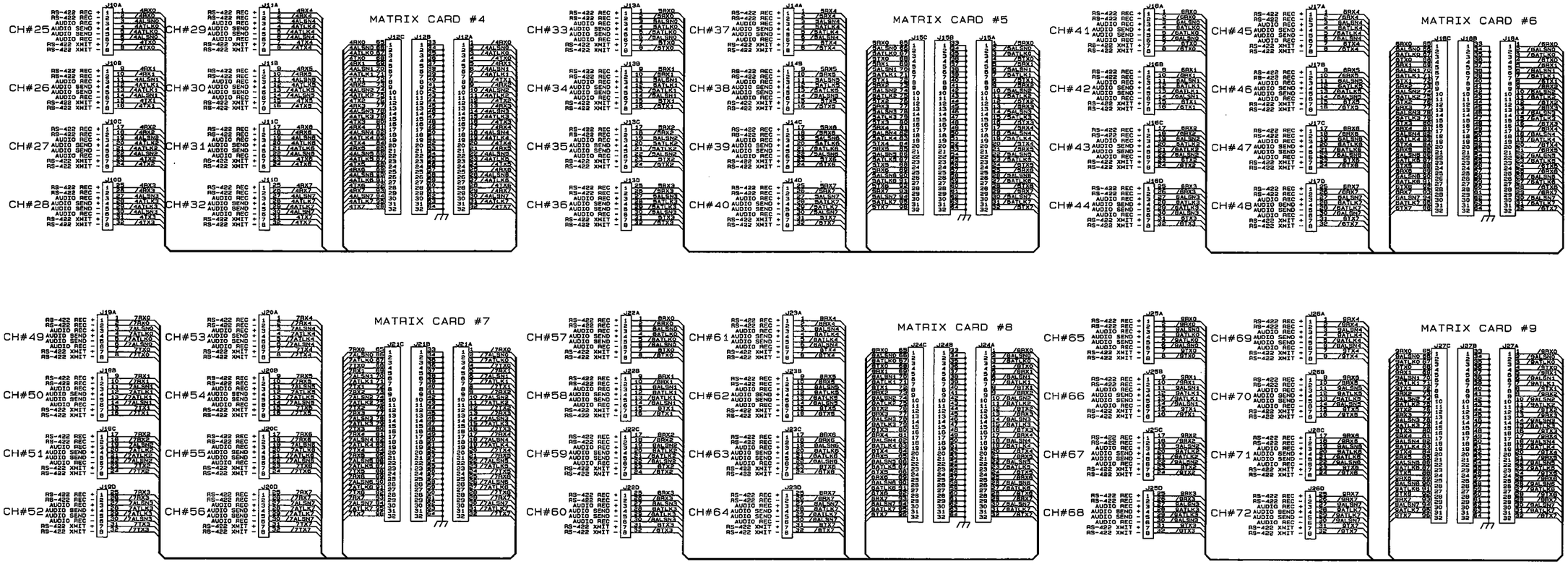
REV	ECO#	DESCRIPTION	DATE	BY	CHK
A	2347	RELEASE TO PROD	4/16/97		

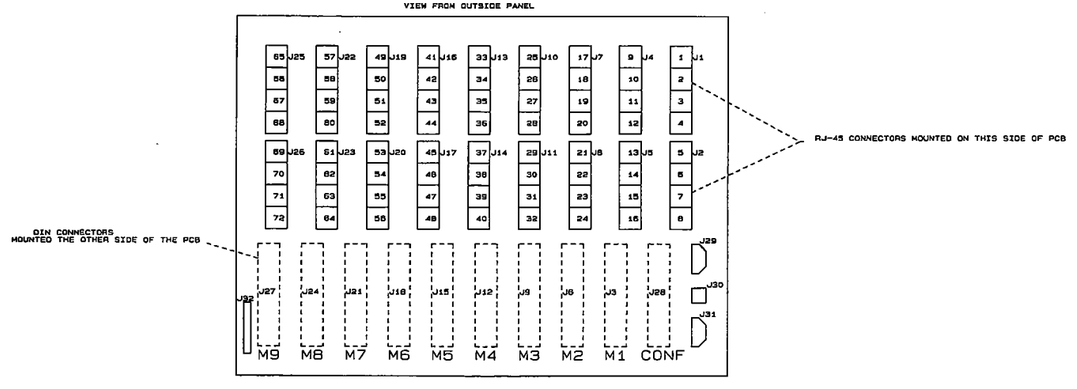
ASSY.# - 710400
PCB # - 170243

SHEET 1 OF 2

DWN Clark McCoy	DATE 02/13/97	CLEAR-COM INTERCOM SYSTEMS	
CHK	DATE 4/16/97	TITLE: SCHEMATIC	
APP	DATE 4/16/97	COMPACT-72 REAR PANNEL PCB	
ORCAD P/N - 710400SA.ORC			
PLOT SIZE - D			
SCALE --------	SIZE D	DWG NO. 710400-SCH-D-	REV A

FIGURE F2-5 Schematic - COM-72 Rear Connector PCB, Rev. A





ASSY.# - 710400
PCB # - 170243

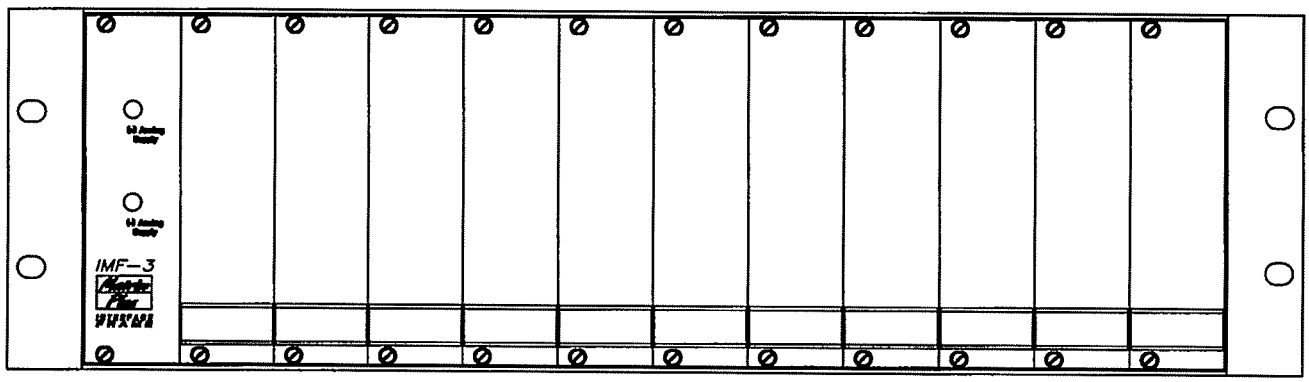
REV	ECO#	DESCRIPTION	DATE	BY	CHK

DWN Clark McCoy	DATE 02/13/97	SHEET 2 OF 2
CHK	DATE	CLEAR-COM INTERCOM SYSTEMS
APP	DATE	TITLE: SCHEMATIC
ORCAD P/N - 710400A..ORC		COMPACT-72 REAR PANNEL PCB
PLOT SIZE - D		
SCALE --------	SIZE D	DWG NO. 710400-SCH-D- REV A

FIGURE F2-5 Schematic - COM-72 Rear Connector PCB, Rev. A

Miscellaneous COM-72 Frame Parts

Device	Description	Part #
Connector	Power Entry Module	210320
Cord	Power Cord, AC	610022
Diode	MBR1545 Dual Schottky 45V/15A	480154
Fuse	4A 20mm Fast Blow Fuse	520032
PCB Assy	CLOCK-1	710391
PCB Assy	CONFIG-1	710388
PCB Assy	COM-72 Dual PS Mother Board	710415
PCB Assy	Digital Mother Board, COM-72	710399
Power Module	COM-72 Power Supply Module	720201
Power Supply	Dual +/- 15V, 65W PS	400015
Power Supply	Single +15V, 65W PS	400016
Relay	SPDT 12V Mini PC Relay	450006
Resistor, Bussed	100 Ohm x 9 (Dig. Mother Board)	415011
Resistor, Bussed	56 Ohm x 9 (Dig. Mother Board)	415012



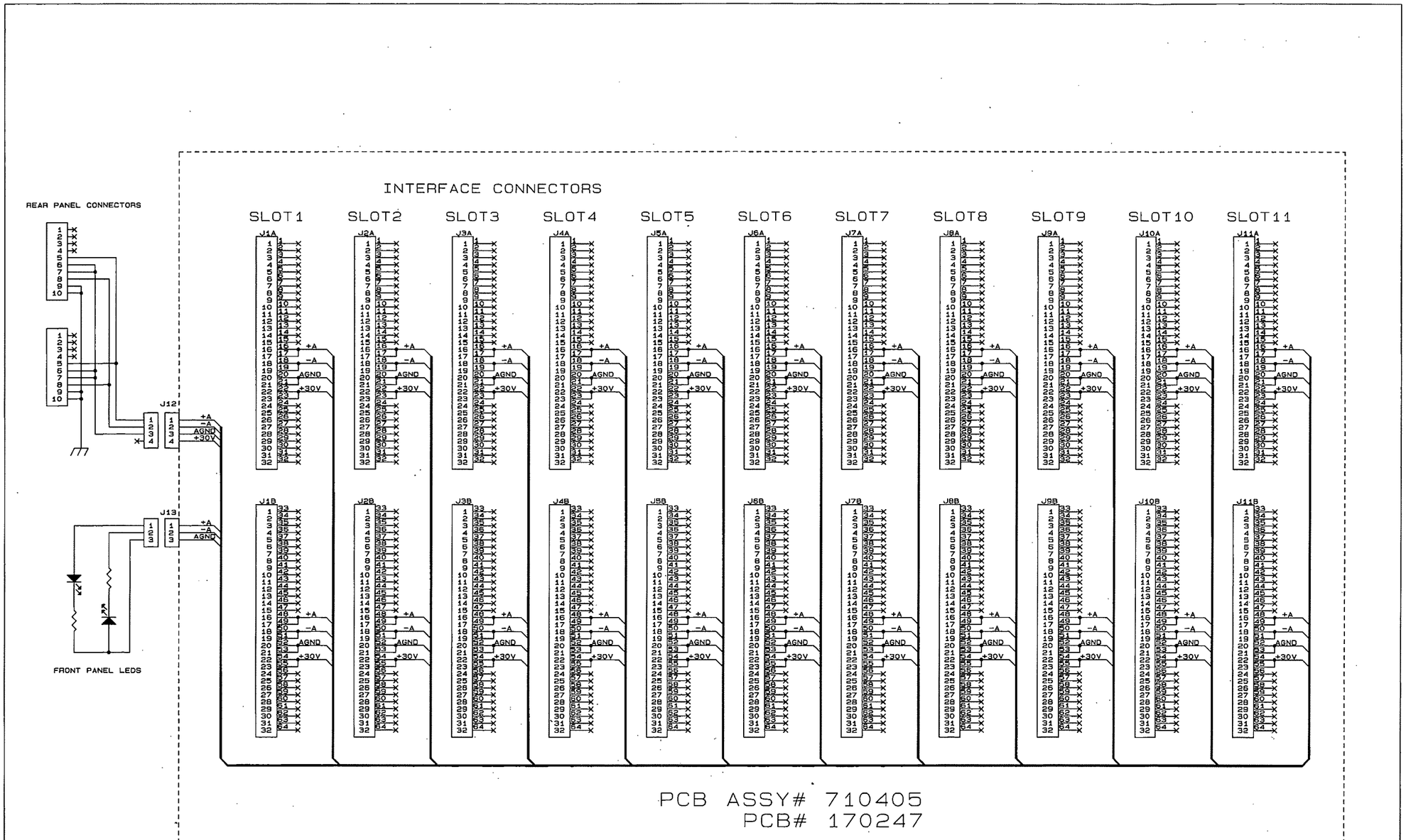
Matrix Plus 3 System IMF-3
INTERFACE MODULE FRAME

Introduction

This Section provides a schematic of the IMF-3 Interface Module Frame. The IMF-3 is specifically designed to house all Interfaces designed for Matrix Plus 3. The IMF-3 is 3 RU high and it can house up to 11 Matrix Plus 3 interfaces.

The IMF-3 is shipped with all of the rear panels installed for all eleven slots. The IMF-3 has a universal rear panel for all interface types. The rear panels are no longer shipped with each interface.

Each of the rear panels have active circuitry to convert the interface I/O style to Matrix Plus 3 port standards.



REV	ECO#	DESCRIPTION	DATE	BY	CHK
A	2348	RELEASE TO PROD	4/16/97		

DWN Clark McCoy	DATE 01/14/97	CLEAR-COM INTERCOM SYSTEMS ®
CHK	DATE	TITLE: SCHEMATIC IMF-3 FRAME
APP	DATE	
ORCAD P/N - 910168SA.ORC		
PLOT SIZE - D		
SCALE	SIZE D	DWG NO. 910168-SCH-D- REV A

FIGURE F4-1 Schematic, Overall - IMF-3 Frame, Rev. A

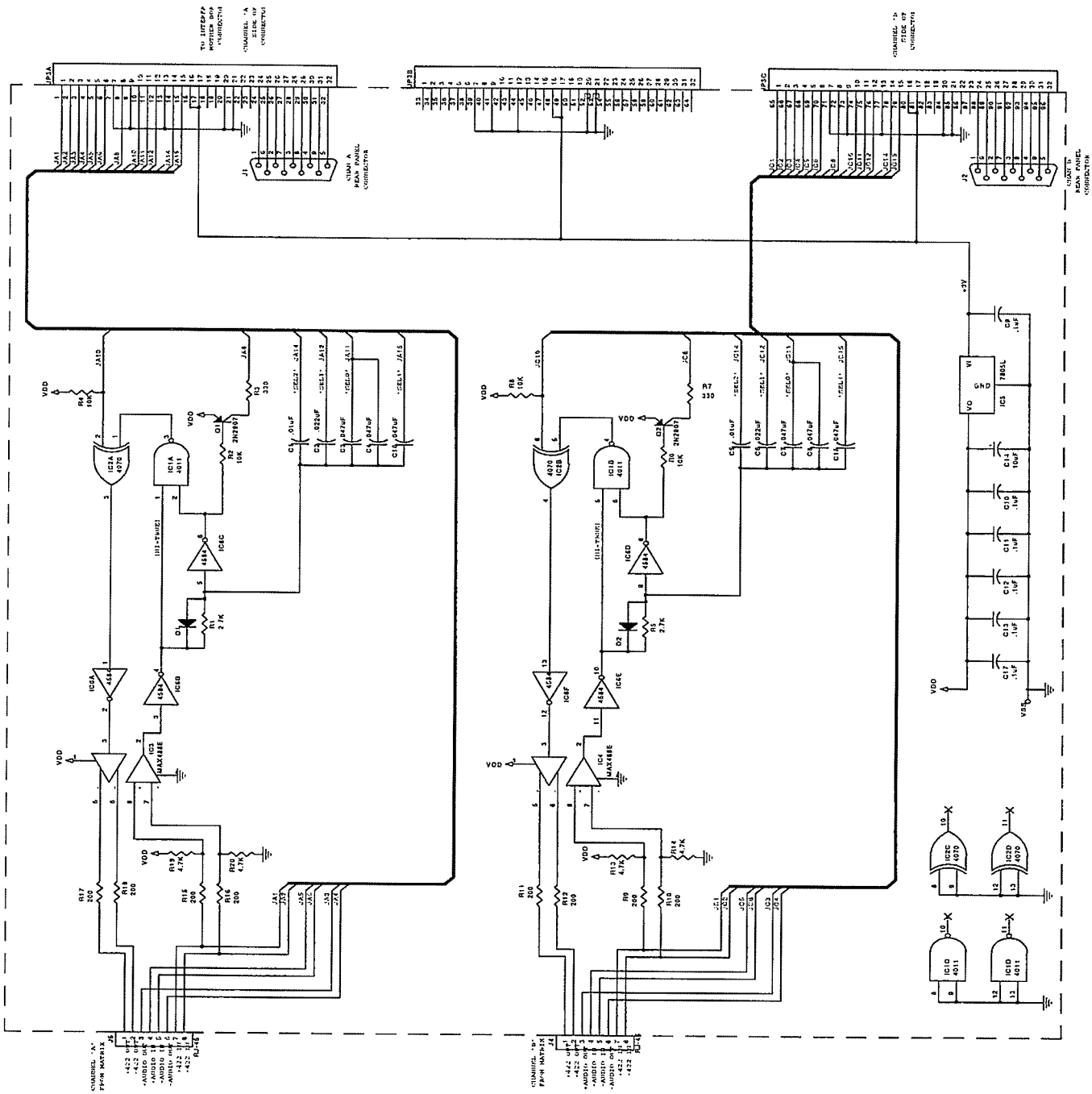


FIGURE F3-2 Schematic, Rear Panel, Rev. A

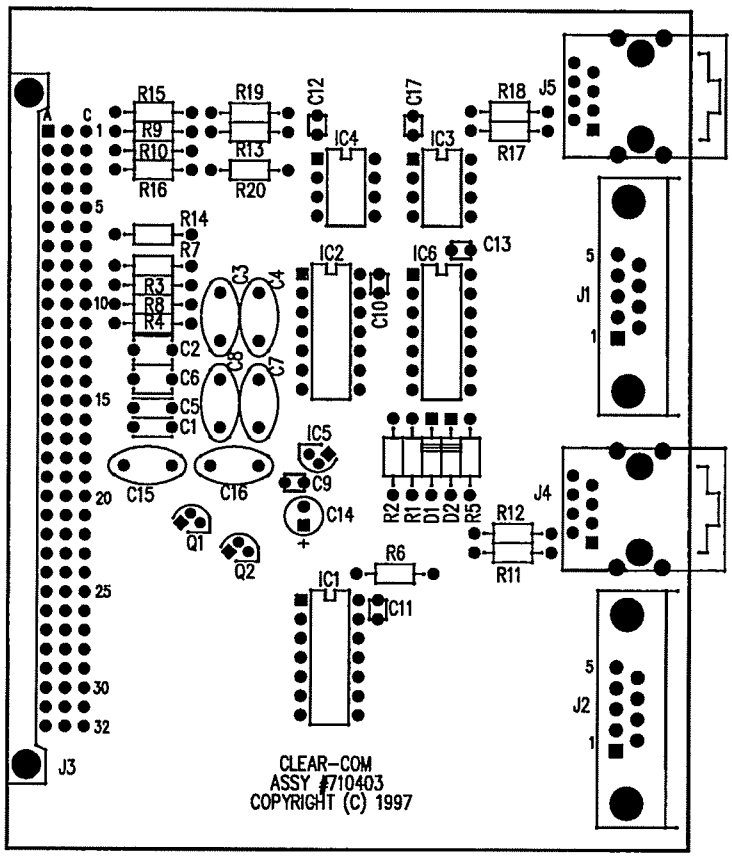


FIGURE F3-3 Rear Panel PCB Assembly Drawing, Rev. A

Bill of Materials for the IMF-3 Interface PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.01	uF	Ceramic	30V	20%	150012	C1,C5
.022	uF	Mylar	100V	10%	150008	C6,C2
.047	uF	Mylar	50V	10%	150005	C3,C4,C7,C8,C15,C16
.1	uF	Monolythic	50V	10%	150035	C9,C10,C11,C12,C13,C17
10	uF	ALU Radial	50V		150064	C14 RJ-45

Resistors

Value		Power	Type	Tol.	Part #	Designator
200	Ohm	1/4W	Carbon Film	5%	410072	R9-R18
330	Ohm	1/4W	Carbon Film	5%	410061	R3,R7
2.7	K Ohm	1/4W	Carbon Film	5%	410040	R5,R1
4.7	K Ohm	1/4W	Carbon Film	5%	410013	R13,R14,R19,R20
10	K Ohm	1/4W	Carbon Film	5%	410016	R2,R4,R6,R8

Diodes & Transistors

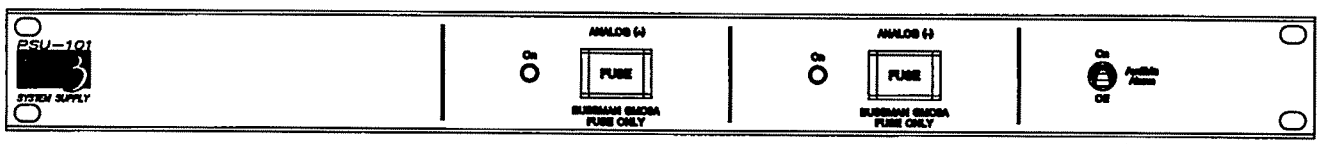
Device	Description	Part #	Designator
Diode	1N4148 Signal 10mA 75PIV	480000	D1,D2
Transistor	2N2907 PNP 30V	480007	Q1,Q2

Integrated Circuits

Device	Description	Part #	Designator
Digital IC	4011 Quad 2 In NAND Gate	480111	IC1
Digital IC	4070B Quad EOR Gate	480067	IC2
Digital IC	4584B Hex Schmitt Trig Buffer	480090	IC6
Digital IC	MAX488E RS-422 Tranceiver Dip8	480231	IC3,IC4
Regulator	7805L Pos 5V Regulator TO-92	480088	IC5

Miscellaneous Components

Type	Description	Part #	Designator
Connector	DB-9M, Right Angle PC Mount	210343	J1,J2
Connector	RJ-45, Right Angle PC Mount	210335	J4,J5



Matrix Plus 3 System PSU-101

POWER SUPPLY MODULE

Introduction

This Section provides troubleshooting information, schematics, assembly drawings and a miscellaneous bill of materials for the PSU-101 Power Supply Module.

Description

Your application may require two or more **redundant** PSU-101 Power Supplies: the DC outputs of the supplies can be connected in parallel (through blocking diodes) so that if one supply fails, the other will continue to power the system. Each supply can be powered by a separate mains AC branch.

Each PSU-101 supply has two DC outputs: +8 volts and -8 volts for analog circuits. Each of the PSU-101's outputs features a green LED that indicates voltage on the associated output.

The front panel also features an Alarm Enable Switch that enables an alarm to sound if one of the three outputs fails. However, this internal alarm is powered from the +8 Volt output—if that output fails, the alarm will not work, unless two PSU-101s are paralleled for redundancy. In redundant operation, if one supply fails, maintenance personnel will be alerted before the second supply can fail.

The rear panel features a set of isolated relay contacts that will operate when any of the supplies fail; they can be wired to an external remote alarm.

CAUTION: *These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer all servicing to qualified servicing personnel.*

Output Voltage Adjustment

Each power output features adjustable output voltage. If voltage adjustment is necessary, set the outputs for 9 VDC $\pm$ 0.1 V under a 1 ampere load (these manuals refer to the output voltages as 8 V; the voltages presented to the frame below the blocking diodes is actually about 8.4 to 8.5 V).

Regulated Power Supply Module Service

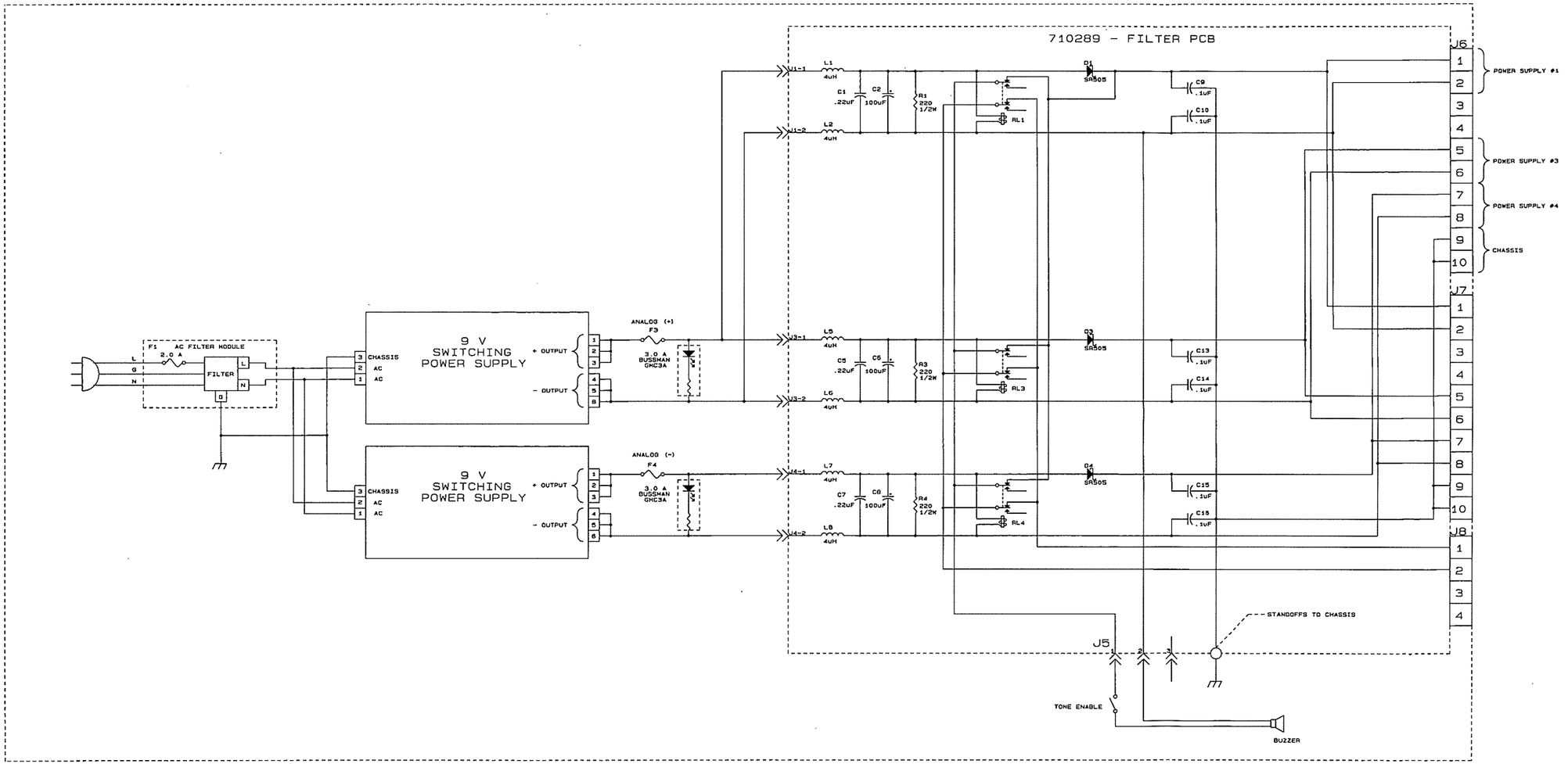
Clear-Com purchases the regulated power supply module used in the PSU-101 as a finished unit. We have no schematics for the module because the manufacturer does not supply them. If the unit fails, the only repair that can be performed is to replace the unit's input fuse.

CAUTION: *For safety considerations, when the PSU-101 power supply is mounted on a rack:*

- *Leave one full rack space above the unit and one full rack space below the unit.*
- *Do not block the ventilation holes.*
- *Leave at least 3 inches of clearance behind the unit.*

Miscellanous Bill of Materials for the PSU-101

Device	Description	Part #	Designator
Buzzer	PIEZO-A-LERT	500121	
Cable	CABLE ASY POWER 10 PIN	730178	
Connector	FILTRD AC LINE CON	210176	
Cord	POWER CORD	610022	
Diode	SR505 Schottky Diode 5A 50V	480178	D3,D4
Fuse	1/2A SLO-BLO 20MM FUSE	520030	
Fuse	2A SLO-BLO 20MM X 5MM FUSE	520039	
Fuse	3A SLO-BLO 20MM X 5MM FUSE	520040	
Fuseholder	20MM FUSHOLDER	520031	
Led	GREEN PANEL 12V	390046	
Power Supply	40 W 9 V SWITCHING	400010	
Relay	DPDT PCB Mount Relay	210270	RL3,RL4
Switch	SPDT MINI TOGGLE	510040	



REV	ECO#	DESCRIPTION	DATE	BY	CHK
A	2373	RELEASE TO PRODUCTION	6/03/97		

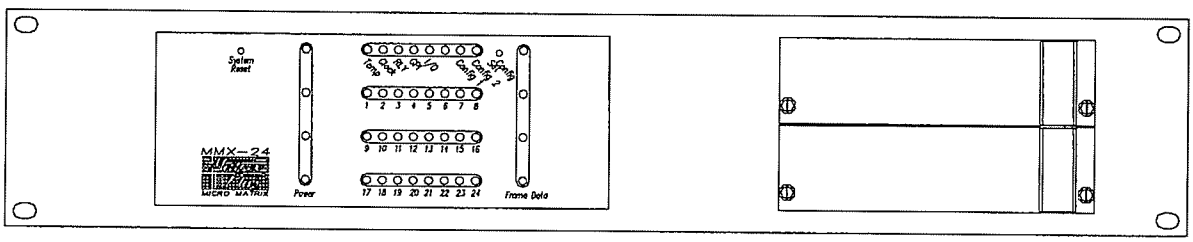
DWN Clark McCoy	DATE 06/03/97
CHK	DATE
APP/	DATE
ORCAD P/N - 910171SA.ORC	
PLOT SIZE - D	
SCALE	SIZE D

CLEAR-COM INTERCOM SYSTEMS

TITLE: SCHEMATIC
PSU-101 MATRIX PLUS 3 INTERFACE POWER SUPPLY

DWG NO. 910171-SCH-D- REV A

FIGURE F4-1 Schematic - PSU-101 Power Supply, Rev. A



Matrix Plus 3 System MMX-24
MICRO MATRIX FRAME

Introduction

This Chapter provides a description of the frame, trouble shooting guidelines, routine maintenance recommendations, and schematic diagrams, and Bills of Materials for the MMX-24/16/8 Card Frame.

The MM-CONFIG and MTX-A8M cards are part of the MMX frame however documentation for them is contained in their own chapters in the Matrix Cards section of the manuals.

Description

The MMX-24/16/8 Card Frame houses the programmable hardware that enables the Matrix Plus 3 System to support up to 24 ports, allowing you to build a 24 x 24 matrix system. A basic MMX-24/16/8 frame includes the following:

- A card frame that holds up to 3 matrix cards.
- A MM-CONFIG card with battery-backed RAM that stores two configurations and communicates with an external configuration computer.
- An external power supply.
- Connectors on the rear panel that support connections to a configuration computer, I/O accessories, alarm I/O, and twenty-four RJ-45 connectors to support three matrix cards.

From a system software point of view the MMX-24/16/8 and the SYS-200 frames are identical except for the number of Matrix cards the frame will support and the number of configurations that can be stored.

Rear Panel Connectors

The rear panels of the MMX-24/16/8 feature connectors that allow you to connect to intercom stations and interfaces, to the computer running the configuration software, and to other separate Matrix Plus 3 systems, in addition to connecting to an external power supply.

Front Panel Controls and Indicators

The front panel of the MMX-24 is divided in two sections. A area on the left side of the frame covers the card frame portion that contains the Matrix Cards and Configuration Card. The right portion of the front panel has two slots for any of the Matrix Plus 3 interfaces. All of the interfaces are provided with special front panels intended for horizontal mounting. Note: If ordering interfaces for the Micro Matrix frame be sure to specify the horizontal versions.

The Micro Matrix does not provide front panel access to the active circuitry in the frame as the COM-72 and SYS-200 provides. To gain access to the matrix cards, the front panel must be removed. All of the necessary indicators of the matrix cards are visible through the front panel.

The active circuitry for the matrix frame is contained in the printed circuit cards located behind the front panel. The circuit cards used are similar to the ones used in the standard matrix frames, but they will only operate in the Micro Matrix frame. A MMX-24 has one MM-CONFIG Configuration Card and three MTX-A8M matrix cards. The MM-CONFIG Card and Matrix Cards each have led indicators that are visible through windows in the front panel.

The MM-CONFIG card is always plugged into the top slot. Matrix Cards are to be plugged in the next 3 slots below. The port assignment of a given card is determined by the card connector on the mother board that the card is plugged into. There are ID jumpers on the motherboard connector telling a matrix card what port numbers it is servicing.

The MM-CONFIG Card has two push-button switches that are available through a small hole in the front panel. One push button allows resetting the all of the microprocessors in the frame and the other is used for manual selection of the two Configurations saved in memory on the MM-CONFIG card.

The functions of the indicators and switches of all of the boards are described in the following paragraphs.

MM-CONFIG Card

The MM-CONFIG card has nine indicator LED'S and two push button switches. The MM-CONFIG is the top row of LEDs in the figure below. The LEDs are visible through the front panel. The push button switches are available through small holes in the front panel.

The following paragraphs are a description of each push-button and led in left to right order as they are seen on the front panel.

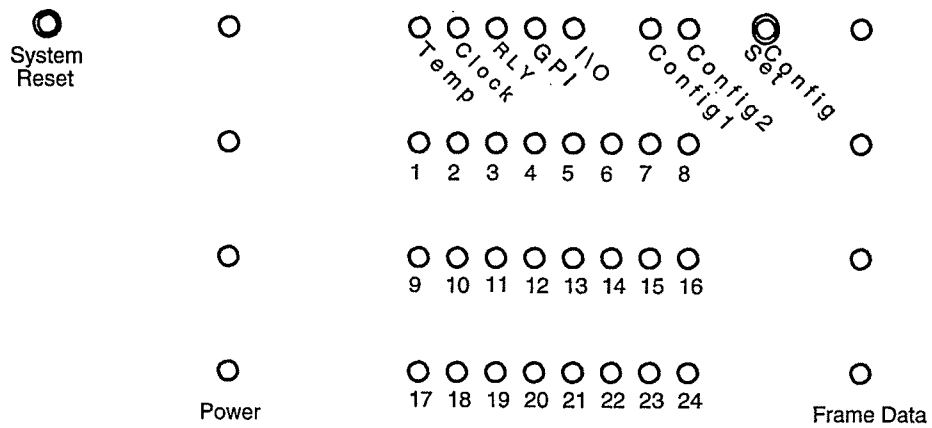


FIGURE F5-1 Micro-Matrix Front Panel LEDs and Controls

- **SYSTEM RESET Push-button:** Pressing and releasing this button using a small screwdriver or stiff wire will cause ALL of the matrix cards and the CONFIG card in the frame to reset.
- **POWER LED "Green":** This green LED is on solid when the DC power on the MM-CONFIG is within specifications.
- **OVER TEMP LED "Red":** This red LED when on, indicates that the temperature as measured on the MM-CONFIG card is out of safe operating range. Safe operating range is between 0 and 50 degrees C (32 and 125 degrees F).
- **CLOCK LED "Red":** The LED marked CLOCK indicates status of the system Clock Group signals driven by the MM-CONFIG card.

  Normally the CLK FAULT LED remains continuously OFF, indicating that all signals associated with system clock are fully functional.

- **GPI LED "Yellow":** This yellow LED has two functions. If it is on solid it indicates that one or more GPI-6 interfaces is connected externally to the Matrix Frame and the MM-CONFIG card is able to communicate with them. The MM-CONFIG card has the equivalent of 1 GPI-6 built on to the board and this led is not indicating it.

  The led will flash shortly (about 3 seconds) if there is a change in status of any of the GPI inputs including the six inputs that are built into the card.

- **RLY LED "Yellow":** This yellow LED has two functions. If it is on solid it indicates that one or more RLY-6 interfaces is connected externally to the Matrix Frame and the MM-CONFIG card is able to communicate with them. The MM-CONFIG card has the equivalent of 1 RLY-6 built on to the board and this led is not indicating it.

  The led will flash shortly (about 3 seconds) if there is a change in status of any of the Relays on any of the RLY-6 Modules including the six that are built into the card.

- **I/O LED "Yellow":** This yellow LED is on any time there is active communication to or from the Configuration Computer.

- **CONFIG 1 LED "Green":** If this green LED is on solid the system is operating on the 1st configuration stored in memory. If this LED is flashing it a warning that the system is about to switch over to this configuration. Refer to the description of the CONFIG SET push-button for a discussion of the flashing function.

- **CONFIG 2 LED "Green":** If this green LED is on solid the system is operating on the 2nd configuration stored in memory. If this LED is flashing it a warning that the system is about to switch over to this configuration.

- **CONFIG SET (Configuration Select) Push-button:** This button is used to manually switch from one configuration to another at the frame. It is located just behind the front panel and is accessed using a small screwdriver or stiff wire. It is also possible to switch configurations from the Configuration Computer and an ICS-2002 station in the system. A valid configuration must be stored in the desired new configuration. The only way to setup a configuration is to download a configuration from the Configuration Computer.

  To change configurations, repeatedly press and release the CPU CONFIG push-button. Each time the button is released the next Configuration LED will begin to flash indicating what configuration is setup to transfer to. The LED for the current configuration will stay on solid. Once the desired LED is flashing pressing and holding the button for 5 seconds will cause the newly selected configuration to be downloaded into all of the matrix cards and stations in the system. If an LED is flashing and the button is not pressed within 5 seconds the flashing will discontinue and the system will continue operate from the original configuration.

- **FRAME DATA LED "Yellow":** This yellow LED indicates communication activity from this card to some other card in the system. The CONFIG-1 card will send regular communication to cause this LED to blink regular. This blinking activity indicates that those cards are indeed communicating on the data bus.

MTX Cards

The MTX-A8 and MTX-D8 cards has ten indicator LEDs. The LEDs are visible through the front panel. The lower three cards in the frame are MTX-A8Ms.

Refer to Figure F5-1 on page 3 of this section for physical location of the LED indicators for the Matrix Cards.

- **POWER LED "Green":** This green LED is on solid when the DC power on the MTX card is within specifications. If it is flashing then one of the two analog power supplies on the board are out of specification. If the LED is out, the digital power supply on the board is off.
- **CHANNEL ACTIVE (Green):** The next eight green LEDs are activity indicators for each of the eight ports on this matrix card. On the front panel each LED is numbered with its port number for the frame. This overall port number corresponds to the RJ-45 number on the rear panel for that port.

  If a station is connected to the port, the LED will be on solid when the station has reported in and is fully functional.

  If an interface is connected the port, the card will sense what type of interface it is and the LED will be on solid.

  If a TALK label is first activated on a port, its LED will flash for 3 seconds to indicate activity on that port.
- **FRAME DATA LED:** This yellow LED indicates communication activity from this card to some other card in the system. The CONFIG-1 card will send regular communication to cause this LED to blink regular. This blinking activity indicates that those cards are indeed communicating on the data bus.

Trouble Shooting Guidelines

The Matrix Plus 3 system is a large complex interconnection of many microprocessor controlled devices. Clear-Com has provided complete schematics for all parts of the system. Because of the complexity, Clear-Com recommends that trouble shooting be limited to identifying the "bad" circuit board, module, or station and swap it out for a known good one. If possible, return the faulty unit to Clear-Com for repair. This section covers the following subjects:

- Access to Internal Matrix Cards
- Differences of Micro Matrix Cards
- Technical Description of the Micro Matrix

Access to Internal Matrix Cards

The MMX-24/16/8 Frame is a housing for the Matrix System. The actual matrix system is distributed between the MM-CONFIG and MTX matrix cards within the frame. Access to the active circuitry within the MMX frames requires removal of the front panel. The following procedure describes the steps necessary to gain access to a card:

1 Unplug the power supply from the rear panel.

2 Remove any interfaces or blank panels over the interface slots.

3 Remove the top cover.

4 Remove the front panel.

5 To remove an individual card, use a pair of long nose pliers on either the extreem left or right side of a board where there are no components to pull on the Card. Pull a little on one side then the other until the board releases from its connectors.

Differences of Micro Matrix Cards

The cards used in the Micro Matrix are different from their counterparts in the other matrix frames. The MM-CONFIG and MTX-A8M will not operate in either a COMPACT-72 or a SYSTEM-200 frame. Neither will a CONFIG-1 or MTX-A8 operate in a Micro Matrix. They will not be harmed if plugged into the wrong frame, however they will not function.

The MM-CONFIG has added new circuitry, different type of power for the board, and reduced RAM for Configuration memory storage.

The MTX-A8M is powered differently from its counterpart.

Technical Description of the Micro Matrix

The Micro Matrix is a scaled down version of a COMPACT-72 with the intention of producing a smaller more cost effective matrix frame for smaller systems.

The mother board construction techniques are the same as for the COMPACT-72 only scalled down.

To simplify the powering of the frame an external +5VDC, +12VDC, and -12VDC is provided to directly power the individual cards without onboard regulators on each card. The regulated +5VDC is brought in on different pins on the connector than in regular matrix cards. The matrix cards are identical to standard Matrix Plus 3 cards except for this powering scheme.

The MM-CONFIG card has a number of different features than the standard CONFIG-1 card. One complete section of a GPI-6 and one complete section of a RLY-6 is built on to the card. More GPI and RLY modules can be added externally as with a normal frame. The built in interfaces occupy the first two of the possible ten RLY and GPI interfaces. Also the number of configurations that can be saved has been reduced to reduce the amount of battery backed memory necessary.

The interface module slots are separate from matrix portion of the unit except that the interfaces are powerred from the + and - 12VDC in the frame. When an interface is purchased it will come with a rear panel module also. The rear panel module will need to be installed by removing one of the blank panels on the rear.

Routine Maintenance Recommendations

The MMX-24/16/8 a Lithium battery for NVM (Non-Volatile Memory) ram storage that does require routine maintenance.

The battery should be disconnected before performing any service on the board, including battery replacement. The battery should be replaced every five years as a preventive maintenance measure. To disconnect the battery, remove the battery disconnect jumper and put it on the unconnected pair of pins on the header. The board will operate with the battery disconnected, but remember that if the system's power is cut:

- All operating parameters will be lost.
- The RAM will lose the configurations.

CAUTION

Lithium batteries can overheat or explode if they are shorted. When you handle the MM-CONFIG board or the loose battery, DO NOT touch any external electrical conductors to the battery's terminals or to the circuits that the terminals are connected to!

Whenever you are servicing the battery, make sure that the jumper on JP1 is connecting the common to either the ON or the OFF pin. If the common is left floating, the MM-CONFIG may behave unpredictably (for example, the microprocessor may reset itself intermittently)

If servicing the battery, replace only with Clear-Com or equivalent type part. Dispose of used batteries according to battery manufacturer's instructions.

Schematics and BOMs Provided in This Chapter

Schematics

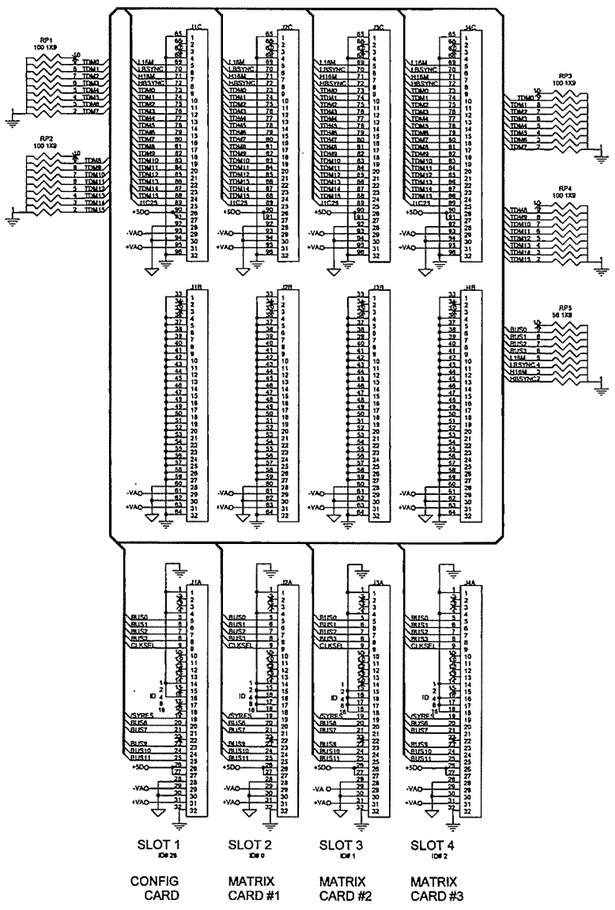
For information on the MM-CONFIG or MTX-A8M cards refer to their chapters in this manual. An overall Schematic of the MMX-24/16/8 frame is included in this chapter.

BOMs

The Bills of Material provided in this chapter have been edited to show only those parts that might need field replacement. For items not covered in these BOMs please contact the Service Department.

Miscellaneous MMX-24/16/8 Frame Parts

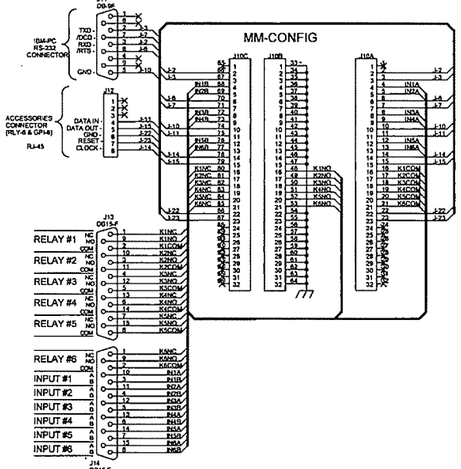
Device	Description	Part #
Cord	Power Cord, AC	610022
PCB Assy	MTX-A8M	710453
PCB Assy	MM-CONFIG	710447
Power Module	MMX-24 Power Supply Module	760051



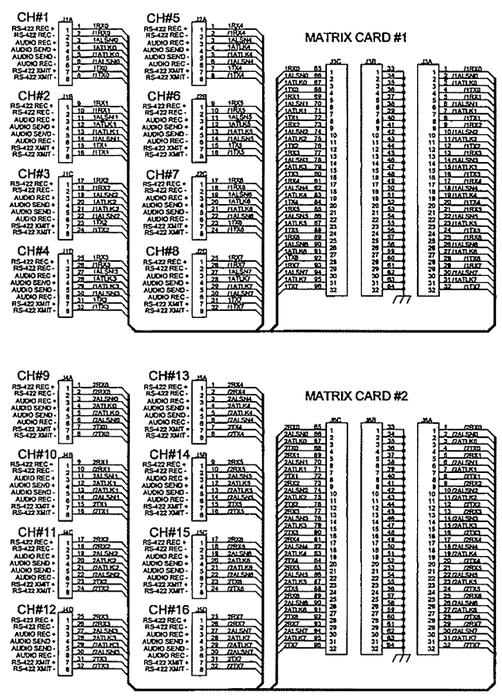
DIGITAL BACK PLANE MOTHER BOARD

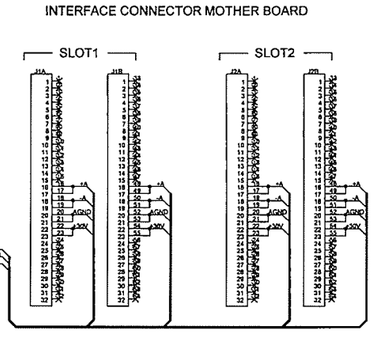
PCB ASSY# 710446
PCB# 170270

(This board is for 5 Volt Matrix and Config cards)

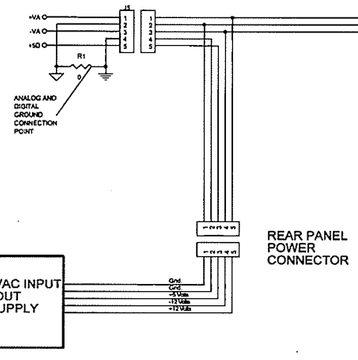


REAR PANEL PCB
PCB ASSY# 710445
PCB# 170269





PCB ASSY# 710444
PCB# 170268



REV	ECO#	DESCRIPTION	DATE	BY	CHK
A	2473	RELEASE TO PRODUCTION	05/07/98	CM	

DWN	Clark McCoy	DATE 05/14/98
CHK		DATE 05/14/98
APP		DATE 05/14/98
ORCAD P/N	760046sa.dsn	
SHEET:	1 OF: 1	
SCALE		SIZE D

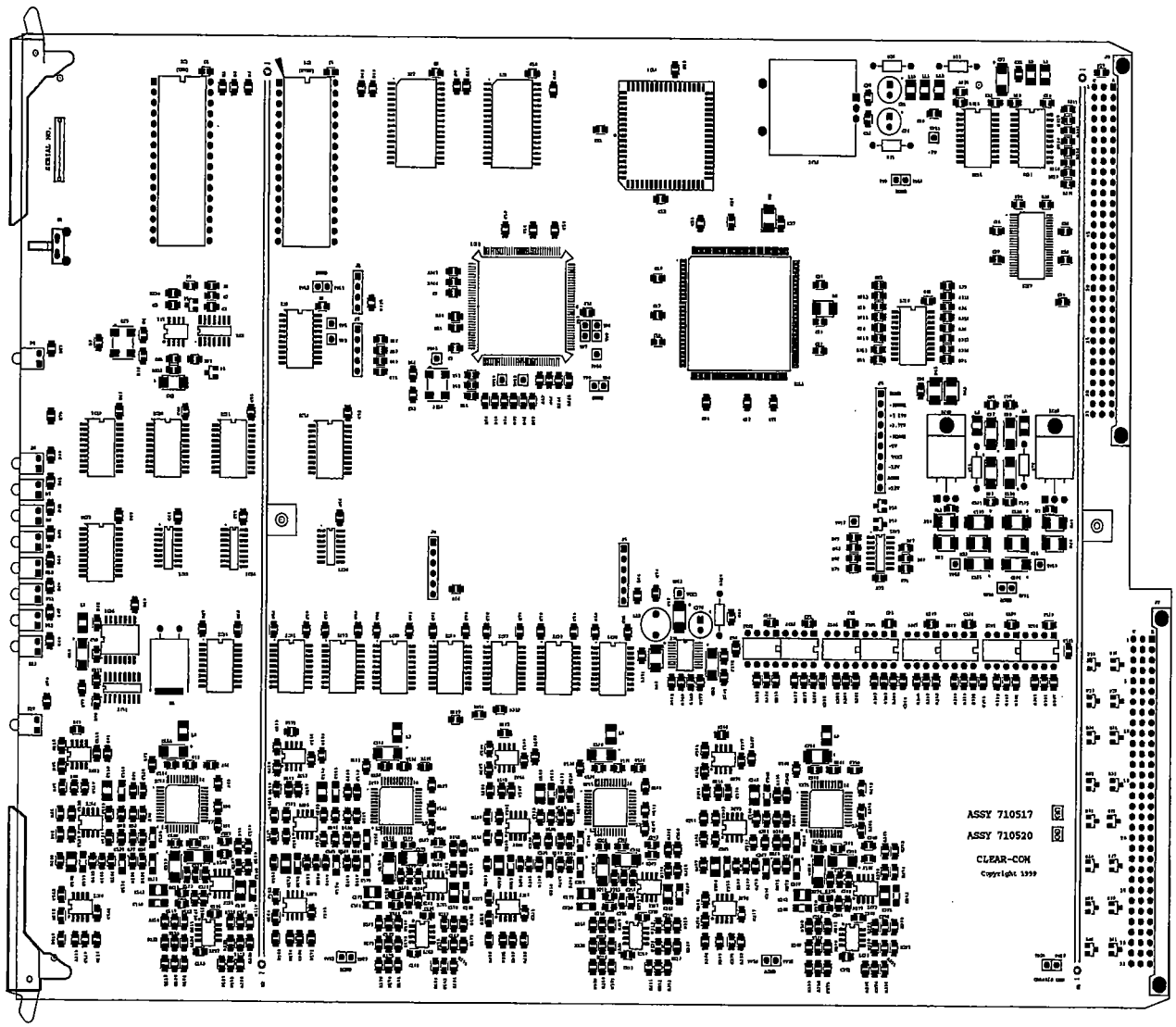
CLEAR-COM® INTERCOM SYSTEMS

TITLE: Schematic MMX-24 Chassis

DWG No. 760046 - SCH - D - REV A

FIGURE F6-1 Schematic, Overall - MMX-24/16/8 Frame, Rev. A

MATRIX CARDS



Matrix Plus 3 System

MVX-A8/L8

M A T R I X C A R D S

Introduction

This section describes the troubleshooting and maintenance of the MVX-A8 and MVX-L8 Matrix Cards. For operation information, see the *Matrix Plus 3 Operation Manual;* for installation, see the *Matrix Plus 3 Installation Manual;* and for programming informaiton, see the *PGM-WIN System Configuration* manual.

Spare cards should be stored in electrically insulating packaging, such as heavy duty plastic bags or in an empty slot in a matrix frame.

Troubleshooting

Troubleshooting the cards can be as simple as pressing the Reset button or understanding the LED indicator or involve more extensive investigation and understanding. The following list and symptoms is accompanied by several suggestions, which should be followed in the order they appear.

Front-Edge Components

The front edge of the cards have an operator-controlled reset button and 10 LED indicators to provide operational status information. The LEDs are visible through labeled holes in the frame's card-compartment door.

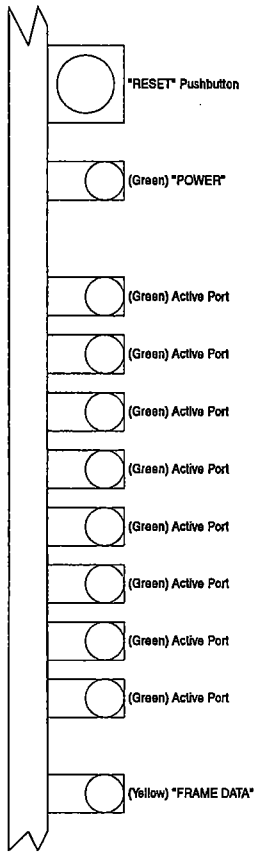


FIGURE M1-1: MVX-A8 and MVX-L8 Front Edge

Reset Button

The Reset Button is located at the top of the front edge of the cards. The button will stop all of the card's microprocessor functioning and restart it from the beginning of its internal program. Under normal operating conditions, it is never necessary to push the button. Technical personnel might push the button if they suspect the card's internal data or the microprocessor's instruction sequence is corrupted.

Note: When the cards are reset, all stations connected to any of the card's ports are also reset. Resetting will erase all of those port's talk and listen paths from the microprocessor's memory, unless the "Restore Talk Paths" and "Restore Listen Paths" fields have been checked in the Setup - System Preferences screen of the configuration program.

Power LED

The Power LED indicates that power is being supplied to the cards. If the digital output is down, the Power LED will not light. If either of the analog outputs is down, the Power LED will flash.

Active Port Indicator LEDs

Each card features individual LEDs to indicate the status of the card's eight ports. Each LED is lit steadily when its port is active (connected to a functioning intercom station or interface) and will flash when a talk path is activated from a station.

Frame Data LED

The Frame Data LED indicates that digital data is being sent to or from the frame. When the system is idle, this LED will flash every 3 sec. to indicate that the system is functional. The flashing is caused by actual communication between the cards.

Symptoms and Suggestions

- **A station indicates that it is disconnected from frame.**

1. Check the LED for the appropriate port on the card. If the LED is not lit, then check the station and the wiring leading to it.
2. Check the Frame Data LED. If there is no indication of frame communication to this card while the other cards in the frame are communicating, reset the card.
3. Replace the card.
4. Replace the station.

- **Audio sounds low or distorted.**

1. Check the frame's positive and negative analog power LEDs (if the frame is a SYS-200, it will be necessary to open the power-supply compartment door). If either LED is off, replace the card.
2. Check the Matrix Card input and output gain settings in the configuration software.
3. Check the station's listen level adjust settings.

- **The card cannot be controlled.**

1. Check the digital power LED. Replace the card if the digital power LED is out.
2. If the digital power LED is on, reset the card.
3. If the card does not reset, replace it.

Explanation of MVX-A8 and MVX-L8 Technical Drawings

The block diagram (Figure M1-2 on page M1-5) includes all of the digital circuitry represented by sheets 2 and 3 (see below) of the schematic drawings.

The assembly drawing (Figure M1-7 on page M1-16) shows the placement of the board's components.

The schematic drawing for the MVX-A8/L8 is divided into four sheets. The following is an description of each sheet.

- Sheet 1 (Figure M1-3 on page M1-7) contains the interconnection diagram of the remaining three sheets, most of the bypass capacitors of the board, and some reference drawings for most of the large surface mount chips.
- Sheet 2 (Figure M1-4 on page M1-9) contains the microprocessor circuitry.
- Sheet 3 (Figure M1-5 on page M1-11) contains the FPGAs that interface between the microprocessor, the DDSP bus, and the digital, 2-wire line drivers.
- Sheet 4 (Figure M1-6 on page M1-13) contains the digital 2-wire line drivers and the DSP for code and rate conversion.

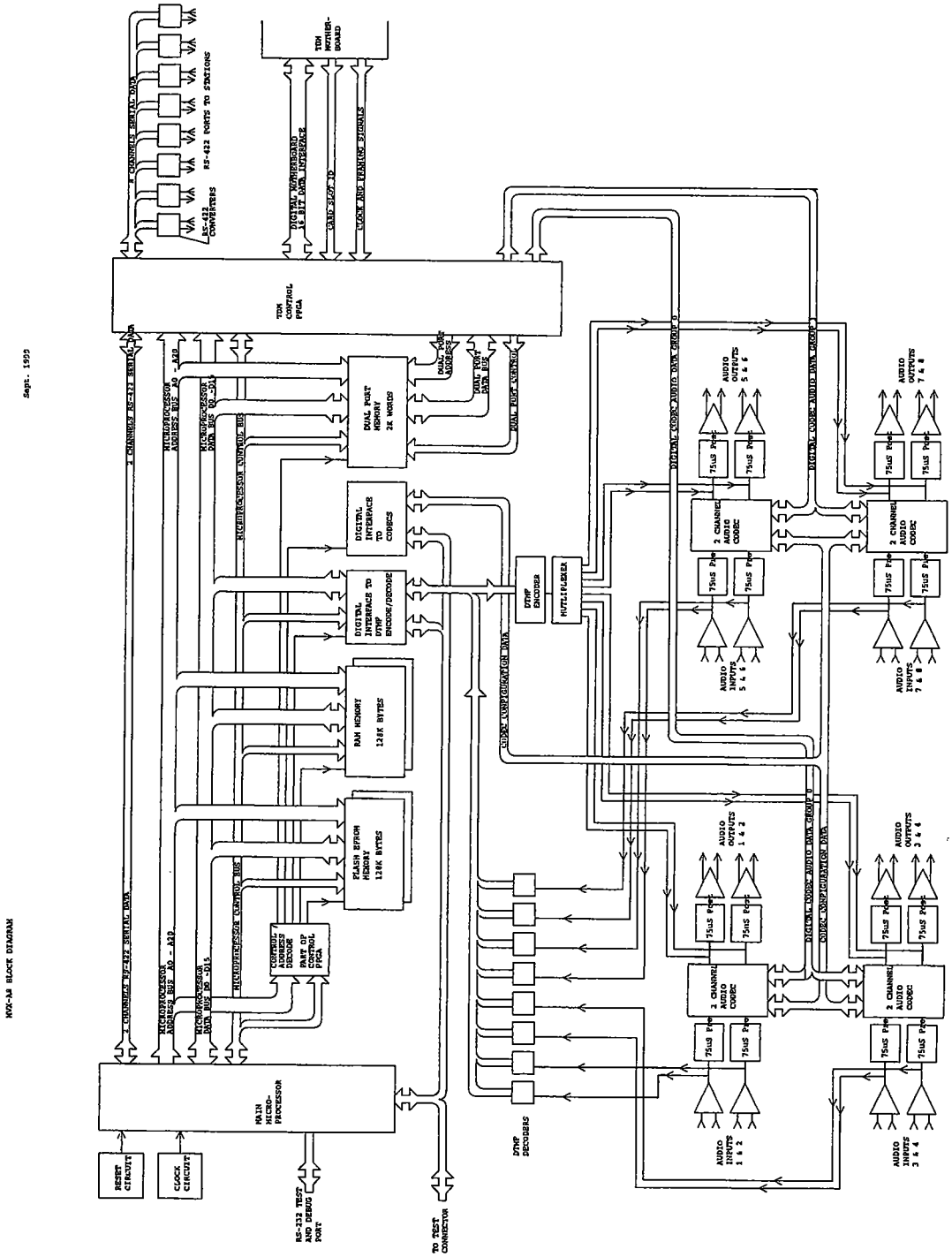


FIGURE M1-2: Digital Block Diagram—MVX-A8

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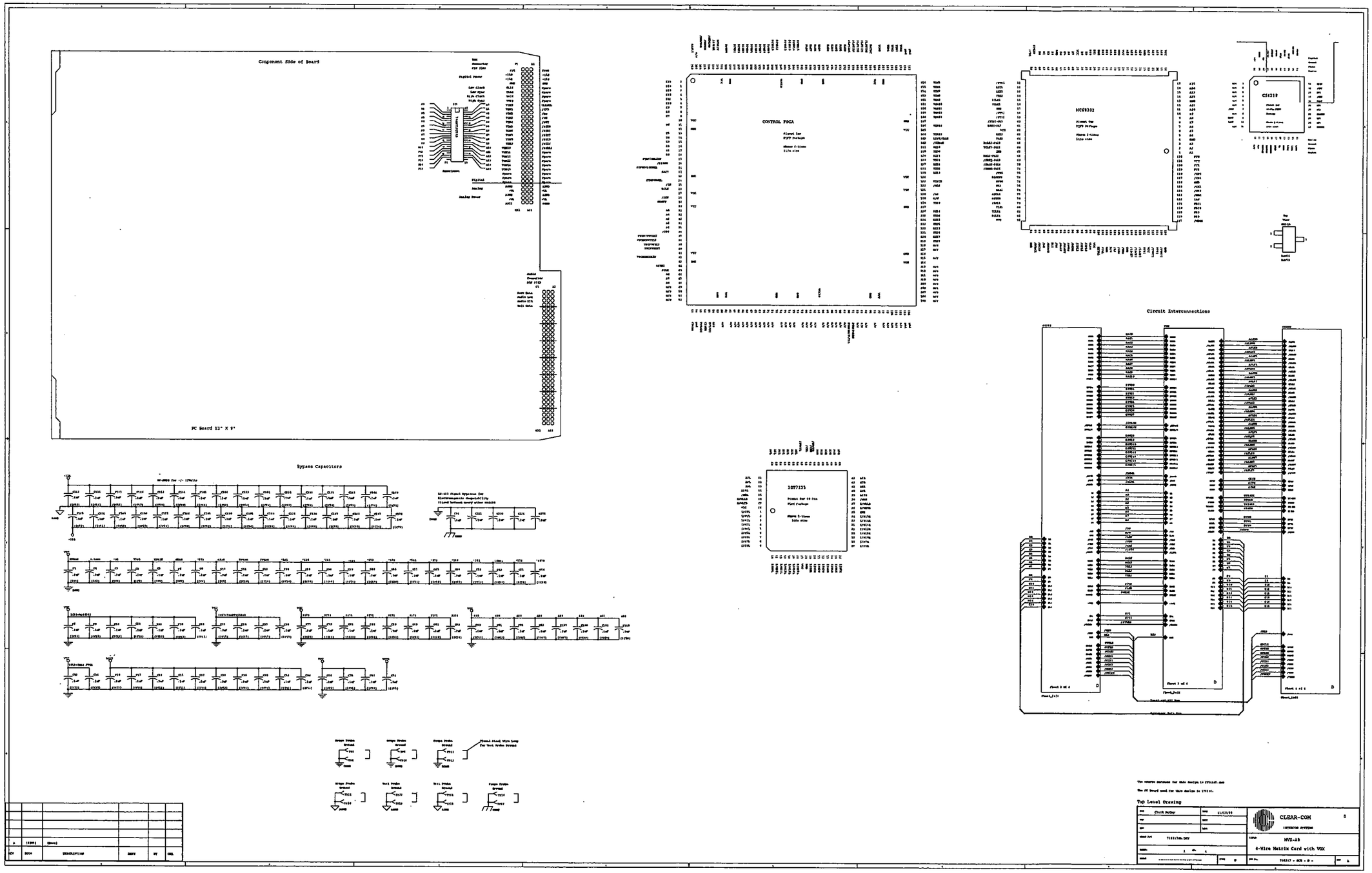

FIGURE M1-3: Schematic - MVX-A8/L8 PCB Sheet 1, Rev. A

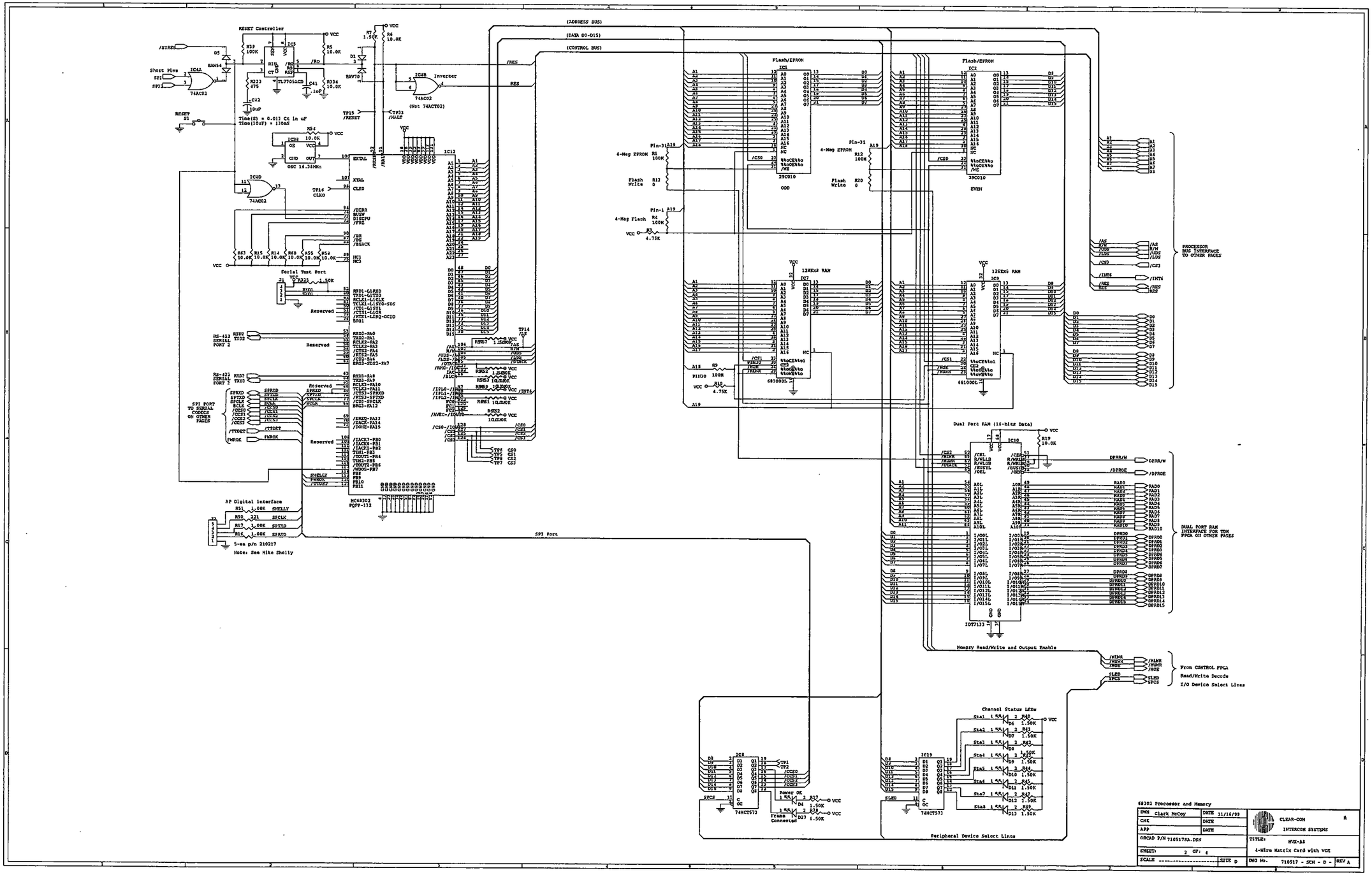

FIGURE M1-4: Schematic—MVX-A8/L8 PCB Sheet 2, Rev. A

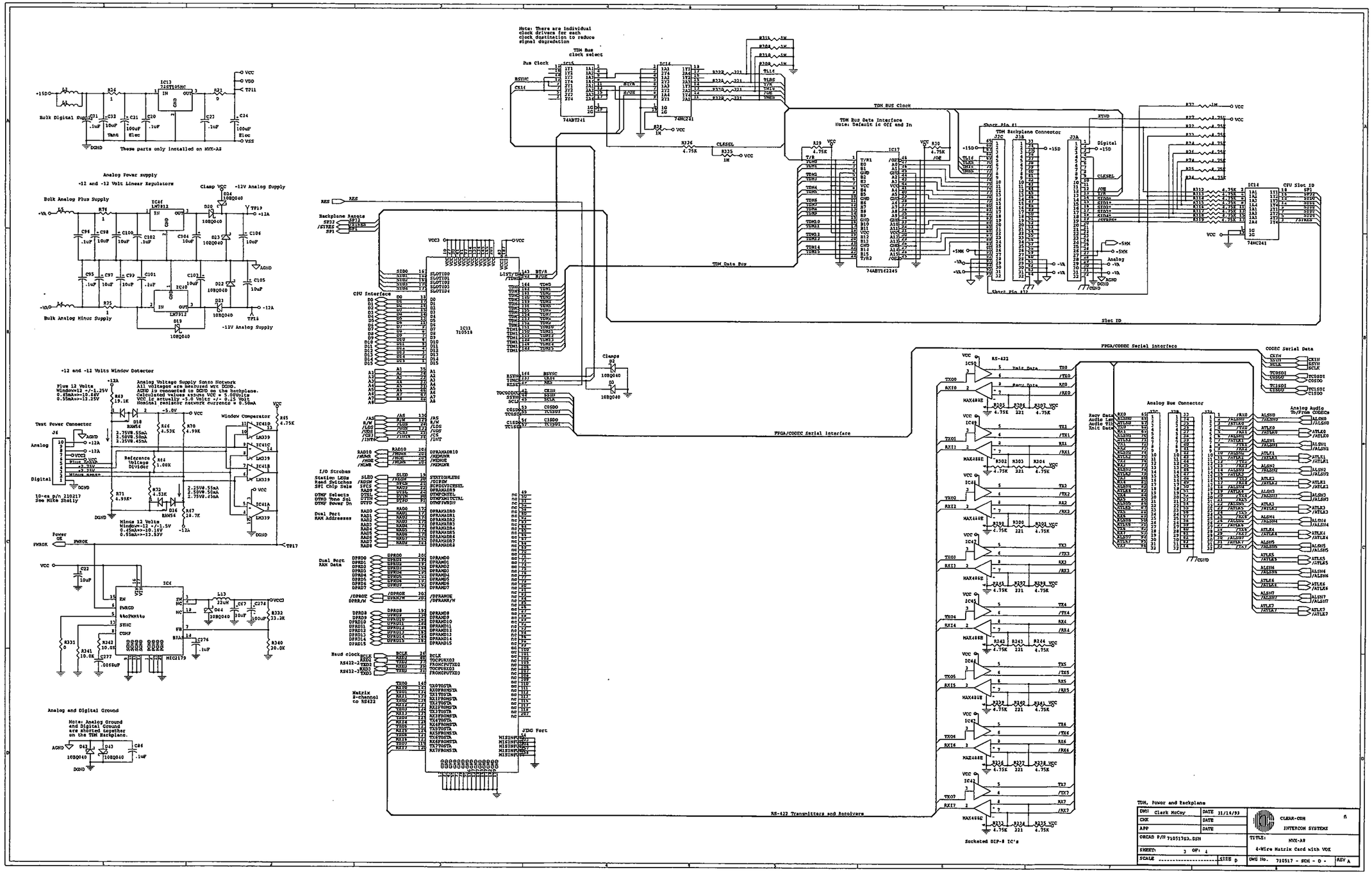

FIGURE M1-5: Schematic—MVX-A8/L8 PCB Sheet 3, Rev. A

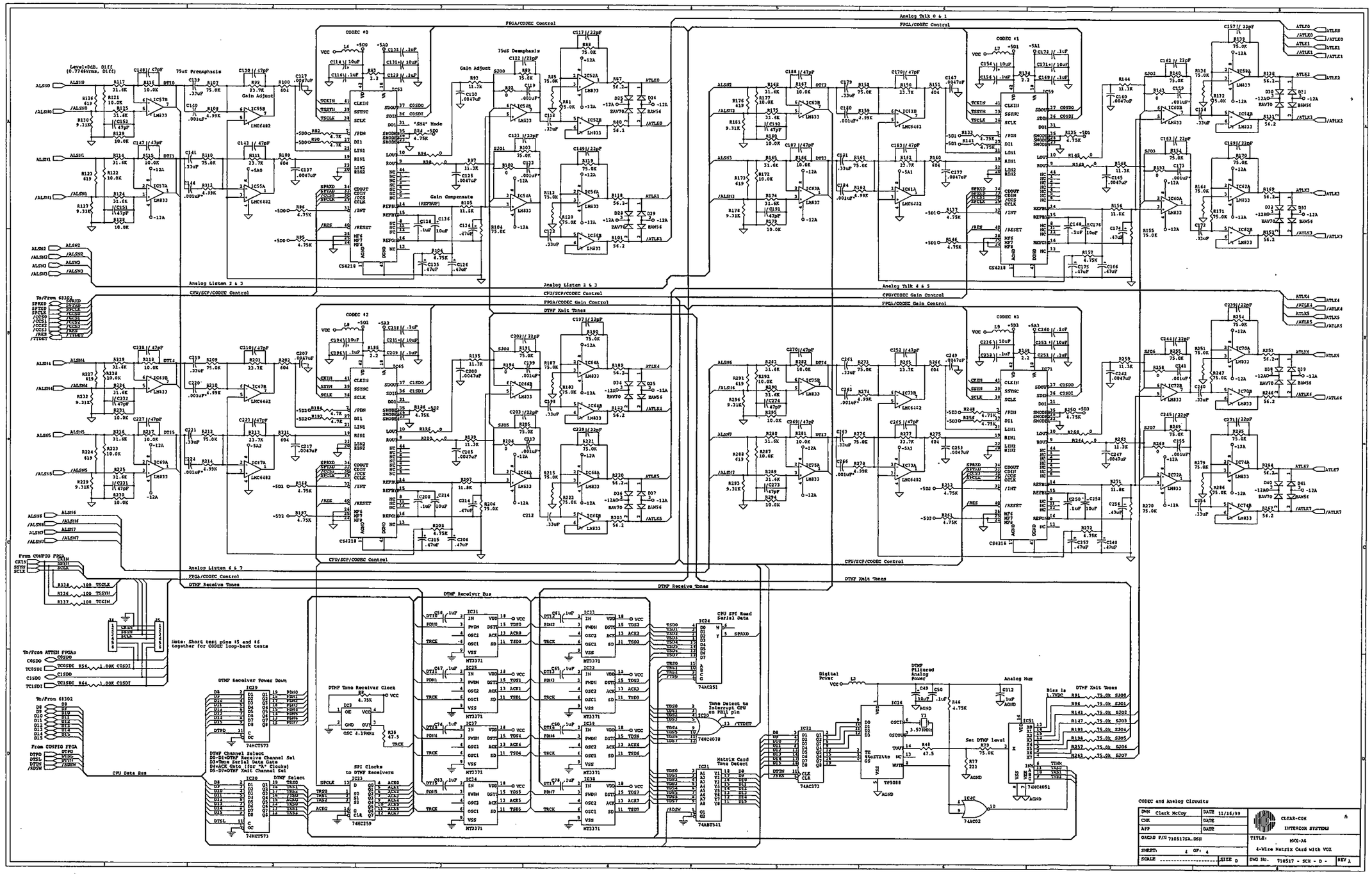

FIGURE M1-6: Schematic—MVX-A8/L8 PCB Sheet 4, Rev. A

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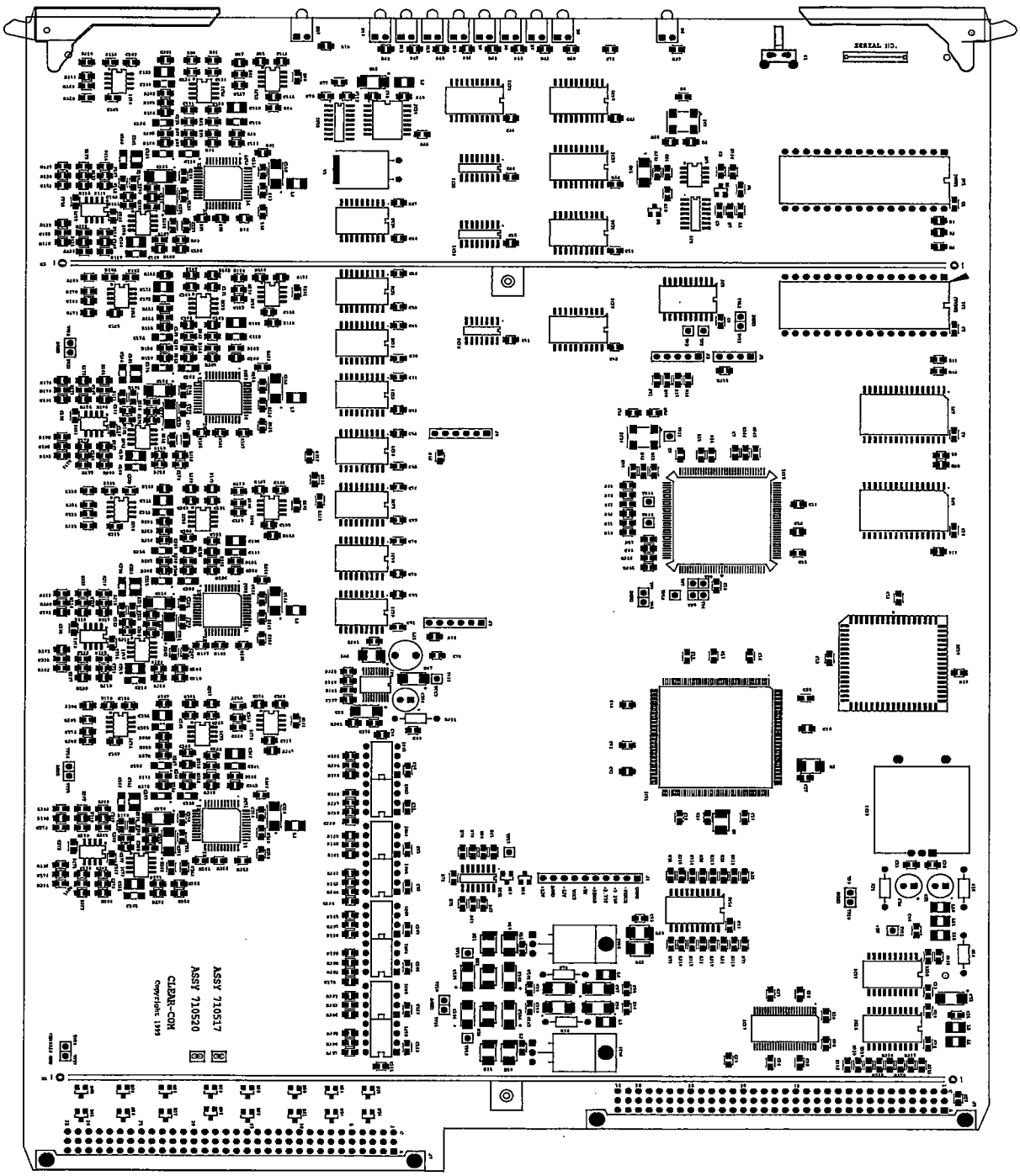


FIGURE M1-7: Assemby Drawing—MVX-A8/L8 PCB, Rev. A

Bill of Materials for the MVX-A8/L8 PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.001	uF	Ceramic Disc SMD	50V	1%	151001	C119 C133 C140 C144 C159 C173 C180 C184 C199 C213 C220 C224 C241 C255 C262 C266
.0047	uF	Ceramic Disc SMD	50V	10%	151156	C120 C125 C127 C137 C160 C165 C167 C177 C200 C205 C207 C217 C242 C247 C249 C259
.0068	uF	Ceramic Disc SMD	50V	10%	151158	C277
.1	uF	Ceramic Disc SMD	50V	10%	151172	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C23 C25 C26 C27 C28 C29 C30 C31 C33 C34 C35 C36 C37 C38 C39 C40 C41 C43 C44 C45 C46 C47 C48 C50 C51 C52 C53 C55 C56 C58 C59 C60 C61 C62 C63 C64
.1	uF	Ceramic Disc SMD	50V	10%	151172	C65 C66 C68 C74 C75 C76 C77 C78 C79 C80 C81 C82 C83 C84 C86 C89 C90 C91 C92 C93 C94 C95 C96 C101 C102 C107 C108 C109 C110 C111 C112 C113 C115 C116 C121 C124 C128 C129 C138 C142 C145 C146 C150 C153 C155 C156 C161 C164 C168 C169 C178 C182 C185 C186 C190 C193 C195 C196 C201 C204 C208 C209 C218 C222 C225 C226 C230 C233

						C234 C235 C237 C238 C243 C246 C250 C251 C260 C264 C267 C268 C272 C275 C276
.33	uF	Ceramic Disc SMD	25V	10%	151178	C118 C132 C139 C141 C158 C172 C179 C181 C198 C212 C219 C221 C240 C254 C261 C263
.47	uF	Tantalum SMD	35V	10%	151184	C126 C134 C135 C166 C174 C175 C206 C214 C215 C248 C256 C257
10	uF	Tantalum SMD	25V	10%	151192	C22 C32 C42 C49 C67 C97 C98 C99 C100 C103 C104 C105 C106 C114 C131 C136 C154 C171 C176 C194 C211 C216 C236 C253 C258
22	pF	Ceramic Disc SMD	50V	5%	151116	C117 C122 C123 C149 C157 C162 C163 C189 C197 C202 C203 C229 C239 C244 C245 C271
47	pF	Ceramic Disc SMD	50V	5%	151120	C130 C143 C147 C148 C151 C152 C170 C183 C187 C188 C191 C192 C210 C223 C227 C228 C231 C232 C252 C265 C269 C270 C273 C274
100	uF	Aluminum	16V	20%	150155	C21 C24 C278

Resistors

Value		Power	Type	Tol.	Part #	Designator
1	OHM	1/4	Carbon Film	5%	410139	R26 R75 R76
0	OHM	1/10	SMD		411100	R13 R20 R92 R94 R98 R102 R143 R145 R149 R153 R194 R196 R200 R204 R258 R260 R264 R268 R331
2.2	OHM	1/10	SMD	5%	411181	R83 R134 R185 R249
10.0	OHM	1/10	SMD	1%	411197	R344
47.5	OHM	1/10	SMD	1%	411262	R48 R38
56.2	OHM	1/10	SMD	1%	411269	R80 R87 R101 R118

						R131 R138 R152 R169 R182 R189 R203 R220 R246 R253 R267 R284
100	OHM	1/10	SMD	1%	411293	R336 R337 R338
221	OHM	1/10	SMD	1%	411326	R50 R77 R234 R237 R240 R243 R297 R300 R303 R306 R327 R328 R329 R330
475	OHM	1/10	SMD	1%	411358	R333
604	OHM	1/10	SMD	1%	411368	R100 R109 R151 R160 R202 R211 R266 R275
619	OHM	1/10	SMD	1%	411369	R123 R126 R173 R176 R224 R227 R288 R291
1.00K	OHM	1/10	SMD	1%	411389	R16 R17 R51 R56 R64 R68
1.50K	OHM	1/10	SMD	1%	411406	R7 R37 R40 R41 R42 R43 R44 R45 R47 R49 R52 R57 R78 R325
4.53K	OHM	1/10	SMD	1%	411452	R66 R72
4.75K	OHM	1/10	SMD	1%	411454	R3 R8 R10 R22 R23 R24
4.75K	OHM	1/10	SMD	1%	411454	R25 R27 R29 R30 R34 R36 R46 R65 R74 R82 R84 R86 R90 R95 R106 R133 R135 R137 R141 R146 R157 R184 R186 R188 R192 R197 R208 R233 R235 R236 R238 R239 R241 R242 R244 R245 R248 R250 R252 R256 R261 R272 R298 R299 R301 R302 R304 R305 R307 R312 R313 R314 R315 R316 R317 R318 R319 R326
4.99K	OHM	1/10	SMD	1%	411456	R70 R71 R108 R112 R159 R163 R210 R214 R274 R278
9.31K	OHM	1/10	SMD	1%	411482	R127 R130 R178 R181 R229 R232 R293 R296
10.0K	OHM	1/10	SMD	1%	411485	R5 R6 R14 R15 R19

						R39 R53 R54 R55 R58 R59 R60 R61 R62 R63 R115 R116 R121 R122 R128 R129 R166 R167 R172 R177 R179 R180 R217 R218 R223 R228 R230 R231 R281 R282 R287 R292 R294 R295 R334 R341 R342 R343 R346
11.3K	OHM	1/10	SMD	1%	411490	R93 R97 R144 R148 R195 R199 RR259 R263
11.8K	OHM	1/10	SMD	1%	411491	R105 R156 R207 R271
19.1K	OHM	1/10	SMD	1%	411512	R69
20.0K	OHM	1/10	SMD	1%	411514	R340
23.7K	OHM	1/10	SMD	1%	411521	R99 R111 R150 R162 R201 R213 R265 R277
28.7K	OHM	1/10	SMD	1%	411529	R67
31.6K	OHM	1/10	SMD	1%	411533	R114 R117 R124 R125 R165 R168 R174 R175 R216 R219 R225 R226 R280 R283 R289 R290
33.2K	OHM	1/10	SMD	1%	411535	R332
75.0K	OHM	1/10	SMD	1%	411569	R79 R81 R85 R88 R89 R91 R96 R103 R104 R107 R110 R113 R119 R120 R132 R136 R139 R140 R142 R147 R154 R155 R158 R161 R164 R170 R171 R183 R187 R190 R191 R193 R198 R205 R206 R209 R212 R215 R221 R222 R247 R251 R254 R255 R257 R262 R269 R270 R273 R276 R279 R285 R286
1.0M	OHM	1/10	SMD	5%	411677	R28 R73 R308 R309 R310 R311 R335

Diodes and Transistors

Device	Description	Part #	Designator
LED	T1 RT ANG PC MTG 5mA GREEN LED	390028	D4 D6 D7 D8 D9 D10 D11 D12 D13
LED	T1 RT ANG PC MTG 5mA AMBER LED	390029	D27
Diode	BAV70 DUAL DIODE COMMON CATHODE	481019	D1 D25 D28 D30 D32 D34 D36 D38 D40
Diode	BAW56 DUAL DIODE COMMON ANODE	481020	D5 D16 D18 D26 D29 D31 D33 D35 D37 D39 D41
Diode	10BQ040 SRECT 1A 40V	481021	D2 D3 D19 D20 D21 D22 D23 D24 D42 D43 D44

Integrated Circuits

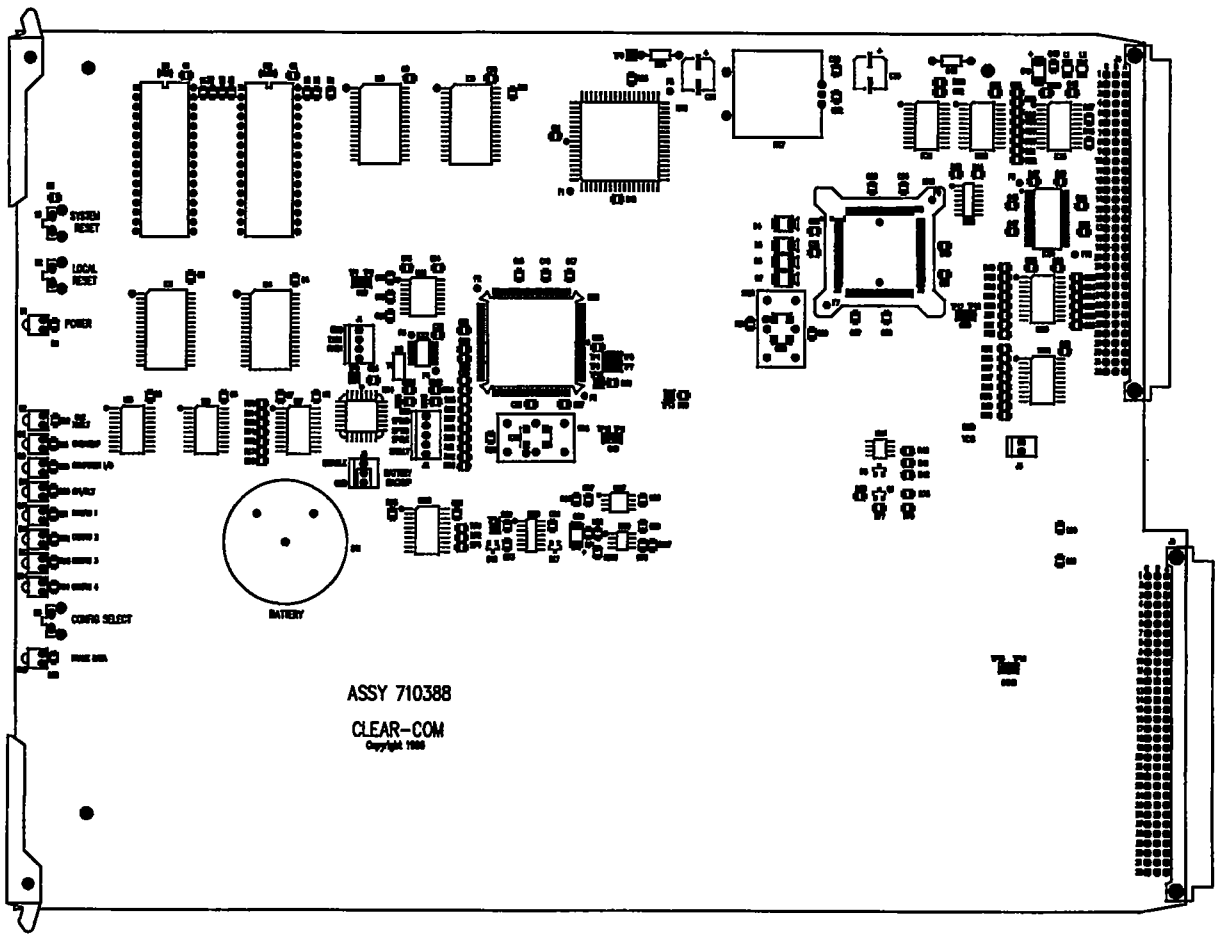
Device	Description	Part #	Designator
IC	488E RS-422 XCVR PROTECTED DIP8	480231	IC42 IC43 IC44 IC45 IC47 IC48 IC49 IC50
IC	78ST105 5V 1.5A 3 TERM SWITCHER	480232	IC13
IC	7812 FIX 12V 1A REGULATOR TO-220	480233	IC46
IC	7912 FIX -12V 1A REGULATOR TO-220	480234	IC40
IC	74HC4051 CMOS 8-CHANNEL MUX/DEMUX	481001	IC51
IC	74HC4078 CMOS 8-INPUT OR/NOR GATE	481002	IC30
IC	74AC02 CMOS QUAD 2-INP NOR GATE	481003	IC4
IC	74ABT241 BIMOS OCTAL 3-STATE BUFF	481005	IC15
IC	74AC251 CMOS 8-INPUT MUX 3-STATE	481006	IC24
IC	74HC259 CMOS LATCHED 8-BIT DECODE	481007	IC23
IC	74ABT541 BICMOS OCT BUFF 3-STATE	481008	IC21
IC	74AC273 CMOS OCTAL D-FLOP.	481009	IC22
IC	74HCT573 CMOS OCTAL LATCH 3-STATE	481010	IC8 IC19 IC20 IC29
IC	74ABT162245 BICMOS 16BIT BUS XCVR	481011	IC17
IC	7133LA CMOS DUAL PORT RAM 2KX16	481012	IC10
IC	681000L CMOS SRAM 128KX8 100NS	481014	IC9 IC7
IC	68302 HCMOS M-CNTRLR 16.67MHZ	481016	IC12
IC	3371 DTMF RECEIVER 0.300" WIDE	481017	IC25 IC31 IC32 IC33 IC34 IC37 IC38 IC39
IC	7705 SUPPLY VOLT SUPERVISOR RESET	481018	IC5
IC	6482 DUAL CMOS OPAMP RAIL/RAIL	481022	IC55 IC61 IC67 IC73

IC	833 DUAL OPAMP	481023	IC52 IC54 IC56 IC57 IC58 IC60 IC62 IC63 IC64 IC66 IC68 IC69 IC70 IC72 IC74 IC75
IC	LM339 QUAD COMPARATOR.	481024	IC41
IC	TP5088WM DTMF GENERATOR/BINARY	481025	IC26
IC	74HC241 CMOS OCTAL BUFFER/DRIVER	481035	IC14 IC16
IC	4218 16-BIT 2 CHANNEL CODEC	481041	IC53 IC59 IC65 IC71
IC	MIC2179 1.5A SYNC BUCK VOLT REG	481070	IC6
IC	4.1943MHZ CRYSTAL CLOCK OSCILLATOR	231001	IC3
IC	16.384MHZ CRYSTAL CLOCK OSCILLATOR	231002	IC28
IC	FPGA, CONTROL MVX-A8	710518	IC11

Miscellaneous

Device	Description	Part #	Designator
Inductor	INDUCTOR 22UH 1.6A SHIELDED	180011	L13
Inductor	FERRITE EMI SUPPRESSOR 400MA	181001	L1 L2 L3 L4 L5 L6 L7 L8 L9
Crystal	3.579545MHZ CRYSTAL	230001	Y1
Switch	PUSHBUTTON SWITCH	510099	S1
LABEL	EPROM MVX-A8 EVEN	250938	
FLASH ROM	29C010 CMOS 128KX8 DIP32	480229	

CONFIG-1



Matrix Plus 3 System CONFIG-1
CONFIGURATION CARD

Introduction

This Section provides maintenance information, schematics, assembly drawings and Bills of Materials for the CONFIG-1 Configuration Card. Maintenance information includes discussions on the card's battery-backed RAM, reset buttons, the Config Select button, and LED indicators.

The CONFIG-1 has the following functions:

- Storing system configurations
- Interfacing with the Configuration Program (on an external PC)
- Directly controlling the RLY-6 and GPI-6 interfaces.

Spare CONFIG-1 boards should be stored in electrically insulated packaging, for example heavy duty plastic bags, or in an empty slot in the matrix frame.

Battery-Backed RAM

The CONFIG-1 features a lithium battery that provides back-up power for its processor's internal RAM. This RAM stores the system's configurations, up to a maximum of four. The battery should be disconnected before performing any service on the board, including battery replacement. The battery should be replaced every five years as a preventive maintenance measure. To disconnect the battery, remove the battery disconnect jumper and put it on the unconnected pair of pins on the header. The board will operate with the battery disconnected, but remember that if the system's power is turned off:

- All operating parameters will be lost.
- The RAM will lose the configurations.

CAUTION

Lithium batteries can overheat or explode if they are shorted. When you handle the CONFIG-1 board or the loose battery, DO NOT touch any external electrical conductors to the battery's terminals or to the circuits that the terminals are connected to!

Whenever you are servicing the battery, make sure that the jumper on JP1 is connecting the common to either the ON or the OFF pin. If the common is left floating, the CONFIG-1 may behave unpredictably (for example, the microprocessor may reset itself intermittently).

Indicators and Controls

The CONFIG-1 features ten indicator LEDS and three pushbuttons, as seen in Figure M2-1 below. The LEDs are visible through holes in the frame's card-compartment door; each hole is labeled. The buttons are accessible only by opening the card-compartment door. Except for the Config. Select button, these indicators and controls should not be used during normal operation. The following paragraphs describe their functions.

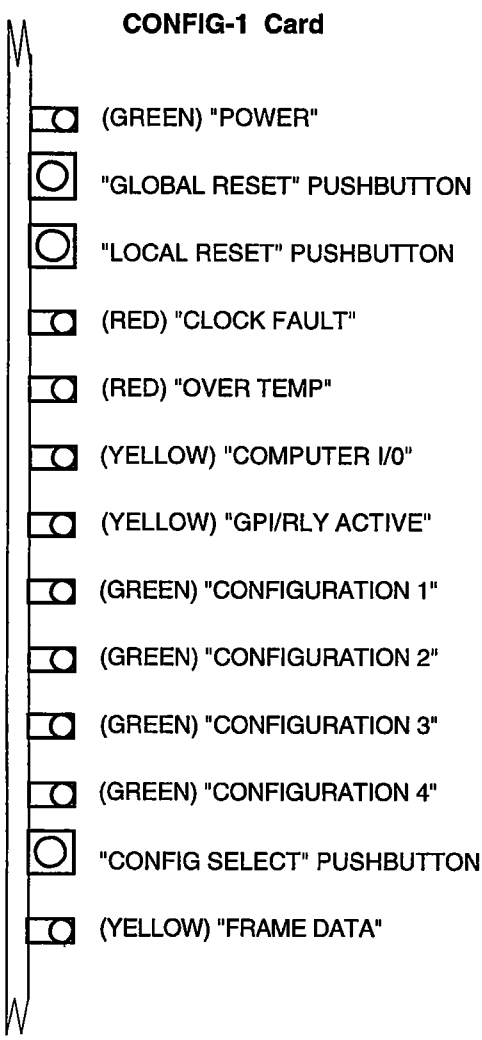


FIGURE M2-1. CONFIG-1 Card: LED Indicators and Buttons

"Power" LED

The "Power" LED indicates that power is being supplied to the CONFIG-1 card.

GLOBAL RESET Button

The GLOBAL RESET button resets all of the MTX cards in the frame, and any stations connected to any of those cards. Resetting a matrix card also sends a new configuration to any stations connected to it. This process takes several seconds for each matrix card. During this time all existing talk paths will be disconnected from each port on each matrix card; these talk paths will not be re-established when the matrix cards have been reactivated unless set in "System Preferences". For further information on when to use the GLOBAL RESET button, see the "Overall" Chapter of this Maintenance Manual.

LOCAL RESET Button

The LOCAL RESET button will reset the CONFIG-1 card. It will restart according to whichever configuration is currently stored in its battery-backed RAM; this enables the CONFIG-1 to be "hot patched"—that is, it can be removed from and replaced in the system during operation without disturbing talk or listen paths in the system. The number of MTX-A8 cards in the frame determines the time that the CONFIG-1 card requires to restore full system operation. During this time (or any other time that the CONFIG-1 card is unplugged or inoperative), all existing talk and listen paths will continue to function. For further information on when to use the LOCAL RESET button, see the "Overall" Chapter of this Maintenance Manual.

"Clock Fault" LED

The "Clock Fault" LED indicates a failure in the frame's clock card.

"Over Temp" LED

The "Over Temp" LED indicates that the air temperature inside the frame has risen above 125° F (50° C). Temperatures above this point are hazardous to semiconductor devices.

"Computer I/O" LED

The "Computer I/O" LED indicates that the frame is communicating with the computer running the Configuration program.

"GPI/RLY Active" LED

The "GPI/RLY Active" LED indicates that the CONFIG-1 is communicating to a GPI/RLY Interface.

"Configuration" LEDs (1-4)

The Configuration program enables you to store as many as four different configurations into any Matrix 3 frame; the four LEDs labeled "Configuration" indicate which of the four configurations is currently in use (see "CPU CONFIG Button" below).

CONFIG SelectButton

The CONFIG SELECT button enables you to select which of the four system configurations you want to use (see the paragraph on the "Configuration" LEDs above). You can also select a configuration using the Configuration program.

"Frame Data" LED

The "Frame Data" LEDs on both the CONFIG-1 and the MTX-A8s indicate that digital data is being sent to or from the frame. When the system is idle, these LEDs will flash at a three second interval to indicate that the system is in "standing by" mode.

Explanation of Config-1 Schematic

The Schematic drawing for the CONFIG-1 Printed Circuit Board is divided into three sheets. The following is an description of each sheet.

Sheet - 1 contains the interconnection diagram of the remaining two sheets, most of the bypass capacitors of the board, and some reference drawings for most of the large surface mount chips.

Sheet - 2 contains the microprocessor circuitry.

Sheet - 3 contains the FPGAs that interface between the microprocessor,and the DDSP bus.

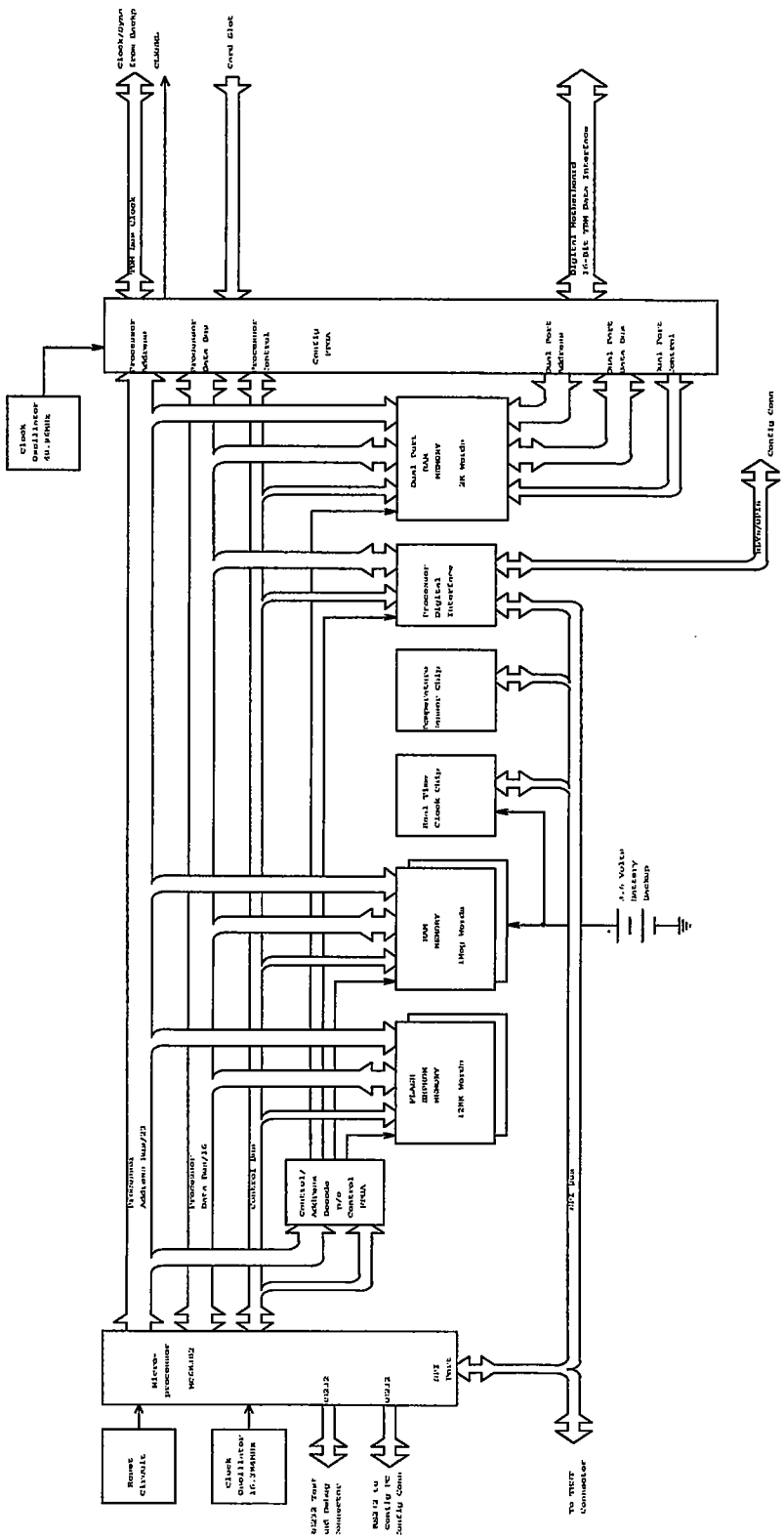
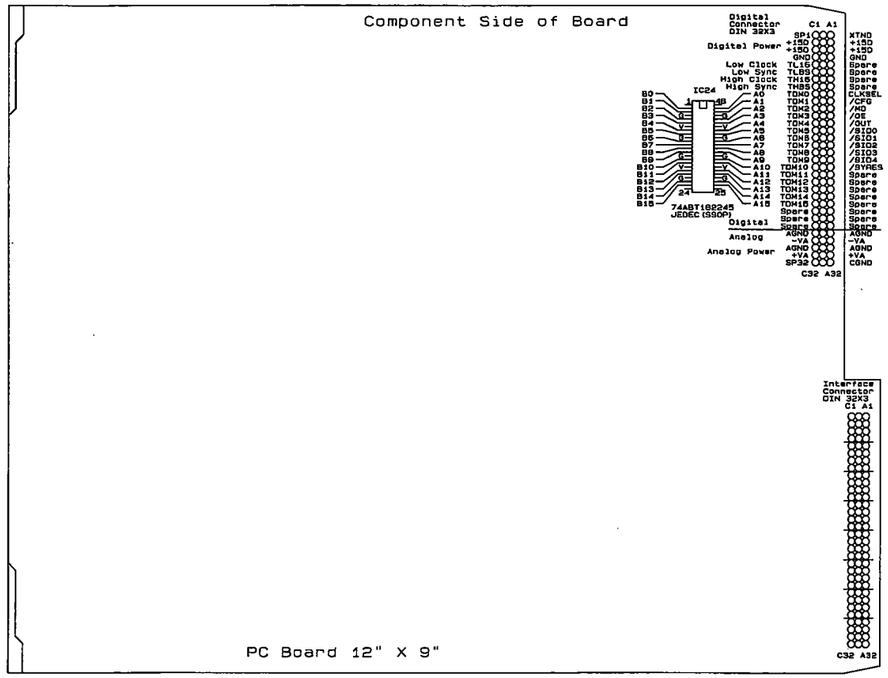
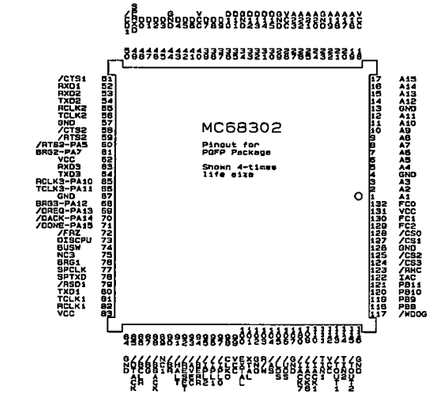
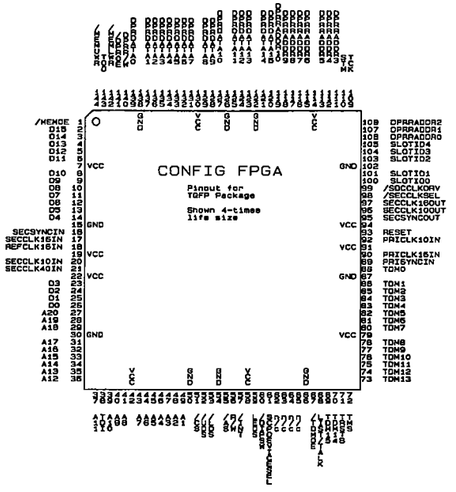
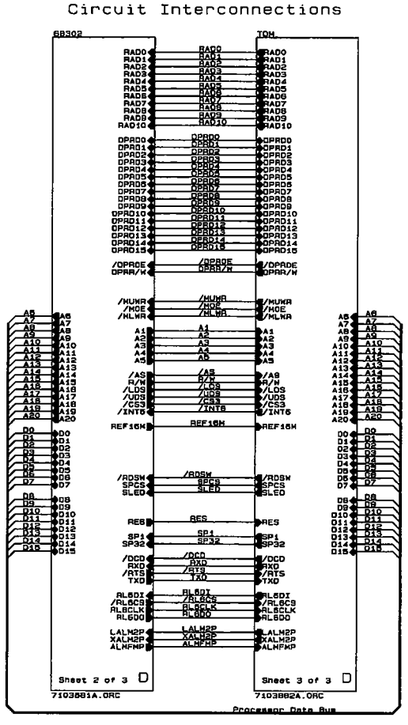


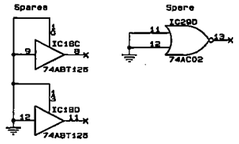
FIGURE M2-2 Block Diagram - CONFIG-1

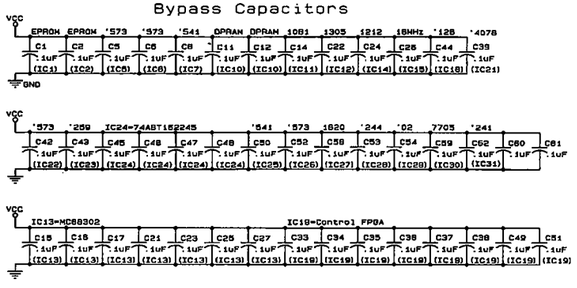


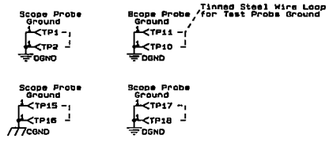












REV	ECO#	DESCRIPTION	DATE	BY	CHK
A	2348	RELEASE TO PRODUCTION	04/15/97		

Top Level Drawing

DWN	JS Galbraith	DATE	04/15/97
CHK		DATE	4/15/97
APP		DATE	4/15/97
ORCAD P/N - 710388SA.ORC			
PLOT SIZE - D			

CLEAR-COM INTERCOM SYSTEMS

TITLE: SCHEMATIC CONFIG-1

Sheet: 1 of 3	SCALE	SIZE D	DWG NO. 710388-SCH-D-	REV A

FIGURE M2-3 Schematic - CONFIG-1 PCB Sheet 1, Rev. A

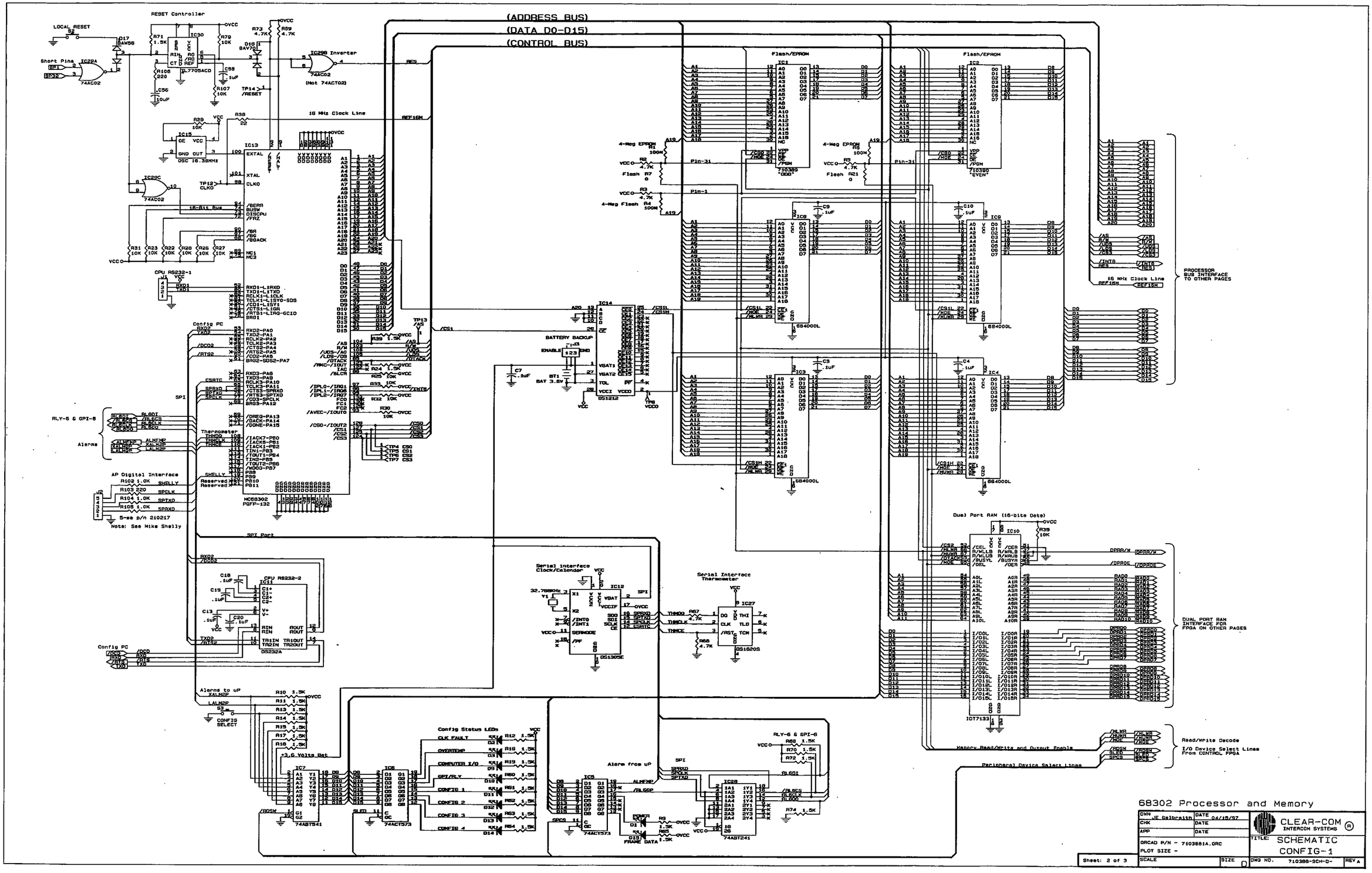


FIGURE M2-4 Schematic - CONFIG-1 PCB Sheet 2, Rev. A

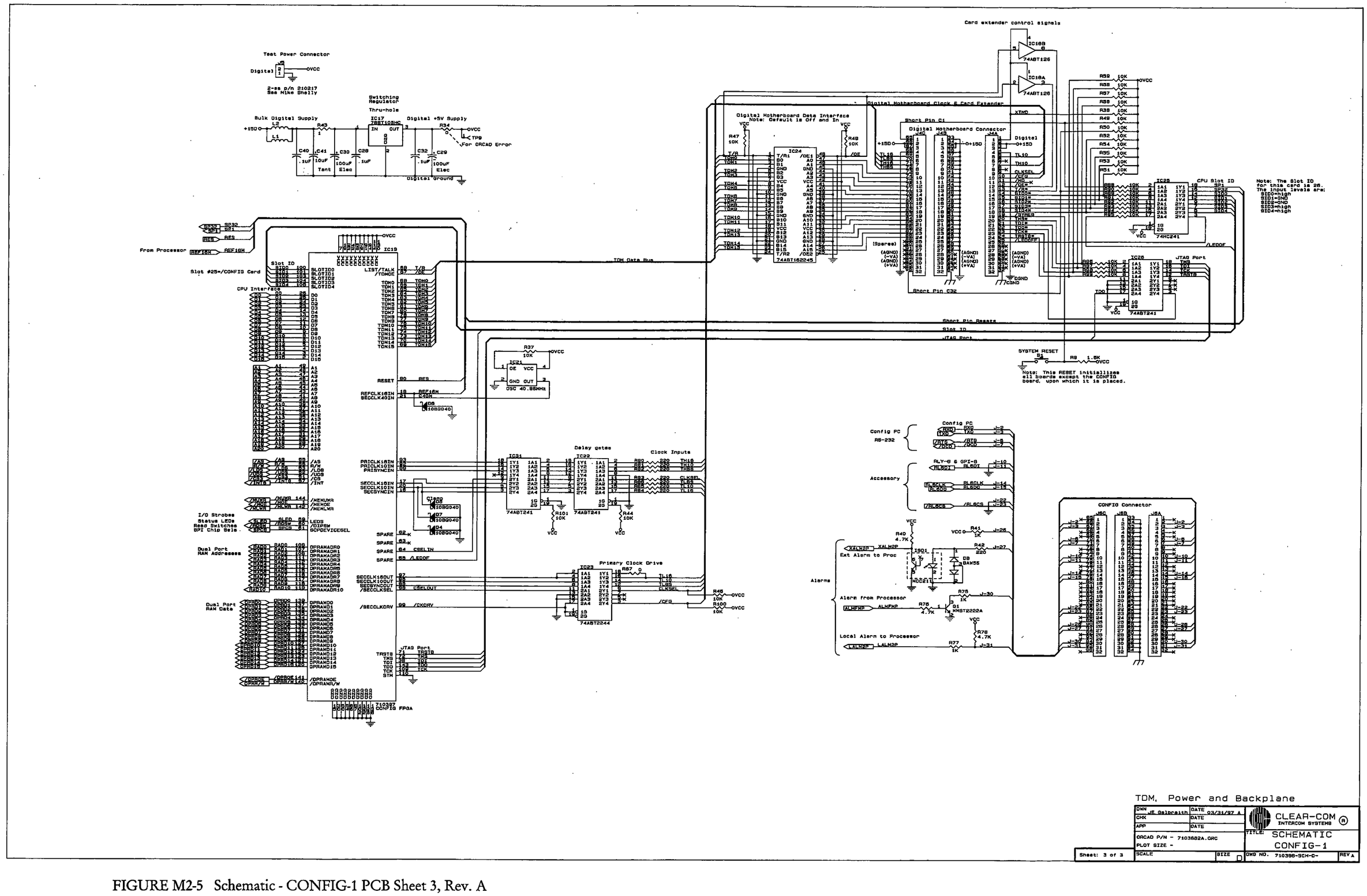


FIGURE M2-5 Schematic - CONFIG-1 PCB Sheet 3, Rev. A

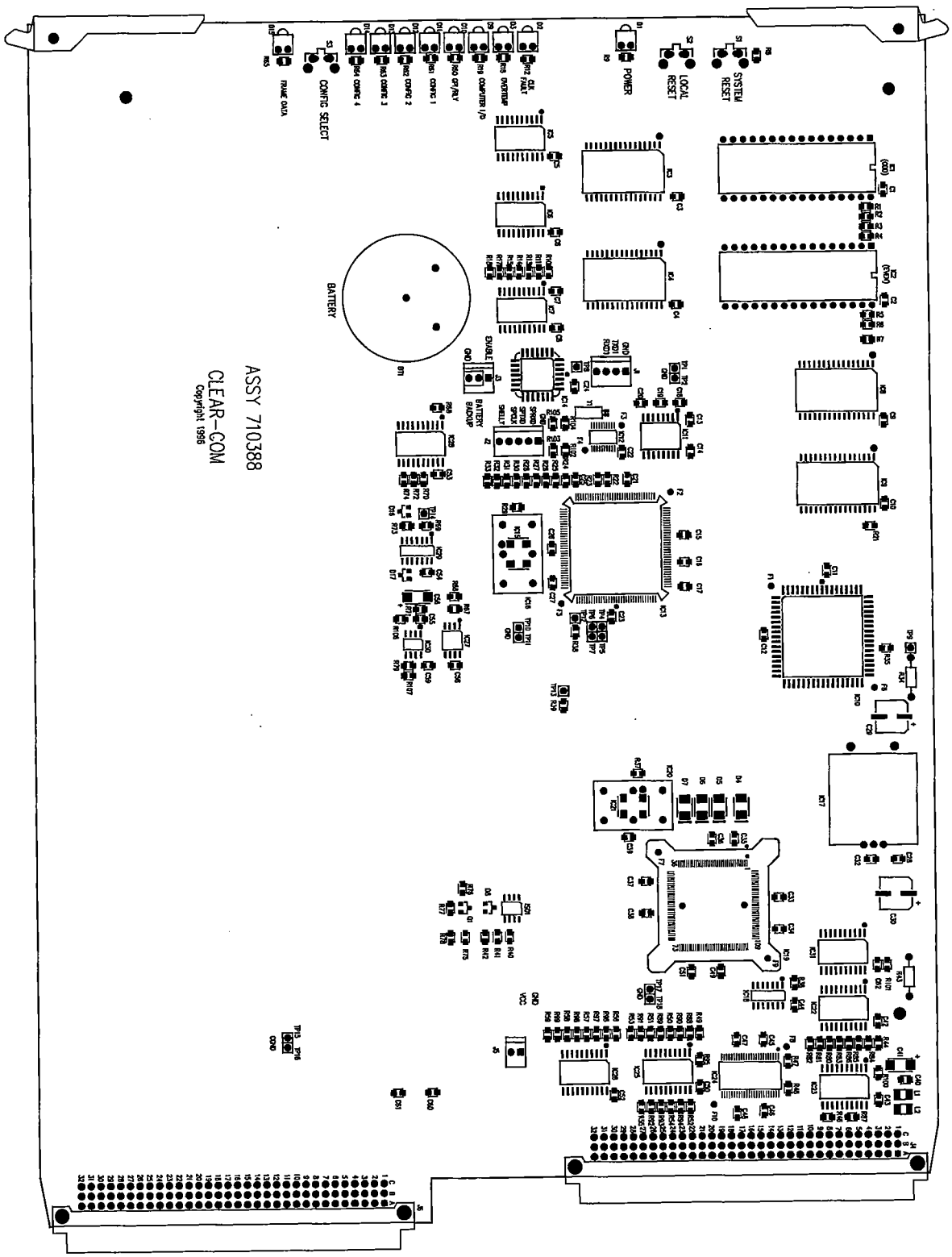


FIGURE M2-6 Assembly Drawing - CONFIG-1 PCB Rev. C

Bill of Materials for the CONFIG-1 PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.1	uF	X7R SMD0805	50V	10%	151172	C1-C28, C32-C40, C42-C55, C58-C62
10	uF	Tant SMD"C"	25V	10%	151192	C41,C56
100	uF	Alu SMT8X10mm	25V	10%	151203	C29,C30

Resistors

Value		Power	Type	Tol.	Part #	Designator
0	Ohm	1/10W	SMD 0805		411100	R7,R21,R87
1	Ohm	1/4W	Carbon Film	5%	410139	R43
22.1	Ohm	1/10W	SMD 0805	1%	411230	R38
221	Ohm	1/10W	SMD 0805	1%	411326	R42, R80-R86, R103,R106
1.00	K Ohm	1/10W	SMD 0805	1%	411389	R41,R75,R77,R102,R104, R105
1.50	K Ohm	1/10W	SMD 0805	1%	411406	R8,R9,R12-R19,R24,R39 R60-R65, R68,R70 R71,R72,R74
4.75	K Ohm	1/10W	SMD 0805	1%	411454	R2,R3,R5,R40,R66,R67, R69,R73,R76,R78
10.0	K Ohm	1/10W	SMD 0805	1%	411485	R22, R23, R25-R33, R35-R37,R44, R46-R59, R79, R88-R101, R107

Diodes & Transistors

Device	Description	Part #	Designator
Diode	10BQ040 SHocctty Rect. 1A 40V	481021	D4-D7
Diode, Dual	BAV70 Common Cathode	481019	D16
Diode, Dual	BAW56 Common Anode	481020	D8,D17
Led	T1 RT ANG 5mA Red	390027	D2,D3
Led	T1 RT ANG 5mA Green	390028	D1,D11-D14
Led	T1 RT ANG 5mA Amber	390029	D9,D10,D15
Transistor	2222A NPN 40V 600mA	481026	Q1

Bill of Materials for the CONFIG-1 PCB (cont.)

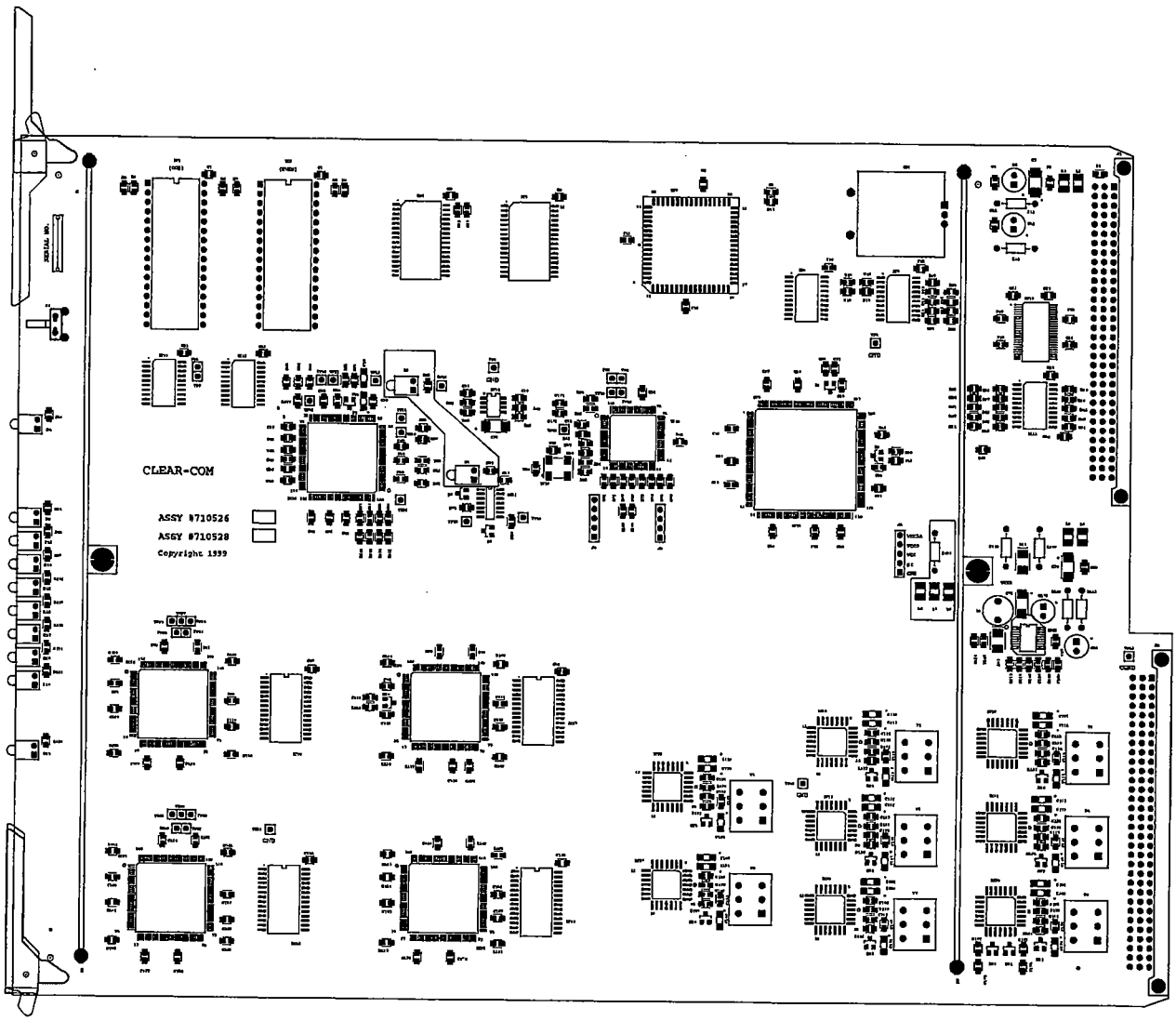
Integrated Circuits

Device	Description	Part #	Designator
Digital IC	74AC02 CMOS Quad 2-In NOR	481003	IC29
Digital IC	74ABT126 Quad 3-State Buffer	481004	IC18
Digital IC	74ABT241 Octal 3-State Buffer	481005	IC22,IC26,IC28,IC31
Digital IC	74HC241 Octal 3-State Buffer	481035	IC25
Digital IC	74ABT541 Octal 3-State Buffer	481008	IC7
Digital IC	74ACT573 Octal 3-State Latch	481010	IC5,IC6
Digital IC	74ABT2244 Octal 3-State Driver	481034	IC23
Digital IC	74ABT162245 16 Bit Bus Xceiver	481011	IC24
Digital IC	DS1212 Non Volitle Mem. Cont.	481029	IC14
Digital IC	DS1305 Real Time Clock	481028	IC12
Digital IC	DS1620 Digital Thermometer	481030	IC27
Digital IC	DS232A Dual RS-232 TX/RX	481031	IC11
Flash ROM	CONFIG-1 #1 (EVEN)	710389	IC2
Flash ROM	CONFIG-1 #2 (ODD)	710390	IC1
FPGA	CONFIG-1 Controller	710397	IC19
Oscillator	16.384 MHz Crystal Clock Osc.	231002	IC15
Oscillator	40.960 MHz Crystal Clock Osc.	231003	IC21
Micro-Processor	68302 16.67MHz	481016	IC13
RAM, Dual Port	7133LA CMOS 2Kx16	481012	IC10
RAM, Static	684000L CMOS 512Kx8 100nS	481015	IC3,IC4,IC8,IC9
Regulator, Sw.	78ST105 5V 1.5A Volt Regulator	480232	IC17
Reset IC	7705 Reset IC	481018	IC30

Miscellaneous Components

Type	Description	Part #	Designator
Battery	Lithium Wafer Cell #TL-5134	400006	BT1
Crystal	32.768 KHz	230006	Y1
Inductor	Ferrite EMI Sup. 400mA	181001	L1,L2
Opto-Coupler	M0C211	481032	ISO1
Switch	Pushbutton, SPST Right Angle	510099	S1,S2,S3

MVX-D8



Matrix Plus 3 System

MVX-D8

M A T R I X C A R D

Introduction

This section describes the troubleshooting and maintenance of the MVX-D8 Digital Matrix Card. For operation information, see the Matrix Plus 3 *Operation Manual;* for installation, see the Matrix Plus 3 *Installation Manual;* and for programming information, see the *PGM-WIN System Configuration Manual.*

Spare cards should be stored in electrically insulating packaging, such as heavy duty plastic bags or in an empty slot in a matrix frame.

Troubleshooting

Troubleshooting the cards can be as simple as pressing the Reset button or understanding the LED indicator or involve more extensive investigation and understanding. The following list and symptoms is accompanied by several suggestions, which should be followed in the order they appear.

Front-Edge Components

The front edge of the cards have an operator-controlled reset button and 10 LED indicators to provide operational status information. The LEDs are visible through labeled holes in the frame's card-compartment door.

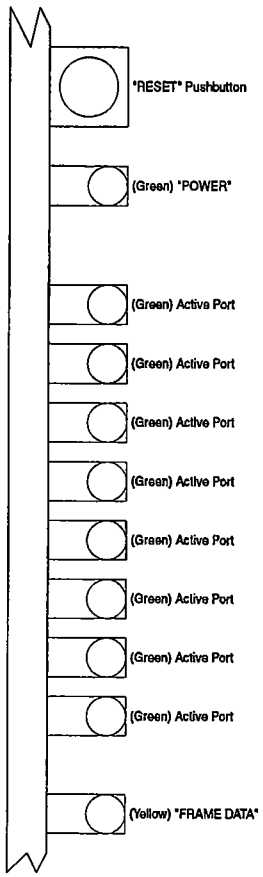


FIGURE M3-1: MVX-D8 Front Edge

Reset Button

The Reset Button is located at the top of the front edge of the card. The button will stop all of the card's microprocessor functioning and restart it from the beginning of its internal program. Under normal operating conditions, it is never necessary to push the button. Technical personnel might push the button if they suspect the card's internal data or the microprocessor's instruction sequence is corrupted.

Note: When the card is reset, all stations connected to any of the card's ports are also reset. Resetting will erase all of those port's talk and listen paths from the microprocessor's memory, unless the "Restore Talk Path" and "Restore Listen Paths" fields have been checked in the Setup - System Preferences screen of the configuration program.

Power LED

The Power LED indicates that power is being supplied to the card. If the digital output is down, the Power LED will not light. If either of the analog outputs is down, the Power LED will flash.

Active Port Indicator LEDs

Each card features individual LEDs to indicate the status of the card's eight ports. Each LED is lit steadily when its port is active (connected to a functioning intercom station or interface) and will flash when a talk path is activated from a station.

Frame Data LED

The Frame Data LED indicates that digital data is being sent to or from the frame. When the system is idle, this LED will flash every 3 sec. to indicate that the system is functional. The flashing is caused by actual communication between the cards.

Symptoms and Possible Solutions

- **A station indicates that it is disconnected from the frame.**

1. Check the LED for the appropriate port on the card. If the LED is not lit, then check the station and the wiring leading to it.
2. Check the Frame Data LED. If there is no indication of frame communication to this card while the other cards in the frame are communicating, reset the card.
3. Replace the card.
4. Replace the station.

- **Audio sounds low or distorted.**

1. Check the frame's positive and negative analog power LEDs (if the frame is a SYS-200, it will be necessary to open the power-supply compartment door). If either LED is off, replace the card.
2. Check the Matrix Card input and output gain settings in the configuration software.
3. Check the station's listen level adjust settings.

- **The card cannot be controlled.**

1. Check the digital power LED. Replace the card if the digital power LED is out.
2. If the digital power LED is on, reset the card.
3. If the card does not reset, replace it.

Explanation of MVX-D8 Technical Drawings

The block diagram (Figure M3-2 on page M3-5) includes all of the digital circuitry represented by sheets 2 and 3 (see below) of the schematic drawings.

The assembly drawing (Figure M3-7 on page M3-16) shows the placement of the board's components.

The schematic drawing for the MVX-D8 is divided into four sheets. The following is an description of each sheet.

- Sheet 1 (Figure M3-3 on page M3-7) contains the interconnection diagram of the remaining three sheets, most of the bypass capacitors of the board, and some reference drawings for most of the large surface mount chips.
- Sheet 2 (Figure M3-4 on page M3-9) contains the microprocessor circuitry.
- Sheet 3 (Figure M3-5 on page M3-11) contains the FPGAs that interface between the microprocessor, the DDSP bus, and the digital, 2-wire line drivers.
- Sheet 4 (Figure M3-6 on page M3-13) contains the digital 2-wire line drivers and the DSP for code and rate conversion.

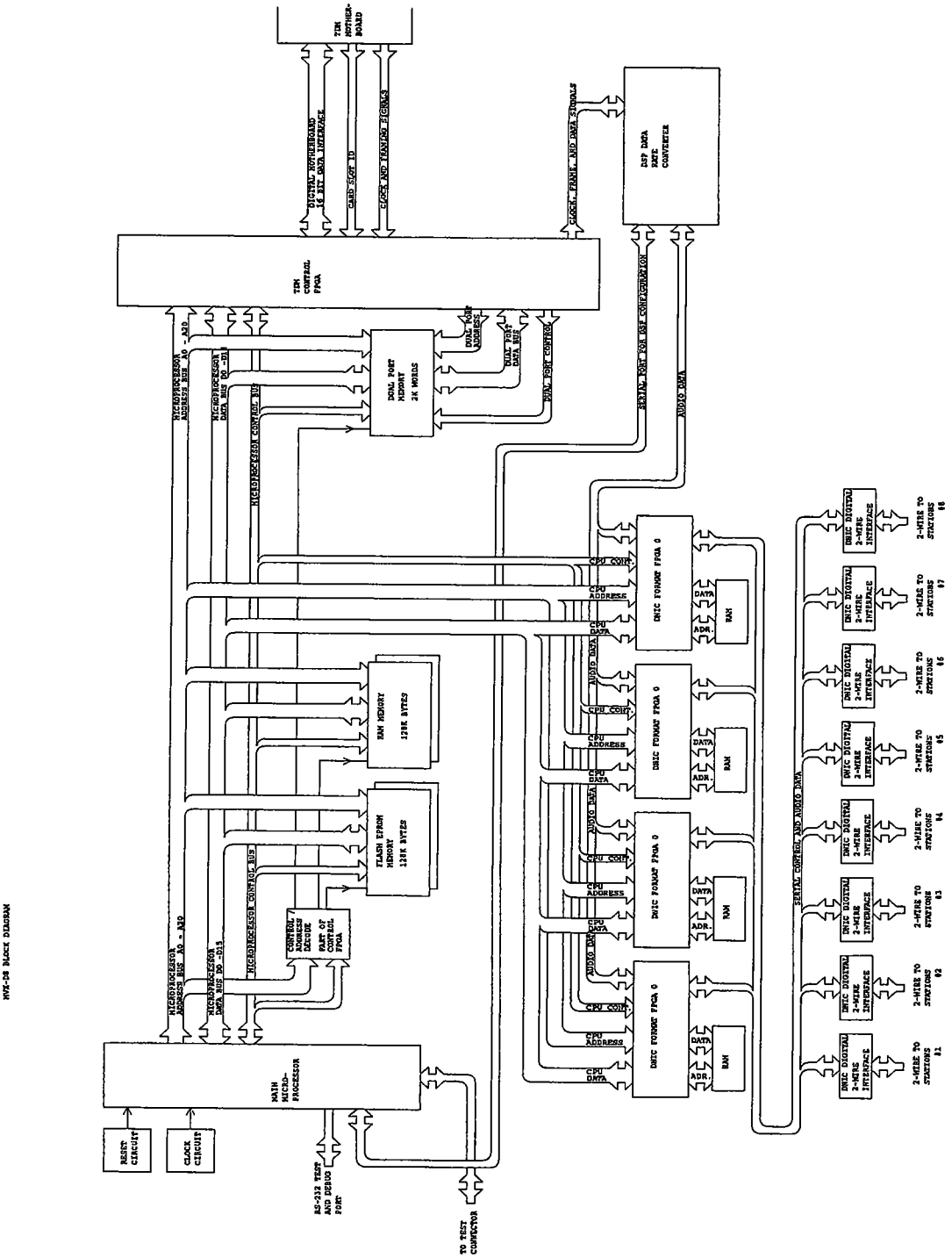


FIGURE M3-2: Digital Block Diagram— MVX-D8

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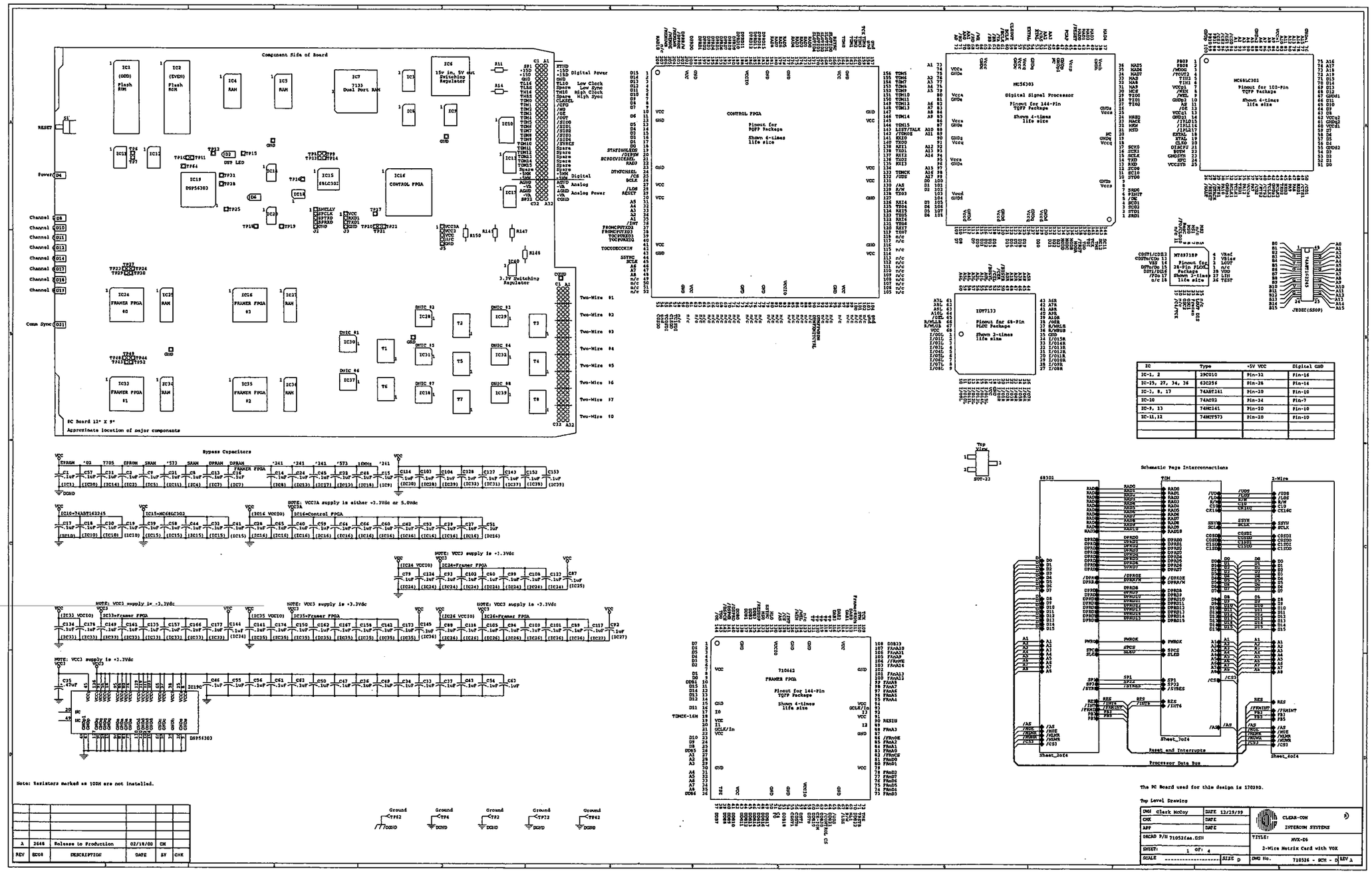

IC	Type	+5V VCC	Digital GND
IC-1, 2	29C010	Pin-32	Pin-16
IC-25, 27, 34, 36	62C256	Pin-28	Pin-14
IC-3, 8, 17	74ABT241	Pin-20	Pin-10
IC-10	74AC02	Pin-14	Pin-7
IC-9, 13	74HC241	Pin-20	Pin-10
IC-11,12	74HCT573	Pin-20	Pin-10

REV	ECO#	DESCRIPTION	DATE	BY	CHK
A	2646	Release to Production	02/19/00	CH	

FIGURE M3-3: Schematic— MVX-D8 PCB Sheet 1, Rev. A

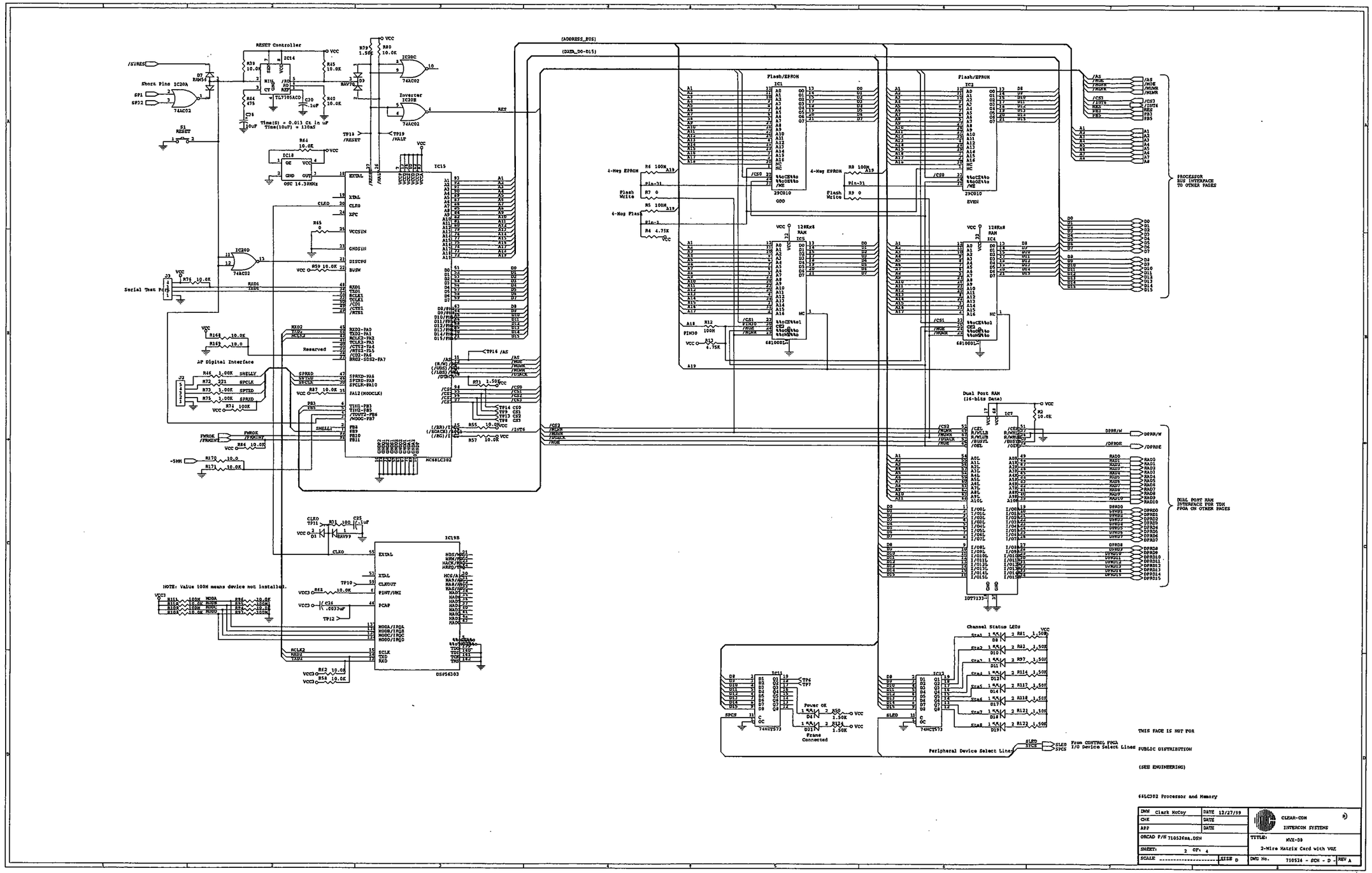

FIGURE M3-4: Schematic— MVX-D8 PCB Sheet 2, Rev. A

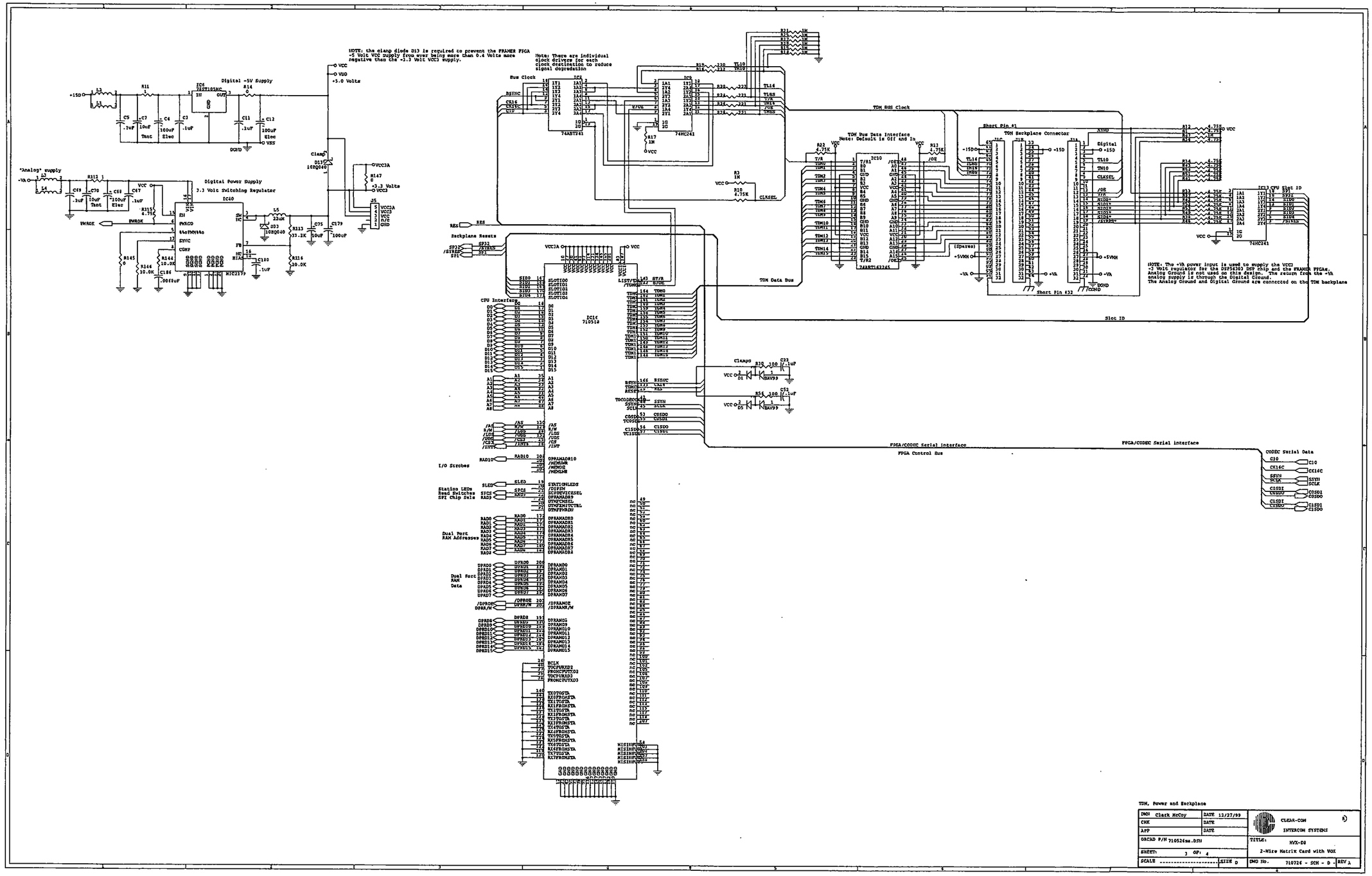

FIGURE M3-5: Schematic— MVX-D8 PCB Sheet 3, Rev. A

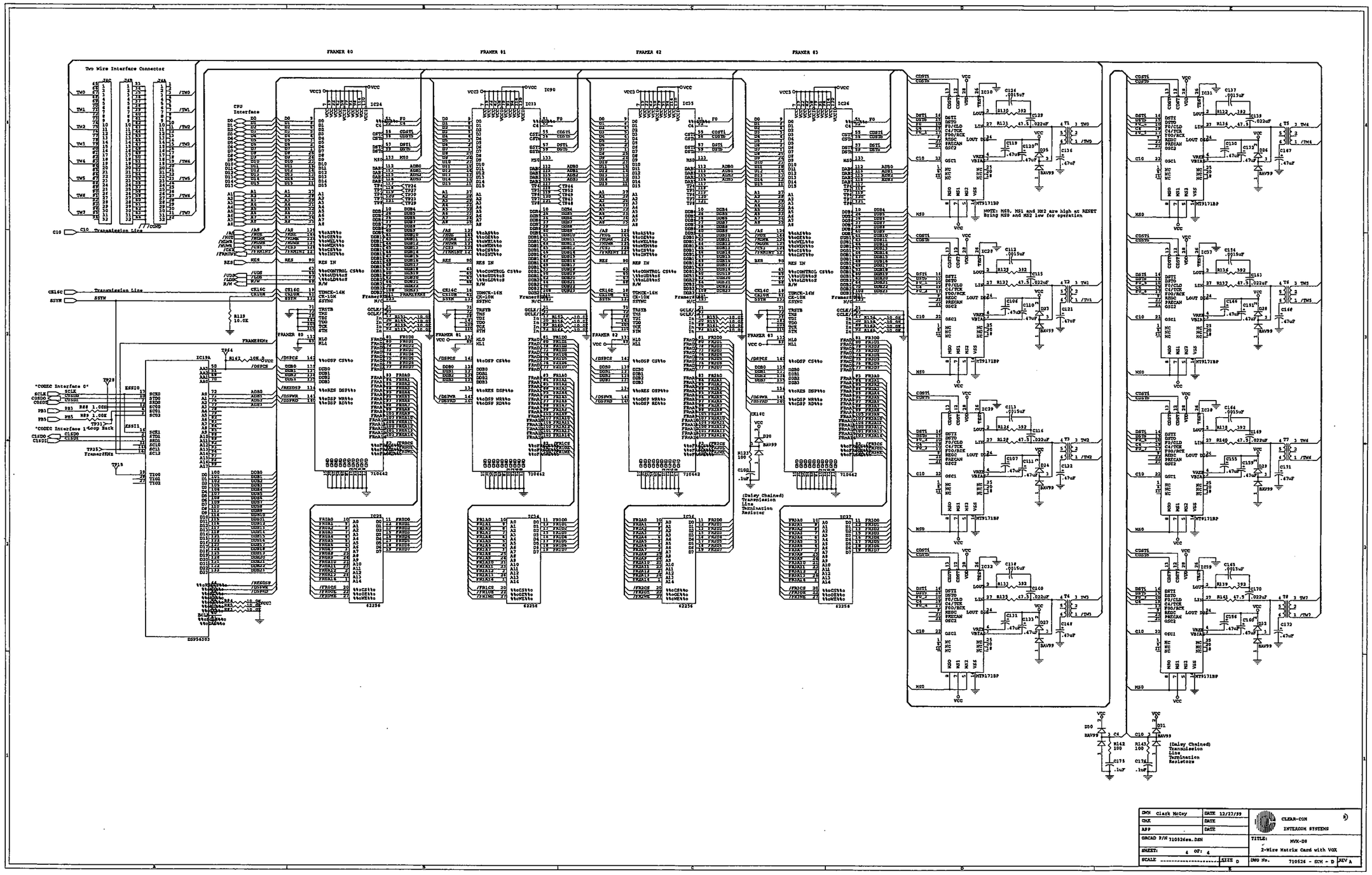

FIGURE M3-6: Schematic— MVX-D8 PCB Sheet 4, Rev. A

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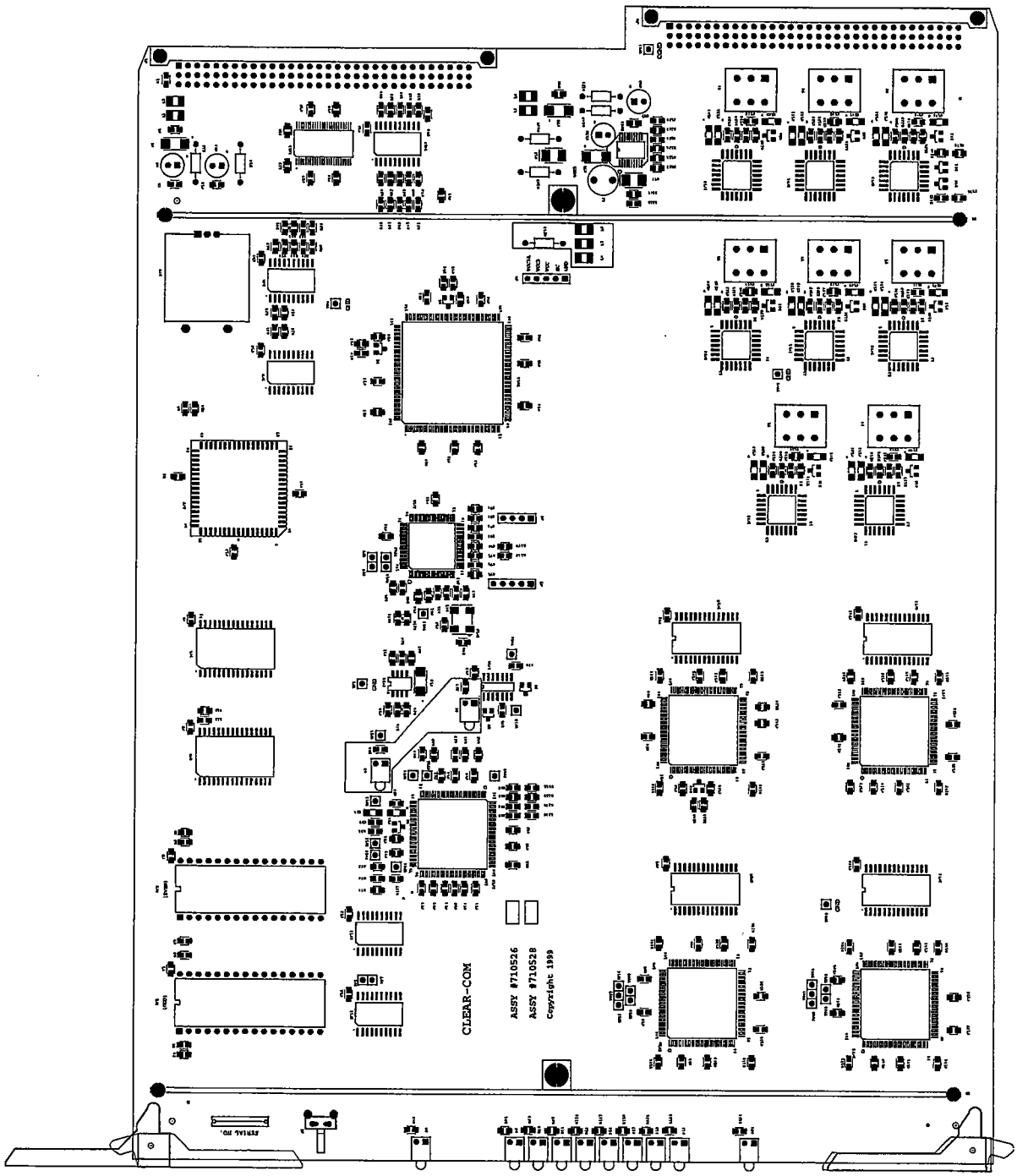


FIGURE M3-7: Assembly Drawing— MVX-D8 PCB, Rev. A

Bill of Materials for the MVX-D8 Main PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.0015	uF	Ceramic Disc SMD	50V	5%	151138	C112 C113 C126 C137 C138 C154 C164 C165
.0033	uF	Ceramic Disc SMD	50V	5%	151002	C26
.0068	uF	Ceramic Disc SMD	50V	10%	151158	C186
.022	uF	Ceramic Disc SMD	50V	10%	151164	C115 C116 C129 C139 C140 C163 C169 C170
.1	uF	Ceramic Disc SMD	50V	10%	151172	C1 C2 C3 C5 C8 C9 C11 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C27 C28 C29 C30 C31 C32 C33 C34 C36 C37 C39 C40 C41 C42 C43 C44 C45 C46 C47 C48 C49 C50 C51 C52 C53 C54 C55 C56 C57 C58 C59 C60 C61 C62 C63 C64 C65 C66 C67 C69 C79 C80 C87 C88 C89 C92 C93 C94 C99 C100 C101 C102 C103 C104 C105 C108 C109 C114 C117 C118 C123 C124 C127 C128 C134 C135 C141 C142 C143 C144 C145 C149 C150 C152 C153 C157 C158 C161 C162 C166 C167 C173 C174 C175 C176 C177 C178 C180
.47	uF	Tantalum SMD	35V	10%	151184	C35 C106 C107 C110 C111

.47	uF	Tantalum SMD	35V	10%	151184	C119 C120 C121 C122 C130 C131 C132 C133 C136 C146 C147 C148 C151 C155 C156 C159 C160 C168 C171 C172
10	uF	Tantalum SMD	25V	10%	151192	C7 C38 C70 C75
100	uF	Aluminum	16V	20%	150155	C4 C12 C68 C179

Resistors

Value		Power	Type	Tol.	Part #	Designator
1	OHM	1/4	Carbon Film	5%	410139	R11 R112
0	OHM	1/10	SMD		411100	R7 R9 R65 R145
10.0	OHM	1/10	SMD	1%	411197	R170 R169
47.5	OHM	1/10	SMD	1%	411262	R127 R128 R131 R134 R135 R137 R140 R141
100	OHM	1/10	SMD	1%	411293	R30 R31 R56 R123 R142 R143
221	OHM	1/10	SMD	1%	411326	R16 R19 R20 R24 R26 R28 R72
392	OHM	1/10	SMD	1%	411350	R125 R126 R130 R132 R133 R136 R138 R139
475	OHM	1/10	SMD	1%	411358	R44
1.00K	OHM	1/10	SMD	1%	411389	R46 R73 R75 R88 R89
1.50K	OHM	1/10	SMD	1%	411406	R50 R71 R79 R81 R82 R97 R114 R117 R118 R121 R122 R124
4.75K	OHM	1/10	SMD	1%	411454	R1 R4 R10 R13 R22 R23 R32 R33 R34 R36 R37 R38 R41 R42 R43 R48 R49 R51 R52 R53 R54 R115
10.0K	OHM	1/10	SMD	1%	411485	R2 R39 R40 R45 R55 R57 R58 R59 R62 R64 R68 R76 R80 R83 R84 R85 R86 R87 R94 R96 R108 R110 R129 R144 R151 R152 R153 R154 R155 R156 R157 R158 R159 R160 R161 R162 R163 R164 R165 R166 R167 R168 R171

20.0K	OHM	1/10	SMD	1%	411514	R116
33.2K	OHM	1/10	SMD	1%	411535	R113
100K	OHM	1/10	SMD	1%	411581	R74
1.0M	OHM	1/10	SMD	5%	411677	R3 R15 R17 R18 R21 R25 R27 R29 R47

Diodes and Transistors

Device	Description	Part #	Designator
LED	T1 RT ANG PC MTG 5mA GREEN LED	390028	D4 D8 D10 D11 D12 D14 D17 D18 D19
LED	T1 RT ANG PC MTG 5mA AMBER LED	390029	D21
Diode	BAV70 DUAL DIODE COMMON CATHODE	481019	D9
Diode	BAW56 DUAL DIODE COMMON ANODE	481020	D7
Diode	10BQ040 SRECT 1A 40V	481021	D13 D33
Diode	BAV99 DUAL DIODE	481033	D1 D3 D5 D20 D23 D24 D25 D26 D27 D28 D29 D30 D31 D32

Integrated Circuits

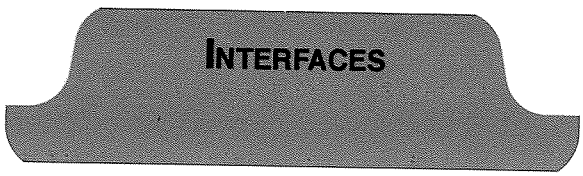
Device	Description	Part #	Designator
IC	32 PIN DIP SOCKET .600 CTR COLLET STYLE	210324	IC1 IC2
IC	16.384MHZ CRYSTAL CLOCK OSCILLATOR	231002	IC18
IC	78ST105 5V 1.5A 3 TERM SWITCHER	480232	IC6
IC	74AC02 CMOS QUAD 2-INP NOR GATE...	481003	IC20
IC	74ABT241 BIMOS OCTAL 3-STATE BUFF	481005	IC8
IC	74HCT573 CMOS OCTAL LATCH 3-STATE	481010	IC12 IC11
IC	74ABT162245 BICMOS 16BIT BUS XCVR	481011	IC10
IC	7133LA CMOS DUAL PORT RAM 2KX16 SMD	481012	IC7
IC	681000L CMOS SRAM 128KX8 100NS	481014	IC4 IC5
IC	7705 SUPPLY VOLT SUPERVISOR RESET	481018	IC14
IC	74HC241 CMOS OCTAL BUFFER/DRIVER	481035	IC13 IC9
IC	MT9171AP DIGITAL NETWORK INT.	481046	IC28 IC29 IC30 IC31 IC32 IC37 IC38 IC39
IC	62256 CMOS SRAM 32K X 8	481047	IC25 IC27 IC34 IC36
IC	56303 24-BIT DSP W/DMA	481048	IC19
IC	68LC302 HCMOS M-CNTRLR 16.67MHZ	481049	IC15
IC	MIC2179 1.5A SYNC BUCK VOLT REG.	481070	IC40
IC	FPGA, DNIC FRAMER, MVX-D8	710442	IC24 IC26 IC33 IC35
IC	FPGA, CONTROL MVX-A8	710518	IC16

Miscellaneous

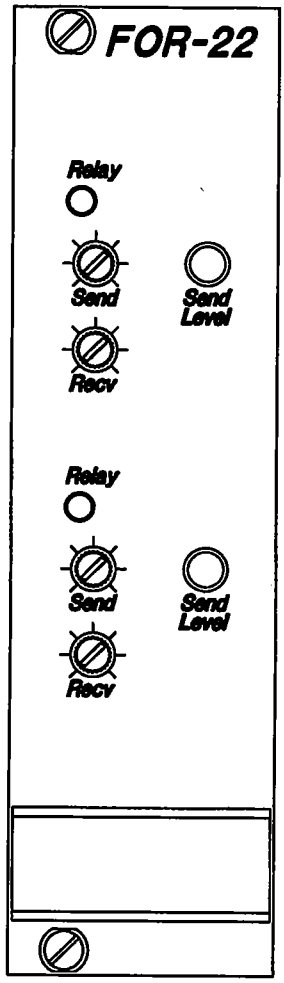
Device	Description	Part #	Designator
Inductor	INDUCTOR 22UH 1.6A SHIELDED	180011	L5
Connector	DIN96 FEMALE RT ANGLE PC	210321	J4 J1
Switch	PUSHBUTTON SWITCH SPST	510099	S1
Transformer	2745B 2:1 PULSE TRANSFORMER	560023	T1 T2 T3 T4 T5 T6 T7 T8
Inductor	FERRITE EMI SUPPRESSOR 400MA	181001	L1 L2

Miscellaneous

Device	Description	Part #	Designator
Inductor	INDUCTOR 22UH 1.6A SHIELDED	180011	L5
Inductor	FERRITE EMI SUPPRESSOR 400MA	181001	L1 L2 L3 L4
Connector	HEADER MULTI PIN HEADER((PER)PIN)	210112	J3(4) J2(5) J5(5)
Connector	DIN96 FEMALE RT ANGLE	210321	J4 J1
Switch	PUSHBUTTON SWITCH SPST RT ANGLE	510099	S1
Transformer	2745B 2:1 PULSE TRANSFORMER	560023	T1 T2 T3 T4 T5 T6 T7 T8


INTERFACES

FOR-22



Matrix Plus 3 System FOR-22
DUAL 4-WIRE INTERFACE MODULE

Introduction

This Section provides block diagrams, schematics, assembly drawings and component lists for the FOR-22 Dual 4-Wire Interface Module.

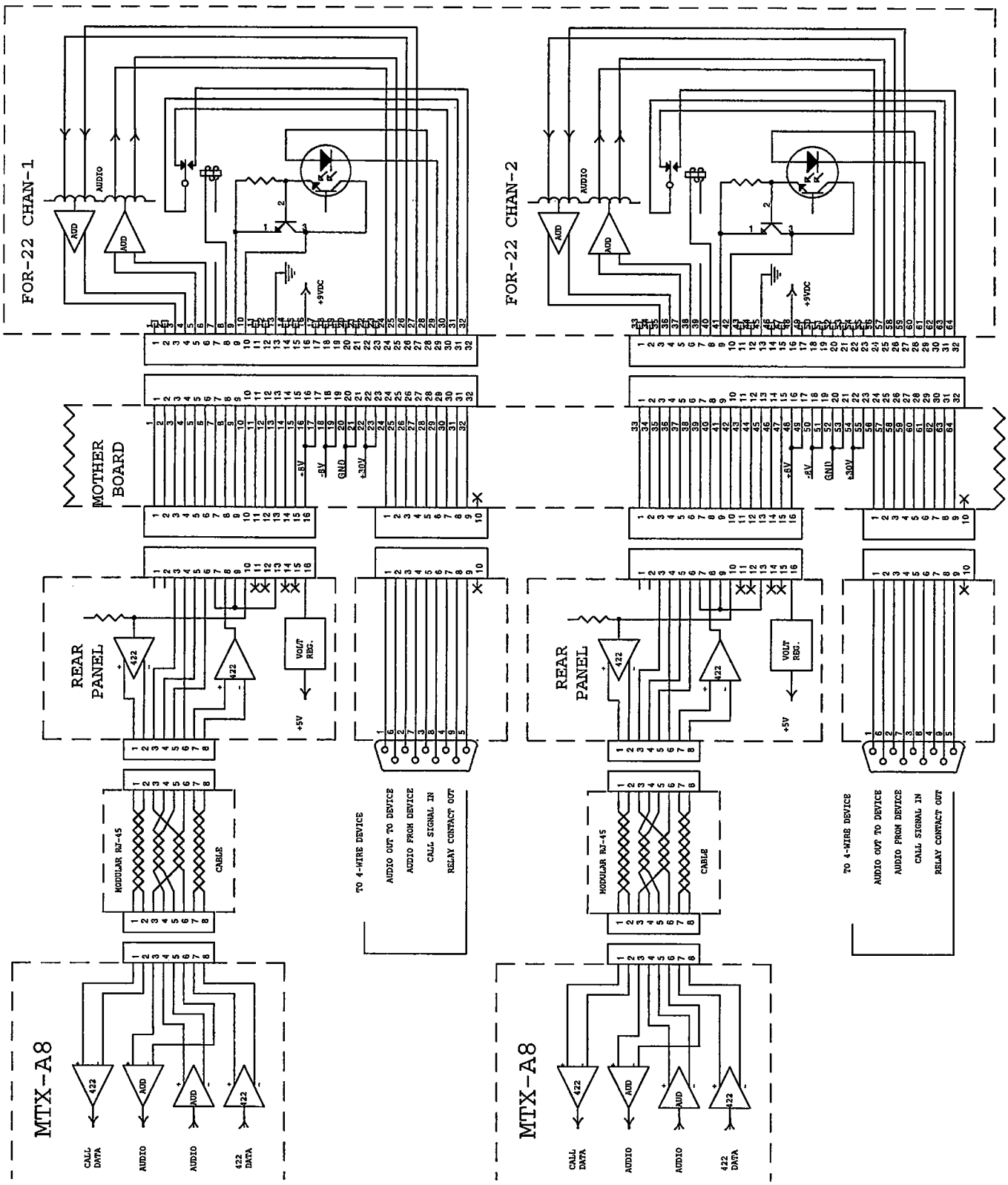


FIGURE I1-1 Block Diagram - FOR-22

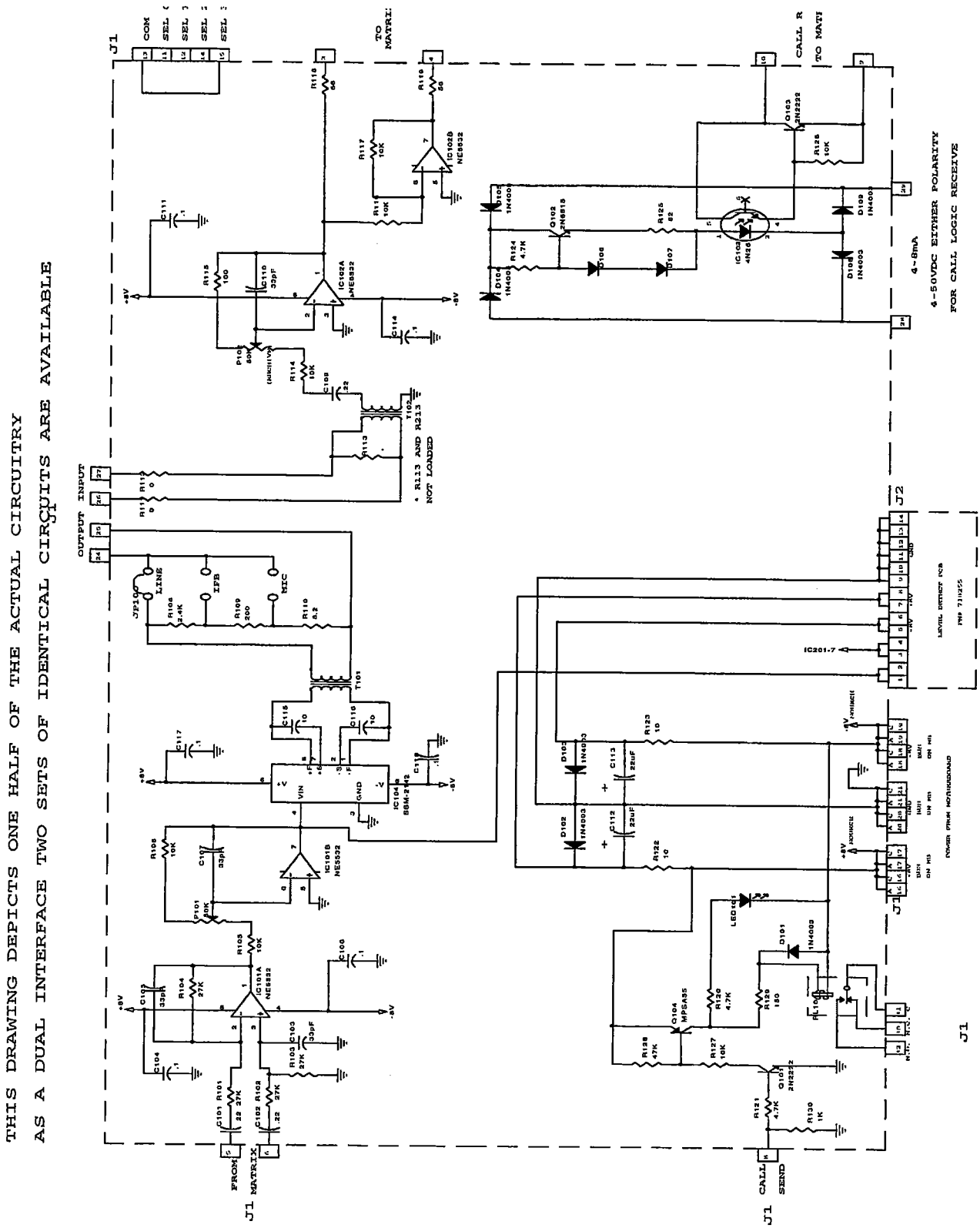


FIGURE I1-2 Schematic - FOR-22 Interface, Rev. A

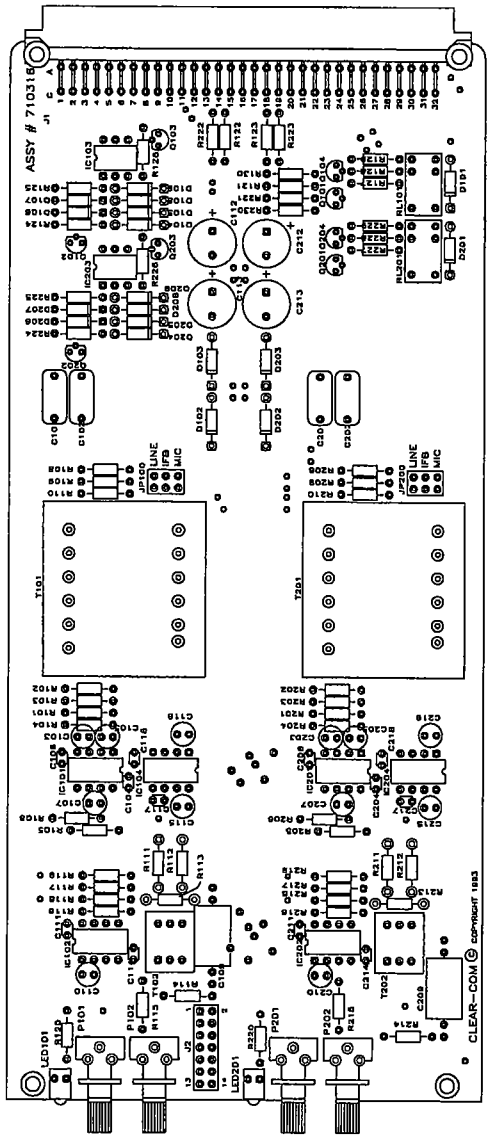


FIGURE I1-3 Assembly Drawing - FOR-22 Main PCB, Rev. A

Bill of Materials for the For-22 Module PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
33	pF	Monolithic	50V	10%	150128	C103 C105 C107 C110 C203 C205 C207 C210
0.1	uF	Monolithic	50V	10%	150035	C104 C106 C111 C114 C117 C118 C204 C206 C211 C214 C217 C218
0.22	uF	Mylar	V	10%	150134	C109 C209
0.22	uF	Mylar	100V	20%	150003	C101 C102 C201 C202
10	uF	Aluminum	35V	10%	150072	C115 C116 C215 C216
1000	uF	Aluminum	16V		150145	C112 C113 C212 C213

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
8.2	OHM	1/4	Carbon Film	5%	410166	R110 R210
10	OHM	1/4	Carbon Film	5%	410002	R122 R123 R222 R223
56	OHM	1/4	Carbon Film	5%	410135	R118 R119 R218 R219
82	OHM	1/4	Carbon Film	5%	410038	R125 R225
100	OHM	1/4	Carbon Film	5%	410071	R115 R215
150	OHM	1/4	Carbon Film	5%	410006	R129 R229
200	OHM	1/4	Carbon Film	5%	410072	R109 R209
1K	OHM	1/4	Carbon Film	5%	410010	R120 R130 R220 R230
2.4K	OHM	1/4	Carbon Film	5%	410103	R108 R208
4.7K	OHM	1/4	Carbon Film	5%	410013	R121 R124 R221 R224
10K	OHM	1/4	Carbon Film	5%	410016	R105 R106 R114 R116 R117 R126 R127 R205 R206 R214 R216 R217 R226 R227
27K	OHM	1/4	Carbon Film	5%	410022	R101 R102 R103 R104 R201 R202 R203 R204
47K	OHM	1/4	Carbon Film	5%	410021	R128 R228

Bill of Materials for the For-22 Module PCB ---- cont.

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4003 RECT 1A 200PIV	480058	D101 D102 D103 D104 D105 D108 D109 D201 D202 D203 D204 D205 D208 D209
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D106 D107 D206 D207
Transistor	2N2222 NPN 30V	480006	Q101 Q103 Q201 Q203
Transistor	2N6515 NPN 250V	480059	Q102 Q202
Transistor	MPS-A55 PNP 60V	480050	Q104 Q204

Integrated Circuits

Device	Description	Part #	Designator
Analog IC	4N26 OPTO COMPILER	480106	IC103 IC203
Analog IC	SSM-2142 BAL DRIVER 8 PIN DIP	480198	IC104 IC204
Op Amp	NE5532 DUAL LO NOISE OP AMP	480070	IC101 IC102 IC201 IC202

Miscellaneous

Device	Description	Part #	Designator
LED	T1 RT ANG 5mA AMBER	390029	LED101 LED201
Pot	50K TRIMPOT	470059	P101 P102 P201 P202
Relay	SPDT 12V MINI PC RELAY	450006	RL101 RL201
Transformer	10K:10K MINIATURE	560034	T102 T202
Transformer	AUDIO XFMR 600:600	560036	T101 T201

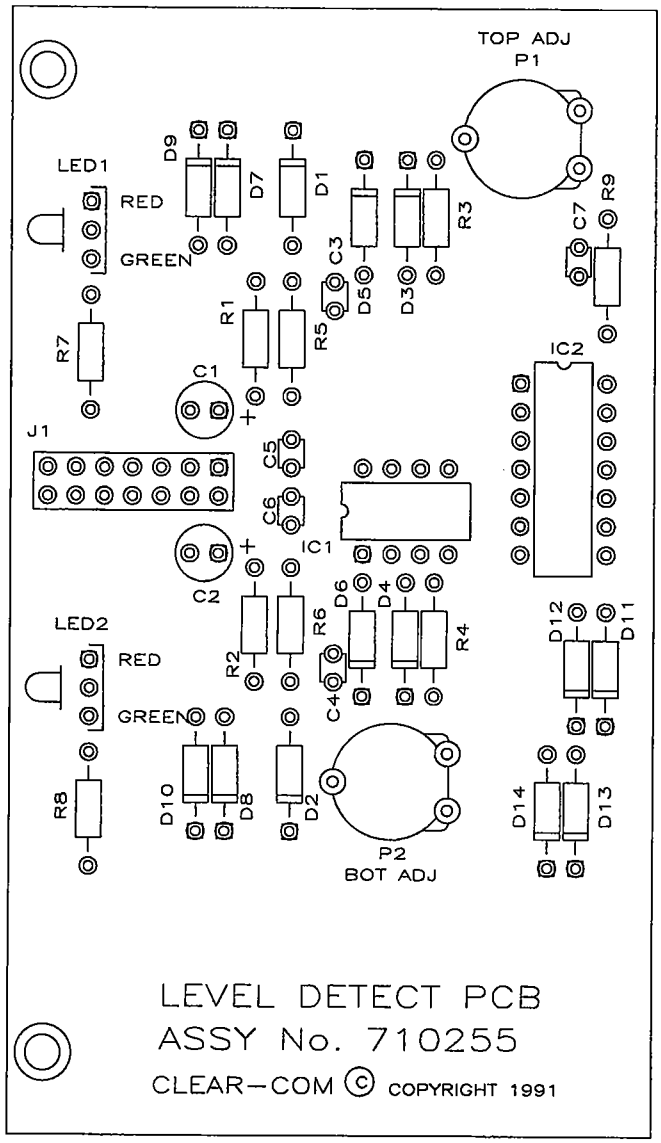


FIGURE I1-4 Assembly Drawing - FOR-22 Level Detect PCB, Rev. B

Bill of Materials for the FOR-22 LED PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
0.1	uF	Monolithic	50V	10%	150035	C5 C6 C7
0.22	uF	Monolithic	50V	20%	150133	C3 C4
0.47	uF	Aluminum	50V		150024	C1 C2

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
220	OHM	1/4	Carbon Film	5%	410007	R7 R8
24K	OHM	1/4	Carbon Film	5%	410083	R3 R4
47K	OHM	1/4	Carbon Film	5%	410021	R1 R2 R9
330K	OHM	1/4	Carbon Film	5%	410033	R5 R6

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12 D13 D14

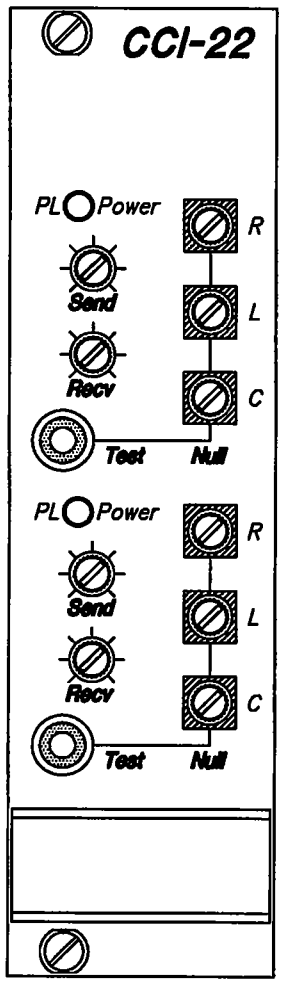
Integrated Circuits

Device	Description	Part #	Designator
Op Amp	LM324 QUAD CMN OP AMP	480063	IC2
Op Amp	NE5532 DUAL LO NOISE OP AMP	480070	IC1 IC1

Miscellaneous

Device	Description	Part #	Designator
POT	100K TRIM POT	470050	P1 P2
LED	BI-COLOR RED/GREEN 3 LEAD	390032	LED1 LED2

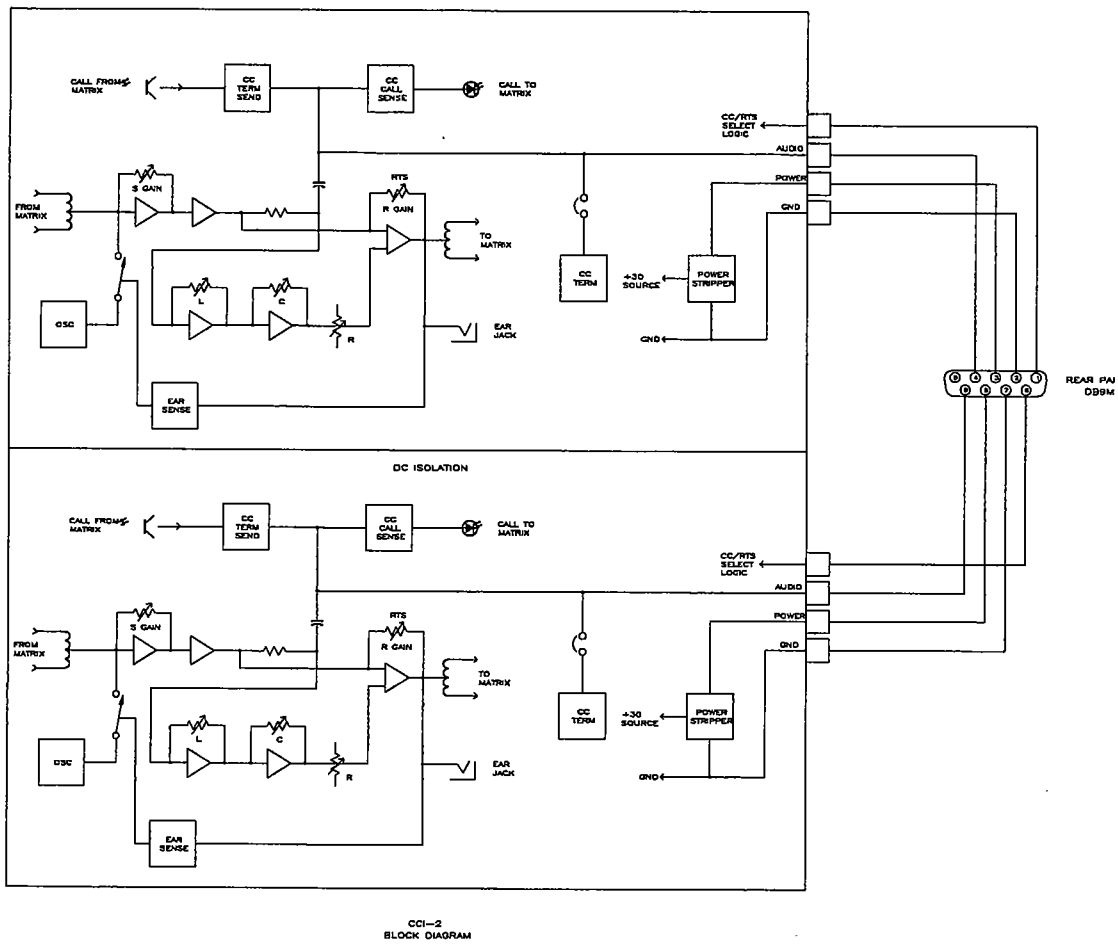
CCI-22



Matrix Plus 3 System CCI-22
DUAL PARTY-LINE INTERFACE MODULE

Introduction

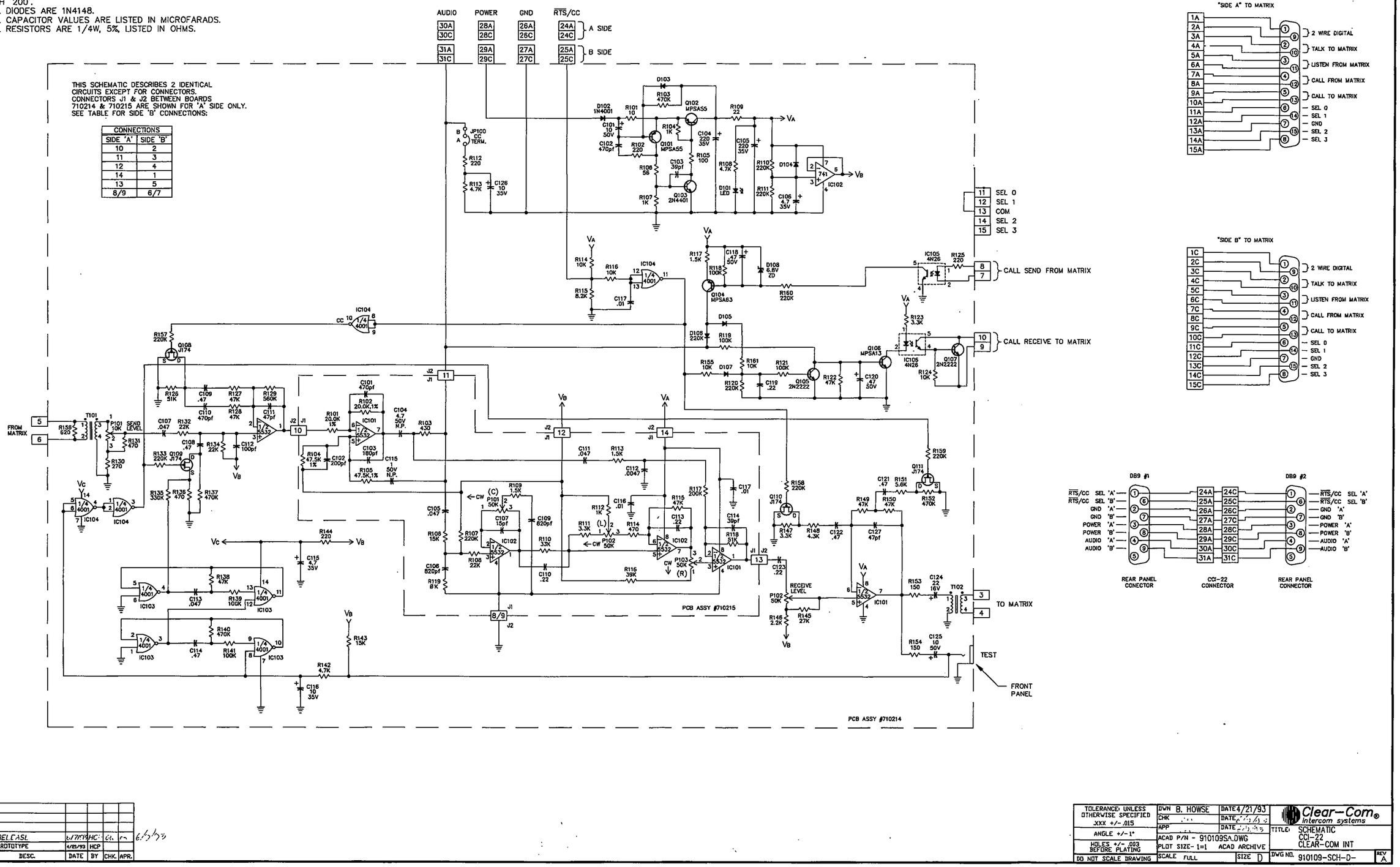
This Section provides schematics, assembly drawings and component lists for the CCI-22 Dual Party-Line Interface Module.



CCI-2
BLOCK DIAGRAM

FIGURE I2-1 Block Diagram - CCI-22 Interface

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DESIGNATORS: THE SCHEMATIC SHOWN IS FOR SIDE 'A'. ALL DESIGNATIONS ON SIDE 'A' BEGIN WITH '100', SIDE 'B' BEGIN WITH '200'.
2. ALL DIODES ARE 1N4148.
3. ALL CAPACITOR VALUES ARE LISTED IN MICROFARADS.
4. ALL RESISTORS ARE 1/4W, 5%, LISTED IN OHMS.



REV	ECO#	DESC.	DATE	BY	CHK.	APR.
A	1041	RELEASE	6/7/93	HCP		6/7/93
99	*	PROTOTYPE	4/21/93	HCP		

TOLERANCE UNLESS OTHERWISE SPECIFIED XXX +/-.015	DWN B. HOWSE DATE 4/21/93
ANGLE +/- 1°	CHK DATE
HOLES +/-.003 BEFORE PLATING	APP DATE
DO NOT SCALE DRAWING	ACAD P/N - 910109SA.DWG PLOT SIZE- 1=1 ACAD ARCHIVE SCALE FULL SIZE D

Clear-Com® Intercom systems

TITLE: SCHEMATIC CCI-22 CLEAR-COM INT

DWG NO. 910109-SCH-D- REV A

FIGURE I2-2 Schematic - CCI-22 Interface, Rev. A

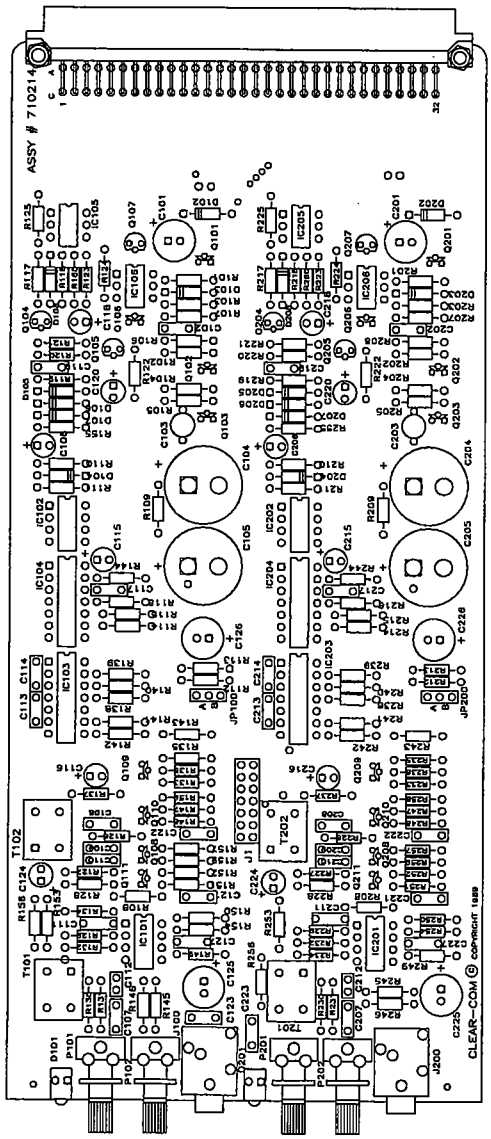


FIGURE I2-3 Assembly Drawing - CCI-22 Main PCB, Rev. D

Bill of Materials for the CCI-22 Module PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
39	pF	Ceramic Disc	50V	5%	150026	C103 C203
47	pF	Ceramic Disc	50V	10%	150041	C111 C127 C211 C227
100	pF	Monolithic	50V	20%	150104	C112 C212
470	pF	Ceramic Disc	50V	10%	150014	C102 C110 C202 C210
0.01	uF	Ceramic Disc	30V	20%	150012	C117 C217
0.047	uF	Monolithic	50V	10%	150078	C107 C113 C207 C213
0.22	uF	Monolithic	100V		150080	C119 C123 C219 C223
0.47	uF	Aluminum	50V		150024	C118 C120 C218 C220
0.47	uF	Monolithic	50V		150043	C108 C109 C114 C121 C122 C208 C209 C214 C221 C222
4.7	uF	Tantalum	35V		150044	C106 C115 C206 C215
10	uF	Aluminum	50V		150064	C101 C116 C125 C126 C201 C216 C225 C226
22	uF	Aluminum	16V		150010	C124 C224
220	uF	Aluminum	35V		150021	C104 C105 C204 C205

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
10	OHM	1/4	Carbon Film	5%	410002	R101 R201
22	OHM	1/4	Carbon Film	5%	410004	R109 R209
56	OHM	1/4	Carbon Film	5%	410135	R106 R206
100	OHM	1/4	Carbon Film	5%	410071	R105 R205
150	OHM	1/4	Carbon Film	5%	410006	R153 R154 R253 R254
220	OHM	1/4	Carbon Film	5%	410007	R102 R112 R125 R144 R202 R212 R225 R244
270	OHM	1/4	Carbon Film	5%	410009	R130 R230
470	OHM	1/4	Carbon Film	5%	410042	R131 R136 R231 R236
620	OHM	1/4	Carbon Film	5%	410054	R156 R256
1K	OHM	1/4	Carbon Film	5%	410010	R104 R107 R204 R207
1.5K	OHM	1/4	Carbon Film	5%	410055	R117 R217
2.2K	OHM	1/4	Carbon Film	5%	410011	R146 R246
3.3K	OHM	1/4	Carbon Film	5%	410015	R123 R147 R223 R247
4.3K	OHM	1/4	Carbon Film	5%	410158	R148 R248
4.7K	OHM	1/4	Carbon Film	5%	410013	R108 R113 R142 R208 R213 R242
5.6K	OHM	1/4	Carbon Film	5%	410056	R151 R251
8.2K	OHM	1/4	Carbon Film	5%	410037	R115 R215

Bill of Materials for the CCI-22 Module PCB ---- cont.

10K	OHM	1/4	Carbon Film	5%	410016	R114 R116 R124 R155 R161 R214 R216 R224 R255 R261
15K	OHM	1/4	Carbon Film	5%	410017	R143 R243
22K	OHM	1/4	Carbon Film	5%	410018	R132 R134 R232 R234
27K	OHM	1/4	Carbon Film	5%	410022	R145 R245
47K	OHM	1/4	Carbon Film	5%	410021	R122 R127 R128 R138 R149 R150 R222 R227 R228 R238 R249 R250
51K	OHM	1/4	Carbon Film	5%	410136	R126 R226
100K	OHM	1/4	Carbon Film	5%	410024	R118 R119 R121 R139 R141 R218 R219 R221 R239 R241
220K	OHM	1/4	Carbon Film	5%	410028	R110 R111 R120 R133 R157 R158 R159 R160 R210 R211 R220 R233 R257 R258 R259 R260
330K	OHM	1/4	Carbon Film	5%	410033	R135 R235
470K	OHM	1/4	Carbon Film	5%	410030	R103 R137 R140 R152 R203 R237 R240 R252
560K	OHM	1/4	Carbon Film	5%	410034	R129 R229

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4001 RECT 1A 50PIV	480001	D102 D104 D202 D204
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D103 D105 D106 D107 D203 D205 D206 D207
Diode	1N957B ZENER 6.8V .4W 5%	480026	D108 D208
Transistor	2N2222 NPN 30V	480006	Q105 Q107 Q205 Q207
Transistor	2N4401 NPN 40V	480047	Q103 Q203
Transistor	J174 JFET PCHAN 8V VGS	480079	Q108 Q109 Q110 Q111 Q208 Q209 Q210 Q211
Transistor	MPS-A13 NPN 30V DARL	480004	Q106 Q206
Transistor	MPS-A55 PNP 60V	480050	Q101 Q102 Q201 Q202
Transistor	MPS-A63 PNP 30V DARL	480008	Q104 Q204

Bill of Materials for the CCI-22 Module PCB ---- cont.

Integrated Circuits

Device	Description	Part #	Designator
Analog IC	4N26 OPTO COMPILER	480106	IC105 IC106 IC205 IC206
Logic Chip	4001 CMOS QUAD 2 IN NOR	480112	IC103 IC104 IC203 IC204
Op Amp	LM741 IC OP AMP 8-PIN DIP	480018	IC102 IC202
Op Amp	NE5532 DUAL LO NOISE OP AMP	480070	IC101 IC201

Miscellaneous

Device	Description	Part #	Designator
Connector	3 COND MINI PHONE JACK	210128	J100 J200
LED	T1 RT ANG 5mA GREEN	390028	D101 D201
Pot	10K TRIMPOT	470058	P101 P201
Pot	50K TRIMPOT	470059	P102 P202
Transformer	600 OHM 1:1 AUDIO TRANS	560026	T101 T102 T201 T202

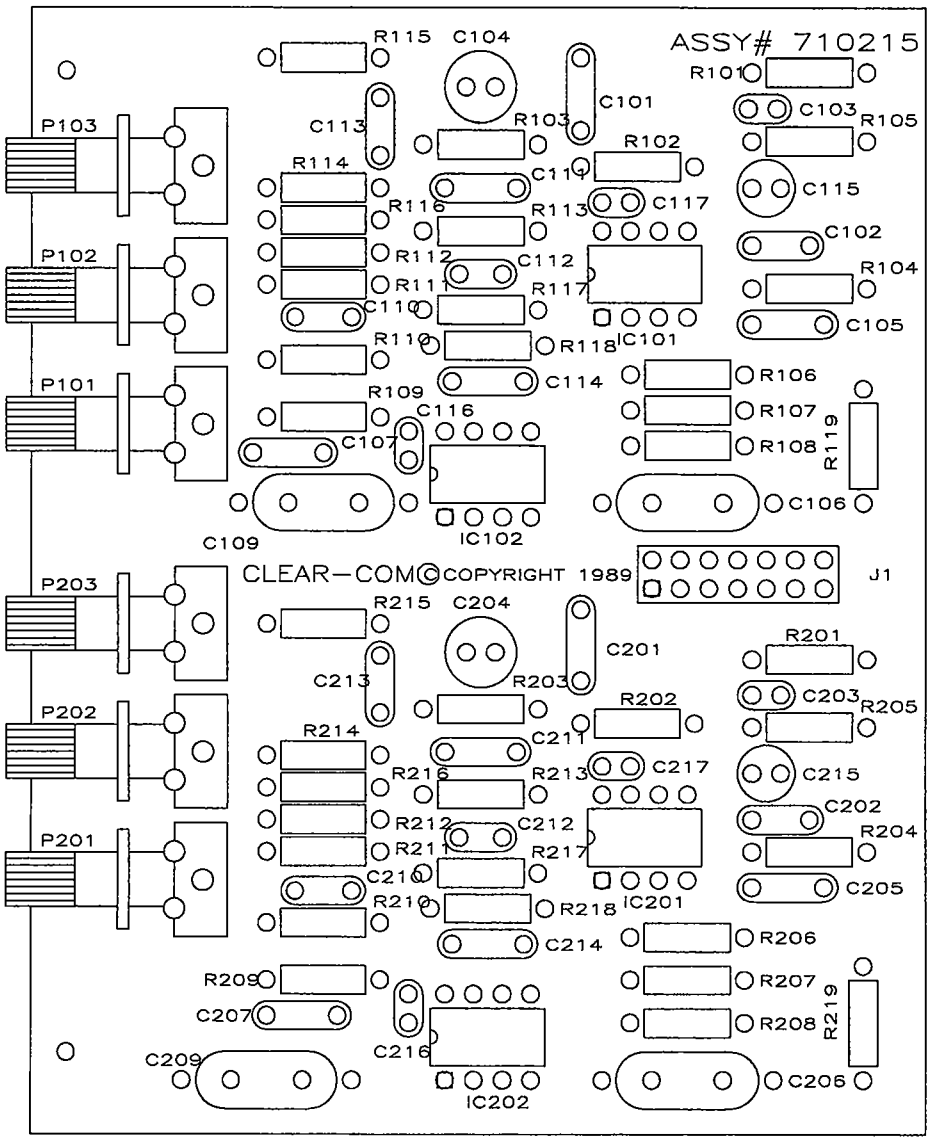


FIGURE I2-4 Assembly Drawing - CCI-22 Null PCB, Rev. D

Bill of Materials for the CCI-22 Null PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
15	pF	Ceramic Disc	1000V	10%	150013	C107 C207
39	pF	Ceramic Disc	50V	5%	150026	C114 C214
180	pF	Monolithic	50V		150144	C103 C203
200	pF	Ceramic Disc	50V	10%	150007	C102 C202
470	pF	Ceramic Disc	50V	10%	150014	C101 C201
820	pF	Ceramic Disc	50V	10%	150049	C106 C109 C206 C209
0.0047	uF	Mylar	50V	10%	150068	C112 C212
0.01	uF	Monolithic	50V	20%	150109	C116 C117 C216 C217
0.047	uF	Metal Polyester	50V	10%	150005	C105 C111 C205 C211
0.22	uF	Monolithic	100V		150080	C110 C113 C210 C213
1	uF	Aluminum	50V	10%	150002	C115 C215
4.7	uF	Aluminum	50V		150087	C104 C204

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
430	OHM	1/4	Carbon Film	5%	410106	R103 R203
470	OHM	1/4	Carbon Film	5%	410042	R114 R214
1K	OHM	1/4	Carbon Film	5%	410010	R112 R212
1.5K	OHM	1/4	Carbon Film	5%	410055	R109 R113 R209 R213
3.3K	OHM	1/4	Carbon Film	5%	410015	R111 R211
15K	OHM	1/4	Carbon Film	5%	410017	R106 R206
20.0K	OHM	1/4	Carbon Film	1%	410086	R101 R102 R201 R202
22K	OHM	1/4	Carbon Film	5%	410018	R108 R208
33K	OHM	1/4	Carbon Film	5%	410020	R110 R210
39K	OHM	1/4	Carbon Film	5%	410019	R116 R216
47K	OHM	1/4	Carbon Film	5%	410021	R115 R215
47.5K	OHM	1/8	Carbon Film	1%	410105	R104 R105 R204 R205
51K	OHM	1/4	Carbon Film	5%	410136	R118 R218
200K	OHM	1/4	Carbon Film	5%	410109	R117 R217
220K	OHM	1/4	Carbon Film	5%	410028	R107 R207

Bill of Materials for the CCI-22 Null PCB ---- cont.

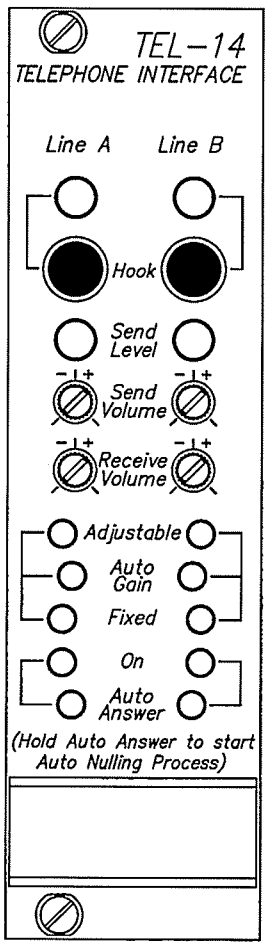
Integrated Circuits

Device	Description	Part #	Designator
Op Amp	NE5532 DUAL LO NOISE OP AMP	480070	IC101 IC102 IC201 IC202

Miscellaneous

Device	Description	Part #	Designator
	50K TRIMPOT PIHER#PT10WH-50K	470059	P101 P102 P103 P201 P202 P203
	PIHER TRIMPOT SHAFT #5116 GREY	240057	

TEL-14



Matrix Plus 3 System TEL-14

TELEPHONE INTERFACE MODULE

Introduction

This Section provides block diagrams, schematics, assembly drawings and component lists for the TEL-14 Two-Channel Auto-Nulling Telephone Interface .

Troubleshooting

To help isolate any problems you may encounter, a list of possible symptoms and possible solutions is provided. Note that the most common option switch setting is with all switches in the ON position. This is also the factory default setting.

1. No front panel LEDs are lit.

- Press the Auto Gain or Auto Answer buttons.
- Check that the card is properly seated in the IMF frame. Remove and reseat it.
- Check that the power cable from the IMF frame is securely connected.
- Check mains AC power to the Matrix System.

2. The TEL-14 will not answer the telephone line. The red Ring/Off Hook LED does not light when the line is called.

- Check that the telephone line is connected to the TEL-14. As a test, unplug the modular cable from the RJ-11 to DB-9F adaptor and plug it into a standard telephone set. Make sure the telephone set can make calls and rings when a call is received on this line. Plug the modular cable back into the RJ-11 to DB-9F adaptor.
- Set the Ring Jumper J6 to the 60V position if the ring voltage is low.

3. The TEL-14 will not automatically answer the telephone line. The red Ring/Off Hook LED lights when the line is called.

- Press the Auto Answer button. Make sure the green Auto Answer LED is lit to allow calls to automatically be answered.
- Make sure the Auto-Answer Ring Count option switch S1-1 is set to the ON position to answer after the first ring. (This switch should be set to the OFF position to answer after the fourth ring.)

4. A telephone call to the TEL-14 cannot be answered from a station. The red Ring/Off Hook LED lights when the line is called.

- Check that the call can be answered by pressing the Hook button while the call is ringing. The Auto Answer LED should turn from red to green when a ringing call is answered.

- Check the Matrix programming to stations which cannot pick up the call. Refer to the Setup Menu and Interfaces Menu Sections of the Operation Manual.

5. When the Self-Service Dial-In feature of the Matrix intercom is used, additional tones are heard over the incoming call prompts.

- Set the Splash Tones option switch S1-7 to the OFF position to eliminate the tones that the TEL-14 produces at the start of a call.

6. Telephone calls cannot be placed from a station. The green Ring/Off Hook LED does not light when a call is attempted.

- Check that the telephone line can be seized by pressing the Hook button. The Auto Answer LED should light green when the line is seized.
- Make sure the Matrix Control option Switch S6-6 is set to the ON position.
- Check the Matrix programming to stations which cannot sieze the telephone line to make a call. Refer to the Setup Menu and Interfaces Menu Sections of the Operation Manual.

7. Telephone calls cannot be placed from a station. The green Ring/Off Hook LED lights when a call is attempted. Dial tone is heard at the station.

- If DTMF dialing will not stop dial tone, press the Auto Gain button to light the yellow Auto Gain Adjustable LED. Increase the send volume just to the point where DTMF dialing will stop dial tone.

8. Telephone calls disconnect when transferring between Matrix stations.

- Set the Immediate Manual Disconnect option switch S1-6 to the OFF position to allow a delay of 15 seconds before disconnecting as a result of station release.

9. Telephone calls disconnect within 2 or 3 seconds after answering.

- Set the Sense Loop Current Interruption option switch S1-5 to the OFF position. This condition indicates that there is below normal DC current on the telephone line.

10. Excessive echo, background noise, or instability is heard during telephone calls or just at the start of a call.

- The TEL-14 will usually adapt within 5 seconds of the start of a call. Before it has adapted, voices may temporarily sound hollow. This effect is normal, but may be minimized by reducing the send and/or receive volume settings.

- Press the Auto Gain button to light the yellow Auto Gain Adjustable LED. Decrease the send and/or receive volume controls until acceptable operation is attained.
- If a speaker station is used, make sure the mic gain is set low and reduce the front panel volume level.
- TEL-14 must be made to renull the telephone line whenever it is connected to a different telephone number. Perform the renulling sequence described in the Operation and Installation Manuals.
- Set the Receive Suppression Disable option switch S6-1 to the OFF position. This will remove noise coming in from the telephone line.
- Set the Intercom Echo Cancel and/or Telephone Echo Cancel option switches S6-2 and S6-3 to the OFF position. Normally this is not necessary and it will result in an undesirable reduction of trans-hybrid loss. These switches should only be set to the OFF position if instability results in an TEL-14 to TEL-14 connection between two intercoms. Never do this to both TEL-14 lines in a connection between two intercoms.
- Set the HDX Disable option switch S6-6 to the OFF position. This is a drastic measure which will cure instability on poor telephone lines, but it will do this at the expense of full-duplex conversation. In this mode, conversation will be half-duplex unless the TEL-14 automatically detects that full-duplex conversation is possible.

11. Sound on the telephone line causes the line to disconnect. The TEL-14 incorporates a precise call progress tone detector, so it is unlikely to sense speech.

- If a steady sound seems to be causing the disconnect, set the Sense Dial Tone option switch S1-2 to the OFF position.
- If interrupted sounds seem to be causing the disconnect, set the Sense Busy Tone and/or Sense Reorder Tone option switches S1-3 and S1-4 to the OFF position.

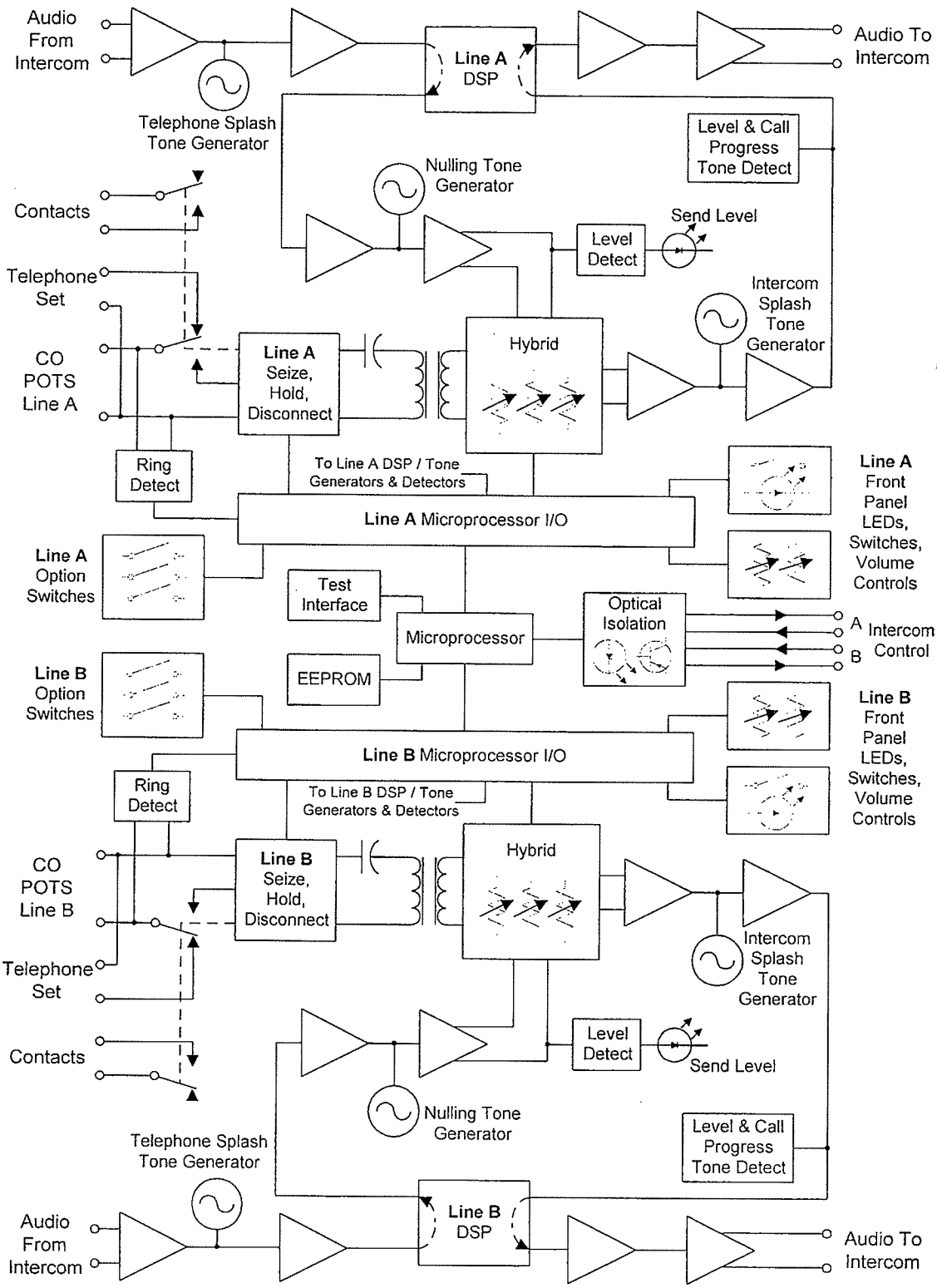
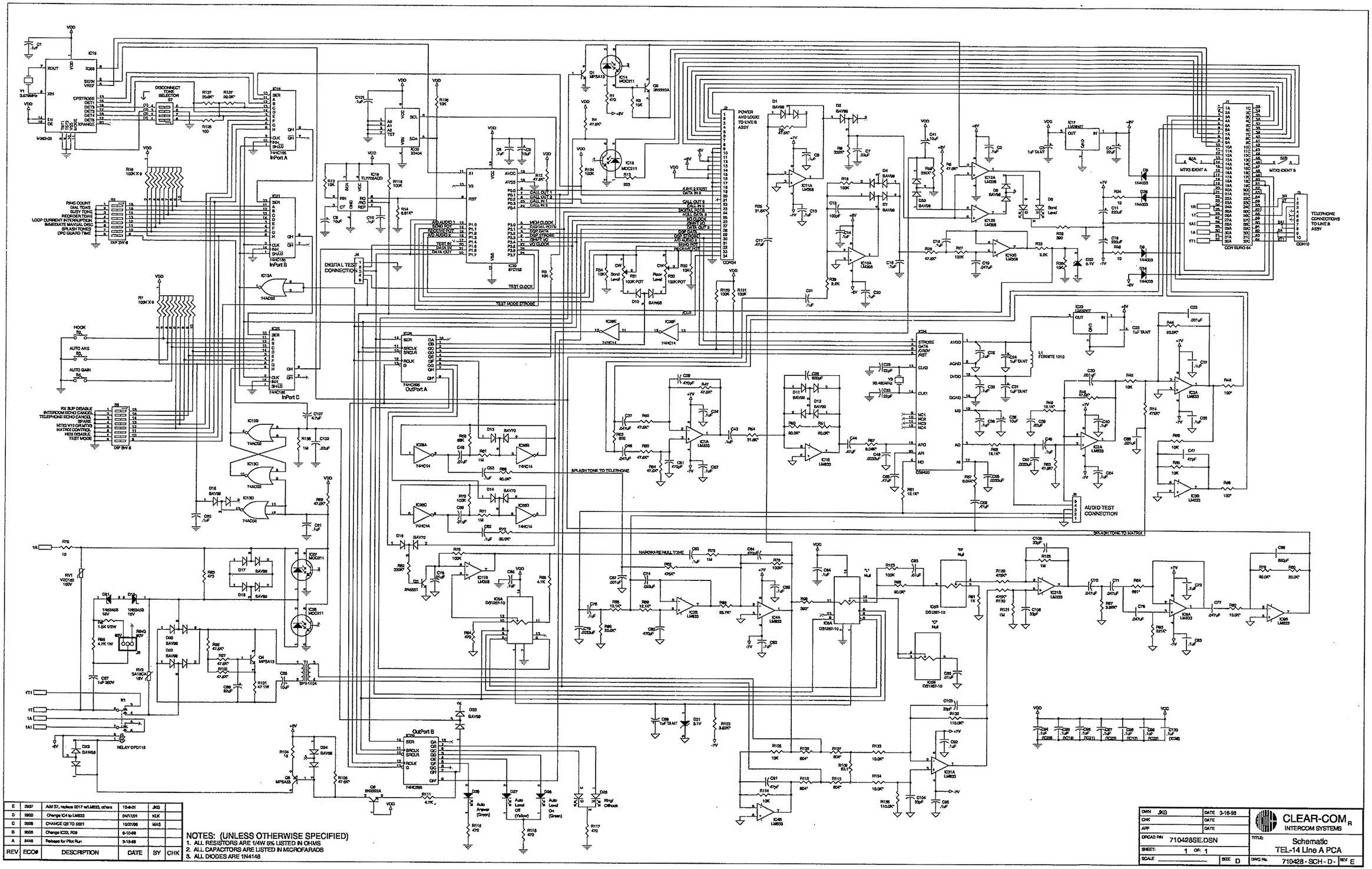


FIGURE I3-1 Block Diagram - TEL-14 Interface



REV	ECO#	DESCRIPTION	DATE	BY	CHK
E	2937	Add 37, replace 2017 w/LM833, others	10-8-01	JKG	
D	2900	Change IC4 to LM833	04/17/01	KLK	
C	2838	CHANGE Q3 TO 2021	10/27/00	MAS	
B	2605	Change IC22, PC9	8-10-00		
A	2448	Release for Pilot Run	3-18-99		

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

DWN JKG	DATE 3-18-98	CLEAR-COM INTERCOM SYSTEMS	
CHK	DATE		
APP	DATE	TITLE Schematic TEL-14 Line A PCA	
ORCAD P/N 710428SE.DSN		SHEET: 1 OF: 1	
SCALE	SIZE D	DWG No. 710428 - SCH - D -	REV E

Figure I3-3 Schematic TEL-14 Interface, Line A, Rev. B

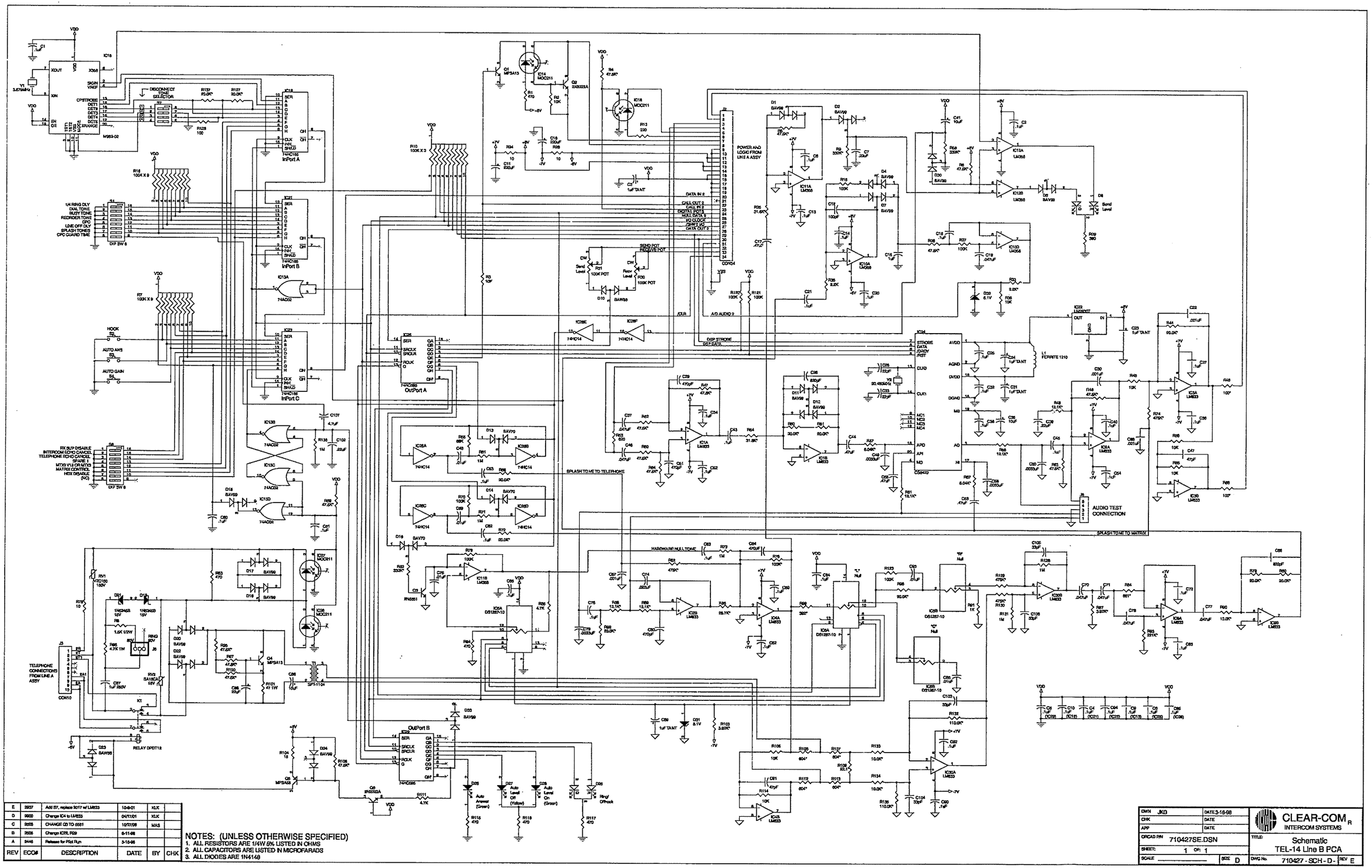


Figure 13-2 Schematic TEL-14 Interface, Line B, Rev.B

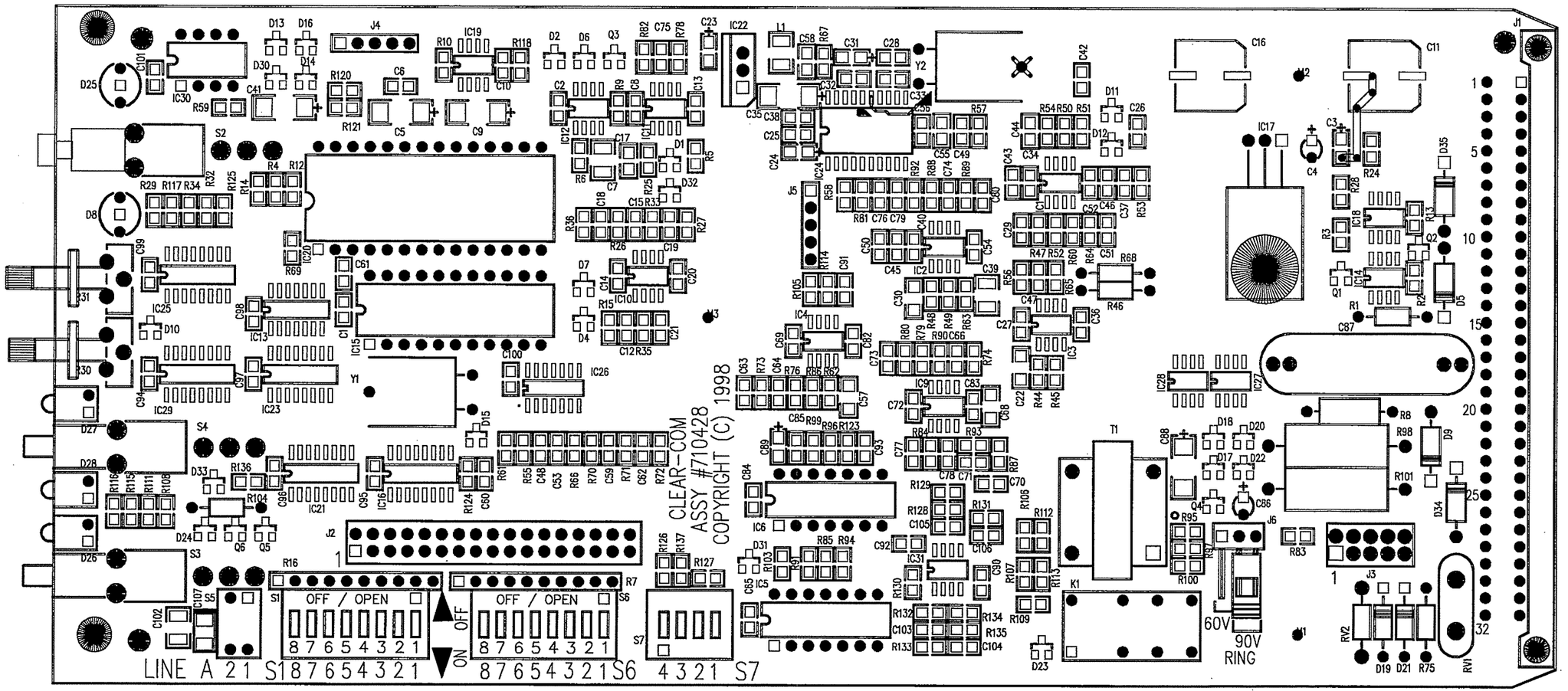


FIGURE I3-4 Assembly Drawing TEL-14 Line A PCB, Rev. B

Bill of Materials for the TEL-14 Line A PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
22	uF	Tantalum	16V		150032	C4 C86
1	uF	Metal Polyester	250V	10%	150160	C87
.001	uF	Ceramic Disc SMD	50V	1%	151001	C22 C30 C57 C68
22	pF	Ceramic Disc SMD	50V	5%	151116	C28 C33
33	pF	Ceramic Disc SMD	50V	5%	151118	C103 C104 C105 C106
47	pF	Ceramic Disc SMD	50V	5%	151120	C47 C91
100	pF	Ceramic Disc SMD	50V	5%	151124	C12
470	pF	Ceramic Disc SMD	50V	5%	151132	C29 C51 C64 C80
820	pF	Ceramic Disc SMD	50V	5%	151135	C26 C66
.0033	uF	Ceramic Disc SMD	50V	10%	151154	C49 C50 C56 C79
.01	uF	Ceramic Disc SMD	50V	10%	151160	C48 C59 C75 C85 C93
.022	uF	Ceramic Disc SMD	50V	10%	151164	C74
.047	uF	Ceramic Disc SMD	50V	10%	151168	C19 C37 C46 C70 C71 C77 C78
.1	uF	Ceramic Disc SMD	50V	10%	151172	C1 C2 C6 C8 C10 C13 C14 C15 C18 C20 C21 C25 C27 C32 C34 C36 C38 C40 C43 C45 C52 C53 C54 C60 C61 C62 C63 C65 C69 C72 C76 C82 C83 C84 C90C92 C94 C95 C96 C97 C98 C99 C100 C101
.22	uF	Ceramic Disc SMD	50V	10%	151176	C7 C39
.47	uF	Tantalum SMD	35V	10%	151184	C17 C44 C55 C58
1	uF	Tantalum SMD	16V	10%	151185	C3 C23 C24 C31 C89
	uF	Tantalum SMD	35V	10%	151189	C107
10	uF	Tantalum SMD	25V	10%	151192	C5 C9 C35 C41 C88
220	uF	Aluminum SMD	25V	10%	151204	C11 C16

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
10	OHM	1/4	Carbon Film	5%	410002	R75
15	OHM	1/4	Carbon Film	5%	410003	R104
470	OHM	1/4	Carbon Film	5%	410042	R1
1.5K	OHM	1/2	Carbon Film	5%	410074	R8
100	OHM	1/8	Metal Film	1%	410156	R46 R68
47	OHM	1	Carbon Film	5%	410211	R101
4.7K	OHM	1	Carbon Film	5%	410212	R98
10.0	OHM	1/10	SMD	1%	411197	R24 R28
100K	OHM		X 9 SIP BUSSED		415002	R7 R16
22.1	OHM	1/10	SMD	1%	411230	R109
100	OHM	1/10	SMD	1%	411293	R126

221	OHM	1/10	SMD	1%	411326	R13
392	OHM	1/10	SMD	1%	411350	R99

Resistors & Resistor Packs ---- cont.

Value		Power	Type	Tol.	Part #	Designator
475	OHM	1/10	SMD	1%	411358	R83 R94 R115 R116 R117
604	OHM	1/10	SMD	1%	411368	R106 R107 R112 R113
619	OHM	1/10	SMD	1%	411369	R53
681	OHM	1/10	SMD	1%	411373	R84
825	OHM	1/10	SMD	1%	411381	R29
1.00K	OHM	1/10	SMD	1%	411389	R91
2.21K	OHM	1/10	SMD	1%	411422	R33 R35
3.92K	OHM	1/10	SMD	1%	411446	R87 R103
4.75K	OHM	1/10	SMD	1%	411454	R111 R85
6.04K	OHM	1/10	SMD	1%	411464	R57 R67
6.81K	OHM	1/10	SMD	1%	411469	R14
10.0K	OHM	1/10	SMD	1%	411485	R2 R3 R10 R32 R34 R36 R45 R56 R65 R90 R105 R114 R125R133 R134
12.1K	OHM	1/10	SMD	1%	411493	R49 R58 R81 R88 R89
20.0K	OHM	1/10	SMD	1%	411514	R44 R50 R51 R66 R72 R79 R80 R92 R96 R127 R137
28.7K	OHM	1/10	SMD	1%	411529	R86
31.6K	OHM	1/10	SMD	1%	411533	R25 R54
47.5K	OHM	1/10	SMD	1%	411550	R4 R5 R6 R12 R26 R47 R48 R52 R60 R63 R64 R69 R95 R97 R100 R108
68.1K	OHM	1/10	SMD	1%	411565	R55
100K	OHM	1/10	SMD	1%	411581	R15 R27 R70 R76 R78 R118 R119 R120 R121 R122 R123 R124
110K	OHM	1/10	SMD	1%	411585	R132 R135
221K	OHM	1/10	SMD	1%	411614	R93
332K	OHM	1/10	SMD	1%	411631	R9 R59 R82
475K	OHM	1/10	SMD	1%	411646	R62 R74
1.0M	OHM	1/10	SMD	5%	411677	R61 R71 R73
Varistor		150V #VZC15 MOV			480161	RV1
Varistor		18V TRANZORB 500W BIDRECT			480239	RV2

Bill of Materials for the TEL-14 Line A PCB ---- cont.

Diodes and Transistors

Device	Description	Part #	Designator
LED	GREEN LED	390028	D26 D28
LED	AMBER LED	390029	D27
LED	BI-COLOR RED/GREEN 3 LEAD	390032	D8 D25
Diode	1N5245B ZENER 15V 1/2W 5%	480053	D19 D21
Dual Diode	BAV70 COM CATHODE SMD	481019	D9 D13 D14 D16
Dual Diode	BAW56 COM ANODE SMD	481020	D5 D10 D23
Transistor	2222A NPN 40V 600MA SMD	481026	Q2 Q3 Q6
Dual Diode	BAV99 SMD	481033	D1 D2 D4 D6 D7 D11 D12 D15 D17 D18 D20 D22 D24 D30
Transistor	MPSA14 DNPN 30V 300MA SMD	481038	Q1 Q4
Transistor	MPSA56 PNP 80V 500MA SMD	481039	Q5
Diode	5.1V 5% ZENER 1/4W SMD	481061	D31 D32
Diode	IN4003 200V IA	480058	D5 D9 D34 D35

Integrated Circuits

Device	Description	Part #	Designator
IC	7805L POS 5V REGULATOR	480088	IC22
IC	74HC14 CMOS HEX SCMITT TRIG	481052	IC26
IC	X2404/512B CMOS EEPROM	480105	IC30
IC	LM2930T POS 5V REG	480153	IC17
IC	DS1267-10 DUAL DIGITAL POT	480195	IC5 IC6
IC	M-982 CALL PROG. DECODER	480238	IC15
IC	CS6420 DSP	481043	IC24
IC	TEL-14 Programmed Microprocessor	710440	IC20
IC	74AC02 CMOS QUAD 2-IN NOR	481003	IC13
IC	7705 RESET	481018	IC19
IC	833 DUAL OPAMP	481023	IC1 IC2 IC3 IC4 IC9 IC31
IC	M0C211 OPTOCOUPLER	481032	IC14 IC18 IC27 IC28
IC	74HC595 SER.IN/PAR.OUT	481036	IC25 IC29
IC	74HC165 CMOS 8-BIT PAR S/R	481037	IC16 IC21 IC23
IC	358 DUAL OPAMP	481042	IC10 IC11 IC12

Bill of Materials for the TEL-14 Line A PCB ---- cont.

Miscellaneous

Device	Description	Part #	Designator
Inductor	FERRITE EMI SUPPRESSOR 400MA	181001	L1
Crystal	3.579545 MHz PARALLEL	230001	Y1
Crystal	20.480 MHz PARALLEL	230008	Y2
Button	Black	240021	S2
Relay	DPDT 12V RELAY ITT#RZ-12W-C	450007	K1
Pot	100K	470043	R30 R31
Switch	SPDT SNAP-ACTION	510043	S2 S3 S4
Switch	2 POS DIP	510052	S5
Switch	4 POS DIP	510039	S7
Switch	8 POS DIP	510078	S6 S1
Transformer	TELCO COUPLING 600 - 600 OHM	560042	T1
	DB-9F TO RJ-11 ADAPTER	770025	
Cable	34 POS RIBBON	730100	
Cable	10-PIN RIBBON	770003	

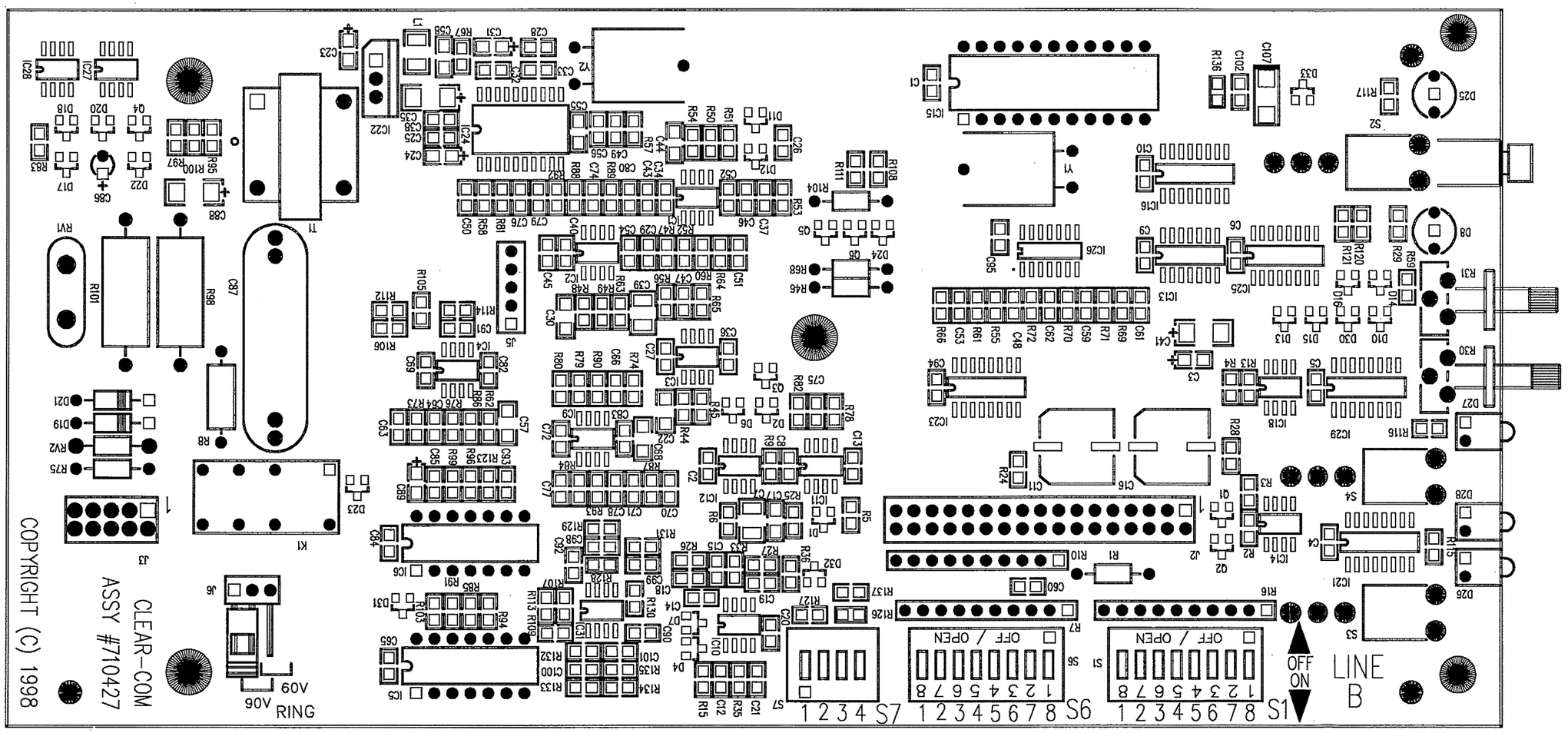


FIGURE I3-5 Assembly Drawing TEL-14 Line B PCB, Rev. B

Rev. B

Bill of Materials for the TEL-14 Line B PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
22	uF	Tantalum	16V		150032	C86
1	uF	Metal Polyester	250V	10%	150160	C87
.001	uF	Ceramic Disc SMD	50V	1%	151001	C22 C30 C57 C68
22	pF	Ceramic Disc SMD	50V	5%	151116	C28 C33
33	pF	Ceramic Disc SMD	50V	5%	151118	C102 C104 C105 C106
47	pF	Ceramic Disc SMD	50V	5%	151120	C47 C91
100	pF	Ceramic Disc SMD	50V	5%	151124	C12
470	pF	Ceramic Disc SMD	50V	5%	151132	C29 C51 C64 C80
820	pF	Ceramic Disc SMD	50V	5%	151135	C26 C66
.0033	uF	Ceramic Disc SMD	50V	10%	151154	C49 C50 C56 C79
.01	uF	Ceramic Disc SMD	50V	10%	151160	C48 C59 C75 C85 C93
.022	uF	Ceramic Disc SMD	50V	10%	151164	C74
.047	uF	Ceramic Disc SMD	50V	10%	151168	C19 C37 C46 C70 C71 C77 C78
.1	uF	Ceramic Disc SMD	50V	10%	151172	C1 C2 C4 C5 C6 C8 C9 C10 C13 C14 C15 C18 C20 C21 C25 C27 C32 C34 C36 C38 C40 C43 C45 C52 C53 C54 C60 C61 C62 C63 C65 C69 C72 C76 C82 C83 C84 C90 C92 C94 C95
.22	uF	Ceramic Disc SMD	50V	10%	151176	C7 C39 C102
.47	uF	Tantalum SMD	35V	10%	151184	C17 C44 C55 C58
1	uF	Tantalum SMD	16V	10%	151185	C3 C23 C24 C31 C89
4.7	uF	Tantalum SMD	35V	10%	151189	C107
10	uF	Tantalum SMD	25V	10%	151192	C35 C41 C88
220	uF	Aluminum SMD	25V	10%	151204	C11 C16

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
10	OHM	1/4	Carbon Film	5%	410002	R75
15	OHM	1/4	Carbon Film	5%	410003	R104
470	OHM	1/4	Carbon Film	5%	410042	R1
1.5K	OHM	1/2	Carbon Film	5%	410074	R8
100	OHM	1/8	Metal Film	1%	410156	R46 R68
47	OHM	1	Carbon Film	5%	410211	R101
4.7K	OHM	1	Carbon Film	5%	410212	R98
10.0	OHM	1/10	SMD	1%	411197	R24 R28
100K	OHM		X 9 SIP BUSSED		415002	R7 R10 R16
22.1	OHM	1/10	SMD	1%	411230	R109
100	OHM	1/10	SMD	1%	411293	R126
221	OHM	1/10	SMD	1%	411326	R13

392	OHM	1/10	SMD	1%	411350	R99
475	OHM	1/10	SMD	1%	411358	R83 R94 R115 R116 R117

Bill of Materials for the TEL-14 Line B PCB ---- cont.

Resistors & Resistor Packs ---- cont.

Value		Power	Type	Tol.	Part #	Designator
604	OHM	1/10	SMD	1%	411368	R106 R107 R112 R113
619	OHM	1/10	SMD	1%	411369	R53
681	OHM	1/10	SMD	1%	411373	R84
825	OHM	1/10	SMD	1%	411381	R29
1.00K	OHM	1/10	SMD	1%	411389	R91
2.21K	OHM	1/10	SMD	1%	411422	R33 R35
3.92K	OHM	1/10	SMD	1%	411446	R87 R103
4.75K	OHM	1/10	SMD	1%	411454	R111 R85
6.04K	OHM	1/10	SMD	1%	411464	R57 R67
10.0K	OHM	1/10	SMD	1%	411485	R2 R3 R36 R45 R56 R65 R77 R90 R105 R114 R133 R134
12.1K	OHM	1/10	SMD	1%	411493	R49 R58 R81 R88 R89
20.0K	OHM	1/10	SMD	1%	411514	R44 R50 R51 R66 R72 R79 R80 R92 R96 R127 R137
28.7K	OHM	1/10	SMD	1%	411529	R86
31.6K	OHM	1/10	SMD	1%	411533	R25 R54
47.5K	OHM	1/10	SMD	1%	411550	R4 R5 R6 R26 R47 R48 R52 R60 R63 R64 R69 R95 R97 R100 R108
68.1K	OHM	1/10	SMD	1%	411565	R55
100K	OHM	1/10	SMD	1%	411581	R15 R27 R70 R76 R78 R120 R121 R123
110K	OHM	1/10	SMD	1%	411585	R132 R135
221K	OHM	1/10	SMD	1%	411614	R93
332K	OHM	1/10	SMD	1%	411631	R9 R59 R82
475K	OHM	1/10	SMD	1%	411646	R62 R74
1.0M	OHM	1/10	SMD	5%	411677	R61 R71 R73
Varistor		150V #VZC15 MOV			480161	RV1
Varistor		18V TRANZORB 500W BIDRECT			480239	RV2

Bill of Materials for the TEL-14 Line B PCB ---- cont.

Diodes and Transistors

Device	Description	Part #	Designator
LED	GREEN	390028	D26 D28
LED	AMBER	390029	D27
LED	BI-COLOR RED/GREEN 3 LEAD	390032	D8 D25
Diode	1N5245B ZENER 15V 1/2W 5%	480053	D19 D21
Dual Diode	BAV70 COMMON CATHODE	481019	D13 D14 D16
Dual Diode	BAW56 COMMON ANODE	481020	D10 D23
Transistor	2222A NPN 40V 600MA	481026	Q2 Q3 Q6
Dual Diode	BAV99 DUAL DIODE	481033	D1 D2 D4 D6 D7 D11D12 D15 D17 D18 D20 D22 D24 D30 D33
Transistor	MPSA14 DNPN 30V 300MA	481038	Q1 Q4
Transistor	MPSA56 PNP 80V 500MA	481039	Q5
Diode	5.1V 5% ZENER 1/4W	481061	D31 D32

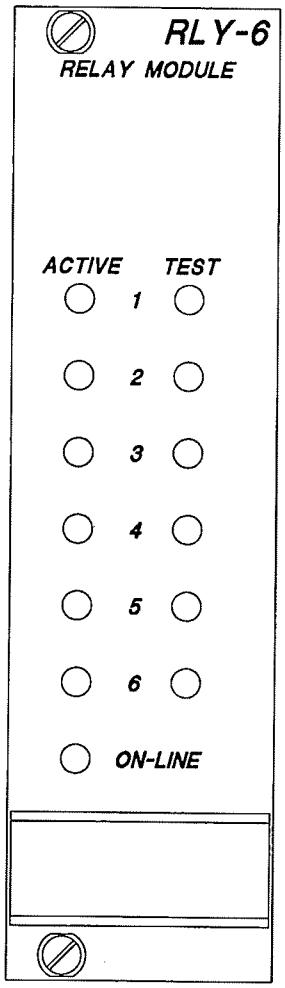
Integrated Circuits

Device	Description	Part #	Designator
IC	7805L POS 5V REGULATOR	480088	IC22
IC	74HC14 CMOS HEX SCMITT TRIG	481052	IC26
IC	DS1267-10 DUAL DIGITAL POT	480195	IC5 IC6
IC	M-982 CALL PROG. DECODER	480238	IC15
IC	CS6420 DSP	481043	IC24
IC	74AC02 CMOS QUAD 2-IN NOR	481003	IC13
IC	833 DUAL OPAMP	481023	IC1 IC2 IC3 IC4 IC9 IC31
IC	M0C211 OPTOCOUPLER	481032	IC14 IC18 IC27 IC28
IC	74HC595 SER. IN/PAR. OUT	481036	IC25 IC29
IC	74HC165 CMOS 8-BIT PAR S/R	481037	IC16 IC21 IC23
IC	358 DUAL OPAMP	481042	IC10 IC11 IC12

Miscellaneous

Device	Description	Part #	Designator
Inductor	FERRITE EMI SUPPRESSOR 400MA	181001	L1
Crystal	3.579545 MHz PARALLEL	230001	Y1
Crystal	20.480 MHz PARALLEL	230008	Y2
Button	BLACK	240021	S2
Relay	DPDT 12V RELAY ITT#RZ-12W-C	450007	K1
Pot	100K	470043	R30 R31
Switch	SPDT SNAP-ACTION	510043	S2 S3 S4
Switch	4 POS DIP	510039	S7
Switch	8 POS DIP	510078	S1 S6
Transformer	TELCO COUPLING 600 - 600 OHM	560042	T1

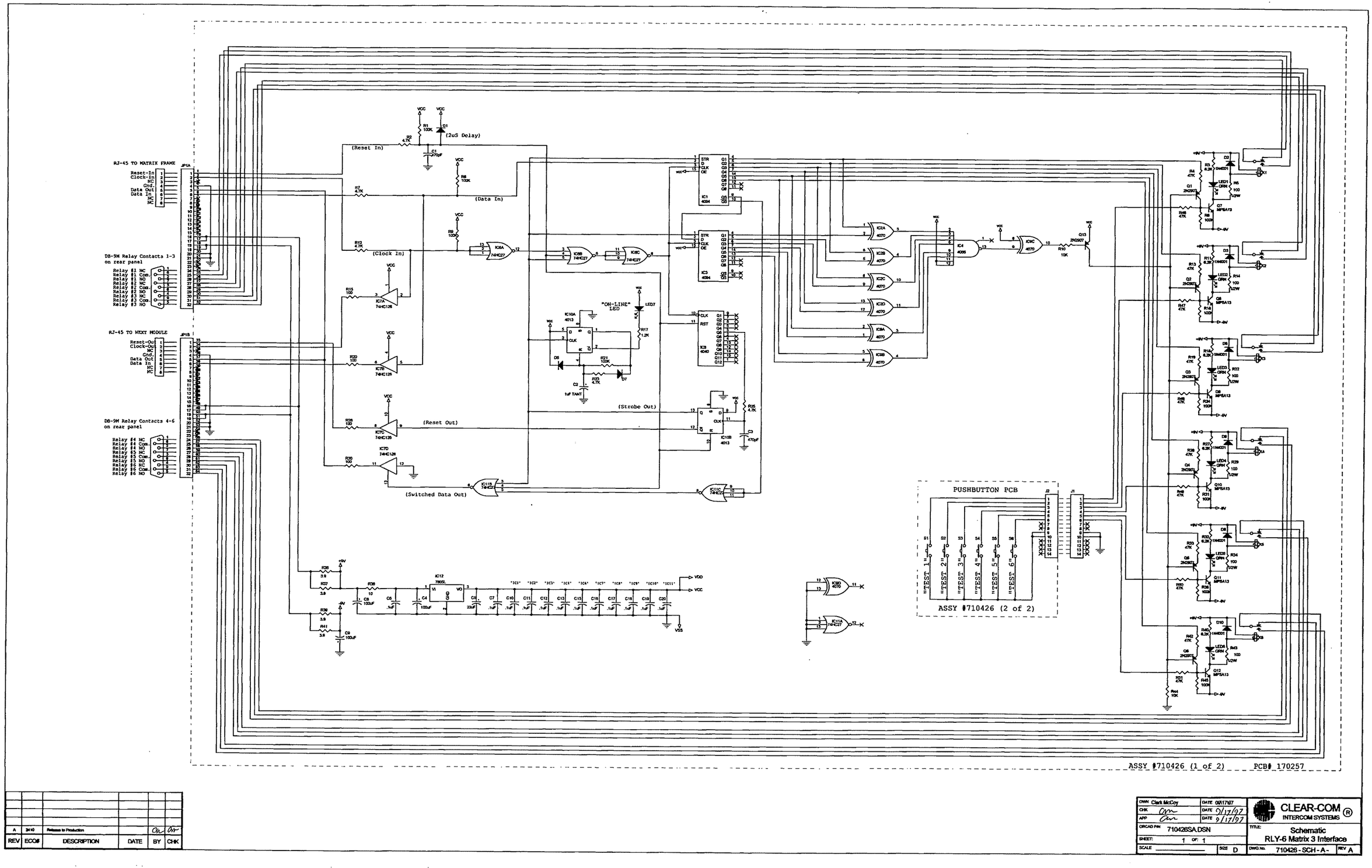
RLY - 6



Matrix Plus 3 System RLY-6
RELAY INTERFACE MODULE

Introduction

This Section provides block diagrams, schematics, assembly drawings and components list for the RLY-6 Relay Interface Module.



REV	ECO#	DESCRIPTION	DATE	BY	CHK
A	3410	Release to Production			

DWN Clark McCoy	DATE 09/17/97	CLEAR-COM® INTERCOM SYSTEMS	
CHK	DATE 9/17/97		
APP	DATE 9/17/97		
ORCAD P/N 710426SA.DSN		TITLE: Schematic RLY-6 Matrix 3 Interface	
SHEET: 1 OF: 1			
SCALE	SIZE D	DWG No. 710426 - SCH - A -	REV A

FIGURE I4-1 Schematic - RLY-6 Interface, Rev. A

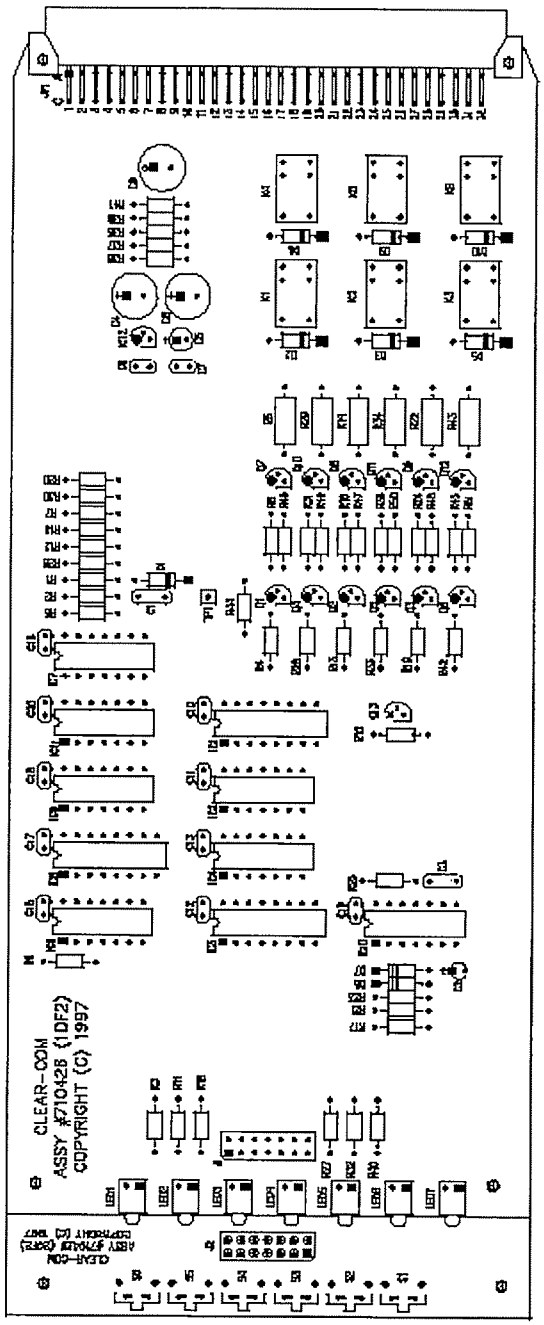


FIGURE I4-2 Assembly Drawing - RLY-6 PCB, Rev. B

Bill of Materials for the RLY-6 PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
470	pF	CER	50V	10%	150014	C1,C3
.1	uF	Monolithic	50V	10%	150035	C6,C7,C10,C11,C12, C13,C15,C16,C17,C18, C19,C20
1	uF	Tant.	35V	20%	150116	C2
22	uF	Aluminum	16V	20%	150142	C5
100	uF	Aluminum	35V	150136		C4,C8,C9

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
3.9	OHM	1/4	Carbon Film	5%	410001	R35,R37,R39,R41
10	OHM	1/4	Carbon Film	5%	410002	R38
100	OHM	1/4	Carbon Film	5%	410071	R15,R20,R26,R30
1.2K	OHM	1/4	Carbon Film	5%	410041	R17
4.7K	OHM	1/4	Carbon Film	5%	410013	R2,R7,R12,R23,R25
6.2K	OHM	1/4	Carbon Film	5%	410137	R3,R11,R18,R27,R32,R40
10K	OHM	1/4	Carbon Film	5%	410016	R10,R44
47K	OHM	1/4	Carbon Film	5%	410021	R4,R13,R19,R28,R33,R42, R46,R47,R48,R49,R50,R51
100K	OHM	1/4	Carbon Film	5%	410024	R1,R6,R8,R9,R16,R21, R24,R31,R36,R45
100	OHM	1/2	Carbon Film	5%	410094	R5,R14,R22,R29,R34,R43

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D1,D6,D7
Diode	1N4001 RECT 1A 50PIV	480001	D2,D3,D5,D8,D9,D10
Transistor	MPS-A13 NPN 30V DARL	480004	Q7,Q8,Q9,Q10,Q11,Q12
Transistor	2N2907 OR 2N4143 PNP 30V	480007	Q1,Q2,Q3,Q4,Q5,Q6,Q13

Bill of Materials for the RLY-6 PCB ---- cont.

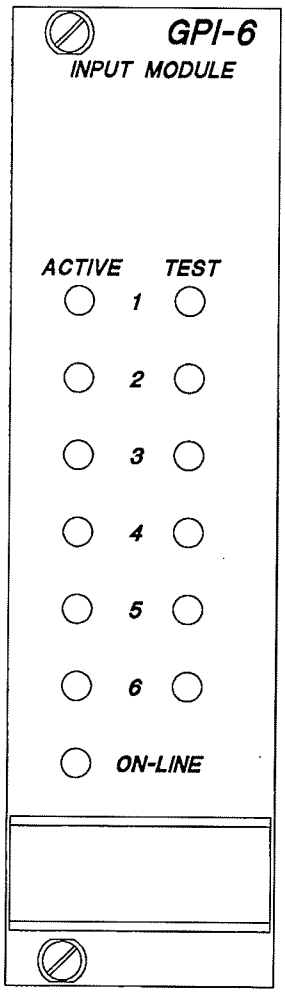
Integrated Circuits

Device	Description	Part #	Designator
Logic Chip	4013 CMOS Dual D FF	480171	IC10
Logic Chip	4040 CMOS 12 Stage Counter	480108	IC8
Logic Chip	4068 CMOS 8-In NAND Gate	480191	IC4
Logic Chip	4070B CMOS Quad XOR Gate	480067	IC2 IC9
Logic Chip	4094B CMOS SHIFT REGISTER	480107	IC1 IC3
Logic Chip	74HC27 3 In NOR Gate	480185	IC11,IC6
Logic Chip	74HC126 Quad Tri-State Buf.	480180	IC7
Regulator	7805L POS 5V REG. TO-92	480088	IC12

Miscellaneous

Device	Description	Part #	Designator
LED	T1 RT ANG PC MTG 5mA GRN	390028	LED1 LED2 LED3 LED4 LED5 LED6
LED	T1 RT ANG PC MTG 5mA YEL	390029	LED7
Relay	SPDT 12V MINI PC RELAY	450006	K1 K2 K3 K4 K5 K6
Switch	Pushbutton SPST Rt. Ang. Mt.	510099	S1,S2,S3,S4,S5,S6

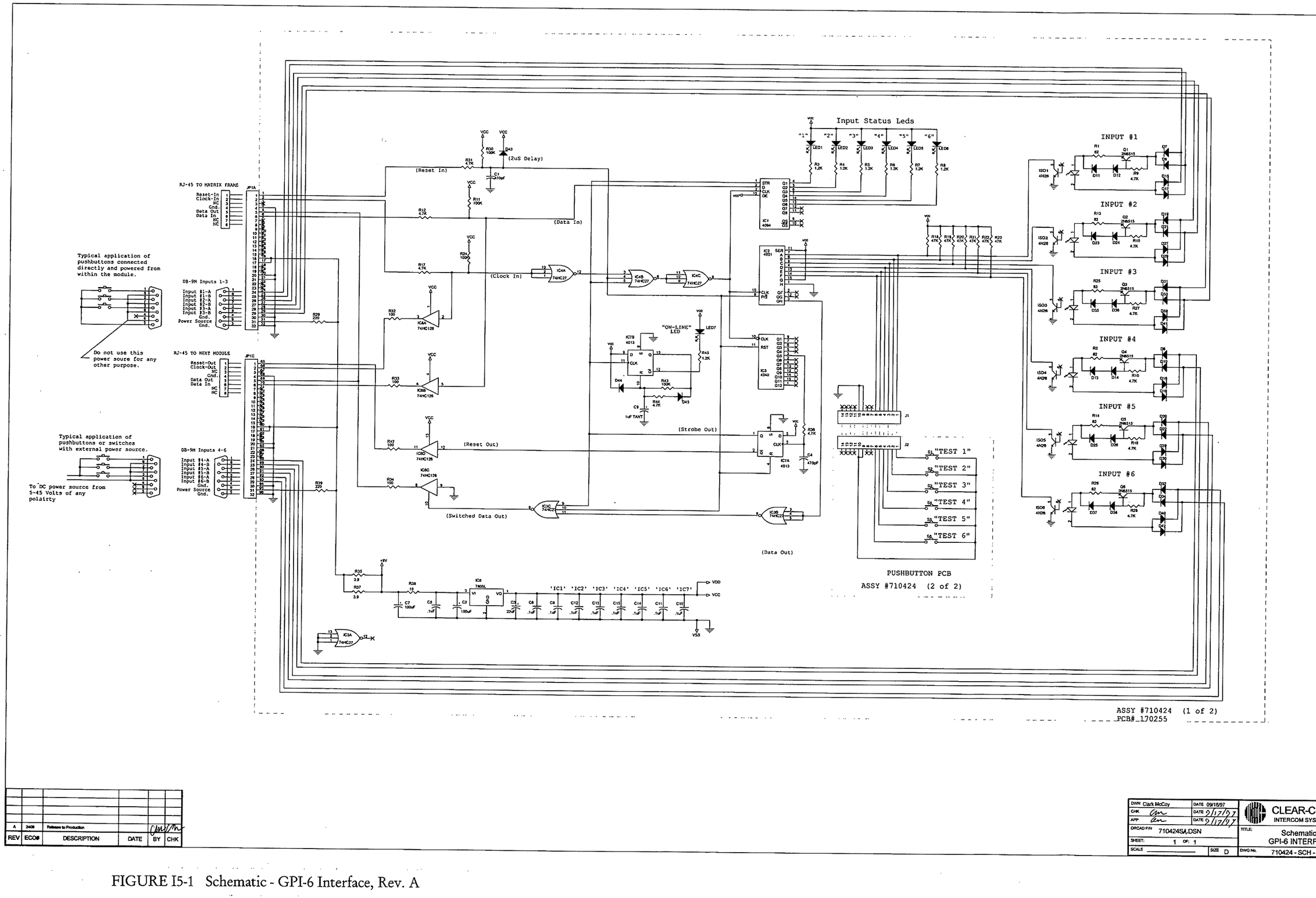
GP1 - 6



Matrix Plus 3 System GPI-6
GENERAL PURPOSE INTERFACE MODULE

Introduction

This Section provides block diagrams, schematics, assembly drawings and components list for the GPI-6 Input Interface Module.



REV	ECO#	DESCRIPTION	DATE	BY	CHK
A	3408	Release to Production			

DWN	Clark McCoy	DATE	09/16/97
CHK		DATE	9/17/97
APP		DATE	9/17/97
ORCAD P/N	710424SA.DSN		
SHEET:	1 OF: 1		
SCALE		SIZE	D

CLEAR-COM® INTERCOM SYSTEMS

TITLE: Schematic GPI-6 INTERFACE

DWG No. 710424 - SCH - D - REV A

FIGURE I5-1 Schematic - GPI-6 Interface, Rev. A

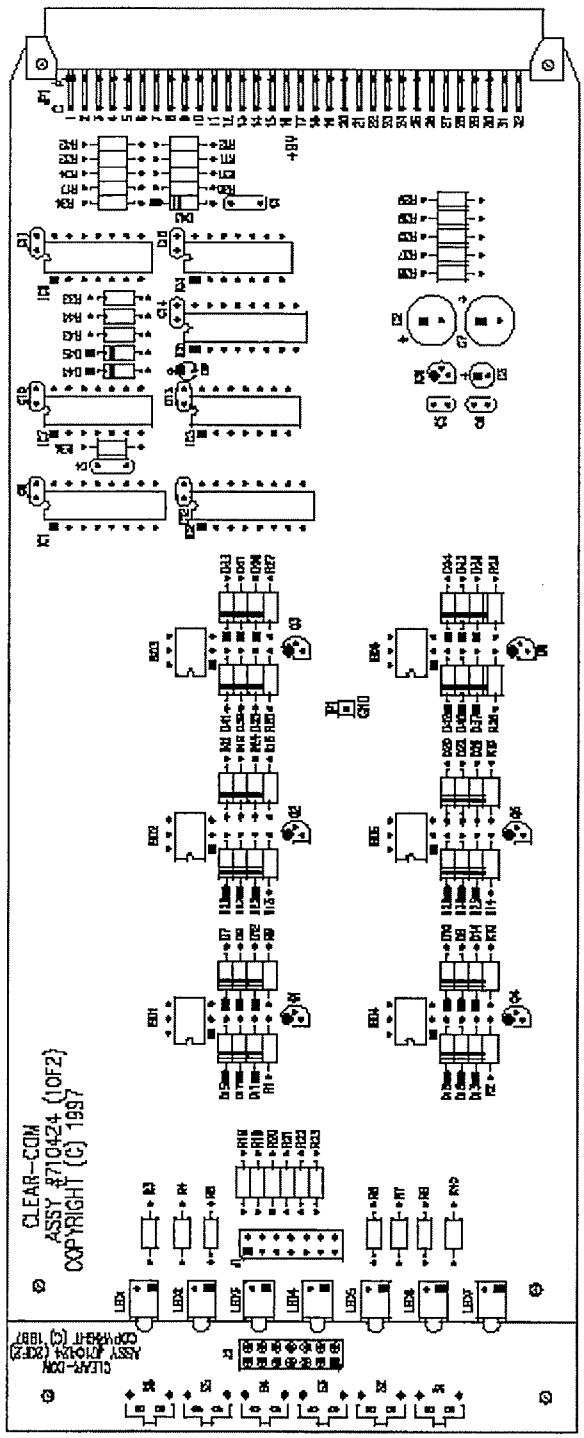


FIGURE I5-2 Assembly Drawing - GPI-6 PCB, Rev. B

Bill of Materials for the GPI-6 PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
470	pF	CER	50V	10%	150014	C1,C4
.1	uF	Monolithic	50V	10%	150035	C5,C6,C8,C10,C11, C12,C13,C14,C15
1	uF	Tant.	35V	20%	150116	C9
22	uF	Aluminum	16V	20%	150142	C3
100	uF	Aluminum	35V	150136		C7,C2

Resistors & Resistor Packs

Value		Power	Type	Tol.	Part #	Designator
3.9	OHM	1/4	Carbon Film	5%	410001	R35,R37
10	OHM	1/4	Carbon Film	5%	410002	R38
100	OHM	1/4	Carbon Film	5%	410071	R32,R33,R34,R42
1.2K	OHM	1/4	Carbon Film	5%	410041	R3,R4,R5,R6,R7,R8,R45
4.7K	OHM	1/4	Carbon Film	5%	410013	R9,R10,R12,R15,R16,R17, R27,R28,R31,R36,R44
6.2K	OHM	1/4	Carbon Film	5%	410137	R3,R11,R18,R27,R32,R40
10K	OHM	1/4	Carbon Film	5%	410016	R10,R44
47K	OHM	1/4	Carbon Film	5%	410021	R18,R19,R20,R21,R22,R23
100K	OHM	1/4	Carbon Film	5%	410024	R11,R24,R30,R43
100	OHM	1/2	Carbon Film	5%	410094	R5,R14,R22,R29,R34,R43
220	OHM	1/4	Carbon Film	5%	410007	R29,R39
82	OHM	1/4	Carbon Film	5%	410038	R1,R2,R13,R14,R25,R26

Diodes and Transistors

Device	Description	Part #	Designator
Diode	1N4148 SIGNAL 10MA 75PIV	480000	D7-D45
Transistor	MPS-A13 NPN 30V Darl	480004	Q7,Q8,Q9,Q10,Q11,Q12
Transistor	2N2907 or 2N4143 PNP 30V	480007	Q1,Q2,Q3,Q4,Q5,Q6,Q13
Transistor	2N6515 NPN Hi Voltage TO-92	480059	Q1,Q2,Q3,Q4,Q5,Q6

Bill of Materials for the GPI-6 PCB ---- cont.

Integrated Circuits

Device	Description	Part #	Designator
Logic Chip	4013 CMOS Dual D FF	480171	IC7
Logic Chip	4021 8 Bit Static Shift Reg	480218	IC2
Logic Chip	4040 CMOS 12 Stage Counter	480108	IC5
Logic Chip	4094B CMOS SHIFT REGISTER	480107	IC1
Logic Chip	74HC27 3 In NOR Gate	480185	IC3,IC4
Logic Chip	74HC126 Quad Tri-State Buf.	480180	IC6
Regulator	7805L POS 5V REG. TO-92	480088	IC8
Opto Coupler	4N26	480106	ISO1,ISO2,ISO3,ISO4, ISO5,ISO6

Miscellaneous

Device	Description	Part #	Designator
LED	T1 RT ANG PC MTG 5mA GRN	390028	LED1 LED2 LED3 LED4 LED5 LED6
LED	T1 RT ANG PC MTG 5mA YEL	390029	LED7
Switch	Pushbutton SPST Rt. Ang. Mt.	510099	S1,S2,S3,S4,S5,S6

PIA - 32

Introduction

This Section describes the PIA-32 Interface and provides maintenance information.

Description

The PIA-32 is a special interface designed to connect Matrix Plus II interfaces and other components that were built to Matrix Plus II port standards to a Matrix Plus 3 system. The audio connections of the two systems are directly compatible, however the 'CALL' signals are not. A 'CALL' signal translation is necessary.

The PIA-32 provides six channels of port translation between the two systems. The interface ID jumpers are also translated between the systems. Using a PIA 32 with a Matrix Plus 3 system allows the following;

1. Use existing Matrix Plus II interfaces in an IMF-1 interface frame when up-grading a matrix system from Plus II to Plus 3.
2. Use of Clear-Com's AB-100 Announcer/Sportcaster Console with Matrix Plus 3 as its matrix port is designed for Plus II.
3. Use third-party products that are designed to Plus II standards.
4. Direct connection between Plus II and Plus 3 ports.

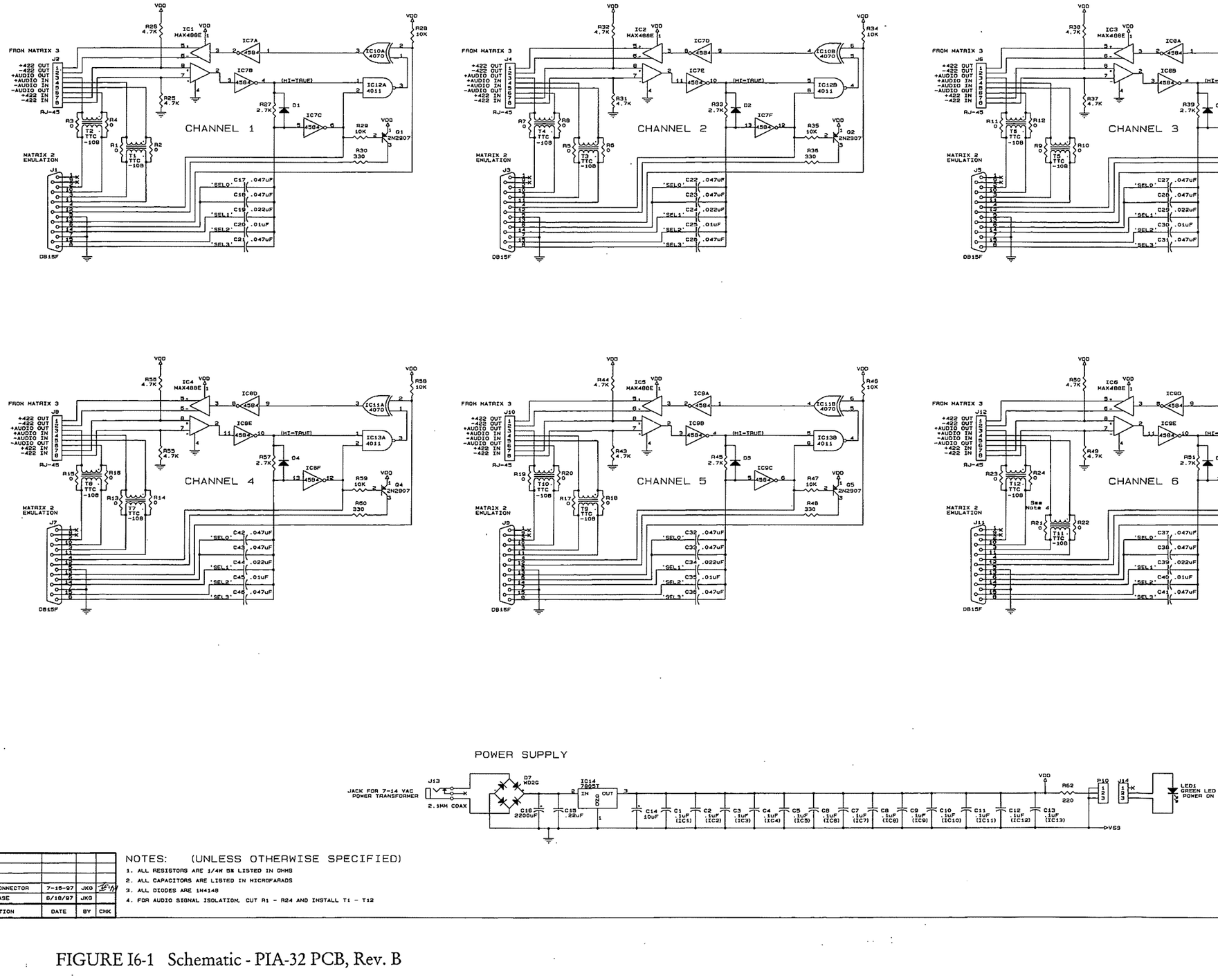
Each PIA-32 channel has a RJ-45 for connection to Matrix Plus 3 and a DB-15F that emulates a Matrix Plus II port. To use a PIA-32 connect a channel's RJ-45 with a jumper cable directly to a port connector on a Matrix Plus 3 frame and treat the DB-15F associated with that channel as if it were on the rear of a Matrix Plus II frame.

The PIA-32 has a inline power transformer that needs to be connected to AC Mains.

Other Information

The main PCB in the unit has space and connections for isolation transformers for each channels input and output. These transformers are not installed and are replaced with 0 Ohm resistors. To install the transformers, remove the resistor jumpers and solder the transformers in place. The schematic also shows these transformers.

Call signals are supported by the PIA-32, however RS-422 station data lines are not supported.



REV	ECO#	DESCRIPTION	DATE	BY	CHK
B	2378	ADD LED CONNECTOR	7-16-97	JKG	
A	2354	RELEASE	6/18/97	JKG	

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
4. FOR AUDIO SIGNAL ISOLATION, CUT R1 - R24 AND INSTALL T1 - T12

DWN: John Giordano	DATE: 7/15/97	CLEAR-COM INTERCOM SYSTEMS	
CHK:	DATE:	TITLE: SCHEMATIC	
APP	DATE	PIA-32 INTERFACE PCB	
ORCAD P/N - 710411SB.ORC			
PLOT SIZE - D			
SCALE	SIZE: D	DWG NO. 710411-SCH-D	REV B

FIGURE I6-1 Schematic - PIA-32 PCB, Rev. B

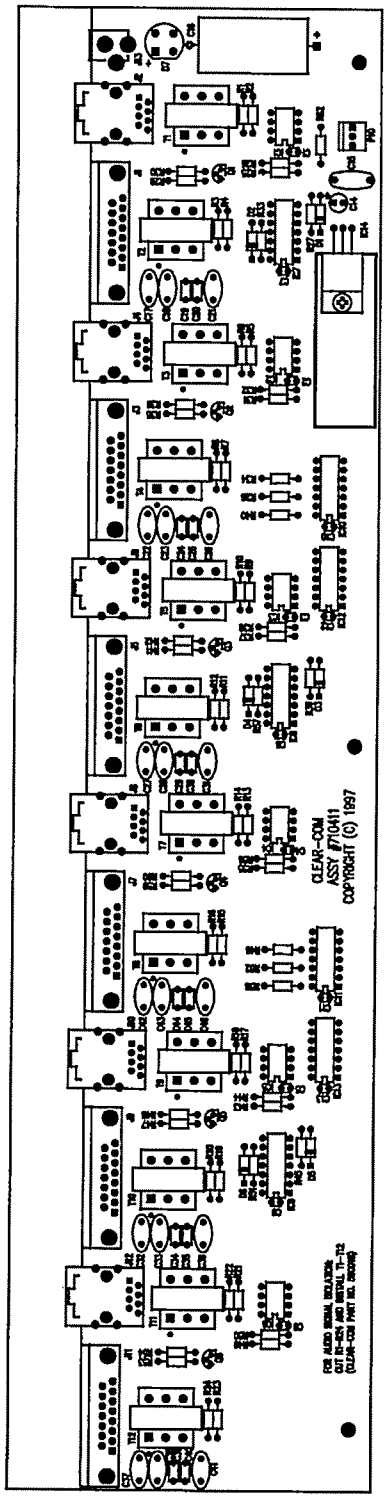


FIGURE I6-2 Assembly Drawing - PIA-32 PCB, Rev. B

Bill of Materials for the PIA-32 Main PCB

Capacitors

Value		Type	Volts	Tol.	Part #	Designator
.01	uF	Mylar	50V	10%	150067	C20,C25,C30,C35,C40,C45
.022	uF	Mylar	100V	10%	150008	C19,C24,C29,C34,C39, C44
.047	uF	Mylar	50V	10%	150005	C17,C18,C21,C22,C23,
.1	uF	Monolythic	50V	10%	150035	C1-C6, C8-C13
.22	uF	Mylar	100V	20%	150003	C15
						C26,C27,C28,C31,C32, C33,C36,C37,C38,C41, C42,C43,C46
10	uF	ALU Radial	50V		150064	C14
2200	uF	ALU Axial	35V		150036	C16

Resistors

Value		Power	Type	Tol.	Part #	Designator
0	Ohm	1/4W	Carbon Film	5%	600000	R1-R24,R61
330	Ohm	1/4W	Carbon Film	5%	410061	R30,R36,R42,R48,R54,R60
2.7	K Ohm	1/4W	Carbon Film	5%	410040	R27,R33,R39,R45,R51,R57
4.7	K Ohm	1/4W	Carbon Film	5%	410013	R25,R26,R31,R32,R37,R38, R43,R44,R49,R50,R55,R56
10	K Ohm	1/4W	Carbon Film	5%	410016	R28,R29,R34,R35,R40,R41, R46,R47,R52,R53,R58,R59

Diodes & Transistors

Device	Description	Part #	Designator
Diode	1N4148 Signal 10mA 75PIV	480000	D1,D2,D3,D4,D5,D6
Diode	2N2907 PNP 30V	480007	Q1,Q2,Q3,Q4,Q5,Q6
Rect., Bridge	1.5A 200V Bridge	480158	D7

Bill of Materials for the PIA-32 Main PCB (cont.)

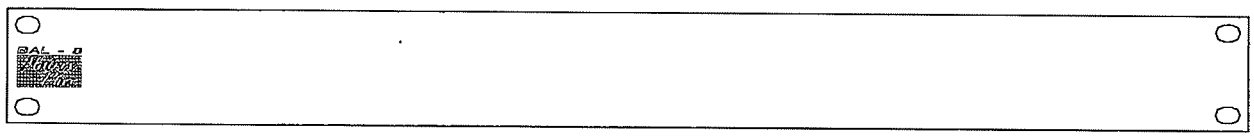
Integrated Circuits

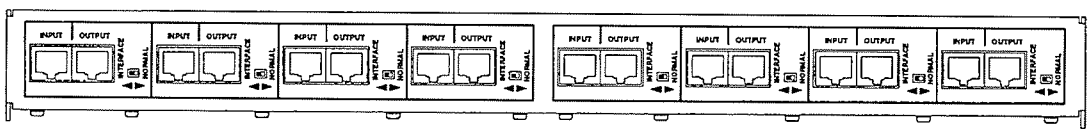
Device	Description	Part #	Designator
Digital IC	4011B Quad 2 In NAND Gate	480111	IC12,IC13
Digital IC	4070B Quad 2 In XOR Gate	480067	IC10,IC11
Digital IC	4584B Hex Schmitt Trigger Buffer	480090	IC7,IC8,IC9
Interface IC	MAX488E RS-422 XCVR Dip8	480231	IC1,IC2,IC3,IC4,IC5,IC6
Regulator IC	7805T POS 5V Regulator TO220	480083	IC14

Miscellaneous Components

Type	Description	Part #	Designator
Connector	2.1mm CO-AX PC Mtg Power	210213	J13
Connector	DB-15F Rt Angle Mount	210187	J1,J3,J5,J7,J9,J11
Connector	RJ-45 Rt Angle Mount Shielded	210335	J2,J4,J6,J8,J10,J12
Led	Panel Mount Green LED	390009	LED1
Transformer	Power XFMR 220V-14V @ .8A	400011	

BAL - 8





Matrix Plus 3 System BAL-8
GROUND ISOLATION INTERFACE

Introduction

This Section describes the BAL-8 and how to install it.

Description

The BAL-8 provides eight channels of transformer isolation and a direct interface to the Matrix Plus 3. The transformer isolation eliminates the hum and noise caused by ground loops. Each channel handles four signals (two audio and two RS-422 data lines).

With the easy-to-operate slide switch, located to the right of each Input/Output connector pair, you can place each channel in Normal or Interface mode. In normal mode (Figure I7-1), the data pairs are not affected. In Interface mode (Figure I7-2), each data pair (*i.e.*, call receive and call send) is connected, indicating to the software that the port is in "direct" mode.

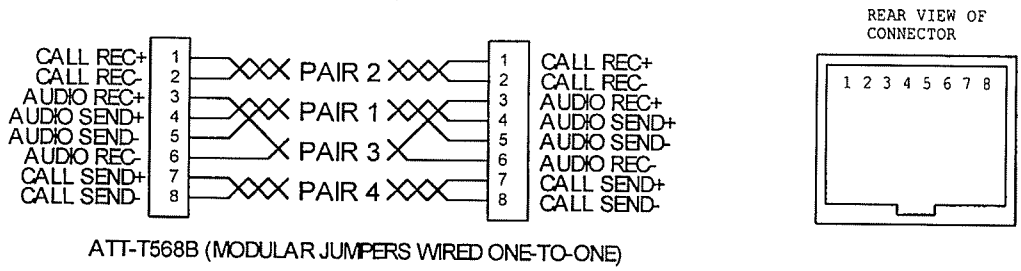


FIGURE I7-1. BAL-8 in Normal Mode (equivalent schematic)

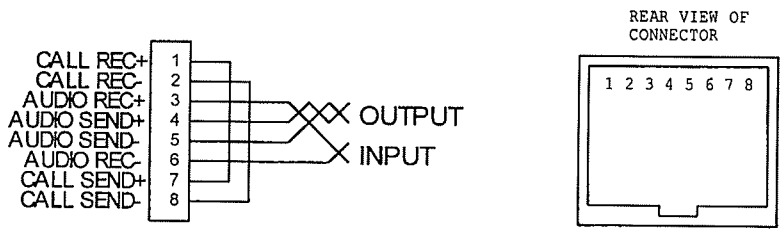


FIGURE I7-2. BAL-8 in Interface Mode (equivalent schematic)

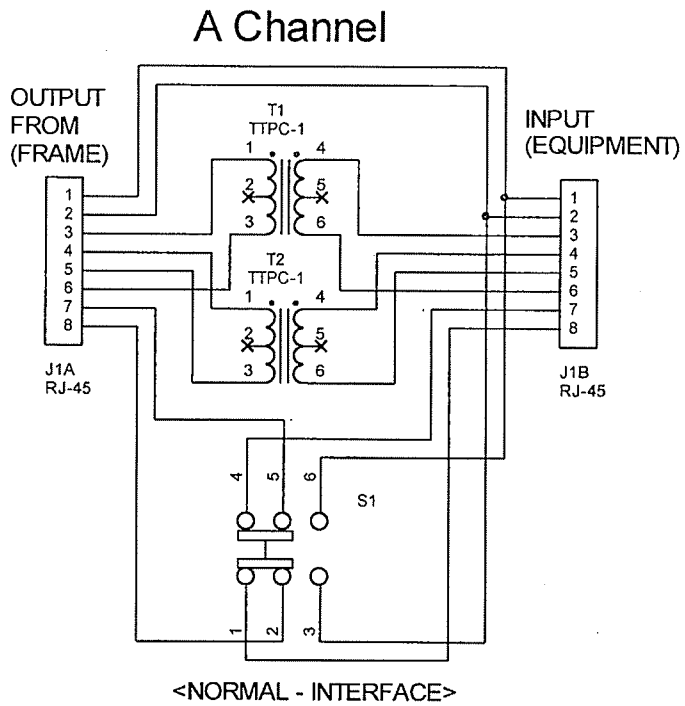


FIGURE I7-3. One Channel in a BAL-8 Circuit Board

Bill of Materials for BAL-8 Main PCB

Miscellaneous

Device	Description	Part #	Designator
Connector	RJ-45 Rt Ang	210335	J1A, J1B, J2A, J2B, J3A, J3B, J4A, J4B, J5A, J5B, J6A, J6B, J7A, J7B, J8A, J8B
Switch	DPDT slide	510124	S1, S2, S3, S4, S5, S6, S7, S8
Transformer	600CT/600CT	560018	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16