Matrix Plus 3 System

Volume II

Installation Manual

Matrix Plus 3 System Installation Manual

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Clear-Com Systems

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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 I** — **Operation Manual** — This 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 III — The *Matrix Plus 3 System Maintenance* 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 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.

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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.

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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.

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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.

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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.

Matrix Cards

Interfaces

Introduction

This chapter describes the steps required to install a Matrix Plus 3 System and customize it to your needs. It is divided into four sections that provide a step-by-step installation guide for your system components and other information that will be useful to you, depending on your specific needs. Each of these sections is described below.

It is highly recommended that the "Overall" section of the *Matrix Plus 3 System Operation* manual be read and understood before attempting the installation. The section describes the Matrix Plus 3 System and explains many of the concepts used in the system. An overall understanding of the system is necessary to make maximum use of its vast capabilities.

The "Wiring Systems Summary" section contains all reference information necessary to wire all connectors in the intercom system. However, many of the components have internal jumpers and adjustments. Information on internal jumpers, adjustments, and device specifications will be found in the individual chapters for each component.

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.

This chapter is divided into the following sections:

Step-By-Step Installation—The first section provides a step-by-step installation guide for the components of your Matrix Plus 3 System as you receive them from the factory.

Component Location Requirements—The second section describes the Matrix Plus 3 System's component location requirements, including a summary of component sizes.

Power Requirements—The third section provides guidelines for providing AC power for the system and how to plan the powering of interface frames.

Wiring Systems Summary—The forth section provides an overview of the various wiring systems that can be used to connect stations and interfaces to the card frame.

Step-By-Step Installation

This section provides a step-by-step guide to installing your Matrix Plus 3 System components as you receive them from the factory. The steps are listed below:

1.   Verify the Shipment

2.   Select Locations for Your Components

3.   Determine Your Wiring Requirements

4.   Install Components in Rack

5.   Install Cables

6.   Cable Connection and Auxiliary Wiring

7.   Mains AC Power

8.   Verify Station to Frame Operation

9.   Configure the System with the Configuration Computer

10. Verify the Operation of the System.

1.   Verify the Shipment

When you receive your equipment, inspect the shipping boxes for shipping damage. Report any shipping damage to the carrier. Your Matrix Plus 3 System distributor is not responsible for shipping damage.

Check the packing list and verify that you received every item on the list. Pay special attention to options that have been installed in intercom stations, such as the OPT-100 option; station options are printed on each station's rear panel.

Save all packing materials (boxes, Styrofoam filler, etc.), since you will need them if any item must be returned because it was shipped by mistake, because of malfunction, or for warranty service.

2.   Select Locations for Your Components

Select locations for the Matrix frame, intercom stations, interface modules, computer, and any other system components. For additional information on limitations imposed on location by the Matrix Plus System see "Component Location Requirements" on page O-9.

3. Determine Your Wiring Requirements

Most of the system wiring is with CAT3 or CAT5 cable with RJ-45 connectors on either end; however, there are various methods available to deliver these cables from one place to another. For more information on RJ-45 connectors and their installation refer the Summary of Wiring Systems later in this section.

Note: Shielded CAT5 is required for compliance with the European Community's CE Mark.

Although some Matrix Stations have a DB-15M (male) connector for connection to the Matrix frame, most have a built-in RJ-45 connector. For those stations with a DB-15 male connector, Clear-Com provides a properly wired DB-15F (female) to RJ-45 adapter for direct connection with RJ-45 terminated cables. Additionally, stations configured for digital communication are equipped with a BNC.

Some of the possibilities are as follows:

- A single 4-pair cable from a matrix port to an individual station can be used with RJ-45s on either end. CAT3 and CAT5 cables are available with RJ-45 terminations already installed. Bulk RJ-45 connectors can be bought and installed on custom length cables.

- Individual CAT3 or CAT5 jumper cables can be wired as a transition to a bulk cable such as a 25-pair, TELCO-type cable. There are commercially available "harmonica-type" connectors for 25-pair cables that have six 4-pair RJ-45 connections.

- Individual CAT3 or CAT5 jumper cables can be wired as a transition to commercially available punch-down blocks.

Note: Shielded CAT5 is required for compliance with the European Community's CE Mark.

4. Install Components in Rack

Install the card frame in the rack. The Matrix frames require adequate ventilation. For additional information on limitations imposed on location by the Matrix Plus System see the "Component Location Requirements" on page O-9.

Caution: Open the frame doors and ensure each Matrix card that it is fully inserted in its slot.

The COMPACT 72 (COM-72) has its power supplies mounted to the frame with screws and are not likely to be jarred in shipping.

The SYSTEM 200 (SYS-200) has plug-in modular power supplies that are reasonably heavy and are shipped separate from the frame and will need to installed in the frame. Refer to the label visible on the bottom rail with the bottom door open for the proper slot to install the power supply modules.

Install the IMF-3 Interface Module Frame in the rack. Your interfaces were shipped to you installed in the IMF-3 frame. Change their positions if required for your system configuration. Install the power supply or supplies in the rack that are necessary for the IMF-3 frames. Install each intercom station in its location. For specific installation procedures for each of these components, see the applicable section of this manual.

5.   Install Cables

Install the wiring between the Matrix frame and the system components. Usually the connectors are wired to the cables after the cables are routed. For further information refer to "Summary of Wiring Systems" on page O-15.

Install the DC power cables that connect the power supply or supplies to the IMF-3. Connect the mains AC power cables for the matrix frame and each station. For further information refer to "Summary of Wiring Systems" on page O-15.

6.   Cable Connection and Auxiliary Wiring

There are several different types of wiring necessary to connect the Matrix Plus 3 System. The following is a summary of the subjects.

Analog Station Wiring—Connect the intercom stations to the frame using CAT3 or CAT5 4-twisted pair cables with RJ-45 connectors. At each station there may be other connector wiring necessary depending on what options and accessories are installed.

Digital Station Wiring—Connect the intercom stations to the frame using CAT3 or CAT5 4-twisted pair cables with RJ-45 connectors. However, because only one pair is required, alternate cabling, which meets CAT3 specifications, can be used. Coax wiring (75 ohm) with BNC connectors is also an option. At each station there may be other connector wiring necessary depending on what options and accessories are installed.

Note: **Shielded CAT5** shielded is required for compliance with the European Community's CE Mark.

Interface Wiring—Connect the interface modules to the frame using CAT3 or CAT5 4-twisted pair cables with RJ-45 connectors. Each interface type requires particular wiring schemes on the DB-9 connectors on the rear of the associated IMF-3 frame per the actual application. Special interfaces such as the RLY-6 and GPI-6 are connected directly via a RJ-45 connector on the rear of the Matrix frame to the appropriate interface input connector on an IMF-3 frame.

Note: Shielded CAT5 is required for compliance with the European Community's CE Mark.

Configuration Computer—To connect the computer to the Matrix frame, used the supplied DB-9 cable or a commercially available RS-232. If an RS-232 cable is used, be sure it provides the connections described in "Summary of Wiring Systems" on page O-15.

External Alarm Connection—Matrix Plus 3 frames have built-in fault alarms systems. If it is desirable to repeat this alarm with some remote enunciator, ALARM I/O relay contacts are available on the matrix frame's rear panel. If some external alarm condition needs to be added to the frame's alarm system, the same connector on the rear panel will allow bringing in an external contact closure to the frame's alarm system.

Note: The MicroMatrix (MMX-24/16/8) frame does not have this connector and does not support the features associated with this connector.

7.   Mains AC Power

Each of the components of the Matrix Plus 3 System require AC power except for the IMF-3 and some expansion key panels for stations. The IMF-3 requires an external power supply. The XP-type Expansion Panels receive power from the station to which they are connected.

Frames

Both Matrix frames have two separate AC Power Entry connectors for two separate power supplies in the system. Either power supply will completely power the system providing 100% power redundancy. If the two power entry modules are connected to different AC power sources and one of them loses power, the other will continue to operate the

system. The MMX-24/16/8 has an external power supply. A bracket has been provided to mount this external supply if necessary.

AC voltage for the frames and the PSU-101 can be 90 to 260 VAC without any switching or fuse changes.

Stations

The ICS-2003, ICS-2110, ICS-1016, and ICS-1008 stations have an external power supply. A bracket has been provided to mount this external supply if necessary. AC voltage for these stations can be 90 to 260 VAC without any switching or fuse changes.

The ICS-1502 can be switched between 115 and 230 VAC. Normally these units are shipped set for 115 VAC. However, if ordered they will be shipped configured for 230 VAC. There is an indicator on the rear of the station showing how the station was shipped from the factory.

The 1 RU stations (ICS-102/92/62/52) have wall mount transformers for 110 VAC and in-line transformers for 220 VAC. Confirm that you have the proper ones for your installation.

Each station will need to be plugged into an AC source at its location.

8.   Verify Station to Frame Operation

After the system is installed and interconnected, the Matrix Frame and any stations connected to it can be checked out by powering them up and using the "default" configuration shipped with the system. If there is no configuration loaded into the CONFIG-1 card, it will invoke a "default" configuration that has the keys of all stations programmed to a series of "party lines." The first key of each station will have "PL01" for a label, the second key will have "PL02," and so on for the rest of the keys on every station.

Data Wiring to Stations—If the stations initialize and download the key configurations from the frame, then it is assumed that the data links between the frame and the station are functional. If all of the red talk LEDs on the station continuously flash together, one or both of the data pairs are not connected correctly.

Audio Wiring to Stations—To check the audio pairs, set a Talk on "PL01" and listens to "PL01" on any other station and an audio path should be established. If both and a talk and a listen is tried at each station, then the audio pairs are functional.

Interface Wiring—All ports are assigned a default label. With an ICS-2003 station or the configuration computer, program a station's key to talk and listen to the port to be tested. Default port labels have the "@" in front of the port number. "@004" would be the default label for port number 4.

Invoking the "Default" Configuration

If the system does not come up with the "default" configuration, it can be invoked several ways.

1. With the configuration computer, clear the current configuration by placing it in the "trash" in the Transfer Screen.

2. With the configuration computer, use the Reset System option in the Transfer Screen.

3. SYS-200 & COM-72—remove the CONFIG-1 card and move the battery jumper from pins 1 to 2 and place them on pins 2 to 3 for about four sec. and then replace the jumper back on pins 1 to 2 and place the card back in its slot. This will clear all configurations from the RAM memory causing the CONFIG card to use the "default" configuration.

Other Frame Indicators to Verify

SYS-200 & COM-72—There are many LEDs on the front of the frame. Proper operation of the frame is indicated by the following LED status:

1. The top "green" LED on all cards should be on solid. This indicates that all of the power supplies on each card is functional.

2. On the CONFIG-1 card the next four LEDs (Clock Fault, Over Temp, Computer I/O, and GPI/RLY Active) should be off.

3. One of the bottom four green LEDs (Configuration 1/2/3/ 4) should be on.

4. The very bottom yellow LED on the CONFIG-1 card and all Matrix cards will go on and off during initial configuration of the system after power up and once the start-up sequence is finished they will periodically flash together indicating that all of the cards are communicating.

5. The eight LEDs in the center of each Matrix card will be off if there is no station or interface connected to it. If a station is connected to a particular port (port number indicated by the number next to the LED) that port's LED will be on solid if the station is powered up and has been logged into the Matrix card. If an interface is connected to a port, its LED will be on solid.

6. SYS-200—On the bottom door the ALARM and Power Supply Fault LEDs should be out.

7. COM-72—The Alarm LED should be off and the three power supply indicator LEDs on both power supplies should be on.

MMX-24/16/8—There are many LEDs on the front of the frame. Proper operation of the frame is indicated by the following LED status:

1. The left-most column of "green" LED on all cards should be on solid. This indicates that all of the power supplies on each card are functional.

2. On the CONFIG-1 card (top card) the next five LEDs (Over Temp, Clock Fault, RLY,GPI, I/O, and) should be off.

3. One of the two green LEDs on the top card (Configuration 1/2) should be on.

4. The right-most yellow LED on the CONFIG card and all Matrix cards will go on and off during initial configuration of the system after power up. Once the start-up sequence is finished, they will periodically flash together indicating that all of the cards are communicating.

5. The eight LEDs in the center of each Matrix card will be off if there is no station or interface connected to it. If a station is connected to a particular port (port number indicated by the number next to the LED) that port's LED will be on solid if the station is powered up and has been logged into the Matrix card. If an interface is connected to a port, its LED will be on solid.

9.   Configure the System with the Configuration Computer

For full operation of the system, it is necessary to enter a system configuration into the configuration program that runs on a PC.

Assignment of port or station names, declaration of interface port functions, assignment of labels to keys on stations, and many other functions of the system must be configured to use the system. Refer to the *Matrix Plus 3 PGM-WIN System Configuration* manual.

10. Verify the Operation of the System

Once the system is configured, a detailed check of each station, interface connection, control functions, and other features should be performed. Each audio path, relay output, and control input needs to be exercised to verify proper operation. Each software function such as Party Lines, ISO, and IFB must be verified. Each installation is different so it is beyond the scope of this manual to outline in detail this phase.

Component Location Requirements

The following paragraphs provide guidelines on the physical installation of components of the Matrix Plus 3 System. The following subjects are discussed:

- Matrix Frames
- Interface Frame(s) and Power Supplies
- Intercom Stations and Accessory Panels
- External PC.

Matrix Frames

The Matrix frame is the central connecting point of the system. All stations, interfaces, and external devices must be connected directly to the Matrix frame, so it should be centrally located. Your system's Matrix frame may be a SYSTEM 200 (SYS-200), a COMPACT 72 (COM-72), or a MicroMatrix (MMX-24/16/8), depending on your needs. The only functional difference between the frames is the number of ports that each can support and the rack space required for each.

The frames should be mounted in the center portion of a rack frame, if possible to allow easy access to the large number of port connectors on the frames. Some planning is also necessary for the dressing of cables in the rack because of the large numbers.

SYS-200—The SYS-200 requires 9 RU (15.75 in. or 400mm) of rack space. The SYS-200 frame has cooling fans in the bottom portion of the

front panel with exit vents for the air in the top front door of the frame. The bottom and top of the frame is not vented forcing all of the air flow to come from the front of the unit, not the inside of the rack. Under normal conditions the SYS-200 frame is immune to heat sources in the rack.

COM-72—The COM-72 requires 6 RU (10.50 in. or 267mm) of rack space. The COM-72 depends on convection for cooling. It does not have forced air cooling as the SYS-200 does. Its top and bottom panels are ventilated to allow air flow.

Caution: It is mandatory that the air flow through the COM-72 frame from the bottom to the top be unimpeded. If there is other equipment mounted above and below the frame that impedes the air flow through the frame, it will be necessary to leave 1 RU of empty space above and below the COM-72 frame as over heating will occur if this is not done. If the frame is mounted in a portable case this air flow must not be impeded.

MMX-24/16/8—The MMX-24/16/8 requires 3 RU (5.25 in. or 133mm) of rack space. A fan cools the MMX-24/16/8 and forces air through the unit horizontally.

Caution—It is mandatory that the air flow across the MMX-24/16/8 frame be unimpeded. In a standard, 19-in. rack the air flow should be sufficient. If the frame is mounted in a portable case, ensure that the air flow is not impeded.

Interface Frame(s) and Power Supplies

The IMF-3 Interface Module Frame(s) house the interface modules. An IMF-3 can accept up to 11 interface modules. Each interface features indicators and controls that must be accessible to operators, so put the interface module frame(s) in a convenient location. Usually interface module frames are located near the Matrix frame, but they can be located farther away. The maximum distance between the matrix frame and the interface frame is 500 ft. (150 m).

Each Matrix frame contains its own power supplies and do not supply any power for interfaces. A separate power supply (PSU-101) is only necessary for interfaces mounted in IMF-3 frames. If redundant power supply pairs are used for interfaces, mount them together. For detailed information on power supply requirements, refer to "Power Requirements" on page O-11.

It is required that you leave an extra 1 RU above and below each external power supply unit. This allows for needed cooling for larger system loads.

Intercom Stations and Expansion Panels

Locate all intercom stations at comfortable heights for operation. Leave at least 2 in. of clearance behind the station's chassis to allow for cable connectors. In some low light conditions, the EL display for the ICS-2003 may be too bright. Refer to the station's section in this manual for "display brightness adjustment."

Accessory panels such as the XP, XPL, AP, or EXP that are intended to expand or enhance the operation of stations are usually mounted just above the station with which they are associated. They can be located up 25 ft. away from the station. A 6-ft. cable is supplied to connect them.

Stations should not be more than 2,500 ft. from the Matrix frame to which that they are connected.

External IBM-Compatible PC

The Matrix Plus 3 PGM-WIN System Configuration Program runs on an external PC that connects to the Matrix frame via a standard PC serial port to a DB-9 RS-232 connector. The maximum recommended length of the cable is approximately 10 ft.

Power Requirements

This section gives guidelines for providing AC power for the system and how to plan the powering of interface frames. Each component type in the Matrix Plus 3 has different power requirements. The following paragraphs describe each:

- Frames
- ICS-2003/ICS-2110/ICS-1016/ICS-1008 Intercom Stations
- ICS-1502 Intercom Station
- ICS-52/62/92/102 Intercom Stations
- XP-12/22 and EXP-1016 Expansion Key Panels
- XPL-12/22 Display Expansion Panels and AP-22 Assignment Panels

- Interface Frame Power Supply Requirements

- PIA-32 Matrix System Plus 3 to Plus II Adapter.

Frames

Both the SYS-200 and the COM-72 are powered by internal DC power supplies that run from AC mains line current. The MMX-24/16/8 is powered by an external supply. The power supplies are "universal," operating over a voltage range of 90-260 VAC at 45 to 65 Hz.

Both the SYS-200 and the COM-72 contain redundant power supplies: if one supply shuts off for any reason, the Matrix can run on the other without interruption. Redundant supplies have separate AC mains power inputs and can be powered by separate AC mains sources: if one source fails, only one of the power supplies will be shut off. In the event of a failure of one of the redundant power supplies, an "alarm" failure condition will be activated.

SYS-200—The SYS-200 has separate modular, plug-in power supplies. The digital circuitry of the frame is powered by a single ended 15 VDC supply module. The analog circuitry is powered by a +/- 15 VDC supply module. There is an extra redundant supply module for each providing complete power redundancy.

A fully loaded (25 Matrix Cards) SYS-200 requires 90 to 260 VAC at 45 to 65 Hz with a maximum dissipation of 400 W.

COM-72—The power supply modules for the COM-72 screw in from the front of the frame. Each module is capable of powering the frame and has all of the digital and analog power supplies necessary.

A fully loaded COM-72 (9 Matrix cards) requires 90 to 260 VAC at 45 to 65 Hz with a maximum dissipation of 200 W.

MMX-24/16/8—The MMX-24/16/8 is powered by an external supply.

The power supplies are "universal," operating over a voltage range of 90 to 260 VAC at 45-65 Hz. The maximum dissipation is 50 W.

ICS-2003/2110/1016/1008 Intercom Stations

These stations have a separate external DC power supply. The power supply is "universal," operating over a voltage range of 90 to 260 VAC at 45 to 65 Hz. The maximum dissipation is 30 W.

ICS-1502 Intercom Station

The ICS-1502 station can run on either 115 or 230 VAC Mains power; the station has an internal, line-voltage selector switch. If the line voltage is changed, the AC fuse must also be changed. A ICS-1502 requires 90 to 125 or 210 to 250 VAC at 45 to 65 Hz with a maximum dissipation of 40 W.

ICS-52/62/92/102 Intercom Stations and XPL/AP Key Panels

These components are powered by transformers that run off of AC mains power: the 120-V transformer requires a two-conductor wall outlet, and is housed in a 2 x 2 x 3 in. direct plug-in module; the 240-V transformer requires a three-conductor wall outlet, and is housed in a 2 x 3 x 5 in. box located in the middle of its cable's length. Each transformer connects to each compact station with the 2.1 mm coaxial power connector on the rear of the station.

An ICS-102/92/62/52 intercom station requires 90 to 125 or 210 to 250 VAC at 45 to 65 Hz with a maximum dissipation of 40 W.

XP-12/22 and EXP-1016 Expansion Key Panels

XP-12/22 and EXP-1016 expansion key panels do not require external mains AC power. They receive DC power from the station to which they are connected.

XPL-12/22 Display Expansion Panels and AP-22 Assignment Panels

XPL-12/22 display expansion panels and AP-type assignment panels require an external transformer identical to those used with the 1 RU stations (90 to 125 or 210 to 250 VAC at 45 to 65 Hz with a maximum dissipation of 40 W).

PIA-32 Matrix System Plus 3 to Plus II Adapter

The PIA-32 converts 6 ports of a Matrix Plus 3 System to the Matrix Plus II format. This translation only supports "Call" signals, not serial data like that sent to stations. The unit requires AC power. An in-line AC transformer is provided that will operate from 90 VAC to 250 VAC at 45 to 65 Hz and power the unit. The maximum power required at 250 VAC is less than 20 W.

Interface Frame Power Supply Requirements

This section describes how to plan the number of power supply units that are required to power a given Matrix Plus 3 System installation. This number can vary depending on the number and type of interfaces in the system, and on the degree of redundancy required. As a rule-of-thumb, one PSU-101 is required for every two IMF-3 frames. The exception is if the frames have a large number of CCI-22 Party-Line interfaces which require no DC power from the IMF-3 frame. However, an IMF-3 with only CCI-22 interfaces still needs to be connected to a PSU-101 as the IMF frame itself needs some DC power for the circuitry on its rear panel.

A PSU-101 requires 90 to 260 VAC at 45 to 65 Hz with a maximum dissipation of 80 W. A PSU-101 connected for redundancy requires very little AC current unless it is used.

An audible alarm is included in the PSU-101, and an additional set of alarm-relay contacts are provided on the supply. Clear-Com recommends that these contacts be connected to the external alarm input of the Matrix frames. If any of the power supplies in the PSU-101 fails, it would cause a system alarm. LEDs on the front of the PSU-101s will indicate the failure.

Installing two PSU-101 power supplies per application provides redundancy because either of the two PSU-101 power supplies can power a complete system. If one fails, it can be removed without interruption of the entire system. Rear panel connectors provide easy parallel connection to the IMF-3 Interface Module Frame.

The current capacities of the power supplies are as follows:

- 9 V analog   3.0 A

- -9 V analog   3.0 A

The following chart provides the current drain of the +/- analog power supplies for all components in the system. Some devices, such as interfaces, have a varying current depending on the operation of features. In applications where it is possible to activate all operating features of all components used, use the maximum current column for planning.

Component	Average Current	Maximum
IMF-3 Frame	0.20 a	0.20 a
CCI-22	0.00 a	0.00 a
FOR-22	0.07 a	0.15 a
TEL-14	0.28 a	0.37 a
RLY-6	0.10 a	0.15 a
GPI-6	0.02 a	0.02 a

TABLE O-1: Current Consumption of Interfaces

Figure O-1 on page O-15 shows the PSU-101 to IMF-3 wiring possibilities.
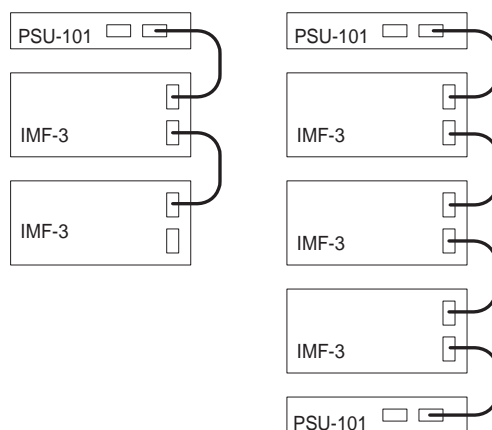
FIGURE O-1: PSU-101 to IMF-3 Wiring

Summary of Wiring Systems

This section provides detailed wiring diagrams for all wiring systems that are to be used with the Matrix Plus 3 System. With the SYS-200 and the COM-72 systems, Clear-Com supplies an RJ-45 Installation Kit at no charge that includes a cable tester with each system sale and other

miscellaneous connectors upon request to assemble cables that interconnect the components of your Matrix Plus 3 System.

Each of the following sections only describe the wiring of cables and connectors. For more detail about mounting, specifications on individual products, and internal adjustments refer to the chapter in this manual for that product. To configure stations and interfaces refer the *Matrix Plus 3 PGM-WIN System Configuration* manual.

The Matrix Plus 3 System features RJ-45 connectors on the rear of the Matrix frame for port connectors. Each station or interface is connected to the frame via a single 4-pair RJ-45 terminated cable. The next paragraphs discuss RJ-45 connectors and all of the detailed wiring diagrams for interconnection of each system component:

RJ-45 Cables

This section describes the use of RJ-45 connectors for interconnecting a Matrix Plus 3 frame to stations and interfaces. The following subjects are covered in the following paragraphs:

•   General Discussion About RJ-45 Connector Cables

•   Clear-Com Kits and Recommendation

•   Installing RJ-45 Connectors.

General Discussion About RJ-45 Connector Cables

Most of the system wiring is with CAT3, CAT4 or CAT5 twisted cable with RJ-45 connectors on either end; however, there are various methods available to deliver these cables from one place to another. Some of the wiring possibilities are as follows:

Note: Shielded CAT5 is required for compliance with the European Community's CE Mark.

•   Although some Matrix Stations have a DB-15M (male) connector for connection to the Matrix frame, most have a built-in RJ-45 connector. For those stations with a DB15 male connector, Clear-Com provides a properly wired DB-15F (female) to RJ-45 adapter for direct connection with RJ-45 terminated cables.

•   Direct 4-pair cable from a Matrix port to an individual station can be used with RJ-45s on either end. CAT3 to CAT5 cables are available with RJ-45 terminations already installed. Bulk RJ-45 connectors can be bought and installed on custom length cables.

•   Individual CAT3 to CAT5 jumper cables can be wired as a transition to a bulk cable such as a 25-pair, Telco-type cable. There are commercially available "harmonica" type connectors for 25 pair cables that have six 4-pair RJ-45 connections.

•   Individual CAT3 to CAT5 jumper cables can be wired as a transition to commercially available punch-down blocks.

The term CAT3 refers to a communications cable standard that calls out transmission characteristics of twisted-pair cables for data communication use. For each increasing "CAT" number the guaranteed bandwidth for data communication purposes is higher. Normally only CAT5 cable,

which is required for compliance with the European Community's CE Mark, is available in a shielded version. CAT3 unshielded cable is more than sufficient for Matrix Plus 3 audio and data pairs. Shielded cable is necessary to meet European CE requirements.

For the 4-pair wiring scheme between the frame stations, Matrix Plus 3 uses the AT&T T568B wiring standard for data cables. Cables for use with Ethernet 10-BASE-T are of this type. Cables are available in solid or stranded wire in #24 or #26 AWG.

Clear-Com Kits and Recommendation

There are at least five different wiring standards that use the RJ-45 connector. Although they look identical, many pre-made cables and utility items, like couplers, will not work properly. You must know what wiring standard is used in accessories that you buy.

Caution—Long runs with flat cable are not acceptable. The data and audio pairs are not twisted, therefore the crosstalk within the cable is high.

The T568B standard is a mature, well supported standard that allows many advantages. Fast easy termination of cables as well as the availability of a vast array of wiring adapters and patching systems allow great versatility for all applications of intercom wiring. RJ-45 connectors are easy and fast to connect to equipment. T568A cables differ only on the color of the insulation on pairs 2 and 3. If you are not cutting the ends off pre-made cable, you do not need to worry about it. Be aware that if you do remove the ends from pre-made cable to shorten or to punch onto blocks, pair 2 and 3 colors may be different.

There is no one type of cable that will suit every different application. Users will need to determine if they require shielding. CAT3, 4-pair twisted is the minimum requirement for Matrix Plus 3. However, it may difficult to find shielded cable that is not CAT5. Remote (OB) applications should consider stranded cable for durability.

Caution—Make sure the type of RJ-45 connector matches your wire type. Connectors are available for both stranded and solid wire. Our intercom stations do not require keyed connectors. Please refer to the following list for connector vendor and port numbers.

Clear-Com recommends a high-volume crimper like the Siemon PT-908. Crimpers are available from Clear-Com. The AMP 2-231652-0 with a set of AMP 853400-1 dies is also acceptable. While many other crimpers may

work, be aware that non-ratchet style crimpers may cause RJ-45 connectors to become intermittent.

Clear-Com recommends that you thoroughly test all cables before connecting them. Clear-Com provides the Siemon STM-8 cable tester and the Siemon Crimper in a kit that is shipped at no charge with SYS-200 and COM-72 orders. This tester will completely test a cable and check for split pairs (improperly paired).

The following products are recommended as possible sources for cables, connectors and tools:

- Crimper—Siemon PT908 or AMP 2-231652-1 with 853400-1 dies

- Stripper—Siemon CPT

- Tester—Siemon STM-8

- Connector RJ-45 Unshielded 26-22 AWG Stranded or Solid— Siemon P-8-8

- Connector RJ-45 Shielded 26-22 AWG Stranded or Solid RJ-45— Siemon PS-8-8

- Cable Unshielded Stranded 4 pair CAT3 24 AWG—Alpha 93F1977WM

- Cable Unshielded Stranded 4 pair CAT5 24 AWG—Commscope 55J4

- Cable Unshielded Solid 4 pair CAT5 24 AWG—Commscope 55N4

- Cable Shielded Solid 4 pair CAT5 24 AWG—Commscope 5NS4.

Installing RJ-45 Connectors

RJ-45 connectors can be a challenge to install correctly unless some of the following techniques are followed. Like most wiring skills, once the you know the "tricks," it's fairly easy. It is very strongly suggested that you test your work using the Siemon STM-8 cable checker included in the Clear-Com Matrix Plus 3 Installation Kit.

The technique that will transform this task from tedious to easy is described next. If you understand it, you can skip reading the rest of the detailed steps. The main hurdle in putting these connectors on correctly is the tendency of the wires to slip out of the correct order as you slide the prepared cable end into the connector. To avoid this problem, try this:

1. Strip enough jacket off the cable to allow you to grasp the wires and pull the jacket back.

2. Untwist the wires and pull them into the correct order and let the jacket slip back to hold them in place.

If you have done it correctly, the wires will stay in the correct order. Trim exposed wires to about 9/16 in. and install into the connector. If this is clear you won't need to read the step-by-step instructions that follow.

1. Strip off enough of the outside vinyl jacket to allow you to grip the wires inside easily (2 in.). While holding the four twisted pairs in one hand, slide back the vinyl jacket and clamp it between your thumb and forefinger. Keep the jacket clamped in this retracted position until the fourth step.

2. Pull the twisted pairs to the one side and untwist them back to the edge of the vinyl jacket. Smooth the kinks out slightly by pulling the conductors through your fingers.

3. In the correct color sequence, pull one wire at a time, straight out, clamping it in place between your thumb and forefinger. If a wire must cross the others, make sure it does it inside the jacket. Make sure your color sequence matches the other side and it does not reverse. If you are rebutting a cable, verify it's color code. The twisted pairs must be positioned correctly.

4. While holding the wires in the correct order, release your clamped thumb and forefinger enough to allow the retracted jacket to slip back. You still need to maintain enough pressure on your thumb and forefinger to hold the jacket and wires flat but the individual wires should stay in the correct order without holding them with your other hand.

5. Cut the exposed wires to the correct length and slip them into the RJ-45 connector as you release your clamped thumb and forefinger. Crimp and test the cable.

6. Shielded cable can be handled almost in the same manner as unshielded cable. However, care must be exercised that the shield is not left pulled back inside the wire jacket. We also recommend that the drain wire is soldered to the side of a shielded style connector. Our tests show that a drain wire that is only crimped and not soldered will make an intermittent connection at best.

Matrix Frame to Station Wiring

Matrix Plus 3 uses a 4-pair (analog), single-pair (digital), or coax (digital) wiring scheme between the frame and stations.

Although some Matrix Stations have a DB-15M (male) connector for connection to the Matrix frame, most have a built-in RJ-45 connector. For those stations with a DB-15 male connector, Clear-Com provides a properly wired DB-15F (female) to RJ-45 adapter for direct connection with RJ-45 terminated cables. Additionally, stations configured for digital communication are equipped with a BNC.
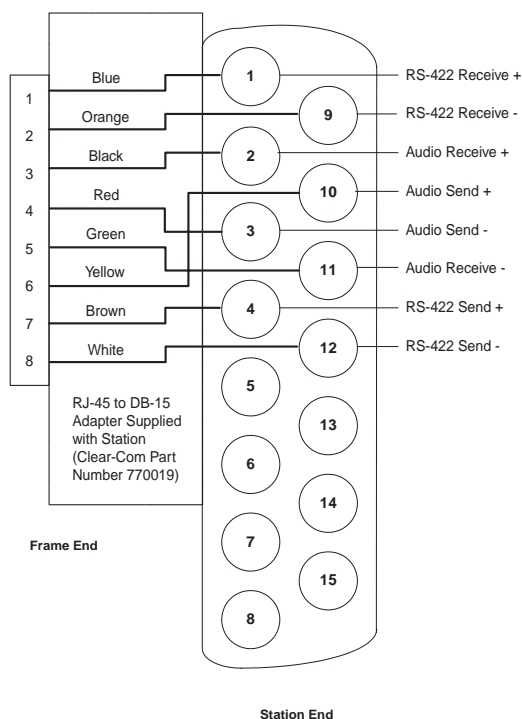
FIGURE O-2: RJ-45 to DB-15 Adapter Wiring

4-Pair Analog

Four-pair analog wiring is typically wired with a CAT3 or CAT5 RJ-45 cable.

- Pair 1 transmits analog audio from the matrix frame to the station.

- Pair 2 transmits digital data from the station back to the matrix frame.

- Pair 3 transmits audio from the station to the matrix frame.

- Pair 4 transmits digital data from the matrix frame back to the station.

ATT-T568B (Modular Jumpers Wired One to One)

Matrix Frame End   Station End

RS-422 Receive +	1	Pair 2	1
RS-422 Receive -	2		2
Audio Receive +	3	Pair 1	3
Audio Send +	4		4
Audio Send -	5	Pair 3	5
Audio Receive -	6		6
RS-422 Send +	7	Pair 4	7
RS-422 Send -	8		8
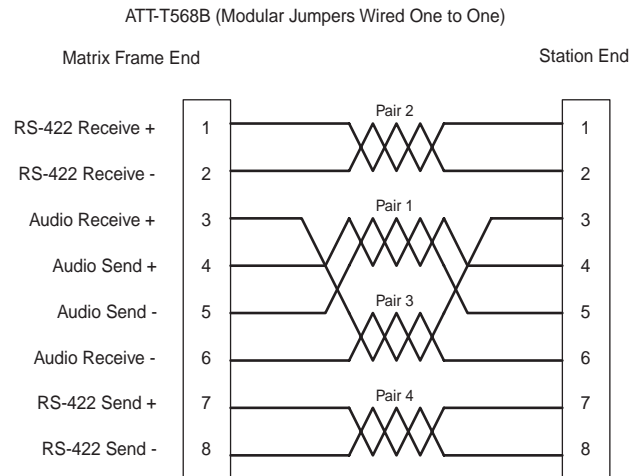
FIGURE O-3: Matrix Frame to Analog Station Wiring Using RJ-45

Single-Pair Digital

Single-pair digital wiring is typically wired with a CAT3 or CAT5 RJ-45 cable.

- Pair 1 transmits and receives multiplexed digital and analog between the matrix frame and the station.

Note: Ensure that the "Select" switch on the station's rear panel is in the correct position for the intended use.

ATT-T568B (Modular Jumpers Wired One to One)

Matrix Frame End   Station End
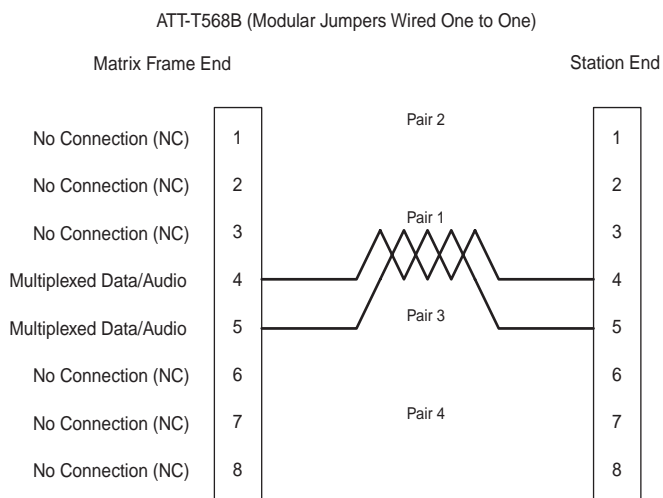
FIGURE O-4: Matrix Frame to Digital Station Wiring Using RJ-45

Coax Digital

Coax digital wiring is typically wired with a CAT3 or CAT5 RJ-45 cable connected to a 75-Ohm coax cable with a transition panel.

• Pair 1 transmits and receives multiplexed digital and analog between the matrix frame and the station.

Note: Ensure that the Select switch on the station's rear panel is in the correct position for the intended use.
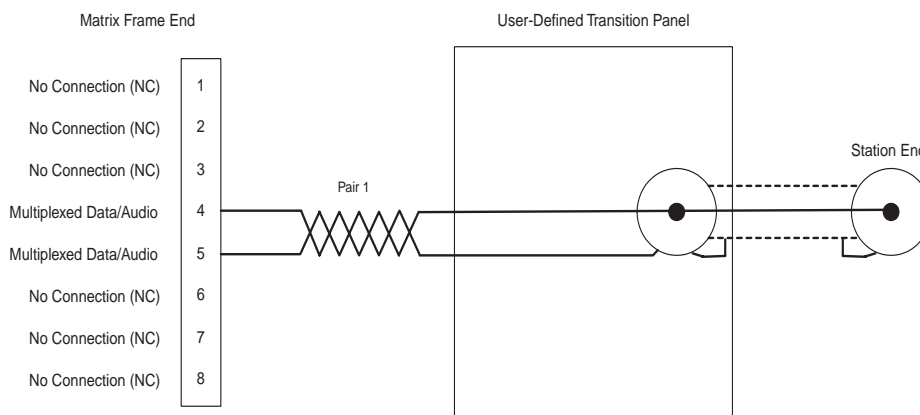
FIGURE O-5: Mattix Frame to Digital Station Wiring Using Coax

Matrix Frame to IMF-3 Interface Wiring

IMF-3 frames that contain the interfaces for Matrix Plus 3 are usually located in the same or an adjacent rack with the Matrix frame so the simplest method of connecting interface modules to the frame is to use RJ-45 cables between a Matrix port and the port connector on the rear of the IMF-3. This section only describes the port connection to an interface. For detailed information on each interface I/O connector that provides the user side of the interface, refer to the section for that interface in this chapter.

The IMF-3 frame has an individual rear panel for each interface. All interfaces use the same rear panel, however the use of the rear-panel connectors will vary with the type of interface.

CCI-22 and FOR-22—The CCI-22 and FOR-22 dual audio interfaces use each of the RJ-45 connectors on its rear panel for connection to the Matrix port. The top RJ-45 is for the first channel of the interface. The lower RJ-45 is for the second channel. The DB-9Ms are the interface's audio and control inputs and outputs. Refer to the section on those interfaces later in this chapter for wiring details.

TEL-14—The TEL-14 interface is a two-channel device and uses each of the RJ-45 connectors on its rear panel for connection to the Matrix port. The top RJ-45 is for Line A of the interface and the lower RJ-45 is for Line B of the interface. The upper and lower DB-9M connectors are the Line A and Line B connections to the telephone line. Clear-Com provides DB-9F to RJ-11 adapters so that standard phone line RJ-11 plugs and jacks can connect directly to the interface. Refer to the section on this interface later in this chapter for wiring details.

Each audio interface has internal ID circuit jumpers that will identify to the Matrix cards the type of interface it is; as a result the ports and interface modules can be moved without having to change the wiring.

RLY-6 and GPI-6—The RLY-6 and GPI-6 use the same RJ-45s, however their function and connection is different. These interfaces are daisy chained in their direct connection to the Matrix frame. RLYs and GPIs do not require connection to a system "port." The first RLY or GPI interface has its RJ-45 connected to the special RJ-45 on the rear panel of the frame marked GPI/RLY Interface. The top connector of the second RLY or GPI interface connects to the bottom RJ-45 of the first. Each successive interface is connected in this daisy-chained fashion.

Figure O-6 on page O-25 shows the rear panel of a IMF-3 wired for RLY-6s and GPI-6s. The CONFIG-1 card will read these modules and will call the first RLY-6 relays 1 to 6. The second RLY-6 will be identified as relays 7 to 12.
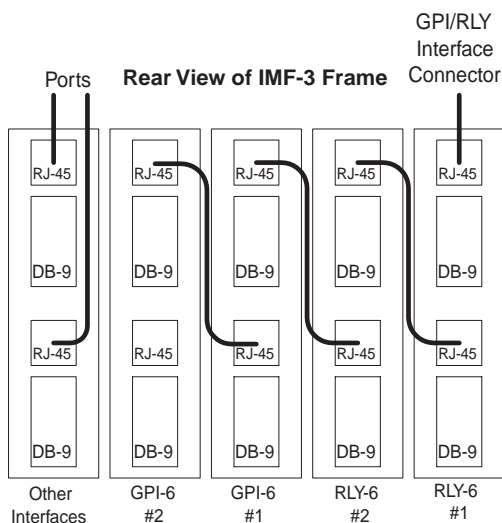

FIGURE O-6: RLY-6/GPI-6 Daisy Chain Connection

Figure O-7 on page O-25 shows the pin assignment of the RJ-45 connectors when used to connect to interfaces (IMF-3 frames).
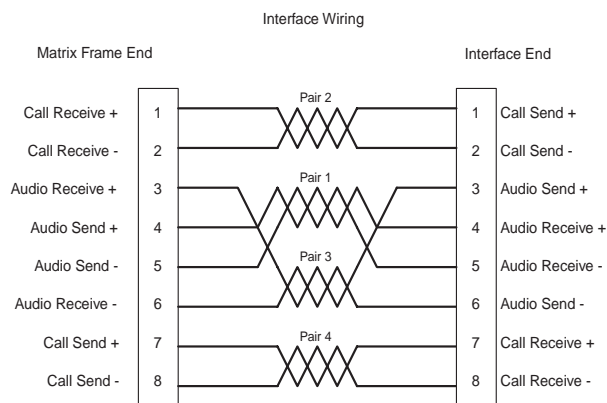
FIGURE O-7: Matrix Frame to IMF-3 Interface Connection

Matrix Frame Direct 4-Wire Port Connection

An external 4-wire audio device can be directly connected to a Port Connector through the four audio pins, as shown in Figure O-8 on page O-26. If there is excessive noise on the lines between this device and the frame, the device may be electronically unbalanced with the rest of the system. The device will need to be isolated with external isolation transformers.

The "CALL SEND" output can be connected to the "CALL REC" input to tell the system software that this is a directly connected port.

The configuration program allows the changing of the audio output reference level between -24, -21, -18, -15, -12, -9, -6, -3, 0, +3, +6, +9, +12, +14 dB. With a +12dB output reference level, it is possible to drive a 200 to 400 Ohm headset directly with a port output for such uses as direct IFB feed.

The Configuration Program allows the changing of the audio input reference level between -12, -9, -6, -3, 0, +3, +6, +9, +11 dB.
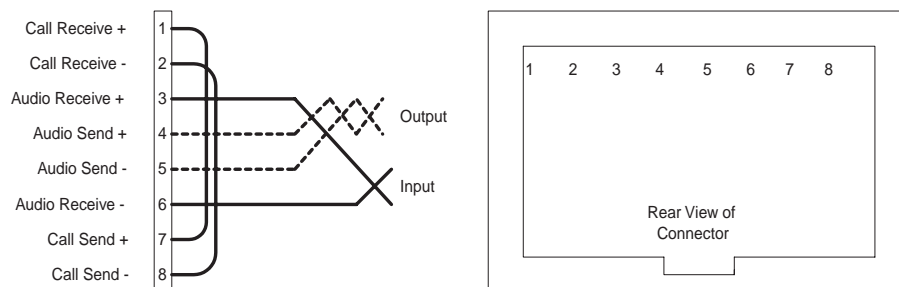
FIGURE O-8: Direct Matrix Port Connection

Matrix Plus 3 Frame Connected Directly to a Matrix Plus 3 Frame

Two Matrix Plus 3 frames can be connected directly together (party-line trunks). By configuring each of the ports in each system as a "party-line," the two systems can use a party-line label and talk and listen to anyone on that party-line in either system. Call signals will also pass from one system to the other.

This method is not Clear-Com's SmartLink product, which allows as many as eight independent remote and local Matrix Plus 3 systems to be "intelligently linked" with multiple "trunks" (see "Matrix Plus 3 Frames Connected Via SmartLink" on page O-27).

To implement "party-line trunking," interconnect the frames as follows below and configure the ports as party lines. Connect the REC lines (both CALL and AUDIO) of a port on one matrix to the appropriate SEND lines of a port on the other (see Figure O-9 on page O-27). This wiring is not a normal RJ-45 to RJ-45 jumper cable. Such a cable could be constructed, however it might be easier to accomplish this crossover wiring at a punch-down block. The Seimon cable tester will not check this wiring.
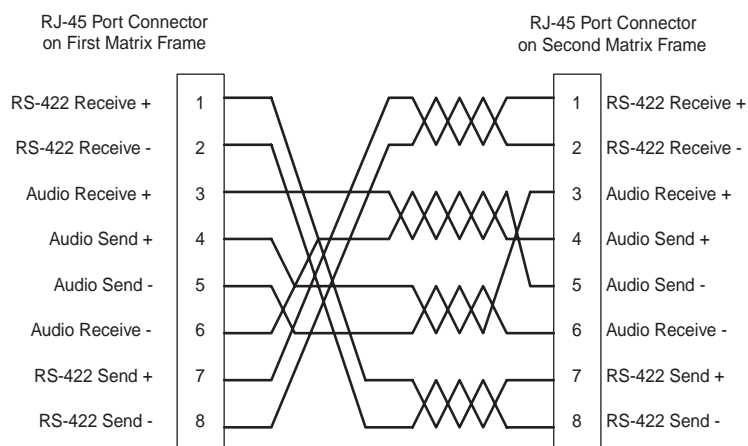
FIGURE O-9: Wiring for two Matrix Plus 3 Frames

Matrix Plus 3 Frames Connected Via SmartLink

SmartLink allows as many as eight separate Matrix systems to be inter-connected, providing seamless communication between the systems. While SmartLink does not actually create a larger system or change the independent status of each system, its automation transparently handles communication requests so that an intercom-station user cannot distinguish between talking to a control room next door or across the continent.

The SmartLink process includes the following components:

*   Hub frame—this frame serves as the central point in a SmartLink system to which all remote frames must connect.

*   Remote frame—a frame in the SmartLink process that is connected to the hub frame.

- MVX-L8 Matrix Card—the MVX-L8's hardware is similar to the MVX-A8's and adds eight ports to a Matrix Plus 3 System. The ports can connect a system frame to interface modules and other systems.

- Trunk—a circuit between two frames used in the SmartLink process to make connections between frame users. SmartLink dynamically allocates the available audio trunks as needed when a talk or listen to another Matrix system is requested.

- Audio trunk—only carries audio between two remote frames or the hub and a remote frame.

- Data/audio trunk—carries both audio and data communication between the hub and a remote frame.

- Primary data/audio trunk—carries the active data connection between the hub and a specific remote frame. This trunk is automatically identified by having the lowest port number in the hub frame relative to all other trunks from that frame.

- Alternate data/audio trunk—takes over the active data connection when the primary data/audio trunk fails. These trunks are automatically defined by being plugged into the next higher port numbers than the primary data/audio trunk. The number of alternate data/audio trunks is only limited by user wiring.

How It Works

After the Matrix systems are configured and powered, SmartLink will automatically detect all connected trunks and generate a detailed "Link Map" which can be displayed from the configuration program.

As each new system is discovered by the hub frame, the labels that have been set as available for access by other systems are shared so that every system is aware of all possible labels that can be accessed. After the labels have been shared, those assigned to station selectors are available for use.

When a station user requests a talk or listen path to a label in another frame, SmartLink will locate the shortest possible path to complete the communication. If this path is between two remote frames connected by an audio-only trunk, SmartLink will route the communication directly between the two frames and bypass the hub frame. If the trunk requirements between two remote frames is underestimated, the hub frame will come into play and thus reduce the number of trunks available for communication to the hub frame.

SmartLink will share trunks if the source or the destination of a communication is common. For example, if several stations in a remote frame are monitoring a source in the hub frame, all users may actually share the same trunk.

If a talk or listen path is requested and a trunk is not available, the request will be denied and the user will receive a busy signal. To avoid busy signals, careful attention must be given to assessing the number of potential, simultaneous users and allocating the adequate number of trunks when planning system wiring.

Wiring

The SmartLink wiring implementation requires a "star configuration" where one frame is designated as the hub. All remote frames are required to have a least one data/audio trunk connected to the hub frame. This connection is made by using an MVX-L8 Matrix Card in each frame and connecting a cable between them (see Figure O-11 on page O-32 and Figure O-12 on page O-33).

Note: Each MVX-L8 in the hub can only have two primary data/audio trunks. Therefore, the hub needs an MVX-L8 card for every two remote systems.

Additional trunks can be connected between the hub and remote systems depending on the expected usage requirements. These trunks can be audio-only or data/audio trunks depending on user requirements. If there are multiple data/audio trunks, only the primary data/audio trunk will be used for data communication. The alternate data/audio trunks will only be used for data communication if the primary data/audio trunk fails.

In addition, trunks can be connected between two remote frames. Although data/audio trunks may be connected between remote systems, SmartLink will ignore the data portion of the trunk.

During operation, the integrity of all system wiring is continuously verified. Therefore, a broken or disconnected cable will automatically be removed from the available trunks. Unused ports on the MVX-L8 card are continuously scanned, which makes adding a trunk as simple as plugging it into the frames.

It's important to distinguish between primary and alternate trunks when connecting systems via long-line transmitters with redundant data/audio trunks. These high-speed lines are typically more expensive and may carry

the primary data/audio trunk, while the alternate may be carried by less-expensive methods.

The maximum distance between SmartLinked systems is 2,000 ft. using a direct-connect cable. Longer distances require an RS-422 data transmitter/repeater.

The SmartLink trunks connecting MVX-L8 ports must be configured as shown in Figure O-10. Each RJ-45 connector must have the receive lines (both RS-422 and audio) of a port on one frame connected to the appropriate send lines of a port on the other. This wiring is not a normal RJ-45-to-RJ-45 patch cable. Although this special RJ-45 cable can be constructed, it might be easier to accomplish this crossover wiring at a punch-down block.
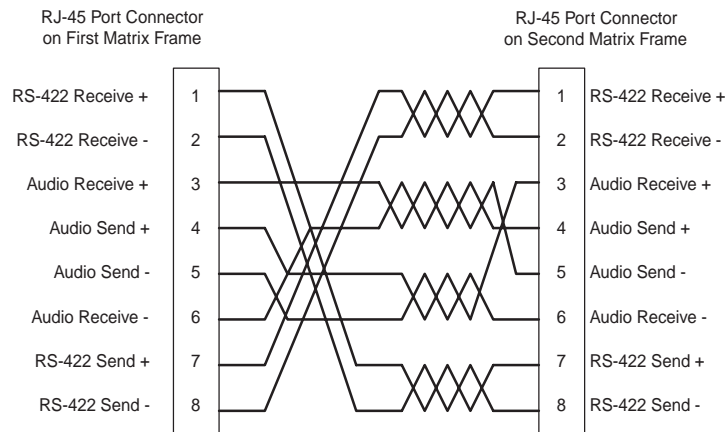
FIGURE O-10: SmartLink Data/Audio Trunk

If audio-only trunks are used, simply omit the RS-422 lines.

Note: The Seimon cable tester will not check this wiring.

Programming

The SmartLink software configuration is done for each system locally through the configuration program. Initial configuration requires three steps:

1.   Use the "Setup - Linking" screen to give each frame a unique system-identification number with one system designated as the hub frame.

2. Set as "available" any local Matrix system labels to be accessed from other SmartLink systems.

3. Use the "Setup - Hardware and Labels" screen to confirm that the "Interframe Trunk" port function is assigned to all ports associated with the MVX-L8 card. The port function will automatically be assigned upon insertion of the MVX-L8 card unless a port function is already declared.

Note: Any MVX-L8 ports not required for SmartLink can be used for interfaces that do not require RS-422 data communications. The interfaces that can be used are CCI-22, FOR-22, TEL-12, TEL-14, and any direct audio connection. This can be done by overriding the default port function of "Interframe Trunk."

Once the initial configuration is complete, all wiring is in place, and SmartLink is operational, remote labels can be assigned to local-station selectors. To do this:

1. Go online with the local frame.

2. Use the "Configure - Key Assignments" screen to select the appropriate SmartLink frame and assign the available labels to the local station.

If the SmartLink system should be disconnected and its available labels are assigned to a local station, those labels will be displayed as "*****" to indicate their unavailability. From the configuration program these labels will be displayed as 'x:yyy,' where 'x' is the "Frame ID" and 'yyy' is the "Label."

For more programming information, see the *PGM-WIN System Configuration* manual.

SmartLink Examples

Figure O-11 on page O-32 illustrates a simple connection between two systems in different cities, Seattle and Chicago. Because only one MVX-L8 is installed per system, the maximum number of audio trunks between these systems is eight; at least one trunk must be an data/audio trunk.

.

Seattle
System 200

Chicago
MicroMatrix

Audio lines

Data/audio line

MTX-A8   MTX-L8   MTX-L8   MTX-A8
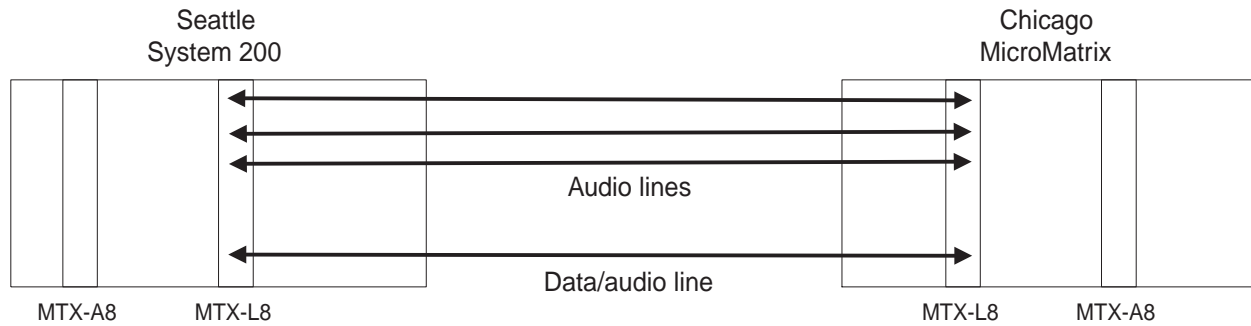
FIGURE O-11: SmartLink Connecting Two Systems

Figure O-12 on page O-33 is more complicated. It illustrates four separate systems connected to a hub in Chicago. As in the other example, each separate system has at least one data/audio trunk connected to the hub. However, the system in Houston has two data/audio trunks to the hub. This is because an uninterrupted connection between the two sites is critical. The two systems in Houston have audio-only trunks to reduce transmission costs.
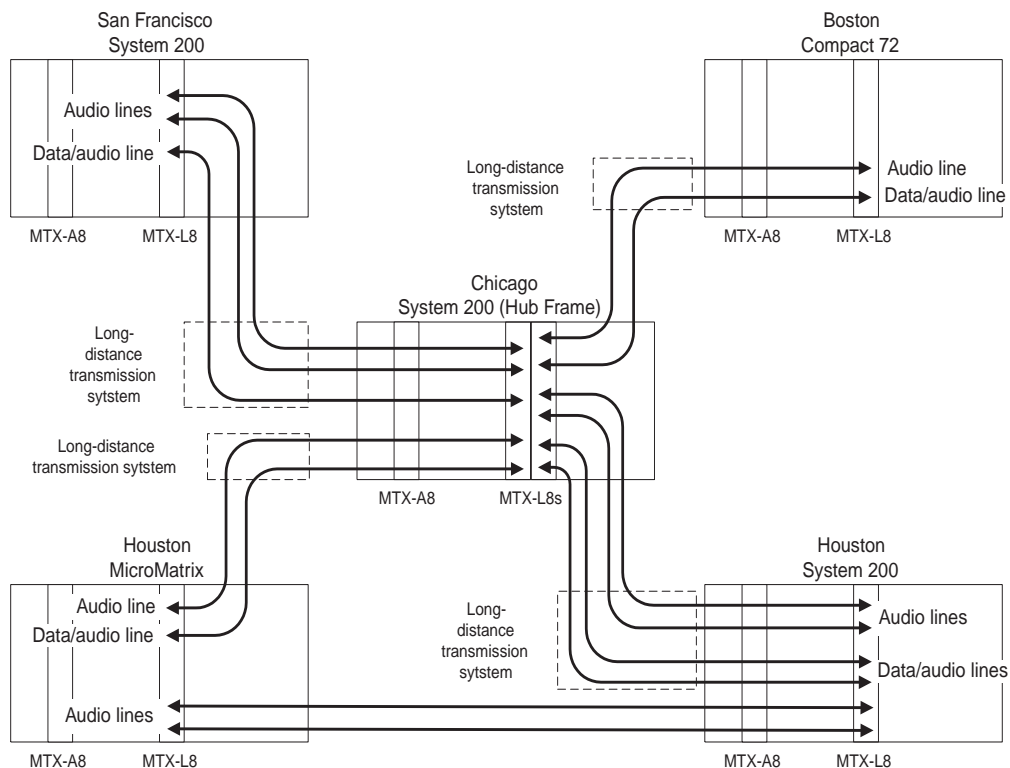
FIGURE O-12: SmartLink Connecting Five Systems

Matrix Plus 3 Frame Connected to Matrix Plus II Components Via a PIA-32

The PIA-32 is designed to interface 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 are also translated between the systems. Using a PIA-32 with a Matrix Plus 3 System allows the following:

- Use existing Matrix Plus II interfaces in an IMF-1 interface frame when upgrading a Matrix frame from Plus II to Plus 3.

- Use of the Clear-Com AB-100 Announcer/Sportcaster Console, whose Matrix port is designed for Plus II, with the Matrix Plus 3 System.

- Use third-party products that are designed to Matrix Plus II standards.

- Direct connection between Matrix Plus II and Matrix Plus 3 ports.

Note: The PIA-32 does not translate the DATA line for station use.

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:

1. Connect a channel's RJ-45 with a jumper cable directly to a port connector on a Matrix Plus 3 frame.

2. Treat the DB-15M associated with that channel as if it were on the rear of a Matrix Plus II frame.

Refer to the Matrix Plus II manual for wiring to its products.

The PIA-32 has an in-line power transformer that needs to be connected to AC Mains.

MMX-24/16/8 Direct RLY/GPI Connections

The MMX-24/16/8 frames have the equivalent of one RLY-6 and one GPI-6 interface module built into the frame. The rear panel has two DB-15F connectors dedicated for these functions. The following diagrams show the wiring of these connectors.
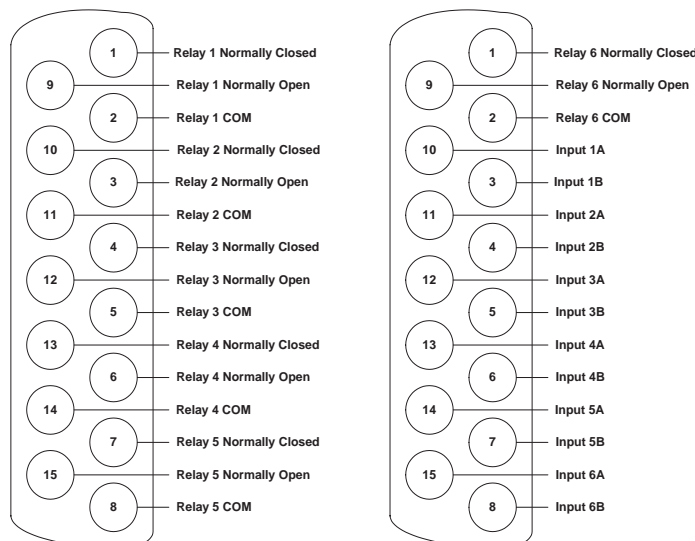
FIGURE O-13: MMX-24/16/8 RLY & GPI Connectors

Matrix Frame to IBM-PC Wiring

The IBM-PC RS-232 connector is used to connect an external PC to the Matrix frame. This computer runs the Matrix Plus 3 System Configuration Program. To configure the serial port refer to the configuration program manual.

Subsequent figures show the connections for a cable that connects the matrix frame to the computer. Two versions are shown, the first (Figure O-14 on page O-35) for a computer serial port with a DB-9M connector on the back (cable connector is female), the second (Figure O-15 on page O-36) for a computer serial port with a DB-25M connector on the back (cable connector is female).
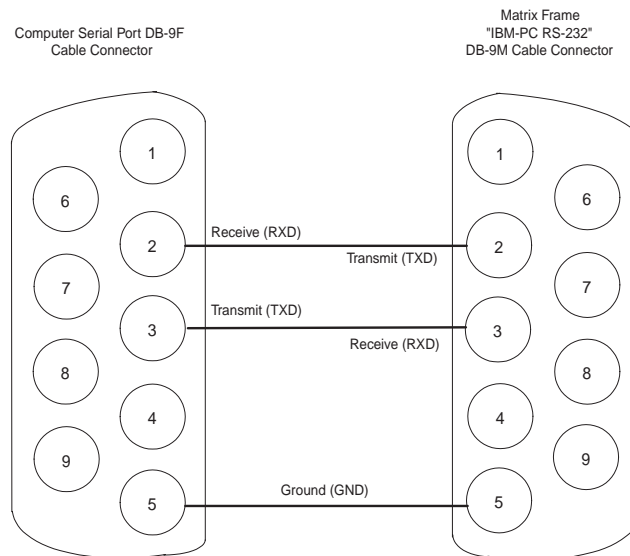
FIGURE O-14: IBM-PC DB-9, RS-232 Cable
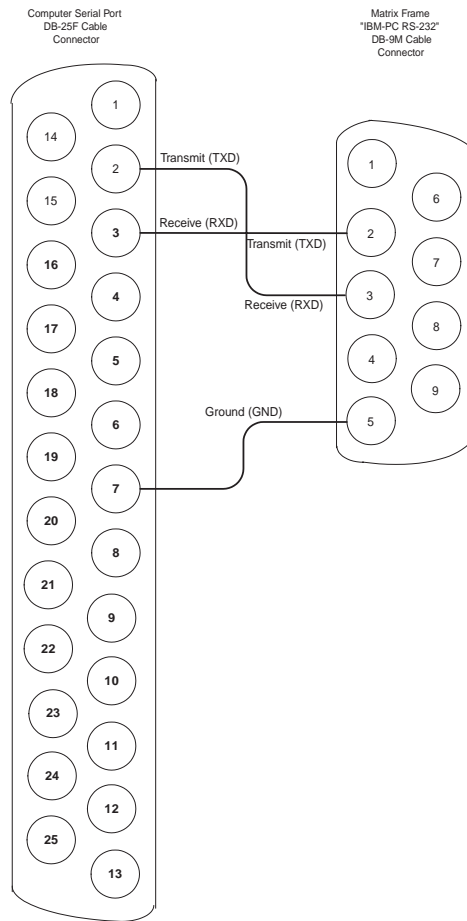
FIGURE O-15: IBM-PC DB-25 RS-232 Cable

Matrix Frame Alarm I/O Wiring

The Alarm I/O connector enables connecting an external alarm device to monitor failures in the frame. Pins are also available for inputting an external alarm source to be included in the frame's Alarm System. For details on the functions that are monitored by the Alarm System refer to the SYS-200 or COM-72 frame section in the *Matrix Plus 3 System Operation* manual.

All failures are recorded by the CONFIG card, which records the times when they occurred. These events can then be viewed in the configuration program.

A failure will activate the relay contacts connected to pins 4, 5, and 9 of the connector (Figure O-16 on page O-37). These contacts are "dry," and are rated at 1 A at 24 VDC. They are **not** recommended for AC mains line current.

A contact closure placed across pins 1 and 6 will also cause an alarm condition. The alarm outputs of the PSU-101 could be wired directly to these pins allowing the CONFIG-1 card to report PSU failures also.
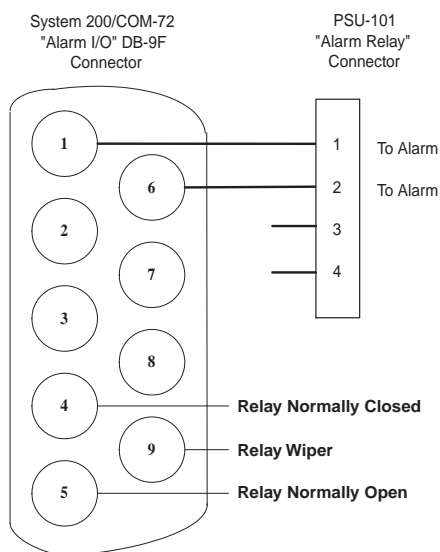
FIGURE O-16: Alarm I/O Connector

FOR-22 Interface Wiring for IMF-3

The FOR-22s are connected to the Matrix frame through the two RJ-45 connectors on the IMF-3 rear panel assembly to which the FOR-22 is connected. For connection to a matrix frame refer to the "Matrix Frame to IMF-3 Interface Wiring" on page O-24.

The user side of the FOR-22 for each channel appears on a DB-9M connector on the rear of the IMF-3 frame. Figure O-17 on page O-38 shows the pinout of either one of these connectors. Each channel is identical.

The following paragraphs describe how to wire for the various type of inputs and outputs available on this connector, which are:

•   External Audio Devices

- Call Signal Input

- Relay Contacts.
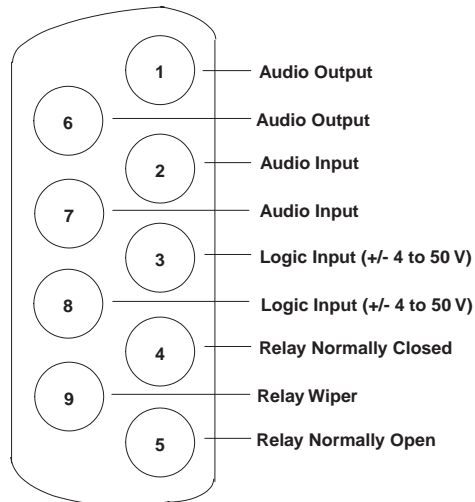
FIGURE O-17: Pinout of the DB-9M I/O Connectors for FOR-22s

External Audio Devices

Connect external audio devices to the FOR-22 ports through the two DB-9M connectors labeled "I/O" on the rear panel. Both audio input and output are transformer isolated. For more information on the various level ranges available on the input and output refer to the FOR-22 chapter of this manual.

Call Signal Input

The Call Signal input is used to receive a call/logic input signal from an external device and send it to the Matrix. The voltage across the pins required to receive a call signal ranges from 4 to 50 V; it can be either positive or negative polarity or AC. The input will draw between 4 and 8 ma.

Relay Contacts

Each FOR-22 channel features a relay that is associated with the logical call signal output of a port. A relay's function depends on the function assigned to the FOR-22 port. Some port functions automatically dedicate the use of the relay. For example, a two-way radio port function uses the relay to key the transmitter. Alternatively, a relay can be assigned to

operate with any label in the system: when that label is activated (either by a talk, listen, or both as set from the configuration program), the relay will be activated. For details on configuring the use of a relay, see the *Matrix Plus 3 PGM-WIN System Configuration* manual.

You can use the relay to activate an external device, such as an applause light in a studio, a cue light, or a security-door lock. The relays feature both "normally open" and "normally closed" contacts. The contacts are rated at 1 a at 24 VDC; they are not designed for switching mains AC line voltage.

CCI-22 Interface Wiring for IMF-3

Each channel of a CCI-22 connects to the matrix frame port through a RJ-45 connector on the IMF-3 rear-panel assembly to which the CCI-22 is connected. For connection to a Matrix frame refer to "Matrix Frame to IMF-3 Interface Wiring" on page O-24. For internal jumper settings and adjustments refer to the CCI-22 section in this manual.

The user side of the CCI-22 for each channel appears on a pair of DB-9M connectors on the rear of the IMF-3 frame. Figure O-18 on page O-39 shows the pinout of either one of these connectors. Both DB-9s are paralleled such that both Party-Line channels are available on each connector. It is possible to wire one DB-9 connector as channel #1 and the second DB-9 as channel #2 or bring both channels out either DB connector together to create a TW-type, party-line connection.

```
  1  —— CC/RTS Channel #2
 6  —— CC/RTS Channel #1
  2  —— Ground Channel #2
 7  —— Ground Channel #1
  3  —— + 30 V DC Power Channel #2
 8  —— + 30 V DC Power Channel #1
  4  —— Audio Channel #2
 9  —— Audio Channel #1
  5  —— No Connect
```
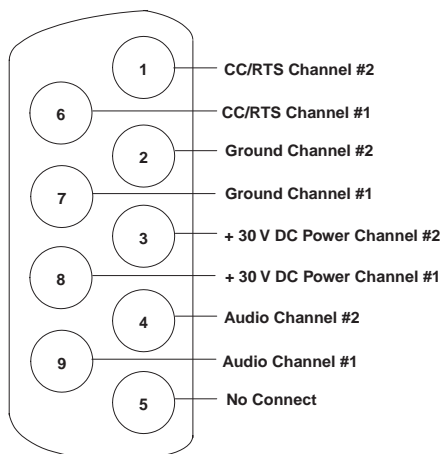
FIGURE O-18: Pinout of the DB-9M Interface I/O Connectors for CCI-22

Clear-Com Party Lines General Discussion

Stations on Clear-Com party lines connect to each other with two-conductor shielded microphone cable. One conductor carries the DC power (28 to 30 V) for that channel, while the other conductor carries the duplex two-way intercom audio signal plus DC "Call Light" signaling for that channel. The shield acts as common ground for both power and signal for the channel.

Power to the CCI-22 interface channels must be provided by the external party line. The power connection for each channel is the "+30 VDC Power" pin on the appropriate DB-9M Interface I/O connector on the rear-panel assembly. The CCI-22 channel is essentially just another "Beltpack" on the party line.

The power pin has DC filtering circuitry that provides a high impedance for the audio such that power can be received from a "powered line or TW line" as is common with RTS systems. For TW operation tie the AUDIO and POWER pins together.

Each party-line channel requires exactly one termination circuit. The termination circuit is usually built into the system component that provides the party line's power. Connecting more than one termination circuit to a party line will impair the sidetone null and degrade the line's audio quality.

When a CCI-22 party-line channel is connected to a Clear-Com party line, the Clear-Com/Other Select pin must be left floating. Grounding this pin selects the RTS mode, which is incompatible with Clear-Com party lines.

TEL-14 Interface Wiring for IMF-3

The TEL-14 is connected to the Matrix frame port through the RJ-45 connectors on the IMF-3 rear-panel assembly to which the TEL-14 is connected. The upper DB-9M connector is used to connect to the first telephone line, A. The upper RJ-45 connector is used to connect telephone line A to the Matrix frame. The lower DB-9M connector is used to connect to the second telephone line, B. The lower RJ-45 connector is used to connect telephone line B to the Matrix frame.

To allow use of a common RJ-11 terminated telephone line, Clear-Com provides two DB-9F to RJ-11 adapters (CC# 770025).

For connection to a Matrix frame refer to "Matrix Frame to IMF-3 Interface Wiring" on page O-24.

For internal dip-switch settings and adjustments, refer to the TEL-14 section in this manual.

Connection To The Telephone Line

Connecting the telephone line can be accomplished with two methods. One would be to use the RJ-11 to DB-9F adapters supplied by Clear-Com with the TEL-14 interface. The second method would be to directly wire each telephone line to a DB-9F connector using the pinouts in Figure O-19 on page O-41, which shows the wiring diagram of the adapter.
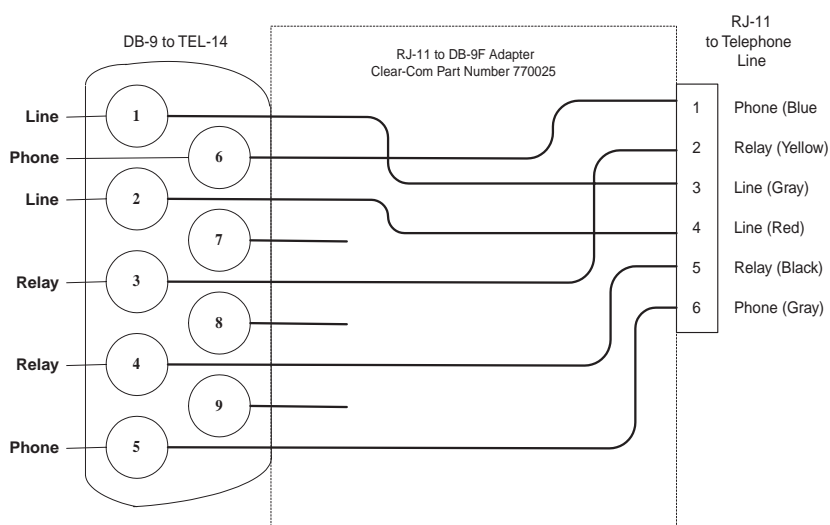
FIGURE O-19: RJ-11 to DB-9 Adapter for TEL-14 Interfaces

The phone line should be an outside line directly connected to the telephone company central office, and isolated from in-house phone systems.

Telephone Set

Although it is possible to use a parallel-connected telephone set to originate calls, it is preferable to use a series-connected telephone set with the TEL-14. This will prevent the impedance of the telephone set from disturbing the telephone line impedance recognized by the TEL-14. It will also allow the TEL-14 to automatically disconnect the telephone when it comes "off-hook." A standard telephone may be installed in series with the TEL-14 by connecting it to pins 1 and 6 of the RJ-11 jack. If telephones must be connected in parallel with the telephone line(s) during

the TEL-14's automatic nulling process, all additional standard telephones must be "on-hook."

Relay Contacts

A pair of relay contacts for each telephone line rated at 2A at 24 VAC are available on the DB-9 or the RJ-11 of the adapter. This pair of contacts is normally open when the line is "on-hook," and closes when the interface goes "off-hook." These contacts are not connected to any other circuitry inside the interface, and can be used to energize a line-in-use indicator light on a standard multiline phone set, or for any other low-power application.

RLY-6 Interface Wiring for IMF-3

The RLY-6 Relay Interface Module provides connection of six programmable relays to the Matrix so that each relay is directly controlled from the Matrix. Multiple RLY-6 Interfaces can be daisy chained to provide connection of up to 60 relays to the Matrix. RLY-6 and GPI-6 modules can be mixed together up to the total limit of 60 items. Five RLY-6 and five GPI-6 modules would provide 30 relays and 30 inputs for a total of 60 inputs and outputs.

In the MMX-24/16/8 the built-in RLY and GPI modules become the first 12 in the set of possible 60 inputs and outputs. Extra modules can be added either in the two interface slots in that frame or with an external IMF-3 frame as described below.

To Matrix Frame

To connect the RLY-6 to the Matrix frame, plug one end of a RJ-45 cable (eight wires with no reversal) into the GPI/RLY INTERFACE connector on the back of the frame. Plug the other end into the top RJ-45 (CH. A MATRIX) connector for the RLY-6.

To connect an additional RLY-6 Interface, plug one end of a short RJ-45 cable into the lower RJ-45 (CH. B MATRIX) for the first RLY-6. Then, plug the other end into the top RJ-45 (CH. A MATRIX) connector for the additional RLY-6. Additional RLY-6 Interfaces are added in the same way, using daisy-chain wiring. If there are multiple RLY-6s used, the relays in the first will be numbered 1 to 6, second will be 7 to 12, etc. GPI-6 modules can be mixed in this daisy-chained scheme. The maximum combined length of all the RJ-45 cables should not exceed 20 ft. (6 m). Refer to Figure O-20 on page O-43.

FIGURE O-20: Rear View of IMF-3 Frame

To External Device

To connect external devices to the RLY-6 Interface, use the two DB-9M connectors on the rear cable assembly panel for the interface. Figure O-21 on page O-44 shows the pin assignment of these connectors as viewed from the frame side of the connector.

If a DB-9F is plugged into the connector labeled CH. A I/O, relays 1 to 3 are available on that connector. The connector labeled CH. B I/O has the contacts for relays 4 to 6. In Figure O-21 on page O-44, the labels on the pins apply to either connector. Example: #1/4 COM refers to the wiper of relay 1 if it is connected to CH. A and the wiper of relay 4 if it is connected to CH. B.
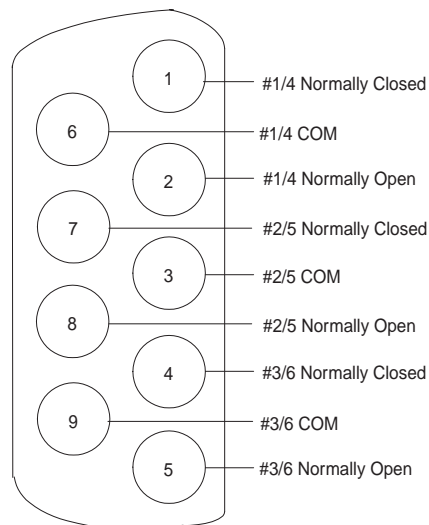
**FIGURE O-21: RLY-6 Interface DB-9M Connectors
Pinout**

Configuration

To associate a relay to a label, use the configuration program, as described in its manual.

GPI-6 Interface Wiring for IMF-3

The GPI-6 Input Interface Module provides connection of six programmable inputs to the Matrix so that each input can control a predefined Matrix function. Multiple GPI-6 Interfaces can be daisy-chained to provide connection of up to 60 inputs to the Matrix. RLY-6 and GPI-6 modules can be mixed together up to the total limit of 60 items. Five RLY-6 and five GPI-6 modules would provide 30 relays and 30 inputs for a total of 60 inputs and outputs.

In the MMX-24/16/8 the built-in RLY and GPI modules become the first 12 in the set of possible 60 inputs and outputs. Extra modules can be added either in the two interface slots in that frame or with an external IMF-3 frame as described below.

To Matrix Frame

To connect the GPI-6 to the Matrix frame, plug one end of a RJ-45 cable (eight wires with no reversal) into the GPI/RLY INTERFACE connector

on the back of the frame. Plug the other end into the top RJ-45 (CH. A MATRIX) connector for the GPI-6.

To connect an additional GPI-6 Interface, plug one end of a short RJ-45 cable into the lower RJ-45 (CH. B MATRIX) for the first GPI-6. Then, plug the other end into the top RJ-45 (CH. A MATRIX) connector for the additional GPI-6. Additional GPI-6 Interfaces are added in the same way, using daisy-chain wiring. If there are multiple GPI-6s used, the inputs in the first will be numbered 1 to 6, second will be 7 to 12, etc. RLY-6 modules can be mixed in this daisy-chained scheme. The maximum combined length of all the RJ-45 cables should not exceed 20 ft. (6 m). Refer to Figure O-20 on page O-43.

To External Device

To connect external devices to the GPI-6 Interface, use the two DB-9M connectors on the rear cable assembly panel for the interface. Figure O-22 on page O-45 shows the pin assignment of these connectors as viewed from the frame side of the connector.

If a DB-9F is plugged into the connector labeled CH. A I/O, inputs 1 to 3 are available on that connector. The connector labeled CH. B I/O has inputs 4 to 6. In Figure O-22 on page O-45, the labels on the pins apply to either connector.
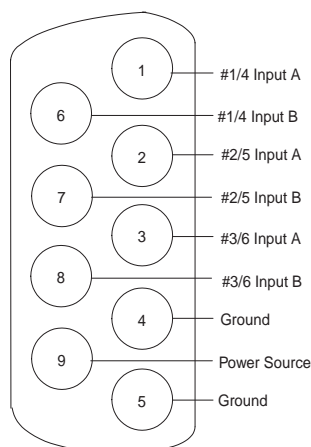
FIGURE O-22: GPI-6 Interface DB-9M Connectors Pinout
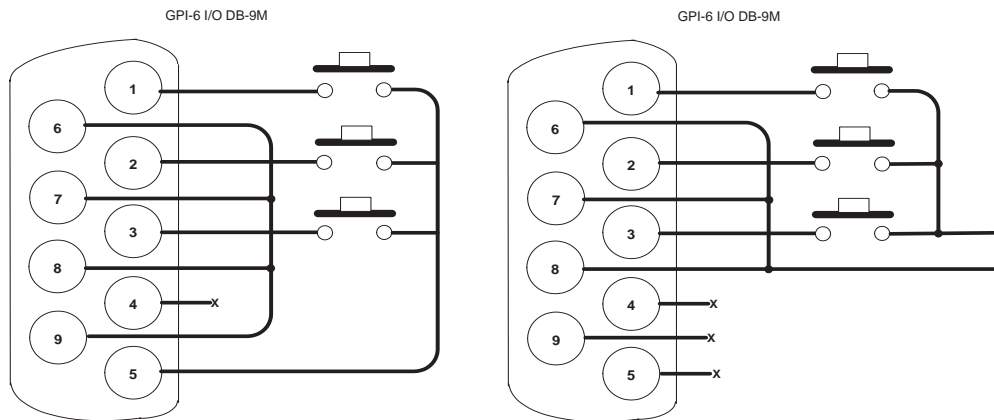
FIGURE O-23: GPI-6 Application Examples

Figure O-22 on page O-45 and Figure O-23 on page O-46 show how to connect switches or contacts using the power source provided by the GPI-6 module or powering switches from external sources. Each input can be wired to be isolated from each other as a further variation.

Configuration

To define an input function, use the configuration program, as described in its manual.

Matrix Station Miscellaneous Connector Wiring

Most local devices connect with the station via the Miscellaneous connector.

The following paragraphs discuss how to wire the various functions available on the Miscellaneous connector. The following topics are discussed:

• External Program Feed Input

• Binaural Headset (All Stations Except ICS-2003/2110/1016)

• Logic Input #1 and Logic Input #2

• Mute Relay Contacts

• Auxiliary Relay Contacts.
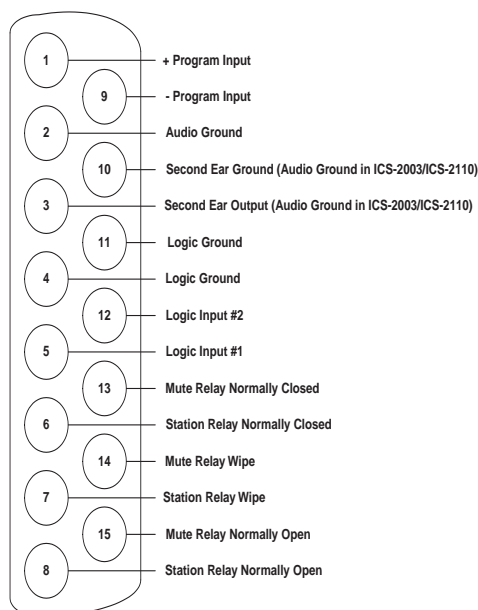
FIGURE O-24: Miscellaneous connector pinout

Pin labels:

- 1 — + Program Input
- 9 — - Program Input
- 2 — Audio Ground
- 10 — Second Ear Ground (Audio Ground in ICS-2003/ICS-2110)
- 3 — Second Ear Output (Audio Ground in ICS-2003/ICS-2110)
- 11 — Logic Ground
- 4 — Logic Ground
- 12 — Logic Input #2
- 5 — Logic Input #1
- 13 — Mute Relay Normally Closed
- 6 — Station Relay Normally Closed
- 14 — Mute Relay Wipe
- 7 — Station Relay Wipe
- 15 — Mute Relay Normally Open
- 8 — Station Relay Normally Open

External Program Feed Input

The external program feed input allows the station operator to monitor audio from an external source while simultaneously monitoring the intercom audio.

The input is designed to accept a balanced, line-level audio feed at a maximum level of 0 dB. On some stations there is no "Program" volume control. This is just a summing input to the "Listen" amplifier.

The program feed input passes through the station's "Program" volume control before being mixed with the audio at the station. The "Program" feed ("program audio") can be heard on the station's speaker and headset; it cannot be heard by other stations in the Matrix.

To connect an External Program Feed to the station connect the balanced audio pair to pins 1 and 9 and connect a shield or ground connection if available to pin 2 of the connector (refer to Figure O-24 on page O-47).

Binaural Headset (All Stations Except ICS-2003/2110/1016)

The second ear output allows an external binaural headset to be connected to the station. One side of the binaural headset is connected to the station's audio feed from the Matrix Frame; this is "intercom audio,"

and its volume level is controlled by the "Intercom" knob on the front panel. The other side of the binaural headset is connected to the station's external program feed input; this is "program audio," and its volume level is controlled by the "Program" knob on the front panel. To implement this connection:

1. Connect one side of the headset to the standard headset connector audio output.

2. Open the configuration program.

3. Go to "Configure - Local Preferences."

4. Select your station and set the check mark in the "Enable Split-Ear Headset" option.

5. Connect the other side of the headset to the Second Ear Output on the Miscellaneous Connector (pin 3 and 10). The Second Ear Output provides the program audio only (refer to Figure O-24 on page O-47).

Logic Input #1 and Logic Input #2

This section describes how to connect to the logic inputs of the station and briefly discusses the functions that can be implemented.

The functions that are available are listed below. For a more detailed description and instructions on how to implement them with the Configuration Program refer to page S1-9 of the ICS-2003 chapter in this manual.

- Mic On/Off (Toggle)

- Mute Mic Output To Frame

- Mic Off (Momentary)

- Answerback Talk/Clear

- Speaker Off

- PTT: Activate All Talks

- Activate Talk Switch #1

- Activate Talk Switch #2

- Activate Listen Labels Button

- Studio Announce

- PTT: Activate Two-Way Radio Talks.

Logic Input #1 supports only active low inputs (0 to 2 VDC with reference to ground), while Logic Input #2 can support either active high (4 to 30 VDC) or active low inputs, depending on whether a jumper has been installed at JP2 (active low is the default with no jumper installed). Refer to the ICS-2002 chapter of this manual for details on setting this jumper. The ICS-2003/2110 only supports an active low input on both inputs.

Use normally open type switches to activate the logic inputs. Connect the switches as follows (refer to Figure O-24 on page O-47):

Logic Input #1—pins 4 to 5 (pin 4 = ground)

Logic Input #2—Pins 11 to 12 (pin 11 = ground)

Do not apply external voltage to the logic inputs, except in the case of Logic Input #2 being configured for an active high input as described above.

Mute Relay Contacts

This set of relay contacts will be activated whenever any talk path is activated at the station. You can use the contacts to activate an external device when a talk path is active, for example muting a control room monitor speaker. Refer to Figure O-24 on page O-47 for wiring details.

Both "normally open" and "normally closed" contacts are provided. They are rated at 1 A at 24 VDC. This relay is not designed for switching mains AC line voltage. To switch an external device that runs on mains AC line voltage, use an external relay (or other switching mechanism) that is activated by this relay.

Auxiliary Relay Contacts

Each Matrix Plus 3 System station includes a relay that is controlled by the system program independent of the local station function. This relay can be assigned to any label(s) in the system, which will activate whenever a talk or listen is set to that label(s). If activating the relay is the only action desired, assign the relay to a Control label. For more details refer to the *Matrix Plus 3 PGM-WIN Configuration Program* manual.

You can use the relay to activate an external device, such as an applause light in a studio, a cue light, or a security door lock. Figure O-24 on page O-47 shows the wiring of the relay contacts to the "Miscellaneous" connector.

Both "normally open" and "normally closed" contacts are provided. They are rated at 1 A at 24 VDC. This relay is not designed for switching mains AC line voltage. To switch an external device that runs on mains AC line voltage, use an external relay (or other switching mechanism) that is activated by this relay.

Binaural Headset (ICS-2003/2110)

The ICS-2003/2110 has a second earphone output, but it functions and is wired different from all other ICS stations. This output is not available on the Miscellaneous connector, but on the main board of the station on a separate header connector. If a six pin headset connector were installed on the front or rear of the station, this output would be available.

The default configuration of the station has both earphone outputs being fed with both intercom and program audio. To separate the Program input to the second ear only, use the PGM-WIN Configuration Program (Configure - Local Preferences).

Figure O-25 on page O-50 shows the wiring of a six pin XLR connector for a binaural headset.
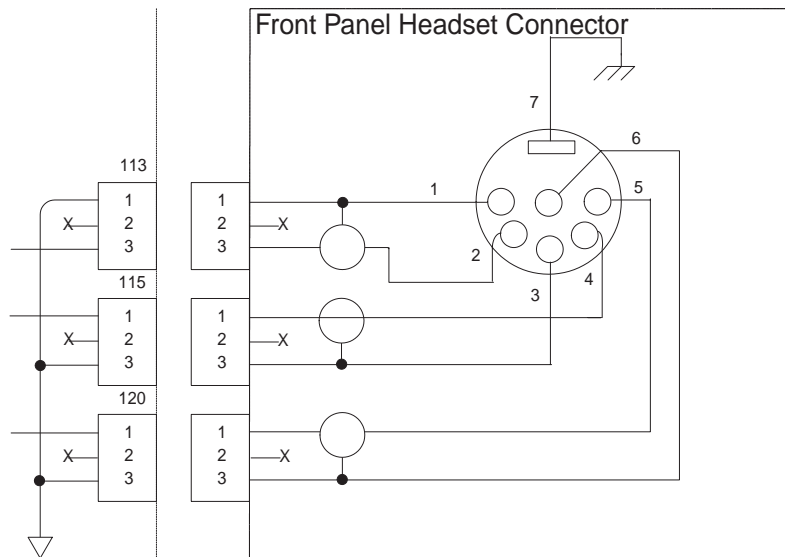
FIGURE O-25: Binaural Headset Wiring

OPT-100 Auxiliary Audio I/O Option

If installed, the OPT-100 Auxiliary Audio I/O Option provides three additional audio output signals, plus a set of relay contacts. The following functions are available:

- Auxiliary Audio Line Level Output

- "Hot Mic" Output

- SA (Stage/ Studio) Announce Output

- SA Relay.

The diagram shown in Figure O-26 on page O-51 is the pinout of the DB-15F "Auxiliary Audio I/O" connector on the back of the intercom station. The following paragraphs describe each function and how to wire for it.

"Auxiliary I/O" Connector DB-15F

Pin	Signal
1	+ SA Output
9	- SA Output
2	Audio Ground
10	Audio Ground
3	SA Relay Normally Open
11	Ground
4	SA Relay Wiper
12	Ground
5	SA Relay Normally Closed
13	- Aux Line Level Out
6	+ Aux Line Level Out
14	Ground
7	Ground
15	- Hot Microphone Out
8	+ Hot Microphone Out
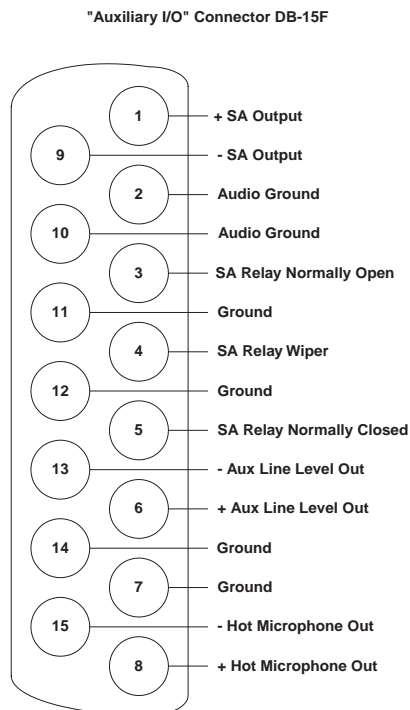
FIGURE O-26: Auxiliary I/O Connector

Auxiliary Audio Line Level Output

The Auxiliary Audio Line Level output is a balanced line-level transformer-isolated feed of the same audio signal that is sent to the

station's internal speaker. For example, this output could be used to feed an external amplifier connected to a set of ceiling loudspeakers.

Connect to pins 6 and 13 for a balanced output. Pin 14 is available as a shield or ground source. Refer to Figure O-26 on page O-51.

Hot Mic Output

The "Hot Mic" output is a balanced line-level transformer-isolated feed of the signal from the currently selected microphone (either the panel microphone or the headset microphone).

The Hot Mic output is active regardless of whether the station has talk paths set, and regardless of the settings of the front panel controls on the station.

Connect to pins 8 and 15 for a balanced output. Pin 7 is available as a shield or ground source. Refer to Figure O-26 on page O-51.

SA (Studio/Stage Announce) Output

The SA output is a balanced line-level transformer-isolated feed of the same signal sent to the Hot Mic output, except that it is only active when the SA button on the station's front panel is pressed or when activated by Logic Input #1 or #2 configured for the Studio Announce Function.

Connect to pins 1 and 9 for a balanced output. Pin 2 is available as a shield or ground source (refer to Figure O-26 on page O-51).

SA Relay

The SA Relay is activated whenever the SA button on the front panel of the station is pressed or when activated by Logic Input #1 or #2 configured for the Studio Announce Function. Both "normally open" and "normally closed" contacts are provided. They are rated at 1 A at 24 VDC. This relay is not designed for switching mains AC line voltage. To switch an external device that runs on mains AC line voltage, use an external relay (or other switching mechanism) that is activated by this relay.

Refer to Figure O-26 on page O-51. The chart below shows the pins available for the SA Relay:

- N. O. (normally open)—Pin 3
- WIPER (common)—Pin 4
- N.C. (normally closed)—Pin 5

Matrix Station Accessory Connector

Connections to stations accessory key panels are via the Accessory Panel connector. To connect an Accessory Panel use the DB-9 connector cable supplied with the Accessory panel. Connect the cable between the station and the input connector of the first Accessory Panel. To connect a second panel use another DB-9 cable and connect it between the output connector of the first panel to the input connector of the second panel. Continue this process for as many Accessory panels as needed for each station.

If a custom length cable is necessary, use a nine-conductor cable of at least 24 AWG are larger wire and wire all pins one-to-one with a male on one end and a female on the other. The distance between the intercom station and the last accessory panel should be no more than 25 ft.

Pin	Signal
1	Serial Data Out
6	+ Voltage Unregulated
2	Serial Clock Out
7	+ Voltage Unregulated
3	Reset (Strobe)
8	Ground
4	Key Data In
9	Ground
5	No Connect
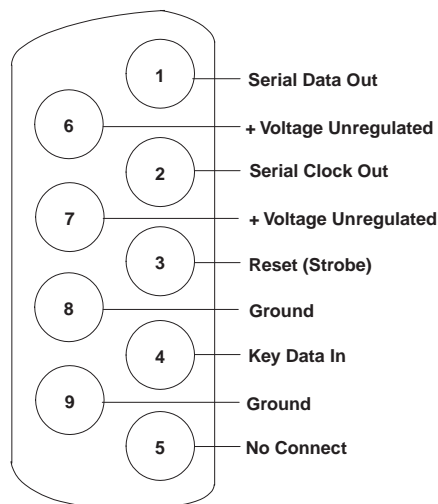
FIGURE O-27: Accessory Panel Connector Pinout
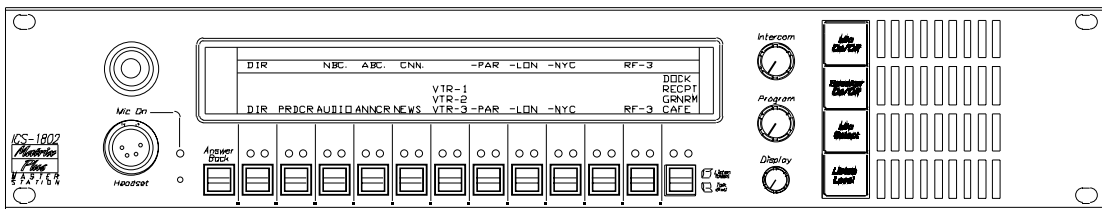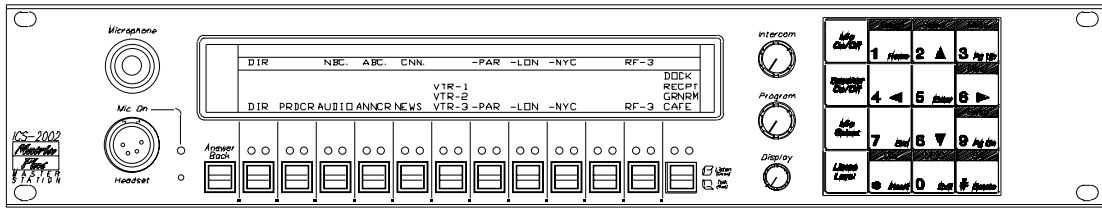
Matrix Plus 3 System   **ICS-2002/1802**

MASTER INTERCOM STATION

Introduction

This section describes the installation, including wiring connections to the matrix frame and other equipment, and technical specifications of the ICS-2002 and ICS-1802 stations. The station wiring is the same for all models with identical rear-panel connectors. The ICS-1802 is almost identical to the ICS-2002, with the exception that the ICS-1802 doesn't have the 12 multifunctional buttons. For operation information, see the *Matrix Plus 3 Operation Manual;* for troubleshooting and maintenance information, see the *Matrix Plus 3 Maintenance Manual;* and for programming information, see the *PGM-WIN System Configuration Manual.*

Most of this section is also applicable to the following models:

- ICS-1502

- ICS-102

- ICS-92

- ICS-62

- ICS-52.

This chapter covers the following subjects related to station installation. Items related to all stations are indicated.

- mounting stations

- accessory panels (all)

- wiring (all)

- mains AC power

- adjustments

- configuration (all)

- specifications.

Mounting Stations

Locate all intercom stations at comfortable heights for operation and leave at least 2 in. of clearance behind the rear of the station's chassis to allow for cable connectors.

Accessory panels, such as the XP, XPL, or AP, that are intended to expand or enhance station operation are usually mounted next to or near the

station with which they are associated. They can be located as far as 25 ft. away from the station. A 6-ft. cable is supplied to connect them.

Wiring

This section provides detailed wiring diagrams for all stations wiring systems.

Matrix Plus 3 uses a twisted, 4-pair transmission scheme between the station and the frame using the industry standard RJ-45 connector. Refer to the Overview section of the *Matrix Plus 3 Installation Manual* for RJ-45 connector installation and use, and the type of cable needed for connection between stations and frames.

Most stations have a DB-15M and an RJ-45 connector to connect them to the frame. Stations with only a DB-15M connector include a kit containing one DB-15F/RJ-45 adapter. The adapter allows the use of RJ-45 connectors on both ends of the connection between the frame and the station.

Connections to external devices via the Miscellaneous connector, use the included is a DB-15M connector to construct one or more cables to connect external devices to the station.

The following paragraphs describe connecting the station to the wires leading to the matrix frame, and all the connections between the station and local devices. Each of the following sections describes cable and station-connector wiring:

*   analog matrix frame to station wiring

*   matrix station Miscellaneous connector wiring

*   OPT-100 Auxiliary Audio I/O option.

Analog Matrix Frame to Station Wiring

The analog audio RS-422 data communication module (COM-10) uses a 4-pair wiring scheme between the frame and stations. This module requires an MVX-A8 in the frame.

Although some Matrix Stations have a DB-15M (male) connector for connection to the Matrix frame, most have a built-in RJ-45 connector. For those stations with a DB-15 male connector, Clear-Com provides a properly wired DB-15F (female) to RJ-45 adapter for direct connection

with RJ-45 terminated cables. Additionally, stations configured for digital communication are equipped with a BNC.

Four-pair analog wiring is typically wired with a CAT3 or CAT5 RJ-45 cable.

• Pair 1 transmits analog audio from the matrix port to the station.

• Pair 2 transmits RS-422 data from the station back to the matrix card port.

• Pair 3 transmits audio from the station to the matrix card port.

• Pair 4 transmits RS-422 data from the matrix port back to the station.

ATT-T568B (Modular Jumpers Wired One to One)

Matrix Frame End				Station End
RS-422 Receive +	1	Pair 2	1	
RS-422 Receive -	2		2	
Audio Receive +	3	Pair 1	3	
Audio Send +	4		4	
Audio Send -	5	Pair 3	5	
Audio Receive -	6		6	
RS-422 Send +	7	Pair 4	7	
RS-422 Send -	8		8	

FIGURE S1-1: Matrix Frame to Station Wiring

Matrix Station Miscellaneous Connector Wiring

Most local devices connect with the station via the Miscellaneous connector.

The following paragraphs discuss how to wire the various functions available on the Miscellaneous connector.

Pin	Signal
1	+ Program Input
9	- Program Input
2	Audio Ground
10	Second Ear Ground
3	Second Ear Output
11	Logic Ground
4	Logic Ground
12	Logic Input #2
5	Logic Input #1
13	Mute Relay Normally Closed
6	Station Relay Normally Closed
14	Mute Relay Wipe
7	Station Relay Wipe
15	Mute Relay Normally Open
8	Station Relay Normally Open
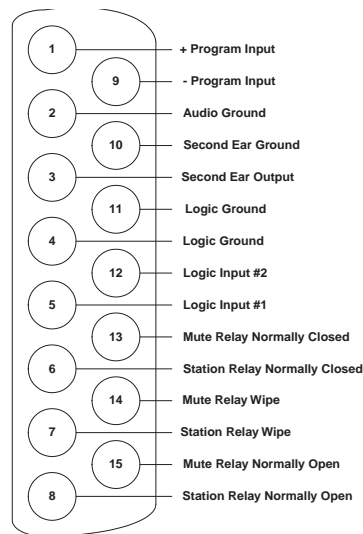
FIGURE S1-2: Miscellaneous Connector Pinout

External Program Feed Input

The external program feed input allows the station operator to simultaneously monitor audio from an external source and intercom audio.

The input is designed to accept a balanced, line-level audio feed at a nominal level of 0 dB. The program feed input passes through the station's "Program" volume control before being mixed with the audio at the station. The program feed (program audio) can be heard on the station's speaker and headset; it cannot be heard by other stations in the Matrix system.

To connect an external program feed to the station:

1. Connect the balanced audio pair to pins 1 and 9.

2. Connect a shield or ground connection if available to the connector's pin 2 (see Figure S1-2 on page S1-4).

Logic Input #1 and #2

Each input can control one of several functions, determined through the configuration program. Typically, these inputs are connected to an external foot switch, a panel-mounted switch, or the logic output of another device.

The following functions are available:

- Mic On/Off—toggles the station's microphone on and off.

- Mute Microphone Output To Frame—turns off the audio from the station to the frame. It does not turn off the Hot Mic output (described in "OPT-100 Auxiliary Audio I/O Option" on page S1-20). For an example of how to use this option, see "External Program Feed Input" on page S1-4.

- Mic Off —momentarily turns off the station's microphone.

- Answer Back Talk/Clear—the same functions as the station's "Answer Back" key. Holding down the switch activates a talk to a label in the answer-back stack. To clear the label, quickly press and release the switch.

- Studio Announce—sends the output of the station's selected microphone (panel or headset) to the station's Studio Announce (SA) audio output, and activates the SA relay. The microphone output is not sent to the frame. The SA output and relay are only present if the station has the OPT-100 Auxiliary Audio I/O Option installed. (The SA options are described in "OPT-100 Auxiliary Audio I/O Option" on page S1-20).

- Speaker OFF—turns off the station speaker, disabling all audible output from the station.

- PTT: Activate All Talk Keys—implements a push-to-talk function for all talk selectors. When the logic input is active, the station operates normally. When the logic input is deactivated, all active talk selectors are disabled. Any controls (relays, etc.) assigned to the labels are activated or deactivated along with their assigned labels. The LED indicators associated with the active talk selectors operate normally regardless of the PTT status. This input only controls latched talks.

- Activate Talk Switch #1—equivalent to pressing the station's first (left most) talk selector; a momentary and latching activation.

- Activate Talk Switch #2—equivalent to pressing the station's second talk selector; a momentary and latching activation.

- Activate Listen Labels Button—equivalent to pressing the "Listens" button on the keypad; all modes of the "Listens" button are supported.

- PTT: Activate Two-Way Radio Keys—implements a push-to-talk function for all two-way radio talk selectors. When the logic input is active, the station operates normally. When the logic input is deactivated, all active two-way radio talk selectors are disabled. Any controls (relays, etc.) assigned to the labels are activated or deactivated along with their assigned labels. The LED indicators associated with the active two-way radio talk selectors operate normally regardless of the PTT status. This input only controls latched talks.

Use normally open type switches to activate the logic inputs. Connect the switches as follows (Figure S1-2 on page S1-4):

Logic input #1—pins 4 to 5 (pin 4 = ground)

Logic input #2—Pins 11 to 12 (pin 11 = ground).

Note: Do not apply external voltage to the logic inputs.

Differences Between the Two Inputs—Logic input #1 supports only active low inputs (0 to 2 VDC with reference to ground), while logic input #2 can support either active high (4 to 30 VDC) or active low inputs, depending on whether a jumper has been installed at JP2 as shown in Figure S1-3 on page S1-6 (active low is the default with no jumper installed).
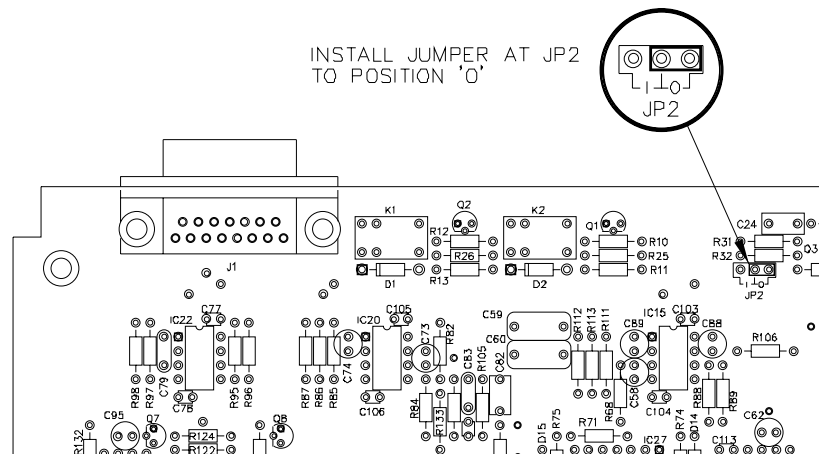
FIGURE S1-3: Jumper Setting for Logic Input Level Selection for Logic Input #2

Mute Relay Contacts

The mute relay is activated whenever any talk selector is activated at the station. The mute relay is commonly wired such that whenever it is activated, the volume of the monitor speaker in that room is decreased (muted). See Figure S1-2 on page S1-4.

Both normally open and normally closed contacts are provided. They are rated at 1 Amp at 24 VDC. This relay is not designed for switching mains AC line voltage. To switch an external device running on mains AC line voltage, use an external relay (or other switching mechanism) activated by this relay.

Programmable Relay Contacts

Each station includes a relay controlled by the system program and independent of the local station function. This relay can be assigned to any label(s) in the system, which will activate whenever a talk or listen is set to that label(s). If activating the relay is the only action desired, assign the relay to a Control label. See the *PGM-WIN System Configuration Manual* for more details.

The relay can activate an external device, such as an applause light in a studio, a cue light, or a security door lock. Any programmable relay in the system can be activated from any station in the system, including a direct-inward-access caller. Figure S1-2 on page S1-4 shows the wiring of the relay contacts to the Miscellaneous connector.

Both normally open and normally closed contacts are provided. They are rated at 1 Amp at 24 VDC. This relay is not designed for switching mains AC line voltage. To switch an external device running on mains AC line voltage, use an external relay (or other switching mechanism) activated by this relay.

Binaural Headset

The external program feed input allows an external binaural headset to be connected to the station. One side of the binaural headset is connected to the station's audio feed from the Matrix Frame (intercom audio) and its volume level is controlled by the "Intercom" knob on the front panel. The other side of the binaural headset is connected to the station's external program feed input (program audio) and its volume level is controlled by the "Program" knob on the front panel. To implement this connection:

1.   Connect one side of the headset to the standard headset connector audio output.

2.   Open the configuration program.

3.   Go to "Configure - Local Preferences."

4.   Select the station and set the check mark in the "Enable Split Ear Headset" option.

5.   Connect the other side of the headset to the Second Ear Output on the "Miscellaneous" Connector (pin 3 and 10). The Second Ear Output provides the program audio only. See Figure S1-2 on page S1-4.

OPT-100 Auxiliary Audio I/O Option

The OPT-100 Auxiliary Audio option provides the following features:

•   Hot Mic output

•   SA audio and relay outputs

•   auxiliary audio line level output.

Figure S1-4 on page S1-9 shows the pinout for the intercom station's DB-15F Auxiliary Audio I/O connector. Following are descriptions and wiring information for the OPT-100 Auxiliary Audio I/O option.

"Auxiliary I/O" Connector DB-15F

Pin	Signal
1	+ SA Output
9	- SA Output
2	Audio Ground
10	Audio Ground
3	SA Relay Normally Open
11	Ground
4	SA Relay Wiper
12	Ground
5	SA Relay Normally Closed
13	- Aux Line Level Out
6	+ Aux Line Level Out
14	Ground
7	Ground
15	- Hot Microphone Out
8	+ Hot Microphone Out
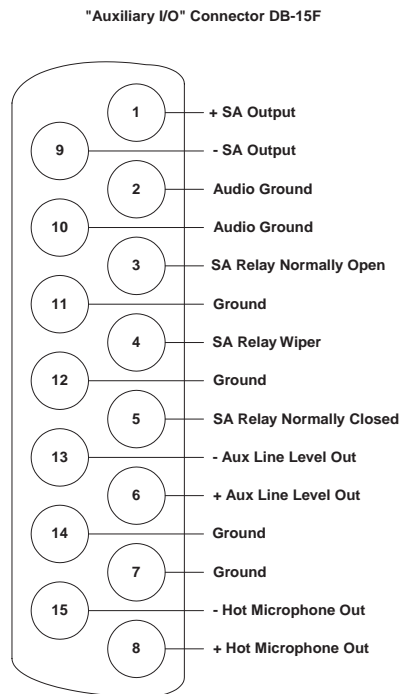
FIGURE S1-4: Auxiliary I/O Connector

Hot Mic Output

The Hot Mic output is a balanced, line-level, transformer-isolated feed of the signal from the currently selected microphone (panel or headset). The Hot Mic output is active regardless of whether the station has talk paths set and regardless of the front-panel's control settings.

Connect to pins 8 and 15 for a balanced output. Pin 7 is available as a shield or ground source (see Figure S1-4 on page S1-9).

Studio/Stage Announce Audio and Relay Outputs

The SA output is a balanced, line-level, transformer-isolated feed with the same signal sent to the Hot Mic output, except it is only active when the SA button on the station's front panel is pressed or when activated by Logic Input #1 or #2, which is configured for the Studio Announce Function.

Connect to pins 1 and 9 for a balanced SA audio output. Pin 2 is available as a shield or ground source (see Figure S1-4 on page S1-9).

Both normally open and normally closed contacts are provided. They are rated at 1 Amp at 24 VDC. This relay is not designed for switching mains AC line voltage. To switch an external device running on mains AC line voltage, use an external relay (or other switching mechanism) activated by this relay (see Figure S1-4 on page S1-9). Table 1 on page S1-10 shows the pins available for the SA relay.

Pin Description	Pin Number
N.O. (normally open)	3
WIPER (common)	4
N.C. (normally closed)	5

Table 1: Studio Announce Pin Availability

Auxiliary Audio Line Level Output

The Auxiliary Audio Line Level output is a balanced, line-level, transformer-isolated feed of the input to the station's internal speaker. For example, this output could be used to feed an external amplifier connected to loudspeakers.

Connect to pins 6 and 13 for a balanced output. Pin 14 is available as a shield or ground source (see Figure S1-4 on page S1-9).

Mains AC Power

The stations require a three-conductor, grounded mains AC power outlet. The stations can operate at either 115 or 230 V AC. Choose the input voltage by using the line-voltage selector switch located on the AC power input module inside the rear of the station chassis. The rear panel has a check box indicating the factory setting for AC line voltage.

To set the AC line input voltage:

1. Remove the AC power cord.

2. Remove the top cover of the station.

3. Select either "115 V" or "230 V" on the AC power input module.

4.   Ensure the proper fuse is used for selected AC input voltage:

•   For 115-V operation, use a 20 mm 0.5 A slow-blow fuse.

•   For 230-V operation, use a 20 mm 0.25 A slow-blow fuse.

Make sure the factory-supplied spare fuse is the proper rating for the selected AC input voltage. The spare fuse is located in the spare-fuse holder of the AC power input module.

To replace the installed fuse and/or spare fuse:

1.   Remove the station's power cord from the power input module.

2.   Find the fuse block in the AC power input module, which is located to the left of the power input connector. Insert a small flathead screwdriver into the slot, which is on the right side of the fuse block, and pry off the cover.

3.   The installed fuse is held in the exposed clips at the back of the fuse block; pry it out with a small screwdriver and press-fit the replacement.

4.   The spare fuse is in a press-fit insert inside the fuse block; push on one end of the press-fit insert with your small screwdriver to pop it out.

Adjustments

The following station parameters are adjustable internally on the station's main PCB or externally by selecting options in the configuration program:

•   headset sidetone (main PCB)

•   panel microphone gain (main PCB)

•   speaker mute (configuration program)

•   page volume level (configuration program)

•   station-to-matrix card baud rate (configuration program).

All these parameters are set to factory defaults. Most stations should operate at these default settings; however, some applications may require readjustment.

Headset Sidetone

Sidetone is the sound of the user's voice in his headset.

To adjust sidetone:

1.   Remove the station cover.

2.   Find the sidetone control (marked "P2 SIDETONE") on the main PCB (see Figure S1-5 on page S1-12).

3.   Connect a headset to the station.

4.   While speaking into the headset microphone, use a small screwdriver to turn the sidetone control until the sidetone is at the desired level.

5.   Reinstall the station cover.
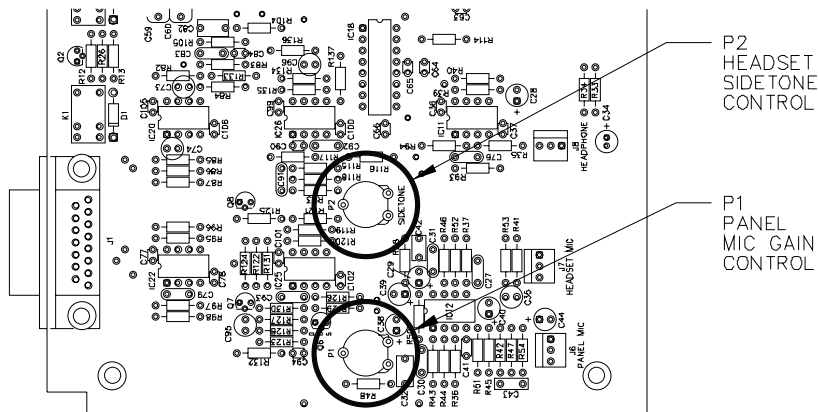
FIGURE S1-5: Sidetone and Panel Mic Gain Adjustment Controls

Panel Mic Gain

You can adjust the preamplifier gain of the panel microphone can be adjusted over a range of 0 to 10 dB; the maximum is the panel microphone gain's default setting. However, if two stations are talking to each other at the same time with the panel microphone gain set to maximum, feedback may occur even if the speaker mute (see "Speaker Mute" on page S1-13) is set to maximum. In this case, it will be necessary to turn the panel microphone gain down. Similarly, in some noisy

environments it may be necessary to turn the panel microphone gain down and have the operator talk more closely into the microphone.

To adjust the panel microphone gain:

1. Remove the station cover.

2. Use a small screwdriver to adjust the control marked "P1" on the Main PCB (see Figure S1-5 on page S1-12).

3. Reinstall the station cover.

Speaker Mute

When a panel microphone and a speaker are used together, feedback is possible. To reduce this possibility, the station software will mute (turn down) the speaker level by some predetermined amount when both the microphone and speaker are enabled. The speaker mute can be adjusted from 0 to 15 dB; its default setting is 6 dB.

To adjust the speaker mute, use the "Configure - Local Preferences" menu of the configuration program.

Page Volume Level

When Page Override is assigned to a label, the audio level at the destination station(s) is predetermined. This function allows talking to someone even if his station's volume control is off. Two things will happen when a station activates such a label:

*   If the destination speaker was off, it will turn on.

*   The station(s)'s speaker output will be at the predetermined level regardless of the "Intercom" volume control setting, unless this control is set higher than the predetermined level.

To set the page volume level, use the "Configure - Local Preferences" menu of the configuration program.

The page volume level can be adjusted within a range of 0 to 10, equivalent to the front-panel control settings of 0 equals off and 10 equals full pot. The page volume level's default setting is 5.

Station-to-Matrix Card Baud Rate

The RS-422 serial data communication between a station and other devices can operate at standard (19.2 k baud, the default) and long-line

(9600 baud) baud rates. Use long-line only if encountering problems with the standard baud rate.

The baud rate is set from the configuration program and the station automatically adapts.

Configuration

Assign each station's name and other parameters by using the Matrix Plus 3 System Configuration Program (see *PGM-WIN System Configuration Manual* for more information). Also refer to the ICS-2002 chapter of the *Matrix Plus 3 System Operation* manual for details regarding the configuration options available from the ICS-2002's menus.

Accessory Panels

The following paragraphs describe how to install the following optional, accessory key panels:

- Non-display Expansion Panels (XP-Type)—add talk/listen selector keys to a station

- Display Expansion Panels (XPL-Type)—add talk/listen selector keys to a station

- Assignment Panels (AP-22)—allow quick source and destination assignments for IFB operation.

The installation procedure is identical for these three panels.

XP Type Expansion Panels

The selectors on the XP series are labeled with paper strips above the selectors; these must be updated any time changes are made.

Model XP-12 provides 10 additional selectors and model XP-22 provides 20 additional selectors.

XP panels can be added to any station.

XPL Type Expansion Panels

The XPL series is similar to the XP series, except the selectors are labeled with electronic displays that are automatically updated whenever changes are made.

Model XPL-12 provides 10 additional selectors with displays and model XPL-22 provides 20 additional selectors with displays. Each station can accept a maximum of 60 additional selectors.

AP Type Panels

AP panels can be used either as selector push buttons with electronic labels, or as a convenient way to assign forced listens. Each station can accept a maximum of 80 additional AP buttons.

Note: XP series panels can not be combined with XPL or AP panels.

A combination of XPL and AP panels can be installed on a station; Table 2 on page S1-15 shows all possible combinations.

XPL	AP
10	20
10	40
10	60
20	20
20	40
30	20
40	20
50	20
60	20
0	80
60	0

Table 2: XPL and AP Panel Combinations

Mounting

All accessory panels are mounted in a standard 19-in. rack, requiring one unit of rack space each. Leave at least 2 in. of clearance behind the rear of the chassis to allow for cable connectors.

Power

XP panels are powered by the station to which they are connected, and do not require connection to the main AC power line.

Each XPL and AP panel is powered by an external AC transformer (included). Confirm that the transformer is correct for the line voltage being used. To connect the AC power transformer to an XPL or AP panel, route the transformer's secondary lead to the "AC Power Input" connector on the back of the panel. This is a 2.1 mm coax connector. When routing the lead, use the lead stress relief on the back of the panel. The panel can be powered by any 12- to 16-V RMS AC source rated for 750 mA.

Station Connection

A cable is supplied with each panel to connect it to a station or to additional panels. The cable is 6-ft. long and has a DB-9F connector on one end and a DB-9M connector on the other end. If custom length cables are required, they should be made with 9 conductor control cable with 22 to 24 AWG wire. The pins should be wired one-to-one between the male and female connectors. The maximum distance between the station and the last expansion panel should be 25 ft.

To connect an accessory panel to an intercom station:

4. Plug the DB-9M end of the cable supplied into the "Accessory Panel" connector on the back of the station.

5. Plug the DB-9F end into the "From Intercom Station" connector on the rear panel of the accessory panel.

To connect an additional accessory panel:

1. Plug the DB-9M end of the additional panel's cable into the "To Next Expansion Panel" connector on the back of the preceding panel.

2. Plug the DB-9F end of that cable into the "From Intercom Station" connector on the back of the additional panel.

More panels can be added by using this "daisy-chaining" method.

The numbering of expansion selectors will be in the order of the daisy chaining. The first panel will be selectors 1 to 20, the second will be selectors 21 to 40, and so forth.

Configuration

After physically mounting the panels and connecting them to a station, the number of accessory selectors installed in the station must be programmed into the configuration program. To do this:

1.   Enter the "Setup - Hardware and Labels" screen.

2.   Find the station in the column on the left side of the screen and pop up the "XP/AP Panels" menu.

Note: Selectors are available in multiples of ten only.

3.   Select the desired combination. It does not matter whether the selectors are on panels that supply 10 selectors (like the XP-12) or twenty selectors (like the XP-22). For example, select the number "30" whether three XP-12s installed or one XP-12 and one XP-22 is installed.

Warning: Make sure the number of expansion selectors shown in the Setup - Hardware and Labels box matches the number of XP panels connected to the station. If this isn't the case, unpredictable results may occur when using the expansion selectors.

Specifications

0 dBv is referenced to 0.775 V RMS

ICS-2002, ICS-1802 Intercom Stations

Front-Panel Controls and Connectors

Talk/Listen Switches:	12
Function Keys	16 (ICS-2002)
	4 (ICS-1802)
Answer Back Switch	1
Volume Controls	2
Headset Connector	1 D4M XLR
Panel Mic Connector	1 1/4 inch Phone Jack

Rear-Panel Connectors

Miscellaneous	DB-15F
To Matrix	DB-15M
Audio IO (OPT-100)	DB-15F

Accessory   DB-9F
AC Power   IEC-320

Panel Microphone Input

Type: Electret
Input Level   40 dBv
Impedance   200 ohms

Headset Microphone Input

Type   Dynamic
Input Level   -55dBv
Gain Adjustment Range   +/- 5dB
Impedance   200 Ohms

Local Program Input

Type   Electronically Balanced
Impedance   8k Ohms Bridging
Level   0 dBv will produce full output of speaker when
                               volume control is fully clockwise

Headphone Outputs

Impedance   50 to 600 Ohms
Power   1/2 W into 50 Ohms

Speaker Amplifier Output

Impedance   8 Ohms
Power   2 W

Line Input (2 -pair Listen from Matrix) (ICS-2002/ICS-1802)

Type   Transformer Balanced
Impedance   8k Ohms Bridging
Level   0 dBv nominal
Freq. Resp.   100 Hz to 15 kHz +/- 2 dB

Line Output (2-pair Talk to Matrix) (ICS-2002/ICS-1802)

Type   Transformer Balanced
Impedance   150 Ohms (when talk active)
Level   0 dBv nominal
Freq. Resp.   100 Hz to 15 kHz, +/- 2 dB

Logic Input #1

Type   5 V logic with pull-up resistor
Logic   True = Short to Ground

Logic Input #2

Type (Option 1)   5 V logic with pull-up resistor
Logic (Option 1)   True = Short to Ground
Type (Option 2)   External Voltage Sense
Logic (Option 2)   Lo = 0 - +2 VDC, Hi = +4 - +30 VDC

Mute Relay

Contact Type   1 pair SPDT (single form C)
Contact Voltage Rating   24 VDC
Contact Current Rating   1 Amp continuous, 2 Amps peak at 24 VDC

Station Relay

Contact Type   1 pair SPDT (single form C)
Contact Voltage Rating   24 VDC
Contact Current Rating   1 Amp continuous, 2 Amps peak at 24 VDC

AC Mains Power

Voltage   117 V AC nominal (105 to 130 V AC)
Or   220 V AC nominal (200 to 240 V AC)
AC Current   0.2 Amp at 117 V AC
                                0.1 Amp at 220 V AC
Frequency   45 to 65 Hz

Temperature

Operating   between 0 and 50 C (32 to 125 F)
Storage   between 0 and 70 C (32 to 150 F)

Humidity

Operation and Storage   Between 20% and 90%, Non-Condensing

Package Dimensions

Height   3.5 in. (8.89 cm), (2 RU, EIA rack)
Width   19.0 in. (48.26 cm)
Depth   6.75 in. (17.15 cm)
Weight   7.5 lbs. (4.0 kg)

OPT-100 Auxiliary Audio I/O Option

Audio

Output Signal Levels	0.0 dBv nominal
Impedance	600 Ohms, transformer balanced
Frequency Response	100 Hz to 10 kHz, +/- 2 dB of mic preamp or external program input
Distortion	Less than 0.5% THD

SA Relay

Contact Type	1 pair SPDT (single form C)
Contact Voltage Rating	24 VDC
Contact Current Rating	1 Amp continuous, 2 Amps peak at 24 VDC

Accessory Panels

XP-12

Height	1.75 in. (44 mm), (1 RU)
Width	19.0 in. (483 mm)
Depth	1.88 in. (46 mm)
Weight	1.2 lbs. (0.5 kg)
Power	Powered by intercom station

XP-22

Height	1.75 in. (44 mm), (1 RU)
Width	19.0 in. (483 mm)
Depth	1.88 in. (46 mm)
Weight	1.5 lbs. (0.7 kg)
Power	Powered by intercom station

XPL-12

Height	1.75 in. (44 mm), (1 RU)
Width	19.0 in. (483 mm)
Depth	2.50 in. (64 mm)
Weight	1.5 lbs. (0.7 kg)
Power	14 VAC, 0.5 Amps (120 VAC 770 mA wall-mount transformer supplied with unit. 220 V AC version available on special order)

XPL-22

Height	1.75 in. (44 mm), (1 RU)

Width	19.0 in. (483 mm)
Depth	2.50 in. (64 mm)
Weight	1.8 lbs. (0.8 kg)
Power	14 V AC, 0.5 Amps (120 V AC 770 mA wall-mount transformer supplied with unit. 220 V AC version available on special order).

AP-22

Height	1.75 in. (44 mm), (1 RU)
Width	19.0 in. (483 mm)
Depth	2.50 in. (64 mm)
Weight	1.8 lbs. (0.8 kg)
Power	14 VAC, 0.5 Amps (120 V AC 770 mA wall-mount transformer supplied with unit. 220 V AC version available on special order).

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

MASTER INTERCOM STATION

Introduction

This section covers installation, adjustment, and specifications of the ICS-102/ICS-102T intercom station. For operation information, see the *Matrix Plus 3 Operation Manual;* for troubleshooting and maintenance information, see the *Matrix Plus 3 Maintenance Manual;* and for programming information, see the *PGM-WIN System Configuration Manual.*

Installation

Installation of the ICS-102/ICS-102T, including options such as expansion key panels, is identical to the ICS-2002, except for the following:

• digital wiring for the ICS-102T

• mains AC power

• physical size

• no front-panel adjustment of local program input

• no "Second Ear" outputs.

Wiring

Digital Matrix Frame to Station Wiring

The ICS-92T and ICS-52T differ from the ICS-92 and ICS-52 because they include a digital audio/data communications module (COM-20) and an MVX-D8 Digital Matrix Card in the frame instead of a COM-10 and an MVX-A8.

The MVX-D8 offers two options for wiring the frame to intercom stations. One option is a single pair of CAT3 or CAT5 4-twisted pair cables with RJ-45 connectors. The second option, available because only one pair is required, is 75-ohm coax.

In addition, each station may require other connector wiring, depending on what options and accessories are installed.

Note: CAT5 is required for compliance with the European Community's CE Mark.

Single-Pair Digital

Single-pair digital wiring is typically wired with a CAT3 or CAT5 RJ-45 cable.

•   Pair 1 transmits and receives multiplexed digital and analog between the matrix port and the station.

Note: Ensure that the Select switch on the station's rear panel is in the correct position for the intended use.

ATT-T568B (Modular Jumpers Wired One to One)

Matrix Frame End			Station End
		Pair 2	
No Connection (NC)	1		1
No Connection (NC)	2		2
No Connection (NC)	3	Pair 1	3
Multiplexed Data/Audio	4		4
Multiplexed Data/Audio	5	Pair 3	5
No Connection (NC)	6		6
No Connection (NC)	7	Pair 4	7
No Connection (NC)	8		8

FIGURE M3-1: Matrix Frame to Digital Station Wiring Using RJ-45

Coax Digital

Coax digital wiring is typically wired with a CAT3 or CAT5 RJ-45 cable connected to a 75-Ohm coax cable with Clear-Com's BNC-16 adapter.

•   Pair 1 transmits and receives multiplexed digital and analog between the matrix port and the station.

Note: Ensure that the Select switch on the station's rear panel is in the correct position for the intended use.
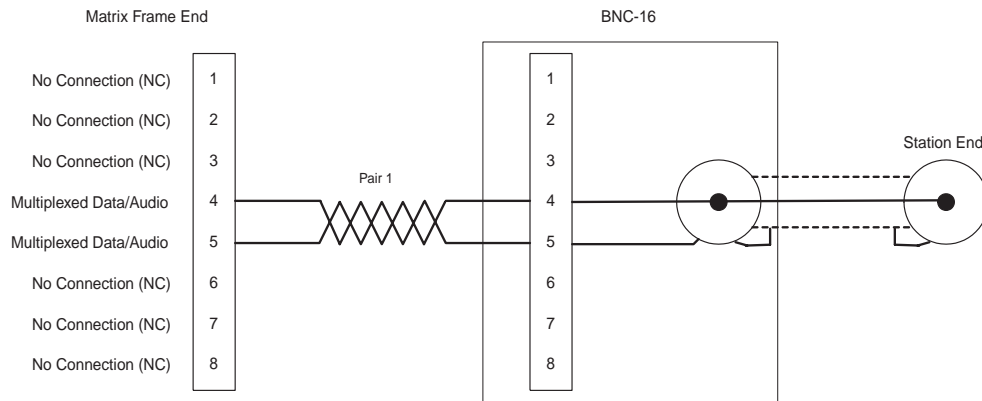
FIGURE M3-2: Matrix Frame to Digital Station Wiring Using BNC-16 and Coax

Mains AC Power

The ICS-102/ICS-102T station can be powered by any source supplying between 12 and 16 V RMS AC at 750 mA. The stations are shipped with a wall-mount transformer that provides 14 V RMS AC to the station. Two types of transformers are available: one operates on a mains AC input power of 117 V (part number 730166) and the other operates on a mains AC input power of 220 V (part number 820049). Make sure to specify the proper transformer when ordering the station. To connect the transformer, route the cord from the transformer's secondary to the station's "AC Power Input" connector on the rear panel. This is a 2.1 mm coax connector. When routing the cord make sure to use the stress relief on the rear panel.

The power input to the station is internally protected with a 0.9 a "poly fuse," a self-healing fuse that will recover when the fault is removed.

Adjustments

The adjustments required to prepare the ICS-102/ICS-102T are the same as those described in the ICS-2002 section of this manual.

Specifications

All specifications of the ICS-102/ICS-102T identical to the ICS-2002, except for the following:

Speaker Amplifier Output

Impedance	8 Ohms
Power	4 W

Power

AC Input to Station	Between 12 and 16 VAC at 750 mA Mains AC Power Input to Wall-Mount Transformer 16 W (150 mA at 115 VAC)

Package Dimensions

Height	1.75 in. (44 mm), (1 RU)
Width	19.0 in. (483 mm)
Depth	6.75 in. (171 mm)
Weight	4.27 lbs. (2.0 kg)

Adjustments

The adjustments required to prepare the ICS-52/ICS-92 are the same as those described in the "ICS-2002" section under the heading "Adjustments", and are not duplicated in this section.

Specifications

All specifications of the ICS-52 and ICS-92 are identical to the ICS-2002 except for the following:

Speaker Amplifier Output

Impedance	8 Ohms
Power	4 Watts

Power

AC Input to Station	Between 12 and 16 VAC at 750 milliamps
	Mains AC Power Input to Wall-Mount Transformer 16 Watts (150 mA at 115 VAC)

Package Dimensions

Height:	1.75 inches (44mm), (1RU)
Width:	19.0 in. (483mm)
Depth:	6.75 in. (171mm)
Weight:	4.27 lbs (2.0Kg)
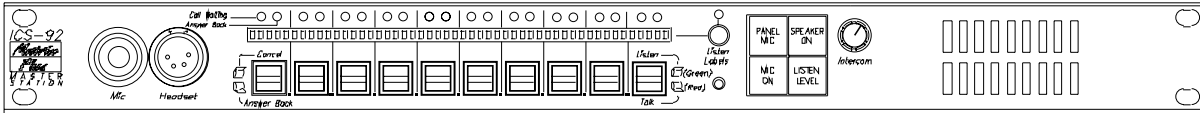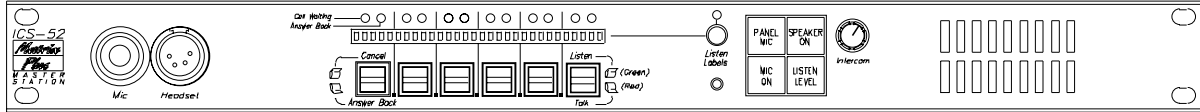
Matrix Plus 3 System   **ICS-92/92T/ICS-52/52T**

MASTER INTERCOM STATION

Introduction

This section covers the installation, adjustment, and specifications of the ICS-92/92T and ICS-52/52T Intercom Stations. For operation information, see the *Matrix Plus 3 Operation Manual;* for troubleshooting and maintenance information, see the *Matrix Plus 3 Maintenance Manual;* and for programming information, see the *PGM-WIN System Configuration Manual.*

Installation

Installation of the ICS-92/92T and ICS-52/52T, including options such as expansion key panels, are identical to the ICS-2002 except for the following:

- digital wiring for the ICS-92T and ICS-52T

- mains AC power

- no front-panel adjustment of local program input

- physical size

- no "Second Ear" output.

Wiring

Digital Matrix Frame to Station Wiring

The ICS-92T and ICS-52T differ from the ICS-92 and ICS-52 because they include a digital audio/data communications module (COM-20) and an MVX-D8 Digital Matrix Card in the frame instead of a COM-10 and an MVX-A8.

The MVX-D8 offers two options for wiring the frame to intercom stations. One option is a single pair of CAT3 or CAT5 4-twisted pair cables with RJ-45 connectors. The second option, available because only one pair is required, is 75-ohm coax.

In addition, each station may require other connector wiring, depending on what options and accessories are installed.

Note: CAT5 is required for compliance with the European Community's CE Mark.

Single-Pair Digital

Single-pair digital wiring is typically wired with a CAT3 or CAT5 RJ-45 cable.

• Pair 1 transmits and receives multiplexed digital and analog between the matrix port and the station.

Note: Ensure that the Select switch on the station's rear panel is in the correct position for the intended use.

ATT-T568B (Modular Jumpers Wired One to One)

Matrix Frame End				Station End
No Connection (NC)	1			1
No Connection (NC)	2			2
No Connection (NC)	3	Pair 1		3
Multiplexed Data/Audio	4			4
Multiplexed Data/Audio	5			5
No Connection (NC)	6			6
No Connection (NC)	7			7
No Connection (NC)	8			8

FIGURE S4-1: Matrix Frame to Digital Station Wiring Using RJ-45

Coax Digital

Coax digital wiring is typically wired with a CAT3 or CAT5 RJ-45 cable connected to a 75-Ohm coax cable with Clear-Com's BNC-16 adapter.

• Pair 1 transmits and receives multiplexed digital and analog between the matrix port and the station.

Note: Ensure that the Select switch on the station's rear panel is in the correct position for the intended use.
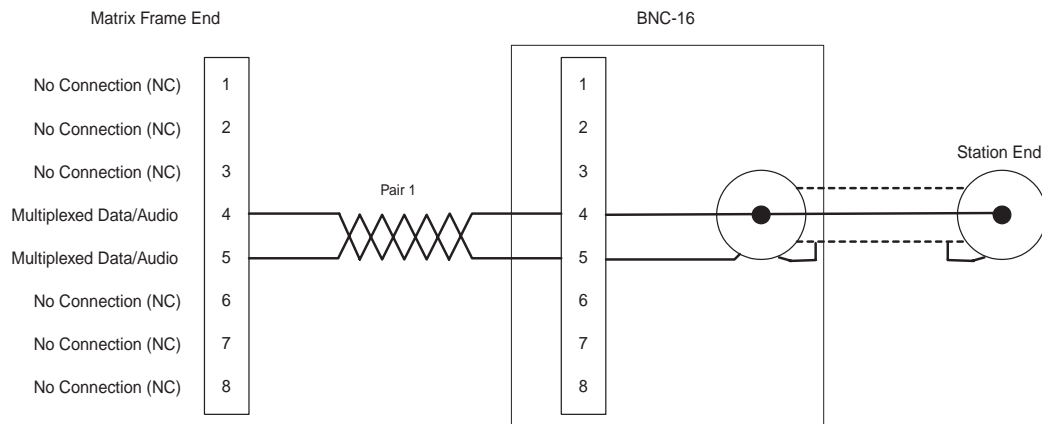
FIGURE S4-2: Matrix Frame to Digital Station Wiring Using BNC-16 and Coax

Mains AC Power

The ICS-52/52T and ICS-92/92T stations can be powered by any source that can supply between 12 and 16 V RMS AC at 750 mA. The stations are shipped with a wall-mount transformer that provides 14 V RMS AC to the station. Two types of transformer are available: one operates on a mains AC input power of 117 V (part number 730166) and the other operates on a mains AC input power of 220 V (part number 820049). Make sure to specify the proper transformer when ordering the station. To connect the transformer, route the cord from the transformer's secondary to the station's "AC Power Input" connector on the rear panel. This is a 2.1 mm coax connector. When routing the cord make sure to use the stress relief on the rear panel.

The power input to the station is internally protected with a 0.9 ampere "poly fuse," a self-healing fuse that will recover when the fault is removed.

Adjustments

The adjustments required to prepare the ICS-92/92T and ICS-52/52T are the same as those described in the ICS-2002 section of this manual.
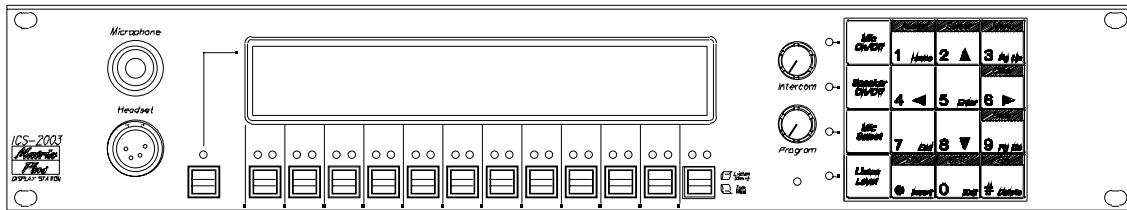
Matrix Plus 3 System   **ICS-2003/2003T**

MASTER INTERCOM STATION

Introduction

This section describes the installation, including wiring connections to the matrix frame and other equipment, and technical specifications of the ICS-2003/ICS-2003T display station. For operation information, see the *Matrix Plus 3 Operation Manual;* for troubleshooting and maintenance information, see the *Matrix Plus 3 Maintenance Manual;* and for programming information, see the *PGM-WIN System Configuration Manual.*

This chapter covers the following subjects related to station installation.

- mounting stations

- accessory panels

- wiring

- mains AC power

- adjustments

- configuration

- specifications.

Mounting Stations

Locate all intercom stations at comfortable heights for operation and leave at least 2 in. of clearance behind the rear of the station's chassis to allow for cable connectors.

Accessory panels, such as the XP, XPL, or AP, that are intended to expand or enhance station operation are usually mounted next to or near the station with which they are associated. They can be located as far as 25 ft. away from the station. A 6-ft. cable is supplied to connect them.

Wiring

This section provides detailed wiring diagrams for all stations wiring systems.

Matrix Plus 3 uses either a twisted, 4-pair transmission, a single-pair twisted, or a coax scheme between the station and the frame using the industry standard RJ-45 connector. Refer to the Overview section of the *Matrix Plus 3 Installation Manual* for RJ-45 connector installation and use, and the type of cable needed for connection between stations and frames.

Most stations have a DB-15M and an RJ-45 connector to connect them to the frame. Stations with only a DB-15M connector include a kit containing one DB-15F/RJ-45 adapter. The adapter allows the use of RJ-45 connectors on both ends of the connection between the frame and the station.

Connections to external devices via the Miscellaneous connector, use the included is a DB-15M connector to construct one or more cables to connect external devices to the station.

The following paragraphs describe connecting the station to the wires leading to the matrix frame, and all the connections between the station and local devices. Each of the following sections describes cable and station-connector wiring:

- analog matrix frame to station wiring

- digital matrix frame to station wiring

- matrix station Miscellaneous connector wiring

- OPT-100 Auxiliary Audio I/O option

- binaural headset wiring.

Analog Matrix Frame to Station Wiring

The analog audio RS-422 data communications module (COM-10) uses a 4-pair wiring scheme between the frame and stations. This module requires an MVX-A8 in the frame.

Although some Matrix Stations have a DB-15M (male) connector for connection to the Matrix frame, most have a built-in RJ-45 connector. For those stations with a DB-15 male connector, Clear-Com provides a properly wired DB-15F (female) to RJ-45 adapter for direct connection with RJ-45 terminated cables. Additionally, stations configured for digital communication are equipped with a BNC.

Four-pair analog wiring is typically wired with a CAT3 or CAT5 RJ-45 cable.

- Pair 1 transmits analog audio from the matrix port to the station.

- Pair 2 transmits RS-422 data from the station back to the matrix card port.

- Pair 3 transmits analog audio from the station to the matrix card port.

• Pair 4 transmits RS-422 data from the matrix port back to the station.

ATT-T568B (Modular Jumpers Wired One to One)

Matrix Frame End   Station End

Matrix Frame End		Pair		Station End
RS-422 Receive +	1	Pair 2		1
RS-422 Receive -	2			2
Audio Receive +	3	Pair 1		3
Audio Send +	4			4
Audio Send -	5	Pair 3		5
Audio Receive -	6			6
RS-422 Send +	7	Pair 4		7
RS-422 Send -	8			8

FIGURE S5-1: Matrix Frame to Station Wiring

Digital Matrix Frame to Station Wiring

The ICS-2003T differs from the ICS-2003 because it includes a digital audio/data communications module (COM-20) and an MVX-D8 Digital Matrix Card in the frame instead of a COM-10 and an MVX-A8.

The MVX-D8 offers two options for wiring the frame to intercom stations. One option is a single pair of CAT3 or CAT5 4-twisted pair cables with RJ-45 connectors. The second option, available because only one pair is required, is 75-ohm coax.

In addition, each station may require other connector wiring, depending on what options and accessories are installed.

Note: CAT5 is required for compliance with the European Community's CE Mark.

Single-Pair Digital

Single-pair digital wiring is typically wired with a CAT3 or CAT5 RJ-45 cable.

• Pair 1 transmits and receives multiplexed audio or data between the matrix port and the station.

Note: Ensure that the Select switch on the station's rear panel is in the correct position for the intended use.

ATT-T568B (Modular Jumpers Wired One to One)

Matrix Frame End   Station End

No Connection (NC)	1		1
No Connection (NC)	2		2
No Connection (NC)	3	Pair 1	3
Multiplexed Data/Audio	4		4
Multiplexed Data/Audio	5		5
No Connection (NC)	6		6
No Connection (NC)	7		7
No Connection (NC)	8		8

**FIGURE S5-2: Matrix Frame to Digital Station Wiring
Using RJ-45**

Coax Digital

Coax digital wiring is typically wired with a CAT3 or CAT5 RJ-45 cable
connected to a 75-Ohm coax cable with Clear-Com's BNC-16 adapter.

• Pair 1 transmits and receives multiplexed digital and analog between
the matrix port and the station.

Note: Ensure that the Select switch on the station's rear panel is in the
correct position for the intended use.

Matrix Frame End   BNC-16

No Connection (NC)	1		1
No Connection (NC)	2		2
No Connection (NC)	3		3
Multiplexed Data/Audio	4	Pair 1	4
Multiplexed Data/Audio	5		5
No Connection (NC)	6		6
No Connection (NC)	7		7
No Connection (NC)	8		8

Station End
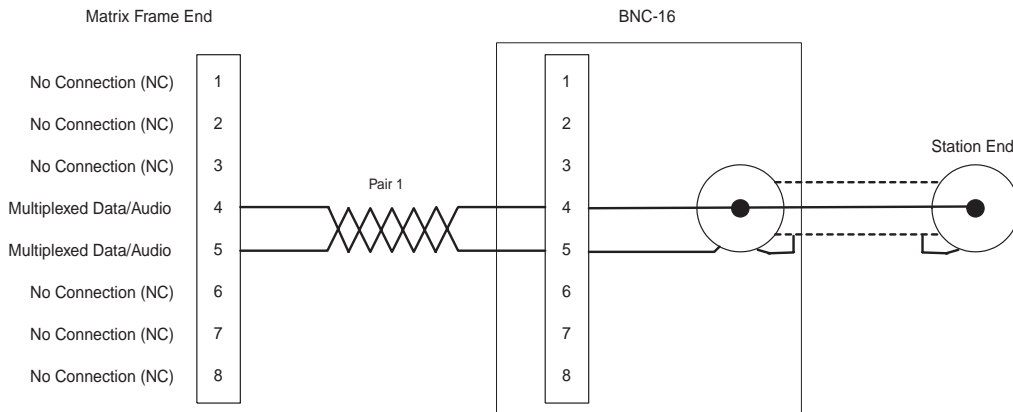
**FIGURE S5-3: Matrix Frame to Digital Station Wiring
Using BNC-16 and Coax**

Matrix Station Miscellaneous Connector Wiring

Most local devices connect with the station via the Miscellaneous connector.

The following paragraphs discuss how to wire the various functions available on the "Miscellaneous" connector.

Pin	Function
1	+ Program Input
9	- Program Input
2	Audio Ground
10	Second Ear Ground
3	Second Ear Output
11	Logic Ground
4	Logic Ground
12	Logic Input #2
5	Logic Input #1
13	Mute Relay Normally Closed
6	Station Relay Normally Closed
14	Mute Relay Wipe
7	Station Relay Wipe
15	Mute Relay Normally Open
8	Station Relay Normally Open
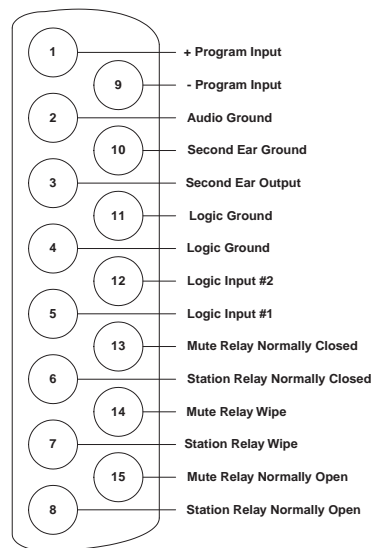
FIGURE S5-4: Miscellaneous Connector Pinout

External Program Feed Input

The external program feed input allows the station operator to simultaneously monitor audio from an external source and intercom audio.

The input is designed to accept a balanced, line-level audio feed at a nominal level of 0 dB. The program feed input passes through the station's "Program" volume control before being mixed with the audio at the station. The program feed (program audio) can be heard on the station's speaker and headset; it cannot be heard by other stations in the Matrix system.

To connect an external program feed to the station:

1. Connect the balanced audio pair to pins 1 and 9.

2. Connect a shield or ground connection if available to the connector's pin 2 (see Figure S5-4 on page S5-5).

Logic Input #1 and #2

Each input can control one of several functions, determined through the configuration program. Typically, these inputs are connected to an external foot switch, a panel-mounted switch, or the logic output of another device.

The following functions are available:

- Mic On/Off—toggles the station's microphone on and off.

- Mute Mic Output To Frame—turns off the audio from the station to the frame. It does not turn off the Hot Mic output (described in "OPT-100 Auxiliary Audio I/O Option" on page S5-8). For an example of how to use this option, see "External Program Feed Input" on page S5-5.

- Mic Off —momentarily turns off the station's microphone.

- Answer Back Talk/Clear—the same functions as the station's "Answer Back" key. Holding down the switch activates a talk to a label in the answer-back stack. To clear the label, quickly press and release the switch.

- Studio Announce—sends the output of the station's selected microphone (panel or headset) to the station's Studio Announce (SA) audio output, and activates the SA relay. The microphone output is not sent to the frame. The SA output and relay are only present if the station has the OPT-100 Auxiliary Audio I/O Option installed. (The SA options are described in "OPT-100 Auxiliary Audio I/O Option" on page S5-8).

- Speaker OFF—turns off the station speaker, disabling all audible output from the station.

- PTT: Activate All Talk Keys (Push To Talk)—when enabled from the configuration program and the logic input is active, the station behaves normally. When this function (logic level) is deactivated, it disables activation of all talk labels, implementing a push-to-talk function for the station. Any controls (relays, etc.) assigned to the labels are activated or deactivated along with their assigned labels. The LED indicators associated with the active labels behave normally regardless of this input's activity. This input controls momentary and latched talks.

- Activate Talk Switch #1—equivalent to pressing the station's first (left most) talk selector; a momentary and latching activation.

- Activate Talk Switch #2—equivalent to pressing the station's second talk selector; a momentary and latching activation.

- Activate Listen Labels Button—equivalent to pressing the "Listens" button on the keypad; all modes of the "Listens" button are supported.

- PTT: Activate Two-Way Radio Keys—implements a push-to-talk function for all two-way radio talk selectors. When the logic input is active, the station operates normally. When the logic input is deactivated, all active two-way radio talk selectors are disabled. Any controls (relays, etc.) assigned to the labels are activated or deactivated along with their assigned labels. The LED indicators associated with the active two-way radio talk selectors operate normally regardless of the PTT status. This input only controls latched talks.

Use normally open type switches to activate the logic inputs. Connect the switches as follows (Figure S5-4 on page S5-5):

Logic input #1—pins 4 to 5 (pin 4 = ground)

Logic input #2—Pins 11 to 12 (pin 11 = ground).

Note: Do not apply external voltage to the logic inputs.

Mute Relay Contacts

The mute relay is activated whenever any talk selector is activated at the station. The mute relay is commonly wired such that whenever it is activated, the volume of the monitor speaker in that room is decreased (muted). See Figure S5-4 on page S5-5.

Both normally open and normally closed contacts are provided. They are rated at 1 Amp at 24 VDC. This relay is not designed for switching mains AC line voltage. To switch an external device running on mains AC line voltage, use an external relay (or other switching mechanism) activated by this relay.

Programmable Relay Contacts

Each station includes a relay controlled by the system program and independent of the local station function. This relay can be assigned to any label(s) in the system, which will activate whenever a talk or listen is set to that label(s). If activating the relay is the only action desired, assign the relay to a Control label. See the *PGM-WIN System Configuration Manual* for more details.

The relay can activate an external device, such as an applause light in a studio, a cue light, or a security door lock. Any programmable relay in the system can be activated from any station in the system, including a direct-inward-access caller. Figure S5-4 on page S5-5 shows the wiring of the relay contacts to the Miscellaneous connector.

Both normally open and normally closed contacts are provided. They are rated at 1 Amp at 24 V DC. This relay is not designed for switching mains AC line voltage. To switch an external device running on mains AC line voltage, use an external relay (or other switching mechanism) activated by this relay.

OPT-100 Auxiliary Audio I/O Option

The OPT-100 Auxiliary Audio option provides the following features:

- Hot Mic output

- SA audio and relay outputs

- auxiliary audio line level output.

Figure S5-5 on page S5-8 shows the pinout for the intercom station's DB-15F Auxiliary Audio I/O connector. Following are descriptions and wiring information for the OPT-100 Auxiliary Audio I/O option.

"Auxiliary I/O" Connector DB-15F

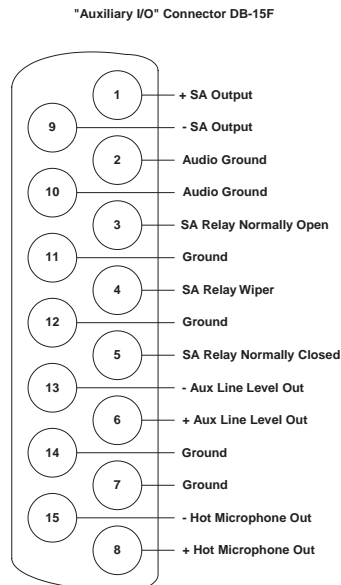| Pin	Signal
1	+ SA Output
9	- SA Output
2	Audio Ground
10	Audio Ground
3	SA Relay Normally Open
11	Ground
4	SA Relay Wiper
12	Ground
5	SA Relay Normally Closed
13	- Aux Line Level Out
6	+ Aux Line Level Out
14	Ground
7	Ground
15	- Hot Microphone Out
8	+ Hot Microphone Out

FIGURE S5-5: Auxiliary I/O Connector

Hot Mic Output

The Hot Mic output is a balanced, line-level, transformer-isolated feed of the signal from the currently selected microphone (panel or headset). The Hot Mic output is active regardless of whether the station has talk paths set and regardless of the front-panel's control settings.

Connect to pins 8 and 15 for a balanced output. Pin 7 is available as a shield or ground source (see Figure S5-5 on page S5-8).

Studio/Stage Announce Audio and Relay Outputs

The SA output is a balanced, line-level, transformer-isolated feed with the same signal sent to the Hot Mic output, except it is only active when the SA button on the station's front panel is pressed or when activated by Logic Input #1 or #2, which is configured for the Studio Announce Function.

Connect to pins 1 and 9 for a balanced SA audio output. Pin 2 is available as a shield or ground source (see Figure S5-5 on page S5-8).

Both normally open and normally closed contacts are provided. They are rated at 1 Amp at 24 VDC. This relay is not designed for switching mains AC line voltage. To switch an external device running on mains AC line voltage, use an external relay (or other switching mechanism) activated by this relay (see Figure S5-5 on page S5-8). Table S5-1 on page S5-9 shows the pins available for the SA relay.

Pin Description	Pin Number
N.O. (normally open)	3
WIPER (common)	4
N.C. (normally closed)	5

Table S5-1: Studio Announce Pins Availability

Auxiliary Audio Line Level Output

The Auxiliary Audio Line Level output is a balanced, line-level, transformer-isolated feed of the input to the station's internal speaker. For example, this output could be used to feed an external amplifier connected to loudspeakers.

Connect to pins 6 and 13 for a balanced output. Pin 14 is available as a shield or ground source (see Figure S5-5 on page S5-8).

Binaural Headset Wiring

Although the station has a second earphone output, it functions and is wired differently than some other ICS stations. The output is not available on the "Miscellaneous" connector, but on the station's main board on a separate header connector. This output would be available if a six-pin headset connector is installed on the front or rear of the station.

The default configuration of the station has both earphone outputs being fed with intercom and program audio. To separate the program input to the second ear only, use the configuration program.

Figure S5-6 on page S5-10 shows the wiring of a six pin XLR connector for a binaural headset.
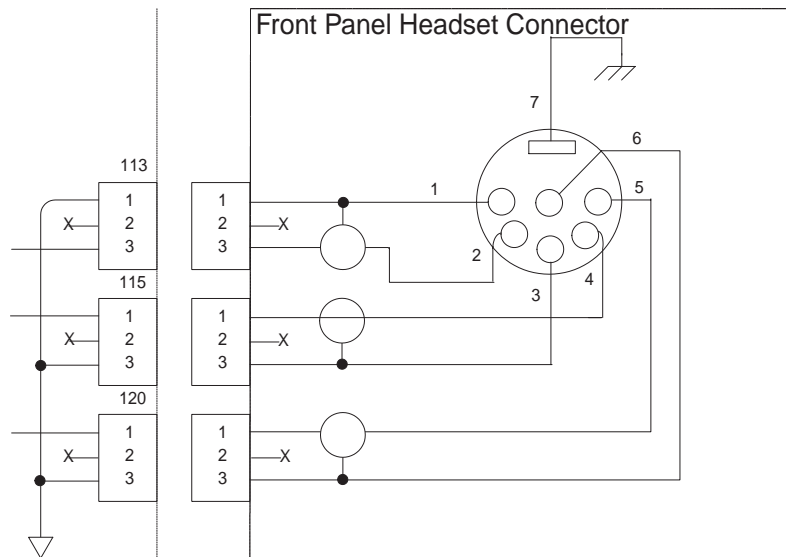

FIGURE S5-6: Binaural Headset Wiring

Mains AC Power

The station has a separate, external DC power supply with a removable AC power cord. The power supply is "universal," operating over a voltage range of 90 to 260 V AC and 45 to 65 Hz. the maximum dissipation is 30 W.

A bracket has been provided to mount this external supply if necessary.

Adjustments

The following station parameters are adjustable internally on the station's main PCB by selecting options in the configuration program:

- headset sidetone
- panel microphone gain
- speaker mute
- page volume level
- station-to-matrix card baud rate.

All these parameters are set to factory defaults. Most stations should operate at these default settings; however, some applications may require readjustment.

Headset Sidetone

Sidetone is the sound of the user's voice in his headset.

To adjust, use the "Configure - Local Preferences" menu of the configuration program.

Panel Mic Gain

The the preamplifier gain of the panel microphone can be adjusted over a range of 0 to 10 dB; the maximum is the panel microphone gain's default setting. However, if two stations are talking to each other at the same time with the panel microphone gain set to maximum, feedback may occur even if the speaker mute (see "Speaker Mute" on page S5-12) is set to maximum. In this case, it will be necessary to turn the panel microphone gain down. Similarly, in some noisy environments it may be necessary to turn the panel microphone gain down and have the operator talk more closely into the microphone.

To adjust, use the "Configure - Local Preferences" menu of the configuration program.

Speaker Mute

When a panel microphone and a speaker are used together, feedback is possible. To reduce this possibility, the station software will mute (turn down) the speaker level by some predetermined amount when both the microphone and speaker are enabled. The speaker mute can be adjusted from 0 to 15 dB; its default setting is 6 dB.

To adjust, use the "Configure - Local Preferences" menu of the configuration program.

Page Volume Level

When Page Override is assigned to a label, the audio level at the destination station(s) is predetermined. This function allows talking to someone even if his station's volume control is off. Two things will happen when a station activates such a label:

- If the destination speaker was off, it will turn on.

- The station(s)'s speaker output will be at the predetermined level regardless of the "Intercom" volume control setting, unless this control is set higher than the predetermined level.

The page volume level can be adjusted within a range of 0 to 10, equivalent to the front-panel control settings of 0 equals off and 10 equals full pot. The page volume level's default setting is 5.

To adjust, use the "Configure - Local Preferences" menu of the configuration program.

Station-to-Matrix Card Baud Rate

The RS-422 serial data communication between a station and other devices can operate at standard (19.2 k baud, the default) and long-line (9600 baud) baud rates. Use long-line only if encountering problems with the standard baud rate.

The baud rate is set from the configuration program and the station automatically adapts.

Configuration

Assign each station's name and other parameters by using the Matrix Plus 3 System Configuration Program (see *PGM-WIN System Configuration*

Manual for more information). Also refer to the ICS-2003 chapter of the *Matrix Plus 3 System Operation* manual for details regarding the configuration options available from the ICS-2003's menus.

Accessory Panels

The following paragraphs describe how to install the following optional, accessory key panels:

- Non-display Expansion Panels (XP-Type)—add talk/listen selectors to a station

- Display Expansion Panels (XPL-Type)—add talk/listen selectors to a station

- Assignment Panels (AP-22)—allow quick source and destination assignments for IFB operation.

The installation procedure is identical for these three panels.

XP Type Expansion Panels

The selectors on the XP series are labeled with paper strips above the selectors; these must be updated any time changes are made.

Model XP-12 provides 10 additional selectors and model XP-22 provides 20 additional selectors.

XP panels can be added to any station.

XPL Type Expansion Panels

The XPL series is similar to the XP series, except the selectors are labeled with electronic displays that are automatically updated whenever changes are made.

Model XPL-12 provides 10 additional selectors with displays and model XPL-22 provides 20 additional selectors with displays. Each station can accept a maximum of 60 additional selectors.

AP Type Panels

AP panels can be used either as selector push buttons with electronic labels, or as a convenient way to assign forced listens. Each station can accept a maximum of 80 additional AP buttons.

Note: XP series panels cannot be combined with XPL or AP panels.

A combination of XPL and AP panels can be installed on a station; Table S5-2 on page S5-14 shows all possible combinations.

XPL	AP
10	20
10	40
10	60
20	20
20	40
30	20
40	20
50	20
60	20
0	80
60	0

Table S5-2: XPL and AP Panel Combinations

Mounting

All accessory panels are mounted in a standard 19-in. rack, requiring one unit of rack space each. Leave at least 2 in. of clearance behind the rear of the chassis to allow for cable connectors.

Power

XP panels are powered by the station to which they are connected, and do not require connection to the main AC power line.

Each XPL and AP panel is powered by an external AC transformer (included). Confirm that the transformer is correct for the line voltage being used. To connect the AC power transformer to an XPL or AP panel, route the transformer's secondary lead to the "AC Power Input"

connector on the back of the panel. This is a 2.1 mm coax connector. When routing the lead, use the lead stress relief on the back of the panel. The panel can be powered by any 12- to 16-V RMS AC source rated for 750 mA.

Station Connection

A cable is supplied with each panel to connect it to a station or to additional panels. The cable is 6-ft. long and has a DB-9F connector on one end and a DB-9M connector on the other end. If custom length cables are to be made, they should be made with 9 conductor control cable with 22 to 24 AWG wire. The pins should be wired one-to-one between the male and female connectors. The maximum distance between the station and the last expansion panel should be 25 ft.

To connect an accessory panel to an intercom station:

3. Plug the DB-9M end of the cable supplied into the "Accessory Panel" connector on the back of the station.

4. Plug the DB-9F end into the "From Intercom Station" connector on the rear panel of the accessory panel.

To connect an additional accessory panel:

1. Plug the DB-9M end of the additional key panel's cable into the "To Next Expansion Panel" connector on the back of the preceding key panel.

2. Plug the DB-9F end of that cable into the "From Intercom Station" connector on the back of the additional key panel.

More panels can be added by using this "daisy-chaining" method.

The numbering of expansion selectors will be in the order of the daisy chaining. The first panel will be selectors 1 to 20, the second will be selectors 21 to 40, and so forth.

Configuration

After physically mounting the key panels and connecting them to a station, the number of accessory keys installed in the station must be programmed into the configuration program. To do this:

1. Enter the "Setup - Hardware and Labels" screen.

2.   Find the station in the column on the left side of the screen
      and pop up the "XP/AP Panels" menu.

Note: Selectors are available in multiples of ten only.

3.   Select the desired combination. It does not matter whether
      the selectors are on panels that supply 10 selectors (like the
      XP-12) or twenty selectors (like the XP-22). For example, you
      would select the number "30" whether using three XP-12s
      installed or one XP-12 and one XP-22.

Warning: Make sure the number of expansion selectors shown in the
Setup - Hardware and Labels box matches the number of XP panels
connected to the station. If this isn't the case, unpredictable results may
occur when using the expansion selectors.

Specifications

0 dBv is referenced to 0.775 V RMS

ICS-2003/2003T Intercom Station

Front-Panel Controls and Connectors

Talk/Listen Switches:	12
Function Buttons	16
Answer Back Switch	1
Volume Controls	2
Headset Connector	1 D4M XLR
Panel Mic Connector	1 1/4 in. Phone Jack

Rear-Panel Connectors

Miscellaneous	DB-15F
To Matrix	RJ-45 & DB-15M
Audio IO (OPT-100)	DB-15F
Accessory	DB-9F
DC Power	5 Pin

Panel Microphone Input

Type:	Electret
Input Level	40 dBv
Gain Adjustment Range	+/-5dB
Impedance	200 Ohms

Headset Microphone Input

Type	Dynamic
Input Level	-55dBv
Gain Adjustment Range	+/- 5dB
Impedance	200 Ohms

Local Program Input

Type	Transformer Isolated
Impedance	8k Ohms Bridging
Level	0 dBv will produce full output of speaker when volume control is fully clockwise

Headphone Outputs

Impedance	50 to 600 Ohms
Power	1/2 W into 50 Ohms

Speaker Amplifier Output

Impedance	8 Ohms
Power	2 W

Line Input (2-pair Listen from Matrix)

Type	Transformer Balanced
Impedance	8k Ohms Bridging
Level	0 dBv nominal
Freq. Resp.	100 Hz to 15 kHz +/- 2 dB

Line Output (2-pair Talk to Matrix)

Type	Transformer Balanced
Impedance	150 Ohms (when talk active)
Level	0 dBv nominal
Freq. Resp.	100 Hz to 15 kHz, +/- 2 dB

Logic Input #1

Type	5 V logic with pull-up resistor
Logic	True = Short to Ground

Logic Input #2

Type	5 V logic with pull-up resistor
Logic	True = Short to Ground

Mute Relay

Contact Type	1 pair SPDT (single form C)
Contact Voltage Rating	24 VDC
Contact Current Rating	1 Amp continuous, 2 Amps peak at 24 VDC

Station Relay

Contact Type	1 pair SPDT (single form C)
Contact Voltage Rating	24 VDC
Contact Current Rating	1 Amp continuous, 2 Amps peak at 24 VDC

AC Mains Power

Voltage	117 VAC nominal (105 to 130 VAC)
Or	220 VAC nominal (200 to 240 VAC)
AC Current	0.2 Amp at 117 VAC
	0.1 Amp at 220 VAC
Frequency	45 to 65 Hz

Temperature

Operating	between 0 and 50 C (32 to 125 F)
Storage	between 0 and 70 C (32 to 150 F)

Humidity

Operation and Storage	Between 20% and 90%, Non-Condensing

Package Dimensions

Height	3.5 in. (8.89 cm), (2 RU, EIA rack)
Width	19.0 in. (48.26 cm)
Depth	6.75 in. (17.15 cm)
Weight	7.5 lbs. (4.0 kg)

OPT-100 Auxiliary Audio I/O Option

Audio

Output Signal Levels	0.0 dBv nominal
Impedance	600 Ohms, transformer balanced
Frequency Response	100 Hz to 10 kHz, +/- 2 dB of microphone preamp or external program input
Distortion	Less than 0.5% THD

SA Relay

Contact Type	1 pair SPDT (single form C)
Contact Voltage Rating	24 VDC
Contact Current Rating	1 Amp continuous, 2 Amps peak at 24 VDC
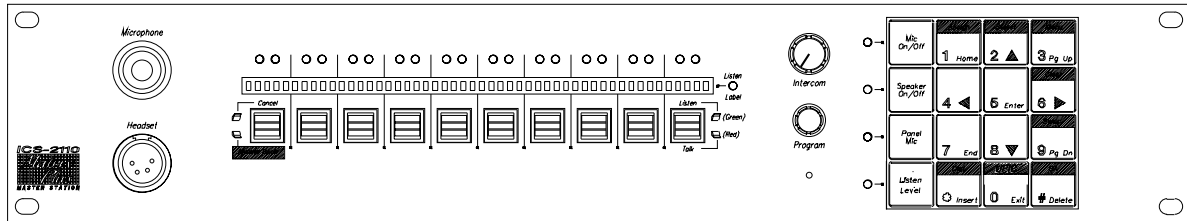
Matrix Plus 3 System   **ICS-2110/2110T**

MASTER INTERCOM STATIONS

Introduction

This section describes the installation, including wiring connections to the matrix frame and other equipment, and technical specifications of the ICS-2110/2110T. For operation information, see the *Matrix Plus 3 Operation Manual;* for troubleshooting and maintenance information, see the *Matrix Plus 3 Maintenance Manual;* and for programming information, see the *PGM-WIN System Configuration Manual.*

This chapter covers the following subjects relating to station installation:

- mounting stations

- accessory panels

- wiring

- mains AC power

- adjustments

- configuration

- specifications.

Mounting Stations

Locate all intercom stations at comfortable heights for operation and leave at least 2 in. of clearance behind the rear of the station's chassis to allow for cable connectors.

Accessory panels, such as the XP, XPL, or AP, that are intended to expand or enhance station operation are usually mounted next to or near the station with which they are associated. They can be located as far as 25 ft. away from the station. A 6-ft. cable is supplied to connect them.

Wiring

This section provides detailed wiring diagrams for all stations wiring systems.

Matrix Plus 3 uses either a twisted, 4-pair transmission, a single-pair twisted, or a coax scheme between the station and the frame using the industry standard RJ-45 connector. Refer to the Overview section of

the *Matrix Plus 3 Installation Manual* for RJ-45 connector installation and use, and the type of cable needed for connection between stations and frames.

Most stations have a DB-15M and an RJ-45 connector to connect them to the frame. Stations with only a DB-15M connector include a kit containing one DB-15F/RJ-45 adapter. The adapter allows the use of RJ-45 connectors on both ends of the connection between the frame and the station.

Connections to external devices via the Miscellaneous connector, use the included is a DB-15M connector to construct one or more cables to connect external devices to the station.

The following paragraphs describe connecting the station to the wires leading to the matrix frame, and all the connections between the station and local devices. Each of the following sections describes cable and station-connector wiring:

- analog matrix frame to station wiring

- digital matrix frame to station wiring

- matrix station Miscellaneous connector wiring

- OPT-100 Auxiliary Audio I/O option

- binaural headset wiring.

Analog Matrix Frame to Station Wiring

The analog audio RS-422 data communications module (COM-10) uses a 4-pair wiring scheme between the frame and stations. This module requires an MVX-A8 in the frame.

Although some Matrix Stations have a DB-15M (male) connector for connection to the Matrix frame, most have a built-in RJ-45 connector. For those stations with a DB-15 male connector, Clear-Com provides a properly wired DB-15F (female) to RJ-45 adapter for direct connection with RJ-45 terminated cables. Additionally, stations configured for digital communication are equipped with a BNC.

Four-pair analog wiring is typically wired with a CAT3 or CAT5 RJ-45 cable.

- Pair 1 transmits analog audio from the matrix port to the station.

- Pair 2 transmits RS-422 data from the station back to the matrix card port.

- Pair 3 transmits analog audio from the station to the matrix card port.

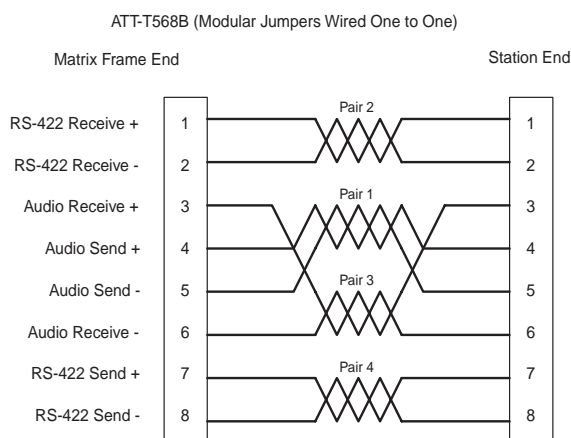- Pair 4 transmits RS-422 data from the matrix port back to the station.

ATT-T568B (Modular Jumpers Wired One to One)

Matrix Frame End   Station End

RS-422 Receive +	1	Pair 2	1
RS-422 Receive -	2		2
Audio Receive +	3	Pair 1	3
Audio Send +	4		4
Audio Send -	5	Pair 3	5
Audio Receive -	6		6
RS-422 Send +	7	Pair 4	7
RS-422 Send -	8		8

FIGURE S6-1:   Matrix Frame to Station Wiring

Digital Matrix Frame to Station Wiring

The ICS-2110T differs from the ICS-2110 because it includes because it includes a digital audio/data communications module (COM-20) and an MVX-D8 Digital Matrix Card in the frame instead of a COM-10 and an MVX-A8.

The MTX-D8 offers two options for wiring the frame to intercom stations. One option is a single pair of CAT3 or CAT5 4-twisted pair cables with RJ-45 connectors. The second option, available because only one pair is required, is 75-ohm coax.

In addition, each station may require other connector wiring, depending on what options and accessories are installed.

Note: CAT5 is required for compliance with the European Community's CE Mark.

Single-Pair Digital

Single-pair digital wiring is typically wired with a CAT3 or CAT5 RJ-45 cable.

• Pair 1 transmits and receives multiplexed audio or data between the matrix port and the station.

Note: Ensure that the Select switch on the station's rear panel is in the correct position for the intended use.

ATT-T568B (Modular Jumpers Wired One to One)

Matrix Frame End			Station End
No Connection (NC)	1		1
No Connection (NC)	2		2
No Connection (NC)	3	Pair 1	3
Multiplexed Data/Audio	4		4
Multiplexed Data/Audio	5		5
No Connection (NC)	6		6
No Connection (NC)	7		7
No Connection (NC)	8		8

FIGURE S6-2: Matrix Frame to Digital Station Wiring Using RJ-45

Coax Digital

Coax digital wiring is typically wired with a CAT3 or CAT5 RJ-45 cable connected to a 75-Ohm coax cable with Clear-Com's BNC-16 adapter.

• Pair 1 transmits and receives multiplexed digital and analog between the matrix port and the station.

Note: Ensure that the Select switch on the station's rear panel is in the correct position for the intended use.
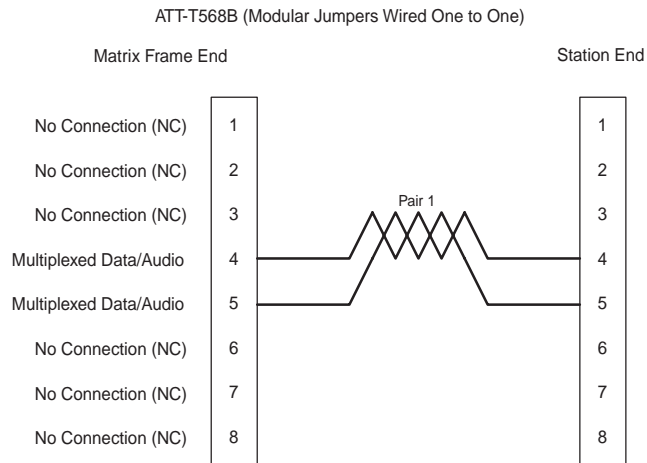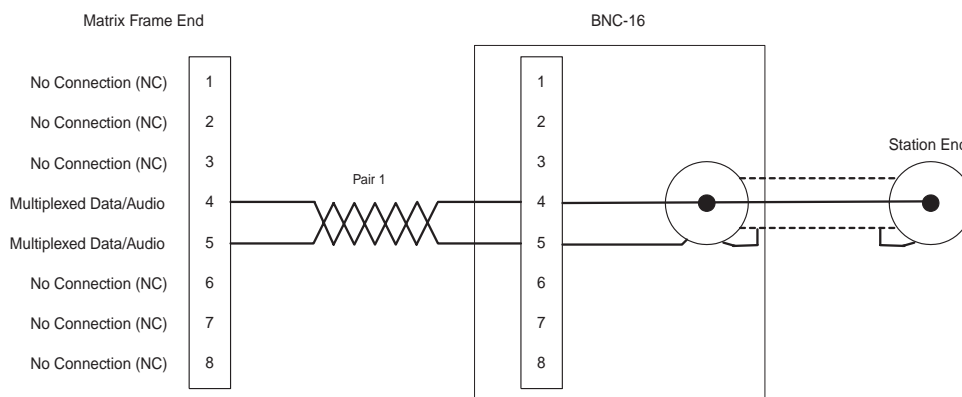
FIGURE S6-3: Matrix Frame to Digital Station Wiring Using BNC-16 and Coax

Matrix Station Miscellaneous Connector Wiring

Most local devices connect with the station via the Miscellaneous connector.

The following paragraphs discuss how to wire the various functions available on the "Miscellaneous" connector.
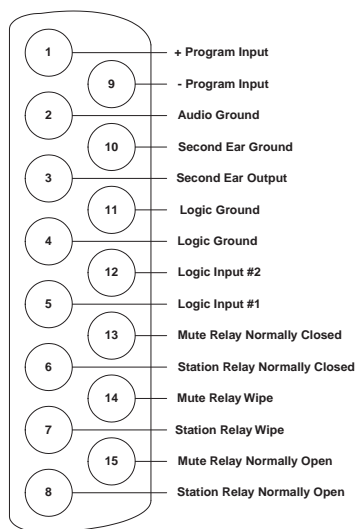

FIGURE S6-4: Miscellaneous connector pinout

External Program Feed Input

The external program feed input allows the station operator to simultaneously monitor audio from an external source and intercom audio.

The input is designed to accept a balanced, line-level audio feed at a nominal level of 0 dB. The program feed input passes through the station's "Program" volume control before being mixed with the audio at the station. The program feed (program audio) can be heard on the station's speaker and headset; it cannot be heard by other stations in the Matrix system.

To connect an external program feed to the station:

1.   Connect the balanced audio pair to pins 1 and 9.

2.   Connect a shield or ground connection if available to the connector's pin 2 (see Figure S6-4 on page S6-5).

Logic Input #1 and #2

Each input can control one of several functions, determined through the configuration program. Typically, these inputs are connected to an external foot switch, a panel-mounted switch, or the logic output of another device.

The following functions are available:

- Mic On/Off—toggles the station's microphone on and off.

- Mute Mic Output To Frame—turns off the audio from the station to the frame. It does not turn off the Hot Mic output (described in "OPT-100 Auxiliary Audio I/O Option" on page S6-8). For an example of how to use this option, see "External Program Feed Input" on page S6-6.

- Mic Off —momentarily turns off the station's microphone.

- Answer Back Talk/Clear—the same functions as the station's "Answer Back" key. Holding down the switch activates a talk to a label in the answer-back stack. To clear the label, quickly press and release the switch.

- Studio Announce—sends the output of the station's selected microphone (panel or headset) to the station's Studio Announce (SA) audio output, and activates the SA relay. The microphone output is not sent to the frame. The SA output and relay are only

present if the station has the OPT-100 Auxiliary Audio I/O Option installed. (The SA options are described in "OPT-100 Auxiliary Audio I/O Option" on page S6-8).

• Speaker OFF—turns off the station speaker, disabling all audible output from the station.

• PTT: Activate All Talk Keys (Push To Talk)—when enabled from the configuration program and the logic input is active, the station behaves normally. When this function (logic level) is deactivated, it disables activation of all talk labels, implementing a push-to-talk function for the station. Any controls (relays, etc.) assigned to the labels are activated or deactivated along with their assigned labels. The LED indicators associated with the active labels behave normally regardless of this input's activity. This input controls momentary and latched talks.

• Activate Talk Switch #1—equivalent to pressing the station's first (left most) talk selector; a momentary and latching activation.

• Activate Talk Switch #2—equivalent to pressing the station's second talk selector; a momentary and latching activation.

• Activate Listen Labels Button—equivalent to pressing the "Listens" button on the keypad; all modes of the "Listens" button are supported.

• PTT: Activate Two-Way Radio Keys—implements a push-to-talk function for all two-way radio talk selectors. When the logic input is active, the station operates normally. When the logic input is deactivated, all active two-way radio talk selectors are disabled. Any controls (relays, etc.) assigned to the labels are activated or deactivated along with their assigned labels. The LED indicators associated with the active two-way radio talk selectors operate normally regardless of the PTT status. This input only controls latched talks.

Use normally open type switches to activate the logic inputs. Connect the switches as follows (Figure S6-4 on page S6-5):

Logic input #1—pins 4 to 5 (pin 4 = ground)

Logic input #2—Pins 11 to 12 (pin 11 = ground).

Note: Do not apply external voltage to the logic inputs.
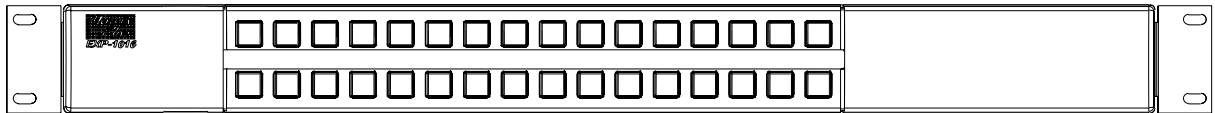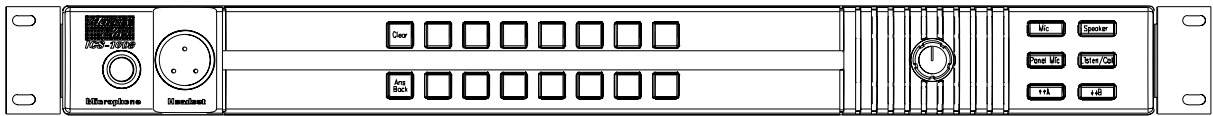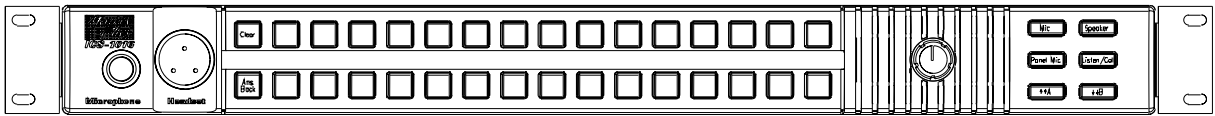
Matrix Plus 3 System   ICS-1016/ICS-1008/EXP-1016

MASTER INTERCOM STATIONS

Introduction

This chapter describes the installation procedure of the ICS-1016 and ICS-1008 Stations and their associated EXP-1016 expansion panel. For operation information, see the *Matrix Plus 3 Operation Manual;* for troubleshooting and maintenance information, see the *Matrix Plus 3 Maintenance Manual;* and for programming information, see the *PGM-WIN System Configuration Manual.*

Equipment Mounting

ICS-1016/ICS-1008

Put all intercom stations at a comfortable operational height. Leave at least 2 in. of clearance at the rear of the station's chassis to allow for cable connectors and access to the rear-panel controls.

EXP-1016

The EXP-1016 is intended to expand or enhance the stations' operation and usually mounted next to or near their associated station. A 6-ft. cable is supplied to connect them. Leave at least 2 in. of clearance at the rear of the expansion panel's chassis to allow for the cable connector.

Wiring

ICS-1016/ICS-1008

The ICS-1016/ICS-1008 uses a twisted, 4-pair transmission scheme to connect it to the frame using the industry standard RJ-45 connector. Refer to the Overview section of the *Matrix Plus 3 Installation Manual* for RJ-45 connector installation and use, and the type of cable needed for connection between stations and frames.

Each pair of the twisted, 4-pair wire has the following function:

- pair 1 transmits analog audio from the matrix port to the station

- pair 2 transmits digital data from the station back to the matrix card port

- pair 3 transmits audio from the station to the matrix card port

- pair 4 transmits digital data from the matrix port back to the station.

ATT-T568B (Modular Jumpers Wired One to One)

Matrix Frame End				Station End

RS-422 Receive + 1   Pair 2   1
RS-422 Receive - 2   2
Audio Receive + 3   Pair 1   3
Audio Send + 4   4
Audio Send - 5   Pair 3   5
Audio Receive - 6   6
RS-422 Send + 7   Pair 4   7
RS-422 Send - 8   8
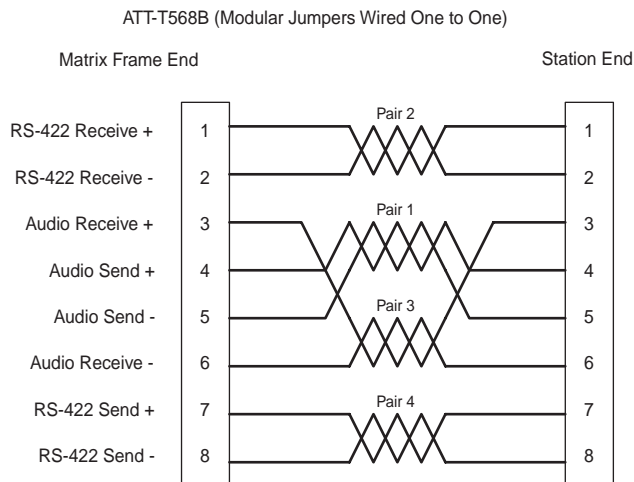
FIGURE S7-1:   Matrix Frame to Station Wiring

EXP-1016

The installation of an EXP-1016 to a station is simple:

1.   Plug the DB-9M end of the additional key panel's cable into the Expansion connector on the back of a station.

2.   Plug the DB-9F end of that cable into the Station connector on the back of the EXP-1016.

Mains AC Power

ICS-1016/ICS-1008

The stations have an external DC power supply with a removable AC power cord. The power supply is "universal," operating over a voltage range of 90 to 260 VAC and 45 to 65 Hz. The maximum dissipation is 30 W. A bracket has been provided to mount this external supply, if necessary.

EXP-1016

The EXP-1016 receives its power from the ICS-1016/ICS-1008.

Adjustments

ICS-1016/ICS-1008

The stations have identical rear-panel controls. They are:

- speaker mute level control
- page override level control
- headset microphone sidetone adjustment
- headset microphone gain adjustment
- panel microphone gain.
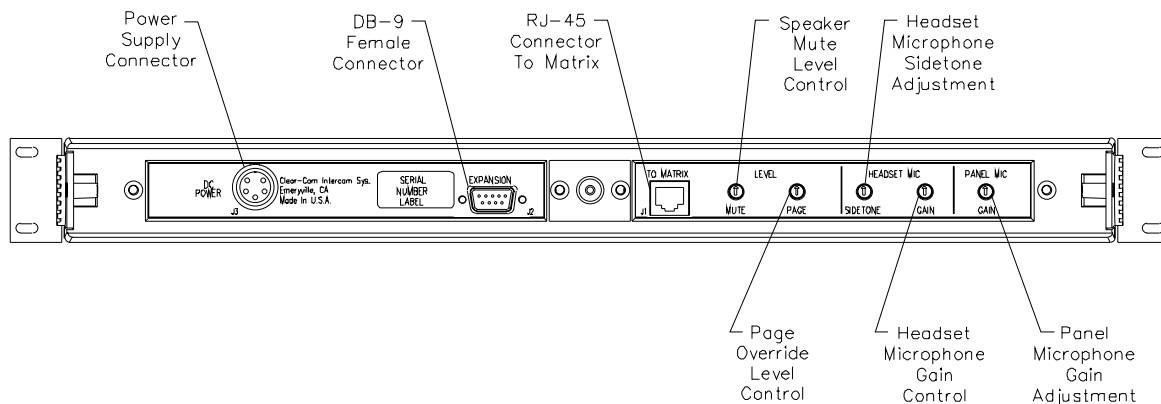
FIGURE S7-2: ICS-1016/ICS-1008 Rear Panel

Speaker Mute Level Control

This knob adjusts the speaker level when any talk is active at the station. This function helps prevent possible feedback. The maximum amount of muting is 15 dB below full volume. If the rear-panel control is set below that level, then muting will have no effect. When shipped from the factory, the mute level is adjusted to provide a -6dB attenuation.

Page Override Level Control

This knob adjusts the page override level. Page Override is a special function in the station in which the intercom volume defaults to a preset a value or the current front-panel volume control setting (whichever is higher) when commanded to by the central matrix. Any fixed group can be assigned the page-override function through the configuration

program. When shipped from the factory, the page override level is adjusted to the equivalent of half volume.

Headset Microphone Sidetone Control

This knob adjusts the headset sidetone level. Sidetone is the sound of the user's voice in his headset. When shipped from the factory, the sidetone is adjusted for maximum sidetone.

Headset and Panel Microphone Gain Controls

These knobs adjust the gain of the headset and panel microphones. The preamplifier gain of the panel and headset microphone can be adjusted over a range of 0 to 20 dB. When shipped from the factory, the headset microphone gain is set to 10 dB and the panel microphone gain is set to 0 dB.

If two stations are talking to each other at the same time with the panel microphone gain set to maximum, feedback may occur even if the Speaker Mute (see "Speaker Mute Level Control" on page S7-3) is set to maximum. In this case, it will be necessary to turn the panel microphone gain down. Similarly, in some noisy environments it may be necessary to turn the panel microphone gain down and have the operator talk more closely into the microphone.

EXP-1016

The expansion panel doesn't have any adjustments.

Configuration

ICS-1016/ICS-1008

Assign each station's name and other parameters by using the Matrix Plus 3 System Configuration Program (see *PGM-WIN System Configuration Manual* for more information).

Note: Environments with a high level of electrical impulses and radio frequencies may disrupt station operation. To ensure that all activated talk and listens paths are automatically restored when the station is reset, check the "Restore talk paths" and "Restore listen paths" boxes in the Setup - System Preferences screen.

EXP-1016

After mounting the key panels and connecting them to a station, the number of accessory keys installed in the station must be programmed into the configuration program as follows:

1.   Enter the Setup - Hardware and Labels screen.

2.   Find the appropriate station in the Port Function column and select it.

3.   Click on the drop-down menu in the XP/AP Keys column and select 32/0.

4.   Click Apply.

Notes: A station can only have one EXP-1016 connected to it.

Environments with a high level of electrical impulses and radio frequencies may disrupt expansion panel operation. To ensure that all activated talk and listens paths are automatically restored when the expansion panel is reset, check the "Restore talk paths" and "Restore listen paths" boxes in the Setup - System Preferences screen.

Specifications

ICS-1016/ICS-1008

Front-Panel Controls and Connectors

Talk/Listen Buttons	30 (ICS-1016); 14 (ICS-1008)
Function Buttons	6
Answer Back Button	1
Clear Button	1
Volume Controls	Intercom
Headset Connector	XLR-4M
Panel Mic Connector	Locking 1/4-in. phone jack

Rear-Panel Connectors

To Matrix	RJ-45
Expansion Option	DB-9F

Panel Microphone Input

Type	Electret with proprietary phone jack
Input Level	- 40 dBv

Gain Adjustment Range	0 to 20 dB
Impedance	200 ohms

Headset Microphone Input

Type	Dynamic
Input Level	- 55 dBv
Gain Adjustment Range	0 to 20 dB
Impedance	200 ohms

Line Input/output

Type	Transformer Balanced
Input Impedance	8k ohms Bridging
Output Impedance	150 ohms
Level	0 dBv nominal
Freq. Resp.	50 Hz to 15 kHz, ± 2 dB

Headphone Outputs

Impedance	50 to 600 ohms
Power	1/2 W into 50 ohms

Temperature

Operating	0 to 50 C (32 to 125 F)
Humidity	20% to 90%, noncondensing

Power

In-Line Power Supply, with 3-pin EIA connector, UL approved power supply

Voltage	90 to 250 VAC, 50 to 60 Hz, 50 VA max.

Dimensions

Height	1.75 in. (89 mm)
Width	19 in. (483 mm)
Depth	6.75 in. (172 mm)

Weight

4.0 lbs.

EXP-1016

Front-Panel Controls and Connectors

Talk/Listen Buttons	32

Rear-Panel Connectors

Expansion Option   DB-9M

Temperature

Operating   0 to 50 C (32 to 125 F)
Humidity   20% to 90%, noncondensing

Power

Powered by the intercom station.

Dimensions

Height   1.75 in. (89 mm)
Width   19 in. (483 mm)
Depth   6.75 in. (172 mm)

Weight

4.0 lbs.

All specifications are subject to change without notice.

Introduction

This Chapter describes how to install the PGM-WIN Matrix Plus 3 System Configuration Program for Windows 95/NT. For operating instructions refer to the separate Configuration Program Operation Manual. The following subjects are discussed in this chapter:

- Minimum Hardware Requirements
- Hardware installation
- Software installation
- Software Initialization
- Verification of Installation
- Troubleshooting

Minimum Hardware Requirements

PGM-WIN's minimum hardware requirements are an IBM or IBM-compatible PC with a 486 DX2-66 CPU, 8 megabytes of RAM, and a mouse, trackball, or other pointing device. PGM-WIN runs on Windows 95 or Windows NT; it is **not** compatible with Windows 3.1. PGM-WIN requires only about 2 megabytes of hard-disk space, so the size of your hard drive should not be a concern. PGM-WIN cannot be run from a diskette or floppy disk.

Hardware Installation

PGM-WIN requires a serial port connection between the frame and the PC computer. PGM-WIN can be configured to use any one of the standard PC serial ports COM1, COM2, COM3, or COM4. Refer to the Software Initialization section later in this chapter.

The "IBM-PC RS-232" connector on the rear of the matrix frame is used to connect the frame to an external PC. Subsequent figures show the connections for a cable that connects the matrix frame to the computer. Two versions are shown, the first (Figure C-1) for a computer serial port with a DB-9M connector on the back (cable connector is female), the second (Figure C-2) for a computer serial port with a DB-25M connector on the back (cable connector is female)..

**TO COMPUTER
SERIAL PORT
DB-9F**

**TO MATRIX FRAME
"IBM-PC RS-232"
DB-9M**
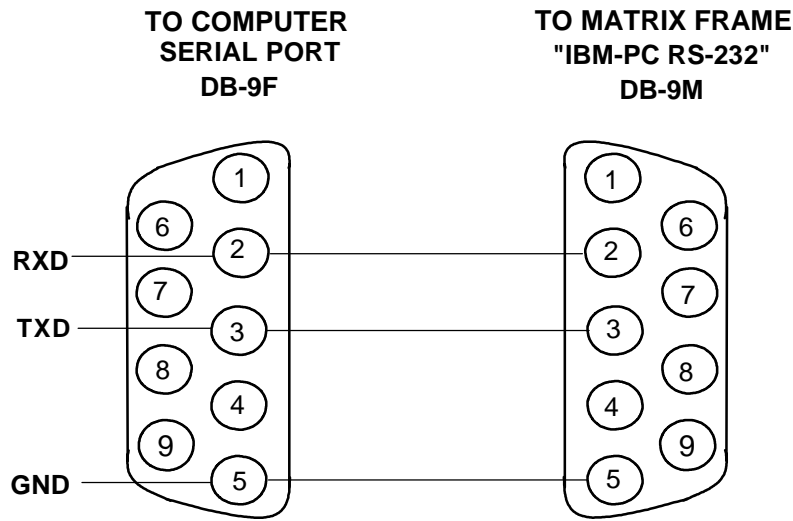
FIGURE C-1 "IBM-PC RS-232" Cable viewed from rear of connectors

**TO COMPUTER
COMPUTER SERIAL PORT
DB-25F**

**TO MATRIX FRAME
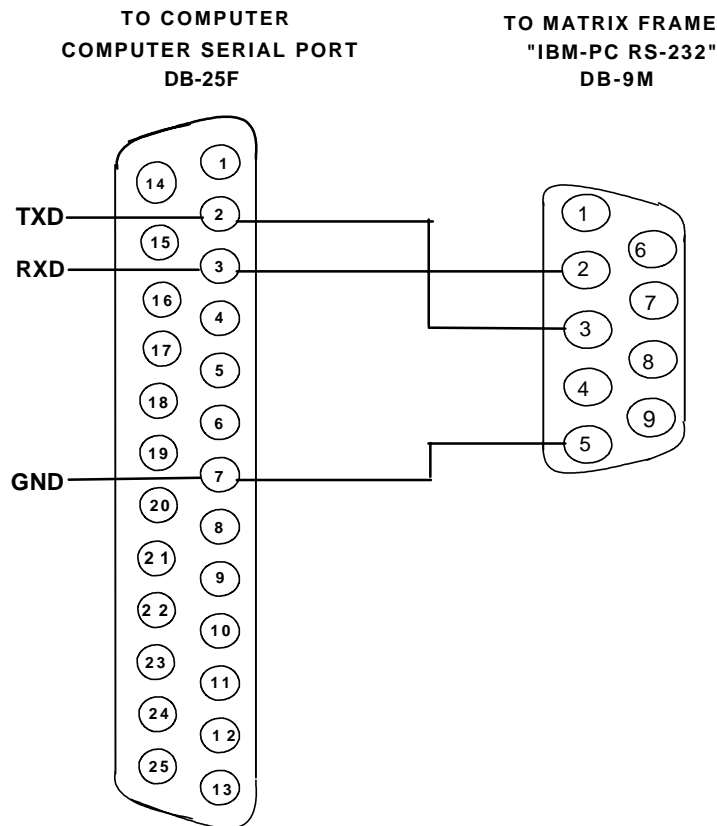"IBM-PC RS-232"
DB-9M**

FIGURE C-2 "IBM-PC RS-232" Viewed from rear of connector

Software Installation

The PGM-WIN Configuration Software is delivered on three 3½" high-density diskettes. As soon as you have opened the shipping package, **make backup copies of the disks**. For details on how to copy disks, please refer to your DOS or Windows Manual. Store the original disks in a safe place.

PGM-WIN is installed on a hard drive the same way as any Windows program:

1 Insert Disk 1 into your 3½" diskette drive (your "a:" drive).

2 Open the "Start" menu and set "Run...".

3 Enter "a: setup" in the window. A box labeled "Welcome" will appear, indicating that you will have begun to upload PGM-WIN.

4 Follow the onscreen instructions to complete the installation.

To exit the program, do as you would with any Windows application:

- Select "Close" from the "Matrix Plus 3" Control menu.
- Select "Exit" from the "File" menu.
- Click the "X" box in the upper right-hand corner of the "Matrix Plus 3" window.

To run the program subsequent to installation, click the "Matrix Plus 3" icon.

Software Initialization

Most PCs will work properly using the default settings for PC serial port and serial baud rate, but they can be changed if neccesary using the "PC Setup..." box from PGM-WIN's "File" menu; this box also enables you to set a password, if desired. These parameters are set as described in the following paragraphs.

The "File - PC Setup..." box features three fields: "Communications", "Preferences", and "Security."

"Communications"

The "Communications" field in turn features two scrollable option lists: "PC Serial Port" and "Baud Rate.

"PC Serial Port": This field enables you to select the PC serial port that will communicate with the matrix frame. The options are COM1, COM2, COM3, or COM4; COM2 is the default as COM1 is usually reserved for the mouse.

"Baud Rate": The "Baud Rate" option list is set to 57.6 K baud by default; this rate will be used in almost all cases. Under certain circumstances (for example, if you have a

very long cable between your PC and the frame) you may need to run at slower baud rates. The CONFIG-1 card will automatically detect the baud rate set by the PC, and will adjust itself to it.

"Security"

The "File - PC Setup..." box' "Security" field enables PGM-WIN's protective password option. The default setting (set at the factory) is to leave the PASSWORD box blank; if no password has been assigned, PGM-WIN will start immediately. If a password has been assigned, you will be prompted to enter the password before you can enter PGM-WIN.

To set the opening password, enter the desired password in the PASSWORD field, then either click "OK" or hit "Enter" (while the cursor is in the field) to confirm it. The password is not case sensitive—that is, "MYPASSWORD" is the same as "mypassword." If you delete any password in the field, you will have restored PGM-WIN to the default setting.

To keep your system secure, put the original **Configuration Program** diskette in a secure place, because it can be used to wipe out any existing passwords and gain access to your system.

If you lose or forget your password, you can clear it and install a new one by repeating the installation procedure; however, you will also need to reconfigure the rest of the "PC Setup..." parameters. NOTE: Save any important configurations under names other than those on the distribution disk.

"Preferences"

This field enables you to make a preference in printing label strips for intercom station assignment keys: the default is black text on a white background, but you can check the box to select "White on Black" if you want.

Verifying the Installation

Once you have connected the PC to the matrix and set the program parameters, you can verify the operation of PGM-WIN and its communication with the matrix frame by loading the matrix' current configuration into the computer. To do this: Select "Open" from the "File" menu.

The computer will send a request for the current configuration to the frame. While the computer is communicating with the frame, the screen will display a progress bar, and the yellow "Computer I/O" LED on the CONFIG-1 card will light.

If the computer correctly receives this configuration information from the matrix frame, the installation is successful. If the configuration file name stored in the CONFIG-1's RAM cannot be found in the "PGM-WIN" file directory, a warning box will appear; this is normal, and it confirms correct data communication with the frame.

If the computer does not correctly receive this configuration information from the matrix frame, the screen will display the error message "The frame is not responding. Check serial port connections". If this message appears, check the cable connecting the computer to the frame to make sure that it is plugged in and that it makes the correct connections as described in the "Serial Port Connection" section above. This message will also be displayed if the matrix frame loses mains AC power, or if the CONFIG-1 card is unplugged from the frame, or is not installed in the proper slot.

The file "Sample.cfg" contains the Matrix Plus 3 System Configuration which features the example Configuration Program screens mentioned in the "Configuration Program Operation Manual." We encourage you to examine and experiment with these screens as you read through the Operation Manual.

Troubleshooting

If communications between the frame and the computer fail, the most common causes are as follows:

1. The wrong serial port has been selected in the "PC Setup..." box.
2. The cable is plugged into the wrong PC serial port connector.
3. The cable is miswired.
4. The PC is not fast enough to support the selected baud rate
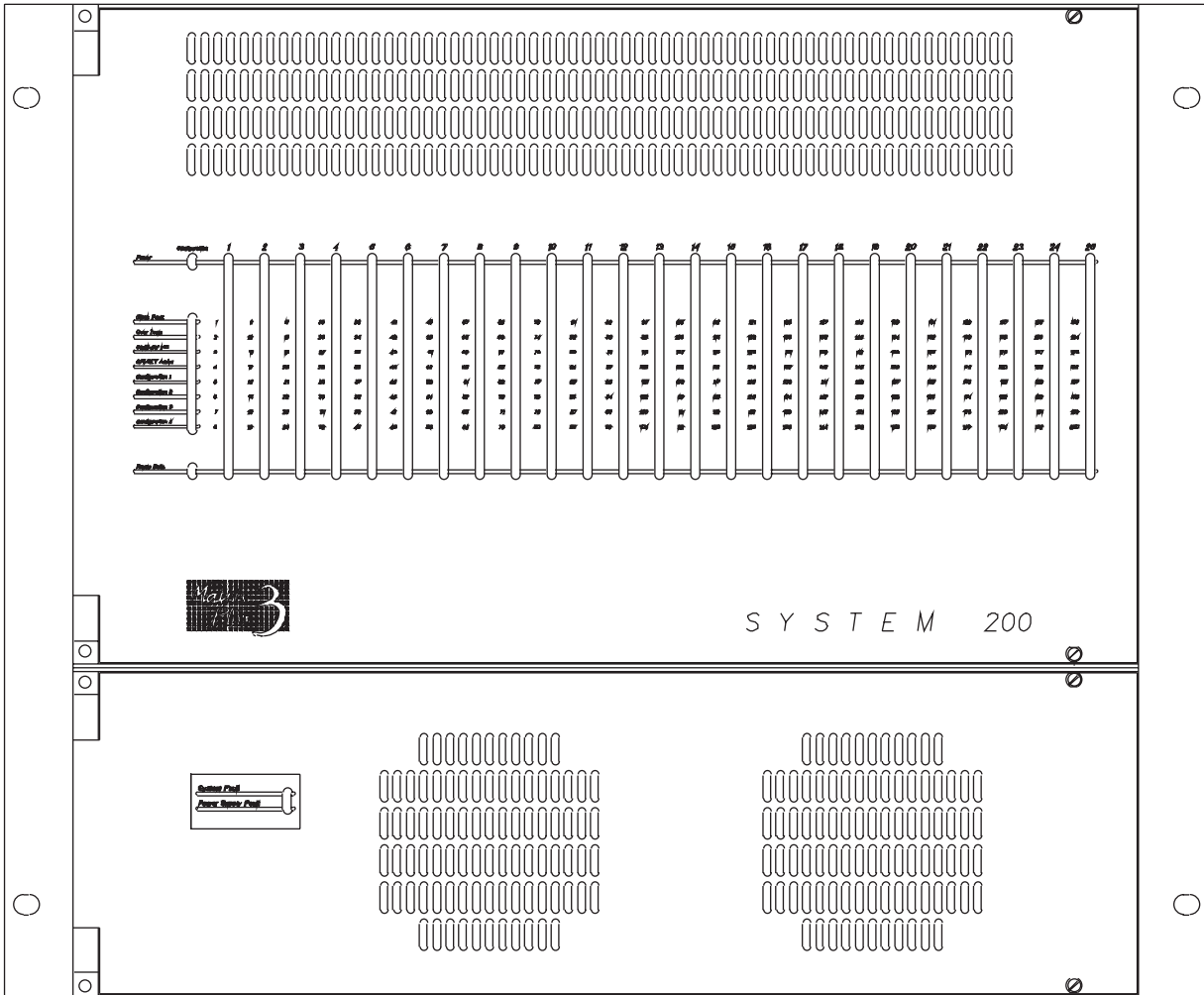5. The cable is too long for the selected baud rate.

If the problem persists, reset the computer and the CONFIG-1 card, and try again. If the problem still persists:

- Check the computer's serial port by running some other device (such as a mouse) through the port
- Try replacing the CONFIG-1 card.

Matrix Plus 3 System   SYS-200
SYSTEM CARD FRAME   200 x 200   25 SLOT

Introduction

This Section describes the installation of the SYS-200 Matrix Frame. Most of this Section also applies to the installation of the COM-72 Matrix Frame. The "COM-72" section will refer to this section where it is applicable. This chapter covers the following subjects:

- Description
- Matrix Frame Installation
- Frame Wiring
- Specifications

Description

The SYS-200 Matrix 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, in up to four different configurations. Every SYS-200 includes in its package:

- A CONFIG-1 card with a battery-backed RAM that stores the configurations (mounted in the frame)
- A clock card (mounted in the frame)
- Four power supplies, two for digital circuits and two for analog circuits (packaged separately). See "Power Supply Installation" on the next page for further details
- An alarm card (mounted in the frame)
- Two cooling fans (mounted on the inside of the power-supply compartment door).

You may have also ordered and received additional items, such as:

- Up to four RP rear panels, each with six blocks of eight RJ-45 connectors apiece.
- Up to 25 MTX-A8 cards, each capable of supporting eight ports.

The SYS-200's rear panel features connectors that allow you to connect to intercom stations and interfaces and to the computer running the Configuration Program, in addition to mains AC power connectors.

Matrix Frame Installation

When you receive the frame from the factory, it will already be assembled and configured to your application's hardware specifications. You will need to supply:

- Cables to connect to stations and interfaces (see "Summary of Wiring Systems" on page O-14 of the OVERVIEW chapter of the Installation Manual.
- A PC with Windows 95 or Windows NT to run the configuration software
- A standard 19-inch rack to install the frame in.

To install the SYS-200:

1   Remove the SYS-200 from its shipping carton.

2   Handles are provided for the frame but they are not mounted. If your application requires handles, install them with the supplied hardware at this time.

3   Install the SYS-200 in the 19-inch rack (it will require 9 RU). The frame has internal cooling fans that receive fresh air from the front of the unit and the exhaust air is brought back out the front of the unit.   Therefore, the enviroment in the rack, if it is nominal, should not be affected by the frame nor will it affect the frame. However; the presence of the closed doors on the front of the frame is part of the air flow design. During operation, both doors must remain closed and the fans must be functional.

4   Install the Power Supply Modules.

5   Check position of all plug-in cards in the frame.

6   Apply AC power to the unit.

This section will discuss the following subjects:

- Power Supply Installation
- Rear RJ-45 Connector Panels

Power Supply Installation

The SYS-200's DC power supplies run on AC mains line current. The supplies are intended to run in combinations of one digital supply and one analog supply; two such combinations per frame assure that every frame will have **redundant power**—that is, the frame will continue operating even if one supply output fails . Clear-Com will furnish one of two types of power-supply combinations with your SYS-200, depending on how many ports your application requires. If you require 104 ports or fewer, each of your combinations will include:

- One PS-D104 supply (rated at 65 watts) to power the SYS-200's digital circuits
- One PS-A104 supply to power the SYS-200's analog circuits (65 watts).

If you require more than 104 ports, each of your combinations will include:

- One PS-D200 supply to power the digital circuits (150 watts).
- One PS-A200 supply to power the analog circuits (115 watts).

To install the power supplies:

1   Remove the power supplies from their shipping cartons.

2   Open the door of the power-supply compartment (lower door). To the right of the alarm card you will find four slots, labeled to indicate the type of supply to be installed in each.

3   Slide the supplies into the slots, making sure to push them fully into their connectors. The SYS-200 can run on just one power-supply combination, but unless you install both and connect mains AC power to both, you will not have redundant power.

4   Connect the supplies to AC mains power using the IEC power connectors on the SYS-200's rear panel.

Rear RJ-45 Connector Panels

The rear panel of the SYS-200 frame is composed of 5 modular panels providing the necessary connectors for the entire 200 port system.

The first panel on the right side viewing the unit from the rear has 8 RJ-45 port connections, a DB-9F for connection to a PC, a RJ-45 for connection to Accessories, a DB-9F for Alarm I/O, and two power connectors.

The second through the fifth panels contain the RJ-45 connectors necessary for the balance of the 200 intercom ports. Normally Clear-Com will only install the rear connector panels needed to support the number of matrix cards ordered at the time of shipment. The unused module spaces will be filled with blank panels. Each of the four panels are identical in circuity but their silk screen designations are different to indicate the proper port numbers. The model numbers for the four panels are as follows:

- RP-56   ----------   Provides connectors for ports 9-56
- RP-104   --------   Provides connectors for ports 57-104
- RP-152   --------   Provides connectors for ports 105-152
- RP-200   --------   Provides connectors for ports 152-200

Field Installation of RP Panels:

If at the time of original installation or for later expansion it is necessary to add RP panels to support more ports, use the following procedure:

1   Remove the blank panel in the module slot that the new RP panel is to be installed in.

2   Install the new RP panel with the screws from the blank panel but do not tighten then. **Leave all of the screws loose.**

3   Opening the front door of the frame, install at least two matrix cards in the new RP panel, one in the first of the six slots for that panel and the other card in the last of the six slots. These cards will align the new rear panel.

4   While the matrix cards are plugged in from the front of the frame, tighten all of the screws on the new RP panel.

This procedure can be done while the system is operating as the RP panels only connect to the two matrix cards that were used for alignment.

This procedure should be repeated anytime a rear panel is removed for any reason.

Frame Wiring

The "Wiring Systems Summary" of the OVERVIEW chapter of this manual has complete wiring details necessary to connect the frame. The subject of RJ-45 cables and the type of cable required for the system is also discussed at length in that section.

The SYS-200 features two IEC mains AC power connectors that provide separate power inputs for redundant power supply combinations. If you connect each AC input to a different mains AC branch, one power supply combination will continue operating if the other combination's mains AC branch opens.

Specifications

Plug-in Card Capacity

Clock slot	1
Configuration slot	1
MTX card slots	25
Power assembly slots	4

Connectors (Rear Panel)

RJ-45	200 Port Connectors
DB-9F	IBM-PC RS-232
RJ-45	GPI/RLY Interface
DB-9F	Alarm I/O
IEC power connector	2 Power Input Connectors

Power Requirements

90 - 250 VAC, 50-60 Hz	350 VA max.

Operating Environment

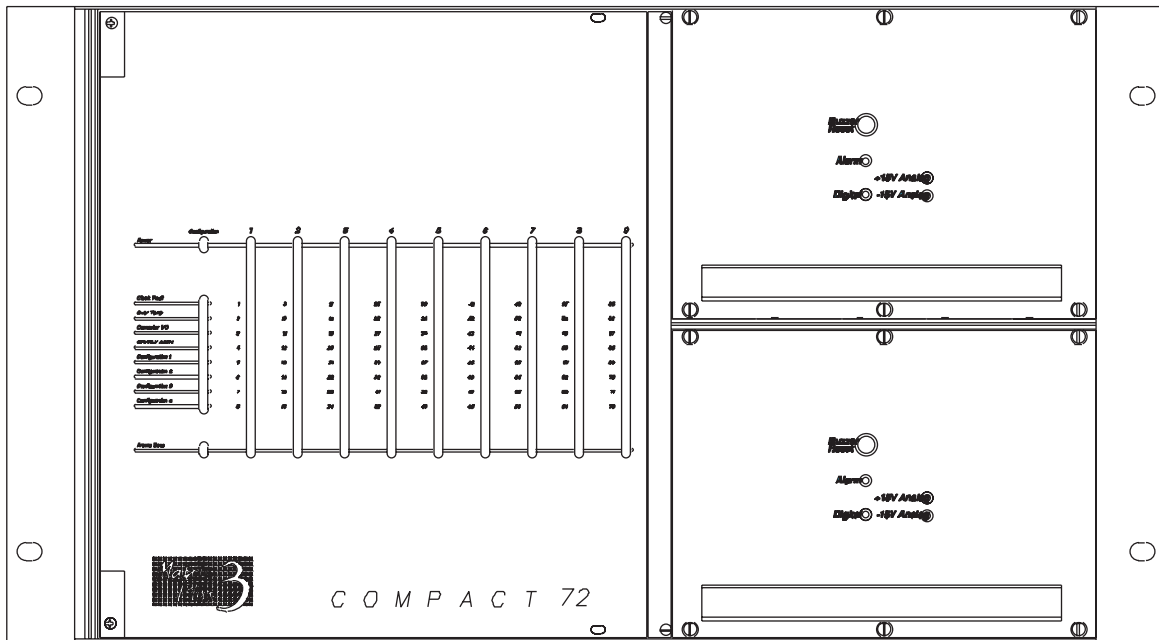|	
Temperature	32 to 122º F (0 to 50º C)
Humidity	40 to 90% relative humidity (non-condensing)

Dimensions

Width	19 inches (48.3 cm)
Height	15.75 inches (39.6 cm)
Depth	13.8 inches (34.8 cm)
Weight	59 lbs (26.8 kg) (fully loaded with cards)

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

Introduction

This Section describes the installation of the COM-72 Matrix Frame. Installation of the COM-72 is in many respects identical to that of the SYS-200 Card Frame; this section will refer to the "SYS-200" section of the Installation manual in all such cases.

Description

The COM-72 Matrix Frame is identical to the SYSTEM-200 frame in function with only two exceptions: it supports 72 ports, and it fits in 6RU of rack space.

Other variations are as follows:

- Cooling Requirements: The COM-72 does not have forced air cooling and therefore depends on convection cooling. **The top and bottom panels of the frame must not be obstructed in the frame to allow for ventilation.** If necessary to assure this, leave 1RU blank space above and below the frame.

- The power supplies are mounted in modules available from the front of the frame.

- All of the RJ-45s for 72 channels are built into the rear panel. There are no additional rear panels for the COM-72 frame.

- The AC power requirement for the frame is much less.

Matrix Frame Installation

When you receive the frame from the factory, it will already be assembled and configured to your application's specifications. You will need to supply:

- Cables to connect to stations and interfaces (see "Summary of Wiring Systems" on page O-14 of the OVERVIEW chapter of the Installation Manual.

- A PC with Windows 95 or Windows NT to run the configuration software

- A standard 19-inch rack to install the frame in.

To install the COM-72:

1   Remove the COM-72 from its shipping carton.

2   Install the COM-72 in the 19-inch rack (it will require 6 RU). **The frame is convection cooled and needs unobstructed air flow in the bottom of the frame and out the top of the frame for proper ventilation.** Therefore, the environment in the rack can affect the operation of the frame.

3   Check position of all plug-in cards in the frame.

4   Apply AC power to the unit.

Specifications

Plug-in Card Capacity

Clock card slot	1
Configuration card slot	1
Matrix card slots	9
Power assembly slots	2

Rear Panel Connectors

RJ-45	72 Port Connectors
DB-9F	IBM-PC RS-232
RJ-45	GPI/RLY Interface
DB-9F	Alarm I/O
IEC power connector	2 Power Input Connectors

Power Requirements

90-250 VAC, 50-60 Hz	200 VA max.

Operating Environment

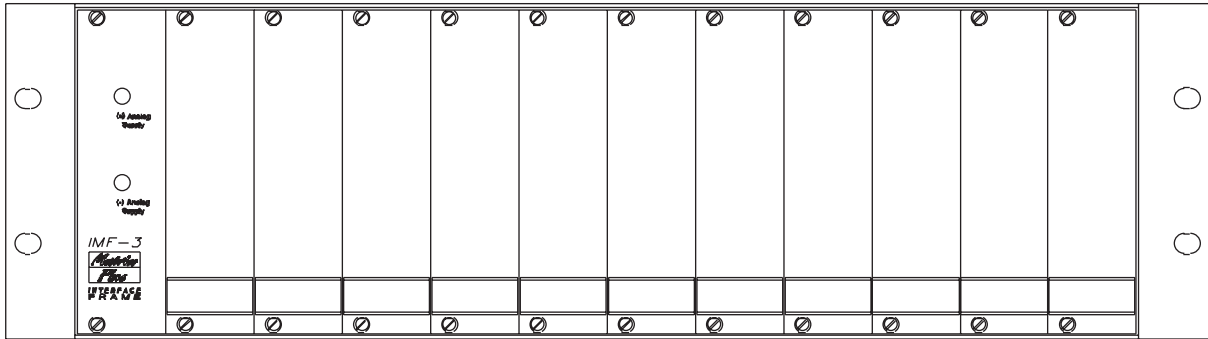|	
Temperature	32 to 122º F (0 to 50º C)
Humidity	40 to 90% relative humidity (non-condensing)

Dimensions

Width	19 inches (48.3 cm)
Height	6RU 10.5 inches (26.4 cm)
Depth	13.8 inches (34.8 cm)
Weight	40 lbs (18.2 kg) (fully loaded with cards)

Matrix Plus 3 System   IMF-3
INTERFACE MODULE FRAME

Introduction

This Section covers the description, power supply requirements, installation and specifications of the IMF-3 Interface Module Frame.

Description

The IMF-3 has the following features:

- It is 3 RU high.
- It can house up to 11 Matrix Plus 3 Interface modules.
- Front panel power indicators.
- Built in universal rear panels for all interface types.

The Matrix Plus 3 system currently has five interface types that allow the matrix frame to connect to almost any type of audio control circuitry. The following interfaces are currently supported by the IMF-3 Interface Frame:

FOR-22 --- 2 channel 4-wire matrix to 4-wire audio plus Logic/"Call Signal" control inputs and outputs

CCI-22 ---- 2 channel 4-wire matrix to 2-wire Party-Line Intercom format

TEL-12A -- 1 channel 4-wire matrix to standard (POTS) telephone line.

RLY-6 ----- 6 SPDT relays directly controlled by the CONFIG-1 card.

GPI-6 ------ 6 general purpose control inputs directly to the CONFIG-1 card.

Each interface slot has an associated connector panel on the rear of the unit that provides the input and output connectors for each interface. Most of the interfaces were orignally designed for older Clear-Com matrix systems (Matrix Plus I and Plus II), therefore some kind of translation of call signals and connector types is necessary to use these interfaces in a Matrix Plus 3 system. The rear panels each have circuity to perform this translation. The rear panels are universal for all interfaces, therefore when you purchase a new interface, IMF-1 rear panels will no longer be shipped with the interface unless specifically requested.

Interface Frame Power Supply Requirements

Power for the frame and the interface installed is entered via two paralleled power connectors intended to connect directly to a PSU-101 power supply designed specifically for that purpose.

This section describes how to plan the number of power supply units that are required to power a given Matrix Plus 3 System installation. This number can vary depending on the number and type of interfaces in the system, and on the degree of redundancy required. As a rule-of-thumb, one PSU-101 is required for every two IMF-3 frames unless the frames have a large number of CCI-22 Party-Line interfaces which require no DC power from the IMF-3 frame. However, an IMF-3 with only CCI-22 interfaces still needs to be connected to a PSU-101 as the IMF frame itself needs some DC power for the circuitry on its rear panel.

A PSU-101 requires 90 to 260 VAC 45 to 65 Hz with a maximum dissipation of 80 Watts. A PSU-101 connected for redundancy requires very little AC current unless it is used.

An audible alarm is included in the PSU-101, and an additional set of alarm relay contacts are provided on the supply. Clear-Com recommends that these contacts be connected to an alarm input of either of the Matrix Frames. If any of the power supplies in the PSU-101 fails it would cause a system alarm. LEDs on the front of the PSU-101s will indicate the failure.

Installing two PSU-101 power supplies per application provides redundancy because either of the two PSU-101s can power a complete system. If one fails, it can be removed without interruption of the entire system. Rear panel connectors provide easy parallel connection to the IMF-3 Interface Module Frame.

The current capacities of the power supplies are as follows:

- +9V Analog   3.0 Amps
- -9V Analog   3.0 Amps

The following chart provides the current drain of the +/- analog power supplies for all components in the system. Some devices such as interfaces have a varying current depending on the operation of features. In applications where it is possible to activate all operating features of all components used, use the maximum current column for planning.

Component	Average Current	Maximum
IMF-3 Frame	0.20 Amps	0.20 Amps
CCI-22	0.00 Amps	0.00 Amps
FOR-22	0.07 Amps	0.15 Amps
TEL-12A	0.15 Amps	0.20 Amps
RLY-6	0.10 Amps	0.15 Amps
GPI-6	0.02 Amps	0.02 Amps

FIGURE F3-1. Current Consumption of Interfaces

Figure I3-2 below shows how to connect the DC power cables supplied with the IMF-3 frame to connect the units. The illustration on the shows one PSU-101 and two IMF-3 frames. The illustration on the right shows three IMF-3 frames connected to two PSU-101s to provide redundancy.
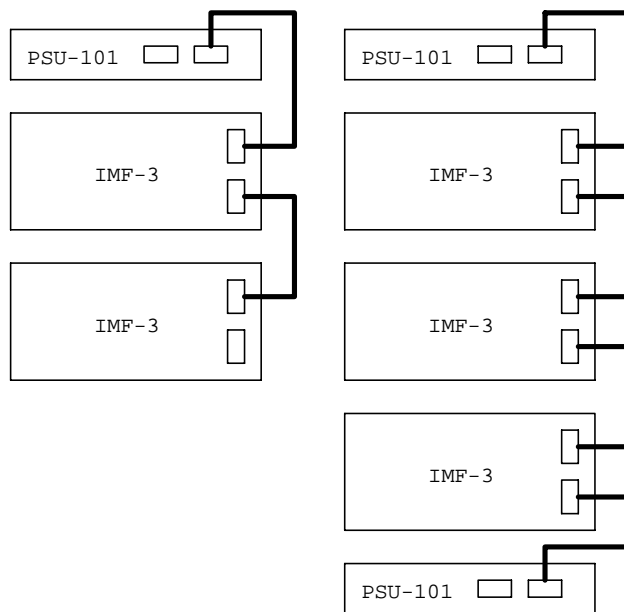

FIGURE F3-2. Power supply wiring of IMF-3 Frames

Installation

To install the IMF-3:

1   Remove the IMF-3 from its shipping carton.

2   Remove the blank plates from each slot that you want to install an interface module in. *

3   Install the interface modules using the captive screws on the front panel of the interface. *

4   Install the IMF-3 in the 19-inch rack.

5   Connect the IMF-3's power directly to a PSU-101 Power Supply as described above.

* Usually the IMF-3 grame will come with yout inital system order with the various interface modules installed in the frame.

Specifications

Plug-in Module Capacity
Quantity   11

Connectors (Rear Panel)
10 Pin Jones   2 Power Input Connectors

Power Requirements
+9 V Analog   0.2 A (frame only--no modules)
 - 9 V Analog   0.2 A (frame only--no modules)
Max. Dissipation   50Watts(frame fully loaded)

Operating Environment
Temperature   32 to 122° F (0 to 50° C)
Humidity   40 to 90 % relative humidity (non-condensing)

Dimensions
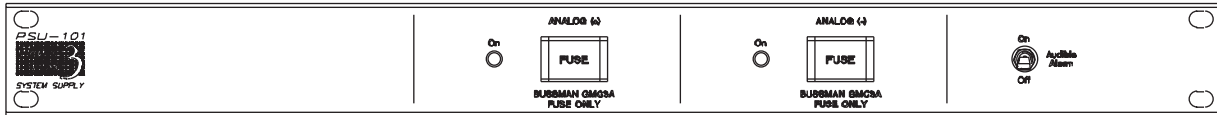Width   19 inches (48.26 cm)
Height   3RU   5.25 inches (13.3 cm)
Depth   13.56 inches (34.44 cm)
Weight   6.25 lbs (2.8 Kg) (no modules installed)

Matrix Plus 3 System   PSU-101
POWER SUPPLY MODULE

Introduction

This Section contains the description, installation procedures and the electrical and mechanical specifications for the PSU-101 Power Supply.

Description

A PSU-101 can power up to two IMF-3s Frame for Interface Module power and possibly more, depending on the mix of interface modules and anticipated usage. Each PSU-101 has two separate 9 VDC regulated power outputs with green LED indicators. The two supplies provide plus and minus voltage for the frame cards' analog audio circuits.

Each output of the PSU-101 features a fuse as listed below:

- + Analog   3.0 A
- - Analog   3.0 A

The PSU-101 features a variety of failure indicators, including:

- A sense circuit that will close a relay contact if any of the three outputs fail
- An audible alarm with a front panel disable switch
- Relay contacts that can be wired to an external alarm.

Two PSU-101s can operate in parallel to provide **redundant power**—if one supply fails, the entire system can continue operating while the faulty supply is replaced. Internal diodes isolate the supplies. Each IMF-3 frame has two paralleled connectors to allow connecting to another IMF frame or another PUS-101.

The Matrix Plus 3's power supply requirements are discussed in the Overview chapter of this volume.

Installation

The following paragraphs describe how to install the PSU-101 in the rack and how to connect it to the matrix.

Rack Space Requirements

The PSU-101 requires 1 RU in a standard 19-inch rack. Allow at least 3 inches of clearance behind the PSU-101 to plug in cables.

Wiring

The PSU-101's back panel features four connectors:

- 1 To Mains AC Power
- 1 Alarm Relay
- 2 Power to Frames

The following paragraphs describe how to connect cables to these connectors.

To Mains AC Power

The PSU-101 Power Supply runs off of mains AC power. If you are running two PSU-101s in parallel to provide redundancy, each unit should be powered by separate AC mains branches.

Alarm Relay

Each PSU-101 includes an **Audible Alarm** switch on the front panel. If this switch is ON, an audible alarm will be activated if one of the two outputs in the unit has failed.

A set of contacts are available on a separate connector on the rear panel of the unit the will close any time one of the two power supplies become inoperable. A 4 pin JONES type connector is supplied with each PSU-101.

Figure F4-1. Alarm Contact Connection


```
1  –To alarm
2  –To alarm
3
4
```
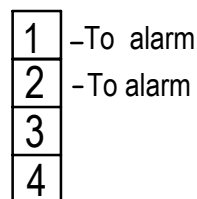
Power To Frame

Each PSU-101 has two **Power To Frame** connectors on the rear panel. The factory supplies a power cord with each IMF-3 frame to connect the PSU-101 to the frame through one of these connectors. The second connector is provided for more complicated systems.

Figure F4-2 below shows how to connect the DC power cables supplied with the IMF-3 frame to connect the units. The illustration on the left shows one PSU-101 and two IMF-3 frames. The illustration on the right shows three IMF-3 frames connected to two PSU-101s redundantely.
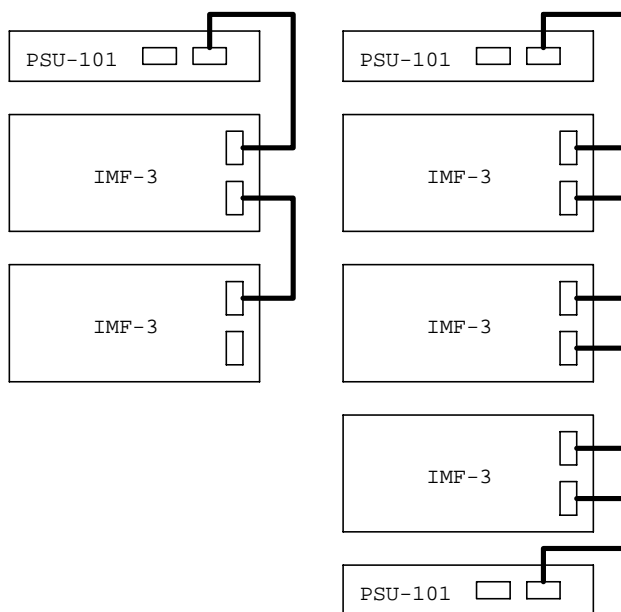

Figure F4-2. Frame Power Wiring

Specifications

Front Panel Controls and Indicators

Indicators	2	Green power output indicator leds
Fuses	2	Fuseholders for the three power supplies
Switches	1	Audible Alarm Enable

Rear Panel Connectors and Controls

Output Conn.	2	300 Series 10 Pin Cinch Jones
Alarm Out	1	300 Series 4 Pin Cinch Jones
Power In Conn.	IEC 320 Type	
Fuse	AC Mains	

Internal Regulated Power Supplies

Quantity	2
Type	Switching
Output Volt.	9.0 VDC
Output Cur.	4.4 Amp. Max.
Output fuse	3.0 Amp Both Supplies

Mains AC Power Input

Voltage	90 - 260 VAC
Power	90 Volt-Amps Max.
Frequency	50 to 60 Hz
Fusing	2.0 Amp.

Operating Environment

Temperature	0 to 50° C (32 to 1220° F)
Humidity	20 % to 90 % Relative Humidity (Non-Condensing)

Package Dimensions

Height	1.75 inches (4.45 cm), (1 RU)
Width	19.0 inches (48.26 cm)
Depth	7.75 inches (19.69 cm)
Weight	4.0 lbs (2.0 Kg)

ASSY 710517
ASSY 710520

CLEAR-COM
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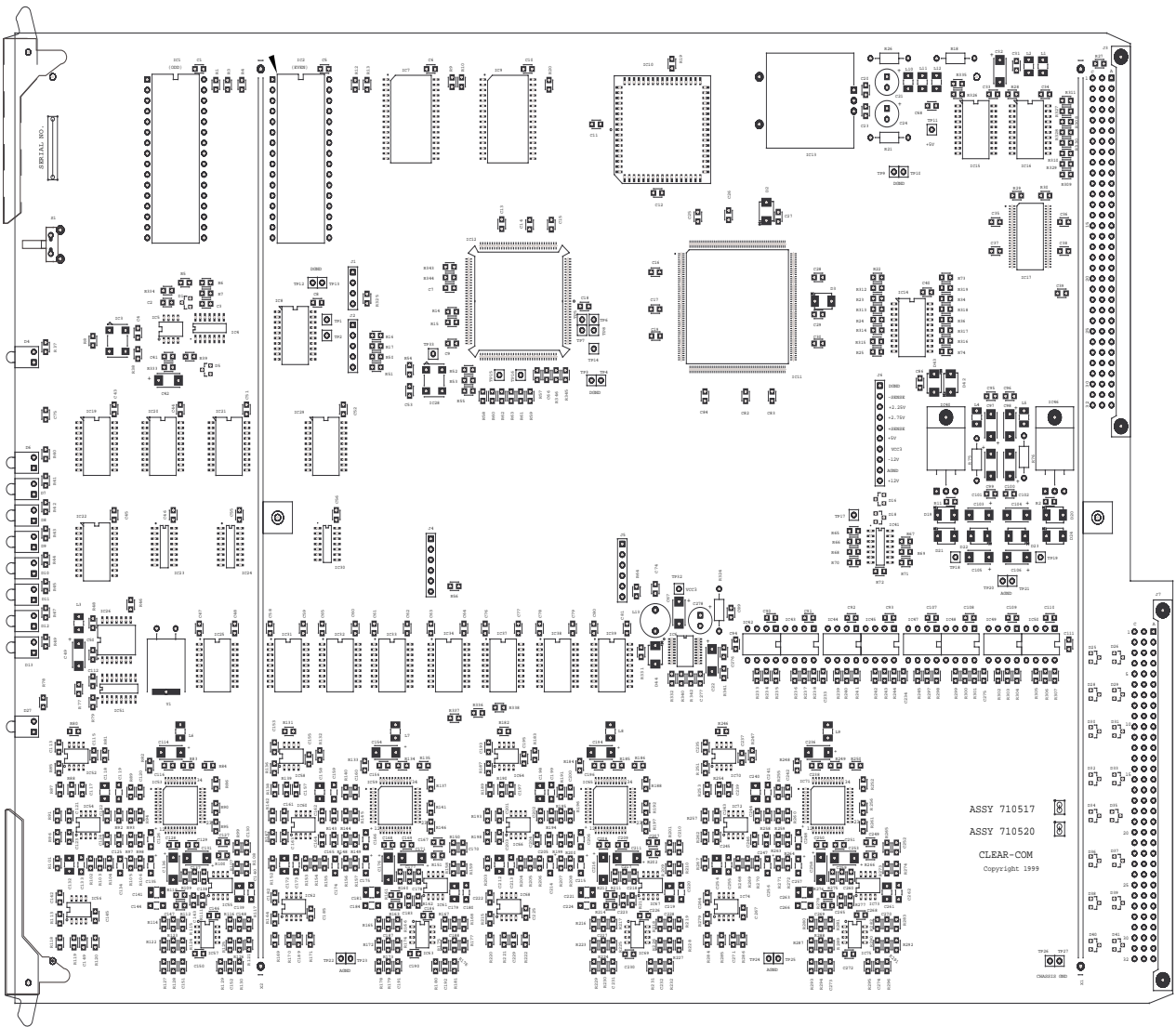
Matrix Plus 3 System   MVX-A8/L8

M A T R I X   C A R D S

Introduction

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

Installation

Installing an MVX-A8 or MVX-L8 card is a simple matter of opening the frame's door and plugging the card in one of the slots marked for MVX cards. The chosen slot should already have a rear panel in which to connect the card's ports.

Note: The SYS-200 has optional rear-panel modules that might need to be installed prior to use.

Matrix cards are held in place in the frame by card ejectors. To insert a card in the frame:

1.   Select the slot into which the MVX-A8 or MVX-L8 will be installed.

Note: The two left-most slots in a Matrix frame are occupied by the CLOCK and the CONFIG-1 cards and do not support matrix ports.

2.   Depress the retainer clips so the card will smoothly slide into the frame.

3.   Carefully place the card in the slot (with the component side facing to the right) and ensure the card is properly seated in the top and bottom of the slot.

4.   When the card is almost to the connector, raise the two ejectors so they clear the retainer clips.

5.   Once the ejectors have cleared the retaining clips, gently lower both ejector tabs simultaneously letting the force of the ejectors insert the board into the frame's connectors.

6.   As a last check, firmly press on the board to make sure it is fully seated in its connectors.

Static Sensitivity

The cards' components include CMOS chips, which static electricity can ruin. Before touching the board, touch a grounded metal object to dissipate any static potential.

Note: While handling the board, be careful not to bend any of the board's connector pins or component leads.

Spare card circuit boards should be stored in electrically insulated packaging, such as anti-static, heavy-duty plastic bags or unused frame slots.

Hot Patching

The card are "hot-patchable" and "self-initializing." This means a faulty card can be removed and replaced while the system is powered. The only parts of the system that will be affected are those assigned to the card's eight ports.

Configuration

Once the card has been physically installed, each of its eight ports must be assigned a function from the configuration program. Assigning port functions does not require operator interaction with the card under nomral circumstances. The PGM-WIN Configuration Program controls all of the port's features. The only operator-accessible control is the Reset button.

The card's LED indicators are used to verify its operation and for troubleshooting purposes.

Front-Edge Components

The front edge of the card has 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.

The LEDs can give quick answers to questions about the card's proper functioning. They indicate:

- if the card has been installed correctly

- if the card can communicate with the system.

FIGURE M1-1: MVX-A8/L8 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 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 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.

Removal

To remove a card:

1. Lift the two ejectors (one top and one bottom of card) simultaneously until the card unseats from its connector.

2. Slide the card out and store it an anti-static packaging.

Specifications

Microprocessor Type

Motorola 68302

Program Memory

FLASH ROM   256 kB

Ram Memory

RAM   265 kB Static CMOS
Dual Port RAM   12 k 16 bit word static CMOS

4-Wire Audio Ports

Port Quantity:	8
Outputs	
Level	0.0 dBv Nominal (adjustable between -24 dB and +14 dB with max output level = +18 dB
Imped.	100 Ohms, Electronically Balanced
Freq. Resp.	100 to 15k Hz ± 1.0 dB
Distortion	Less than 0.1% THD Outputs
Inputs	
Level	0.0 dBv Nominal
Imped.	600 Ohms, Electronically Balanced
Freq. Resp.	100 to 15k Hz ± 1.0 dB
Distortion	Less than 0.1% THD

DTMF Tone Characteristics

DTMF Tones	Standard "USA Telephone Central Office" compatible
Tone Burst Duration	(Sending) 60 milliseconds
	(Typical) 52 milliseconds (maximum)
	(Receiving) 20 milliseconds (munimum)

Dimensions

Form Factor	6U "Euro" Style PC Board
Connectors	Two 96-pin "Euro" Style
Dimensions	12.5 x 9.2 inches (320 x 233 mm)
Weight	0.6 lb (0.27 kg)

Matrix Plus 3 System   CONFIG-1
CONFIGURATION CARD

ASSY 710388

CLEAR-COM
Copyright 1993
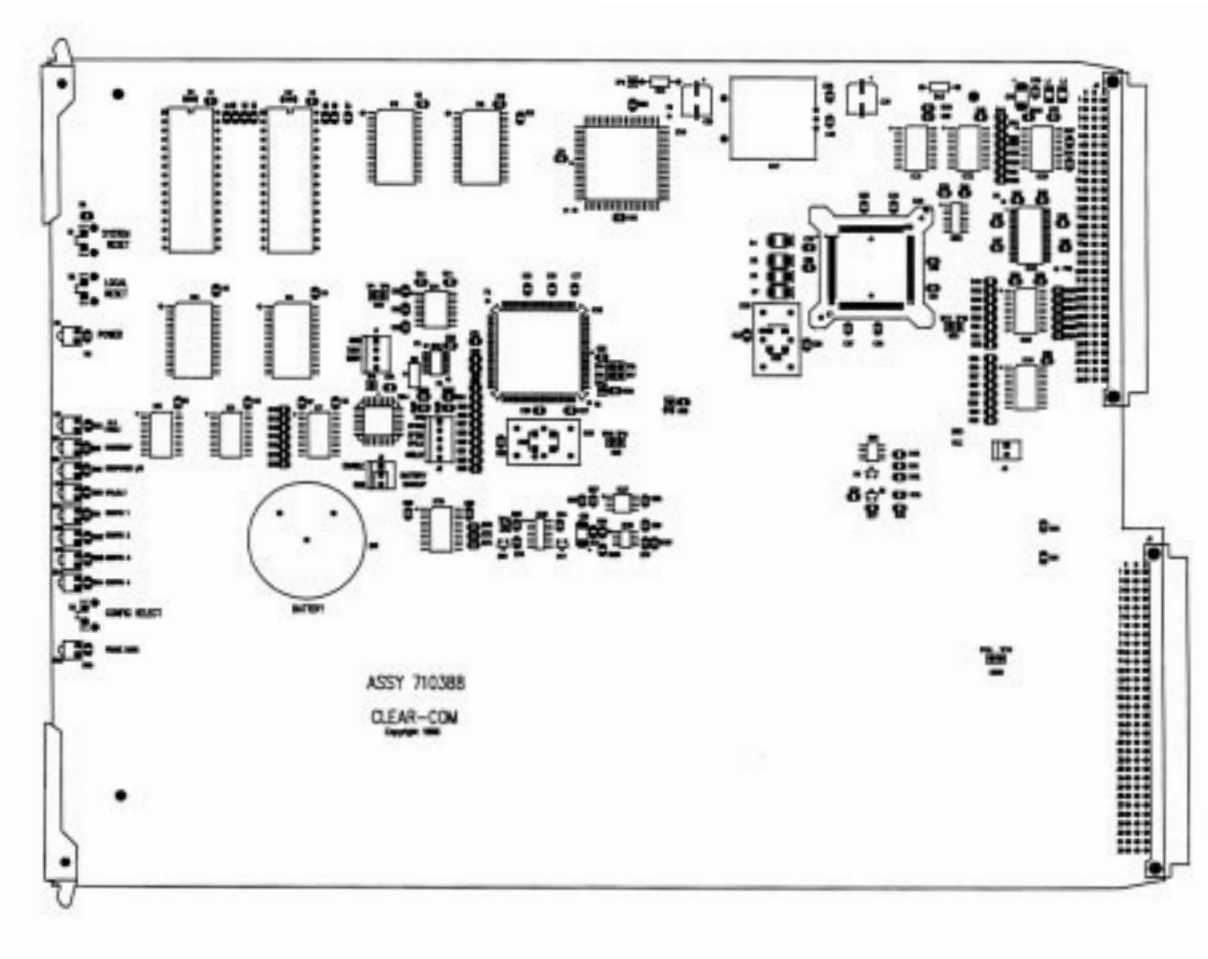
Introduction

This Section describes the CONFIG-1 Card and how to install it into the matrix frame. It describes verifying the installation and operation of the CONFIG-1 based upon the pattern of the LED indicators on the card. This Section also provides the card's specifications.

Description

A CONFIG-1 card is required for full operation of every Matrix Plus 3 card frame. Its functions include:

- Storing system configurations
- Interfacing with the Configuration Program (on an external PC)
- Directly controlling the RLY-6 and GPI-6 interfaces.
- Event Log

A battery-backed RAM stores the system's configurations; it is large enough to store four complete configurations. Figure M2-1 on page M1-3 shows the CONFIG-1 as viewed from the front of the matrix card frame.

Installation

The paragraphs below describe how to install the CONFIG-1, including:

- What precautions to take while handling the board
- What precautions to take with the RAM back-up battery
- How to verify the installation.

Handling

The board's components include CMOS chips—static electricity can ruin them. Before touching the board with your hands, touch a grounded metal object to dissipate any static potential; while handling the board, be careful not to bend any of the board's connector pins or component leads. Spare CONFIG-1 circuit boards should be stored in electrically insulated packaging—for example, anit-static heavy-duty plastic bags.

The matrix cards are held in place in the frame by card ejectors. To remove a card, lift the two ejectors (one top and one bottom of card) together until the card unseats from its connector.

To insert a card in the frame, carefully place the card in the slots taking care to depress the retainer clips allowing the card to slide into the frame. Make sure that the card is in the slot both top and bottom. When the card is almost to the connector raise the two ejectors allowing them to clear the retainer clips. When they have cleared the retaining clips, gently lower both ejector tabs together letting the force the ejectors provide insert the board into the connectors in the frame. As a last check, press on the board to make sure it is fully seated in its connectors.

Hot Patching

All matrix cards are "hot Patchable" and "self initalizing". A faulty CONFIG-1 card can be removed and replaced while the system is powered, having no effect of any part of the system operation except to GPI/RLY interfaces and communication to the Configuration Computer. The matrix cards will continue to be fully functional.

RAM Back-Up Battery

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 routine preventive maintenance. To disconnect the battery, move the jumper on JP1 so that it connects the common to the OFF pin. The board will operate with the battery disconnected, but keep in mind; the RAM will lose the configurations when the system is powered down.

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).

Verification of Installation

The CONFIG-1 features ten indicator LEDS.   The LEDs are visible through holes in the frame's card-compartment door; each hole is labeled. The LEDs can give quick answers to questions about the card's proper functioning:

- Has the card has been installed correctly?
- Can the card power up the system?
- Can the card communicate with the system?

The following paragraphs describe each LED's function during system operation. There are many LEDs on the front of the frame. Proper operation of the frame is indicated by the following LED status:

1   The top 'green' LED on all cards should be on solid. This indicates that all of the power supplies on each card is functional.

2   On the CONFIG card the next four LEDs (Clock Fault, Over Temp, Computer I/O, and GPI/RLY Active) should be off.

3   One of the bottom four LEDs (Configuration 1/2/3/4) should be on.

The "Frame Data" LEDs (bottom yellow)on both the MTX-A8s and the CONFIG-1 indicate that digital data is being sent to or from the frame. When the system is idle, these LEDs will flash to indicate that the system is functional. The "flashing" is caused by actual communication between the cards, indicating that the basic frame communication is operational.

For detailed information on the function of the LEDs and the pushbutton switches on the front edge of the CONFIG-1 card refer to the chapter in the Operation Manual for the card.

Specifications

Microprocessor
Motorola 68302

Program Memory
FLASH ROM   256 K Byte

Static RAM
Static CMOS   2 Meg Bytes

Dual Port RAM
Static CMOS   2K 16 Bit Words

Dimensions
Form Factor: 6U "Euro" Style PC Board
Connectors: 2 96-pin "Euro" Style
Dimensions: 12.5 by 9.2 inches (320 by 233 mm)
Weight: 0.6 lb (0.27 Kg)

CLEAR-COM

ASSY #710526

ASSY #710528

Copyright 1999
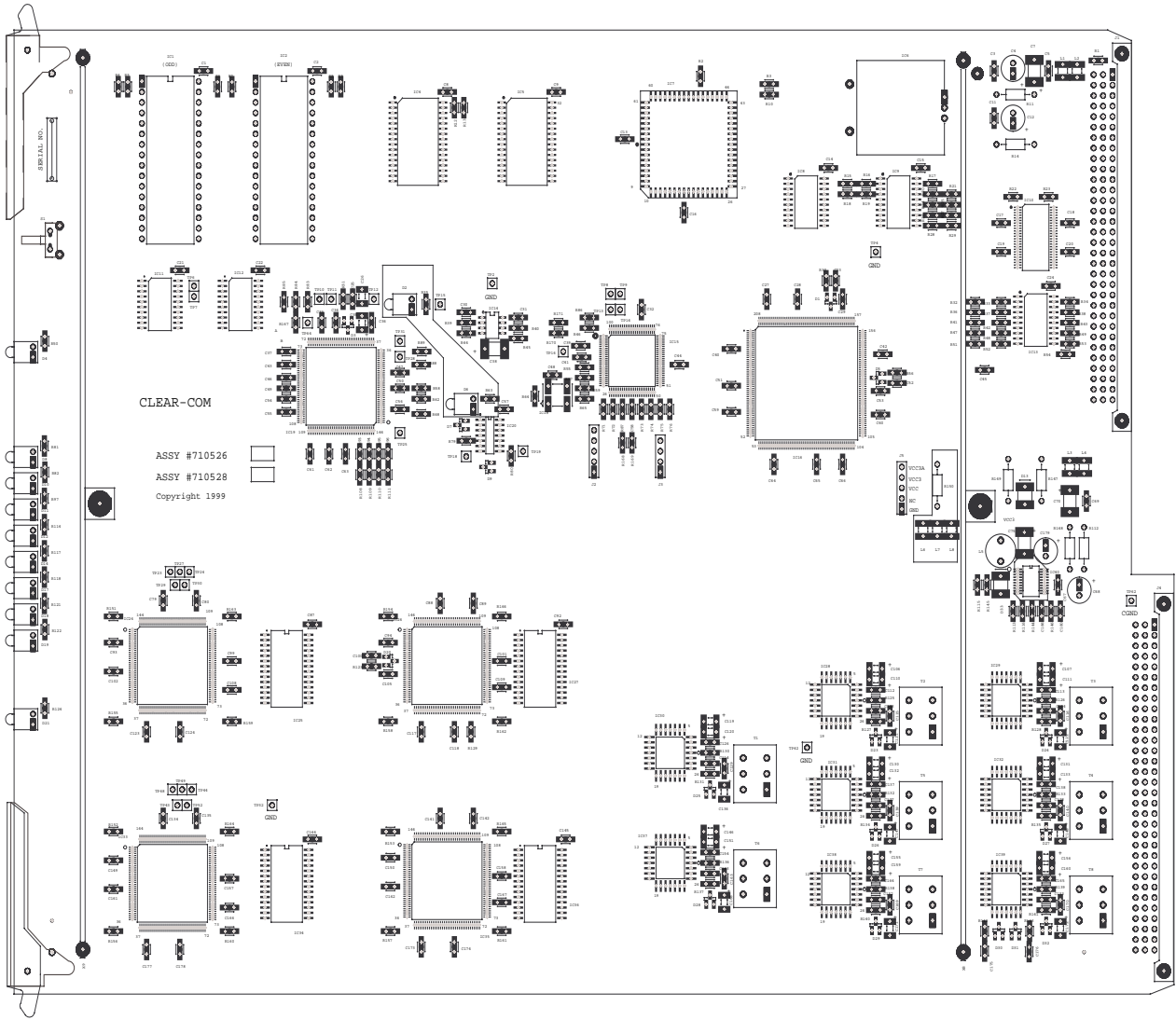
Matrix Plus 3 System   **MVX-D8**

M A T R I X   C A R D

Introduction

This section describes the installation of the MVX-D8 Digital Matrix Card. For operation information, see the Matrix Plus 3 *Operation Manual;* for troubleshooting and maintenance information, see the Matrix Plus 3 *Maintenance Manual;* and for programming information, see the *PGM-WIN System Configuration Manual.*

Installation

Installing the card is a simple matter of opening the frame's door and plugging the card in one of the slots marked for MVX cards. The chosen slot should already have a rear panel in which to connect the card's ports.

Note: The SYS-200 has optional rear-panel modules that might need to be installed prior to use.

Matrix cards are held in place in the frame by card ejectors. To insert a card in the frame:

1.   Select the slot into which the card will be installed.

Note: The two left-most slots in a Matrix frame are occupied by the CLOCK and the CONFIG-1 cards and do not support matrix ports.

2.   Depress the retainer clips so the card will smoothly slide into the frame.

3.   Carefully place the card in the slot (with the component side facing to the right) and ensure the card is properly seated in the top and bottom of the slot.

4.   When the card is almost to the connector, raise the two ejectors so they clear the retainer clips.

5.   Once the ejectors have cleared the retaining clips, gently lower both ejector tabs simultaneously letting the force of the ejectors insert the board into the frame's connectors.

6.   As a last check, firmly press on the board to make sure it is fully seated in its connectors.

Static Sensitivity

The card's components include CMOS chips, which static electricity can ruin. Before touching the board, touch a grounded metal object to dissipate any static potential.

Note: While handling the board, be careful not to bend any of the board's connector pins or component leads.

Spare card circuit boards should be stored in electrically insulated packaging, such as anti-static, heavy-duty plastic bags or unused frame slots.

Hot Patching

The card is "hot-patchable" and "self-initializing." This means a faulty card can be removed and replaced while the system is powered. The only parts of the system that will be affected are those assigned to the card's eight ports.

Configuration

Once the card has been physically installed, each of its eight ports must be assigned a function from the configuration program. Assigning port functions does not require operator interaction with the card under normal circumstances. The PGM-WIN Configuration Program controls all of the port's features. The only operator-accessible control is the Reset button.

The card's LED indicators are used to verify its operation and for troubleshooting purposes.

Front-Edge Components

The front edge of the card has 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.

 The LEDs can give quick answers to questions about the card's proper functioning. They indicate:

- if the card has been installed correctly

- if the card can communicate with the system.
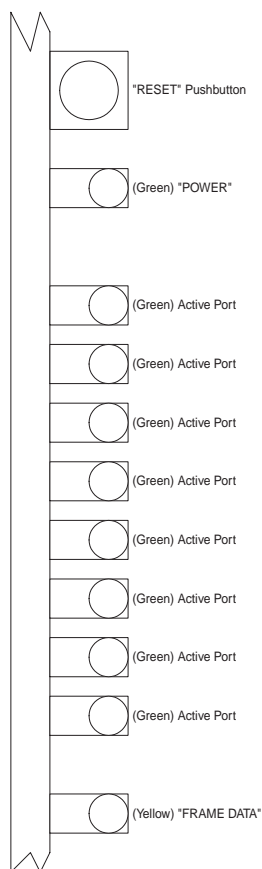
FIGURE M3-1: MVX-D8 Front Edge

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 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 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.

Removal

To remove a card:

1.   Lift the two ejectors (one top and one bottom of card) simultaneously until the card unseats from its connector.

2.   Slide the card out and store it an anti-static packaging.

Specifications

Microprocessor Type

Motorola   68LC302

Program Memory

Flash ROM   256 kB

RAM Memory

RAM   265 kB Static CMOS
Dual Port RAM   12 k 16 bit word static CMOS

Single-Pair Multiplexed Audio/Data Ports

Port Quantity:	Eight
Wire Type and Length	Single, twisted-pair, 24 to 26 AWG, 10,000 ft. (3 km)
	75-ohm coax, RG-59 typical, 10,000 ft. (3 km)
Isolation:	
Twisted pair	Both ends transformer isolated
Coax	Common grounded shield
Transmission Type:	U-type loop
Data Rate:	160 kB/sec., full duplex
Audio Coding:	Eight-bit companded at 16 k samples/sec.
Frequency Response	30 Hz to 7.5 kHz +/- 1.5 dB (transmission system only)
Single-to-Noise Ratio	> 70 dB, 30 Hz to 7.5 kHz

Dimensions
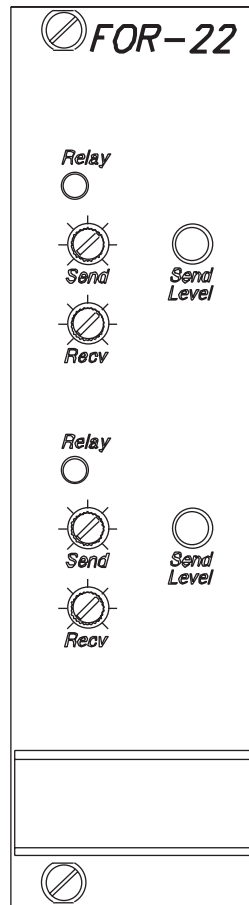
Form Factor:	6U "Euro" Style PC Board
Connectors:	Two 96-pin "Euro" Style
Dimensions:	12. 5 x 9.2 in. (320 x 233 mm)
Weight:	0.6 lb (0.27 kg)

Matrix Plus 3 System   FOR-22

DUAL 4-WIRE INTERFACE MODULE

Introduction

This Section describes the FOR-22 Dual 4-Wire Interface and its installation in the matrix, including setting internal jumpers, wiring to external devices, operation of the front panel controls and indicators, and electrical and mechanical specifications. For schematics and component lists see the Matrix Plus 3 System Maintenance Manual (Volume III). The following subjects are covered in this chapter.

- Description
- Installation In IMF Frame
- Wiring
- Adjustments
- Configuration
- Specifications

Description

Each of the two channels of the FOR-22 Dual 4-Wire Interface provides the following functions for a port in the Matrix Plus 3 System:

- Transformer isolation between an external 4-wire audio device and the port
- A relay which is activated by a "call signal" (logic signal) from the matrix
- An LED indicator that lights when the relay is active as a result of a call signal from the matrix
- An optically isolated call signal input (from the external device to the matrix)
- Separate "send" (to external device) and "receive" (from external device) level controls on front panel
- Send levels adjustable for line level, IFB feed level, and microphone level (set by internal jumpers)
- A 2-color LED indicates correct audio signal level to external device

The FOR-22 occupies one slot in the IMF-3 Interface Frame. When installed each channel connects to the matrix frame via an RJ-45 connector on the rear of the IMF-3 frame, and to the external, or "user", device via a DB-9M connector on the rear of the IMF-3.

Installation In IMF Frame

This section describes how to install a FOR-22 in an IMF-3 frame. There are certain options available on the FOR-22 that can be changed before installation. The audio output level can be set to different ranges depending on the type of input is being driven. The input of a channel can have a bridged pad added to allow higher input levels.

FOR-22 Module Frame Installation

To install the FOR-22 interface module in the IMF-3 interface frame:

1 Select a slot to install the interface in.

2 Remove the blank plate covering the slot.

3 Set any Audio Output Level Jumpers necessary.

4 Set any Audio Input Level modifications necessary.

5 Slide the FOR-22 in the slot and ensure that the card is full seated.

6 Tighten the FOR-22's front panel mounting screws.

Audio Output Level Jumper

The audio output is transformer isolated. There is a jumper field for each channel that allows three basic operating levels depending on what type of external input is being driven. Following levels can be produced by each channel:

Line level ----------------------------- 0.0 dBv at 600 ohms

Clear-Com IFB level ------------ -15 dBv at 200 ohms

Microphone level ----------------- -55.0 dBv at 20 ohms

To set channel 1 for the desired level:

1 Find jumper block JP100 on the circuit board.

2 Move the jumper so that it connects the pair of jumper pins labeled with the desired level (Line, IFB, or Mic).

To set channel 2, repeat the above procedure using JP200.

Each FOR-22 channel can also be adjusted using its "Send" front panel control.

Audio Input Level Greater Than +10 dBv

To accommodate input levels greater than +10 dBv on either channel, the FOR-22 circuit board can be modified to build bridging pads on the primary side of each channel's input transformer. To build a bridging pad:

1 Find the jumpers labeled R111 and R112 (for channel 1) or R211 and R212 (for channel 2). These jumpers are located under the "Level Detect" daughterboard; it may be necessary to disassemble the FOR-22 module to access them. The jumpers look like 1/4 watt resistors with a single black band (indicating "0 ohms").

2 Replace the jumpers with resistors according to the values shown in Table F1-1 below.

3 Install R113 (for channel 1) or R213 (for channel 2) according to the values shown in Table F1-1 below.

TABLE F1-1 RESISTOR VALUES FOR AUDIO INPUT BRIDGING PADS			
ATTENUATION (dBv)	R111/R211 (Ohm)	R112/R212 (Ohm)	R113/R213 (Ohm)
15	470	470	1.2k
20	1k	1k	1k
25	1k	1k	470
30	1.2k	1.2k	470

Wiring

The FOR-22's are connected to the matrix frame through the two RJ-45 connectors on the IMF-3 rear panel assembly that the FOR-22 is connected to. For connection to a matrix frame refer to the **Matrix Frame to IMF-3 Interface Wiring** section in the OVERALL chapter of this Installation Manual.

The "user" side of the FOR-22 for each channel is on a DB-9M connector on the rear of the IMF-3 frame. Figure F1-1 below shows the pinout of either one of these connectors. Each channel is identical.

The following paragraphs describe how to wire for the various type of inputs and outputs available on this connector. The following subjects are:

- External Audio Devices
- Call Signal Input
- Relay Contacts

**FOR-22 I/O
DB-9M**

```
 (1) ———————————— +AUDIO OUTPUT
(6) ———————————— -AUDIO OUTPUT
 (2) ———————————— +AUDIO INPUT
(7) ———————————— -AUDIO INPUT
 (3) ———————————— LOGIC INPUT  ( ± 4 TO 50 VOLTS)
(8) ———————————— LOGIC INPUT  ( ± 4 TO 50 VOLTS)
 (4) ———————————— NORMALLY CLOSED (RELAY CONTACT)
(9) ———————————— WIPER
 (5) ———————————— NORMALLY OPEN (RELAY CONTACT)
```
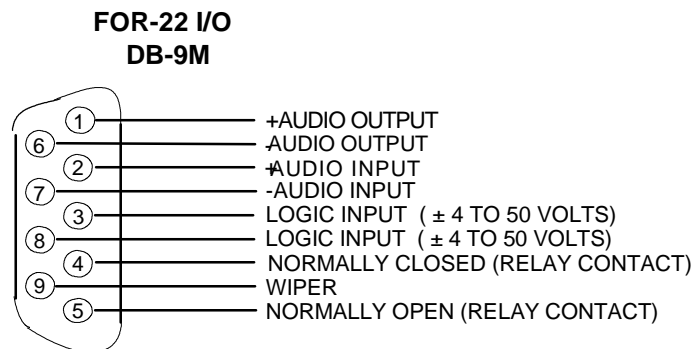
FIGURE F1-1. Pinout of the DB-9M I/O Connectors for FOR-22s

External Audio Devices

Connect external audio devices to the FOR-22 ports through the two DB-9M connectors labeled "I/O" on the rear panel assembly panel. Both audio input and output are transformer isolated. Refer to Fig. F1-1 above for pinouts.

Call Signal Input

The Call Signal input is used to receive a "call signal" or logic input from an external device and sent it to the matrix. The voltage across the pins required to receive a call signal ranges from 4 Volts to 50 Volts; it can be either positive or negative polarity or AC. The input will draw between 4 and 8 milliamps. Refer to Fig. F1-1 on the previous page for pinouts.

Relay Contacts

Each FOR-22 channel features a relay that is associated with the logical "call signal" output of a port. A relay's function depends on the function assigned to the FOR-22 port. A relay can be assigned to operate with any label in the system: when that label is activated (either by a talk, listen, or both as set from the configuration program), the relay will be activated. Or it can be assigned to be activated by a call signal, for example to operate a 2-way radio transmitter.   For details on configuring the use of a relay, see the following entries in the Configuration Program Manual:

- "Setup - Hardware and Labels"
- "Configure - Global Controls".

You can use the relay to activate an external device, such as an applause light in a studio, a cue light, or a security door lock. The relays feature both "normally open" and "normally closed" contacts. The contacts are rated at 1 Amp at 24 Volts DC; they are not designed for switching mains AC line voltage. Refer to Fig. F1-1 on the previous page for pinouts.

Adjustments

After installation the front panel controls should be set to accomidate the normal range of input and output levels encountered. The following is a discussion of the controls and indicators on the front of the interface.

"Send Level" Control

The "send level" control allows adjustment of the output level of the channel from the matrix to the external device/system..

"Send Level" LED

The 2-color "Send Level" LED lights green when an audio signal is being sent to the external device or system at a typical acceptable level. The LED lights red when the audio output signal level is too high.

"Recv" Control

The "Recv" ("Receive") level controls affect the level of signals sent from external devices or system to the matrix. The "Recv" controls have a range of ± 10 dB.

Relay Active LED

The yellow "Relay" LED lights whenever the relay is activated. Intermittant fast blinking on this LED is normal.

Configuration

The Matrix System will automatically configure the port. It will assign a label and declare the port a 4-Wire port. The Configuration Program can be used to modify these parameters.

Specifications

0 dBv is Referenced to 0.775 Volts RMS

Audio Output

Nominal Output Level	Selectable by Jumper Between 0 dBv, -15 dBv, or -55 dBv
Impedance	600 ohms at 0 dBv
	200 ohms at -15 dBv
	20 ohms at -55 dBv
Frequency Response	200-10k Hz, ±3 dB
Maximum Output Level	+20 dBv

Audio Input

Level	0 dBv Nominal
Impedance	>10K ohms (bridging)
Frequency Response	200-10k Hz, ±3 dB

Call Signal Input

Threshold	4 Volts DC, Positive or Negative Polarity
Maximum Input Voltage	50 Volts

Relay Contacts

Contact Type	1 pair SPDT (single form C)
Contact Voltage Rating	24 Volts DC
Contact Current Rating	1 Amp continuous, 2 Amps peak at 24 Volts DC

DC Isolation

greater than 10 Megohms.

Power Supply

Supplied by the a PSU-101 power supply

Voltage Required	± 8 Volts DC Unregulated
Current Required	30 milliamps (per supply, no LEDs or relays active)
	160 milliamps (positive supply, LEDs and relays active)
	140 milliamps (negative supply, all LEDs and relays active)

Connectors (on rear of IMF-3 frame)

RJ-45 "To Matrix" Connectors --------------------- 2
DB-9M "Interface I/O" Connectors ------------- 2

Operating Environment

Temperature	Between 0 and 70° C (32-150° F)

Package Dimensions

Frame Slot Usage	1 slot of IMF-3
Weight	0.54 lbs (0.22 Kg)

CCI-22

PL ◯ Power   R
Send   L
Recv   C
Test   Null

PL ◯ Power   R
Send   L
Recv   C
Test   Null
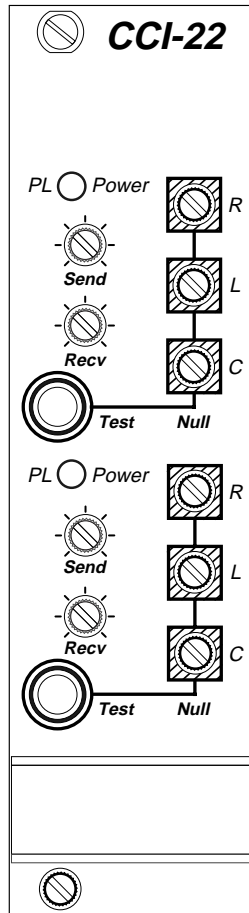
Matrix Plus 3 System   **CCI-22**

I N T E R F A C E

Introduction

This section describes the installation of the CCI-22 Dual Party-Line Interface, including setting internal jumpers, wiring to external devices, front-panel control and indicator operation, and electrical and mechanical specifications. For operation information, see the *Matrix Plus 3 Operation Manual;* for maintenance and troubleshooting information, see the *Matrix Plus 3 Maintenance Manual;* and for configuration information, see *PGM-WIN System Configuration.*

Installation In IMF Frame

To install the CCI-22 interface module in the IMF-3 interface frame:

1.   Select a slot in which to install the interface.

2.   Remove the blank plate covering the slot.

3.   Set any Party-Line Termination Jumpers as necessary.

4.   Slide the CCI-22 in the slot and ensure that the card is fully seated.

5.   Tighten the CCI-22's front-panel mounting screws.

Termination of Party-Lines

A "Clear-Com termination network" (also known simply as a "termination") is a Resistor-Capacitor (RC) circuit that must be connected between the Audio and Ground lines of any Clear-Com party-line. To ensure correct operation of the external party-line, only one termination can be installed on any given party-line.

A party-line termination is normally provided by the component powering the party-line. Although the CCI-22 is not designed to supply power to an external party-line system, each channel of the CCI-22 features a Clear-Com termination circuit that can be connected to the party-line by installing a jumper. This termination network is not normally connected, and should only be connected in the rare case that the external party-line does not include a termination circuit. An example of the use of these termination networks is in Figure I2-6 on page I2-7.

If a party-line has more than one termination circuit, it will not null correctly (see "Sidetone Null Adjustment" on page I2-10). The most common symptom of this is when the line does not null, even though the

"R" null control has been turned all the way counter-clockwise. If this happens, check all components connected to the party-line that are capable of providing a termination to be sure that only one termination is connected to the party-line.

The two termination circuits on the CCI-22 connect to the channel A and B party-lines; they are enabled and disabled by the jumpers at JP100 (which controls the termination circuit for channel A) and JP200 (which controls the termination for channel B). JP100 and JP200 are located near the center of the CCI-22 main circuit board, and are shown as a detail in the assembly drawing for the CCI-22 main circuit board in the CCI-22 chapter of the *Matrix Plus 3 System Maintenance Manual.* When either jumper is next to the label "B," its termination is disabled; moving the jumper next to the label "A" enables the termination.

Wiring

The CCI-22s are connected to the matrix frame through the two RJ-45 connectors on the IMF-3 rear panel assembly to which CCI-22 is connected. For connection to a matrix frame refer to the "Installation In IMF Frame" on page I2-1. For internal jumper settings and adjustments refer to "Adjustments" on page I2-10.

The "user" side of the CCI-22 for each channel is on a pair of DB-9M connectors on the rear of the IMF-3 frame. Figure I2-1 on page I2-3 shows the pinout of either one of these connectors. Both DB-9Ms are paralleled such that both party-line channels are available on each connector. It is possible to wire one DB-9 connector as channel #1, the second DB-9M as channel #2, or bring both channels out either DB connector separately or create a TW type party-line connection.
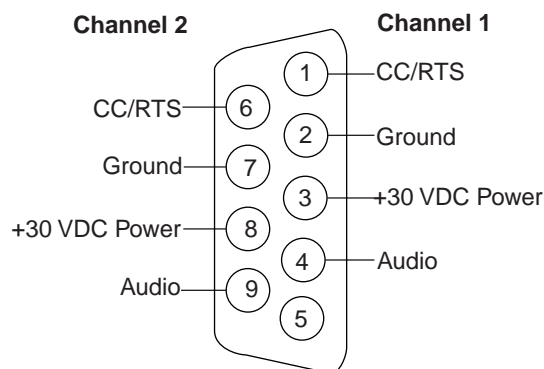
Channel 2   **Channel 1**

```
                  1 ──CC/RTS
    CC/RTS── 6
                  2 ──Ground
    Ground── 7
                  3 ──+30 VDC Power
+30 VDC Power── 8
                  4 ──Audio
     Audio── 9
                  5
```

FIGURE I2-1: Pinout of the DB-9M Interface I/O Connectors

Clear-Com Party Lines General Discussion

Stations on Clear-Com party-lines are connected with two-conductor shielded microphone cable. One conductor carries the DC power (28 to 30 V), while the other carries the duplex two-way intercom audio signal and DC "Call Light" signalling. The shield acts as common ground for both the power and signal.

Power to the CCI-22 interface channels must be provided by the external party-line. The power connection for each channel is the "+30 VDC Power" pin on the appropriate DB-9M Interface I/O connector located on the rear-panel assembly. The CCI-22 channel is essentially just another "beltpack" on the party-line.

The power pin has a DC filtering circuitry to provide a high impedance for the audio so the power can be received from a "powered line or TW line" as is common with RTS systems. For TW operation tie the AUDIO and POWER pins together.

Each party-line channel requires exactly one termination circuit. The termination circuit is usually built into the system component providing the party-line's power. Connecting more than one termination circuit to a party-line will impair the sidetone null and degrade the line's audio quality.

When a CCI-22 party-line channel is connected to a Clear-Com party-line, the Clear-Com/Other Select pin must be left floating. Grounding this pin selects the RTS mode, which is incompatible with Clear-Com party-lines.

Two Separate Party Lines

The diagram in Figure I2-2 on page I2-4 shows the CCI-22's two channels connecting two independent external party-lines to the matrix. Each external party-line provides its own power and termination. The wiring diagrams in Figure I2-3 on page I2-5 and Figure I2-4 on page I2-5 show an external switch on the Clear-Com/Other Select pin; this switch allows the CCI-22 channel to be used on either Clear-Com or RTS party-lines.

In the wiring diagram inFigure I2-3 on page I2-5, all connections to the CCI-22 are made using only one of the CCI-22's two parallel DB-9M connectors. The wiring diagram in Figure I2-4 on page I2-5 shows the same connections as Figure I2-3 on page I2-5, except that each DB-9M connector is wired separately. Use the wiring method that is most convenient for the installation.
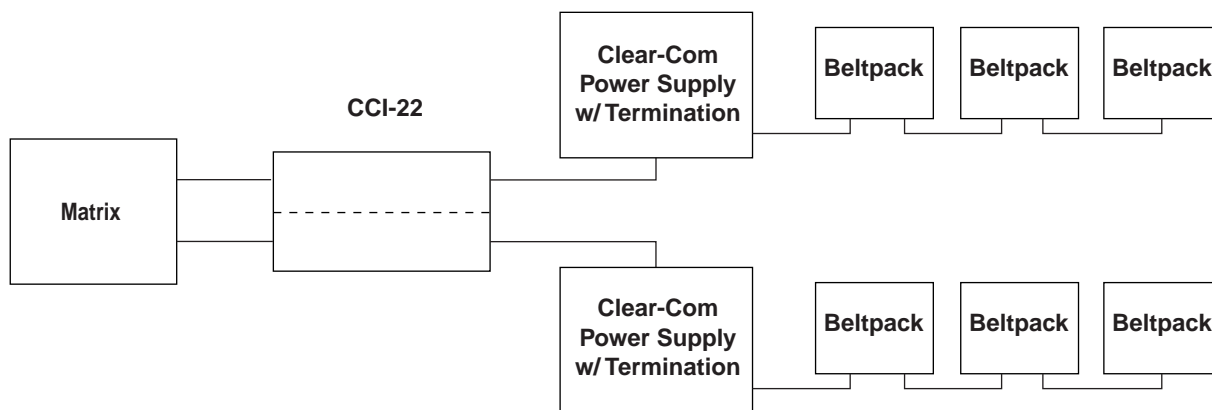

FIGURE I2-2: Two External Party-Lines Connected to the CCI-22
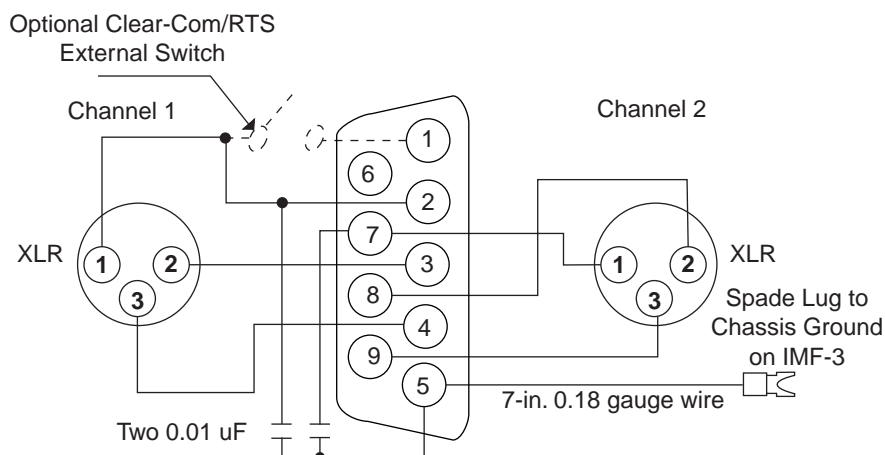
FIGURE I2-3: One DB-9 Connected to the CCI-22
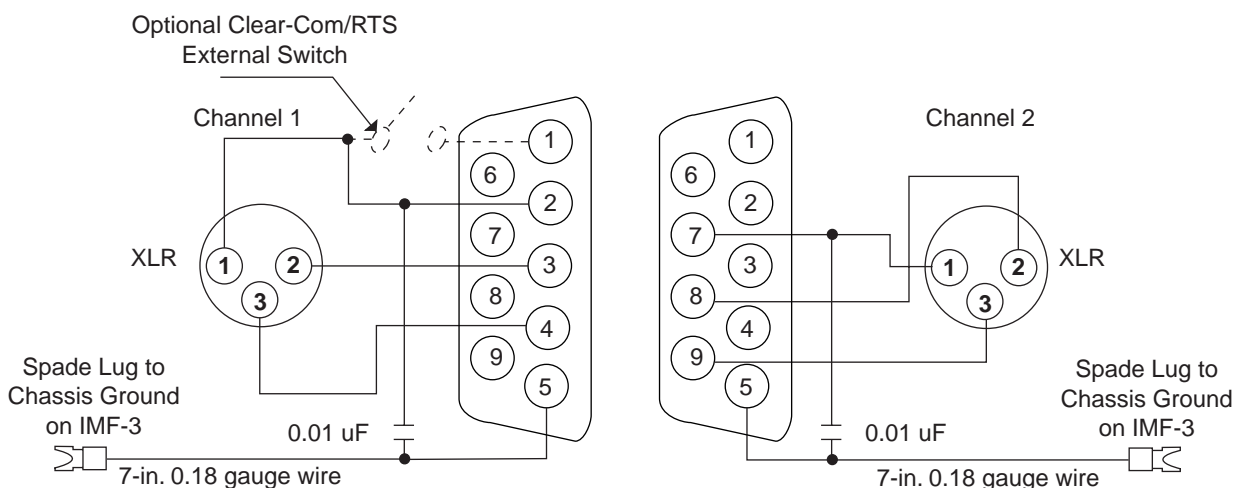
FIGURE I2-4: Two Separate DB-9 Connections to the CCI-22

Multiple Clear-Com Beltpack Channels from One Power Supply

A single two-output power supply can provide power for more than two CCI-22 party-line channels. In this case the power supply provides power for each party-line, but each CCI-22 channel provides the termination for each party-line. Many Clear-Com power supplies have a switch to enable or disable the termination circuits from each of its outputs. If using such a supply:

1.   Disable the terminations by using the switch.

2.   Connect the PS-22 output to all of the CCI-22 channels to be powered using the standard three connections in the XLR connector.

3.   Set the termination jumper for each CCI-22 channel to position "A" (termination connected) as described in "Termination of Party-Lines" on page I2-1

If the power supply does not have a termination disconnect switch, wire the system as shown in Figure I2-6 on page I2-7. In this configuration, only the power supply channel's power and ground lines are connected to the party-line.

Note: Do not connect the power supply output's terminated audio line to the party-line.

Do not let the power supply output's current rating exceed the total current drawn by the devices powered.
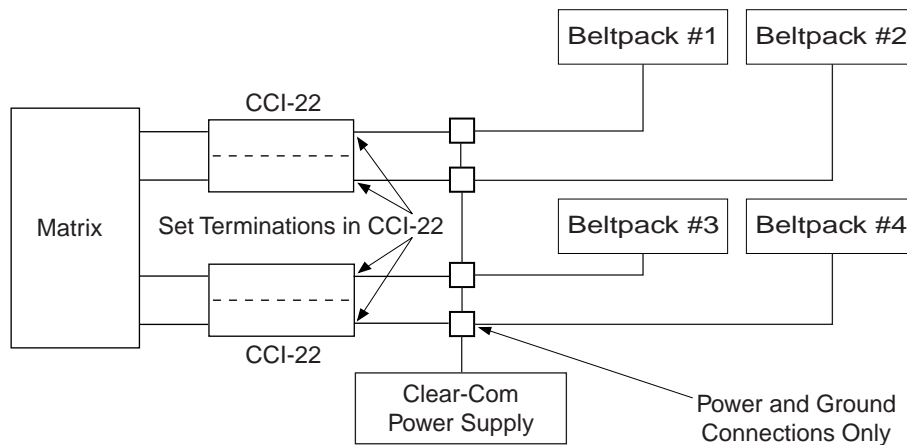
FIGURE I2-5: Diagram of One Power Supply with Four CCI-22 Terminations
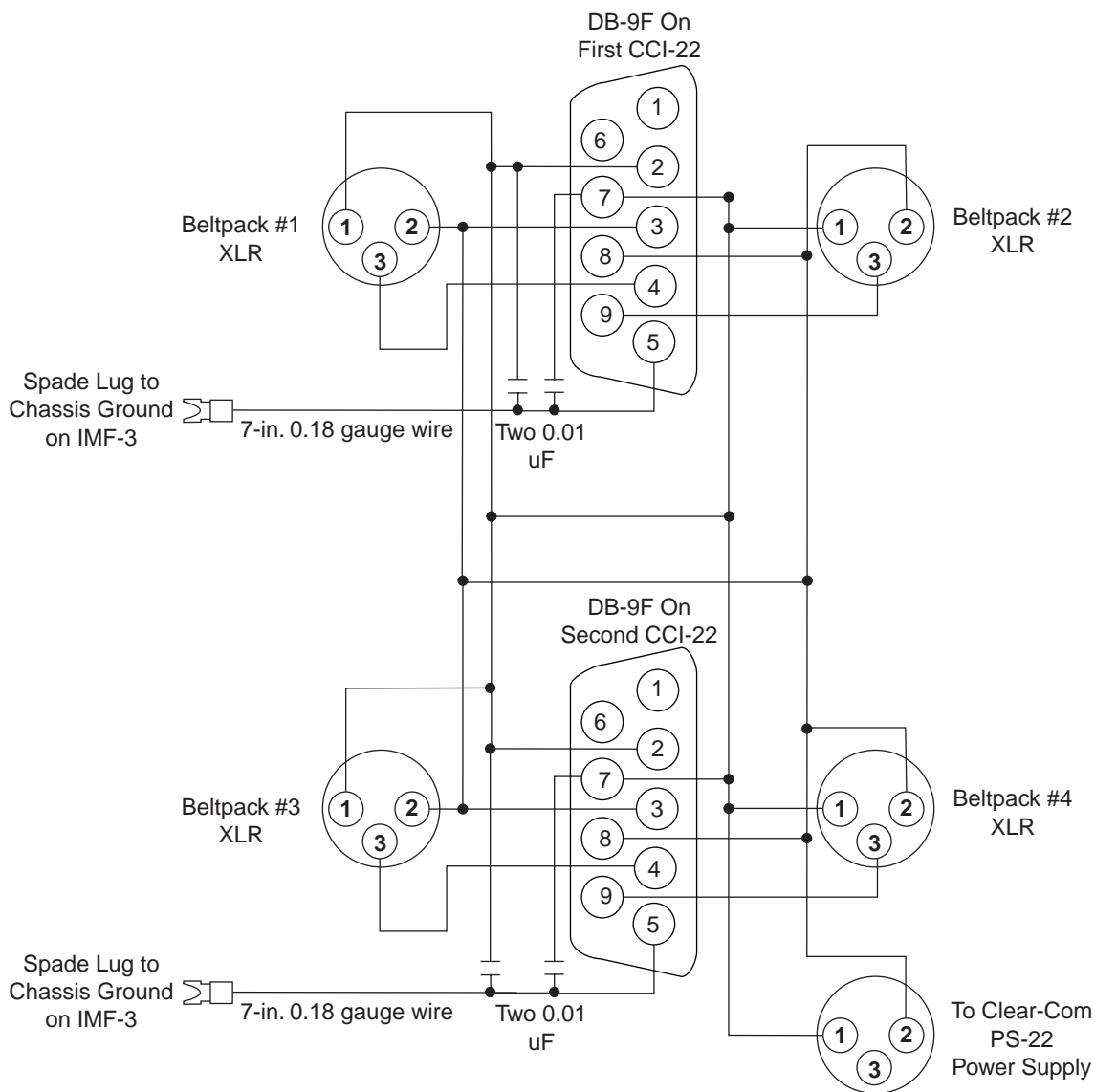
FIGURE I2-6: Wiring of One Power Supply for More than Two Party-Line Channels

To "RTS" Two Channel 2-Wire Party-Lines

Stations on RTS two-channel 2-wire party lines are connected with two-conductor shielded cable. Each of the two shielded conductors carries both the DC power and the audio signal for one channel, providing two channels per cable. The shield is a common ground for both channels.

The matrix can be connected to a two channel two-conductor "RTS" line using the CCI-22's two channels. The CCI-22 does not support RTS call signals.

Power to the CCI-22's channels must be provided by the external party line. The power connection for each channel is the "+30 VDC Power" pin on the appropriate DB9-M Interface I/O connector on the rear-panel assembly. When connected to an RTS system, each channel's power input circuit will filter out the audio signal on the RTS line.

Audio is fed to each CCI-22 channel via the "Audio" pin on the appropriate DB9-M Interface I/O connector on the rear-panel assembly. When connected to an RTS system, each channel's audio input circuit will filter out the DC power on the RTS line.

The Clear-Com/RTS pin must be grounded when a CCI-22 party-line channel is connected to an RTS party line. Leaving this pin floating selects "Clear-Com" mode, which is incompatible with RTS party lines.

The termination jumper of each CCI-22 channel must be set to "B" (termination disabled).

CCI-22 channels can be connected to RTS party lines in a variety of configurations, depending on how the power and grounds are connected between the party line and the CCI-22 channel. The following paragraphs describe the options.

Power from "Channel A" Line Only

Figure I2-7 on page I2-9 shows only one non-Clear-Com channel powering both CCI-22 channels. The grounds are connected near the CCI-22's DB9 connector. Interface I/O Connector with one non-Clear-Com channel powering both interfaces (seen from the Cable Side of the Connectors).
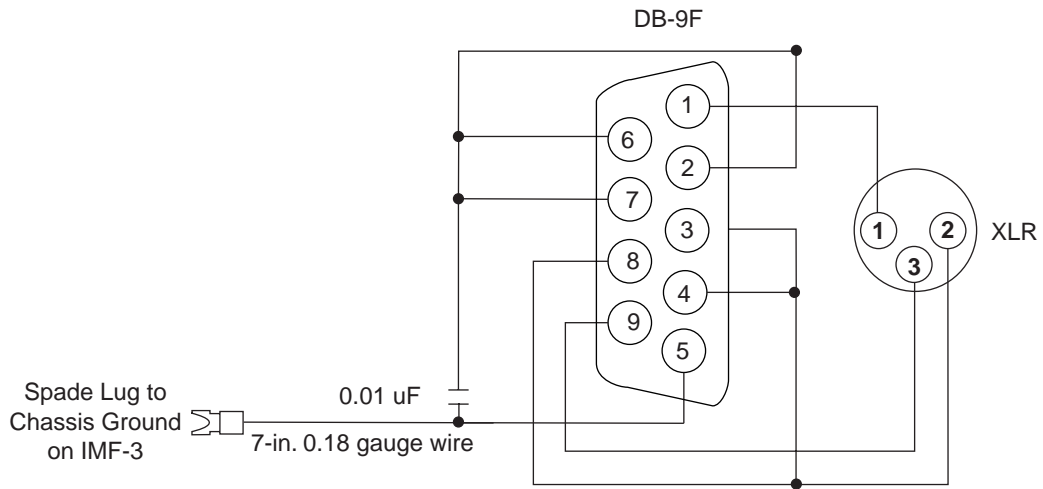
FIGURE I2-7: Cable Wiring Connection for Two RTS Party-Line Channels to the

Two Isolated RTS Lines

In Figure I2-8 on page I2-9, each RTS channel is completely isolated from the other, including the grounds.
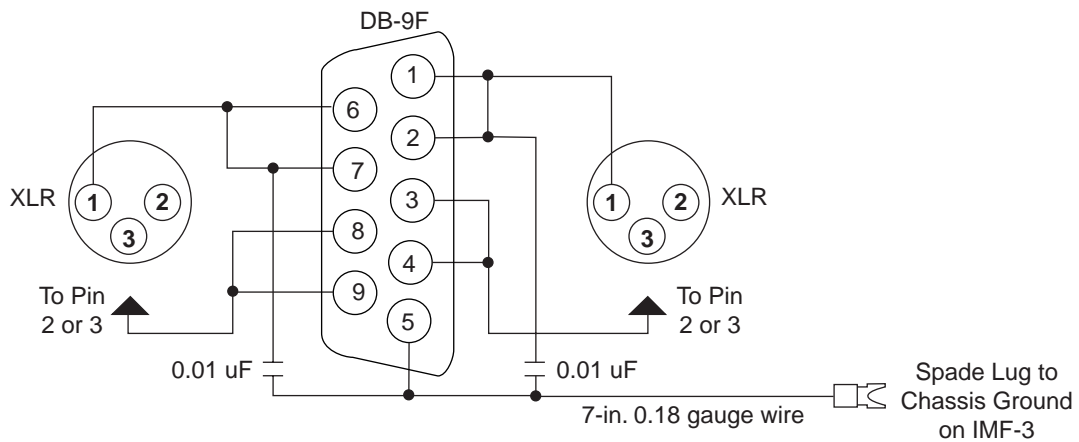

FIGURE I2-8: Cable Wiring Connections between Two Isolated RTS Party-Line Channels

Adjustments

Power LED

The green "PL Power" LEDs indicate whether the interface channels are getting +30 VDC power from the external party line to which they are connected.

Level Controls

The "Send" level controls affect the level of the audio signals from the matrix to the external party line.

The "Recv" level controls affect the level of the audio from the party line to the matrix. The level controls have a range of ±13 dB; they are normally set to the midrange position.

Sidetone Null Adjustment

Sidetone is the sound of the operator's voice in his headset. In interfaces, it is necessary to null (minimize) the sidetone as much as possible when an external party line is placed in the matrix environment. Ideally, there should be no portion of the talk signal in the listen signal.

The CCI-22 features sophisticated built-in nulling circuitry, including a test-tone generator and an accessory earphone. The earphone plugs into a phone jack on the front panel. When the earphone is plugged in, it automatically switches on a test tone and monitors the output of the null circuit.

Separate "R" (resistance), "L" (inductance), and "C" (capacitance) controls compensate for each component of the line's's impedance, providing the best null possible.

The null circuit is effective on line lengths between zero and 4000 ft. with impedances in the range of 120 to 350 ohms, and can reduce local audio in the received signal by more than 30 dB over the frequency range of 200 Hz to 8 kHz.

To null one channel of the CCI-22:

1. Connect the external party-line devices to the CCI-22 channel. Make sure that any connected devices do not have their microphones on.

2.   Plug the accessory earphone into the front-panel jack labeled "Test." This will disconnect the interface from the matrix and enable a test oscillator. The oscillator produces a square wave with both low and high harmonics, allowing testing of all frequencies. The test tone pulses approximately every 0.5 sec.

3.   While listening to the test tone in the earphone, adjust the "R" control until the tone is at a minimum.

4.   Repeat Step 3 with the "L" and "C" controls. Because these controls interact, steps 3 and 4 will have to be repeated several times the test tone is minimized. Continue adjustment until the tone is minimal. If a deep null cannot be obtained, it is likely that something is wrong either with the wiring in the external party line or with one of the other devices attached to it.

Following are some troubleshooting hints if a deep null cannot be obtained.

•   If the "R" control is turned fully counter-clockwise, the line has either more than one termination, or an excessive resistive load.

•   If the "R" control is fully clockwise, then the line has no termination.

•   The "L" control compensates for the low-frequency inductive and capacitive elements the wiring of the external party line presents to the line. If the "L" control is fully turned in either direction, it is likely that there is a problem in the external party line. When a Clear-Com party line is connected, the "L" control should be just to one side of its mid-pot position.

•   The "C" control compensates for cable capacitance; the setting depends on the length of the line. If the "C" control is fully counter-clockwise, it indicates a very short line (under 10 ft.); this is a valid setting for a short line.

•   If the "C" control is fully clockwise, it indicates an excessively long line (more than 4000 ft.).

Configuration

The system will automatically configure the port. It will assign a label and declare the port as a party line. The configuration program can be used to modify these parameters.

Specifications

0 dBv is referenced to 0.775 V RMS

Party-Line Characteristics (Clear-Com Mode)

Audio Level	-15 dBv nominal
Clipping Level	+3 dBv minimum
Impedance	Greater than 10k ohms (bridging)
Frequency Response	200 to 10k Hz, ±3 dB

Party-Line Characteristics (RTS Mode)

Audio Level	-10 dBv nominal
Clipping Level	+5 dBv minimum
Impedance	Greater than 10k ohms (bridging)
Frequency Response	200 to 10k Hz, ±3 dB

Call Signal Input (Clear-Com Mode)

Threshold	4 VDC on Audio Line

Call Signal Output (Clear-Com Mode)

Level	11 VDC Minimum on Audio Line

Nulling Capability

Line Length	0 to 4000 ft.
Line Impedance	120 to 350 ohms
Depth of Null	Greater than 30 dB, 200 to 8k Hz

DC Isolation

From the IMF-3 frame to an external input or output: >10 Megohms.

Power Consumption (Each Channel)

Maximum   40 ma at 20 to 30 VDC
(Power is supplied by the external party-line)

Connectors

RJ-45 "To Matrix" Connectors   2
DB-9M "Interface I/O" Connectors   2
1/8 in. Phone Jack   1 on Front Panel

Operating Environment

Temperature   Between 0 and 70 C (32 to 150 F)

Package Dimensions

Frame Slot Usage   1 slot of IMF-3
Weight   0.54 lbs (0.22 kg)

Matrix Plus 3 System   TEL-14
TELEPHONE INTERFACE MODULE

TEL-14
TELEPHONE INTERFACE

Line A   Line B

Hook

Send
Level

– | +   – | +
Send
Volume

– | +   – | +
Receive
Volume

Adjustable

Auto
Gain

Fixed

Adjustable

Auto
Gain

(Hold Auto Answer to start
Auto Nulling Process)
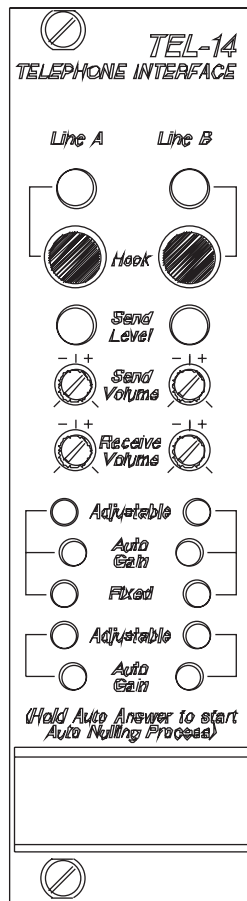
Introduction

This Section describes the TEL-14 Two-Channel Auto-Nulling Telephone Interface and its installation in the matrix, including setting internal option switches, wiring to external devices, operation of the front panel controls and indicators, and electrical and mechanical specifications. For schematics and component lists see the Matrix Plus 3 System Maintenance Manual (Volume III). The following subjects are covered in this chapter:

- Description (Page I3-2)
- Installation in IMF Frame (Page I3-3)
- Wiring (Page I3-3)
- Setup (Page I3-5)
- Matrix Configuration (Page I3-17)
- Specifications (Page I3-18)

The TEL-14's panel controls and internal option switches can select any one of a large number of modes of operation for the TEL-14. For this reason, this section describes each option switch individually, and then describes the installation settings for five of the TEL-14's most common modes:

- Intercom Station Telephone Access
- Self-Service Dial-In
- Manual Call Screening
- Intercom-to-Intercom
- Party Line Dial-In

Note: Other configurations are possible, in addition to the configurations described here. However, certain configurations may result in undesirable crosstalk, as a result of the limitations of the TEL-14's circuitry. For example, consider a news reporter who calls into the matrix. You would like to provide the reporter with a program feed, and at the same time route his voice in through the matrix to a live broadcast. However, the TEL-14 cannot *perfectly* isolate his talk from his listen, so some of his outgoing program feed may leak into his incoming voice.

Note: When using the TEL-14 with a speaker station, keep the panel mic gain low. In general, keep all gain controls set to a level which is acceptable, but not excessive.

CAUTION: The TEL-14 works with POTS (Plain Old Telephone Service) Central Office (CO) lines. Analog station lines from some PABXs are not compatible.

Description

The TEL-14 allows two standard loop start POTS (Plain Old Telephone Service) lines to connect to ports in the Matrix Plus 3 System. The TEL-14 Dual Telephone Interface may be installed in a Matrix Plus Interface Frame or MicroMatrix Frame.

The following functions are available for each line:

- Front panel indication of "Ring" and "Off Hook" with a single bi-color LED.
- Front panel mounted manual "Hook" switch button for manual operation of the interface. The "Hook" switch function can also be controlled from the matrix port the line is assigned to.
- Front panel indication of "Send Level" with a single bi-color LED.
- Front panel "Send Volume" and "Receive Volume" controls are provided. An "Auto Gain" button selects whether the automatic gain control limit is fixed to a normal level or adjustable to other levels.   The setting of this button is retained when the TEL-14 is removed from the frame or powered down.
- Auto-Answer of incoming calls is a front panel button selection. An option switch selects answering each call after 1 or 4 rings. The setting of the front panel button is retained when the TEL-14 is removed from the frame or powered down.
- Front panel control for commanding automatic renulling of the telephone line hybrid.
- Automatic echo suppression DSP.
- Transformer isolation between the telephone line and intercom.
- Occupies a single slot in the interface or MicroMatrix frame.
- Relay contacts are available to indicate externally an "Off Hook" condition on each line. ("A/A1" leads)

Installation in an IMF Frame

The TEL-14 module can be installed in any available slot in a Matrix Plus Interface Frame, or MicroMatrix Frame.

To install the TEL-14 interface module:

1   Select a slot to install the interface in.
2   Remove the blank plate covering the slot.
3   Set the option switches for the desired mode of operation.
4   Install the TEL-14 in the slot and make sure the card is fully seated.
5   Tighten the TEL-14 assembly's front panel mounting screws.

Wiring

TEL-14 Interface Wiring for IMF-3

The TEL-14 Line A circuit is connected to the matrix frame through the RJ-45 connector on the interface rear panel assembly that the TEL-14 is connected to. The DB-9M connector immediately adjacent to the RJ-45 is used to connect to the telephone line. Similarly, the second RJ-45 and DB-9M connectors connect the TEL-14 Line B circuit. Clear-Com provides DB-9F to RJ-11 adapters (CC# 770025) that allow the use of common RJ-11 telephone jacks and cords.

CAUTION: The TEL-14 works with POTS (Plain Old Telephone Service) CO (Central Office) lines. Analog station lines in some PABXs are not compatible.

Internal Settings and Adjustments

For internal option switch settings and adjustments refer to the Setup section later in this chapter.

Connection To The Telephone Line

Connecting the telephone line can be accomplished with two methods. One is to use the RJ-11 to DB-9M adapters supplied by Clear-Com (CC#770025) with the TEL-14 interface. The second method is to directly wire each telephone line to a DB-9 connector using the pinouts in FIG. I3-1 below. Note the Clear-Com #770020 adapter, which may be alternately supplied, does not have the wiring to pins 1 and 6 of the RJ-11 connector. If it is necessary to use a series-connected telephone set with the TEL-14, contact the Service Department to obtain a CC#770025 adapter instead. Fig. I3-1 shows the wiring diagram of the adapter for one line.
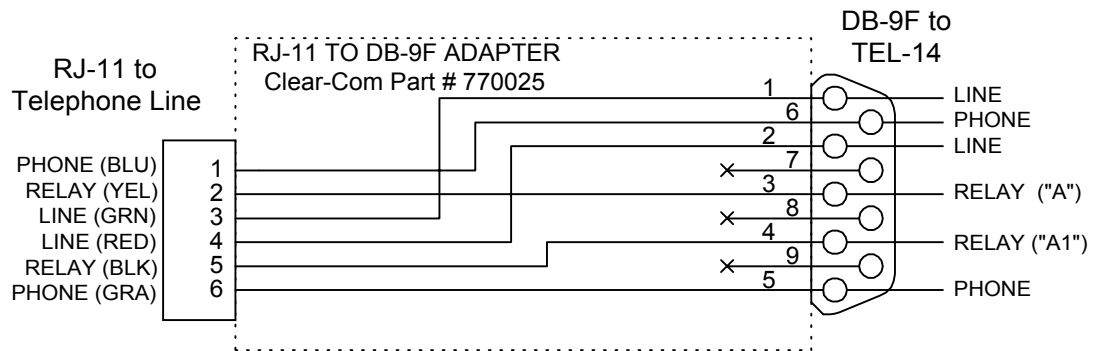
FIGURE I3-1. RJ-11 to DB-9 Adapter for TEL-14 Interface

The phone line must be an outside (POTS) line directly connected to the telephone company central office, and isolated from in-house phone systems. A standard telephone can be installed in parallel with this line if desired, but it should not be used while the TEL-14 is offhook. When the TEL-14 is automatically adjusting its sidetone null, all additional standard telephones must be "on-hook".

It is preferable to use a series-connected telephone set with the TEL-14. This will prevent the impedance of the telephone set from disturbing the telephone line impedance recognized by the TEL-14. It will also allow the TEL-14 to automatically disconnect the telephone when it comes offhook. A standard telephone may be installed in series with the TEL-14 by connecting it to pins 1 and 6 of the RJ-11 jack. Refer to Figure I3-2 for a diagram showing one way to connect the TEL-14 in series with a telephone.

FIGURE I3-2. Series Telephone Connection

Relay Contacts

A pair of relay contacts for each line ("A/A1 leads") rated at 2A @ 24 VAC are available on the DB-9M connector or the RJ-11 adapter. This pair of contacts is normally open when the line is "on-hook" and closes when the TEL-14 goes "off-hook". These contacts are not connected to any other circuitry inside the TEL-14 and can be used to energize a line-in-use indicator light on a standard multi-line phone set, or for any other low-power application.
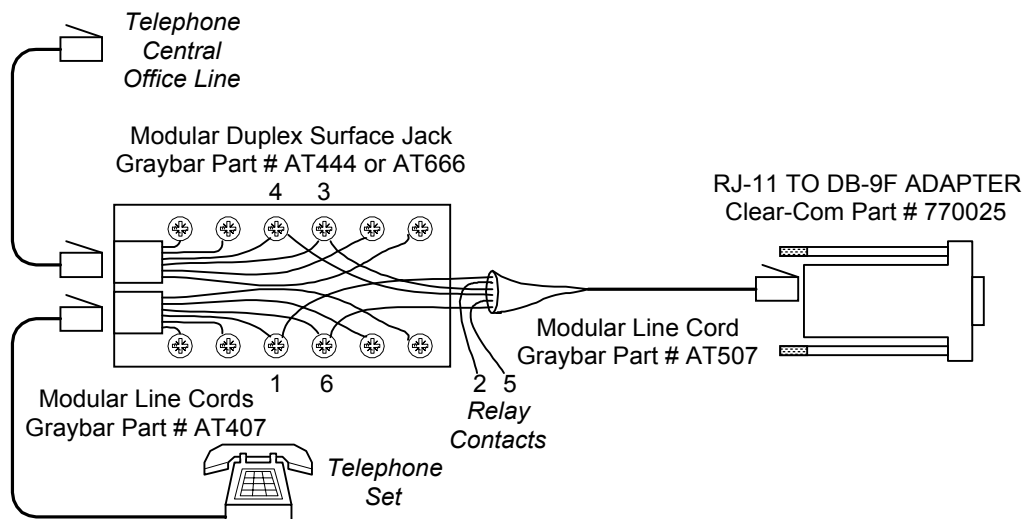
Setup

Automatic Telephone Line Null

The TEL-14 features sophisticated automatic nulling circuitry, in addition to its integral echo cancellation system. This nulling capability is in two parts:

- The initial telephone line hybrid null is performed the first time a telephone line is connected to the TEL-14 or whenever a different telephone line is connected. This process is automatic, but must be initiated by the user. The way to do this is described later in this section and in the Operation Manual.

- The continuous dynamic voice null takes place during each telephone call. It automatically "fine-tunes" the null and cancels echoes.

The TEL-14 must null itself to the telephone line before normal operation is optimal. This procedure is to be performed once whenever the TEL-14 is connected to a different telephone line. Once this nulling procedure is performed, the TEL-14 will remember the telephone line characteristics when it is removed from the frame or loses power. It is necessary to null (minimize) the sidetone (the sound of the operator's own voice in his or her headset) when an external telephone line is placed in an intercom environment. Ideally, there should be no portion of the talk signal in the listen signal. The TEL-14's sidetone nulling procedure is described here.

Before calling the TEL-14 to automatically null it, connect the external telephone line and any other devices that affect the line's impedance. These include other telephone extensions connected in parallel on the same line. The phone line must be active (turned on at the central telephone office) during the nulling process, and all local parallel phone sets must be plugged in but on-hook so the line is in its normal operating state.

1 Enable the "Auto Answer" function using the front panel button.
2 Call the TEL-14 interface from a standard telephone set or cellular phone. **Do not** call the TEL-14 from another TEL-14 in an intercom.
3 Press and hold the "Auto Answer" button for 5 seconds. The green "Auto Answer On" LED will turn off and then turn on again after 5 seconds. When this happens, release the "Auto Answer" button.

4   Maintain silence on the telephone line. The TEL-14 will listen for one second of silence before beginning.   The "Ring/Off Hook" LED will then flicker yellow and a series of tones will appear on the telephone line. These tones will be heard on the telephone line, but not on the intercom. Maintain silence during this process.

5   At the conclusion of the tones, the automatic nulling process is complete.

After this initial automatic nulling adjustment has been made, the TEL-14 will remain adapted to this telephone line. There will be no white noise or tones at the beginning of each call, but instead the TEL-14 will use voices to dynamically adapt the interface to account for any residual nulling which may be needed. Typically, the TEL-14 will have adapted within 5 seconds of the start of the 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. Throughout the call the TEL-14 will continue to perform continuous, automatic echo cancellation and adaptation to acoustic changes.

The above initial automatic nulling process should not need to be repeated, unless the telephone line connection is changed to a different telephone number or if there is reason to believe the telephone line impedance has changed significantly--for example, if echoing or feedback occurs at a lower volume setting than before.

If an almost complete null cannot be obtained, it is likely something is wrong either with the wiring in the telephone line, or with one or more of the other devices attached to the telephone line. Refer to the Option Switch section of this manual for ways to use the TEL-14 options to improve its ability to adapt to poor conditions. Note that the null circuits in the TEL-14 are designed in accordance with North American standards, and require the signal levels and impedance of the line be within these standards. The length of the telephone line between the TEL-14 and the Central Telephone Office should not be excessively long.

Option Switch Settings

The TEL-14's panel controls and internal option switches can select any one of a large number of modes of operation for the TEL-14. The following subjects are covered in the following paragraphs:

- Default Option Switch Settings
- Matrix Compatibility
- Individual Option Switch Descriptions
- Option Switch Settings for 5 Typical Modes of Operation

Default Option Switch Settings

Figure I3-3 shows the Option Switches for each line in their factory set positions. The Option Switches are located on the lower edge of the Line A and B circuit boards, respectively, behind the Auto Answer buttons. The factory set position for each switch is the ON position, which is in the direction of the card edge for each line.

The Option Switch position numbers (1-8) are silkscreened on the circuit board. Follow these position numbers rather than any which may appear on the switches. **The factory set positions (all ON except for S7-2 and S7-4 which are off) are correct for the typical application of receiving calls from standard telephone sets or cellular phones.** You may change the switch settings based upon their individual descriptions on the following pages, or upon one of the applications described.

The TEL-14 must be unplugged from the frame to access the Option Switches. The TEL-14 may be removed and inserted with the frame powered. With the exception of the Normal / Test Mode switch and MTX3 Identification switches, which are not used on Line B, the Line A and Line B switch numbering is identical. The TEL-14 will retain its telephone line settings while it is unplugged, so it is important to plug it back into the same slot.

Line A

Line B

S7

Off On

4

1

S7

On Off

1

4

Disconnect Tone Selection

S6

Off On

Off	1	On
Off		On
Off		On
Off		On
Off		On
Off		On
Off		On
Test	8	Normal

Receive Suppression Disable
Intercom Echo Cancellation
Telephone Echo Cancellation
Spare
MTX2 V12 or MTX3
Matrix Control
HDX Disable
Normal / Test Mode*   Spare

S6

On Off

On	8	Off
On		Off
On		Off
On		Off
On		Off
On		Off
On		Off
On	8	Off

Edge of the Circuit Board

Edge of the Circuit Board

S1

Off On

4	1	1
Off		On
Off		On
Off		On
Off		On
Off		On
Off		On
Short	8	Normal

Ring Count
Sense Dial Tone
Sense Busy Tone
Sense Reorder Tone
Sense Loop Current Interruption
Immediate Manual Disconnect
Splash Tones
Loop Current Interruption Guard Time

S1

On Off

1	8	4
On		Off
On		Off
On		Off
On		Off
On		Off
On		Off
Normal	8	Short

S5

Off On

| Off | 1 | On |
| Off | 2 | On |

MTX3 Identification A
MTX3 Identification B

Line A

Line B

Front Panel End

Factory Default: All Switches ON
except S7-2 & S7-4 which are OFF
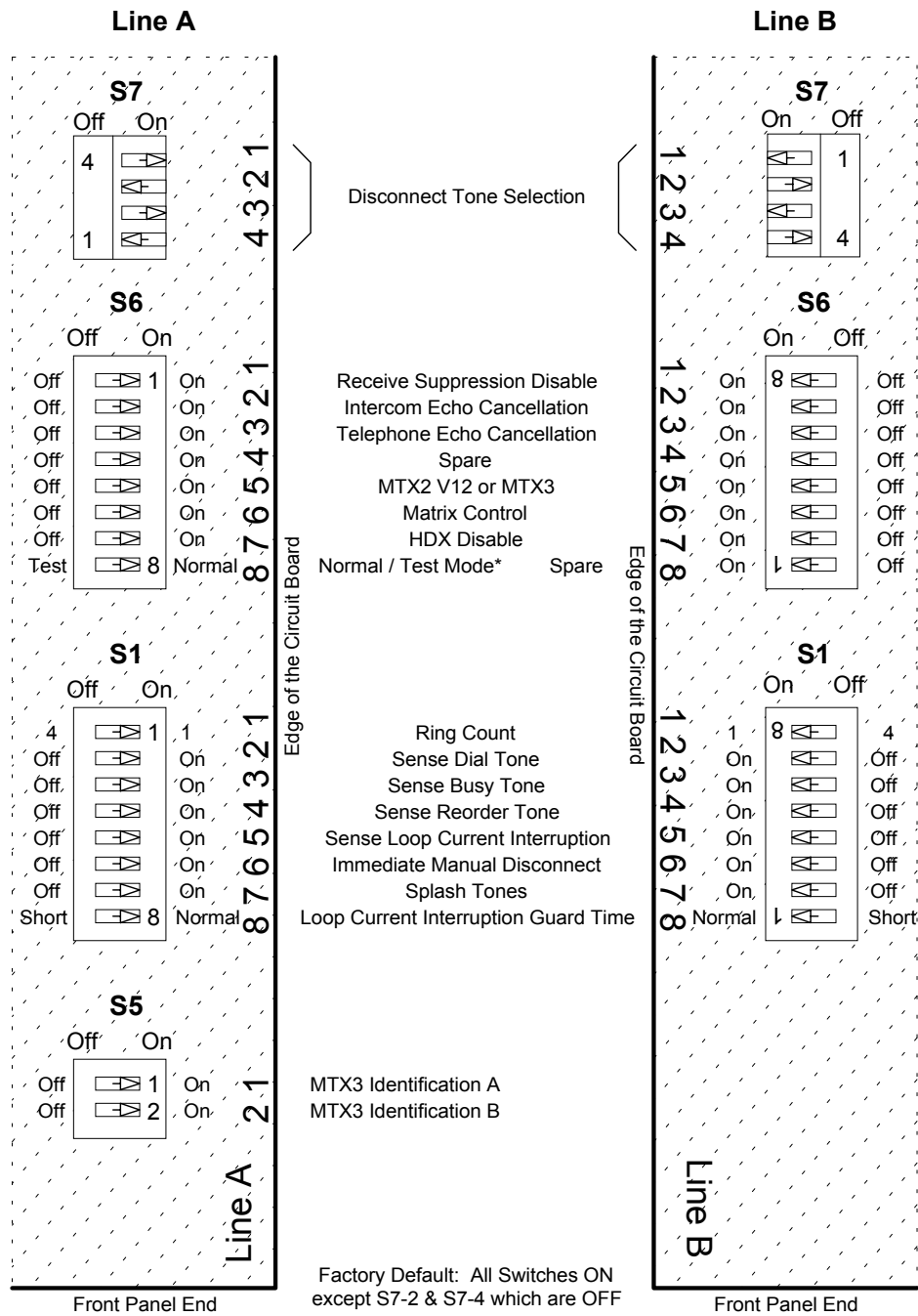
Front Panel End

FIGURE I3-3. TEL-14 Option Switches

Matrix Compatibility Option Switches

The TEL-14 is compatible with both Matrix Plus II and Matrix Plus 3 intercom systems, although the Option Switches must be set for each system as follows:

Switches S5-1 and S5-2:   Set the Matrix Identification option switches S5-1 and S5-2 to ON if you have a Matrix Plus 3 intercom system or to OFF if you have a Matrix Plus II intercom system. The factory default position is ON.

Switch S6-5:   If you have a Matrix Plus II intercom system with software older than revision 12.x, set the Matrix Control option switch (S6-5) to OFF.

Individual Option Switch Descriptions and Settings

<u>Note:</u> The default position for each option switch is the ON position (except for S7-2 and S7-4 which are OFF). The ON position of each switch is set in the direction of the edge of the circuit board on both the Line A and Line B circuit boards. **Leave each switch in the default position unless there is a specific reason to change it.**

Switch S6-1 Receive Suppression Disable: It is generally advantageous to suppress incoming noise from the telephone line when the distant party is not speaking. However, some users may want to leave the incoming sound on when the distant party is not speaking. This will enhance the sense that someone is on the other end of the telephone line, especially when intercom headsets are used. However, if two TEL-14 lines were connected into the same party line, it would be advantageous to set Receive Suppression Disable to the OFF position. This prevents noise from one or more telephone lines from interfering with intercom communication and improves the stability of the connection. Refer to the Party Line Dial-In Mode section of this manual. To leave the telephone line audio connected when the distant party is not speaking, set option switch S6-1 to ON. To mute the telephone line audio when the distant party is not speaking, set option switch S6-1 to OFF. The factory default setting is ON, causing Receive Suppression to be disabled.

Switch S6-2 Intercom Echo Cancellation: Depending upon the system configuration and room acoustics, audio communications may be improved by turning off the automatic intercom echo cancellation. Refer to the Intercom-to-Intercom Mode section of this manual. Normally, however, leaving the automatic echo cancellation turned ON results in the best communications. To enable automatic intercom echo cancellation, set option switch S6-2 to ON. To disable automatic intercom echo cancellation, set option switch S6-2 to OFF. The factory default setting is ON, causing automatic intercom echo cancellation to be enabled.

Switch S6-3 Telephone Echo Cancellation: Depending upon the system configuration and telephone line conditions, audio communications may be improved by turning off

the automatic telephone echo cancellation. Refer to the Intercom-to-Intercom Mode section of this manual. Normally, however, leaving the automatic echo cancellation turned ON results in the best communications. To enable automatic telephone echo cancellation, set option switch S6-3 to ON. To disable automatic telephone echo cancellation, set option switch S6-3 to OFF. The factory default setting is ON, causing automatic telephone echo cancellation to be enabled.

Switch S6-4 Spare: This switch is not used, but is reserved for future feature improvements in the TEL-14. It should be left in its factory default ON position.

Switch S6-5 Software Compatibility: The Software Compatibility switch enables the TEL-14 to be backwards-compatible with Matrix Plus II software, revisions 10 and 11. When the TEL-14 is shipped as part of a system, this switch is set at the factory to match that system's software revision. If the TEL-14 is shipped individually, this switch is set to ON (compatible with Matrix Plus II, revisions 12 or higher, or with Matrix Plus 3). If the TEL-14 is to be installed in a Matrix Plus II system running revisions 10 or 11, you must set this switch to OFF.

Switch S6-6 Matrix Control: <u>**NOTE: This switch is normally only used in Matrix Plus II intercom systems using revision 11 software or earlier. In later releases, this function is controlled by the "Prevent Stations From Calling Out" option in the "Configure - Local Preferences" screen for the telephone port.**</u>

When Matrix Control is enabled, a telephone call can be initiated by any intercom station that has a TEL-14 port label assigned to a selector key. Matrix Control enables the station to activate talk paths to the TEL-14, which will cause the TEL-14 to seize the line. The station can also pick up a call on the TEL-14 line.

When Matrix Control is disabled, stations cannot initiate telephone calls, and can only talk on the telephone line after the line has already been seized by the TEL-14. This may be desirable if the interface line is dedicated to manual operation, or to answering incoming calls automatically.

Matrix Control will be automatically disabled if:

- The telephone line is automatically answered at the interface.
- The telephone line is manually seized at the interface by pushing the "Hook" button.

To enable Matrix Control, set option switch S6-6 to ON.

Switch S6-7 Half-Duplex Disable: In extreme conditions involving very poor telephone lines or conditions that cause instability and echo, acceptable performance can be obtained by enabling automatic switching to half-duplex conversation. In this mode the DSP controlling the echo canceling will automatically determine whether full-duplex or

half duplex will result in better operation. To restrict operation to full-duplex, set option switch S6-7 to ON. To allow half- or full-duplex modes to be automatically determined, set option switch S6-7 to OFF. The factory default setting is ON, restricting operation to full-duplex.

Switch S6-8 Normal / Test Mode: This switch is only active on the Line A card, but serves both lines. Switch S6-8 should normally be left ON, enabling Normal Mode.

Switch S1-1 Auto-Answer Ring Count: The Auto-Answer Ring Count determines the number of times the telephone line must ring before the TEL-14 automatically answers it. The ring count can be set to either 1 ring or 4 rings. To set the Auto-Answer Ring Count to 1 ring, set option switch S1-1 to ON. To set the Auto-Answer Ring Count to 4 rings, set option switch S1-1 to OFF. The factory default setting is ON, providing an Auto-Answer Ring Count of 1.

Switch S1-2 Sense Dial Tone: The TEL-14 can automatically disconnect from the telephone line when it senses dial tone. If necessary, this capability can be disabled. To enable automatic disconnects resulting from dial tone, set option switch S1-2 to ON. Dial tone disconnects are automatically disabled for the first 10 seconds of outgoing calls to allow time to begin dialing, regardless of this switch setting. To disable automatic disconnects resulting from dial tone, set option switch S1-2 to OFF. The factory default setting is ON, providing an automatic disconnect when the TEL-14 senses dial tone.

Switch S1-3 Sense Busy Tone: The TEL-14 can automatically disconnect from the telephone line when it senses busy tone. If necessary, this capability can be disabled. To enable automatic disconnects resulting from busy tone, set option switch S1-4 to ON. To disable automatic disconnects resulting from busy tone, set option switch S1-4 to OFF. The factory default setting is ON, providing an automatic disconnect when the TEL-14 senses busy tone.

Switch S1-4 Sense Reorder Tone: The TEL-14 can automatically disconnect from the telephone line when it senses reorder (fast busy) tone. If necessary, this capability can be disabled. To enable automatic disconnects resulting from reorder tone, set option switch S1-4 to ON. To disable automatic disconnects resulting from reorder tone, set option switch S1-4 to OFF. The factory default setting is ON, providing an automatic disconnect when the TEL-14 senses reorder tone.

Switch S1-5 Sense Loop Current Interruption: The TEL-14 can automatically disconnect from the telephone line when it senses the interruption in loop current that happens on most telephone lines shortly after the distant caller disconnects. If necessary, this capability can be disabled. To enable automatic disconnects resulting from an interruption in loop current, set option switch S1-5 to ON. To disable automatic disconnects resulting from interruption in loop current, set option switch S1-5 to OFF. The factory

default setting is ON, providing an automatic disconnect when the TEL-14 senses an interruption in loop current.

Switch S1-6 Immediate Manual Disconnect: The TEL-14 can immediately disconnect a telephone call when the last station connected to it releases. Sometimes it is useful to delay disconnecting the telephone line when a station releases it. This allows the same or another station to pick up the line again and avoid losing the caller. The TEL-14 can automatically delay manual disconnects for 15 seconds. To enable immediate manual disconnects, set option switch S1-6 to ON. To delay manual disconnects, set option switch S1-6 to OFF. The factory default setting is ON, providing an immediate manual disconnect.

Switch S1-7 Splash Tones: Using "Splash Tones" the TEL-14 provides an indication to the caller that the call has been answered and provides an indication to the intercom that a caller is connecting. Depending upon requirements, these tones may be disabled. To enable splash tones, set option switch S1-7 to ON. To disable splash tones, set option switch S1-7 to OFF. The factory default setting is ON, providing splash tones at the start of each call.

Switch S1-8 Guard Time: In the first few seconds after the TEL-14 answers an incoming call, the telephone system may produce momentary interruptions in the current feeding the TEL-14. These interruptions may not occur in some telephone systems. When set to the Normal position, a guard time of about 5 seconds is in effect to prevent these interruptions from prematurely disconnecting the call. Depending upon how the TEL-14 is used, it may be common to have very short telephone calls lasting less than 5 seconds. If the Guard Time switch S1-8 is set to Normal, the TEL-14 will not be able to detect the disconnect pulse at the end of these short calls. The Short setting of the Guard Time switch changes the guard time to about 0.25 seconds. If very short calls will be common and if the telephone system does not produce any momentary interruptions at the start of a call, then the Guard Time switch S1-8 may be set to the Short setting. If the short setting is used and calls sometimes prematurely disconnect within the first few seconds, then the Normal setting must be used. The factory setting is Normal (ON).

Switch S5-1 & S5-2 Matrix Plus 3 Identification: This switch will identify the card to a Matrix Plus 3 Intercom System as a TEL-14. S5-1 and S5-2 should always be operated in concert so that either both are ON or both are OFF. If the TEL-14 is used with a Matrix Plus 3 Intercom System, they should be set to the ON position. If the TEL-14 is used with a Matrix Plus II Intercom System, they should be set to the OFF position. The factory default setting is ON.

Switches S7-1, S7-2, S7-3, and S7-4 Disconnect Tone Selection: These switches set the frequency of the call progress tones that the TEL-14 will sense as an indication of a disconnected call. Call progress tones are the dial tones or busy tones often heard after

the distant caller hangs up. These tones can be used by the TEL-14 as a means of detecting when a call is complete and must be disconnected. These tones vary in different parts of the world and in different telephone systems. The factory default setting for S7 is for North America. The variety of possible settings is shown in the following table:

Frequency	Example Country	Cadence*	S7-1	S7-2	S7-3	S7-4
480+620 Hz	North America	Interrupted	ON	OFF	ON	OFF
350+440 Hz	North America	Steady	ON	OFF	ON	OFF
400 Hz	Chile, Thailand	Interrupted	ON	ON	OFF	OFF
425 Hz	Austria, Germany	Interrupted	OFF	OFF	OFF	ON
440 Hz	Czech Republic	Interrupted	OFF	OFF	OFF	OFF

Table I3-1. Disconnect Tone Settings

* Note that the appropriate Tone Sense switches S1-2, S1-3, and S1-4 must be set to ON for 1 Hz cadence, 2 Hz cadence, or steady tones to be sensed as disconnects.

Ring Jumper J6 Ring Voltage Sensitivity: If the ring voltage from the telephone line is low and the TEL-14 will not answer to it, this jumper can be set to the 60V position. Low ring voltages are often encountered outside of the United States. The factory default setting is the 90V position, providing sensitivity to the typical 90 VAC ring found in the United States.

Option Switch Settings for 5 Typical Modes of Operation

The TEL-14's panel controls and internal option switches can select any one of a large number of modes of operation for the TEL-14. The following paragraphs describe the settings for five of the most common of these modes:

- Intercom Station Telephone Access
- Self-Service Dial-In
- Manual Call Screening
- Intercom-to-Intercom
- Party Line Dial-In

For operating instructions for these modes, see the TEL-14 section of the Matrix Plus 3 System Operation Manual (Volume I). For configuration options refer to the Configuration Program Manual.

Intercom Station Telephone Access Mode

In Intercom Station Telephone Access mode, a call on a TEL-14 line can be answered by any intercom station with a selector key assigned to a TEL-14 port label. Intercom stations can originate a call by using the "Dial Phone" mode. To allow dialing, the "Prevent Stations From Calling Out" option in the "Configure - Local Preferences" screen for the TEL-14 port must not be set.

If the call must originate at another station model, then this station must have a key programmed to activate a DTMF sequence. Another way to arrange this is for the operator to have access to a standard telephone set connected with the TEL-14 line (for further information, see "Manual Call Screening Operation" below).

The default settings of the TEL-14 allow Station Access mode. You can prevent station operators from tying up the outside line by setting the "Prevent Stations From Calling Out" option in the "Configure - Local Preferences" screen for this port.

Self-Service Dial-In Mode

In Self-Service Dial-In mode (also referred to as "Telephone IFB" mode), the TEL-14 will answer automatically whenever outside callers dial in. The caller can be automatically connected to a preset party-line, station, or program feed. Using "direct inward access" the caller can specify paths within the matrix. Auto-Disconnect will release the line automatically after the caller hangs up.

To set the TEL-14 controls for Self-Service Dial-In mode:

1   Set the "Splash Tones" option switch (S1-7) to OFF. This will prevent the TEL-14 splash tones from sounding. The Matrix intercom will supply tones to prompt inward dialing.

2   Set the remaining option switches to ON, the factory set position, or as otherwise required.

You can prevent station operators from tying up the outside line by setting the "Prevent Stations From Calling Out" option in the "Configure - Local Preferences" screen for this port.

Manual Call Screening Mode

In Manual Call Screening mode, incoming calls can be answered by a "master" operator with physical access to the TEL-14 "Hook" button. A standard telephone, wired in series with the TEL-14, is used to initially pick up the call. When the telephone has been wired in series with the TEL-14, picking it up will not cause the interface to go off-hook, nor will this interfere with a call already in progress.

Once the master station operator determines which station should receive the incoming telephone call, he calls that station and informs them that a call is waiting. The operator then presses the "Hook" button on the TEL-14, bringing it off-hook, disconnecting the telephone set, and making the incoming telephone call available to any station that has the TEL-14 assigned to a key. The destination then accesses the call by activating the listen or talk key to the TEL-14. Once the Hook button has been activated, the operator hangs up the standard telephone.

When the call is complete, the destination station operator can inform the master operator, and the master operator can hang up the TEL-14 using the "Hook" button. If the "Auto-Disconnect" option switches are set, the TEL-14 will release the telephone line automatically when the caller hangs up. The telephone line will not be released if the talk path to the TEL-14 port is deactivated. This prevents a station operator from inadvertently disconnecting an in-bound caller. The destination station operator can also use the Remote Telephone Line Release feature to hang up the phone.

The operator can also originate outside calls on the standard telephone, and make them available to destinations within the matrix.

To set the TEL-14's controls for Manual Call Screening mode:

1 The "Auto-Disconnect" option switches (S1-2 through S1-5) can be set either ON or OFF. This will determine whether the operator will be required to manually hang up the line after each call by using the "Hook" button. It is recommended, however that the Loop Current Interruption option S1-5 be left in the ON position to avoid instability or feedback during open switching intervals on the telephone line at the end of a call.

2 Set the "Immediate Manual Disconnect" option switch (S1-6) to OFF. This will prevent callers from being accidentally disconnected if they are transferred from one Matrix intercom station to another.

3 Set the "Splash Tones" option switch (S1-7) to OFF. This will prevent the TEL-14 splash tones from sounding.

4 Set the remaining option switches to ON, the factory set position, or as otherwise required.

You can prevent station operators from tying up the outside line by setting the "Prevent Stations From Calling Out" option in the "Configure - Local Preferences" screen for this port.

Intercom-to-Intercom Mode

The TEL-14 may be used to interconnect two remotely located intercom systems through a telephone line. To set up the connection, one TEL-14 must originate a call to the other. Intercom station equipped with a keypad can originate the call by using the station's "Dial Phone" mode. If the operator of a station not equipped with a keypad

must originate the call, either he or she must have a key programmed to activate a DTMF sequence..

To allow dialing, the "Prevent Stations From Calling Out" option in the "Configure - Local Preferences" screen for the TEL-14 port must not be set. After the call is made, the distant TEL-14 goes off-hook and the incoming telephone call becomes available to the telephone keys the TEL-14 port is preset to.

To set the TEL-14's controls for Intercom-to-Intercom mode:

 1   The "Auto-Disconnect" option switches (S1-2 through S1-5) should be at the factory set ON position. This will allow the TEL-14 to disconnect when the call ends.

 2   Set the "Immediate Manual Disconnect" option switch (S1-6) to OFF. (The effect is described in the "Operation" section below.)

 3   Set the "Splash Tones" option switch (S1-7) to OFF. This will prevent the TEL-14 splash tones from sounding.

 4   Set the "Intercom Echo Cancel" (S6-2) and "Telephone Echo Cancel" (S6-3) option switches to OFF. This should be done to the TEL-14 on **only one** of the intercoms.

 5   Set the remaining option switches to ON, the factory set position, or as otherwise required.

In this type of connection, there is a possibility the echo canceller DSPs in the two TEL-14 cards will interfere with each other and cause instability. Note that setting the "Intercom Echo Cancellation" (S6-2) and "Telephone Echo Cancellation" (S6-3) option switches to OFF on **one** of the TEL-14 cards will improve this condition but result in slightly more sidetone in that card.

Party Line Dial-In Mode

Two TEL-14 lines may be programmed into the same party line. The TEL-14s should be set to "Auto Answer" and "Auto Disconnect" to allow people to use telephones or cellular phones to connect to and leave the party line at will. The callers may communicate with each other, as well as anyone on the party line.

To set the TEL-14's controls for Party Line Dial-In mode:

 1   The "Auto-Disconnect" option switches (S1-2 through S1-5) should be at the factory set ON position. This will allow the TEL-14 to disconnect when the call ends.

 2   Set the "Receive Suppression Disable" option switch (S6-1) to OFF.

 3   If using revision 11 Matrix intercom software, set the "Matrix Control" option switch (S6-5) to OFF. This will prevent intercom users from

disconnecting people who may be speaking from telephone line to telephone line.

4 Set the remaining option switches to ON, the factory set position, or as otherwise required.

In this type of connection, there is a possibility that excess telephone line noise may interfere with communication on the intercom party line, or that poor telephone connections could cause instability in the two TEL-14 cards. For this reason it is recommended to turn OFF the Receive Suppression Disable option switch S6-1 on each TEL-14 line programmed into the party line. This will allow the TEL-14 to automatically quiet the telephone line when there is no incoming voice.

Matrix Configuration

The Matrix System will automatically configure the port. A Matrix Plus 3 system will configure it as a TEL-14. A Matrix Plus II system will configure it as a TEL-12. The Matrix System will assign a label and declare the port as a Telephone port type. The Configuration Program can be used to modify these parameters.

Specifications

Audio

Frequency Response	300 Hz - 3500 Hz
Send Gain Control Range	± 12 dB
Send Gain (@ 0 dB setting)	-12 dBv on intercom line produces -9 dBm on telephone line
Receive Gain Control Range	± 12 dB
Receive Gain (@ 0 dB setting)	-27 dBm on telephone line produces -12 dBv on intercom line
Trans-Hybrid Loss	> 40 dB, typical

Ring Detect Sensitivity

The TEL-14 will operate with most international telephone ring signal standards.

Telephone Disconnect

Dial Tone*	350 Hz + 440 Hz, continuous
Busy Tone*	480 Hz + 620 Hz, 0.5 sec on / 0.5 sec off
Reorder Tone*	480 Hz + 620 Hz, 0.25 sec on / 0.25 sec off
Loop Current Interruption	> 5 mS

* or as set according to Table I3-3

Telephone Line Isolation

Dielectric Strength	1500 VAC
Resistance	>10 Meg Ohms between each telephone line and the Matrix Plus Interface Frame.

Power Supply

Supplied by the matrix interface module frame's power supply

Voltage Required	Between ±8 and ±12 Volts DC Unregulated
Current Required	370 milliamps (positive supply, maximum)
	130 milliamps (negative supply, maximum)

Connectors

RJ-45 "To Matrix" Connector	2 for Intercom connection
DB-9M Connector	2 for Telephone Line, Telephone Set, and Relay Contact connections (RJ-11 adapter supplied)

Relay Contacts

Type	Dry, Normally Open when TEL-14 is On-Hook
Voltage	24 Volts AC
Current	2 Amps Maximum

Operating Environment

Temperature	Between 0 and 70° C (32-150° F)

Package Dimensions

Frame Slot Usage	1 slot of Matrix Plus Interface Frame
Height	5 1/16" (129 mm)
Width	1 3/8" (35 mm)
Depth	9 5/32" (233 mm)
Weight	0.78 lbs (0.32 Kg)

Matrix Plus 3 System   RLY-6

RELAY INTERFACE MODULE

RLY-6
RELAY MODULE

ACTIVE   TEST
1
2
3
4
5
6
ON-LINE
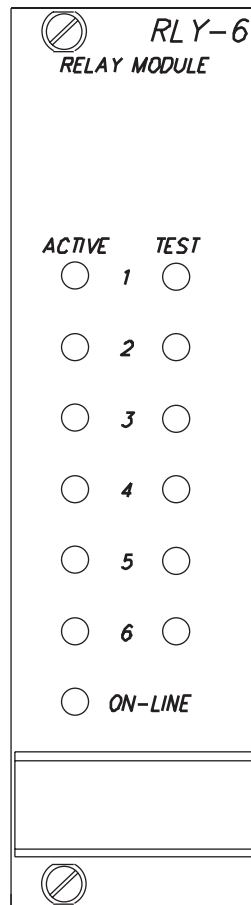
Introduction

This Section describes the installation of the RLY-6 Relay Interface Module, wiring to the external devices, and provides electrical and mechanical specifications.

Description

The RLY-6 Relay Interface Module provides connection of six programmable relays to the matrix so that each relay is directly controlled from the matrix. Multiple RLY-6 Interfaces can be daisy-chained to provide connection of up to 60 relays to the matrix. RLY-6 and GPI-6 modules can be mixed together up to the total limit of 60 items. Five RLY-6 and five GPI-6 modules would provide 30 relays and 30 inputs for a total of 60 ins and outs.

The RLY-6 provides the following functions:

    1   Six independent sets of relay contacts which are activated from the CONFIG-1 frame configuration card in the matrix frame.

    2   DC isolation between relay device(s) and the system.

    3   An LED indicator for each relay that lights when the relay is active .

Each RLY-6 Interface relay contact is a single-throw double-pole pair for use by the user. They are rated at 1 Amp at 24 Volts DC (resistive load). The RLY-6 is not designed for switching mains AC line voltage. To switch an external device that runs on the mains AC line voltage, use an external relay that is activated by the RLY-6.

The RLY-6 Interface contains circuitry to ensure that relays are not inadvertently activated during power-up until commanded by the CONFIG-1 Card in the frame.

Logical control of the relays in the RLY-6 Interface is provided by associating a relay with any other label in the system using the Configuration Program. Activating a TALK or LISTEN label with a relay associated to it will also activate that relay. There is a special classification of labels that can be just relays called Control Labels. See the section on this subject in the Configuration Program.

A TEST push-button switch is provided for each relay to allow local activation of the relay for hardware testing purposes.

The RLY-6 occupies one slot in the IMF-3 Interface Frame. Connections are made to the matrix frame via a 8-pin RJ-45 connector, and to the external devices via two DB-9M connectors. There are no adjustment controls for the RLY-6.

Installation

To install the RLY-6 Interface module in the IMF-3 frame, select a slot to install the interface in. Remove the blank plate covering the slot. Install the RLY-6 in the slot.

The IMF-3 frame has a universal rear panel that is used for all Matrix Plus 3 Interface modules. The rest of the installation consists of connecting the control input to the module, (the top RJ-45 for the channel) to the Matrix frame or the 'daisy-chain' output (the bottom RJ-45) of another RLY-6 or GPI-6 interface module.
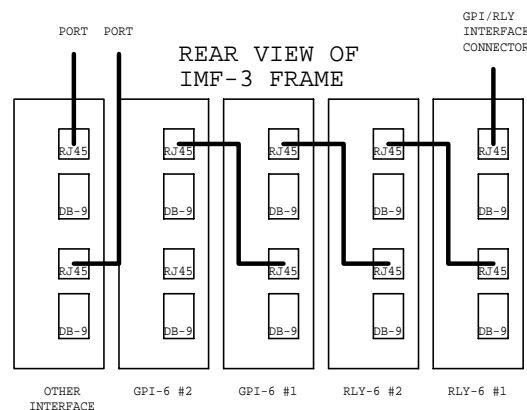
Wiring

The following paragraphs describe connecting the RLY-6 to the matrix frame and external devices.

To Matrix Frame

To connect the RLY-6 to the matrix frame, plug one end of a RJ-45 cable (eight wires with no reversal) into the **GPI-RLY INTERFACE** connector on the back of the frame. Plug the other end into the top RJ-45 (CH. A MATRIX) connector for the RLY-6.

To connect an additional RLY-6 Interface, plug one end of a short RJ-45 cable into the lower RJ-45 (CH. B MATRIX) for the first RLY-6. Then, plug the other end into the top RJ-45 (CH. A MATRIX) connector additional RLY-6. Additional RLY-6 Interfaces are added in the same way, using "daisy-chain" wiring. If there are multiple RLY-6s used, the relays in the first will be numbered 1 to 6, second will be 7 to 12, etc. GPI-6 modules can be mixed in this 'daisy-chained' scheme. The maximum combined length of all the RJ-45 cabels should not exceed 20 feet (6 meters). Refer to the illustration below.
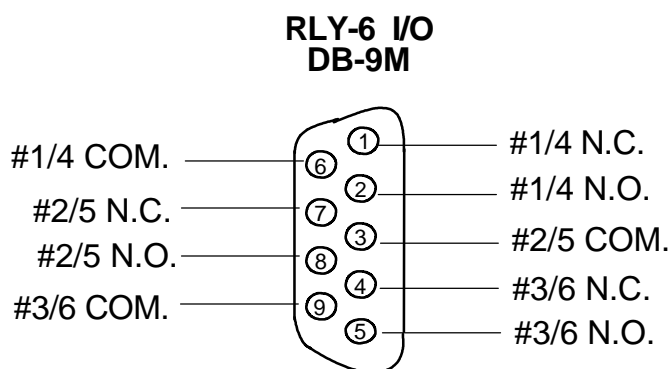
To External Device

To connect external devices to the RLY-6 Interface, use the two DB-9M connectors on the rear cable assembly panel for the interface. Figure I4-2 shows the pin assignment of these connectors as viewed from the frame side of the connector.

If a DB-9F is plugged into the connector labeled CH. A I/O, relays 1-3 are available on that connector. The connector labeled CH.A I/O has the contacts for relays 4-6. In the illustration below, the labels on the pins apply to either connector. Example: #1/4 COM. refers to the wiper of relay 1 if it is connected to CH. A and the wiper of relay 4 if it is connected to CH. B.

FIGURE I4-2. RLY-6 Interface DB-9M Connectors Pinout

**RLY-6 I/O
DB-9M**

#1/4 COM. ——— ⑥ ① ——— #1/4 N.C.

#2/5 N.C. ——— ⑦ ② ——— #1/4 N.O.

#2/5 N.O. ——— ⑧ ③ ——— #2/5 COM.

#3/6 COM. ——— ⑨ ④ ——— #3/6 N.C.

⑤ ——— #3/6 N.O.

Configuration

To associate a relay to a label, use the Configuration Program, as described in its manual.

Specifications

Relay

Type	1 Form C
Quantity	6
Contact Max. Volts	24 Volts DC
Contact Max. Cur.	1 Amp continuous,
	(2 amps peak at 24 volts DC (resistive load)
DC Isolation	10 Meg ohms.

Module Power Supply Requirements

Voltage Required	8 – 10 Volts DC
Current Required	150 mA max (25 mA per relay when active)

Connectors

Relay contacts	2 ea. DB-9M
Matrix Connection	2 ea. RJ-45 ea.

Indicators and Controls

LED Indicators	6 Green (1 ea. per relay)
	1 Yellow (Frame Data)
Pushbutton Switches	6 (1 Test Pushbutton per relay)

Wiring Requirements

Maximum line lengths for connection to Matrix Frame

Matrix Frame to IMF-3 Frame shall be less than	15 feet (5 meters)
Maximum line length between IMF-3 interface inputs	6 inches (15 cm)

Operating Environment

Temperature	0 and 70° C (32 -150° F)

Package Dimensions

Height	5 1/16" (129 mM)
Width	1 3/8" (35 mM)
Depth	9 5/32" (233 mM)
Weight	.35 LBS (.15 Kg)

Matrix Plus 3 System   GPI-6

GENERAL PURPOSE INTERFACE MODULE

GPI-6

INPUT MODULE

ACTIVE   TEST

○   1   ○

○   2   ○

○   3   ○

○   4   ○

○   5   ○

○   6   ○

○   ON-LINE
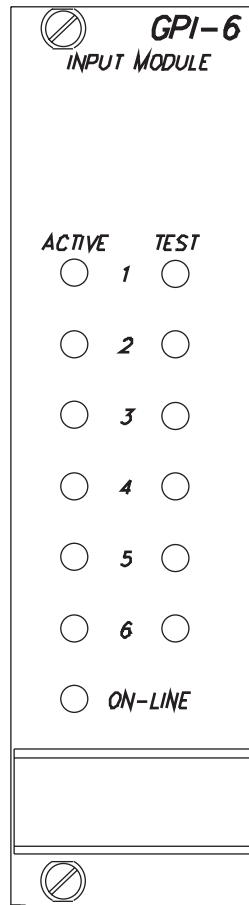
Introduction

This Section describes the installation of the GPI-6 Input Interface Module, wiring to the external devices, and provides electrical and mechanical specifications.

Description

The GPI-6 Input Interface Module provides connection of six programmable inputs to the matrix so that each input can control a predefined matrix function. Multiple GPI-6 Interfaces can be daisy-chained to provide connection of up to 60 inputs to the matrix. RLY-6 and GPI-6 modules can be mixed together up to the total limit of 60 items. Five RLY-6 and five GPI-6 modules would provide 30 relays and 30 inputs for a total of 60 ins and outs.

The GPI-6 provides the following functions:

1   Senses six independent sets of logic inputs which can activate functions in the matrix frame as defined by the configuration program.
2   DC isolation between the external device(s) and the system.
3   An LED indicator for each input that lights when the input is active .

Each GPI-6 Interface input will sense a voltage between 5 to 45 volts of either polarity. Over this voltage range the maximum signal current drawn by the card will be 7 mA.

The LED indicators for each input actually indicate what the matrix system has read from the inputs so that these indicators show that the interface is really working.

A TEST push-button switch is provided for each input to allow local activation of the software function associated with the input.

The GPI-6 occupies one slot in the IMF-3 Interface Frame. Connections are made to the matrix frame and other modules via an 8-pin RJ-45 connector, and to the external devices via two DB-9M connectors. There are no adjustment controls for the GPI-6.

Installation

To install the GPI-6 Interface module in the IMF-3 frame, select a slot to install the interface in. Remove the blank plate covering the slot. Install the GPI-6 in the slot.

The IMF-3 frame has a universal rear panel that is used for all Matrix Plus 3 Interface modules. The rest of the installation consists of connecting the control input to the module, (the top RJ-45 for the channel) to the Matrix frame or the 'daisy-chain' output (bottom RJ-45) on another RLY-6 or GPI-6 interface module.
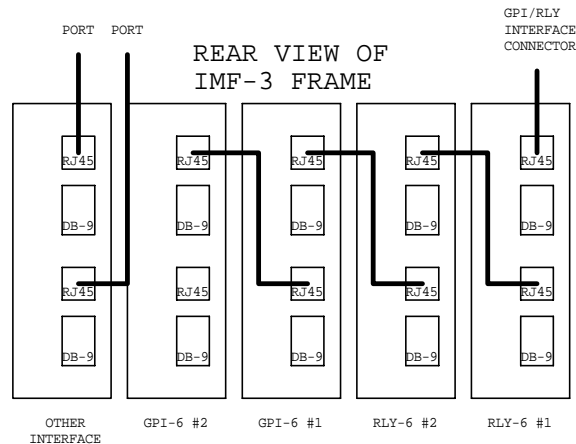
Wiring

The following paragraphs describe connecting the GPI-6 modules to the matrix frame and external devices.

To Matrix Frame

To connect the GPI-6 to the matrix frame, plug one end of a RJ-45 cable into the **GPI-RLY INTERFACE** connector on the back of the frame. Plug the other end into the top RJ-45 (CH. A MATRIX) connector for the GPI-6.

To connect an additional GPI-6 Interface, plug one end of a short RJ-45 cable into the lower RJ-45 (CH. B MATRIX) for the first GPI-6. Then, plug the other end into the top RJ-45 (CH. A MATRIX) connector additional GPI-6. Additional GPI-6 Interfaces are added in the same way, using "daisy-chain" wiring. If there are multiple GPI-6s used, the inputs in the first will be numbered 1 to 6, second will be 7 to 12, etc. RLY-6 modules can be mixed in this 'daisy-chained' scheme. The maximum combined length of all the RJ-45 cabels should not exceed 20 feet (6 meters). Refer to the illustration below.

To External Device

```
                  PORT  PORT                              GPI/RLY
                                                         INTERFACE
                                                         CONNECTOR
                            REAR VIEW OF
                            IMF-3 FRAME

        ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐
        │      │ │      │ │      │ │      │ │      │
        │ ▢    │ │ ▢────┼─┼─▢    │ │ ▢────┼─┼─▢    │
        │RJ45  │ │RJ45  │ │RJ45  │ │RJ45  │ │RJ45  │
        │      │ │      │ │      │ │      │ │      │
        │ ▢    │ │ ▢    │ │ ▢    │ │ ▢    │ │ ▢    │
        │DB-9  │ │DB-9  │ │DB-9  │ │DB-9  │ │DB-9  │
        │      │ │      │ │      │ │      │ │      │
        │ ▢────┼─┘      │ │ ▢────┼─┘      │ │ ▢    │
        │RJ45  │ │RJ45  │ │RJ45  │ │RJ45  │ │RJ45  │
        │      │ │      │ │      │ │      │ │      │
        │ ▢    │ │ ▢    │ │ ▢    │ │ ▢    │ │ ▢    │
        │DB-9  │ │DB-9  │ │DB-9  │ │DB-9  │ │DB-9  │
        └──────┘ └──────┘ └──────┘ └──────┘ └──────┘
          OTHER    GPI-6 #2  GPI-6 #1  RLY-6 #2  RLY-6 #1
        INTERFACE
```

To connect external devices to the GPI-6 Interface, use the two DB-9M connectors on the rear cable assembly panel for the interface. Figure I5-2 shows the pin assignment of these connectors as viewed from the frame side of the connector.

If a DB-9F is plugged into the connector labeled CH. A I/O, inputs 1-3 are available on that connector. The connector labeled CH.A I/O has inputs 4-6. In the illustration below, the labels on the pins apply to either connector.

FIGURE I5-2. GPI-6 Interface DB-9M Connectors Pinout
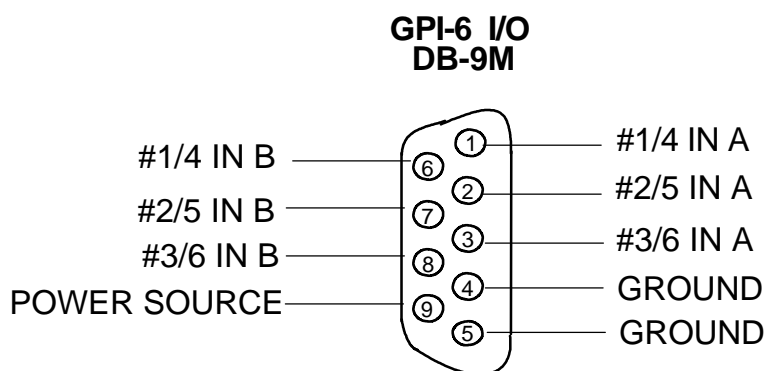
FIGURE I5-3. GPI-6 Application Examples
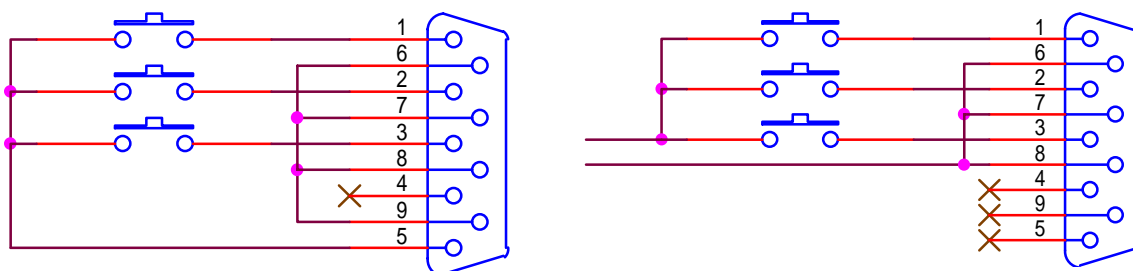
The two illustrations above show how to connect switches or contacts using the power source provided by the GPI-6 module or powering switches from external sources. Each input can be wired to be isolated from each other as a further variation.

Configuration

To define an input function, use the Configuration Program, as described in its manual.

Specifications

Input

Type	Opto-Isolated current limited

Quantity   6
Voltage Range   5 - 45 Volts DC
Input Current   4 - 7 mA
DC Isolation   10 Meg ohms

Module Power Supply Requirements
Voltage Required   8 – 10 Volts DC
Current Required   <20 mA

Connectors
Input Connections   2 ea. DB-9M
Matrix Connection   2 ea. RJ-45 ea.

Indicators and Controls
LED Indicators   6 Green (1 ea. per input)
                     1 Yellow (Frame Data)
Pushbutton Switches 6 (1 Test Pushbutton per input)

Wiring Requirements
Maximum line lengths for connection to Matrix Frame
  Matrix Frame to IMF-3 Frame shall be less than   15 feet (5 meters)
  Maximum line length between IMF-3 interface inputs   6 inches (15 cm)

Operating Environment
Temperature   0 and 70° C (32 -150° F)

Package Dimensions
Height   5 1/16" (129 mM)
Width   1 3/8"   (35 mM)
Depth   9 5/32" (233 mM)
Weight   .35 LBS (.15 Kg)

Matrix Plus 3 System   PIA-32

INTERFACE ADAPTER

PIA-32

INTERFACE ADAPTER

Power
○
On

Introduction

This Section describes the PIA-32 Interface and how to install it.

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 Consolewith 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.

Refer to the Matrix Plus II manual for wiring to its products.

The PIA-32 has a inline power transformer that needs to be connected to AC Mains.
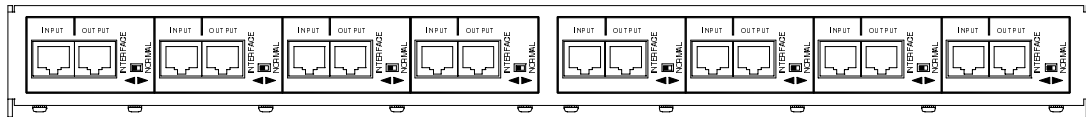
Matrix Plus 3 System BAL-8
GROUND ISOLATION INTERFACE

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 and call send) is connected, indicating to the software that the port is in "direct" mode.
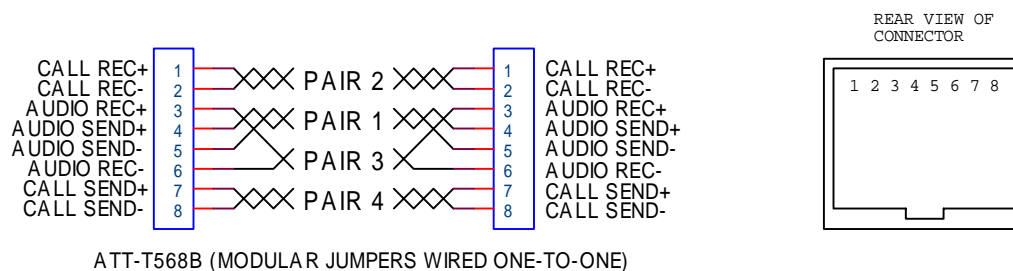

FIGURE I7-1. BAL-8 in Normal Mode (equivalent schematic)
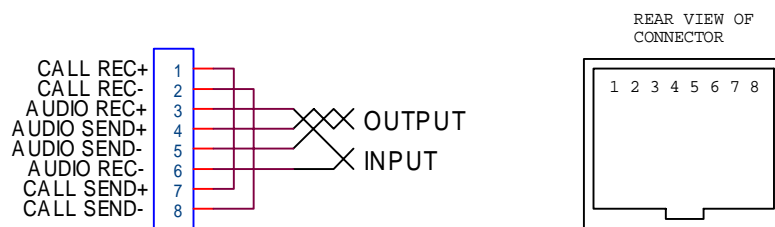

FIGURE I7-2. BAL-8 in Interface Mode (equivalent schematic)

Installation in a Matrix Plus 3 Frame

Once the BAL-8 is mounted, all connections are made between the source, the Matrix Plus 3 Frame, and destinations, public-address systems, radio receivers, etc., via RJ-45 jumpers. A complete connection includes two RJ-45 jumpers—one connecting a Matrix Plus 3 port to an Output port in one of the BAL-8's channels and the other connecting the same channel's Input port to the intended destination equipment.

One linking option is to connect the last eight ports of a Clear-Com's MicroMatrix to the eight Output ports on the BAL-8 as shown in Figure I7-3. Each of the BAL-8's Input ports can then be connected to destination equipment.

Each channel can operate in either Normal or Interface mode. Although the BAL-8 is shipped in Interface mode, you can slide the switch to the right to select the Normal mode.

- Use the Normal mode if the channel is directly connected to a Matrix Plus 3 station or other RS-422 data device.

- Use Interface mode if the channel is directly connected to an external device, such as a public-address system or a radio receiver.
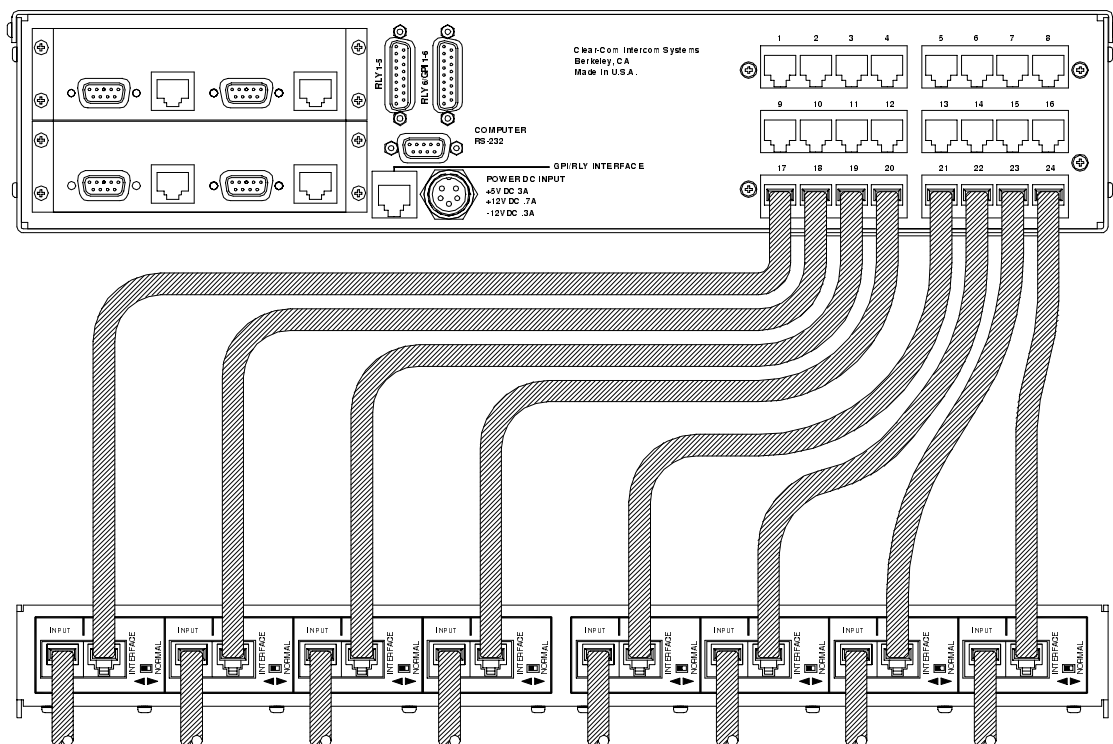

FIGURE I7-3. BAL-8 Connections