



GAI-TRONICS® CORPORATION  
A HUBBELL COMPANY

# ITR2000A Tone Remote Desk Set User and Installation Manual

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## Scope of Manual

This manual offers descriptive data and service information for the ITR2000A Tone Remote Desk Set. Service diagrams and printed circuit board details are a part of this service manual.

## Nomenclature

The model number, located on the nameplate on the bottom, specifically identifies GAI-Tronics equipment. If additional options are ordered, the option will be identified on the circuit board.

## Ordering Replacement Parts

When ordering replacement parts or requesting equipment information, please include the complete identification number. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part and sufficient description of the desired component to identify it. Order parts from:

### **Customer Service**

GAI-Tronics Corporation

400 E. Wyomissing Ave.

Mohnton, PA 19540

US: 800-492-1212

Outside US: 610-777-1374

## Service and Repair

Inoperative or malfunctioning equipment should be returned to the factory for repair. Please call **1-800-492-1212** to obtain a Return Authorization number, published repair prices, and shipping instructions.

**NOTE:** A purchase order or credit card number is required prior to processing non-warranty repairs.

## FCC Interference Warning

The FCC requires that manuals pertaining to Class A and Class B computing devices must contain warnings about possible interference with local residential radio and TV reception. This warning reads as follows:

**NOTE:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## Safe Handling of CMOS Integrated Circuit Devices

Many of the integrated circuit devices used in communications equipment are of the Complementary Metal Oxide Semiconductor (CMOS) type. Because of their high open circuit impedance, CMOS integrated circuits are vulnerable to damage from static charges. Care must be taken handling, shipping, and servicing them and the assemblies in which they are used.

Even though protection devices are provided in CMOS integrated circuit inputs, the protection is effective only against overvoltage in the hundreds of volts range such as is encountered in an operating system. In a system, circuit elements distribute static charges and load the CMOS circuits, decreasing the chance of damage. However, CMOS circuits can be damaged by improper handling of the modules, even in a system.

To avoid damage to circuits, observe the following handling, shipping, and servicing precautions:

1. Prior to and while servicing a circuit module, particularly after moving within the service area, momentarily touch both hands to a bare metal, earth-grounded surface. This will discharge any static charge that may have accumulated on the person doing the servicing.

**NOTE:** Wearing a conductive wrist strap will minimize static build-up during servicing.

2. Whenever possible, avoid touching any electrically conductive parts of the circuit module with your hands.
3. Power down the unit before installing or removing the circuit module.
4. When servicing a circuit module, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) because they contribute to static build-up. Similarly, disconnect the test probe prior to removing the ground lead.
5. All electrically powered test equipment should be grounded. Apply the ground lead from the test equipment to the circuit module before connecting the test probe.
6. If a circuit module is removed from the system, it is desirable to lay it on a conductive surface (such as a sheet of aluminum foil) which is connected to ground through 100k of resistance.
7. When soldering, be sure the soldering iron is grounded and has a grounded tip.
8. Prior to connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary in the replacement of an integrated circuit device), be sure to discharge any static build-up as described in procedure 1. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch pins on the CMOS device and associated board wiring.
9. When replacing a CMOS integrated circuit device, leave the device in its conductive rail container or conductive foam until it is to be inserted into the printed circuit module.
10. All low impedance test equipment (such as pulse generators, etc.) should be connected to CMOS device inputs after power is applied to the CMOS circuitry. Similarly, such low impedance equipment should be disconnected before power is turned off.
11. Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a similar material (aluminum foil may be used). **Never use non-conductive material** for packaging these modules.

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 Features and Benefits of the ITR2000A Tone Remote Desk Set

Table 1. Features and Benefits

Feature	Benefit
Programmable 4-frequency function control	Any one of 16 EIA standard tones can be programmed for each frequency/function key.
Parallel status updating	Enhanced system flexibility when multiple desk sets are connected in parallel. Each desk set operator knows the selected frequency.
Line Operated Transmit Light (LOTL)	LEDs indicate when another desk set is transmitting; selectable speaker mute. Can be used to solve feedback problems.
Intercom capability	Desk set users can communicate without radio transmission.
Monitor	Users can hear co-channel activity.
Programmable voice delay	User can speak immediately after pressing PTT or transmitter without clipped words.
Front-mounted controls and adjustments	Includes mute/unmute and local speaker on/off.
Parallel TX audio (two- or four-wire)	User can hear audio transmitted by another desk set.
Full-duplex capable with two- or four-wire	Two-wire full-duplex operation with two-wire adapter useful for full-duplex and trunking radio systems. (See the GAI-Tronics ITA2000.)
Adjustable RX input sensitivity and TX output level	Allows flexibility with different radio systems and user environments where radio output levels, line losses, and noise factors vary.
Line receive and transmit compression	Automatically normalizes varying input and output levels caused by system factors.
Built-in internal mic and speaker	Allows for handset-free communication.
Audio accessory connection	Users have numerous audio accessory options to maximize ease-of-use and productivity.
Scanning operation (when installed with ITA2000S Scanning Adapter)	Identifies received audio frequency.

## Introduction to the ITR2000A Desk Set

The ITR2000A Desk Set is an effective tool for maximizing the flexibility of radio systems. When used with a tone remote adapter, it provides numerous options for remote control of base station radio. Control point distances are limited only by telephone line capabilities (usually 300 miles). The number of desk sets that can be set up in parallel is dependent on radio system design.

The standard features include parallel status updating, four-frequency control, monitor, intercom, line operated transmit light (LOTL), parallel transmit mute, programmable voice delay, and full-duplex capability.

## Desk Set Button Panel

Refer to the figure below for the locations of the buttons and LEDs on the desk set button panel.

**Volume Buttons:** The desk set includes two buttons labeled VOLUME imprinted with up and down arrows. They increase and decrease the local speaker volume, mic levels, and are used as programming function keys.

**CTL:** The CTL (Control) button is used in conjunction with VOLUME Up and VOLUME Down to control the local speaker.

**IC:** The IC (Intercom) button allows communication between desk set users without transmission over the radio, and is used in programming functions.

**Monitor Button and LED:** The MONITOR button is used to place the radio in the monitor mode. The MONITOR LED illuminates while the unit is in the monitor mode, and it flashes as indication when a parallel-connected device is transmitting.

**Monitor Button and LED:** The red TRANSMIT button is used to initiate voice transmissions by placing the desk set in the transmit mode. The TRANSMIT LED illuminates when transmitting, and it flashes as indication when a parallel-connected device is transmitting.

**F1, F2, F3, and F4 Programmable Buttons:** The four buttons can each be programmed with one of 16 available function tones. Each button contains an internal red LED that lights to indicate that it is currently selected. They are also used as indicator for the line output level and line-in sensitivity adjustments.

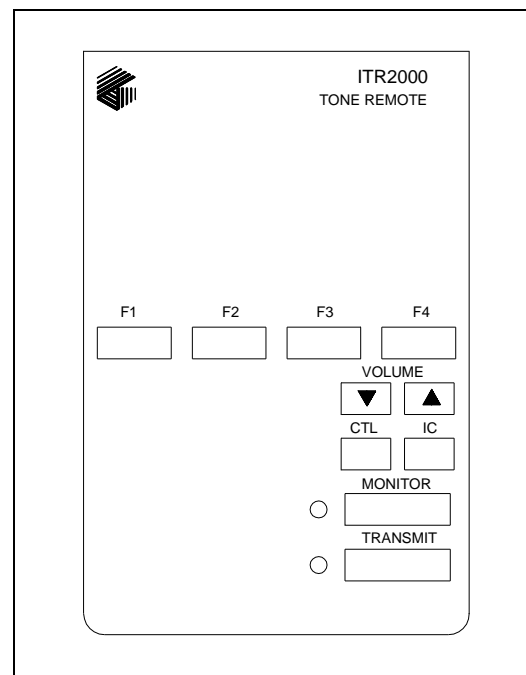


Figure 1. Front View of the ITR2000A Desk Set Button Panel



## Internal Microphone and Speaker

The handset must be on-hook in order to use the internal microphone, which is intended for use in low noise environments. The internal microphone and speaker are provided to allow hands-free communication.

## Handset

The desk set is equipped with a handset with a coil cord used for receiving and transmitting calls. The handset includes a push-to-talk (PTT) pressbar.

## Connectors

The ITR2000A includes a five-pin 12 V dc nominal power connector, an eight-pin audio accessory connector, and a modular phone line connector on the rear. The locations are shown in the figure below:

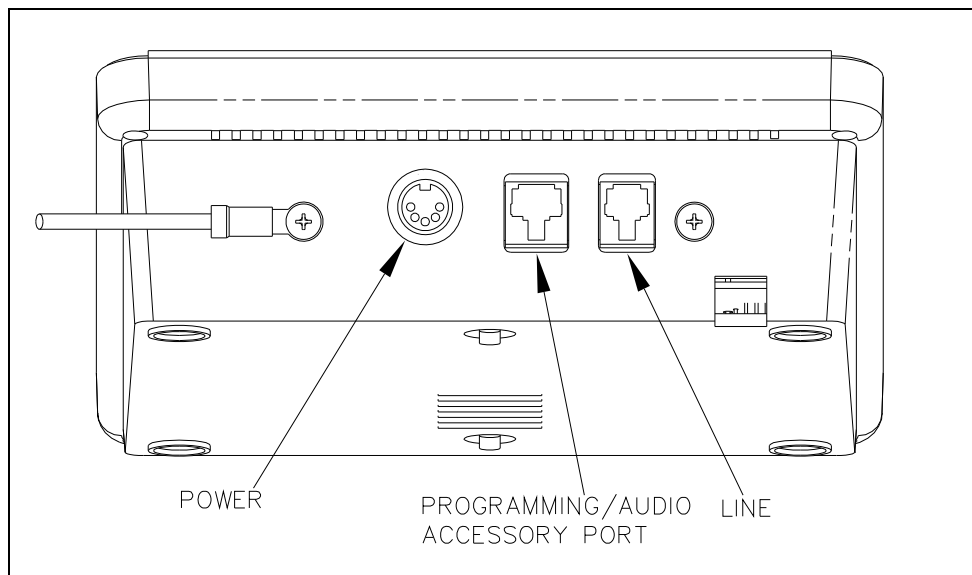


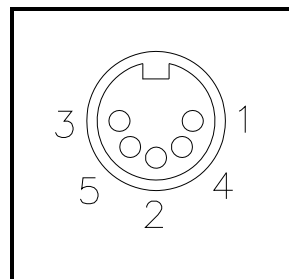
Figure 2. ITR2000A Desk Set – Rear View

### Power Connector

The ITR2000A is powered by a listed ac wall transformer supplying nominal 12 V dc. The operating range is 10.5 to 16 V dc. The five-pin power connector diagram and pinout are shown below:

Figure 3.

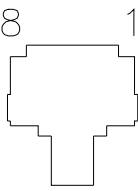
Pin	Function
1	-IN
2	Battery +IN
3	+IN
4	-IN
5	+IN



## Audio Accessory/RS-232 Port (P411)

The ITR2000A contains an eight-pin modular desk mic port to provide audio accessory options. Possible accessories include desk mic, gooseneck mic, boom mic, headset, or footswitch. The port is also used as the connector to a PC for CARD Suite programming.

Table 2.

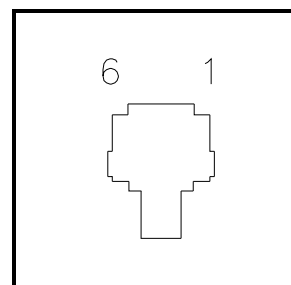
Mic Input		Pin	Function
Type:	Passive input	1	B+ OUT (through 10 ohm)
Input Impedance:	>2k ohm	2	RS-232 TX OUT
Nominal Input Level:	-20 dBm	3	Monitor IN (closure to ground)
Input Adjustment Range:	N/A	4	AGND
		5	Mic IN (with bias voltage)
		6	PTT IN (closure to ground)
		7	RS-232 RX IN
		8	RX audio OUT (handset audio)

## Line Connector (P401)

The modular six-pin line connector is located on the rear of the desk set. See rear view diagram above. The line connector pinout and diagram are shown below:

Figure 4.

Pin	Function
1	
2	Four-wire RX +IN
3	Two-wire TX +OUT/RX IN
4	Two-wire TX -OUT/RX IN
5	Four-wire RX -IN
6	



## Control Tones

Standard EIA tone keying tones are used for controlling the radio system. The sequence is:

- A 2175 Hz High Level Guard Tone (HLGT) for 120 ms.
- One of 16 function tones (FT) is sent for 40 ms.

FTs range from 2050 Hz to 550 Hz in 100 Hz steps. The FT level is 10 dB lower than the HLGT.

Table 3. Control Tones

Monitor	2050	FT4	1650	FT8	1250	FT12	850
FT1	1950	FT5	1550	FT9	1150	FT13	750
FT2	1850	FT6	1450	FT10	1050	FT14	650
FT3	1750	FT7	1350	FT11	950	FT15	550

- A 2175 Hz Low Level Guard Tone (LLGT) is generated for the duration of the transmission. The LLGT is not generated during monitor. Because voice is present with this LLGT, a 2175 Hz filtering is required in the tone panel.

When the monitor (CTCSS disable) is activated, the HLGT is generated for 120 ms, then a function tone of 2050 Hz is generated for 40 ms.

## Tone Levels

Assuming that the ITR2000A has the HLGT output level set to 0 dBm:

- The FT level and audio voice level are –10 dBm (10 dB below HLGT)
- The LLGT level is –30 dBm.
- The HLGT and FT durations are programmable.

Some tone panels use the value of the FT frequency to provide certain radio control functions. If the radio supports channel changes from an external logic source, the FT1 frequency of 1950 Hz could be used to change the radio to channel 1. An FT6 frequency of 1450 Hz could change the radio to channel 6.

## Accessories

Table 4. Accessories

Description	Part No.
GAI-Tronics Programming Bundle Flash Drive	XAC4000B
Desk Microphone	XDM004A
Footswitch (requires XAAB002A)	XFS002A
Desktop Gooseneck Microphone (requires XAAB002A)	XDM005A
Amplified Headset, Single Earpiece (requires coiled cord)	XHS003C
Coiled Cord for XHS003C (requires XAAB002A)	XCC004B
Coiled Cord with PTT for XHS003C (requires XAAB002A)	XCC003C
Programming Cable	XAC0004A
Audio Accessory Box	XAAB002A

## Field Replacement Items

Table 5. Replacement Items

Description	Part No.
PTT Handset with Cord, Black	HANDSET-BLACK
Replacement Power Supply, 100–240 V ac/12 V dc	40419-008
Power Supply Adapter, European	40420-001
Power Supply Adapter, UK	40420-002
Power Supply Adapter, Australia	40420-003
Power Supply Adapter Korea	40420-004
Replacement Main PCBA	69296-003
Replacement Power Supply PCBA	69298-001
Replacement Speaker Assembly	61501-014

## Performance Specifications

Color .....	Black
Physical size.....	7.6 W × 8.9 L × 4.7 H inches
Weight.....	2.4 lbs.
Temperature range .....	–35° C to +70° C
Humidity .....	95% at 50° C (non-condensing)
Power input.....	10.5 to 16 V dc; 400 mA maximum
Frequency response.....	+/-3 dB from 300 to 3000 Hz (except notch filter)
Hum and noise .....	Less than –45 dB below rated outputs
Audio output to speakers .....	1 watt minimum with level in compression range
Audio distortion .....	Less than 3% THD
Maximum number of remotes.....	As required by the system design
Microphone connections.....	Eight-pin modular
Control functions (Tones standard as shipped)	
Guard tone.....	2175 Hz, programmable
F1 to F4 tones .....	Each can be programmed from 550–2050 Hz in 100 Hz increments
Monitor .....	2050 Hz, programmable 550–2050 Hz in 100 Hz increments

## Introduction

The ITR2000A Tone Remote Desk Set provides radio system control from a remote location. The ITR2000A control tones are sent to the remote adapter through a telephone line, and are used to control radio functions such as transmit, channel change, and monitor.

Receive audio from the radio system is sent to the ITR2000A from the radio via the same telephone line connection. The F1, F2, F3, and F4 buttons allow selection of four different base station frequencies. These frequencies are dependent on your radio's capabilities.

The ITR2000A is compatible with tone adapters that accept standard EIA tone keying sequences.

## Front Panel Buttons

### TRANSMIT Button and LED

Press TRANSMIT to place the desk set in the transmit mode and initiate voice transmissions. The TRANSMIT LED illuminates and the MONITOR LED extinguishes. See "Initiating Calls" section below. TRANSMIT is also used in programming functions. See "Level Adjustments and Diagnostics" in the "Installation" section of this manual.

### MONITOR Button and LED

Press MONITOR to place the desk set, adapter, and the radio in the monitor mode (CTCSS/CDCSS disable). The MONITOR LED remains lit while in the unit is in the monitor mode. The ITR2000A remains in the monitor mode until a call is initiated (PTT) or guard tone is detected on the line.

MONITOR is also used in programming functions. See "Level Adjustments and Diagnostics" in the "Installation" section of this manual.

### IC (Intercom) Button

Press IC to communicate between desk sets without transmitting over the radio. When IC is pressed and held, microphone audio is routed to the line without activating the radio transmitter. Other tone remote desk sets on the same line will hear the audio automatically.

The IC button is also used in programming functions. See “Level Adjustments and Diagnostics” in the “Installation” section of this manual.

### CTL (Control) Button

CTL is used in conjunction with VOLUME Up and Down to manually control the local speaker when the handset is off-hook. Press and hold CTL, and then press VOLUME Up or VOLUME Down.

### VOLUME Up/Down Buttons

#### **Local Speaker Volume:**

- Press VOLUME Up or VOLUME Down to adjust the local speaker volume if the handset is on-hook.
- Press CTL + VOLUME Up to enable the local speaker while the handset is off-hook. When the handset is placed back on-hook, the local speaker again operates normally— that is, it will be disabled whenever the handset is taken off-hook.

#### **Local Speaker Mute:**

- Press CTL + VOLUME Down to mute the local speaker.
- Press VOLUME Up, VOLUME Down, or CTL + VOLUME Up to unmute the local speaker.

#### **Handset Speaker Volume (with handset off-hook):**

Press VOLUME Up or VOLUME Down to adjust the handset speaker volume.

The volume control buttons are also used to adjust the sensitivity of the selected microphone, and in programming functions. Refer to the “Microphone Sensitivity and Level Adjustments and Diagnostics” in the “Installation” section for further instructions.

### F1, F2, F3, and F4 Programmable Buttons

F1, F2, F3, and F4 are programmable for specific function tones using the CARD Suite Software. Refer to the “CARD Suite Software Programming” section for programming instructions.

Each time the ITR2000A is powered up, the status of the radio is unknown. The red LED flashes in the programmable button last selected before the unit was powered down to provide indication of the currently selected function tone. The flashing continues until the user or a parallel desk set transmits or changes frequencies.

Each time guard tone is detected on the line, the ITR2000A assumes that the status of the radio is unknown until a function tone is decoded at the proper time. Note that the programmable button LED will remain flashing even if the user keys the MONITOR button after power up. This is because the monitor command does not control which frequency is being monitored, and the state of the radio is still unknown.

### Receiving Calls

When power is applied, the desk set is in the receive mode, allowing receive audio to be heard through the speaker or handset. The desk set is always in receive mode unless the user presses TRANSMIT or IC.

The desk set contains an internal or local speaker and a handset speaker, which operate as follows:

- When the handset is in the cradle or on-hook, receive audio is heard on the local internal speaker.
- When the handset is off-hook, receive audio is routed to the handset.

## Initiating Calls

Before initiating a call, press MONITOR to verify that the radio channel is clear. To initiate a call, press TRANSMIT or the handset push-to-talk (PTT) pressbar. The TRANSMIT LED illuminates when transmitting.

Always allow a short delay before speaking to allow time for the radio channel to be established. The TRANSMIT button or handset PTT bar must be held down while talking to the radio user and released to listen. When the transmission is completed, the TRANSMIT LED extinguishes and the desk set returns to the receive mode.

### Handset Transmit

Using the handset is recommended when the desk set is located in noisy surroundings, or if full-duplex 2-wire operation is desired. Press the handset PTT bar or TRANSMIT button and speak into the handset microphone.

### Transmit From Internal Microphone

Use the internal microphone only in low noise environments. The handset must be on-hook for the internal microphone to operate. Press TRANSMIT and speak in the direction of the internal microphone. For the best transmit audio quality, maintain a distance of about 12 to 18 inches from the microphone.

### Transmit From Desk Microphone or Footswitch

The ITR2000A can be keyed to transmit with an external desk microphone, headset, or footswitch through the audio accessory port. When a PTT is asserted through this port, the TX audio originates there. With the optional relay I/O module, it is possible to key the unit from virtually any logic closure by using the input remap function of the module.

**NOTE:** Some desk microphones operate as follows:

After pressing MONITOR from the desk mic, the desk set front panel does not allow transmit until after the desk mic transmit. It may be possible to change this by reversing the PTT and monitor polarity on the accessory connector.



## Scanning Operation

When used with the ITA2000S Scanning Adapter, the ITR2000A Tone Remote Desk Set provides scanning functionality and display for up to four frequencies (channels). The scanning adapter rapidly samples all four frequencies available to the ITR2000A Desk Set, searching for a carrier signal. Detection of a carrier signal on a channel halts the scan and causes that channel's associated frequency button to illuminate.

**NOTE:** The ITR2000A must be programmed for parallel status update operation with the CARD Suite Programming Software, found in the No. XAC4000B Programming Bundle Flash Drive.

### Operation

Upon power-up, the scanning adapter automatically starts scan. While in scan mode, the adapter channel-steers the radio at the configured scan rate. The MONITOR button illuminates yellow, indicating scan mode. Upon detection of carrier, the unit stops scan and generates the appropriate tone sequence to the phone line and the MONITOR button extinguishes. This tone sequence is decoded by the ITR2000A Desk Set, the associated channel is selected, and the appropriate frequency button (F1–F4) is illuminated. The desk set operator monitors receive and transmit on that frequency.

The ITR2000A Desk Set MONITOR button can be used as a manual scan on/off switch. Pressing the MONITOR button causes the adapter to start scanning if not in scan mode or stop scanning if in scan mode. If the adapter is scanning and the MONITOR button is pressed, the adapter stops on the current channel. The recommended operation is to allow the detected carrier signal to perform the stop scan function automatically, using the MONITOR button to resume scan after a conversation has been completed.

While in scan mode, the Frequency buttons (F1 – F4) are used to initiate a conversation or transmission. An example of this operation is as follows:

1. While scanning, the ITR2000A Desk Set operator wishes to transmit on channel 3. Before doing so, the operator must ensure that the channel is clear by placing the radio in monitor mode on channel 3. To do this, the operator simply presses the F3 button, automatically placing the radio in monitor mode (do not press the MONITOR button on the desk set).
2. The operator monitors the channel for activity and, upon assuring there is none, presses the TRANSMIT key on the ITR2000A. The operator releases the TRANSMIT key on the ITR2000A Desk Set and the adapter releases PTT from the radio. The operator carries on a normal conversation with the field radio. If the operator wishes to again place the radio in monitor mode on channel 3, the F3 key must be pressed again.
3. Upon loss of carrier, the unit resumes scan after an amount of time or until manually started by the ITR2000A Desk Set (by pressing the MONITOR button), depending on the configuration of the unit.

## Parallel Status Operation

The ITR2000A supports parallel status updating. This feature allows the dispatch positions to know the status of the base station. To decode this information, the unit senses high level guard tone (HLGT), then decodes the function tone (FT2) following. Due to various tone control schemes supported by the unit, it is important to understand the rules of decoding the function tones. They are as follows:

1. If the monitor function is decoded, the unit is placed into monitor mode. If any transmit function tone is programmed the same as the monitor function tone, that transmit function tone will not be decoded.
2. If two transmit function tones are programmed to the same frequency, only the first of the tones in the sequence will be decoded; the subsequent transmit function tones set to the same frequency will not.
3. If a PTT function tone is programmed, it is not decoded since this does not contain channel control information. If a transmit function tone is programmed the same as the PTT function tone, the transmit function tone will not be decoded.

To illustrate the priority of the decode, the following can be used:

### Highest Priority

- Monitor Function Tone
- Supervisor ON Function Tone
- Supervisor OFF Function Tone
- PTT Function Tone
- Transmit Function Tone (FT1 to FT16)

### Lowest Priority

## Planning the Installation

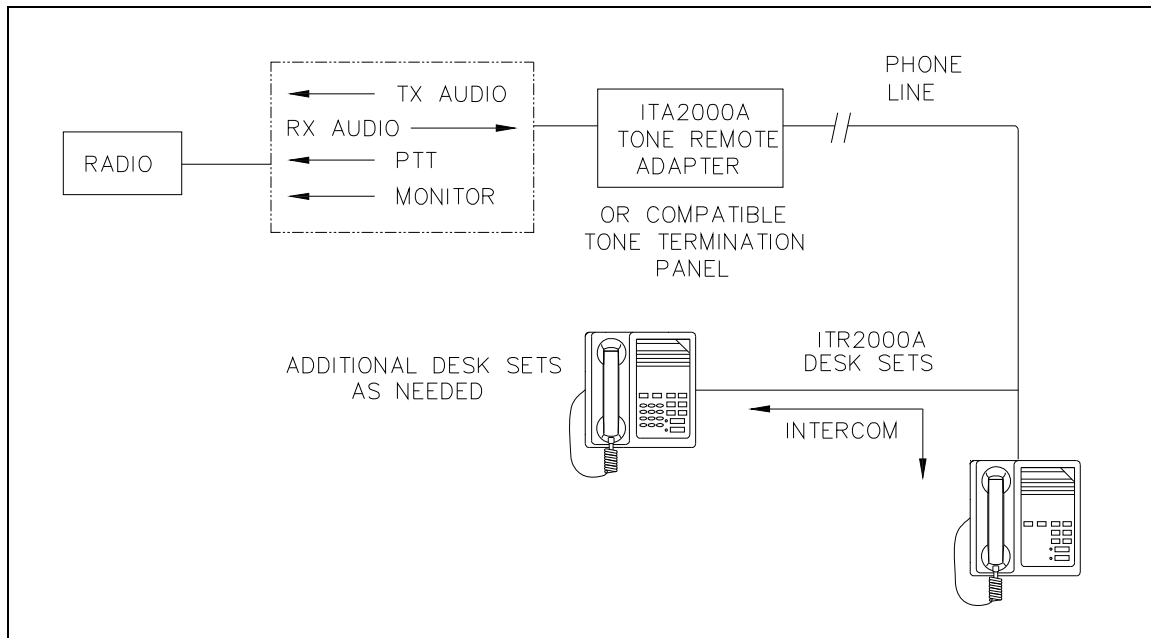


Figure 5. Typical ITR2000A Installation

## Mechanical Receipt Inspection

The ITR2000A Tone Remote Desk Set is shipped in a cardboard container with inserts. Thoroughly inspect it as soon as possible after delivery. In-transit damage should be immediately reported to the transportation company.

## Mounting

The desk set can be placed on a desk or mounted vertically on a wall. However, some options may prohibit wall mounting. To wall mount the desk set, remove the four bottom screws from the base and then rotate the base 180°. Reinstall the four screws to the base and rotate the handset hook located on the front of the unit.

## FCC Interference Warnings

The FCC requires that manuals pertaining to Class A and Class B computing devices contain warnings about possible interference with local and residential radio and TV reception. Please read these warnings and all safety information in the “Foreword” section of this manual.

## Electrostatic Discharge (ESD) Protection

The ITR2000A has ESD protection circuitry that provides a high degree of protection against ESD, and power and telephone line surges. The circuitry shunts the transient currents to earth ground through the ground terminal. One of the two screws located on the back of the desk set can be used as an earth ground terminal. See the rear view of the desk set for the ground screw terminal locations.

The ground terminal must be connected to a high quality earth ground point to obtain maximum protection. Ideally, the ground point should originate at a 1/2-inch copper rod driven at least 6 feet into the soil with a No. 16 AWG (or larger) copper wire run to the ground terminal taking the shortest path possible. Where this is not possible, ground to a nearby water pipe or best available ground.

## Equipment Required

### Test Equipment

- RF service monitor
- AC voltmeter with dB ranges for measuring audio levels

### Documentation

- base station's tone remote adapter manual
- these installation instructions

## Cable Installation Safety Considerations

Interconnecting, communications, and Class 2 dc power cables should be separated from electrical light or other Class 1 circuits by at least 2 inches. The exception is where Class I wiring or power circuits are run in a raceway, or are metal-sheathed or metal-clad, or are permanently separated from the conductors of the other circuitry by a continuous and firmly fixed nonconductor such as porcelain tubes or flexible tubing in addition to the insulation on the wire. Communications cables and in-building wiring should be listed and marked for the purpose according to NEC Article 800.

## Telephone Line Lightning and Over-Voltage Protection

The ITR2000A Tone Remote Desk Set has an over-current phone line fuse which protects against occasional extreme fault conditions that may get past the primary protectors. An example of such a fault condition is a power line cross. If the fuse requires replacement, use only with the same type fuse.

For maximum surge and lightning protection, building primary (over-voltage) protectors should be installed at the point where the telephone lines enter the radio equipment building. Primary protectors are usually required by local codes and should be provided by your leased line provider.

## Power Connection

Connect the ITR2000A to the listed ac wall transformer, which supplies nominal 12 V dc. Optionally, the desk set can be powered by other dc sources. The operating range is 10.5 to 16 V dc. Refer to the power connection pinout on page 5 of the "Description" section.

## Line Connection

Connect the telephone line to the modular connector located on the back of the desk set. Refer to the pinout on page 6 in the “Description” section. The six-pin modular jack is a full/half duplex connection to the line. The CARD Suite Programming Software allows selection of a four-wire type of connection to the line. In the two-wire mode, the hybrid will be auto-balancing. An average of ten desk sets can be connected in parallel, depending on the system design. The maximum loss between any two desk sets or between a desk set and the station should not exceed 20 dB. Desk sets are shipped with line terminations active. With parallel units connected, only the farthest desk set units should be terminated. Observe right to left pinout for pins 1 through 6.

### Line Considerations - Private Circuit

If leased lines from your local telephone company are used between the ITR2000A and the ITA2000A or similar tone remote adapter, the telephone company (Local Exchange Carrier) may request a Facility Interface Code (FIC). The FIC is subject to local availability.

Table 6. Analog Facility Interface Code

FIC	Description
02N02	Two-wire private line; no signaling conversion by LEC (IN-Band)
02N04	Four-wire private line; no signaling conversion by LEC (IN-Band)
Metallic	Two- or four-wire metallic private line (tip, ring, and sleeve circuits)

Within a manufacturing plant, a campus, or large building, customer-supplied metallic pairs may be used. Metallic pairs must be used if the dc control option is installed. It is not necessary to have dc continuity on these lines.

### Circuit Conditioning

The desk set is designed to work with good-quality analog speech band or leased private circuit. This was previously known as ‘basic’ conditioning under Series 2000/3002 service.

- The line must be non-PSTN (no dial tone, talk-battery, or signaling).
- Less than 20 dB line loss should exist from the ITR2000A to the tone panel.

This equipment falls under the Category II, FCC Tariff #260 Service and is exempt from FCC Part 68 registration. (Ref. FCC Form 730 Application Guide pages 1–5.) For two-wire operation, 2000 Series lines may be used with or without conditioning. C1 or C2 conditioning is available for these lines and relates to the envelope delay distortion and attenuation. A basic conditioned line may be used if it is the only type available. Overall system quality is limited by the quality of these lines.

## Audio Accessory/RS-232 Port Connection

Use the eight-pin audio accessory/RS-232 port to connect a PC to the ITR2000A with the proper connecting cable in order to use the CARD Suite Programming software. See the “CARD Suite Programming Software” section of this manual for instructions on set up.

After programming is complete, connect an audio accessory, such as a desk microphone, gooseneck microphone, boom microphone, headset, or footswitch, if desired. The microphone input type is passive, with an input impedance of greater than 2k ohms and a nominal input level of –20 dBm. Refer to the audio accessory/RS-232 port pinout on page 6 in the “Description” section.

## Microphone Sensitivity

After connections have been made, the ITR2000A must be configured for transmit and receive audio levels. These adjustments are made using the front panel buttons. The microphone sensitivity adjustment is used to compensate for different user voice levels and varied acoustical conditions. Refer to the following instructions to adjust the different microphones.

### Internal Microphone

1. Place the handset in the cradle.
2. While holding down IC button, momentarily press VOLUME Up button.  
A single beep is heard to indicate that the microphone sensitivity level can be adjusted.  
No audible beep indicates the microphone sensitivity adjustment function is already enabled.
3. Press and hold TRANSMIT, speak into the internal microphone, and press VOLUME Up or VOLUME Down to increase sensitivity or decrease microphone sensitivity.

**NOTE:** The display shows the relative TX level as a number between 1 and 5. To confirm the absolute level, measure the transmit level across the TX line pair using an ac millivolt meter or dBm meter.

4. After the adjustment has been made, press and hold the IC button, and momentarily press the VOLUME Down button.  
A single beep is heard to indicate the microphone adjustment has been saved and the adjustment function had been closed. No audible beep indicates the microphone adjustment function has already been closed.

### Handset Microphone

1. With the handset off-hook, hold down the IC button and momentarily press the VOLUME Up button.  
A single beep is heard in the earpiece to indicate that the microphone sensitivity level can be adjusted. No audible beep indicates the microphone sensitivity adjustment is already enabled.
2. To adjust the sensitivity level, press the handset PTT button, speak into the handset microphone, and press VOLUME Up or VOLUME Down to increase or decrease the sensitivity level.
3. After adjustment has been made, hold down the IC button and momentarily press the VOLUME Down button.  
A single beep is heard to indicate the microphone setting has been saved, and the adjustment function has been closed. No audible beep indicates the microphone adjustment has already been closed.

### Accessory Microphone

1. With the handset on-hook, hold down the IC button and momentarily press the VOLUME Up button.  
A single beep is heard to indicate that the microphone sensitivity level can be adjusted. No audible beep indicates the microphone sensitivity adjustment function is already enabled.
2. To adjust the sensitivity level, press the accessory microphone PTT/TRANSMIT button, speak into the accessory microphone, and press the VOLUME Up or VOLUME Down to increase or decrease the sensitivity level.
3. After the adjustment has been made, hold down the IC button and momentarily press the VOLUME Down button. A single beep is heard to indicate the microphone setting has been saved, and the adjustment function has been closed. No audible beep indicates the microphone adjustment function has already been closed.

## Level Adjustments and Diagnostics

After connections have been made, the desk set must be configured for transmit and receive audio levels. These adjustments are made using the front panel buttons.

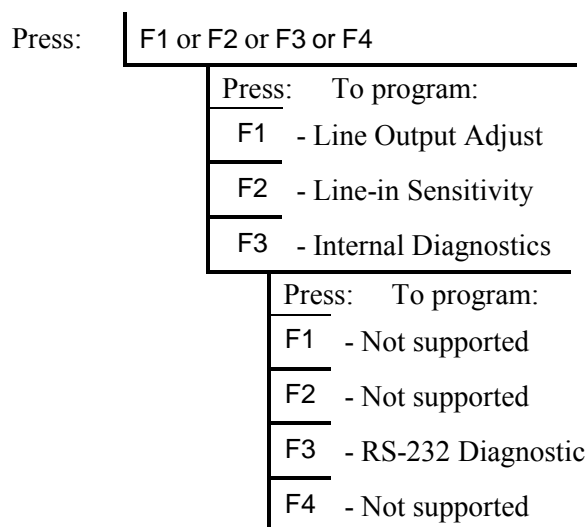
F1, F2, F3, and F4 are used to program the ITR2000A for specific installations and perform diagnostics. They are:

- Line Output Adjust
- Line-In Sensitivity
- Diagnostics

Desk sets are shipped from the factory with default settings that meet most installation requirements. The default settings are:

- 10 dBm for Line Output Level Adjustment
- 9 dBm for Line-in Compensation

However, it is important to verify that these parameters are adjusted to meet your specific installation needs. The tree diagram below illustrates which buttons to press to access the programming features.



### Main Programming Selection Mode

Enter the main programming selection mode as follows:

1. Remove power to the ITR2000A.
2. Reapply power while holding down one of the programmable buttons, F1, F2, F3, or F4.
3. The F1, F2 and F3 LEDs flash, indicating the programming mode is activated and which buttons are active. Release the programmable button.

## F1 – Line Output Adjust (Transmit)

Connect an ac voltmeter or SinAd meter across the line to achieve the proper level setting. Ensure that the line is terminated with a 600-ohm load.

After entering the main programming selection mode, press the F1 button to adjust the line output level. **NOTE:** The level is factory set at –10 dBm. The range for this setting is –10 dBm to +12 dBm.

After pressing the F1 button, the F1 through F4 LEDs light to indicate the current line output level setting. As the setting is changed, the F1 through F4 LEDs indicate the new value. The desk set buttons perform the following functions when in the Line Output Adjust mode:

Table 7.

Button	Function
VOLUME Up	Increases the output level, verifying the proper level with the meter connected to the line.
VOLUME Down	Decreases the output level, verifying the proper level with the meter connected to the line.
TRANSMIT	Saves the current setting and exits back to the main selection mode.
MONITOR	Restores the previously programmed setting.
IC (INTERCOM)	Exits the Line Output Adjustment mode without saving the selection, but maintains the current setting until power is cycled. This is useful for experimenting with different settings.

Refer to the Line Output Level table below for the LED lighting pattern that indicates the levels.

Table 8. Line Output (TX) Level Adjustment

Level	F1 LED is:	F2 LED is:	F3 LED is:	F4 LED is:	Line Level (600 Ohm)
1	OFF	OFF	OFF	OFF	–10 dB (factory default)
2	OFF	OFF	OFF	ON	–8 dB
3	OFF	OFF	ON	OFF	–6 dB
4	OFF	OFF	ON	ON	–4 dB
5	OFF	ON	OFF	OFF	–2 dB
6	OFF	ON	OFF	ON	0 dB
7	OFF	ON	ON	OFF	+2 dB
8	OFF	ON	ON	ON	+4 dB
9	ON	OFF	OFF	OFF	+6 dB
10	ON	OFF	OFF	ON	+8 dB
11	ON	OFF	ON	OFF	+10 dB
12	ON	OFF	ON	ON	+12 dB



## F2 – Line-in Sensitivity (Receive)

After entering the main programming selection mode, press F2 to adjust the line-in sensitivity. This adjustment allows the desk set to compensate for a range of 21 dB of line variation in 3 dB increments. The compensation is considered a pre-gain to the line-in circuitry of the desk set.

For example, if the RX audio output of the radio tone panel or ITA2000A is –10 dBm and the phone system has 10 dB of line loss, the ITR2000A line-in sensitivity should be set to level 6 (–9 dBm) to accommodate the 10 dB of incurred line loss.

After pressing F2, the F1 through F4 LEDs light to indicate the current line-in sensitivity level setting. As the setting is changed, the F1 through F4 LEDs indicate the new value. The desk set buttons provide the following functions when used in the Line-in Sensitivity mode:

Table 9.

Button	Function
VOLUME Up	Increases the line-in sensitivity or reduces the pre-gain for the line input.
VOLUME DOWN	Decreases the line-in sensitivity or increases the pre-gain for the line input.
TRANSMIT	Saves the current setting and exits back to the main selection mode.
MONITOR	Restores the previously programmed setting.
IC	Exits the Line-in Sensitivity Adjustment mode without saving the selection, but maintains the current setting until power is cycled. This is useful for experimenting with different settings.

Refer to the Line-in Compensation table below for an explanation of how the LED lighting pattern indicates the levels.

Table 10. Line-in (RX) Compensation

Level	F1 LED is:	F2 LED is:	F3 LED is:	F4 LED is:	Line-in Compensation
1	OFF	OFF	OFF	OFF	+6 dBm
2	OFF	OFF	OFF	ON	+3 dBm
3	OFF	OFF	ON	OFF	0 dBm
4	OFF	OFF	ON	ON	–3 dBm
5	OFF	ON	OFF	OFF	–6 dBm
6	OFF	ON	OFF	On	–9 dBm (factory default)
7	OFF	ON	ON	OFF	–12 dBm
8	OFF	ON	ON	ON	–15 dBm

## F3 – Internal Diagnostics

After pressing F3 to enter the internal diagnostics mode, all of the programmable button LEDs flash. Use TRANSMIT to return to the main programming selection mode.

Table 11.

Button	Function
F1	Not supported in the ITR2000A.
F2	Not supported in the ITR2000A.
F3	<p>RS-232 diagnostic: This diagnostic tests the RS-232 using a loop-back test. When entered, F1 through F4 LEDs are off.</p> <p>Short TXD P411-2 to RXD P411-7.</p> <ul style="list-style-type: none"> <li>• If the RS-232 port is working, the F1 through F4 LEDs count as long as the short is present.</li> <li>• Removing the short stops the count.</li> <li>• Reconnecting the short continues the count.</li> </ul> <p>It is important to measure the actual level of the TXD signal to ensure full positive and negative swing. Use TRANSMIT to return to the internal diagnostic selection mode.</p>
F4	Not supported in the ITR2000A.
TRANSMIT	Returns the ITR2000A to the main programming selection mode.

To quickly reset the desk set to default levels:

Enter the main programming selection mode and while depressing the CTL button, press the VOLUME Up button. Wait for all LEDs to flash continuously (approximately 2 seconds), then press the TRANSMIT button.

## General Description

GAI-Tronics' CARD Suite Programming Software, included in the No. XAC4000B Programming Bundle Flash Drive, is needed to program some of the functions and parameter settings of the dispatch equipment. It allows entry of operational programming data into your personal computer for transfer to the equipment. The programmed data can be retrieved, edited, archived, and printed in hard copy for record keeping. Detailed programming information can be found in CARD Suite's Help file. The following information is provided as guidance to initiate the programming application.

## Connection

The GAI-Tronics equipment must be connected to your personal computer with the programming cable, Part No. XAC0004A, before the programming software can be used. To make this connection, attach the cable to the COM1 or COM2 connector on the computer. Connect the other end to the programming jack on the GAI-Tronics equipment.

## Installation

The minimum system requirement necessary to support the CARD Suite Software Application is Windows 95 or newer. However, CARD Suite is not compatible with Windows NT. It is compatible with Windows XP (Home or Professional), Vista, and Windows 7 when used in Virtual Mode.

The CARD Suite Programming Application components are contained on the No. XAC4000B Programming Bundle Flash Drive. Please exit all other programs that are running until the installation is complete.

1. Place the flash drive in the computer's USB port.  
Select the **START** button and then select **Run** from the Start menu. At the prompt, type **x:\software select menu.exe** where **x** represents the drive letter that is associated with your flash drive. A CARD Suite icon should appear on the desktop display after successful installation.
2. After opening the program, select the appropriate product icon, click on **File** in the toolbar and select **New Archive** to begin creating an archive.
3. Enter an archive description (name) and customer/site (name), select the method of creating the archive (default values or reading a connected unit), and click **Ok** button to create the archive.
4. View the **Help** file for programming guidance.



## Troubleshooting the ITR2000A Desk Set

The following is a list of potential problems you may encounter and possible solutions.

Table 12. Troubleshooting

Problem	Possible Solution
Refer to these solutions in addition to the ones suggested for the problems below.	Verify that there is a valid telephone line path from the ITR2000A to the tone remote adapter.
	Ensure that the telephone line is balanced by making sure neither side of the telephone line is grounded.
The ITR2000A will not cause the tone remote adapter to key the radio.	Ensure that the proper tone adapter function tone for keying the radio is programmed into the ITR2000A. Refer to the tone remote adapter user manual for valid function tones that will key the radio.
	Ensure that the ITR2000A output level is set properly. The high level guard tone should be set in a range of 0 dBm to -10 dBm into the telephone line. Assuming no more than 20 dB of line loss on the telephone line, this level should be adequate for the tone adapter to decode the tone sequence.
Low or distorted RX audio	<p>Ensure that the tone remote adapter is interfaced correctly to the radio system. The quality of the audio signal output depends on the tone remote adapter.</p> <ol style="list-style-type: none"> <li>1. Use an RF service monitor modulated by a 1000 Hz tone at 60% of rated system deviation at the receive frequency and CTCSS/CDCSS (if necessary). Measure and note the level of the 1000 Hz tone across the ITR2000A telephone line.</li> <li>2. Remove the 1000 Hz tone and set the ITR2000A receive level according to the table shown on page 21. If an RF service monitor is not available, use a portable or mobile radio.</li> <li>3. Transmit to the station and measure the nominal voice audio on the ITR2000A telephone line.</li> <li>4. Set the ITR2000A receive level to the nearest level that was measured according to the tables on page 21.</li> </ol>
Unsquelled noise in RX audio.	The tone adapter must be connected to a muted and de-emphasized receive point in the radio. If connected directly to a detector or discriminator output, continuous noise is heard unless the tone panel has a squelch circuit to mute the receive radio.
No RX audio.	Ensure that the tone remote adapter is supplying receive audio onto the telephone line.
	Ensure that the ITR2000A desk set local speaker is not muted.

Problem	Possible Solution
Low TX audio.	Verify that the ITR2000A TX output level is properly set and ensure that there is no more than 20 dB of loss in the telephone line, which can cause degradation of the audio signal.
	Verify that the microphone sensitivity is set properly: <ol style="list-style-type: none"> <li>1. Using an RF service monitor set to the transmit frequency of the radio, transmit from the ITR2000A and speak into the handset. Note the transmit deviation level.</li> <li>2. Refer to the “Microphone Sensitivity” section and adjust the handset transmit level output up or down for the desired modulation level. Refer to page 18. It may be necessary to adjust the transmit audio output on the tone remote adapter at the station.</li> </ol>
Distorted TX audio.	Verify that the tone remote adapter’s transmit audio output level is not set too high for the station’s rated input level. Refer to the station and tone remote adapter manuals for proper setting and adjustment procedures.
	Verify that the microphone sensitivity is set properly. Use an RF service monitor set to the station transmit frequency. Transmit from the ITR2000A and speak into the handset. Note the transmit level. Refer to the “Microphone Sensitivity” section and adjust the handset transmit level output up or down for the desired deviation. Refer to the “Line Output Adjustment Level” table on page 20 of the “Installation” section for nominal transmit output levels, and follow the “Adjustments and Diagnostics” information to set the transmit output level for the internal microphone.
ITR2000A does not transmit or receive.	Ensure that the ITR2000A is connected to an ac or dc (if using a dc power supply option) power source.
	Check for a blown fuse.
No audio on local speaker	Ensure that the volume is not turned down all the way, and the handset is on-hook. If receive audio is not switched to the local speaker when the handset is on-hook, the handset may be defective.
	Ensure the local speaker is not muted.
Parallel status updating is not working properly.	Ensure that the F1 through the F4 buttons on parallel ITR2000As are programmed identically for the same function tone settings. If the ITR2000A decodes a function tone not programmed into one of four buttons, the F1 button LED flashes to indicate an unknown function decode.

### Fuse Replacement



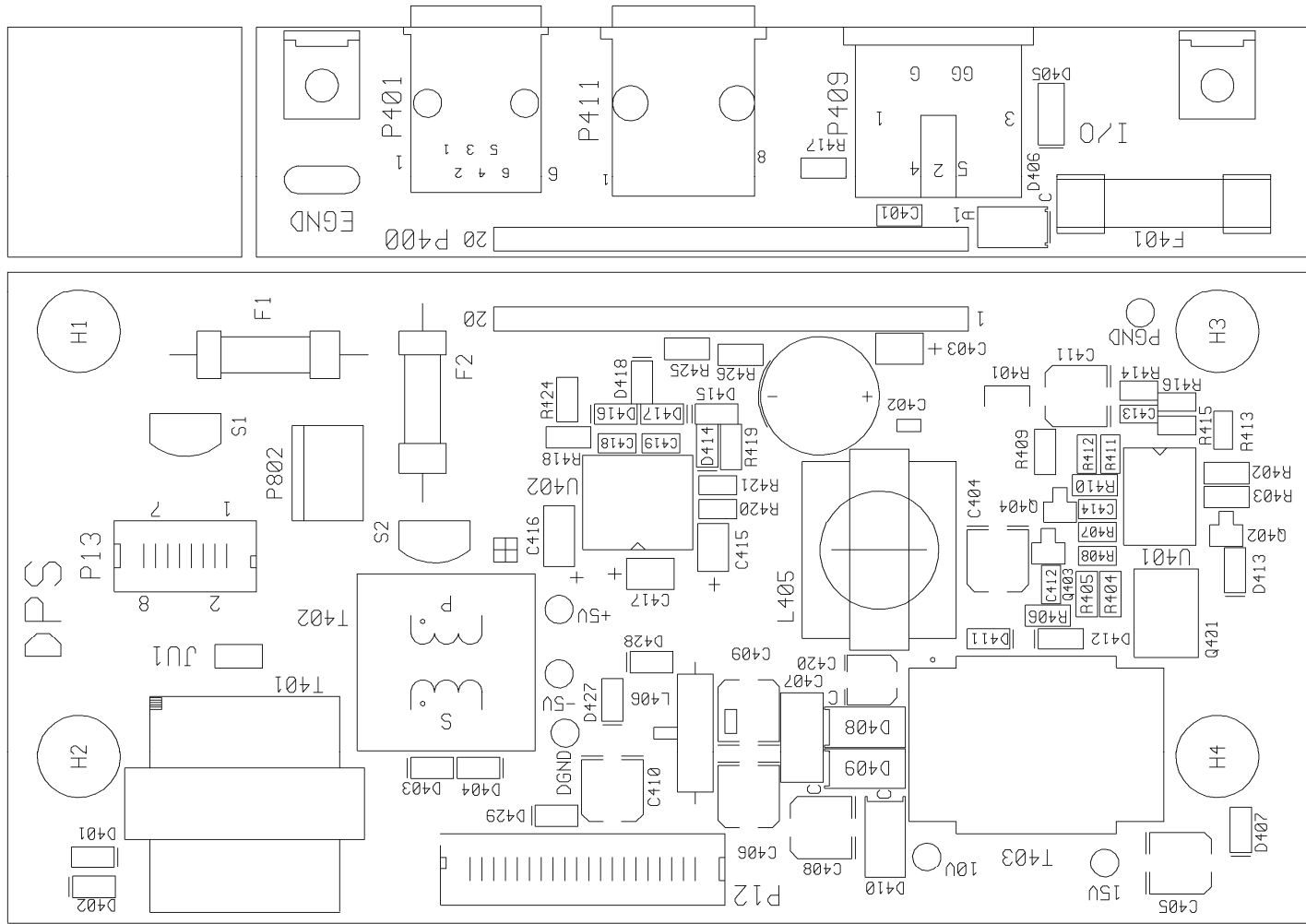
**For continued safe operation, replace fuses with the same type:**

- **F401 is a Bussman GMA 1 amp FB fuse.**



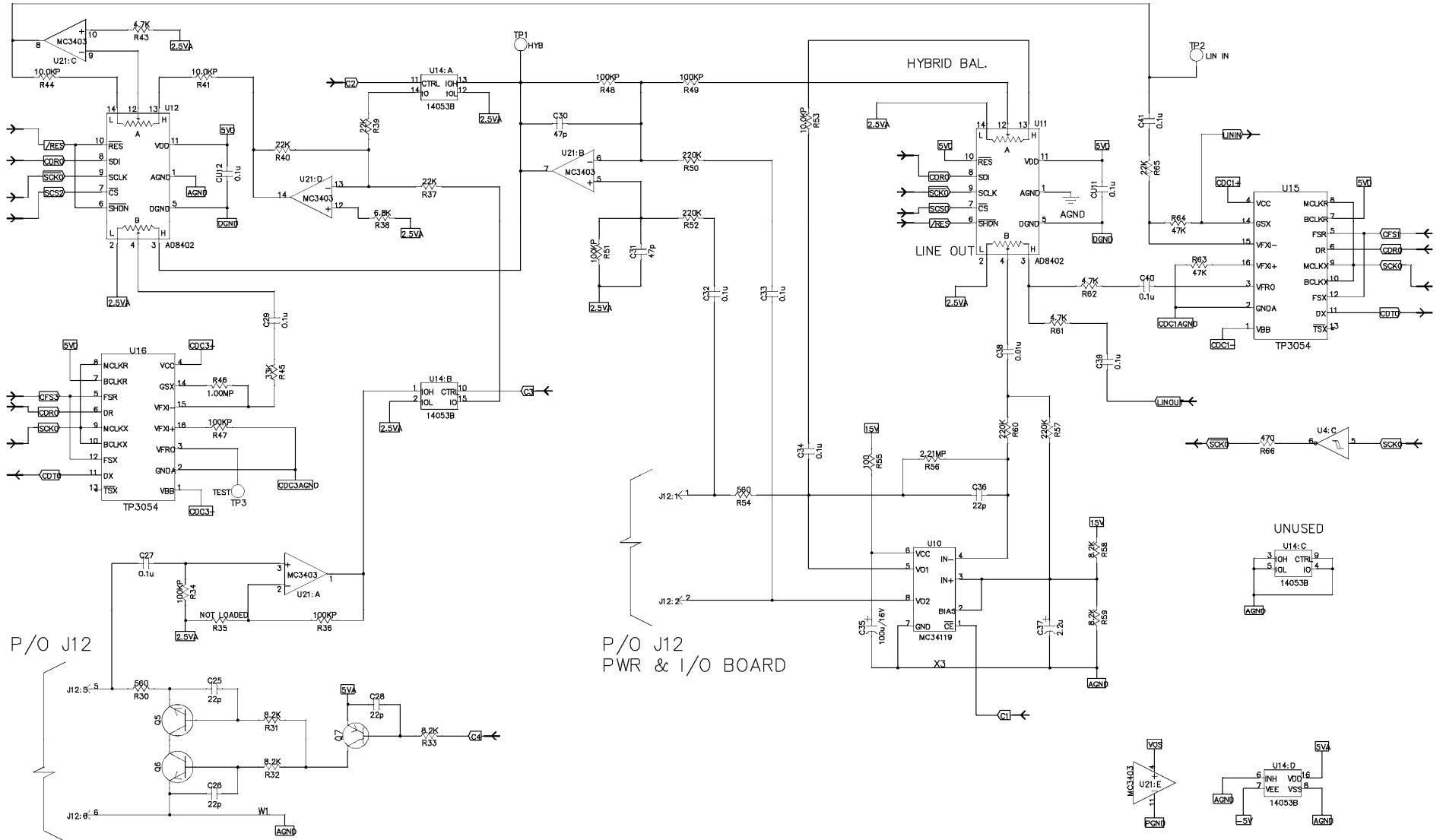




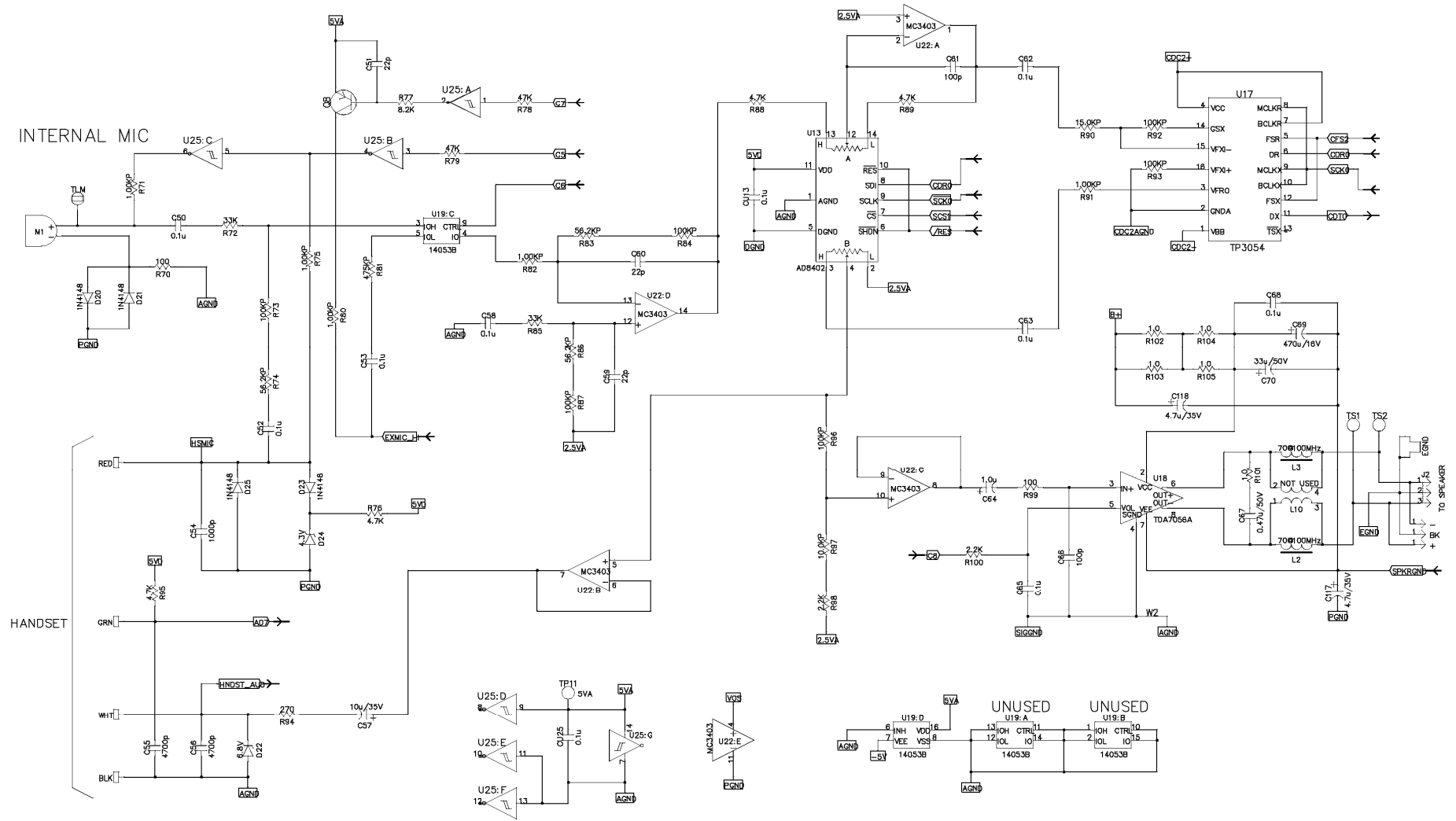




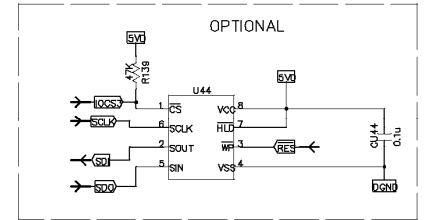
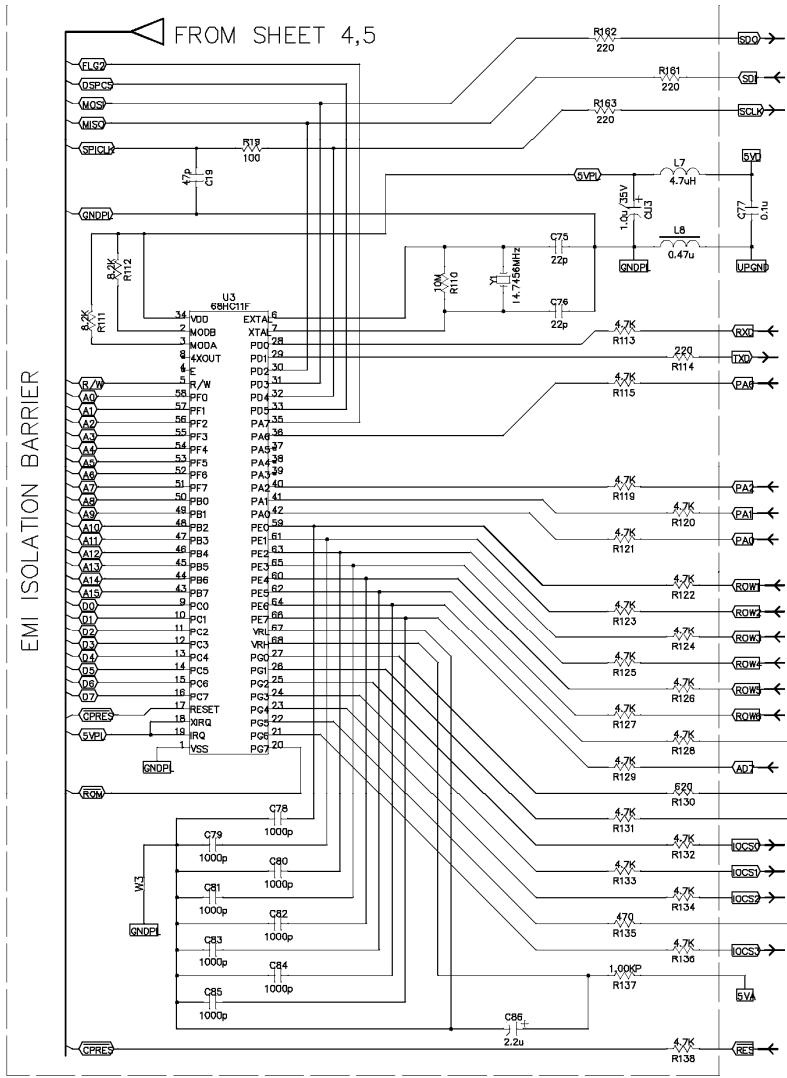




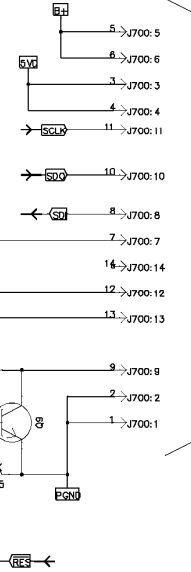
Line Interface Schematic - Sheet 1



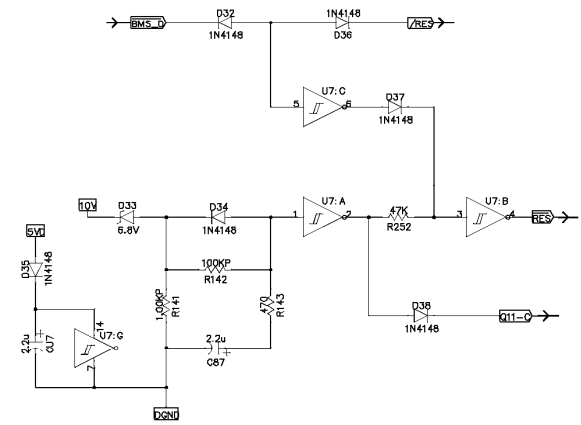
User Audio I/O Schematic Diagram - Sheet 2



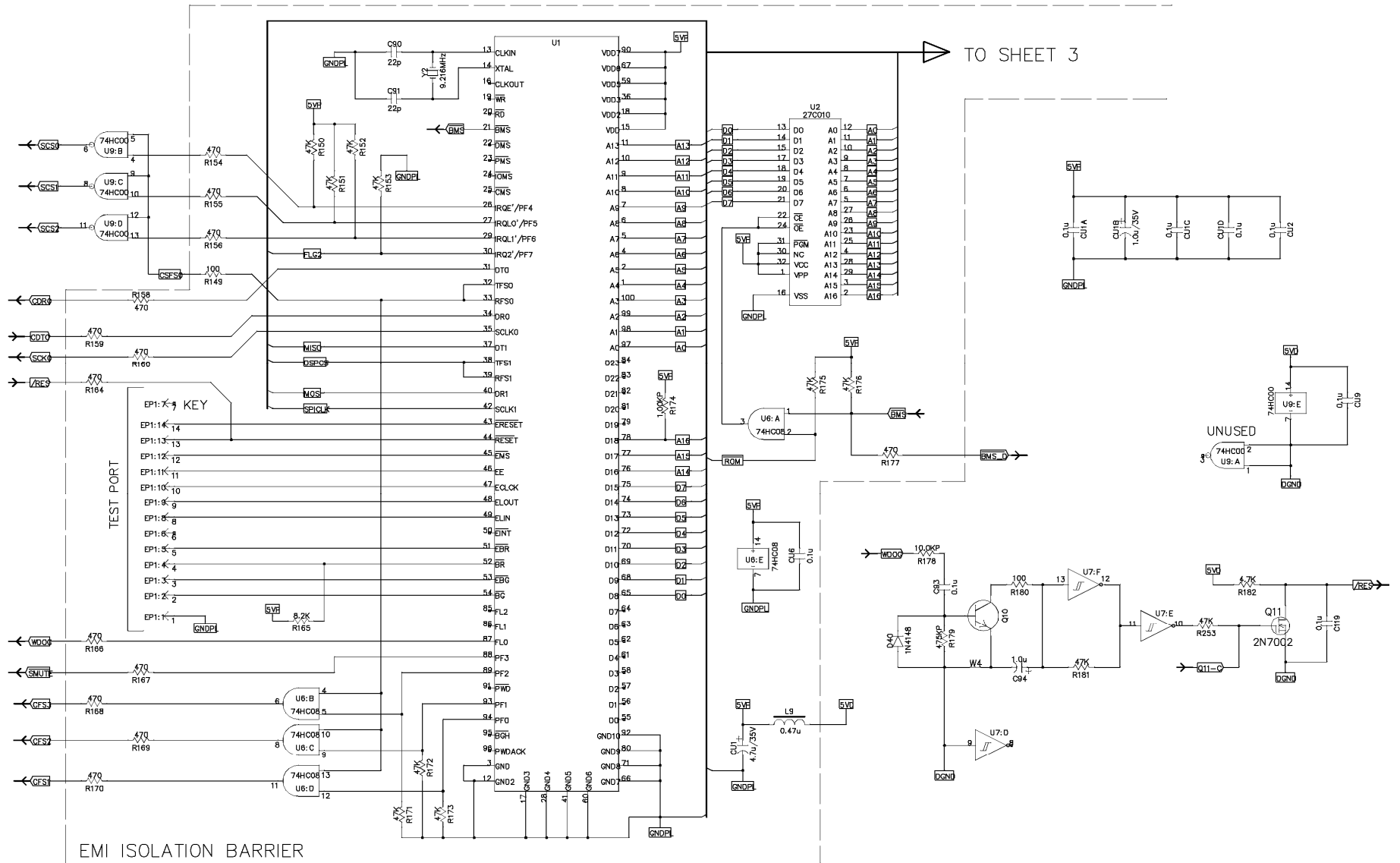
OPTION MODULE



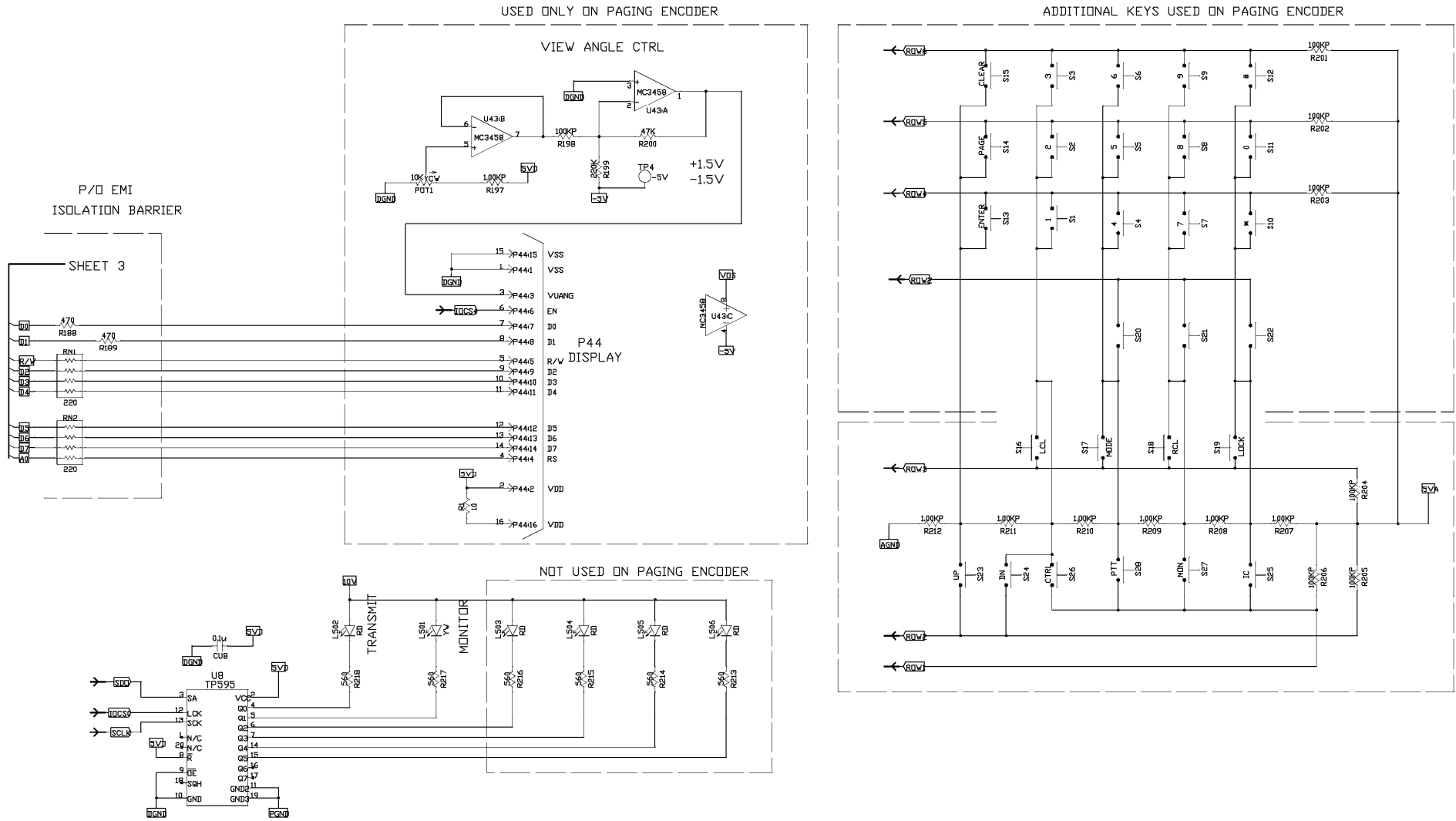
N.V.RAM PROTECTION



Control Microprocessor I/O Schematic Diagram - Sheet 3



DSP Block Schematic Diagram - Sheet 4



Tone Keypanel Schematic Diagram - Sheet 5







## Definitions and Acronyms

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Term	Definition
<b>CSQ</b>	Carrier squelch
<b>CTCSS</b>	A means of grouping users of a common radio channel. Subaudible tones are transmitted with audio; a particular radio's speaker (or the speakers of a group of radios) will unmute to broadcast a transmission only if the associated subaudible tone identifies it as belonging to the radio's user group.
<b>CDCSS</b>	A system analogous to CTCSS but using low speed digital signaling instead of subaudible tones.
<b>HLGT</b>	High level guard tone
<b>LLGT</b>	Low level guard tone
<b>PTT</b>	Push-to-talk

