



GAI-TRONICS® CORPORATION
A HUBBELL COMPANY

ITA2000A Series Tone Remote Adapter with Scanning

User and Installation Manual



*U.S. Patent 6,950,653

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Scope of Manual

This manual offers descriptive data and service information for the ITA2000A Tone Remote Adapter with Scanning. The unit is shipped as a conventional tone remote adapter but can easily be converted to a scanning tone remote adapter with a simple switch setting change. Please refer to the switch settings located in the Installation section of this 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.

Many ITA2000A features are the same in both Conventional and Scan modes. If a feature is particular to either mode, the mode will be identified.

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. A Return Authorization can also be obtained by visiting our website at www.gai-tronics.com.

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.

 Features and Benefits of the ITA2000A Tone Remote Adapter

Feature	Benefit
Adjustable receive input sensitivity and transmit output level	Allows flexibility with different radio systems and user environments, where radio output levels, line losses, and noise factors vary.
Autolevel	Reduces the need for site visits to adjust audio pots. Mobiles receive consistently high receive sound level, with fewer repeat requests.
Selectable input/output logic control	All inputs/outputs can be individually selected to go active high or to ground, depending on the radio, offering compatibility with many radio systems.
Full-duplex capable with 2- or 4-wire	With 2-wire capable desk set (such as an ITR2000A), gives full-duplex operation for use with most full-duplex and trunking radio systems.
Modular telephone line connection on back	Easy-to-install telephone line cable.
Selectable timed or continuous monitor ²	Flexible monitoring option.
Multiple parallel desk set support	System flexibility and productivity are enhanced when several desk sets are connected.
16-channel control ¹	Each of the five-channel steer outputs can be used to change channels and other functions on certain radios.
Courtesy tones	Sends a tone to the desk set when a mobile has stopped transmitting.
Selectable 2175 Hz guard tone keying ²	High and low level guard tones and function tones are sent in applications where tones are needed. (e.g. wireless phone line extension).
Supervisor control	Allows the dispatcher at the ITA2000A to override remote desk sets and accessory.
Front panel mic jack	Allows dispatch control with desk microphone, headset, handset, etc.
Accessory port	Allows connection of other devices, such as a local desk set or telephone interconnect.

¹16-channel control is available only when configured for Conventional mode. When configured for Scan mode, only 15-channel control is available.

²Available only when configured for Conventional mode.

Additional Features and Benefits of the ITA2000A Tone Remote Adapter in Scan Mode

Feature	Benefit
Adds scanning capability to conventional multi-channel radios	Enhances radio functionality by using channel steering capability of both non-scanning and scanning radios. Reduces overall system cost.
Scanning of up to 15 frequencies	A single multi-channel radio can remotely monitor multiple frequencies, reducing the number of radios required for dispatch applications.
Allows remote scanning and radio control from multiple dispatch points	Using regular leased lines, multiple dispatchers can monitor and control scanning capability. Each dispatch point displays currently active receive channel.
Flexible scanning configuration	Number of channels, scan rate, scan-stop time, and scan resume can all be easily configured using readily accessible DIP switches.
Talk-back scanning	Allows dispatcher to transmit on last active receive channel.
Remote scan on/off	Scanning can be remotely turned on or off. Properly equipped parallel dispatch devices are updated with the status.
15-channel control	Each of the five channel steer outputs can be used to change channels and other functions on certain radios.

Product Overview

The ITA2000A Tone Remote Adapter uses a state-of-the-art digital signal processor (DSP) to ensure highly accurate and fast tone encoding/decoding and audio filtering. It allows a radio to be remotely controlled through dedicated, leased telephone lines or in-house wiring using standard EIA tone keying sequences.

The advantages include flexible configuration, front panel controls and status indicators for set-up convenience, automatic level control (ALC), and a dispatcher/service mic jack. It is compact, measuring 7.03 W × 6.3 L × 1.5 H inches, and supports full-duplex or simplex, 2- or 4-wire desk set stations. The ITA2000A has an accessory connector that supports local control devices, such as a telephone interconnect, extended local desk set, or a secondary radio.

Using GAI-Tronics' ITR2000A or IPE2500A Tone Remote Desk Set, the ITA2000A programmed for Scan mode (using patented techniques), adds tone remote scanning and scan start/stop capability to conventional, multi-channel, steering-capable radios. Dispatch points are updated using these techniques through the use of the parallel status update feature found in the GAI-Tronics Model ITR2000A and IPE2500A Desk Sets.

To accommodate radios that vary in their active input logic, the ITA2000A can be set up to provide discrete active output logic functions. Active low or active high outputs can be set for each radio and accessory Channel Selection Output, Monitor, Push-to-Talk, Push-to-Talk Sense, and CSQ Detect.

ITA2000A Accessories

Description	Part No.
GM300/MAXTRAC or Motorola GR1225 Radio Interface Cable	61531-007
Kenwood Radio Interface Cable (KCT-19)	61531-004
Radio Interface Cable (bare leads), 3-foot (included with unit)	97C160-0003
Power Supply, 100-240 V ac/12 V dc ¹	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
Fuse, F2, (Telco line only) Bussmann C515S 1.25A	4612-23015-25
Fuse, F1, (Power) Bussmann Type GMA-1A	4612-23500-01
Dual 19-inch Rack Mount, 1.75-inch high (Can hold two ITA2000A units.)	XAC0005A

¹Power (12 V dc) may be obtained directly from the controlled radio. A local power supply, if required, must be ordered separately.

Specifications

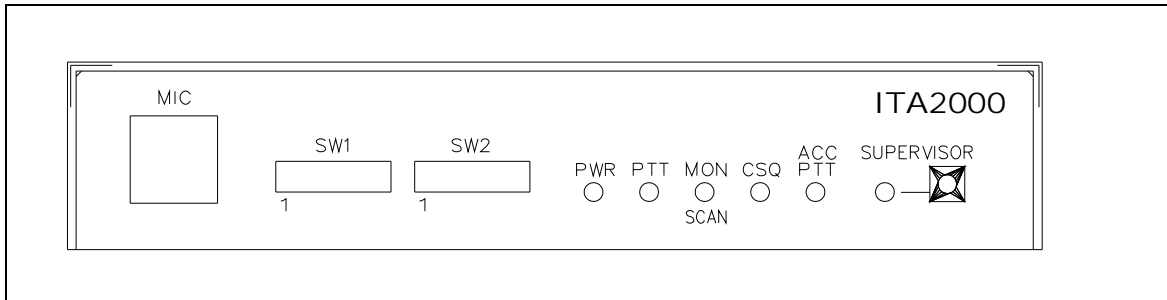
Color	Black
Physical size.....	7.03 W × 6.3 L × 1.5 H inches
Weight.....	4 lbs.
Temperature range	-30° C to 70° C
Humidity	95% at 50° C
Input power (main or aux.)	10.5 to 16 V dc; 100 mA maximum
Frequency response.....	±3 dB, 300 to 3000 Hz (except TX and RX audio notch at 2175 Hz)
Hum and noise	More than -45 dB below rated output
Line audio input	Microprocessor automatically compensates for line losses of up to 24 dB
Audio distortion	Less than 3% THD
RX input.....	32 mV ac to 4.5 V ac into 600 ohms (nominal 300 mV ac)
TX input.....	32 mV ac to 800 mV ac into 600 ohms (nominal 80 mV ac)
Line input.....	-25 dBm to 0 dBm AGC to reference (nominal -10 dBm)
Line output.....	-15 dBm to +10 dBm adjustable into 600 ohms (nominal -10 dBm)
Logic outputs	PTT, CH-STEER; 20 mA, 100 mW dissipated
Maximum number of desk sets supported (practical limit)	10
Microphone connections.....	Desk microphone
Input tone tolerance	±2%
Safety	Class III SELV powered equipment. Powered by optional UL-listed (E104603) and CSA certified (LR67888) ac adapter.
EMI	USA: FCC Part 15, Sub. B-Verification Canada: ICES-003
Line Interface.....	FCC Part 68 Exempt (Category II Tariff #260 service for private/leased line applications) IC: Designed to meet CS03-8. (Cert. Pending) Category: Voice-band metallic private line channel interface.

F1	1950 Hz	F5	1550 Hz	F9	1150 Hz	F13	750 Hz
F2	1850 Hz	F6	1450 Hz	F10	1050 Hz	F14	650 Hz
F3	1750 Hz	F7	1350 Hz	F11	950 Hz	F15	550 Hz
F4	1650 Hz	F8	1250 Hz	F12	850 Hz	Scan Start/Stop¹ or, Monitor/F16²	2050 Hz

¹Scan operation only

²Conventional operation only - Monitor/F16 is switch-selectable. See the programmable switch settings in the "Installation" section of this manual.

Front Panel LED Operation



Front View of the ITA2000A

PWR LED

The PWR LED illuminates to indicate that the ITA2000A power is on and the DSP is operating.

PTT LED

The push-to-talk LED, labeled PTT, illuminates when a valid transmit request has been decoded or the mic PTT is actuated.

MON/SCAN LED

Conventional: The timed or constant monitor LED, labeled MON, illuminates when the ITA2000A is in the monitor mode.

Scan: The SCAN LED blinks at the scan rate when the ITA2000A is scanning, and is lit steadily when in monitor mode.

CSQ LED

The CSQ LED illuminates when a carrier detect input is active.

ACC PTT LED

The ACC PTT LED illuminates when the accessory PTT input is active.

SUPERVISOR LED

The SUPERVISOR LED illuminates when the ITA2000A is placed into supervisor mode.

Supervisor Button

The SUPERVISOR button with the associated LED indicator provide full dispatcher control of the radio system. This button is used to enter the supervisor mode or the test mode. Refer to the Operation section for more information.

Desk Microphone Port

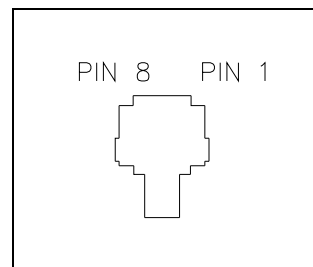
The front panel desk microphone port (MIC), is an 8-pin modular connector that supports an external connection for local dispatch control. (Possible accessories include desk, gooseneck, or boom microphones, or a headset or footswitch via the GAI-Tronics XAAB002A Audio Accessory Box).

Audio from this microphone is routed to the station transmit and receive audio and the telephone line while push-to-talk is applied from the external microphone. The front-panel mic audio does not have a guard tone notch applied. Station receive audio is also provided at the MIC connector. This feature allows a headset or similar device to be used in place of a desk microphone.

An external microphone monitor function places the ITA2000A in the monitor mode while asserting PL/DPL disable at the radio connector. The microphone input type is passive, with an input impedance of less than 2 k Ω and a nominal input level of -20 dBm. The GAI-Tronics XDM004A Desk Microphone is an acceptable example.

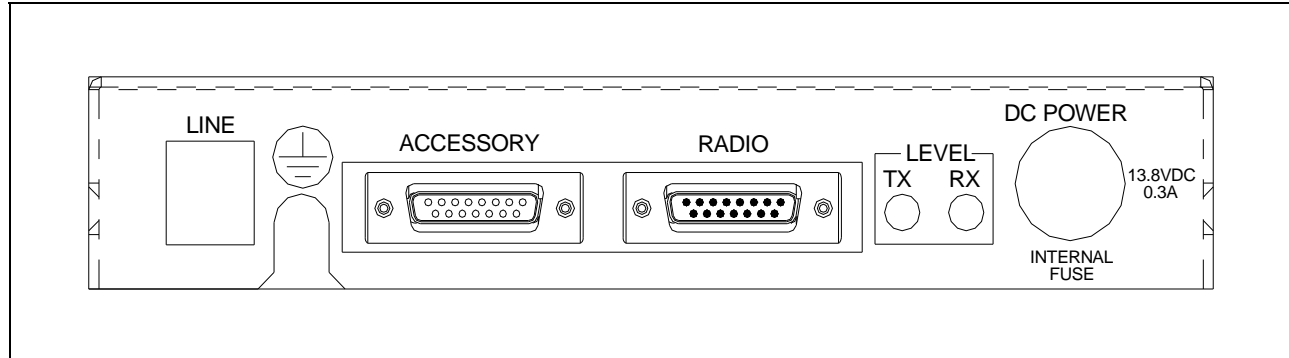
Desk Microphone Port Pinout

Pin No.	Function
1	B+ OUT (through 10 ohms)
2	N/C
3	Monitor IN (closure to ground)
4	AGND
5	Mic IN (with bias voltage)
6	PTT IN (closure to ground)
7	N/C
8	RX audio OUT (handset audio)



Desk Mic Port Pinout

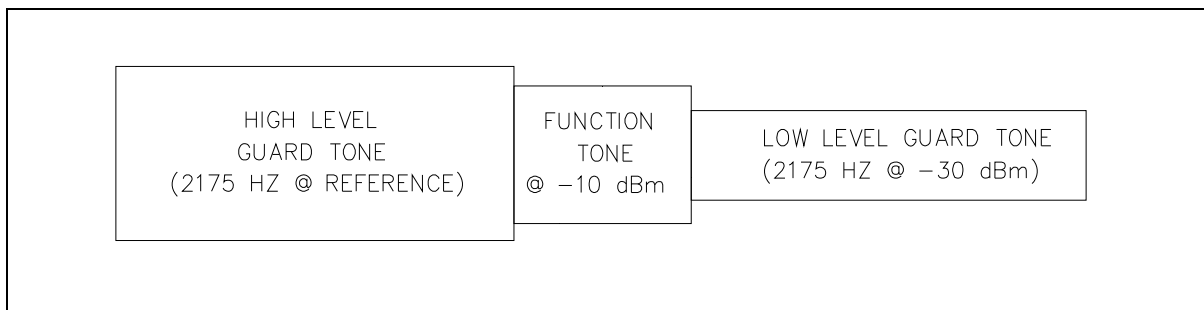
The rear view of the ITA2000A shows the line, accessory, radio, and power connector locations. Also shown are the TX and RX level adjustment pots, and the location of the internal fuse.



Rear View of the ITA2000A

Tone Control Interface

The ITA2000A decodes standard EIA tone keying control tones for controlling the radio system. The control tone convention can be seen below.



Standard EIA Tone Control Sequence

The function tone frequency ranges from 550 Hz to 2050 Hz in 100 Hz increments. 2050 Hz represents monitor in Conventional mode and scan start/stop in Scan mode, 1950 Hz for F1, 1850 Hz for F2 down to 550 Hz for F15.

When scanning and carrier is detected, a similar tone sequence is generated to the phone line where HLGT is generated for 40 ms followed by a 20 ms function tone representative of the current channel. This tone sequence will be decoded by desk sets capable of fast parallel status update, such as the GAI-Tronics ITR2000A and IPE2500A. The use of products that are not capable of decoding this fast tone sequence is not advisable, as the reliability of the operator information may be less than desirable.

Scan Start/Stop in the Scan Mode

Upon power-up, the ITA2000A will automatically start scanning. While in scan mode, the ITA2000A asserts, in sequence, the channel steer pins at the configured scan rate. Upon detection of carrier, the unit stops scan and generates the appropriate tone sequence to the phone line. Upon loss of carrier, the unit resumes scan after the configured scan stop time, or until manually started by that attached desk set, depending on the configuration of the unit. When the unit resumes scan, a monitor function tone burst is generated indicating to the attached desk sets that scan has resumed. If the operator wishes to stop the scan resume before the scan stop time expires, the scan should be stopped using the scan stop feature.

The ITA2000A supports a remote scan start/stop toggle feature via the monitor function tone or 2050 Hz. Pressing the desk set MONITOR button causes a 2050 Hz tone sequence to be generated. When in scan mode, if a valid 2050 Hz tone sequence is decoded, the unit stops scan on the current scan channel and generates a tone burst to the phone line indicating to the attached desk set(s) the channel on which the scan was stopped.

Likewise, when not in scan mode, if a valid 2050 Hz tone sequence is detected, the unit will resume scan. The decoding of this 2050 Hz tone sequence by parallel desk sets indicates that scan has been resumed. While in scan mode, if a channel steer is done by the desk set, the unit will cease scan. If the unit is configured to resume scan after PTT, the unit will do so after the first PTT from the desk set. If the operator wishes to remain on the channel indefinitely, scan must be stopped prior to issuing the channel steer.

Radio Monitor in Scan Mode

The ITA2000A does not use a monitor function tone for assertion of monitor that may be required in some installations, when in scan mode. To place the ITA2000A into monitor mode, the desk set must force a channel steer to the desired channel by generating the appropriate function tone burst. This causes the ITA2000A to stop scan and assert the PL/DPL disable output to the radio placing the radio in monitor mode. When in this mode, the SCAN LED is lit. Subsequent transmissions by the desk set will cause this assertion to be cleared until the desk set, again, generates an appropriate function tone burst.

An example of this operation using an IPE2500A Tone Remote Desk Set is as follows:

1. While scanning, the 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. The operator presses the “3” key on the IPE2500A causing the desk set to generate a tone burst consisting of HLGT followed by a function tone of 1750 Hz. Note that no low-level guard tone is generated. The ITA2000A stops scan, switches to channel 3, asserts the PL/DPL output placing the radio in monitor mode, and lights the SCAN LED.
2. The operator monitors the channel for activity and, upon assuring there is none, presses the TRANSMIT key on the IPE2500A. The desk set generates a tone burst of HLGT followed by a function tone of 1750 Hz, which is followed by LLGT. The ITA2000A asserts the radio PTT, clears the assertion of the PL/DPL output and extinguishes the SCAN LED.
3. The operator releases the TRANSMIT key on the IPE2500A and the ITA2000A releases PTT from the radio. The ITA2000A does not reassert the PL/DPL output to the radio. The operator carries on a conversation with the field unit normally. If the unit is configured to resume scan after PTT, the unit will do so after the scan-stop time has passed upon releasing PTT unless scan was halted prior to the transmission.
4. If the operator wishes to again place the radio in monitor mode on channel 3, he must press the “3” key again. The ITA2000A will decode the tone burst and place the radio into monitor mode as in number 1 above.

Supervisor Mode

The ITA2000A is placed in the supervisor mode by pressing the **SUPERVISOR** button for less than four seconds, or by pressing either the **MONITOR** or **PTT** buttons of an attached desk-mic accessory. This feature can be disabled in Conventional mode. When supervisor mode is entered, the **SUPERVISOR LED** illuminates and the ITA2000A enters home-mode state. This is useful when a dispatcher needs to disable control of the radio from all desk set operators and the accessory input. Pressing the **SUPERVISOR** button again for less than four seconds is the only method used to exit supervisor mode and return the ITA2000A to normal operation.

In the home-mode state, the ITA2000A clears all channel steer lines to the radio and generates continuous guard tone to the phone line. In addition, the ITA2000A ceases scanning if in Scan mode. The generation of guard tone serves two purposes. First, all LOTL-equipped desk sets such as the ITR2000A or IPE2500A connected to the ITA2000A will recognize the base station is now in use and will effectively lock out any operations. Second, when using the Scan mode, the generation of the guard tone will clear the scan (monitor) indicator of these connected desk sets indicating that scan has stopped.

When home-mode is exited, the ITA2000A returns to the previously selected channel, or if in Scan mode, returns to the previous scan state. If scan were active prior to entering the home-mode state, the ITA2000A returns to scan upon exiting home-mode state and generates a tone burst to the phone line to update the connected desk sets appropriately. If scan were not active prior to entering home-mode state, the ITA2000A will not resume scan upon exiting home-mode state.

Accessory Operation

The ITA2000A includes an accessory connector to allow access to the radio from other devices such as an ILD1000A Local Control Desk Set, a PL1877A Telephone Interconnect, or an additional ITA2000. With such devices, control of the radio is limited to monitor and PTT. When an accessory device requires access to the radio, it will assert the appropriate input on the accessory connector. When this assertion is detected, the ITA2000A enters home-mode state. This feature can be disabled when in Conventional mode.

When an accessory asserts the accessory monitor input, the ITA2000A enters home-mode state. When the accessory releases the accessory monitor input, the ITA2000A exits home-mode state. If in Scan mode, the ITA2000A resumes scan after the scan stop time if scan were active prior to the assertion of the accessory monitor input.

When the accessory asserts the accessory PTT input, the ITA2000A enters home-mode state for the duration of the assertion when in Scan mode. When the accessory releases the accessory PTT input, Conventional mode exits home-mode state, and Scan mode immediately returns to the previous scan state.

Test Mode

To enter the test mode, press the SUPERVISOR button for more than four seconds. All LEDs illuminate for two seconds indicating the ITA2000A has entered the test mode.

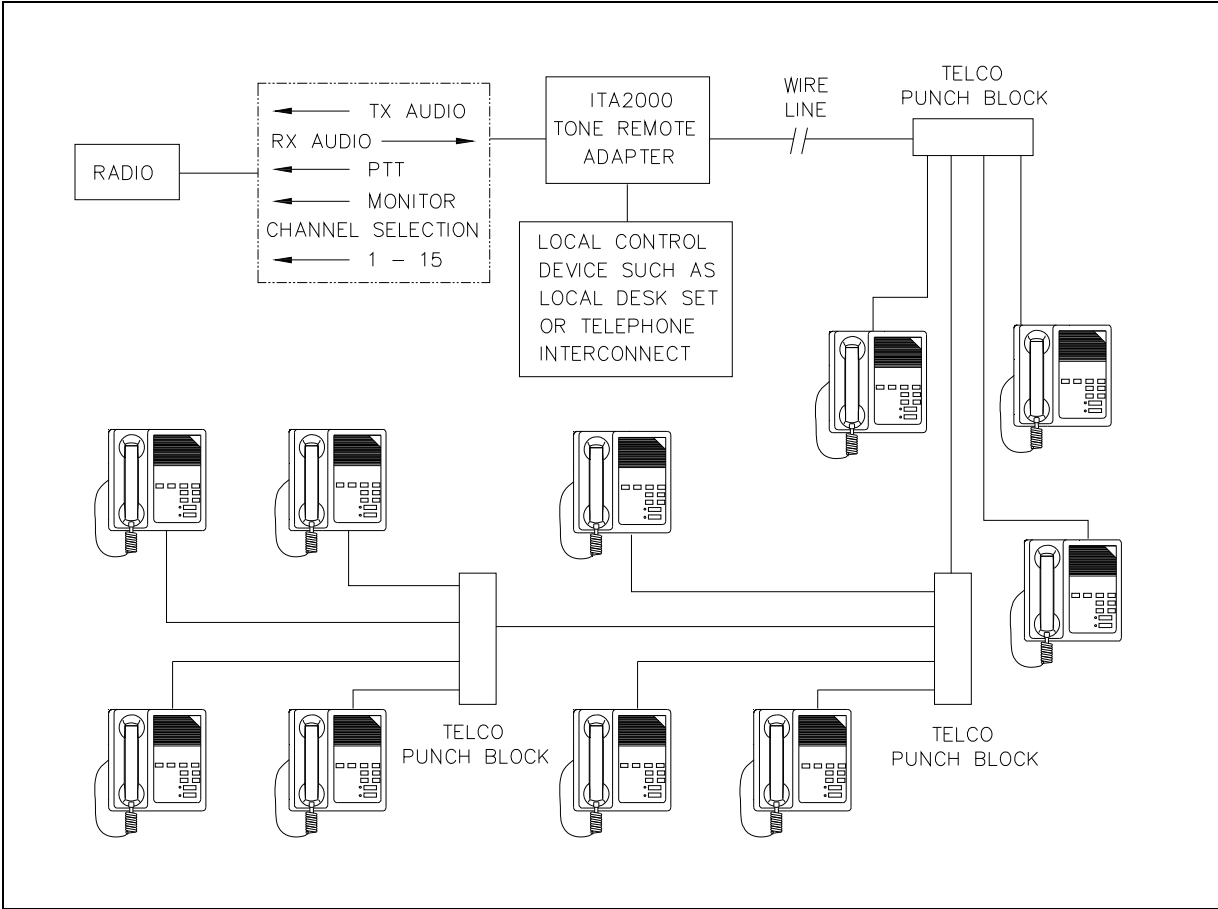
While the ITA2000A is in test mode, pressing the SUPERVISOR button momentarily (less than four seconds) causes the ITA2000A to step up to the next test.



Disconnect the ITA2000A from the radio and disconnect all accessories from the ITA2000A when performing Diagnostic Tests 2, 3, and 4. These diagnostics are used for factory testing only and perform input/output configuration tests that may damage the interface to the radio and/or any accessories connected to the ITA2000A.

Pressing the button again for at least four seconds takes the ITA2000A out of the test mode.

Planning the Installation



Typical ITA2000A Installation

Mounting

The ITA2000A Tone Remote Adapter can be installed in a customer-supplied rack or cabinet, or can be placed on a desk for convenience when used with microphones and other accessories. A 19-inch standard rack panel, 1.75 inches high, is also available. The GAI-Tronics part number is XAC0005A.

Equipment Required

Test Equipment

- RF service monitor, or Communications Service Analyzer such as the Motorola R-2600 with RTL-1003A transformer
- audio ACVM
- multimeter or VOM
- #1 Phillips screwdriver
- 8-pin modular plug with 'pigtail' leads

Documentation

- this installation manual
- associated radio installation/technical manual
- service monitor manual

Cable Installation Safety Considerations

Interconnecting, communications, and Class 2 dc power cables should be separated from electrical light or other Class 1 circuit by at least 2 inches. The exception is where Class 1 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. Optional cabling kits comply with these requirements and are recommended.

Telephone Line Lightning and Over-voltage Protection

The ITA2000A employs over-current phone line fuses F1 and F2. These fuses protect against occasional extreme fault conditions that may get past the primary protectors. An example of a fault condition is a power line cross. If these fuses ever require replacement, replace F1 or F2 only with the same type Bussmann C515S 1.25A fuse.

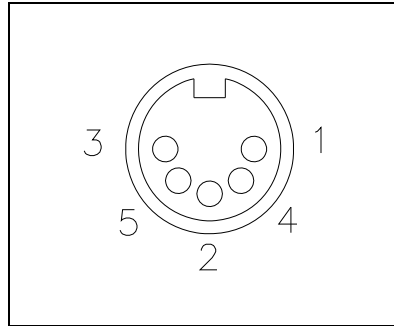
For maximum surge and lightning protection, building primary (over-voltage) protectors must be installed at the point where the phone lines enter the radio equipment building. Primary protectors are usually required by local codes and should be provided by your leased line provider.

Power Connections

The ITA2000A is supplied with a dc power cable. Plug the cable's DIN connector into the dc power receptacle on the rear of the unit. Connect the red lead to the positive terminal and the black lead to the negative terminal of the station's dc power supply. This supply must be capable of supplying the 0.3 A current required by the ITA2000A.

The ITA2000A operates properly on input voltages from 10.5 to 16 V dc. The optional 40419-008 UL-listed/CSA-certified Class 2 ac wall transformer should be used if a suitable dc source such as the station's dc supply is not available. The power connection pinout is as follows:

Pins	Function
Pin 1	-IN
Pin 2	N/C
Pin 3	+IN
Pin 4	-IN
Pin 5	+IN



 **CAUTION** 

For safe operation, use only a listed or certified Class 2 ac adapter.

Conventional to Scanning Operation Conversion

NOTE: The ITA2000A includes an LED labeled MON (top) and SCAN (bottom). It is the third LED from the left when looking at the unit from the front. In Conventional mode, the LED indicates monitor operation. In Scan mode, the LED will flash at the scan rate and illuminates steadily when the adapter locks onto a channel (monitor).

Locate SW1-7 on the unit's front panel, and place it in the down position.

The unit will perform a reboot and begin operation in the Scan mode. When the unit is powered up or when exiting diagnostics, the hybrid balance tone will be heard twice. This will not cause any harm to the system.

NOTE: The scan or scanning features of the radio must not be programmed or selected. The ITA2000A will not function properly if the radio is programmed with scan functions.

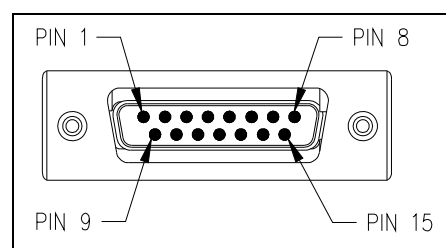
Radio Connector (J2)

The radio connector is located on the rear of the ITA2000A. The connector pinout appears below:

Input/Output Radio Connector Table

Pin	Wire Color	Description	Input/Output	Range
J2-1	Black/white	Channel Steer 3	O	JU4 B position = Lo (0 V dc)* JU4 A position = Hi (B+)
J2-2	Blue/white	CSQ Detect (SW1-1 must be Down) Refer to Switch Table.	I	SW1-2 UP = Lo (0 V dc)* SW1-2 DOWN = Hi (B+)
J2-3	Green	RX Audio + (Selectable) 300 mVRMS nominal/default	I	Range 1: -20 dB Jumper = OUT 32 mVRMS-1.6 VRMS Range 2: -20 dB Jumper = IN 1.5 VRMS-4.5 VRMS
J2-4	Black	AGND		
J2-5	White/black	Channel Steer 2	O	JU5 B position = Lo (0 V dc)* JU5 A position = Hi (B+)
J2-6	White	PTT	O	JU2 B position = Lo (0 V dc)* JU2 A position = Hi (B+)
J2-7	Orange	RX PL Disable	O	Closure between pins 7 and 14
J2-8	Red	Channel Steer 0	O	JU7 B position = Lo (0 V dc)* JU7 A position = Hi (B+)
J2-9	Red/white	Channel Steer 4	O	JU3 B position = Lo (0 V dc)* JU3 A position = Hi (B+)
J2-10	Green/white	CSQ and CTCSS Detect (SW1-1 must be Down.) Refer to Switch Table.	I	SW1-2 UP = Lo (0 V dc)* SW1-2 DOWN = Hi (B+)
J2-11	Green/Black	RX Audio - (AGND)	I	Connected internally to pin 4 at radio end of cable.
J2-12	Blue	TX Audio	O	32 mVRMS-800 mVRMS 560 ohms
J2-13	Blue/black	PTT Sense	I	SW1-3 UP = Lo (0 V dc)* SW1-3 DOWN = Hi (B+)
J2-14	Orange/black	RX PL Disable	O	Closure between pins 7 and 14
J2-15	Red/black	Channel Steer 1	O	JU6 B position = Lo (0 V dc)* JU6 A position = Hi (B+)

*default from the factory



Radio Connector Pinout

Transmit Audio – Pin 12

Connect this single-ended output to a microphone input circuit or exciter input of the transmit section. The radio should be capable of a level from 32 mV_{RMS} to 800 mV_{RMS}.

Receive Audio – Pin 3 RX High (+), Pin 11 RX Low (-)

Connect to a speaker or detector audio source from a radio receiver capable of supplying a level in the range of 250 mV_{RMS} to 4.5 V_{RMS}. Ensure that SW2-1 is set properly.

NOTE: It is best to connect to a point not controlled by a volume potentiometer to avoid the receive audio being affected by someone adjusting the volume control.

If connecting to a volume potentiometer, connect to the high side so the level can not be changed. Connect pin 11 to audio ground (AGND) if a receive return is not provided. Pin 11 should be shorted with Pin 4 on the radio connector.

Push-to-Talk (PTT) Output – Pin 6

This output must be connected to a point in the radio that causes it to transmit when active. When this input on the radio is active, ensure that the microphone input circuit where the transmit audio of the desk set (pin 12) is connected will be active also.

Monitor – Pin 7, Pin 14

These pins provide a closure output for receive PL/DPL disable (monitor), and is activated when the ITA2000A decodes a function tone of 2050 Hz from a tone remote desk set when in Conventional mode. These pins are activated by a channel steer sequence until a PTT or scanning is resumed in Scan mode.

Connect to the radio receive PL/DPL disable input so the radio will go into carrier squelch mode. Since this connection is a closure, one side of the closure can be connected to B+ or ground, depending on the desired activation function logic. If receive PL/DPL disable is not supported by the radio, or is not desired, disregard this connection.

Carrier Detect Input – Pin 2

The ITA2000A can be set up to accept an active low or high logic level for routing radio audio to accessory and remotes when carrier is detected. Connect pin 2 to a radio output that goes active when a valid receive carrier is present.

Carrier and PL/DPL Detect – Pin 10

Connect pin 10 to an output in the radio that goes active when a valid receive carrier and PL/DPL is present. This indicates channel activity when the radio has been placed in monitor mode.

Push-to-Talk (PTT) Sense Input – Pin 13

Connect pin 13 to a point in the radio that goes active (set by SW1-3) when the radio is keyed from a source other than the ITA2000A. When the ITA2000A senses the radio is keyed, it holds off any remote or accessory transmit until the PTT sense clears.

NOTE: If this function is not available, disregard this connection.

Channel Select – Pins 1, 5, 8, 9, and 15

Connect pins 1, 5, 8, 9, and 15 to the points in the radio that will cause it to change channels when the active logic is present. The active level of these outputs can be set to active low or high as determined by jumpers JU3 through JU7.

These pins output the binary equivalent of the decoded function tone from the tone remote or the current scan selected channel. The chart that follows shows the pin designation and output for the decoded function tone. These outputs can be used to control other logic-driven functions of radios that support such features.

Channel Select Pin Designation/Output Chart

F#	Frequency	Pin 9	Pin 1	Pin 5	Pin 15	Pin 8
		MSB	Bit 3	Bit 2	Bit 1	LSB
F1	1950 Hz	High	High	High	High	Low
F2	1850 Hz	High	High	High	Low	High
F3	1750 Hz	High	High	High	Low	Low
F4	1650 Hz	High	High	Low	High	High
F5	1550 Hz	High	High	Low	High	Low
F6	1450 Hz	High	High	Low	Low	High
F7	1350 Hz	High	High	Low	Low	Low
F8	1250 Hz	High	Low	High	High	High
F9	1150 Hz	High	Low	High	High	Low
F10	1050 Hz	High	Low	High	Low	High
F11	950 Hz	High	Low	High	Low	Low
F12	850 Hz	High	Low	Low	High	High
F13	750 Hz	High	Low	Low	High	Low
F14	650 Hz	High	Low	Low	Low	High
F15	550 Hz	High	Low	Low	Low	Low
F16*	2050 Hz	Low	High	High	High	High

*F16 is switch selectable between a monitor and channel steer function (Conventional) or scan on/off function (Scan).

NOTE: The logic is inverted if the ITA2000A channel selection outputs are set for active high.

If programmable or N/C pins are not used, clip off or secure in a fashion to prevent leads from shorting together, thus preventing damage to the adapter or the radio.

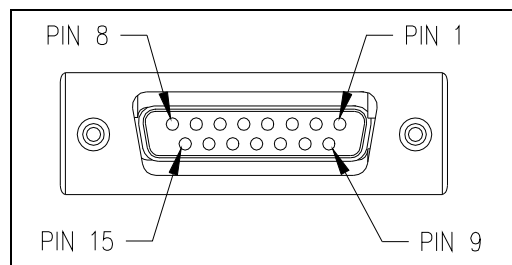
Accessory Connector (J3)

The accessory connector is located on the rear of the ITA2000A Tone Remote Adapter.

Input/Output Accessory Connector Table

Pin	Wire Color	Description	Input/ Output	Range
J3-1	Black/white	Channel Steer 3	O	JU11 B position = Lo (0 V dc)* JU11 A position = Hi (B+)
J3-2	Blue/ white	Carrier Squelch Detect OUT	O	JU8 B position = Lo (0 V dc)* JU8 A position = Hi (B+)
J3-3	Green	RX Audio +300 mVRMS	O	
J3-4	Black	AGND		
J3-5	White/black	Channel Steer 2	O	JU12 B position = Lo (0 V dc)* JU12 A position = Hi (B+)
J3-6	White	PTT	I	Lo (0 V dc)
J3-7	Orange	RX PL Disable	O	Closure between pins 7 and 14
J3-8	Red	Channel Steer 0	O	JU14 B position = Lo (0 V dc)* JU14 A position = Hi (B+)
J3-9	Red/white	Channel Steer 4	O	JU10 B position = Lo (0 V dc)* JU10 A position = Hi (B+)
J3-10	Green/white	CSQ and CTCSS Detect	I	SW1-2 UP = Lo (0 V dc)* SW1-2 DOWN = Hi (B+)
J3-11	Green/black	RX Audio	O	Connected internally to pin 4 at radio end of cable.
J3-12	Blue	TX Audio 80 mV ac	I	
J3-13	Blue/black	PTT OUT	O	JU9 B position = Lo (0 V dc)* JU9 A position = Hi (B+)
J3-14	Orange/black	RX PL Disable	I	Closure between pins 7 and 14
J3-15	Red/black	Channel Steer 1	O	JU13 B position = Lo (0 V dc)* JU13 A position = Hi (B+)

*default from the factory



Accessory Connector Pinout

ITA2000A to Kenwood TK-790/890 Series Radio Connection Chart

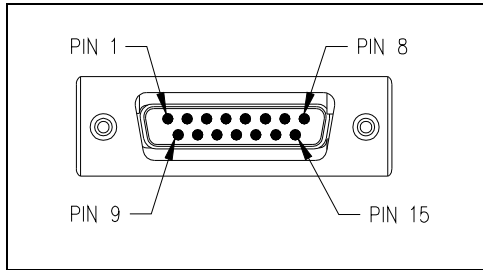
Adapter Pin	Adapter Function	Wire Color	Radio Connector Pin	Radio Function
1	Channel steer 3	Blk w/white stripe	5	Auxiliary input 4 (programmable)
2	CSQ Detect IN	Blue w/white stripe	8, 20 , 21, 22	Auxiliary output 2 (program to COR)
3	RX audio +	Green	17	RX audio signal output
4	AGND	Black	7	Earth
5	Channel steer 2	White w/blk stripe	4	Auxiliary input 3 (programmable)
6	PTT	White	6	Auxiliary input 5 (program to PTT)
7	Monitor	Orange	5	Auxiliary input 4 (program to MON)
8	Channel steer 0	Red	2	Auxiliary input 1 (programmable)
9	Channel steer 4	Red w/white stripe	5	Auxiliary input 4 (programmable)
10	CTCSS IN	Grn w/white stripe	N/C	
11	RX audio –	Grn w/black stripe	7	Earth. Connected internally to 15D pin 4 at radio end of cable.
12	TX audio +	Blue	13	MIC/Data input signal 1
13				
14	Monitor low	Orange w/blk stripe	7	Earth. Connected internally to 15D pin 4 at radio end of cable.
15	Channel steer 1	Red w/black stripe	3	Auxiliary input 2 (programmable)
Connector Housing	Shield	Connected internally to 15D pin 4 at radio end of cable.		

NOTES:

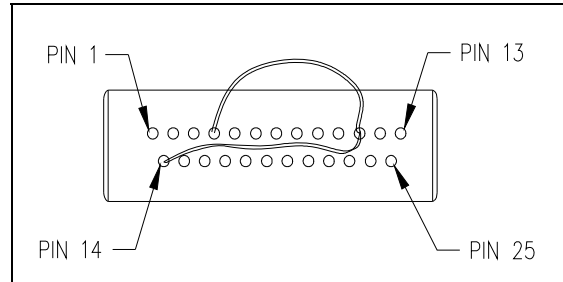
- The Carrier Detect Signal (COR) must be programmed to an auxiliary output pin. The Radio Connection Chart shows COR programmed to auxiliary output 2, which is pin 8 of the radio connector. Carrier Detect is Active High (SW1-2 = DN).
- The PTT signal must be programmed to an auxiliary input 5, as per the Radio Connection Chart.
- If the monitor function is required, the MON signal must be programmed to auxiliary input 4, as per the Radio Connection Chart. Programming the MON signal alters the maximum number of channels that can be scanned. Normally, a maximum of 15 channels can be scanned, however, use of the MON function limits the maximum to 8 channels. Pin 7 of the adapter must be connected to the RX CTCSS Disable Input (MON) pin of the radio. Pin 14 of the adapter must be connected to GRND.

⚠ WARNING ⚠

If programmable or N/C pins are not used, clip off or secure in a fashion to prevent leads from shorting together, thus preventing damage to the adapter or the radio.



Adapter Radio Connector



Connector Termination with Internal Jumpers
Connecting Pins 4 - 11- 14.

ITA2000A to RPG Radio Connection Chart

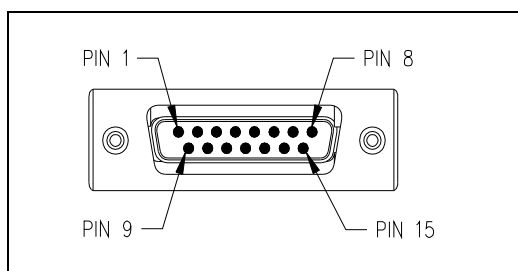
Adapter Pin	Adapter Function	Wire Color	Radio Connector Pin	Radio Function
1	Channel steer 3	Black w/white stripe	6, 8, 9, 12, or 14	Programmable
2	CSQ Detect IN	Blue w/white stripe	4, 8, 12, or 14	Programmable
3	RX audio +	Green	11	RX audio
4	AGND	Black	7	GND
5	Channel steer 2	White w/black stripe	6, 8, 9, 12, or 14	Programmable
6	PTT	White	3	Mic PTT
7	Monitor	Orange	14, or 6, 8, 9, 12	PL disable (monitor)
8	Channel steer 0	Red	6, 8, 9, 12, or 14	Programmable
9	Channel steer 4	Red w/white stripe	6, 8, 9, 12, or 14	Programmable
10	CTCSS IN	Green w/white stripe	4, 8, 12, or 14	Programmable
11	RX audio –	Connected internally to 15D pin 4 at radio end of cable.		
12	TX audio +	Blue	2	Mic audio
13	PTT Sense IN	Blue w/black stripe	N/C	
14	Monitor low	Connected internally to 15D pin 4 at radio end of cable.		
15	Channel steer 1	Red w/black stripe	6, 8, 9, 12, or 14	Programmable
Connector Housing	Shield	Connected internally to 15D pin 4 at radio end of cable.		

NOTE: The radio must be programmed to disable emergency functions from pin 9.

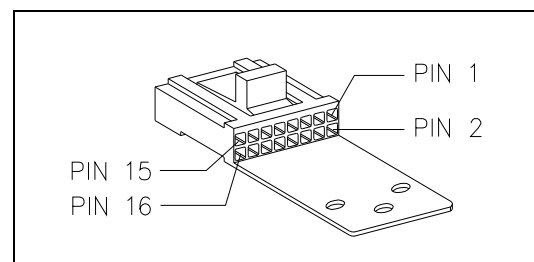
RPG includes: DESKTRAC, GM300, M1225 (four-channel only).



If programmable or N/C pins are not used, clip off or secure in a fashion to prevent leads from shorting together, thus preventing damage to the adapter or the radio.



Adapter Radio Connector



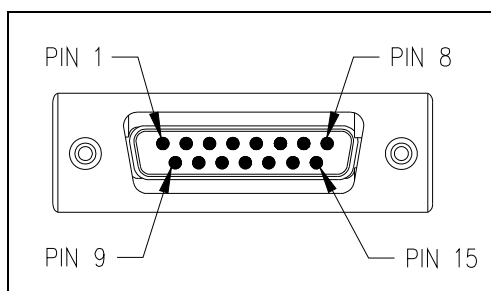
Radio Connector

ITA2000A Tone Remote Adapter to MCS2000 Radio Connection Chart (Conventional Mode Only)

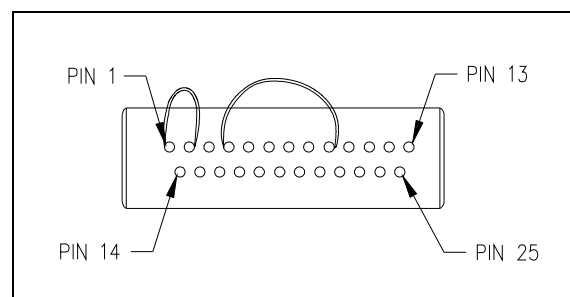
15-Pin Pin #	Adapter Function	Wire Color	Radio Connector Pin #	Radio Function
1	Channel Steer 3	Black w/white stripe	N/C	Programmable
2	CSQ Detect IN	Blue w/white stripe	8	Programmable
3	RX audio +	Green	11	RX audio
4	AGND	Black	10	GND
5	Channel Steer 2	White w/black stripe	N/C	Programmable
6	PTT	White	21	Mic PTT
7	Monitor	Orange	7	CTCSS disable (monitor)
8	Channel Steer 0	Red	N/C	Programmable
9	Channel Steer 4	Red w/white stripe	N/C	Programmable
10	CTCSS IN	Green w/white stripe	8	Programmable
11	RX audio –	Connected internally to 15D pin 4 at radio end of cable.		
12	TX audio +	Blue	23	Mic audio
13				
14	Monitor low	Connected internally to 15D pin 4 at radio end of cable.		
15	Channel Steer 1	Red w/black stripe	N/C	Programmable
Connector Housing	Shield	Connected internally to 15D pin 4 at radio end of cable.		

⚠ WARNING ⚠

If programmable or N/C pins are not used, clip off or secure in a fashion to prevent leads from shorting together, thus preventing damage to the adapter or the radio.



Adapter Radio Connector



HLN6412 Connector Termination with Internal Jumpers Connecting Pins 1-2 and Pins 4-9.

Radio Tie Line (Telephone) Connections

If leased lines from your local telephone company are used between the remotes and the ITA2000A Tone Remote Adapter, the telephone company (local exchange carrier) may request a Facility Interface Code (FIC). Refer to the Analog Facility Interface Code Table that follows for information about codes that may be available.

Analog Facility Interface Codes

FIC	Description
02NO2	2-wire private line; no signaling conversion by LEC. (IN-Band)
02NO4	4-wire private line; no signaling conversion by LEC. (IN-Band)
Metallic	2- or 4-wire metallic private line. (Hoot and Holler circuits)

Within a manufacturing plant, campus, or large building, customer lines referred to as metallic pairs may be used. To make appropriate phone line connections, refer to the Telephone Line Connection Table below.

Telephone Line Connection Table

J1 Connector Pins	Description	Color and Direction
3 and 4	2-wire TX/RX pair	Red/green; bi-directional required.
3 and 4	4-wire TX audio control	Red/green; may be uni-directional or bi-directional
5 and 2	4-wire RX audio only	Yellow/black; may be uni-directional or bi-directional.

Jumpers

The default setting of the circuit board jumpers provide normal operation and should be changed only for special applications. Remove the cover of the ITA2000A to access these jumpers. The “A” and “B” positions are indicated on the PCBA.

Jumper Table

A = Active High B = Active Low

Jumper No.	Default Value	Description
JU2	B	Radio PTT
JU3	B	Channel Steer Output 4
JU4	B	Channel Steer Output 3
JU5	B	Channel Steer Output 2
JU6	B	Channel Steer Output 1
JU7	B	Channel Steer Output 0
JU8	B	Accessory CSQ Output
JU9	B	Accessory PTT Output
JU10	B	Channel Steer Output 4
JU11	B	Channel Steer Output 3
JU12	B	Channel Steer Output 2
JU13	B	Channel Steer Output 1
JU14	B	Channel Steer Output 0
-20 dB	Out	Reduces radio RX by -20 dB
JU20	2W	Select 2-wire/4-wire audio
JU21	2W	Select 2-wire/4-wire audio
JU22	In	Enables audio hybrid for 2-wire configuration
JU24	2W	Select 2-wire/4-wire enable
JU30	Out	Converts the B+ supply to a 15 V power supply to increase audio output.
JU31	Pins 1 and 2 Pins 2 and 3*	Selects Channel Steer 4 Output. Selects J3-9 as alternate dc input.

*If pins 2 and 3 are selected, Channel Steer Bit 4 will be disabled.

Channel Revert (Conventional Mode Only)

Channel Revert allows the ITA2000A to output a certain value on the four channel selection lines after a transmit is complete from the remote. The value output on the channel selection lines is determined by switches SW2-5 through SW2-8.

Channel Revert Settings Table

Switch	Determines:	Up/Down									
SW2-4	Whether channel selections are latched to last decoded frequency, or revert to a preprogrammed channel (SW2-5 to SW2-8) after transmit from land line.	Up = Do not revert Down = Revert based on SW2-5 to SW2-8.									
SW2-5 to SW2-8	The binary representation of the revert channel. NOTE: Revert channel must correspond to a BCD* code 1 - 15. Revert to F16 is <u>not</u> possible. *Binary coded decimal		SW2					SW2			
		Ch	5	6	7	8	Ch	5	6	7	8
		Home	↑	↑	↑	↑	8	↓	↑	↑	↑
		1	↑	↑	↑	↓	9	↓	↑	↑	↓
		2	↑	↑	↓	↑	10	↓	↑	↓	↑
		3	↑	↑	↓	↓	11	↓	↑	↓	↓
		4	↑	↓	↑	↑	12	↓	↓	↑	↑
		5	↑	↓	↑	↓	13	↓	↓	↑	↓
		6	↑	↓	↓	↑	14	↓	↓	↓	↑
7	↑	↓	↓	↓	15	↓	↓	↓	↓		

Configuration Switch Settings for Conventional Mode Operation

Two sets of programming switches are included on the front panel of the ITA2000A. They are used to set up and interface with the radio system. The switch function settings are as follows:

Switch Settings for SW1 (Conventional)

Switch	Determines:	Up	Down
SW1-1*	The method of carrier detection from radio.	Uses radio receive audio (RX VOX detect). SW1-2 is ignored.	Uses logic output from radio.
SW1-2	The active logic levels for carrier detect if SW1-1 is down.	Active Low	Active High
SW1-3	The active input level of radio PTT sense on radio connector pin 13.	Active Low	Active High
SW1-4	Whether courtesy beep generation is enabled or disabled.	Disabled	Enabled
SW1-5	F16 Enable	2050 Hz is used for monitor	2050 Hz is used for F16
SW1-6	The polarity of monitor input from desk mic.	Active Low	Active High
SW1-7	Operate in Conventional or Scan mode	Operate in Conventional mode	Operate in Scan mode
SW1-8**	Enter Supervisor Mode upon pressing desk-mic PTT or Monitor buttons.	Disabled	Enabled

*When configured for receive vox detect, the radio receive audio is continuously routed to the phone line regardless of the vox status using firmware TNA1B and later. The CSQ LED and courtesy tone, if enabled, are still controlled by the vox status.

**Available in firmware TNA2C and later.

Switch Settings for SW2 (Conventional)

Switch	Determines:	Up	Down
SW2-1	The receive audio input for radio connector pin 3.	Speaker level audio (unsquelched de-emphasized audio)	Detector audio (squelched, requires de-emphasis)
SW2-2	Whether tone panel will PTT on HLG T detect and pass the high and low level function tones to transmit audio.	PTT after valid function tone detect and filter tones to transmit audio.	PTT on HLG T detect, pass tones to transmit audio.
SW2-3	The timing of monitor output after a valid monitor command is detected.	Monitor output latched until a valid transmit command is detected from the wire line.	Monitor output is active 4 seconds after a valid monitor command is detected.
SW2-4	Whether channel selections are latched to last decoded frequency, or revert to a preprogrammed channel (SW2-5 to SW2-8) after transmit from wire line.	Stay on last decoded frequency from wire line.	Revert to the channel determined by SW2-5 to SW2-8.
SW2-5 to SW2-8	<p>The binary representation of revert channel. SW2-5 is MSB and SW2-8 is LSB.</p> <p>Example: To revert to channel 3 after transmit, set the switch as follows:</p> <p>SW2-5 = Up, SW2-6 = Up, SW2-7 = Down, SW2-8 = Down.</p> <p>See Channel Revert Chart on page 27</p> <p>NOTE: Revert to F16 is <u>not</u> possible.</p>	High	Low

Configuration Switch Settings for Scan Mode Operation

Two sets of configuration switches are included on the front panel of the ITA2000A. The switch function settings are as follows:

Switch Settings for SW1 (Scan)

Switch	Determines:	Up	Down
SW1-1	The receive audio input for radio connector pin 3.	Speaker level audio (unsquelched de-emphasized audio)	Detector audio (squelched, requires de-emphasis)
SW1-2	The active input level for carrier detect.	Active Low	Active High
SW1-3	The active input level of radio PTT sense on radio connector pin 13.	Active Low	Active High
SW1-4	Whether courtesy beep generation is enabled or disabled.	Disabled	Enabled
SW1-5	How scan resumes after a desk set PTT.	The unit will cease scan and not resume after a desk set PTT	The unit will resume scan after the scan-stop time upon release of the desk set PTT
SW1-6	The polarity of monitor input from desk mic.	Active Low/ Normally Open	Active High/ Normally Closed
SW1-7	Operate in Conventional or Scan mode	Operates in Conventional mode	Operates in Scan mode
SW1-8	How scanning resumes after loss of carrier detect	The unit will cease scan and not resume after a loss of carrier detect	The unit will resume scan after the scan-stop time upon loss of carrier detect

Switch Settings for SW2 (Scan)

Switch	Determines:	Up/Down Settings																																																			
SW2-1 to SW2-4	<p>Scan Limit: Maximum number of channels to be scanned.</p> <p>Sequence of scanning starts at channel 1 and counts upward to the maximum number of channels to be scanned. Once the maximum channel has been reached the scanning sequence repeats beginning with channel 1.</p> <p>NOTE: The wrap-around time for scanning the same channel is a function of the scan limit and the scan rate. For example, if the scan limit is 10 and the scan rate is 100 ms, the minimum wrap-around time for any one channel is 10×100 ms, or 1 second.</p>		<table border="1"> <thead> <tr> <th></th> <th colspan="4">SW2</th> </tr> <tr> <th>Scan</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Home</td> <td>↑</td> <td>↑</td> <td>↑</td> <td>↑</td> </tr> <tr> <td>1</td> <td>↑</td> <td>↑</td> <td>↑</td> <td>↓</td> </tr> <tr> <td>2</td> <td>↑</td> <td>↑</td> <td>↓</td> <td>↑</td> </tr> <tr> <td>3</td> <td>↑</td> <td>↑</td> <td>↓</td> <td>↓</td> </tr> <tr> <td>4</td> <td>↑</td> <td>↓</td> <td>↑</td> <td>↑</td> </tr> <tr> <td>5</td> <td>↑</td> <td>↓</td> <td>↑</td> <td>↓</td> </tr> <tr> <td>6</td> <td>↑</td> <td>↓</td> <td>↓</td> <td>↑</td> </tr> <tr> <td>7</td> <td>↑</td> <td>↓</td> <td>↓</td> <td>↓</td> </tr> </tbody> </table>		SW2				Scan	1	2	3	4	Home	↑	↑	↑	↑	1	↑	↑	↑	↓	2	↑	↑	↓	↑	3	↑	↑	↓	↓	4	↑	↓	↑	↑	5	↑	↓	↑	↓	6	↑	↓	↓	↑	7	↑	↓	↓	↓
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SW2-5 to SW2-7	<p>Scan Rate (ms): Time allotted for carrier detect per channel frequency.</p> <p>Depending upon the radio and the programming of the radio used, the time required for detection of valid carrier can vary. Factors such as the design of the radio, use of PL/DPL and quieting can affect carrier detection time. Consult your radio manual and manufacturer for specific carrier-detect times.</p> <p>NOTE: The scan rate should be set for the maximum time any one channel requires for reliable carrier detection.</p>		<table border="1"> <thead> <tr> <th></th> <th colspan="3">SW2</th> </tr> <tr> <th>Rate (ms)</th> <th>5</th> <th>6</th> <th>7</th> </tr> </thead> <tbody> <tr> <td>100</td> <td>↑</td> <td>↑</td> <td>↑</td> </tr> <tr> <td>120</td> <td>↑</td> <td>↑</td> <td>↓</td> </tr> <tr> <td>160</td> <td>↑</td> <td>↓</td> <td>↑</td> </tr> <tr> <td>200</td> <td>↑</td> <td>↓</td> <td>↓</td> </tr> </tbody> </table>		SW2			Rate (ms)	5	6	7	100	↑	↑	↑	120	↑	↑	↓	160	↑	↓	↑	200	↑	↓	↓																										
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SW2-8	<p>Scan Stop Time: Time scan halts after a desk set PTT (SW1-5) or carrier is no longer detected (SW1-8).</p>	<p>UP = 4 seconds</p> <p>DN = 2 seconds</p>																																																			

NOTE: Scan Rate Setting - Due to the differences in radios, the scan rate should be selected from the slowest level (500 ms) first. The scan rate can be affected by the PL/DPL decode time within certain radio transceivers.

Level Settings and Adjustments

Receive Audio Level

The ITA2000A is shipped from the factory set to accept a 300 mV receive audio input level from the station's receiver. To accommodate receivers with different audio levels, perform the following steps:

1. After verifying the connections are properly made to the station in accordance with the installation instructions, apply power to the station and the ITA2000A.
2. Inject a fully quieted (approximately 1000 microvolt) RF signal set to the station receiver's antenna connector. Modulate the RF generator with a 1000 Hz tone at rated system deviation.
3. If applicable, enable the proper PL or DPL code on the RF generator at 15% system deviation (approximately 750 Hz of deviation).
4. Adjust the RX level pot for -6 dBm (388 mV) at U18 pin 7, or mic jack J4 pin 8.
5. Remove the 1000 Hz tone or use diagnostic Test 1.

Line Output Level

The phone line level has been factory-set to 0 dBm at reference input level. This setting should be adequate for most installations. Use the following procedure if readjustment is ever required:

NOTE: For this adjustment, it is necessary to open the housing to gain access to the line out potentiometer located on the PCBA. It is important that the receive audio level (RX) is set properly prior to setting the line output level.

1. Perform steps 1 through 3 in the Receive Audio Level section above.
2. While monitoring the line level with an ac voltmeter (with phone line connected), adjust the line out potentiometer, pot 3, for the required level.

NOTE: It is important not to exceed the level recommended by the line provider.

Transmit Audio Level

Begin by causing the station to transmit by sending a 1000 Hz tone at reference level from a remote dispatch console or desk set.

A communications service analyzer with a built-in tone remote testing function, such as the Motorola R2600, may be used to emulate the remote at the adapter site. Refer to the analyzer's instruction manual for specifics of this method. This method uses the RTL-1003A Transformer.

Alternately, have a person located at the remote dispatch point perform a test transmission by speaking at a normal voice level into the microphone of a desk set while the remote is in the transmit mode.

When working alone, another option is to carry a spare tone remote desk set to the base site. Connect it to the adapter's phone line connector, and use it to perform this test. The remote's transmit level must be within the automatic gain control range of the adapter, which is -24 dBm to 0 dBm.

Monitor the station with the modulation monitor set to the station's operating frequency. Adjust the TX potentiometer on the rear of the ITA2000A to just produce rated system deviation. Excessive input levels will cause distortion and increased background noise. A setting that is too low will result in low volume levels at the mobile receivers.

A final operational check using live speech from a remote dispatch location should be made to confirm any of the previously described methods used to set the transmit audio level.

Test Diagnostics

Enter this mode by pressing the SUPERVISOR button for more than 4 seconds. All LEDs illuminate for 2 seconds, indicating the ITA2000A is in the test mode. Pressing the SUPERVISOR button momentarily (less than 4 seconds) causes the ITA2000A to step up to the next test.



Tests 2, 3, and 4 are for factory testing only. Disconnect the ITA2000A from the radio and disconnect all accessories from the ITA2000A when performing Diagnostic Tests 2, 3, and 4. These diagnostics are intended for factory testing only and perform input/output configuration tests that may damage the interface to the radio and/or any accessories connected to the ITA2000A.

Test 1: Test 1 can be used to set up system audio levels. It routes a 1000 Hz reference tone to the telephone line and the transmit audio of the radio connector.

1. Adjust the transmit audio pot to the desired level of system deviation.
2. To set the ITA2000A receive audio sensitivity level from the radio, inject a 1000 Hz tone into the receive audio input of the radio connector at the level representing the radio receive audio level.
NOTE: If a radio is connected to the radio connector, an RF service monitor can be set up to send a 1000 Hz tone to the radio at 2/3 system deviation.
3. With the tone present, the receive input level pot can be adjusted until the ACC PTT lights indicate that the proper receive audio level threshold has been achieved.

Technical Overview

U1 performs various tasks requested by the firmware which reconditions the signal, such as 2175 Hz guard tone filtering, line auto-leveling, tone generation, tone filtering, tone decoding, and 2-wire audio hybrid control. Radio RX audio and TX audio from the remote line is digitized in codec U20 and U21 to allow U1 to perform digital signal processing. After U1 reconditions the digital signal, the signal is passed to the codec, where it is converted back to analog at the internal reference level of -6 dBm. Hardware gain circuitry is used to adjust the signal for the desired audio output level external to the unit.

The ITA2000A has seven configurable logic inputs; U8 provides the status of these inputs to U1, where U1 processes the data and the end result is output by U11. An internal hardware jumper (JU2-JU14) can configure each output, DL0-DL7, for a logic high or logic low. U11 drives DL0-DL7 low; when the jumper is in the B position this provides an active low output, when the jumper is in the A position the signal drives a transistor applying B+ to the output providing an active Hi output.

The ITA2000A takes the external audio input signals it receives and uses gain stages to produce an internal reference level of -6 dBm. This internal reference level is then used as nominal input/output level for codecs U20 and U21.

Transmit Audio

Audio from the phone line enters the unit at J1-3 and J1-4 and passes through transformer T2 and then buffered by amplifier U24c. The output of U24c is fed into digital pot U22; the DSP U1 adjusts U22 for an output (internal reference) level of -6 dB. The reference level is input at pin 14 of codec U21. The digital output of U21 is fed to U1 DSP. The digital signal is then converted back to analog and output at pin 3 of codec U20 at the internal reference level of -6 dB.

For radio mic TX, the reference level is adjusted with pot 1 and amplifier U16 to accommodate an output range of 32 to 800 mV ac into a 560-ohm load. For TX audio to the accessory, the reference level is adjusted with amplifier U17 for an output of 300 mV ac into a 560-ohm load.

Radio Audio

Radio RX audio enters the unit at J2-3 and J2-11 and is converted to a single-ended signal by op-amp U18. Pot 2 (RX audio sensitivity) is used to adjust the output of U18a for the internal reference level of -6 dBm. This reference level is output to the desk mic connector. For accessory RX audio, the reference level is adjusted with amplifier U17 for an output of 300 mV ac into a 560-ohm load.

For telephone line output, the reference level is passed to U20 where it is converted from analog to digital, the signal is then reconditioned by U1 DSP and converted back to analog by U21 and output at U21-3 at the reference level of -6 dBm. The output of U21-3 is passed to amplifier U23 where pot 3 (line out) adjusts the output to accommodate for a range of -15 dBm to $+10$ dBm into a 600-ohm load at the telephone line output J1-3 and J1-4.

Accessory Transmit

Accessory TX audio input J3-12 expects a nominal input level of 80 mV ac. U18 buffers the signal and U19 routes the signal to the radio TX and the telephone line output based on the state of the accessory PTT J3-6. For radio TX, the audio is routed to amplifier U16, then output to the radio TX. For telephone line output, the audio is routed to amplifier U23, then output to the telephone line connection.

Desk Mic Transmit

Input at J4-5, TX audio from the desk mic jack is controlled with U19 based on the state of J4-6 (desk mic PTT input) and routed to radio TX output, telephone line output, and the accessory RX output.

For radio TX, the audio is routed to amplifier U16, then output to the radio TX. For telephone line output, the audio is routed to amplifier U23, then output to the telephone line connection. For accessory RX output, the audio is routed to amplifier U27, then output to the accessory RX output.

Reset Circuit

An internal watchdog circuit consisting of U3, Q1, C5, and associated components provides reset to the DSP. In normal operation U1 generates an IRQ signal on pin 30 that drives Q1 keeping C5 discharged. If the IRQ signal is not present, C5 will charge and force U3 pin 6 low. U29, low voltage monitor IC resets U1 whenever the 5 V dc supply is out of tolerance and provides approximately 200 ms of reset upon power up.

Troubleshooting the ITA2000A Tone Remote Adapter

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

Problem	Possible Solution
The ITA2000A will not key the radio.	Ensure that the tone remotes are generating a function tone that the ITA2000A uses for keying the radio.
	Ensure that one of the ITA2000A PTT outputs is connected to the radio. (Pin 6 for ground keying or active high.) Refer to the Jumper Table on page 26 of this manual.
	Check the telephone line continuity from the ITA2000A to the remote.
	Check that the telephone line is balanced by making sure neither side of the telephone line is grounded.
Radio is keyed constantly while the ITA2000A is connected.	Ensure that the JU2 jumper is set for the proper active state: JU2 A position = B+ keying JU2 B position = Ground keying
RX audio is low or distorted.	Ensure that the ITA2000A receive sensitivity is set properly. See the Level Settings and Adjustments information starting on page 32 in the “Installation” section of this manual.
	Ensure that the telephone line is balanced by making sure neither side of the telephone line is grounded.
	Ensure that there is no more than 20 dB of loss in the telephone line.
There is squelch noise in RX audio, or no RX audio.	Ensure that the telephone line is balanced by making sure neither side of the telephone line is grounded.
	Ensure that there is no more than 20 dB of loss in the telephone line.
	Ensure that the ITA2000A audio input (pins 3 and 11) is connected to a point in the radio that has receive audio present when a valid carrier and PL/DPL (if needed) is detected.
	Check that the volume pot has not been turned down if the ITA2000A RX audio is connected to the volume pot of the radio's speaker. Connect to the high side of the volume pot.
	Ensure that the proper input polarity of the CSQ detect has been set with SW1-2.
	Ensure that the scan rate is properly set using SW2-5 through SW2-7.
TX audio is distorted.	Verify that the tone adapter transmit audio output level is not set too high for the radio's expected input level. Adjust the TX output level pot for proper setting.

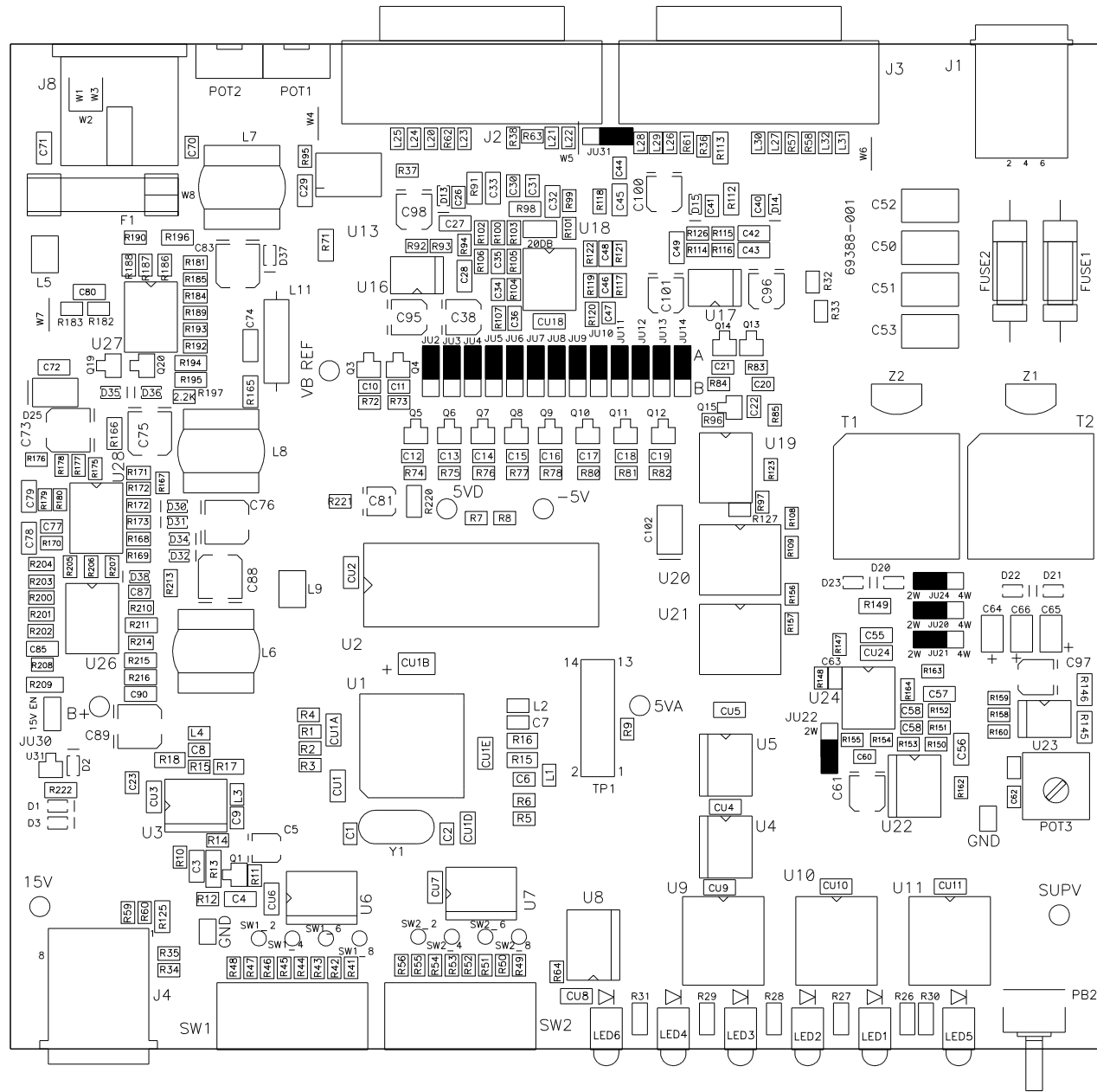
Problem	Possible Solution
There is no TX audio.	Verify that the radio is being keyed when transmitting to the ITA2000A from a tone remote. If the radio is not being keyed, refer to the section above describing the radio not being keyed.
	Ensure that the ITA2000A audio output (J2-12) is connected to a point in the radio that causes the audio to be transmitted when the radio is keyed.
	Verify that the ITA2000A TX output level is properly set and there is no more than 20 dB of loss in the telephone line. If appropriate, adjust the transmit audio output or desk set microphone sensitivity.
ITA2000A does not scan.	Ensure that the proper input polarity of the CSQ detect has been set with SW1-2.
	Ensure that SW2-1 through SW2-4 are set according to the maximum number of channels to be scanned.
	If SW1-8 is configured for resume scan after PTT, ensure that PTT is generated by the remote.
	Ensure that there is no off-hook mic or shorting plug connected to the mic port of the ITA2000A, and that the monitor pin of the accessory connector is not asserted.
ITA2000A does not transmit or receive.	Ensure that there is a telephone line audio path from the ITA2000A to the tone remote desk set.
	Check that neither fuse is open on the telephone line.
	Ensure that the ITA2000A is connected to a dc or ac (with a dc power supply option) power source.
A tone is being output on the phone line during and accessory/desk-mic PTT or Monitor assertion.	<p>In Scan mode, this feature allows for the clearing of status and lock-out of any connected tone remotes.</p> <p>In Conventional mode, this feature allows the lock-out of any connected tone remote. It can be disabled by placing SW1-8 in the down position.</p>

Fuse Replacement

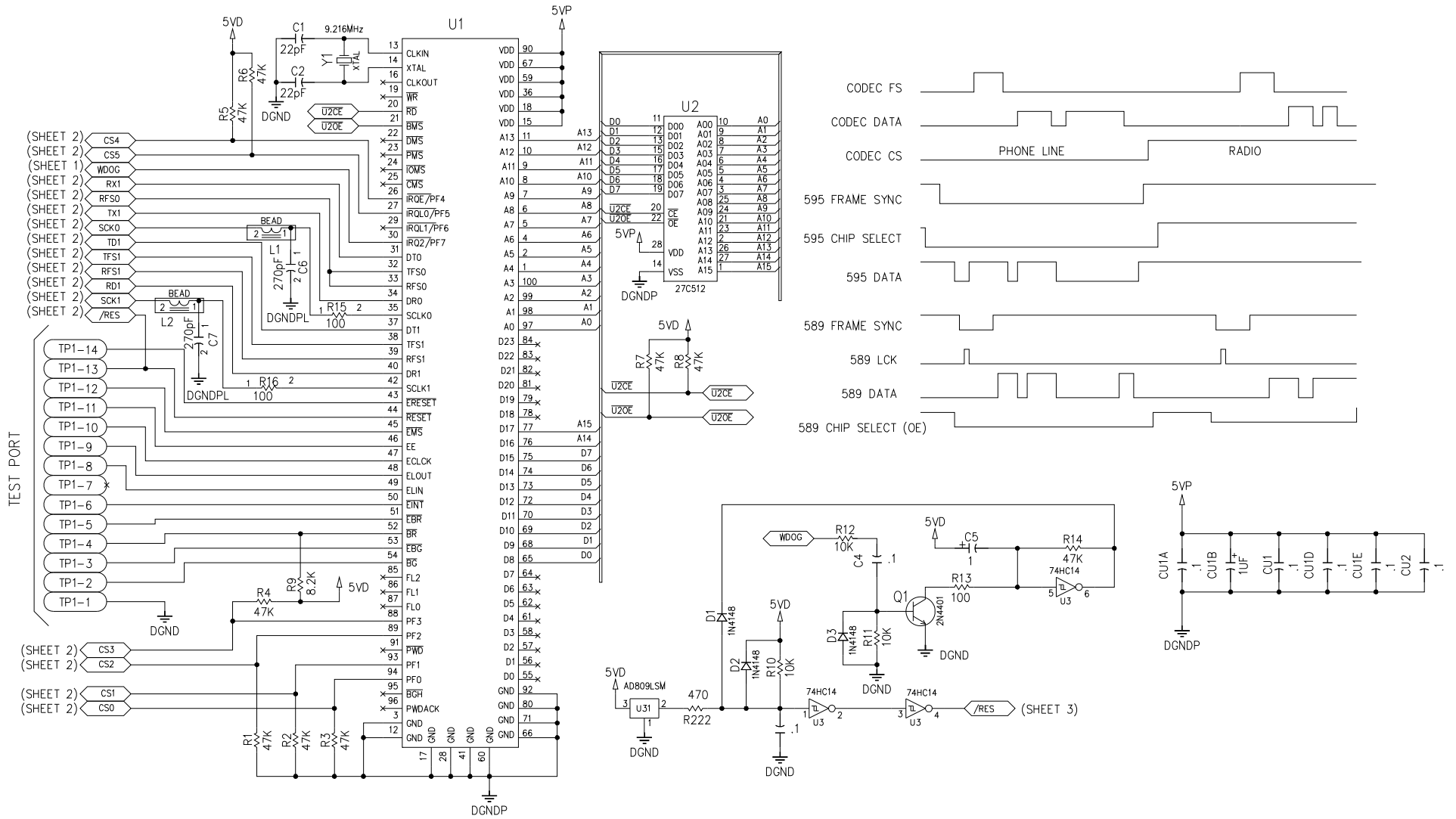


For continued safe operation, replace fuses with the same type.

- **Fuse F1 (power supply) is 1 amp, 250 V, 5 mm × 20 mm.**
- **Line fuses (F1 and F2) are Bussmann C515S 1.25A 2AG SB.**

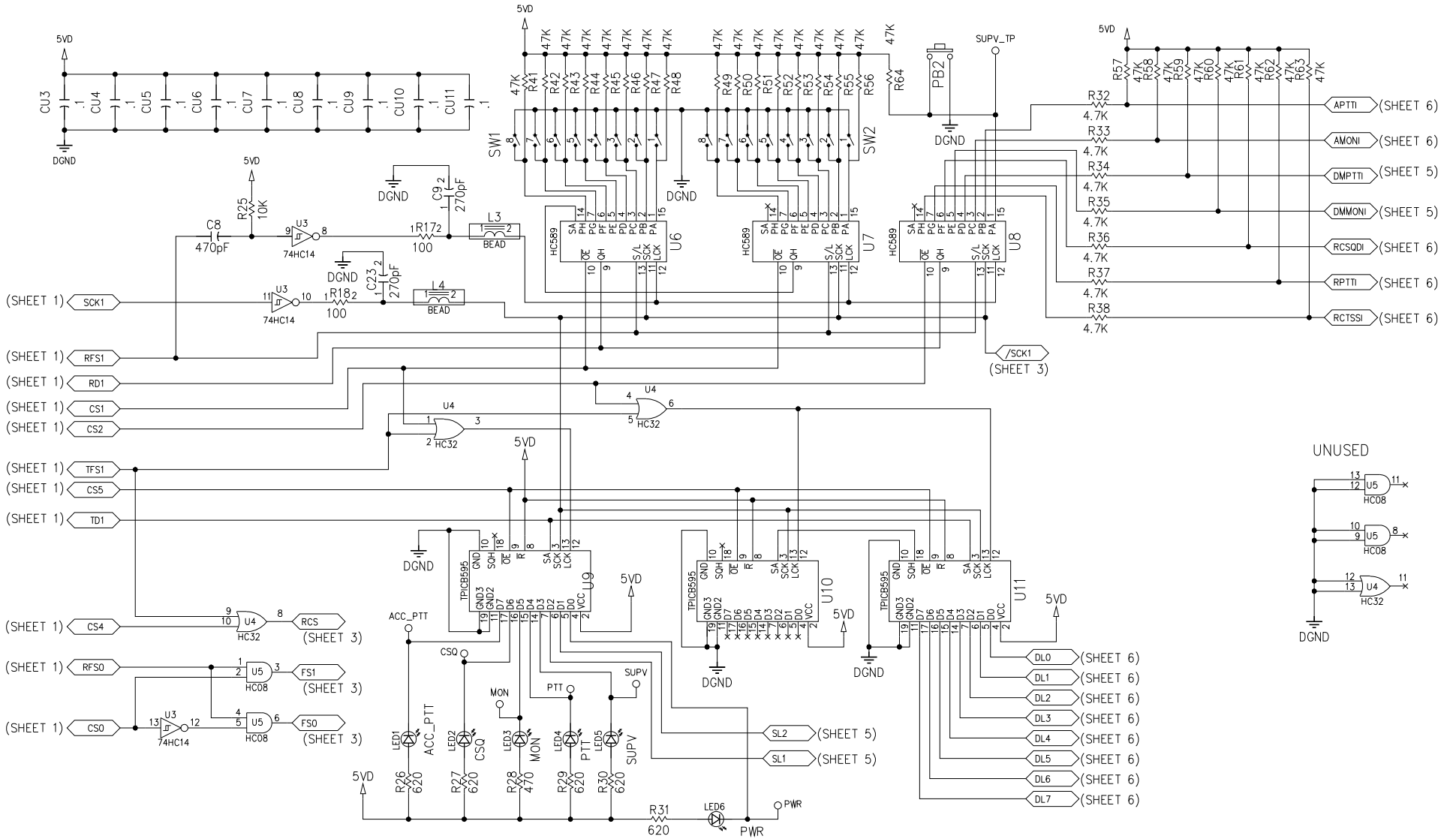


DIGITAL SECTION



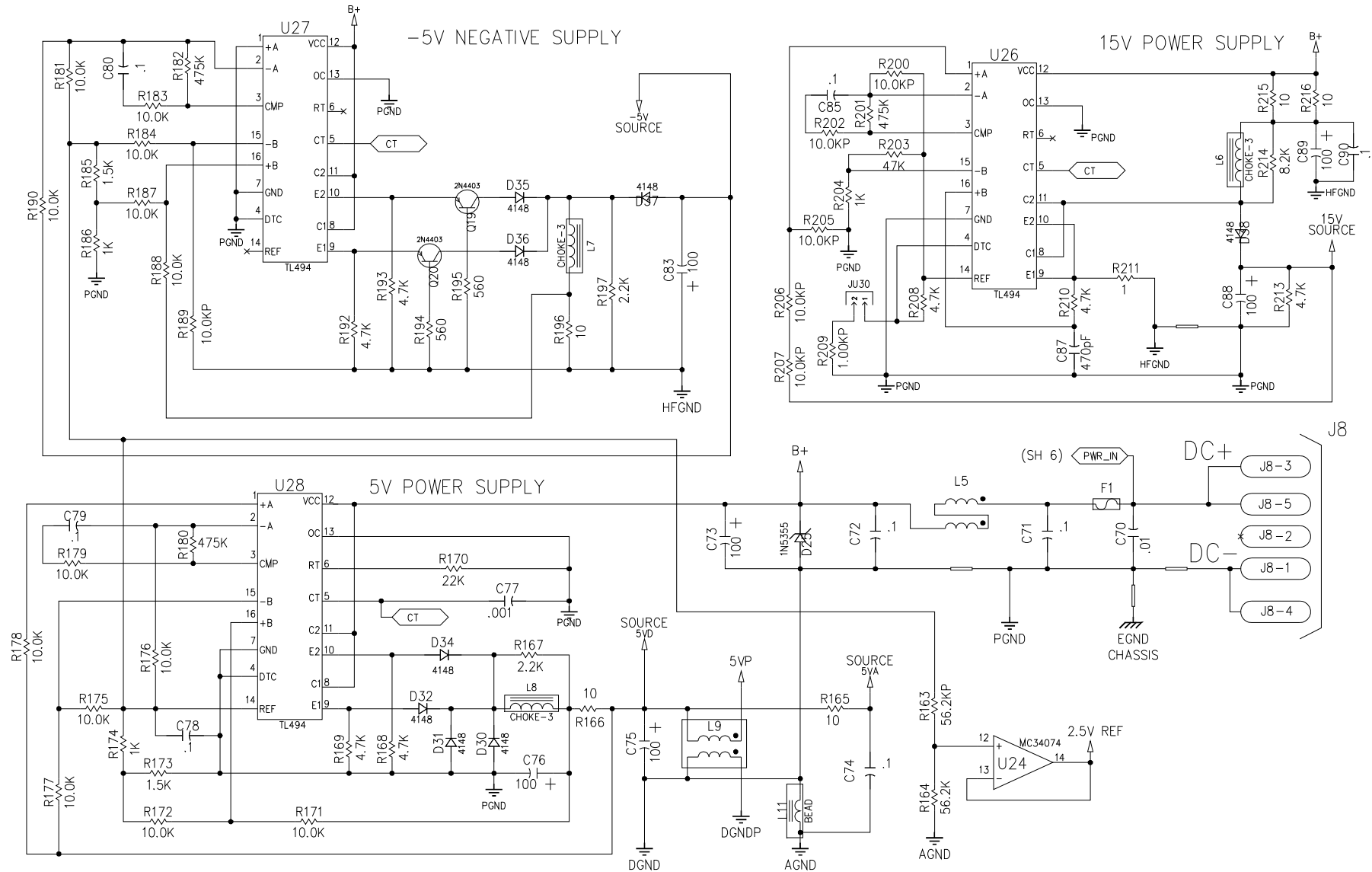
Digital Section - Schematic Diagram Sheet 1 of 6

SERIAL LOGIC



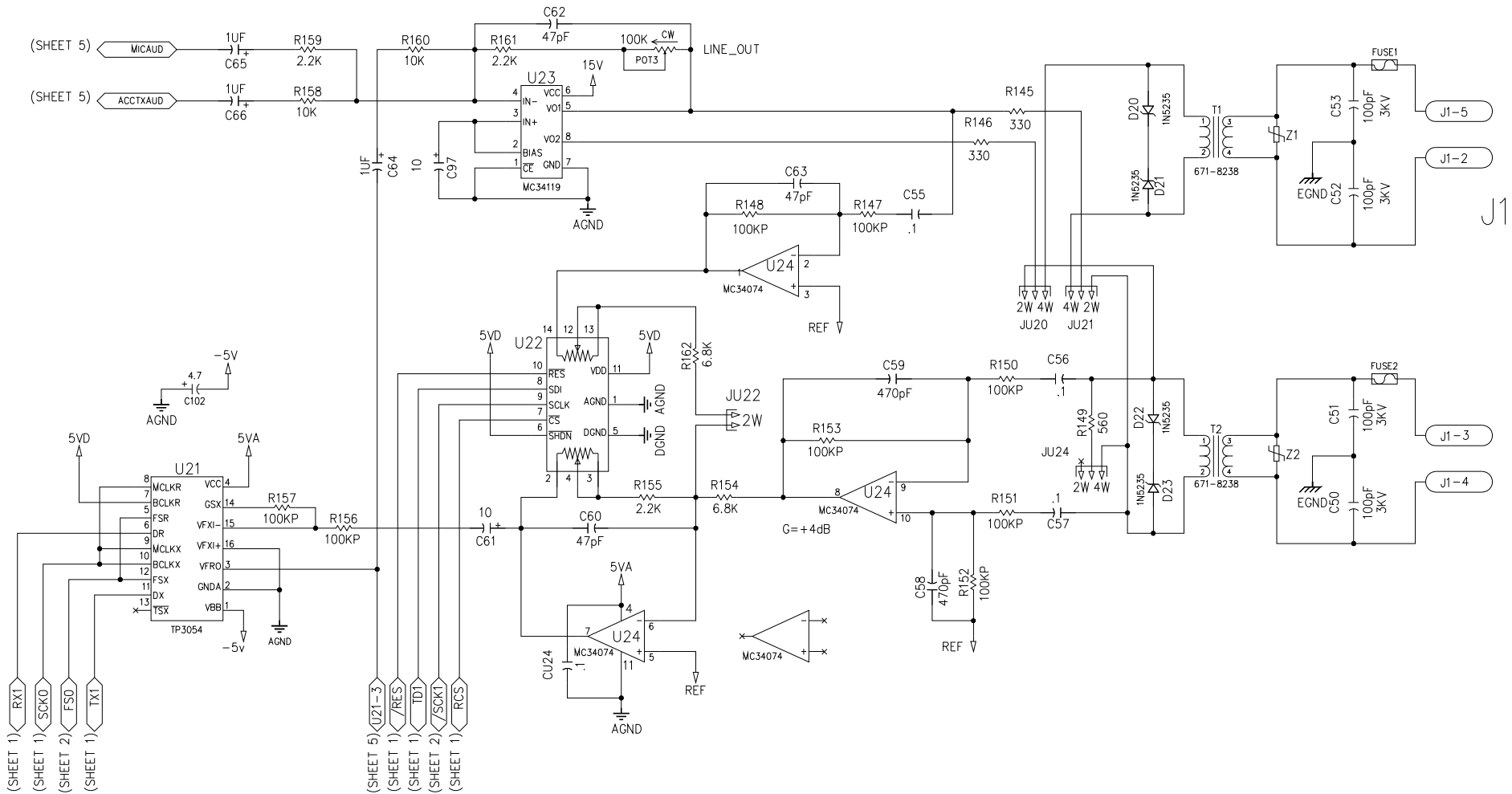
Serial Logic - Schematic Diagram Sheet 2 of 6

POWER SUPPLY SECTION



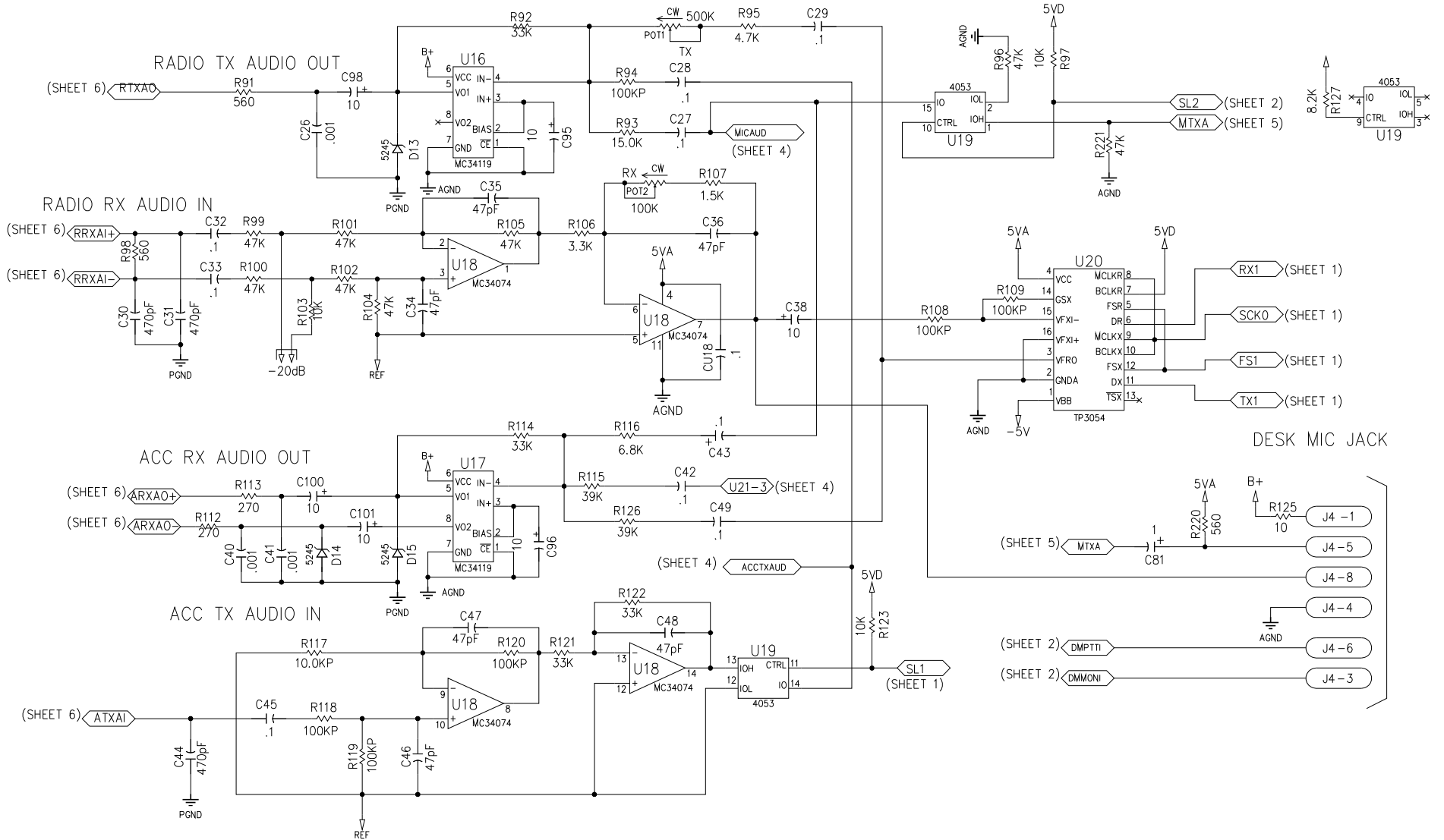
Power Supply Section - Schematic Diagram Sheet 3 of 6

LINE INTERFACE



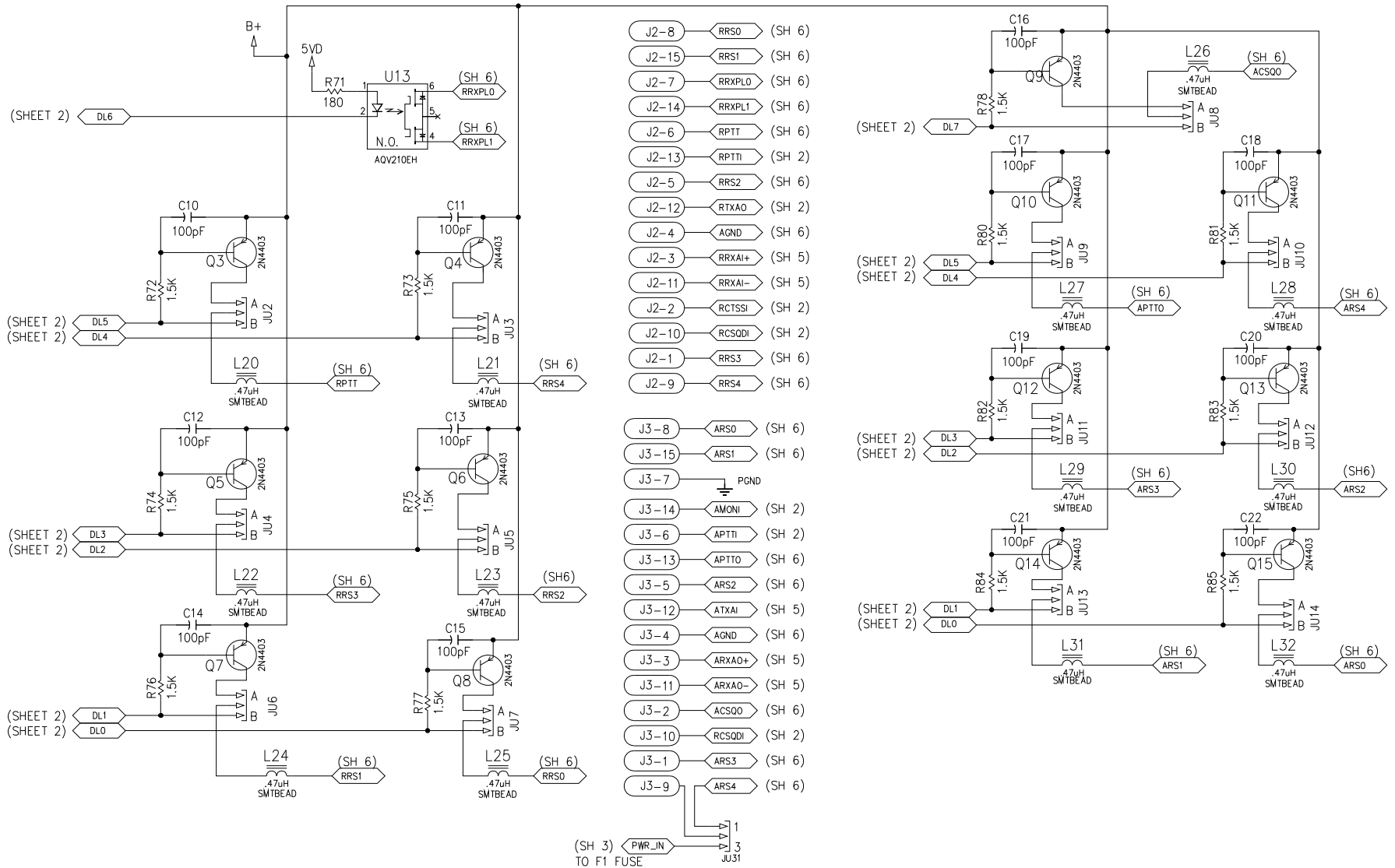
Line Interface - Schematic Diagram Sheet 4 of 6

RADIO, PHONE, MIC



Radio, Phone, and Mic - Schematic Diagram Sheet 5 of 6

OUTPUT PORT



Output Port - Schematic Diagram Sheet 6 of 6

Notes:

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Definitions and Acronyms

Term	Definition
Channel	A single path, separated by frequency or time divisions, for transmitting electrical signals. A receive (one-way) or receive and transmit (two-way) frequency path.
CSQ	Carrier squelch
FT	Function tone
HLGT	High level guard tone
Home Mode	All channel steers not asserted and scan stopped.
LLGT	Low level guard tone
Monitor Mode	PL/DPL disable
DPL	A system analogous to PL but using low speed digital signaling instead of subaudible tones.
PL	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.
PTT	Push-to-talk
