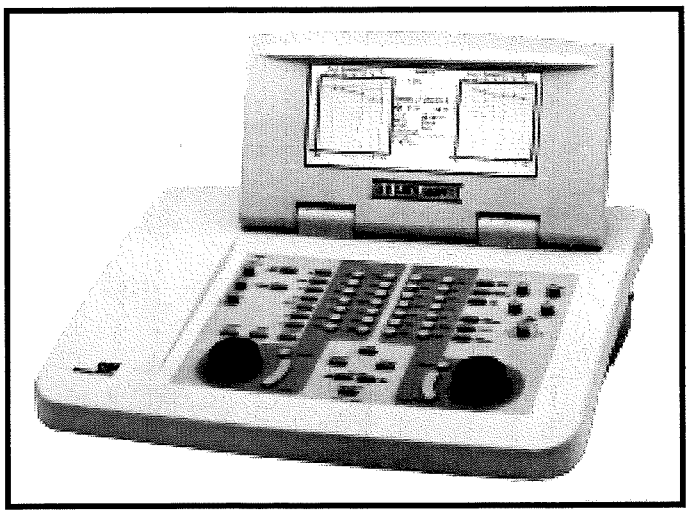
GSI 61

Clinical Audiometer



Service Manual

Model Numbers:
1761-9700-XXE
1761-9780-XXE

GSI

Grason-Stadler, Inc.

Grason-Stadler, Inc.
1 Westchester Drive
Milford, NH 03055-3056
Tel: 603-672-0470
Fax: 603-672-0487

Service Manual 1761-0110, Rev. 5
Printed April, 1999

Warranty

We, Grason-Stadler, Inc., warrant that this product is free from defects in material and workmanship and, when properly installed and used, will perform in accordance with applicable specifications. If within one year after original shipment it is found not to meet this standard, it will be repaired, or at our option, replaced at no charge except for transportation costs, when returned to an authorized Grason-Stadler facility. If field service is requested, there will be no charge for labor or material; however, there will be a charge for travel expense at the service center's current rate.

NOTE

Changes in the product not approved in writing by Grason-Stadler shall void this warranty. Grason-Stadler shall not be responsible for any indirect, special or consequential damages, even if notice has been given in advance of the possibility of such damages.

This warranty is in lieu of all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose.

GSI

Grason-Stadler, Inc.

Revision History: GSI 61 Service Manual 1761-0110

Date	Rev	Change Order
April 1999	5	DCO-0152
March 1997	4	1761-0130
January 1997	3	1761-0123
February 1996	2	1761-0062
January 1996	1	1761-0038

Table of Contents

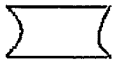
WARNING

The GSI 61 Audiometer is designed to be used with a hospital grade outlet. Injury to personnel or damage to equipment can result when a three-prong adapter is connected between the Audiometer's power plug and an A/C outlet or extension cord.

Accessory Hazard Warning

This IEC 601-1/CSA C22.2 No. 601.1M90 listed medical instrument should be interconnected with accessories that have proper electrical compatibility and which are listed as meeting the requirements of the UL Medical and Dental Equipment Standard UL2601. Connection of accessories not meeting these requirements may result in electrical leakage currents in excess of those allowed by the standard and present a potential electrical shock hazard to the person being tested.

Key to Schematic Symbols

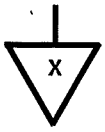


RMS - Voltages which are designated in this symbol are AC Rms levels.

DC - Voltages which are designated in this symbol are DC levels.

Pk to Pk - Voltages which are designated in this symbol are Peak to Peak.

TP - Test point; male pin which is generally at a convenient point on a board for quick scope or voltmeter connections.

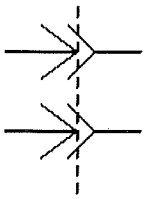


Ground - Ground symbol which when shown with a letter designates a ground structure that returns separately to main instrument ground.

JP

Jumper - Jumper connects to two Wire Ties (WTs).

On-Board Connection - Any line on a schematic which is terminated with an X and a designation means that the next point it goes is on the same PC Board but elsewhere on one of the schematics (another sheet of a multi-sheet drawing).



Connector - Generally shows a connection which leaves the board. When a dotted line passes through several, it means they share a common designation, i.e., P1.

{##}

Designates sheet number(s) of schematic on which the signal path continues.

No Connect

= 14 VDC. Polarity for DC power supplies is designated by letters instead of +/- signs.

= -14 VDC. E.g.; +14 VDC is labeled 14V, and -14 VDC is labeled 14VN. The same applies to +/- 7, +/- 5 VDC throughout.

Foreword

General Service Information

Operating, check-out procedures and other information can be found in the Instruction Manual (1761-0100). Repair and/or bench testing of GSI 61 Audiometers should be performed only by trained personnel. The following instructions are provided primarily for use by persons who are skilled in the repair of electronic equipment.

CAUTION!

The GSI 61 is an IEC 601-1/CSA approved Audiometer; consequently if any parts are replaced during the repair of this unit, only an exact replacement should be made. Any alterations of the present electrical or mechanical construction or components will void these safety Approvals.

CMOS Handling Precautions

Many of the integrated circuits on the P.C. Boards are of CMOS and NMOS type.

CAUTION!

Failure to observe the following precautions whenever a circuit board or an integrated-circuit package is handled can result in damage to the GSI 61.

a. Place instrument and parts on a grounded, conductive work surface.

b. Ground yourself (with a strap having about 1 M Ohm resistance).

c. Ground the frame of any test instrument or soldering iron to be used.

d. If any circuit boards are to be stored or transported, enclose them in conductive (anti-static) envelopes.

Product Specifications

1

Catalog Listings

1761-9700	Clinical Audiometer without RS-232	U.S.A.
1761-9700-XX	Clinical Audiometer without RS-232 (XX indicates power and plug configuration)	Export
1761-9780	Clinical Audiometer with RS-232	U.S.A.
1761-9780-XX	Clinical Audiometer with RS-232 (XX indicates power and plug configuration)	Export

Description

The GSI 61 is a microprocessor based, two channel diagnostic Audiometer with built-in power amplifiers. It has all the capabilities necessary to perform the standard battery of tests. It also has the increased mixing and routing capabilities needed for hearing aid evaluations. Each diagnostic test is readily selected by choosing the appropriate combination of stimuli and transducer on the front panel. The test conditions and monitor meters are clearly shown by characters and images on an illuminated display (LCD). An optional RS- 232C interface is provided to connect to an external computer for test result storage and/or report generation, including audiograms. There is also a high frequency option.

The GSI 61 is supplied with an instruction manual.

Standards

The GSI 61 meets or exceeds the following standards and specifications for audiometers:

ANSI S3.6 1989	Audiometers Type 1
ANSI S3.43 1992	For Calibration of Pure-Tone Bone Conduction Audiometers
ISO 389 1991	Acoustics - Standard Reference Zero for the Calibration of Pure-Tone Air-Conduction Audiometers
ISO 389 Amendment 1	For.Calibration of Insert Phones
ISO 389-3	For Calibration of Bone Vibrators
ISO 389-4	For Calibration of Narrow Band Masking Noise
ISO 389-7 (Draft 1993),	
ISO 8253-2 1992	Reference Data for Speaker Calibration
ISO 226-1 (1993)	(Draft): RETL Under Free-Field and Diffuse Field Listening Conditions
IEC 645-1 1992	Type 1 Audiometers
IEC 645-2 1993	Type A-E Speech Audiometers
IEC 645-4 1995	Equipment for Extended High-Frequency Audiometry
IEC 601-1 Class 1 Type B	Medical Electrical Equipment Requirements for Safety
CSA C22.2 No. 601.1-M90	Electromedical Equipment Safety
UL 2601 (UL 544)	Medical and Dental Equipment Safety Standards
EN60601-1-2	Conforms with the 89/336/EEC EMC Directive
EN55011B	Group 1 Class A for EMI and EMC
CE 0050	Conforms with provisions noted in the 93/42/EEC Medical Devices Directive

General Requirements

Safety

The GSI 61 was designed to comply with Underwriters Laboratories Safety Standard 2601 for medical and dental equipment and IEC 601-1.

Warm-up Time

10 minutes, to allow analog circuits to stabilize.

Supply Variations and Environmental Conditions:

Allowable line voltage and variation:

100 VAC ± 10%
120 VAC ± 10%
220 VAC ± 10%
230/240 VAC ± 10%

Frequency Range:

50-60 Hz ± 6%

Temperature and Humidity Operating Range:

Operating temperature range (in degrees):	+15 ℃ to +40 ℃
Relative humidity range:	5% to 90%
Storage temperature:	-20 ℃ to +60 ℃

Unwanted Sound Radiation

Unwanted Sound from the Earphone:

Tone Signal with Tone OFF:

At a hearing level setting of 60 dB and with the Tone "off" the electrical signal in any one-third Octave band shall be at least 10 dB below the signal corresponding to the Reference Equivalent Threshold Level for any frequency.

With the Tone ON:

The unwanted signal in the Non-test earphone shall be at least 70 dB below the test tone as measured when the hearing level control is set to 70 dB or greater.

For subjective measurements of unwanted sound:

From a stated earphone, no test subject shall detect any sound other than the test tone for the frequency range 250 to 6000 Hz and any setting of the masking or hearing level controls at a setting of 70 dB. For frequencies outside this range but within the range 125 to 8000 Hz and above, the test shall be performed at a setting of 50 dB. The tests shall be conducted in both the "on" and the "off" position of the tone switch.

Speech Signal (Signal/Noise):

Background noise SPL, measured with "A" Weighted filters, is below the test signal by at least 45 dB.

Unwanted sounds from a bone vibrator:

The bone vibrator shall not radiate sound at any test frequency to such an extent that the sound reaching the Test ear by air conduction, through the unoccluded ear canal, might impair the validity of the bone conduction measurement.

Unwanted sound from an audiometer:

Any sound due to the operation of audiometer controls during the actual listening test, or to radiation from the Audiometer, shall be inaudible at each setting of the hearing level dial up to and including 50 dB (this limitation applies only to those controls that could furnish the patient with a clue which might influence the test results).

Marking

As defined per standards, will be shown on the display and Instruction Manual. ANSI 3.6-Sec. 12, IEC 601 Clause 6, IEC 645-1 Type 1 Sec. 10, IEC 645-2 Type A-E Sec. 17.

Signal Sources

Pure Tones

Frequency and Hearing Level Range:
Refer to Table 1 for guaranteed maximum hearing levels for Tone and Speech. Any attempt to change or select a hearing level control that is outside the limit will result in one of the following:

1.) The HL will stop at the limit value
2.) The HL will go to the nearest lower level of the step size. In either case, the dB HL display will flash momentarily and then remain at the new value.
3.) A "No Response" indication will appear.

Note: The lowest hearing level for all transducers is: -10 dB except when using the High Frequency phones in the range of 8 kHz to 20 kHz. The lowest hearing level is -20 dB.

Pure Tone Frequency Accuracy:
± 1%

Pure Tone Harmonic Distortion:
The maximum harmonic distortion is equal to or better than the values given in Table 2.

Note: The test was done using couplers except as indicated, in which case it was done electrically.

Frequency Modulated Tone (FM)
Frequency deviation: ± 5%
Modulator signal 5Hz with triangular waveform.
Accuracy of deviation: ± 1%

Speech Source: (Microphone, Ext A, Ext B)

Frequency response:
The output sound pressure level generated by the loudspeaker and Telephonics earphone with any test signal in the frequency range from 250 to 4000 Hz shall not differ by more than ± 3 dB from the average sound pressure level of all the test signals in this range. For any test signal between 250 Hz and 125 Hz, the tolerance is +0/-10 dB and between 4000 and 6300 Hz, it is ± 5 dB. For the bone vibrator output, the frequency response and tolerances in the range from 250 to 4000 Hz shall be specified. For earphone equivalent free field output, mode correction figures representing the frequency dependent difference between the free field sensitivity level and the coupler sensitivity level for the type of earphones used shall be added to the measured coupler sound pressure levels before applying the tolerances. The measurements for frequency response shall be made using pink noise as a source and the resultant output measured with 1/3 octave filters.

Signal Sources continued

Frequency response for recorded speech:
Since this audiometer has the means of replaying analog recorded speech material, the tolerance shall be increased by ± 1 dB within the range from 250 to 4000 Hz, and ± 2 dB outside this range.

Frequency response for microphone input:
The output voltage level generated at the terminals of the microphone for any input test signal within the frequency range from 125 to 8000 Hz shall not differ by more than ± 3 dB from the average level of all test signals in this range.

Overall Distortion:
The Total Harmonic Distortion for the earphone output shall not exceed 2.5%. This shall be measured with a pure tone input at the test frequencies 250, 500 and 1000 Hz and at a level 9 dB above the reference zero position of the Signal level indicator. For Insert Phone and Bone Vibrator characteristics, see Table 2.
The total harmonic distortion for the loudspeaker output shall not exceed 3% at 80 HL. This shall be measured with a pure tone input at the test frequencies 250, 500 and 1000 Hz and at a level 9 dB above the reference zero position of the signal level indicator. At 100 dB Sound Pressure Level the Total Harmonic Distortion shall be less than 10%. The distortion requirements for the Bone Vibrator are shown in Table 2.

Monitor:
The monitoring indicator meets the ballistic characteristic stated in IEC 268-7.

Standard Reference Sound Pressure Level for Speech:
See Table 3 for Standard Reference Levels.

Masking Sounds:

Narrow Band Noise:

Band limits:	See Table 4
Minimum roll off on both sides:	12 dB/octave
Stop band more than:	40 dB

Broad Band Noise: (White Noise)
Pressure spectrum uniformity ref. 1000 Hz for a frequency range from 100 Hz to 4000 Hz: ±5 dB

Masking Noise of Speech:
Spectrum uniformity from 100 to 1000 Hz: ±3 dB
Roll off from 1000 to 6000 Hz: 12 dB/octave with a tolerance of less than ±5 dB.

Note: Bone vibrator frequency response limitations will influence how closely the masking sound specification can be met.

Signal Level Control

Pure tone and speech accuracy:
Sound pressure and vibration levels for a frequency range:

from 125 Hz to 4000 Hz:	±3 dB
at 6000 Hz, 8000 Hz, and 12000:	±5 dB

With the high frequency option installed:
8000 to 16000: ± 5 dB
at 18000 and 20000: ±10 dB

Mixing error (when 2 signals drive the same transducer): ± 1.0 dB

Hearing level control for tone or speech signals:

Increments:
The HL control can be set to 1, 2, or 5 dB increments.

Accuracy of controls:
Accuracy of two successive HL steps in:
the 1 dB increment: ± 0.3 dB
The 2 dB increment: ± 0.6 dB
The 5 dB increment: ± 1.0 dB

Masking Sound Level Control:

Increments:
Same as the HL control

Reference Levels: (See Table 3)
Narrow band noise: ISO 389-4

Noise for masking of speech: Same as speech reference level. (See Table 3).

White noise masking of tone:
The white noise is calibrated in effective masking. At 0 dB HL, the sound pressure level, in a 1/3 octave band of white noise centered to a tone frequency is higher than the reference level of the tone. See Table 3.

White noise masking of speech:
The white noise is calibrated in effective masking. At 0 dB HL, the sound pressure level, in a band from 125 Hz to 1000 Hz, is the same as the speech reference level.

Note: Narrow Band and White Noise can be custom calibrated - See Cal Mode.

Accuracy of controls:
Sound pressure level accuracy: +5/-3 dB
Accuracy of two successive HL steps:
1 dB increments: ± 0.3 dB
2 dB increments: ± 0.6 dB
5 dB increments: ± 1.0 dB

Masking level range:
See Table 1.

Tone switching:

On/off ratio:
For steady state signals at 60 dB HL setting, the Off signal level is below -10 dB HL. At 70 dB HL and above, the Off signal is below the On signal by at least 70 dB.

Rise/Fall Times:

Rise/fall time:	35 msec ± 15 msec
Delay time less than:	200 msec from the time present switch is on.

Pulsed tone timing:

200 msec on, 200 msec off. ± 35 msec.

SISI Test

Base line: continuous tone presented at base line

Increment intensity: selectable 1.0, 2.0, or 5.0 dB accuracy within ± 0.1 dB.

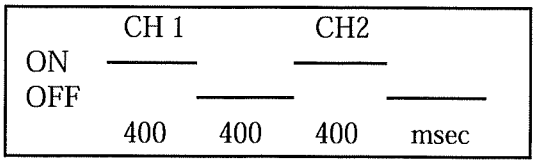
Increment timing:

Increments presented every:	4.8 Sec (± 480 msec)
Increment duration:	200 msec (± 20 msec)
Increment rise/fall time:	25 msec (± 10 msec)

Reference Tone Facilities

The instrument provides alternated and simultaneous tone presentation features. All signal parameters in this mode meet the same specification as in tone mode. Either audio channel can be used for reference signal presentation. The alternate and simultaneous signal presentation can be presented manually. Alternate signal can be presented automatically.

Automatic Alternate Test Timing:



The two channels alternately present the tone every 800 msec. Above is the result if Channel 1 interrupter is pressed first. Channel 2 would start first if Channel 2 interrupter was pressed first.

Signal on time, each channel (50% points) 400 msec ± 35 msec

Signal off time, each channel (10% points) 1200 msec

When both channels are presented simultaneously the onset of the second tone (50%) will be within 5 msec of the first tone.

Transducers

(See Table 3 for Reference Threshold Levels)

Air Conduction

Supra-aural

The test earphone headset is comprised of a matched pair of Telephonics TDH-50P earphones, Model 51 cushions, headband, and earphone cords. Headband static force = 4.5N ± 0.5N. The earphones are calibrated in an IEC 318 coupler per ISO 389 or NBS 9A coupler per S3.6-1969 Standard Reference Threshold levels. See Table 3 for coupler RTLs. A dip switch is provided to select coupler RTL.

Insert Earphone

There are two optional insert phones. One single receiver, eartips, and cord or a pair of matched E•A•RTONE™ 3A receivers. The insert phones are calibrated

in an IEC 711 coupler. A dip switch is provided for use with the 2cc coupler, Type HA-2. See the Reference Threshold Levels in Table 3.

Sound Field System (Optional)
The sound field system is comprised of a pair of speakers (developed per GSI specifications), and connecting cables. The sound field system is calibrated per RTLs in Table 3.

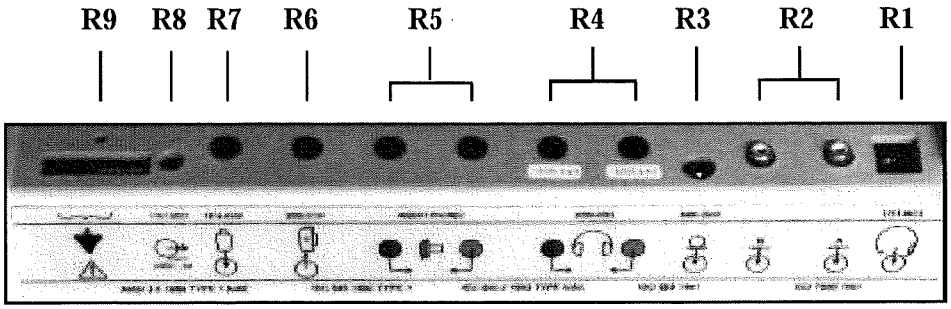
High Frequency Earphones
The high frequency earphones are calibrated in an IEC 318 coupler with a flat plate adaptor.

Bone Conduction Transducer

Bone Vibrator Assembly
The bone vibrator consists of a Radio-Ear B71 bone vibrator, headband, and a cord. The bone vibrator is calibrated per RTLs in Table 3 on an ANSI/IEC mechanical coupler.

I/O Connectors

The connectors on the rear panel of the GSI 61 are shown in the following diagram. The label and jacks are visible looking down onto the instrument, behind the LCD.



R1 - Test Mic /Monitor Headset (4 Position Modular Phone Jack)

Pin	Function	Output Voltage	Impedance
1	Mic High and +6 VDC	0.2 to 6.0 mV RMS	1.8 K ohm (output)
2	Phone Low	GND	0 ohm
3	Phone High	3.0 mV to 1.0 V	300 ohm
4	Mic Shield	GND	0 ohm

R2 - Ext A and Ext B (RCA plug)

Input jacks for optional stereo tape cassette or CD player. Voltage range required: 0.2 to 1.0 V_{RMS} to obtain 0 VU. Input Impedance: 15 K ohm

R3 - Talkback Microphone (3.5 mm stereo jack)

Position	Function	Output Voltage	Impedance
1 Tip	Mic High	0.2 to 2.0 mV RMS and +6V DC	10 K ohm
2 Ring	Mic Low	- - - - -	- - - - -
3 Shield	Chassis Ground	- - - - -	- - - - -

R4 - Left and Right Ear Phone Outputs

(1/4 inch stereo jack)

Stereo phone jacks for left (blue) and right (red) earphones, patch cords, or High Frequency earphone connector cords.
Voltage: 1µV to 7.0 V RMS (4.45 V RMS for High Frequency)
Output impedance: 5 ohms or less

R5 - Left and Right Insert Phone Outputs

(1/4 inch monaural jack)

Monaural phone jacks for left and right insert phones or patch cords.
Voltage: 1µV to 4.0 V
Output impedance: 5 ohms or less

Note: ***When the Single Insert Phone option is used, it must be plugged into the left insert phone output.***

R6 - Bone Vibrator

(1/4 inch phone jack)

Jack for bone vibrator or gray patch cord.
Voltage: 200 µV to 5.00 V RMS
Output impedance: 5 ohms or less

R7 - Subject Response Handswitch

(1/4 inch phone jack)

Accepts plug from the cable attached to the patient's response handswitch or handswitch patch cord.

Pin	Function	Voltage	Impedance
1	Shield	GND	0 ohm
2	Digital GND	GND	0 ohm
3	Response input	+5V/GND	1K ohm/0 ohm

R8 - CD Player Power Jack

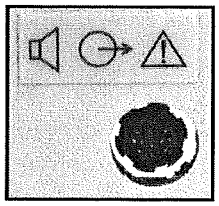
(2 pin power jack)

Provides 5 V DC for CD Player.

R9 - Dip Switch/Cal Switch

An eight position bank of switches accessible by an authorized service representative.

R10 - Speakers

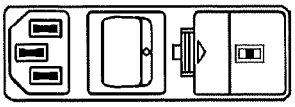


(5 pin DIN connector) Located on rear of instrument.

Connects to left and right loudspeakers.

Pin	Function	Impedance
1	Left speaker (high)	1.0 ohm
2	Left GND	0 ohm
3	Right speaker (high)	1.0 ohm
4	Left speaker (low)	1.0 ohm
5	Right speaker (low)	1.0 ohm
SHLD	Right GND	0 ohm

Power Module



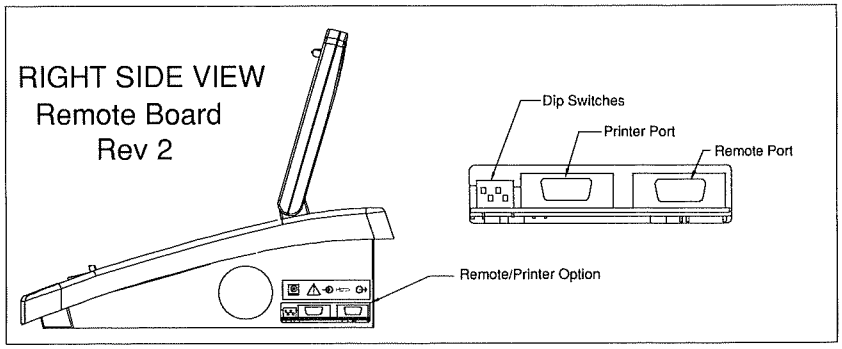
The power module is on the left side panel.
The power entry module is composed of the power switch, fuse drawer and voltage selection switch, and power cord with hospital grade plug appropriate for the country of destination.

When turned ON, the GSI 61 automatically initializes and displays a screen which states the type of audiometer (IEC and ANSI specified for speech audiometry) followed by a status screen. With the status display, the GSI61 is brought to the initialization state. The frequency is set at 1000 Hz and:

Channel 1	**Channel 2**
Steady tone	NB Noise
Phone-Right	Phone-Left
0 dB HL	-10 dB HL

Remote Option Board (RS-232): Rev 2

The RS-232 connectors for the Rev 2 Remote Board are shown below.



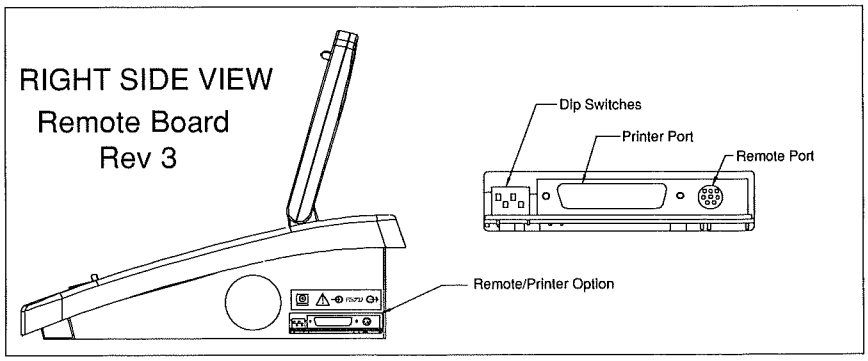
RS 232 Remote Port A 9 pin, DB 9 female locking connector which accepts the RS 232C cable necessary for the interface of the GSI61 and a computer.

Printer Port A 9 pin, DB 9 female locking connector for the serial connection to a serial to parallel interface box. This box then is attached to a parallel printer.

DIP Switches See below.

Remote Option Board (RS-232): Rev 3

The RS-232 connectors for the Rev 3 Remote Board are shown below.



RS 232 Remote Port A mini-DIN connector which uses a standard Apple "Hayes Modem" cable (supplied) to provide serial connection to your equipment.

Printer Port A 25-pin PC-Printer interface connector. Connects to your printer via a standard PC-parallel printer cable.

DIP Switches For more detail on these DIP switch settings, and attaching and using a printer, refer to the Optional Accessories section of the GSI 61 User Manual.

Accessories Supplied

Description ..... GSI Part Number

Patch Cords
5 Gray Transducer Cords 4204-0505
1 Power Cord ..... Country Dependent

1 Test Headset 8000-0063
A matched pair of TDH-50 Earphones with Model 51 cushions, headband and cords.

Bone Vibrator Assembly 8000-0130
B71 Bone Vibrator, headband and cord.

1 Handswitch Assembly 7874-0156

1 Test Microphone / Monitor Headset 1761-9623
Electret microphone with boom, earphone with headband and cord, earphone cushion.

1 Talkback Microphone Assembly 8000-0039
Microphone with cord and mounting hardware

Instruction Manual 1761-0100

Optional Accessories

CD Player 1761-9621
with D/C Power Cable and 3.5 mm to RCA Plug Adaptor Cable

Stereo Tape Cassette 1761-9622

Insert Phone Pair Assembly 1700-9606
E•A•RTONE™ 3A Pair (50 Ohm) and cords

1 Single Insert Phone Assembly 1700-9609
with cord, box of eartips

Sound Field Systems

Basic Speakers (90 dB) 1761-9630
2 Speakers and 1 Speaker Cable

High Performance Speakers (96 dB) 1761-9635
2 High Performance Speakers and Cable

Only for use with High Performance (>150 Watt) Speakers!

Booster Amp 220-240V 1761-9636
Booster Amp, Dual-Channel, 220-240V and Cable

Booster Amp 100-120V 1761-9637
Booster Amp, Dual-Channel, 100-120V and Cable

High Performance Sound Field System (102 dB) with Amp, 220-240V 1761-9638
Produces hearing levels over 102 dB HL. Consists of dual-channel amplifier, twin loudspeakers, cables for speakers to amp and amp to GSI 61.

High Performance Sound Field System (102 dB) with Amp, 100-120V *1761-9639*
Produces hearing levels over 102 dB HL. Consists of dual-channel amplifier, twin loudspeakers, cables for speakers to amp and amp to GSI 61.

High Frequency Options

With Sound Booth:

High Frequency Headphones *1761-9602*
with cables to Sound Booth

High Frequency Cables *1761-9603*
from Sound Booth to GSI 61
(Customer may already own High Freq Headphones)

Without Sound Booth:

High Frequency Headphones *1761-9604*
with cables to GSI 61

High Frequency Cables *1761-9605*
from Headphones to GSI 61
(Customer may already own High Freq Headphones)

Remote Options

Remote RS-232/Printer Interface *1761-9680*
Printer, Color (North America only) *1761-9610*

Power and Power Line

Power rating: 90 Watts
Maximum Apparent Power: 120 Volt-Amperes
Selectable Line Voltages:
100 VAC
120 VAC
220 VAC
230-240 VAC

Allowable line voltage variation: ± 10% @ 50-60 Hz

Conversion to Different VAC Line Voltages

The GSI 61 can be converted to four (4) different VACs: 100, 120, 220 and 240 by reconfiguring the Power Entry Module. See Section 10 of this manual.

Safety and Electrostatic Protection Tests:

Dielectric withstand between primary circuit and patient connected circuit;
the breakdown voltage is: Reference IEC 601 Clauses 18 and 20.
Leakage current between patient connected circuit and ground;
the leakage current is less than 50 µAmp (ref. IEC 601-1).
Electrostatic discharge test simulates static discharge from human to circuitry.

Test voltage:
15 KV, no soft failures, 20 KV, no hard failures. See Procedure ESPT-6.
Charge magnitude at 10 KV:
1.5 µCoulomb

Shipping Data

	WIDTH		HEIGHT*		DEPTH		NET WT.		SHIP WT.	
	in	(mm)	in	(mm)	in	(mm)	lbs	(kgs)	lbs	(kgs)
GSI 61	19.77	(502)	12.6	(320)	15.26	(387)	19	(8.7)	30	(13.6)
Speakers	18.6	(472.4)	24	(609.6)	13.6	(345.4)	31.2	(14.15)	37	(16.8)

* Height measured with display in upright position.
With display lowered, height is 5.64" (143 mm).

Calibration Requirements

GSI recommends quarterly calibration checks for the GSI 61 along with annual certification. ASHA requires quarterly electroacoustic calibration checks and annual electroacoustic calibration. It is good practice to perform daily biologic checks. See the Calibration Section of this manual for complete calibration instructions.

Materials Used in Manufacture

Unit Enclosure/Case Material	**Top Cover and Display (LCD) Case:** Painted molded plastic of GE resin Lexan 500 (10% glass filled). **Base:** Clear Chromate Aluminum (5052) with finish coat of Sherman Williams paint.
Patch Cords	**Cable Jacket:** PVC. *The patch cords connect the Instrument to the patch panel on the side of a Sound Booth, which in turn connects to the Headphones, Handswitch and other accessories.*
Labels	**Front Panel:** Velvet textured Lexan .020 thick **Jack Panel:** Velvet textured Lexan .020 thick **Voltage:** Polycarbonate low-gloss .010 thick **Product Marking:** Polyester .005 thick **RS 232/Blank:** Velvet textured Lexan .050 thick
Switches, Front Panel	Shincor Shin-Etsu/Novacor KE-951 U Silicone Rubber
Control Knobs	**Metal:** Small: Black Powder coat Aluminum Large: Nickel plate Aluminum **Rubber:** Small and Large: Shincor Shin-Etsu/Novacor KE-951 U Silicone Rubber
Test Headset/Phones	**Cushion, rubber:** Buna-S (base) and Sponge Neoprene (cap). **Headband:** PVC **Cord:** PVC
Subject Response Handswitch	**Switch and Button:** GE Cycolac "T"
Bone Vibrator	**Vibrator:** GE Cycolac "T"
AudioCups	**Cushion:** Rubber **Housing:** ABS
Basic & High Performance Speakers	**Basic:** Cabinet is "chip board" covered with 100% synthetic carpet (will melt but will not burn). **High Performance:** Top and Bottom are oak wood finished with Tongue oil. Sides are "chip board" painted black. Grille cloth is synthetic yarn (flame resistant monofilament and modacrylic yarns).

TABLE 1
GUARANTEED MAXIMUM HEARING LEVELS: TONE, SPEECH AND MASKING SOUNDS

Tone Freq. (Hz)	Supra-aural Earphone	Bone Vibrator (dB) Mastoid	Bone Vibrator (dB) Forehead[9]	Insert Phone Single (dB)	Insert Phone E A R 3A (dB)	Sound Field System[7] (dB)	Sennheiser HDA 200 High Freq.
125	85	---	---	---	90	70	
250	105	45	33	100	100	65	
500	120	65	51	110	110	95	
750	120	70	57	110	115	100	
1000	120	75	66	110	115	100	
1500	120	80	69	110	115	100	
2000	120	80	68	110	115	100	
3000	120	80	68	110	115	105	
4000	120	75	67	105	115	105	
6000	110	50	39	90	105	95	
8000	100	45	35	---	90	80	100
12000	85	---	---	---	---	80	
Speech[6]	105	65	56	95	110	90	
Speech Noise[8]	95[6]	65	56	95	100	85	---
9000						80	100
10000						80	95
11200						80	95
12500						80	84
14000						75	75
16000						50	55
18000						---	33
20000						---	14

NOTES:

1. The maximum hearing levels for the Narrow Band Masking signals are 15 dB below the pure tone levels. The maximum levels for white noise masking signals are 30 dB below the pure tone levels. The maximum levels for speech masking signals are the same as speech.
2. When mixing two signals to a single transducer, the maximum level in one channel will be 6 dB less that what is shown on the table.
3. Levels for the Sound Field System assume no booster amplifier. Only one channel can be set to a maximum HL at a time.
4. The Sound Field System levels assume that the head is positioned one meter from the speaker at a 45 degree azimuth. The environment must meet or exceed ANSI S3.1-1977 standards.
5. Crest factor for speech of 9 dB is assumed to meet THD requirements. IEC 645-1, IEC 645-2 Clause 10.2.
6. The maximum hearing level for speech with speech filter in place is 100 dB.
7. Basic speakers, no booster, 45 °Azimuth.
8. Speech Noise values are rounded to the nearest 5 dB increment.
9. Bone Vibrator-Forehead max HL numbers are calculated based on Mastoid vs. Forehead RTLs in ANSI S3.43-1992 and ISO 7566-1987.

Table 2
Maximum harmonic distortion in percent
Supra-aural earphone

Frequency (Hz)	125 & 12000	250	6000 & 8000	500-4000
Test hearing level (dB)	75	90	90	110
Second harmonic	2	2	2	2
Third harmonic	2	2	-	2
Fourth & each higher	0.3	0.3	-	0.3
All sub-harmonics	-	0.3	0.3	0.3
Total harmonics	2	2	2	2

	Bone Vibrator			Insert Phone		
Frequency (Hz)	250	500,750, 6000	1000 - 4000	250	6000	500 - 4000
Test hearing Level (dB)	15	50	60	90	80	100
Second harmonic	5	5	5	2	2	2
Third harmonic	2	2	2	2	-	2
Fourth & each higher	1	1	1	0.3	-	0.3
All sub-harmonics	-	-	-	0.3	0.3	0.3
Total harmonics	5	5	5	2	2	2

Note: Measurement of harmonics at frequencies above 10 kHz is not required. For air conduction, distortion shall be measured acoustically on an acoustic coupler. For bone conduction, distortion shall be measured on a mechanical coupler. At test signals > 4000 Hz, measurements will be done electrically.

Table 3
Reference Threshold Levels
(See definitions in notes below)

Freq (Hz)	"A" TDH50 303/9A	"B" TDH50/318	"C" B71/ Mastoid	"D" B71/ Forehead	"E" Sgl Ins/ 126/HA2	"F" SPKR 0 Deg	"G" SPKR 45 Deg	"H" 3A/126 HA-2	"I" 3A/711 EAR Sim	"J" NBN/ ISO	"K" SENN HDA200
125	47.5	45.0	---	---	---	24.0	23.5	26.0	28.0	4	29.5
250	26.5	27.0	67.0	79.0	23.5**	13.0	12.0	14.0	17.5	4	18.0
500	13.5	13.5	58.0	72.0	16.5**	6.0	3.0	5.5	9.5	4	9.5
750	8.5	9.0	48.5	61.5	10.5**	4.0	0.5	2.0	6.0	5	6.5
1000	7.5	7.5	42.5	51.0	9.0 **	4.0	0.0	0.0	5.5	6	6.5
1500	7.5	7.5	36.5	47.5	9.0 **	2.5	-1.0	2.0	9.5	6	5.5
2000	11.0	9.0	31.0	42.5	13.5**	0.5	-2.5	3.0	11.5	6	3.0
3000	9.5	11.5	30.0	42.0	9.5**	-4.0	-9.0	3.5	13.0	6	3.0
4000	10.5	12.0	35.5	43.5	1.5**	-4.5	-8.5	5.5	15.0	5	8.5
6000	13.5	16.0	40.0	51.0	0.5**	4.5	-3.0	2.0	16.0	5	9.5
8000	13.0	15.5	40.0	50.0	---	13.5	8.0	0.0	15.5	5	16.0
12000	17.5*	---	---	---	---	13.5	11.5	---	---	5*	27.5
Speech	20.0	20.0	55.0*	63.5*	21.5**	16.5	12.5	12.5	18		
9000						15.5	10.5			5	17.0
10000						15.5	11.0			5	21.5
11200						14.0	10.0			5	21.0
12500						13.0	11.5			5	27.5
14000						18.0	16.0			5	37.5
16000						44.5	43.5			5	58.0
18000										5	83.0
20000										5	105.0

Definitions:

"A" Telephonics earphone TDH-50P re 20µPa calibrated in 9A coupler (ANSI 3.6)
"B" Telephonics earphone TDH-50P re 20µPa calibrated in IEC 318 coupler (ISO 389 -1991)
"C" Radioear bone vibrator B71 (unoccluded test ear) mastoid position Re 1un ISO 389-3 - ANSI 3.43
"D" Radioear bone vibrator B71 (unoccluded test ear) forehead position Re 1un ISO 389-3 - ANSI 3.43
"E" Single insert phone Re 20µPa calibrated in IEC 126 coupler
"F" Sound Field System @ 0 degree azimuth ISO 389-7
"G" Sound Field System @ 45 degree azimuth (Ref. ISO 389-7) & ISO 8253-2 1992
"H" EAR 3A calibrated in IEC 126 coupler ISO 389 Amendment 1
"I" EAR 3A and Single Insert calibrated in IEC 711 coupler ISO 389 Amendment 1
"J" Reference levels for narrow band noise relative to pure tone per ISO 389-4. White noise reference levels equivalent to narrow band reference levels. White noise disabled above 12 kHz.
"K" Sennheiser HDA 200 High Frequency Earphones (option)

* = interpolated
** = values determined by GSI
§ = rounded from 16.1

Table 4
Narrow Band Masking Noise:
Upper and Lower Cutoff Frequencies
at the 3 dB Points of the Spectral Density

Center Frequency (Hz)	Lower cutoff Frequency (Hz)		Upper cutoff Frequency (Hz)	
	Min	Max	Min	Max
125	105	111	140	149
250	210	223	281	297
500	420	445	561	595
750	631	668	842	892
1000	841	891	1120	1190
1500	1260	1340	1680	1780
2000	1680	1780	2240	2380
3000	2520	2670	3370	3570
4000	3360	3560	4490	4760
6000	5050	5350	6730	7140
*8000	6730	7130	8980	9510
*12000	10092	10693	13464	14275

* due to the limitations of existing couplers and artificial ears, acoustic measurements are not required.

Upper and Lower Cutoff Frequencies at the 3 dB Points of the Spectral Density for the High Frequency Option. (Measure Electrically)

Center Frequency (Hz)	Lower Cutoff Min	Frequency (Hz) Max	Upper Cutoff Min	Frequency (Hz) Max
8000	6730	7130	8980	9510
9000	7570	8020	10100	10700
10000	8410	8910	11220	11890
11200	9420	9980	12570	13320
12500	10510	11140	14030	14870
14000	11770	12470	15710	16650
16000	13450	14250	17960	19030
18000	15138	16042	20196	21413
20000	16820	17815	22440	23792

Table 5
Compatible stimuli between channels

Channel 1

	Tone	Mic	Tape A	Tape B	NBN	SPN	WTN*
Tone	V	V	V	V	V	X	V
Mic	V	V	V	V	X	V	V
Tape A	V	V	V	V	X	V	V
Tape B	V	V	V	V	X	V	V
NBN	V	X	X	X	V	X	X
SPN	X	V	V	V	X	V	X
WTN*	V	V	V	V	X	X	V

V = Valid combination of stimuli between channels.
X = Invalid combination of stimuli between channels.
* = If WTN is selected on both channels, then it is calibrated for speech. If WTN is selected on only one channel, it will be calibrated according to the stimulus on the opposite channel.
The selection of Tone or NBN on one channel and Speech type signal on the other is a valid combination provided that R/L or L/R routing is not selected.

Table 6
Compatible stimuli and test types

	Tone	Mic	Tape A	Tape B	NBN	SPN	WTN
FM	V	X	X	X	X	X	X
Pulsed	V	X	X	X	V*	X	X**
FM + Pulsed	V	X	X	X	X	X	X
Alt	V	X	X	X	X*	X	X
SISI	V	X	X	X	X	X	X
FM & SISI	V	X	X	X	X	X	X
FM & Alt	V	X	X	X	X	X	X

V = Valid combination of signal and test type.
X = Invalid combination of signal and test type.
** = When WTN/WTN is the selected stimulus, calibration for WTN will be for speech signals.
* = Valid for situations when NBN is selected for both channels.

Table 7

Characteristic data for equivalent free field response $G_f - G_c$ in dB

F in Hz	TDH 50
125	-19
160	-17*
200	-14.5*
250	-12
315	-9*
400	-5, 5*
500	-2, 5
630	-1
750	-
800	-2
1000	-3
1250	-2
1500	-
1600	-6, 5
2000	-9
2500	-10, 5
3000	-
3150	-12, 5
4000	-13
5000	-8, 5
6000	-
6300	-12
8000	-7, 5

* interpolated

Table 8

Max permissible radiated noise

Frequency in Hz	Max permissible Rad noise SPL (dB)	Model 51 Cush Attenuation (dB)	Max permissible rad noise w/ modified 51 cushion
125	17	9.8	26.8
250	10	7.5	17.5
500	5	8.4	13.4
1000	4	15	19
2000	5	24.7	29.7
3150	1	29.8	30.8
4000	-1	30.1	29.1
6300	6	29	35
8000	12	28.2	40.2

Notes:

1. The radiated noise levels from the instrument at 1 meter shall meet the requirements specified in this table.
2. Model 51 cushion attenuation is from J. Acoust. Soc. Am. 70(5), Nov 1981 Pp 1235-1238.
3. Maxinium permissible radiated noise SPL is based on ISO/DIS 8253-2 p.9, Table 2.
4. dB SPL re: 20 µPa.

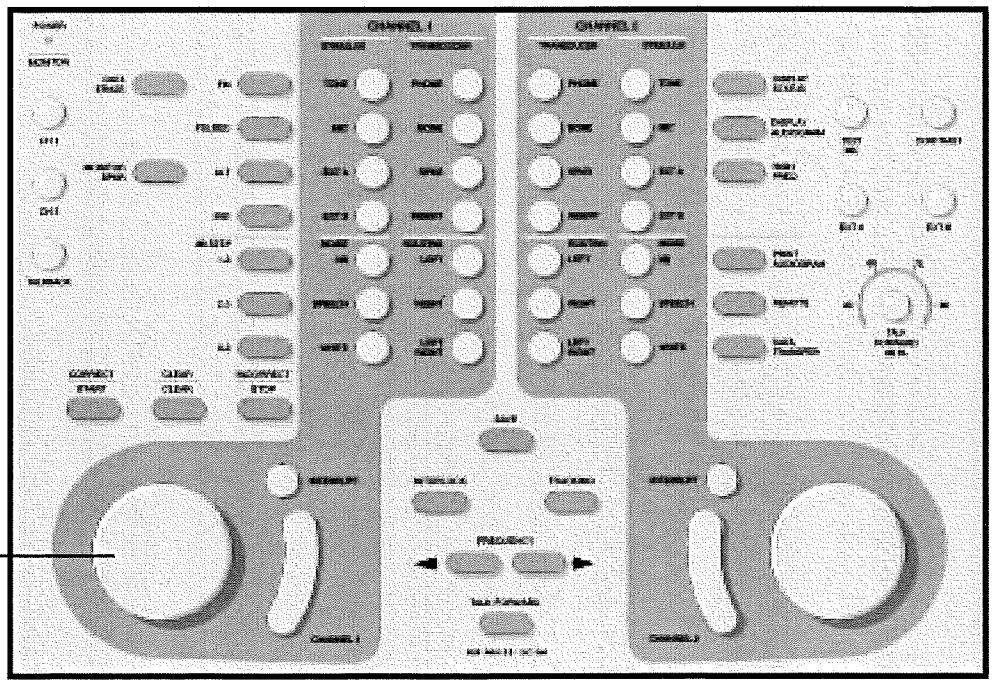
Functional Specifications

2

The GSI 61 Clinical Audiometer is a microprocessor controlled, two channel Audiometer for use in the clinical/diagnostic environment. It has two separate sets of controls, one for each of the channels. Each channel can be operated independently by its tone bar, or the two channels can be activated simultaneously through the use of the interlock button. The GSI 61 permits the routing of the test signal through earphones (matched TDH-50P), a bone vibrator (B71), optional loudspeakers, optional Paired Insert Phones (EAR) or single Insert Phone, and optional High Frequency (Sennheiser HDA 200) Earphones.

All data, including the instrument selected parameters, are displayed on an articulating Liquid Crystal Display (LCD). Pure tone test results are presented in either a "status" or audiogram format. The status format clearly shows all test conditions and permits the calibration check of input from the microphone or from recorded test materials. The audiogram format for pure tone testing displays the stored threshold values for the patient under test. The display can be tilted to improve the viewing angle for an individual user and to allow easy access to the rear jack panel.

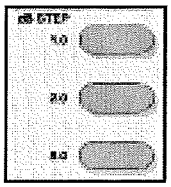
The controls on the front panel of the GSI 61 are shown below.



Attenuators (HL Controls) Channel 1 and Channel 2

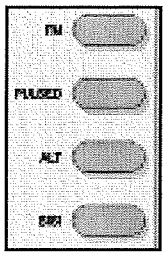
The GSI 61 contains two independent HL rotary controls for test signal and masking intensity level control with a range of -10 dB HL to 120 dB HL. (If the High Frequency option using Sennheiser earphones is installed and active, the High Frequency intensity level control ranges from -20 dB HL to 110 dB HL.)

dB Step Size



These pushbuttons allow the operator to change the intensity step size to 1.0, 2.0 or 5.0 dB. When the GSI 61 is powered up, the dB step size is automatically set to the default of 5 dB increments. These pushbuttons are also used to select the intensity increase when testing in the SISI mode.

Signal Format Selectors



FM - (Frequency Modulation or Warble Tone)
This pushbutton enables pure tones to be warbled at a rate of 5 Hz with a ± 5% allowable deviation around the selected center frequency. FM is available in all pure tone test modes, including SISI, Pulsed, ALT and High Frequency (optional).

Pulsed - This pushbutton causes the tone to be pulsed at the rate of 200 msec ON, 200 msec OFF. Note that the Pulsed tone is not available in SISI or ALTernate test conditions. When a speech test mode is activated, Pulsed is no longer activated.

Alternate - This pushbutton locks both channels together and alternates the tone presentation between the two channels: 400 msec ON Channel 1, 400 msec OFF Channel 1, 400 msec ON Channel 2, 400 msec OFF Channel 2. Both channels receive TONE as the input stimulus. The frequency is automatically set to 1000 Hz and the dB step size, HL settings and the routing reflect the conditions prior to the selection of ALTernate test type. The tones can be manually presented by depressing either PRESENT bar or automatically presented by pressing either INTERRUPT button. The intensity of the tones can be adjusted independently by use of the Channel 1 and Channel 2 attenuators.

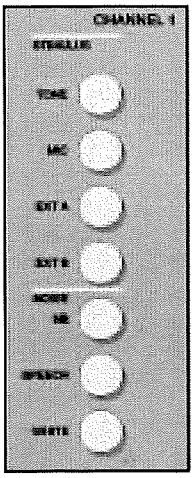
SISI - This pushbutton provides an intensity increment every 5 seconds to a steady or FM tone in the selected channel for 200 milliseconds. The SISI test may be run at step sizes of 1.0, 2.0 or 5.0 dB. When SISI is selected, the GSI 61 automatically initializes Channel 1 to receive tone and Channel 2 to receive NB noise. The step size is initialized to 5.0 dB but may be changed to either 1.0 or 2.0 dB at any time during the test. Channel 1 and Channel 2 are set to 0 dB HL; the frequency is set to 1000 Hz. Output transducer and routing reflects the state of the GSI 61 prior to the selection of SISI. Depress the Interrupt pushbutton to allow the SISI increments to be presented every 5 seconds. Press the Interrupt button a second time to terminate the SISI presentation. (Operating the Channel 2 tone bar with Interlock selected in SISI also terminates the SISI increment presentation.)
In order to deselect the preselected signal format, change to any non-compatible test stimulus or push the same signal format again. The following table illustrates the compatibilities of test stimulus and signal formats.

VALID SIGNAL FORMATS/ STIMULUS COMBINATIONS

	TONE	MIC	EXT A	EXT B	NBN	SPEECH	WHITE
FM	V	X	X	X	X	X	X
PULSED	V	X	X	X	V	X	V*
ALT	V	X	X	X	V	X	V*
SISI	V	X	X	X	X	X	X

V = Valid combination of signal format and stimulus.
X = Invalid combination of signal format and stimulus.
* = When White/White is selected stimulus, calibration for White noise will be for speech.

Stimulus Channel 1 and Channel 2



Tone — The Tone pushbutton allows the selection of a pure tone presentation for air/bone conduction testing with the choice of four transducer types; Phone (both the standard TDH 50P and the optional High Frequency earphones), Bone, Speaker, or Insert. When Tone is selected, Narrow Band Noise automatically routes to the opposite channel if the stimulus type on the opposite channel is not compatible with Tone. **Note that the selection of Tone on one channel and Mic on the opposite channel is a valid combination. This setting allows the operator to have contact with the patient, especially a young child, without the need to select Talk Forward.**

Mic — The Mic pushbutton provides input capability from the test microphone for live-voice testing with the choice of four transducer types: Phone, Bone, Speaker, or Insert. When Mic is selected, Speech Noise automatically routes to the opposite channel if the stimulus type on the opposite channel is not compatible with MIC. **Note that the selection of Mic on one channel and Tone on the opposite channel is a valid combination. This setting allows the operator to have contact with the patient, especially a young child, without the need to select Talk Forward.**

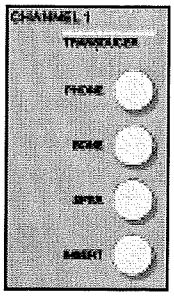
Ext A, Ext B — External A and External B accept recorded speech material from an optional compact disc player, a two channel tape cassette or a reel-to-reel tape recorder. When Ext A or Ext B is selected on one channel, Speech Noise automatically routes to the opposite channel if the stimulus type on the opposite channel is not compatible with Ext A or Ext B. Note that the selection of Ext A, or Ext B, on one channel and Tone on the opposite channel is a valid combination.

Narrow Band Noise — The NB Noise pushbutton selects narrow band noise. This is a noise centered at each test frequency and available for all frequencies with a 3 dB down bandwidth of greater than octave but less than ½ octave. The maximum dB HL is 15 dB below the maximum pure tone level and is calibrated in effective masking.

Speech Noise — The Speech Noise pushbutton selects speech noise. This is a white noise filtered to a low and middle frequency band, simulating the average spectrum of conversational speech. Speech noise is calibrated in effective masking level and consists of equal energy per frequency from 250 to 100 Hz with a 12 dB/octave roll-off from 1000 to 6000 Hz. The maximum dB HL for speech noise is equal to the maximum HL for the speech type signals in each transducer.

White Noise — This pushbutton selects White Noise. White noise is a broad band signal containing acoustic energy at all frequencies between 125 Hz and 12000 Hz. White noise is calibrated for pure tone effective masking if a tone type signal is selected on the opposite channel, and for speech effective masking if a speech type signal is selected on the opposite channel. The maximum HL for white noise selected with a tone signal is 35 dB below the maximum pure tone level. The maximum HL for white noise selected with a speech signal is equal to the maximum HL for the speech signal.

Transducer Output Selector

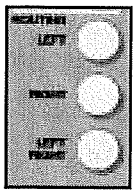


These pushbuttons allow the easy selection of the transducer for each stimulus available for Channel 1 and Channel 2. A transducer selection may be changed at any time.

VALID TRANSDUCER COMBINATIONS

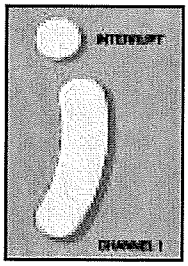
Channel 2	Channel 1			
	Phone	Bone	Speaker	Insert
Phone	Valid	Valid	Valid	Valid
Bone	Valid	Valid	Valid	Valid
Speaker	Valid	Valid	Valid	Valid
Insert	Valid	Valid	Valid	Valid

Routing Output Selector



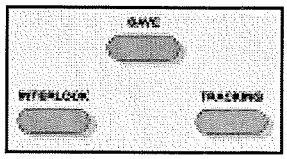
These pushbuttons allow the easy selection of the routing from the stimulus to the output transducer available for Channel 1 and Channel 2. When first powered on, the routing for Channel 1 will be right and the routing for Channel 2 is left. Left/Right mixes the stimuli from both channels to each transducer and drives both the left and right transducers with the combined signal. Both the Channel 1 and Channel 2 maximum dB HL limits in mixing are appropriately decreased from the non-mixed maximum dB HL limits. Left/Right -Left/Right routing is restricted to Phone/Phone, Speaker/Speaker and Insert/Insert (paired insert option). Left/Right routing is invalid for bone and the single insert phone.

Tone Bar / Interrupt



Each tone bar operates independently to cause the presentation of the selected stimulus for as long as the bar is depressed. The channel turns off immediately when the bar is released. When ALTernate is selected and the tone bar is released, the complete presentation of both channel signals is completed. These pushbuttons determine the status of the respective tone bars and operate independently of each other. When the Interrupt is in the off position, the corresponding channel is activated by depressing the Tone bar and deactivated by releasing the Tone bar. To turn on the Interrupt, press the pushbutton. When Interrupt is in the on position, the corresponding channel is deactivated by pressing the Tone bar and activated by releasing the bar. When Interrupt is active, an icon is displayed on the LCD. Note that in the ALTernate test mode, the Interrupt pushbuttons do not operate independently of each other.

Interlock



This pushbutton locks both tone bars together so that operating one channel will also operate the other, according to the status of the Interrupt buttons. To unlock the Tone bars, press the Interlock button again. When the Interlock is active, a message is displayed on the LCD.

Save

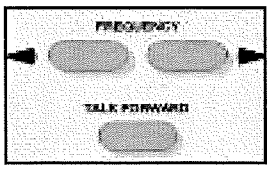
This pushbutton, when pressed saves: the current dB HL level representing the threshold level, and effective masking level if selected, transducers and routing. In the Display Audiogram format, the appropriate symbol appears for each Save press.

Tracking

This pushbutton allows the Channel 2 hearing level to track the Channel 1 hearing level by a selected dB difference. When in Tracking, any dB change to the Channel 1 HL causes the Channel 2 HL to change by the same amount, until the limit of the Channel 1 transducer is reached. If the dB HL limit is reached in Channel 2 before

Channel 1, the Channel 2 dB HL display will temporarily flash and remain at this level. Tracking remains on. When the Channel 1 dB returns to a level at which the selected difference between the two channels can resume, Channel 2 again tracks Channel 1. Tracking is in the off state upon initialization of any test type. Once tracking is selected, it is possible to manually change the intensity of Channel 2 to alter the dB difference between the two channels without deselecting Tracking. To exit Tracking, press the button again. When Tracking is active, a message is displayed on the LCD.

Frequency Up/Down

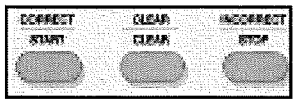


These pushbuttons allow the choice of twelve standard audiometric frequencies: 125 Hz, 250 Hz, 500 Hz, 750 Hz, 1000 Hz, 1500 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz, 8000 Hz and 12000 Hz. If the high frequency option is activated, these pushbuttons allow a choice of nine high frequencies: 8 kHz, 9 kHz, 10 kHz, 11.2 kHz, 12.5 kHz, 14 kHz, 16 kHz, 18 kHz, and 20 kHz. Each press of the right (→) pushbutton selects the next higher frequency. Each press of the left (←) pushbutton selects the next lower frequency. The new frequency is selected when the pushbutton is released. When at the lower limit of the frequency selection, pressing the (←) pushbutton will cause the display to roll over to the highest frequency limit, and vice versa. If a transducer with a narrower range is selected, only valid frequencies for that transducer are available.

Talk Forward

Pressing this pushbutton allows the operator to speak directly to the patient through the microphone at the level set by the Talk Forward control by interrupting the stimulus presentation. Talk Forward can be used with any available transducer, including the optional High Frequency earphones. While Talk Forward is on, the only control which can be activated is the Print, if available. The GSI 61 resumes the test status held prior to pressing the Talk Forward pushbutton when the pushbutton is released.

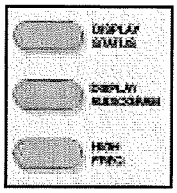
Scorer/Timer



The Correct, Clear and Incorrect pushbuttons are used for scoring results in Speech, ALTernate or SISI tests. The scorer is displayed in the test status area of the Status screen. When Speech, SISI or ALT is selected, the scorer initializes to 0/0 = 0%. The operator presses the Correct or Incorrect pushbutton after each presentation, depending on the response. The display indicates the number of correct responses and the total number of presentations along with the percentage of those correctly identified. The display clears with the pressing of the Clear pushbutton.

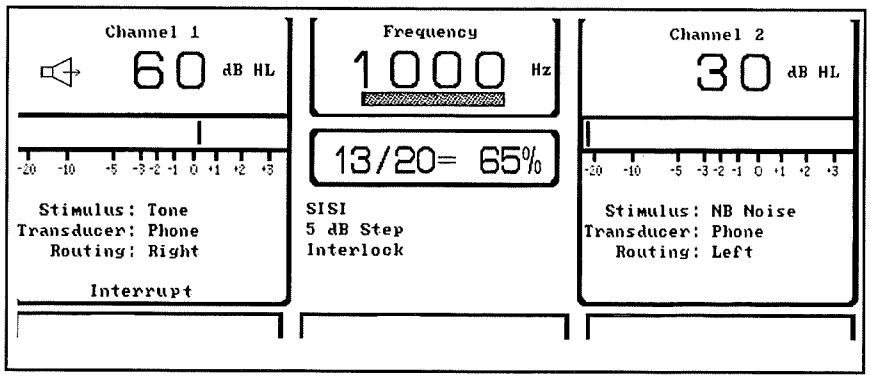
During tone tests (excluding ALTernate and SISI), the Scorer/Timer pushbuttons may be used to start, clear and stop the timer. The timer is displayed in the test status area of the Status screen. When the timer is first selected, it initializes to 0:00 (0 minutes: 00 seconds). The timer starts when the Start pushbutton is pressed. Times up to 199 minutes and 59 seconds may be displayed before the timer resets to 0:00. The timer may be halted at any point by pressing the Stop pushbutton. The stopped time is displayed. Upon pressing the Start pushbutton after the Stop pushbutton, timing is resumed from the currently displayed value. Pressing Clear while the timer is running is invalid. Pressing Clear after Stop resets the timer to 0:00.

Displays



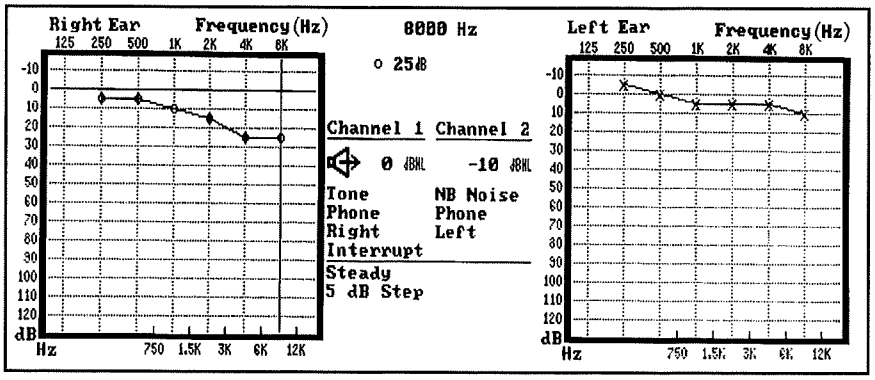
These pushbuttons are used to select the format for the screen display format on the LCD.

Display Status — When the Display Status pushbutton is pressed, the display is formatted as shown in the following Figure: Front Panel Display - Status. This display indicates the current instrument state and VU meters.



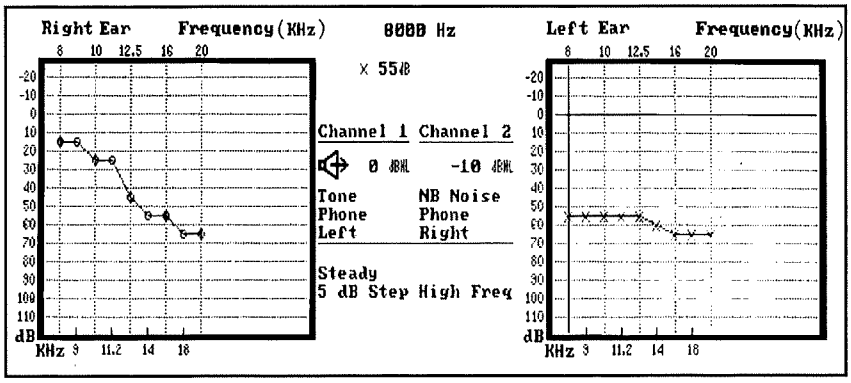
Display Status

Display Audiogram — When the Display Audiogram pushbutton is pressed, the display is formatted as shown in the following Figure: Front Panel Display - Audiogram. Two audiograms with the standard range of frequencies (125 Hz to 12,000 Hz), or the High Frequency ranges (8 kHz to 20 kHz), and the instrument status are displayed.



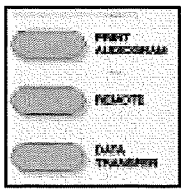
Display Audiogram

High Frequency — When the High Frequency pushbutton is pressed with the High Frequency option installed, the system allows tone testing in the extended range from 8 kHz to 20 kHz. The display remains in the Display Status or Display Audiogram format as previously selected. If the High Frequency option has not been installed and the pushbutton is pressed, the error message, "Not Available" appears in the error message area of the display.



Display High Frequency

Print Audiogram



If the printer option is available and the Print Audiogram pushbutton is pressed, the current saved test information in audiogram format is sent to the printer. If there is no data stored in the GSI 61 memory and the Print Audiogram pushbutton is pressed, the message "No Tests To Print" appears in the error message area. If the printer option is not active and the pushbutton is pressed, the message "Not Available" appears.

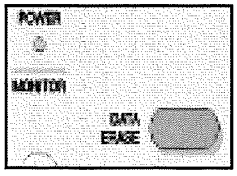
Remote

When the Remote (RS-232) option is installed, pressing the Remote pushbutton allows the GSI 61, when connected to an external computer, to transmit and receive data from this device. If the option is not installed and the pushbutton is pressed, the message "Not Available" appears.

Data Transfer

When Remote is enabled and the Data Transfer button is pressed, a data record containing the stored test data in a previously selected format is transmitted to a remote device. Data may be transferred point-by-point or as a complete battery of all saved test results. The data transfer format is set by an authorized GSI Service Engineer. If the pushbutton is pressed when the Remote option is not active, the message "Not Available" is displayed.

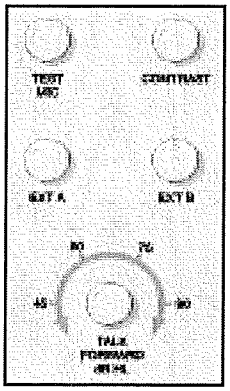
Data Erase



When the Data Erase pushbutton is pressed for at least 0.5 second, all of the stored test data in the GSI 61 is erased and the message "Erasing Data" is displayed on the LCD. If no data is stored in the GSI 61 memory, the message "No Test Data Stored" is displayed.

Contrast

This rotary control is used to set the brightness of the LCD.



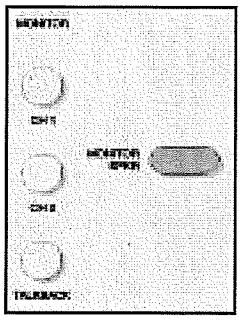
Mic, Ext A and Ext B Level Controls

These rotary controls are used to adjust the signal intensity from the test microphone or the external devices, so that the level reflects accurately on the VU meters on the Status display. These inputs are adjusted by turning the appropriate control until an indication of 0 dB on the average is obtained on the selected channel VU meter. Note: it has been suggested that for live voice speech testing, the operator should calibrate the GSI 61 to a 1000 Hz pure tone introduced into the microphone. When using an external source, calibrate to the 1000 Hz pretest tone.

Talk Forward Level Control

This rotary control allows the operator to adjust the intensity in a continuous range of 45 to 90 dB HL when giving the subject instructions through use of the Talk Forward function. The level selected by this control is calibrated to the transducer currently being used with the subject.

Monitor Controls

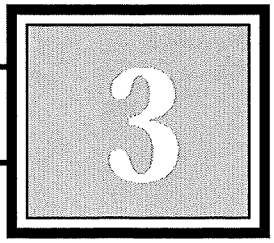


The Monitor Headphone or Speaker allows the operator to listen to the stimuli as they are presented or to listen to the patient's comments through the talk-back system. The Channel 1 and Channel 2 rotary controls adjust the intensity of the sound presented through the monitor headphone or speaker. The Talkback rotary control adjusts the intensity of the patient's voice. The Monitor Spkr pushbutton is used to turn on the Monitor Speaker. When Mic is selected, or when the Talk Forward is operated, that channel's input to the monitor speaker is disabled to reduce acoustic feedback.

Power

This Power Monitor green light emitting diode (LED), located in the upper left portion of the keypanel, is illuminated when power is supplied to the GSI 61.

Audio Peripherals

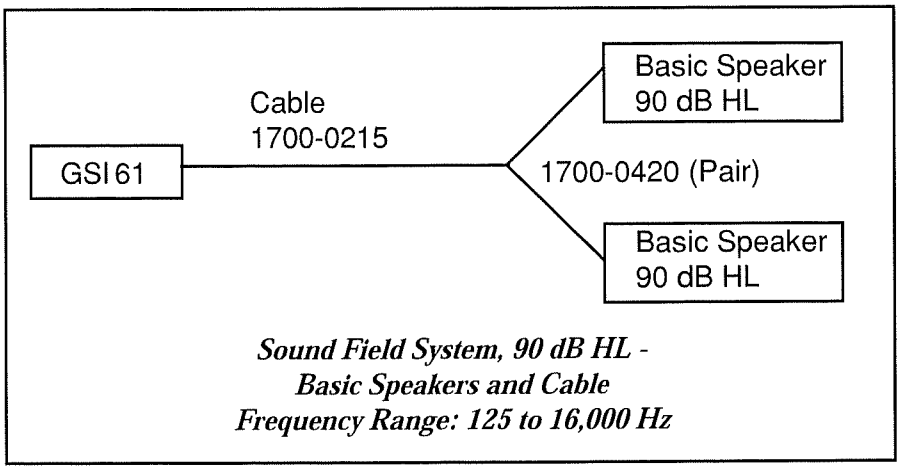


Following is a list of GSI catalog numbers and descriptions of peripherals for the GSI 61. Please refer to the Rear Panel figure in Section 1, page 1-7, for the location of the corresponding connections.

Connector #	GSI Part #	Description	
R1	**1761-9623**	**Test Microphone / Monitor Headset**	
	Consists of:	1761-0470	Test Mic / Headset Assembly
R2	**1761-9621**	**CD Player, portable** *OR*	
	1761-9622	**Stereo Tape Cassette Player**	
R3	**8000-0039**	**Talkback Microphone Assembly**	
R4	**8000-0063**	**Test Headset Assembly (Set of matched TDH 50Ps).**	
	Consists of:	8000-0062	Matched pair of TDH 50Ps
		8000-0001	Adult Headband Assembly
		8000-0009	Earphone cushion - Type 51 (2 req'd)
		4204-0160	Right Earphone Cord (Red)
		4204-0161	Left Earphone Cord (Blue)
OR	**1761-9602**	**High Frequency Headphones with GSI 61 to sound booth connector cable (¼" stereo plug to dual ¼" mono plug).**	
	Consists of:	1761-0590	High Frequency Headset
		1761-0270	Left Patch Cord (¼" stereo plug to dual "blue" mono plug)
		1761-0271	Right Patch Cord (¼" stereo plug to dual "red" mono plug)
OR	**1761-9605**	**High Frequency Cables to GSI 61 for connecting both TDH & High Frequency Phones directly to GSI 61.**	
	Consists of:	1761-0272	Left (blue) TDH/High Freq "Y" Cable (¼" stereo plug to 2 x ¼" mono jack)
		1761-0273	Right (red) TDH/High Freq "Y" Cable (¼" stereo plug to 2 x ¼" mono jack)
R5	**1700-9606**	**Paired Insert Phones (E•A•RTONE™ 3A)**	
		Including 4204-0505 Phone Patch Cords, 6', ¼", 2 ea.	
	Note:	*Replacement foam eartip numbers are:*	
	1700-9604	*Standard size, 50/Pkg.*	*1700-9605 Small size, 50/Pkg.*
OR	**1700-9609**	**Single Insert Phone**	
		Including 4204-0505 Phone Patch Cords, 6', ¼", 2 ea.	
	Consists of:	8000-0037	Insert Phone - 470 Ohms
		8000-0255	Eartip Coupler (White Nylon)
		4204-0210	Coaxial Insert Phone Cable
		1722-7024	Eartips - Set (8 Std sizes)

R6	**8000-0130**	**Bone Vibrator Assembly (B71)**	
	Consists of:	8000-0131	Bone Vibrator (B71, 50 Ohm)
		8000-0132	Headband for Bone Vibrator
		4204-0145	Cable, Bone Vibrator
R7	**7874-0156**	**Subject Response Switch**	
R8	**N/A**	**CD Player Power Jack**	
R9	**N/A**	**Access Plate** Covering Calibration Mode entry switch and bank of 8 calibration mode option switches.	
R10	**1761-9630**	**Speakers (90dB) with Cables**	
	Consists of:	1700-0420	Pair of medium sensitivity speakers
		1700-0215	Speaker Cable Assembly (DIN to spkr)
OR	**1761-9635**	**Speakers, High Performance (96 dB) with Cables**	
	Consists of:	1700-2002	Single High Performance Speaker (x2)
		1700-0215	Speaker Cable Assembly (DIN to spkr)
OR	**1761-9636**	**Booster Amp with Cable, 220-240V**	
	Consists of:	1700-0446	Power Amp, Dual Chan, 220-240V
		1761-0222	Cable, Booster Amp
OR	**1761-9637**	**Booster Amp with Cable, 100-120V**	
	Consists of:	1700-0426	Power Amp, Dual Chan, 100-120V
		1761-0222	Cable, Booster Amp
OR	**1761-9638**	**Sound Field System, 102dB, 220-240V**	
	Consists of:	1700-2002	Speaker (x2)
		1700-0446	Power Amp, Dual Chan, 220-240V
		1761-0222	Cable, Booster Amp
		0034-6400	Cable, 2 Cond., Shielded (25 Ft. long) Qty 2
OR	**1761-9639**	**Sound Field System, 102dB, 100-120V**	
	Consists of:	1700-2002	Speaker (x2)
		1700-0426	Power Amp, Dual Chan, 100-120V
		1761-0222	Cable, Booster Amp
		0034-6400	Cable, 2 Cond., Shielded (25 Ft. long) Qty 2

Sound Field System:
Basic Speakers
1761-9630



Sound Field System, 90 dB HL -
Basic Speakers and Cable
Frequency Range: 125 to 16,000 Hz

Speaker Specifications

Drivers ..... 8" Co-motional Coaxial Transducer

Power Rating ..... 40 Watts continuous program power. Continuous Program Power is defined as 3 dB greater than continuous sine wave power and is a conservative expression of the transducer's ability to handle typical speech and music program material.

Frequency Response Efficiency ..... > 93 dB
(1 Watt input pink noise at 1 meter on axis)

Impedance ..... 8 Ohms

Crossover Frequency ..... 2500 Hz

Total Harmonic Distortion with 40 W Input ..... 2% Max.

Enclosure Type ..... Air Suspension

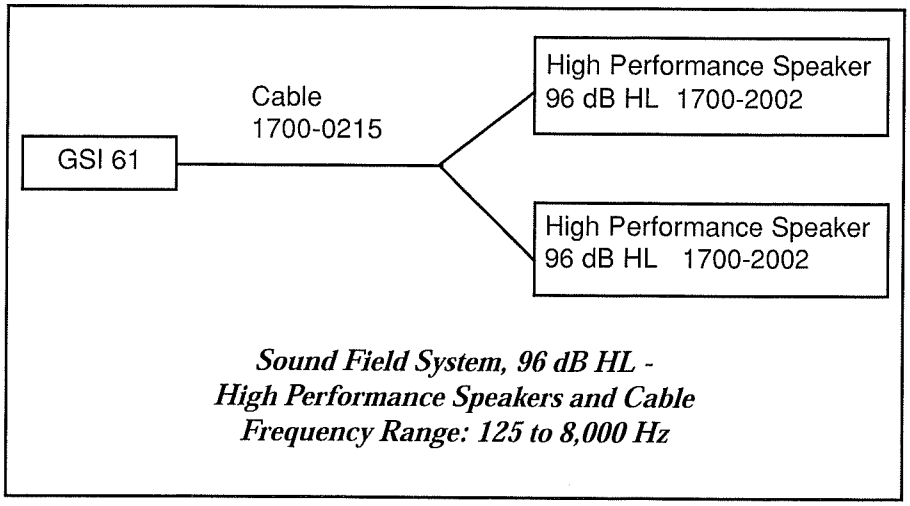
Cabinet ..... Carpeted over Chip Board

Dimensions ..... Triangular Corner Speaker.

Height:	24"
Width:	13.5"
Depth:	7.25"

Net Weight ..... 11.5 lbs. per Speaker

Sound Field System: High Performance Speakers 1761-9635



Sound Field System, 96 dB HL - High Performance Speakers and Cable Frequency Range: 125 to 8,000 Hz

Nominal Diameter ..... 200 mm (8 in.)

Rated Impedance ..... 8 Ohms

Power Capacity ..... 200 W Continuous Program Power. Continuous Program Power is defined as 3 dB greater than continuous sine wave power and is a conservative expression of the transducer's ability to handle typical speech and music program material.

Sensitivity (Typ) ..... 97 dB SPL, 1W, 1 Meter, Pink Noise from 500 Hz to 2.5 kHz

Minimum Impedance ..... 6.2 Ohms ± 10% @ 25 ℃

Voice Coil Diameter ..... 50 mm (2 in.)
Positive voltage on black terminal gives forward diaphragm motion.

Thiele-Small Parameters ..... fs: 85 Hz
Ots: 0.35
Vas: 14 L (0.5 ft^3)
Xmax: 3.0 mm (0.12 in.)
No (Half Space): 2.1%

Mounting Information

Overall Diameter ..... 299 mm (9 in.)
Bolt Circle Diameter ..... 194 mm (7 $^5/_8$ in.)
Baffle Cutout Diameter Front or Rear Mount ..... 179 mm (7 $^1/_{16}$ in.)
Typical Volume Displaced by Driver when mounted in enclosure ..... 15 L (0.02 Ft^3)
Depth ..... 98 mm (3 $^7/_8$ in.)
Net Weight ..... 3.9 Kg (8 $^9/_{16}$ lb.)
Shipping Weight ..... 4.3 Kg (9 $^3/_8$ lb.)

Speaker Installation Instructions

1. Position the speaker in the corner of the sound room on a chair or box approximately 18" high.

2. Locate 2 cross-members on each sound room wall behind the speaker. The speaker mounting brackets will be secured to these cross-members for sturdy support of the speakers.

3. Mark the edge of the speaker cabinet with a piece of chalk or rub a pencil eraser on the grill cloth at the center of each cross-member. The speaker mounting brackets will be secured to the speaker at these points.

4. Position the speaker mounting brackets on the rear sides of the speakers centered along the marks previously made. Locate them so that the center countersunk hole is on the edge of the speaker and the end countersunk hole is on the plywood.

5. Mark the hole locations and drill pilot holes for #10 hardware.

6. Secure the brackets to the speaker using 1-¼" wood screws in the edges and ¾" wood screws in the end holes.

7. Feed the unterminated end of the speaker wires through the "feed-through" hole on the sound room patch panel. **Do not patch the speaker cables through patch cords.**

8. Connect speaker wire to speaker.

9. Reposition the speaker in the corner and drill pilot holes for #10 self-tapping screws into the sound room cross-members using the mounting brackets as guides.

10. Secure the speaker to the wall using the 1-¼" #10 self-tapping screws.

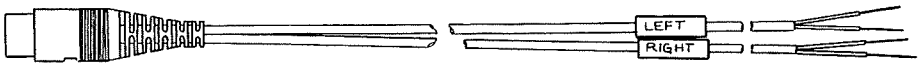
11. Route the speaker cable down the corner of the room and across the bottom of the wall and secure every 2 feet or so with cable clamps.

12. Cover wire terminations with velcro patch, provided.

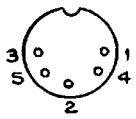
GSI 61 Loudspeaker Installation Kit Parts List (0162-0417)

Description	Part No.	Qty.
Mounting Brackets	0162-0403	4
Cable Clamp	4314-0017	10
Wood Screw #10 x ¾"	7044-0009	4
Wood Screw #10 x 1-¼"	7044-0011	4
Sheet Metal Screw #6 x ½"	7044-2524	10
Self-Tapping Screw #10 x ¼"	7044-2534	4
Velcro Hook, 2" Wide x 3.5" Long	0025-0140	1

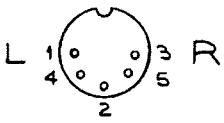
Detail of Speaker Cable - 1700-0215



Inside View



Outside View



CONNECTION CHART		
FROM	TO DIN CONN.	COLOR
LEFT +	P1	RED
LEFT -	P4	BLACK
RIGHT +	P3	RED
RIGHT -	P5	BLACK

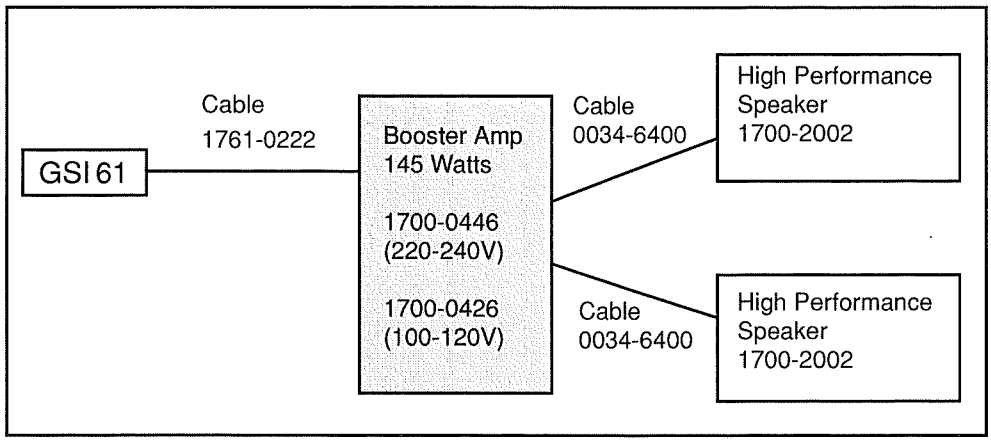
Note: L&R high (+) and low (-) signals are push/pull amp outputs. **DO NOT ALLOW EITHER + OR - TO TOUCH GROUND. DO NOT USE PATCH CORDS TO CONNECT SPEAKERS TO AUDIOMETER. FEED SPEAKER CABLE THROUGH SOUND ROOM PANEL "FEED-THROUGH" HOLE.**

Booster Amps - 1761-9636 (220-240V) & 1761-9637 (100-120V)

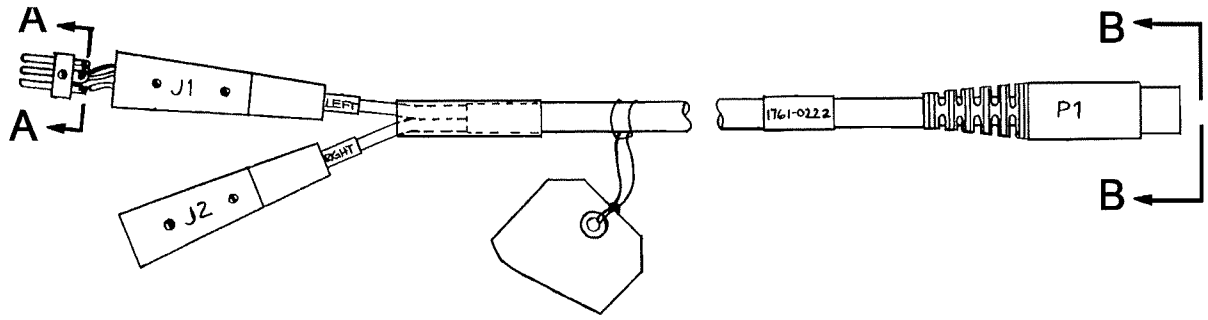
The Booster Amp Options are for customers who may already own a set of High Performance Speakers, but need the Amp and cables custom to the GSI 61. For customers who have neither, the 102 dB Sound Field System Options are available. In both cases, the following diagram shows the connection setup.

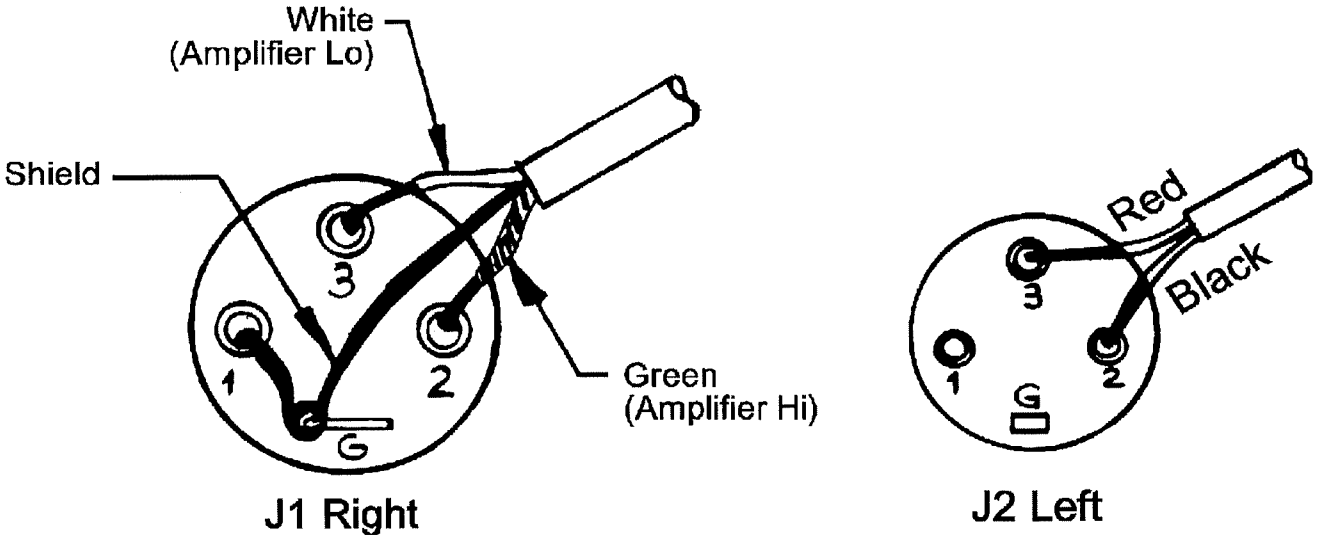
OR

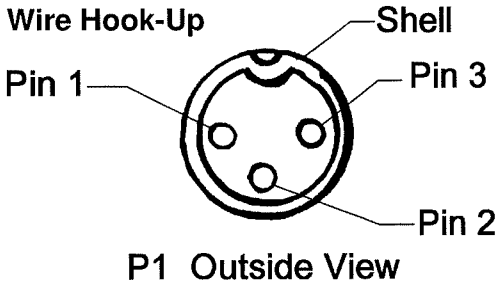
Sound Field Systems - 1761-9638 (220-240V) & 1761-9639 (100-120V)

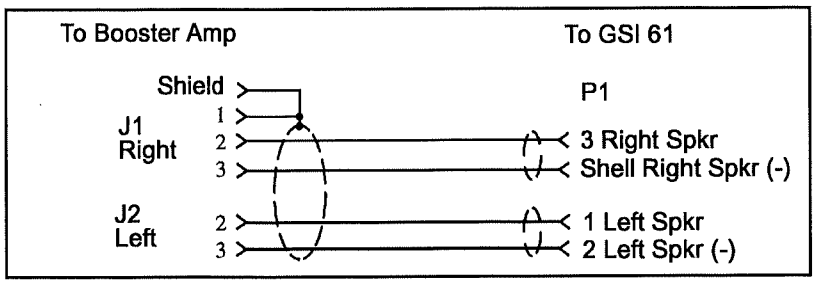


Detail of Booster Amp
Cable - 1761-0222









CONNECTION CHART			
J1 & J2	ITEM	COLOR	P1
2 - LEFT (+)		BLACK	1
3 - LEFT (-)		RED	2
G & 1	CABLE	SHIELD	N/C
2 - RIGHT (-)		GREEN	3
3 - RIGHT (-)		WHITE	SHELL

Booster Amplifier Specifications
1700-0426: 100-120V
1700-0446: 220-240V

Type ..... Two Channel Audio Power Amplifier

Gain ..... 26.5 dB (Each Channel)

Continuous Average Power Output ..... 145 Watts per Channel @ 8 Ohms
270 Watts per Channel @ 4 Ohms
400 Watts at Bridged Mono @ 8 Ohms

Frequency Response ..... ± 0.25 dB from 20 Hz to 20 kHz

Distortion ..... THD - less than 0.1% from 20 Hz to 20 kHz at Rated Power
SMPTE - IMD less than 0.01% at Rated Power

Hum / Noise ..... -104 dB below rated output (unweighted 20 kHz bandwidth)

Slew Rate ..... Typically 40 Volts per Microsecond

Input Sensitivity ..... 1.5V RMS for rated output

Damping Factor @ 8 Ohms ..... 250, 20 Hz to 1 kHz @ 8 Ohms

Input Impedance ..... 15 K Ohms Nominal balanced or unbalanced bridging

Input Connectors ..... (2) ¼" Phone Jacks and (2) XLR Jacks
(Balanced and Unbalanced)

Cooling ..... Passive - Combined with High Efficiency
Output Stage for reduced operating temperature, built-in internal fan

Output Connectors ..... Dual 5-way binding posts

Controls and Indicators ..... (Front Panel - AC Main Power Switch
Power On LED, Channel 1 and Channel 2 Level Controls. Signal and Clip Indicators, Mono Bridge Switch, Ground Lift

Amplifier and Load Protection ..... Indefinite short circuit, Open circuit, and over-temp protection. Stable under reactive and mismatched loads. Inputs protected from overload. DC fault, transient and excess low frequency protection.

Dimensions ..... 5.25" H (13.3 cm) 19" W (48.3 cm)
11.875" (30.2 cm) Behind Panel
13.375" (34 cm) Overall

Weight ..... 30 lbs. (13.6 Kg)

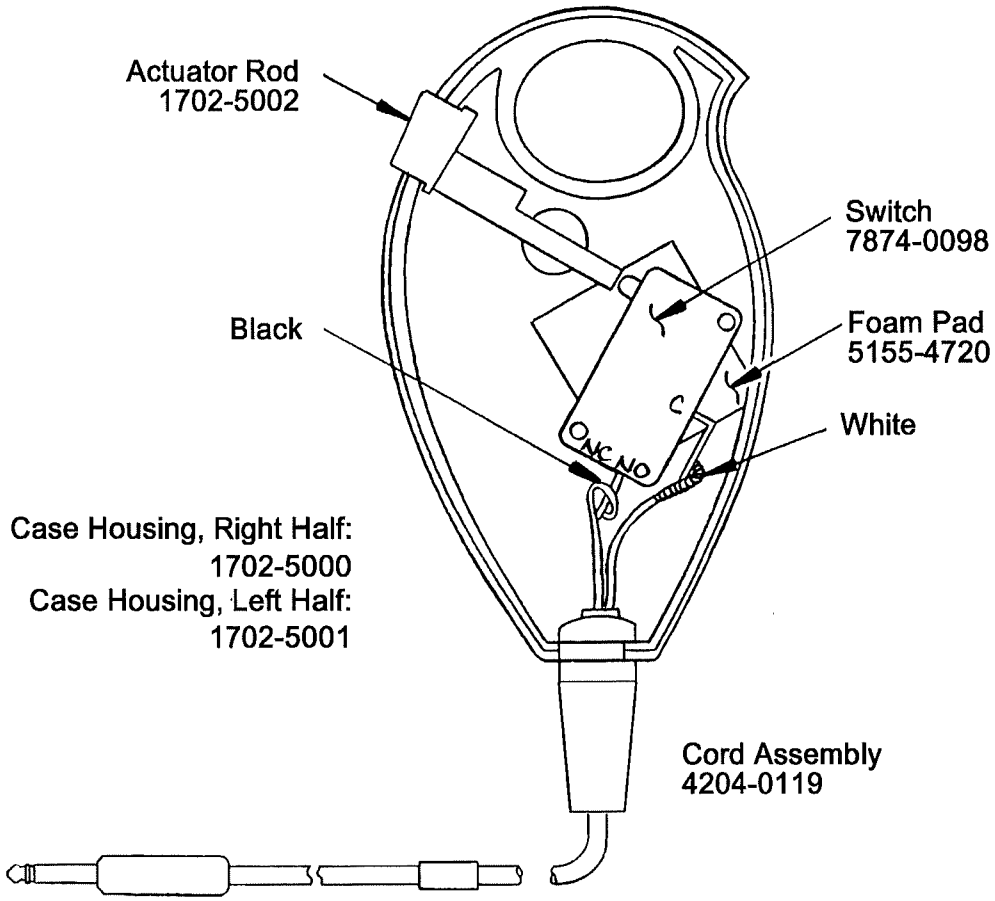
Shipping Weight ..... 34 lbs. (15.5 Kg)

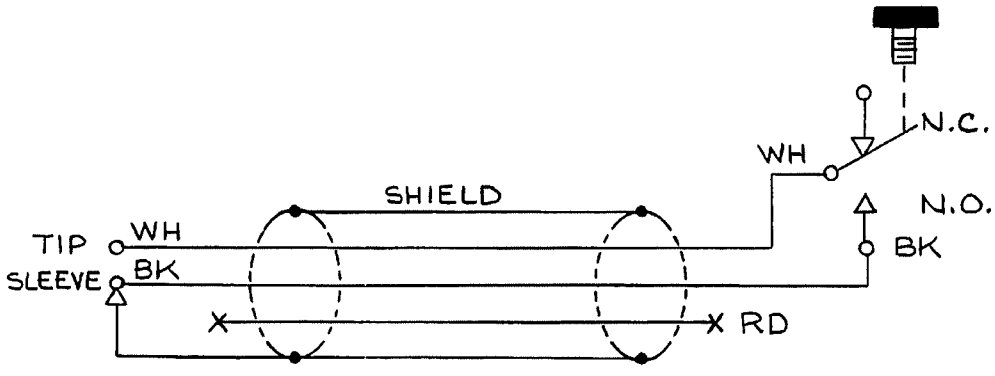
Power Requirement

For 1700-0426, 100-120V ..... 100-125 VAC, 50-60 Hz
90W (Idle), 500W (Max)

For 1700-0446, 220-240V ..... 220 VAC, 50-60 Hz
90W (Idle), 500W (Max)

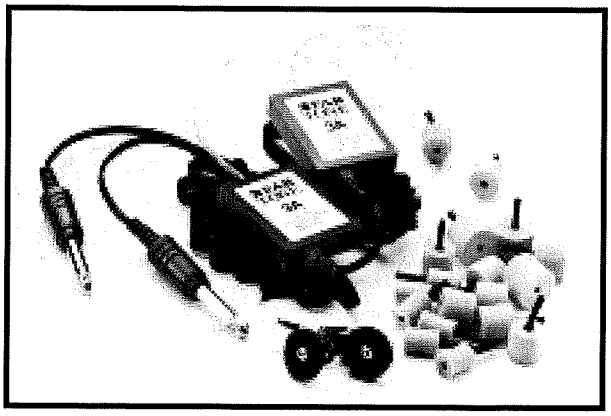
Handswitch Assembly
Detail - 7874-0156





Schematic

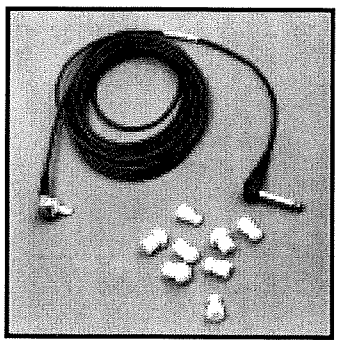
E•A•RTONE™ 3A Insert Earphone Set - 1700-9606



There are two insert earphones options available for use with the GSI 61. The first option is the paired E•A•RTONE™ 3A Insert Phone Set which allows for the use of these insert phones in addition to the TDH 50P earphones. The phones are connected to the panel on the rear of the GSI 61 in the positions labeled Insert Left and Insert Right.

The use of these earphones is recommended in order to minimize collapsing of the ear canals while reducing the occlusion effect seen in bone conduction testing when the ear is covered. Inset phones are ideal for hearing aid evaluations where they can be used to accurately simulate situations for speech testing of hearing aided patients. Noise exclusion is improved at low frequencies where background noise may be a problem. These insert phones may be used with the tome (125 Hz to 8000 Hz), speech and noise signals.

Single Insert Phone- 1700-9609



The second inset phone option is a single phone. This insert may be used with tone (250 Hz to 6000 Hz), speech and noise signals.

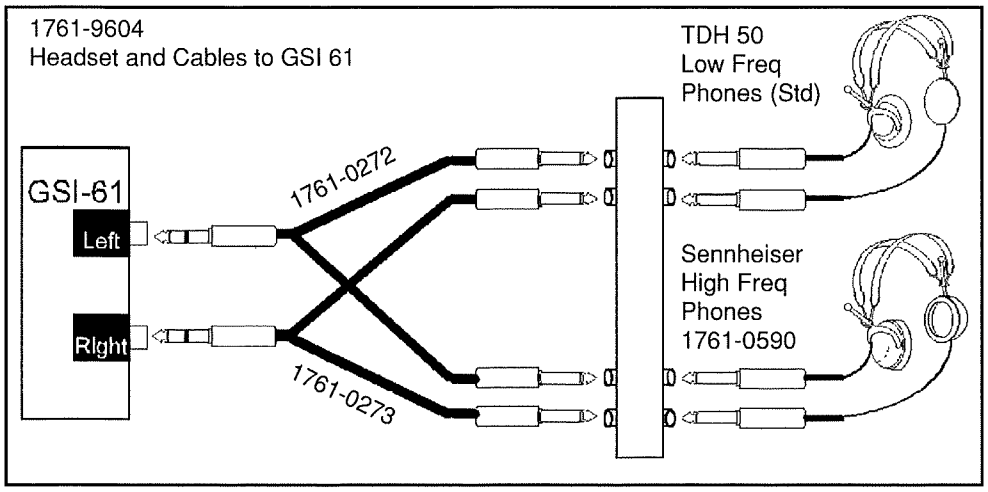
Note: When the single insert phone option is used, the insert phone is connected to the rear of the GSI 61 at the Insert Left position.

High Frequency Earphones - 1761-9604 (to GSI 61)

The option exists to include high frequency audiometry on the GSI 61. The High Frequency earphones are connected to stereo cable extensions which in turn are connected into the Right and Left phone jacks on the rear panel. When the High Frequency Option is installed, connect the standard TDH 50P earphone cords into the stereo cable extensions labelled Std. The following two figures show the installation of the High Frequency and TDH 50P earphones.

When the Sennheiser High Frequency phones are used and the High Frequency option is enables, the frequencies available for testing are 8 kHz, 9 kHz, 10 kHz, 11.2 kHz, 12.5 kHz, 14 kHz, 16 kHz, 18 kHz and 20 kHz. The intensity range is from -20 dB to 110 dB HL. High Frequency audiometry can also be performed in Sound Field using the Basic Speakers configuration. In High Frequency Sound Field, the frequencies of 8 kHz, 9 kHz, 10 kHz, 11.2 kHz, 12.5 kHz, 14 kHz and 16 kHz are available.

Cable Set - 1761-9605 (from Headphones to GSI 61)

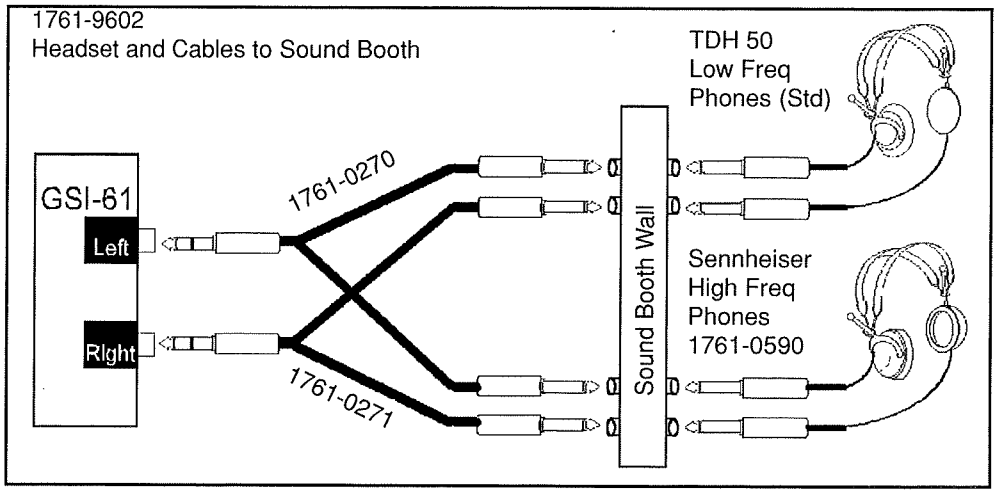


High Frequency Option Setup - Without Sound Booth

Cables without Headset, 1761-9605, consists of same two cables: 1761-0272 and 1761-0273.

High Frequency Earphones - 1761-9602 (to Sound Booth)

Cable Set - 1761-9603 (from Sound Booth to GSI 61)

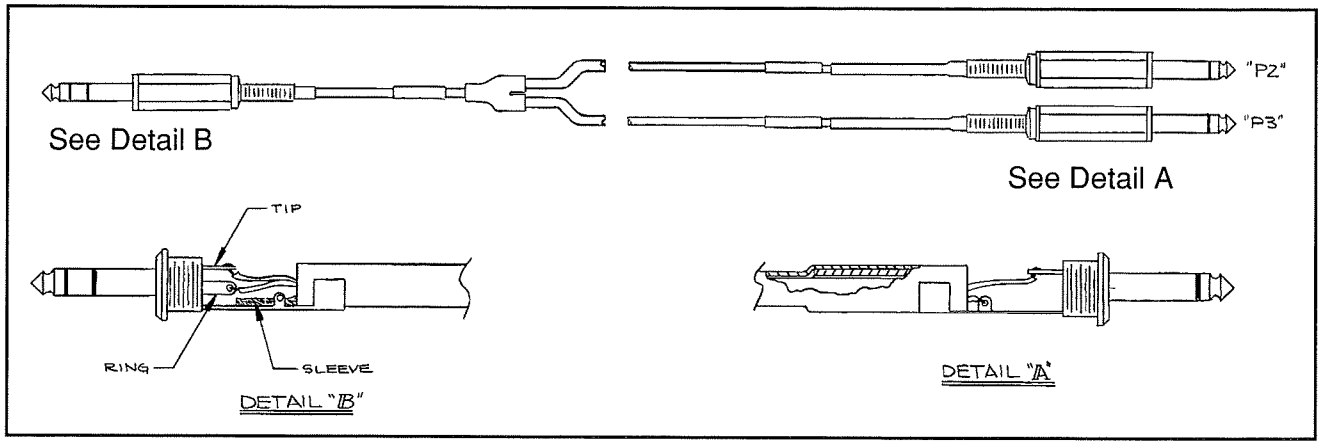


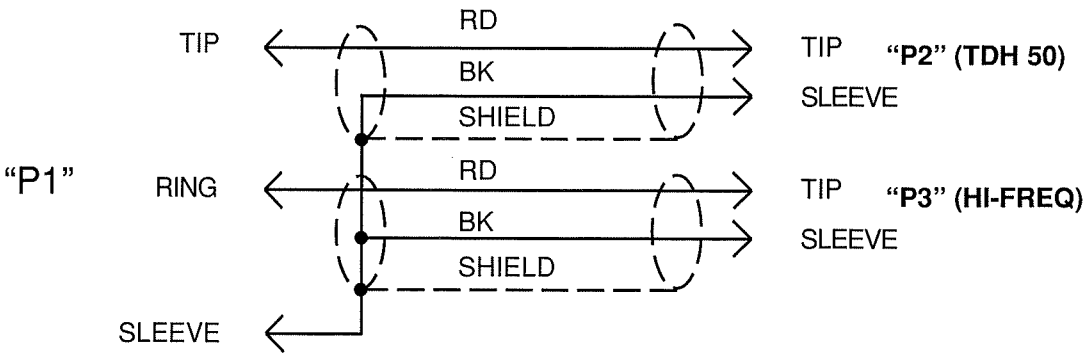
High Frequency Option Setup - With Sound Booth

Cables without Headset, 1761-9603, consists of same two cables: 1761-0270 and 1761-0271.

Detail of Cables, Patch, M/M: 1761-0270 (L) 1761-0271

Assembly and Schematic is the same for these two cables; their only difference is that one is red, and one is blue.

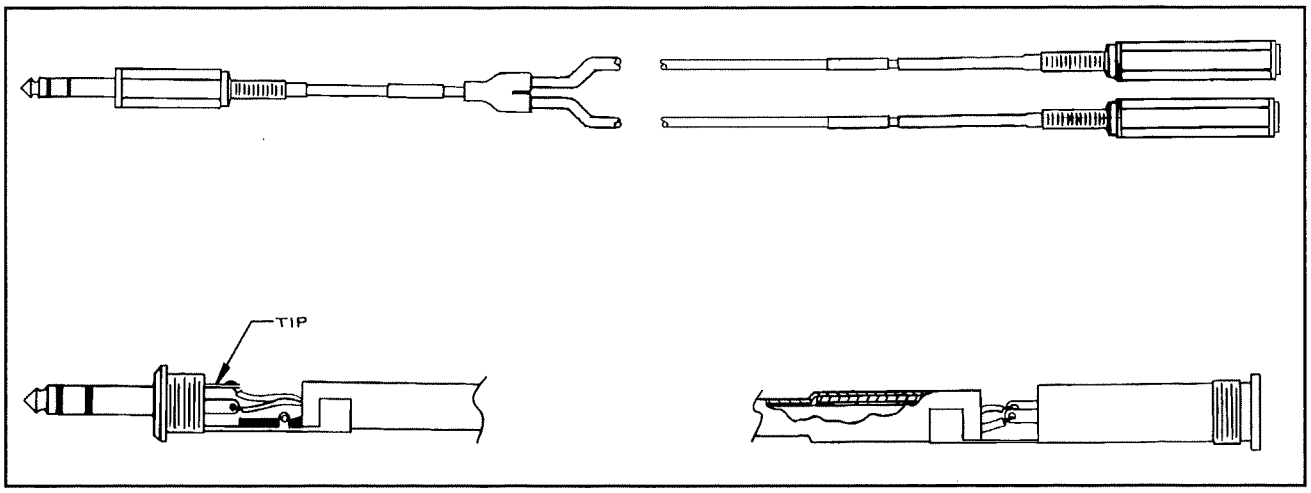


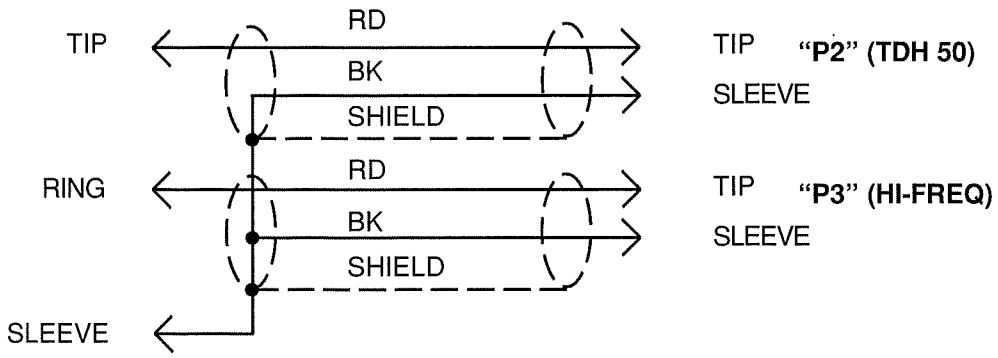


Note: Shield is not connected to P2 or P3.

Detail of Cables, Patch, M/F:
1761-0272 (L)
1761-0273 (R)

Assembly and Schematic is the same for these two cables; their only difference is that one is red, and one is blue.





Note: Shield is not connected to P2 or P3.

Detail of CD Player - 1761-9621

Specifications

8 Hour play on 2 AA batteries
Supplied with Line Out cord (Mini stereo to 2 Phono)

Frequency Response: 20 Hz to 20 kHz, +1/-2 dB

Output:

Phones	15 mW + 15 mW @ 16 Ohms
Line Output	0.7 V RMS @ 50 K Ohms

Operating Temp: 5 °C to 35 °C (41 °F to 95 °F)

Power Requirement: 4.5 VDC Min, 500 mA

This CD Player has been specially modified for use with the GSI 61 Audiometer. To install the CD Player:

1. Connect the power cable to the rear of the CD Player. This connector is identified by a yellow ring.
2. Connect the other end of the power cable to the 

position, indicated by the part number 1761-9621 on the jack panel of the GSI 61.
3. Connect the Y cable, Mini stereo to RCA plug, to the LINE OUT position on the side of the CD Player.
4. Connect the red RCA plug on the Y cable to the 

position, and the white RCA plug to the 

position on the jack panel of the GSI 61.
5. Place the CD Player on a level surface next to the GSI 61.

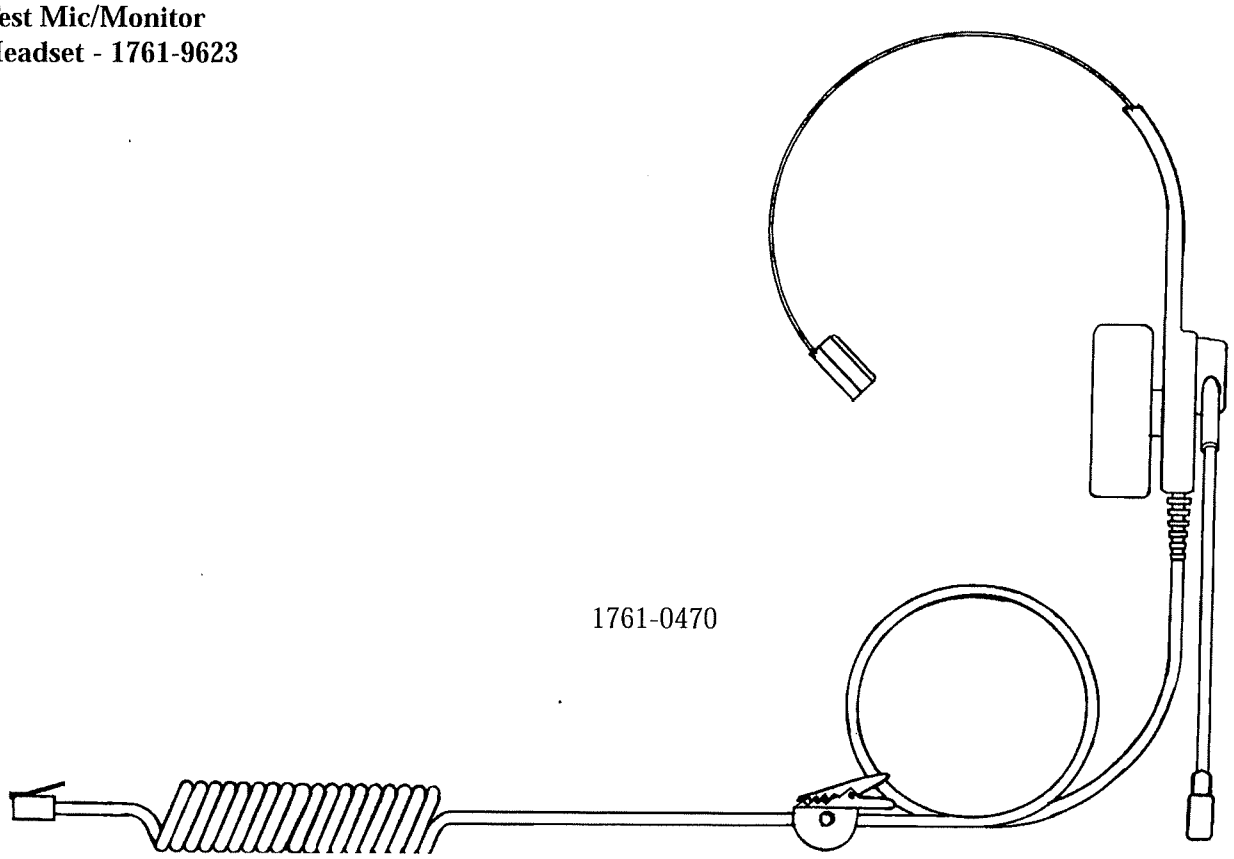
Detail of Cassette Deck - 1761-9622

Type	Double cassette deck
Tape Track Format	4-Track/2 Channel System
Tape Speed	4.8 cm/sec (Normal) 9.5 cm/sec (High)
Frequency Response (-20 dB Recording)	
Type IV Tape	20 to 17,000 Hz (30 to 16,000 Hz ± 3 dB)
Type II Tape	20 to 16,000 Hz (30 to 15,000 Hz ± 3 dB)
Type I Tape	20 to 16,000 Hz (30 to 15,000 Hz ± 3 dB)
Signal to Noise Ratio	58 dB (S = 315 Hz, k3 = 3%, N = A-weighted, Type IV tape)

The S/N is improved by about 15 dB at 500 Hz and by max. 20 dB at 1 kHz ~ 10 kHz with Dolby C NR on and improved by 5 dB at 1 kHz and by 10 dB at above 5 kHz with Dolby B NR on.

Improvement of MOL	4 dB at 10 kHz with Dolby C NR on.
Wow/Flutter	0.08% (WRMS), ± 0.2% (DIN/IEC)
Channel Separation	40 dB (1 kHz)
Crosstalk	60 dB (1 kHz)
Harmonic Distortion	k3; 0.8% (Type IV tape, 315 Hz, 0 VU)
Heads	
Deck A	METAPERM head for playback x 1
Deck B	METAPERM head for recording/ playback, 2-gap ferrite head for erasure; combination head x 1
Motors	Electric Governed DC motor for capstan x 1 DC motor for reel x 1 DC motor for mechanism drive x 1 (For both decks A and B)
Fast Forward/Rewind Time	Approx. 110 sec (For C-60 Tape)
Input Terminals	
LINE IN (x1 circuit)	Input sensitivity: 80 mV (0 VU) Input Impedance: 50 k Ohms
MIC x1 (Monaural)	Input sensitivity: 0.4 mV (-68 dBV) Matching Impedance: 600 ~ 10 k Ohms
Output Terminals	
LINE OUT (x1 circuit)	Output Level: 300 mV (0 VU) Output Impedance: 5 k Ohms
PHONES x 1	Output Level: 0.3 mW/8 Ohms (0 VU) Matching Impedance: 8 Ohms-1 kOhm
Other terminals:	COMPU LINK-3/SYNCHRO x 2
Power Requirements	AC 240 V, 50 Hz (Australia) AC 230 V, 50 Hz (U.K.) AC 120 V, 60 Hz (U.S.A.)
Power Consumption	With power switch ON 17 Watts With power switch standby 4.0 Watts
Dimensions (W x H x D)	$17\ ^{3}/_{16}$ " x $5\ ^{5}/_{16}$ " x $13\ ^{1}/_{16}$ "
Weight	10.9 lbs. (4.9 kg)

Test Mic/Monitor
Headset - 1761-9623



1761-0470

Specifications

Microphone Frequency Response	100 Hz to 6 kHz ± 3 dB
Sensitivity	-40 dB ± 4 dB Re 1 v/Pa @ 1 kHz @ 0.25"
Supply Voltage	3.5 to 20 VDC
Operating Temp	0 to 50 °C
Receiver Sound Pressure Level	114 dB ± 4 dB @ 1 kHz/mW Max.
Freq. Response	300 Hz to 4 kHz
Impedance	300 Ohms Nominal
Receiver Type	Dynamic

Mechanical

Microphone Boom	Swivels 270 Degrees
Stabilizer Cushion (T-Bar Cushion)	Nontoxic Hypo-allergenic

TalkBack Microphone 8000-0039 **Installation Procedure**

1. Install grommet into Mic bracket.

2. Position bracket over sound room window with angle pointing toward center of ceiling.

3. Screw bracket to sound room grid using supplied #6 screw.
   Note: Only fasten bottom of bracket at this time.

4. Push Talkback Mic through grommet and route cable down along side bracket. Using clamp and a #6 screw, attach cable against bracket using upper hole in bracket.

5. Route cable around window edges and secure to wall using cable clamps and #6 screws.
   Note: Depending on sound room type, it may be possible to slide cable clamps under window molding rather than using #6 screws.

6. Push connector end of cable through weep hole in sound room patch panel and connect to appropriate jack on rear of GSI 61.

GSI 61 Talkback Microphone & Installation Kit Parts List

Description	Part No.	
Talkback Mounting Bracket	1700-8011	
Grommet, ½ inch ID	4110-0700	
Cable Clamps	4314-0017	(Qty 8)
Pan Head Screws #6 x ½"	7044-2524	(Qty 10)
Talkback Mic Assembly	8000-0039	
Microphone Clip	5194-0101	

Calibration

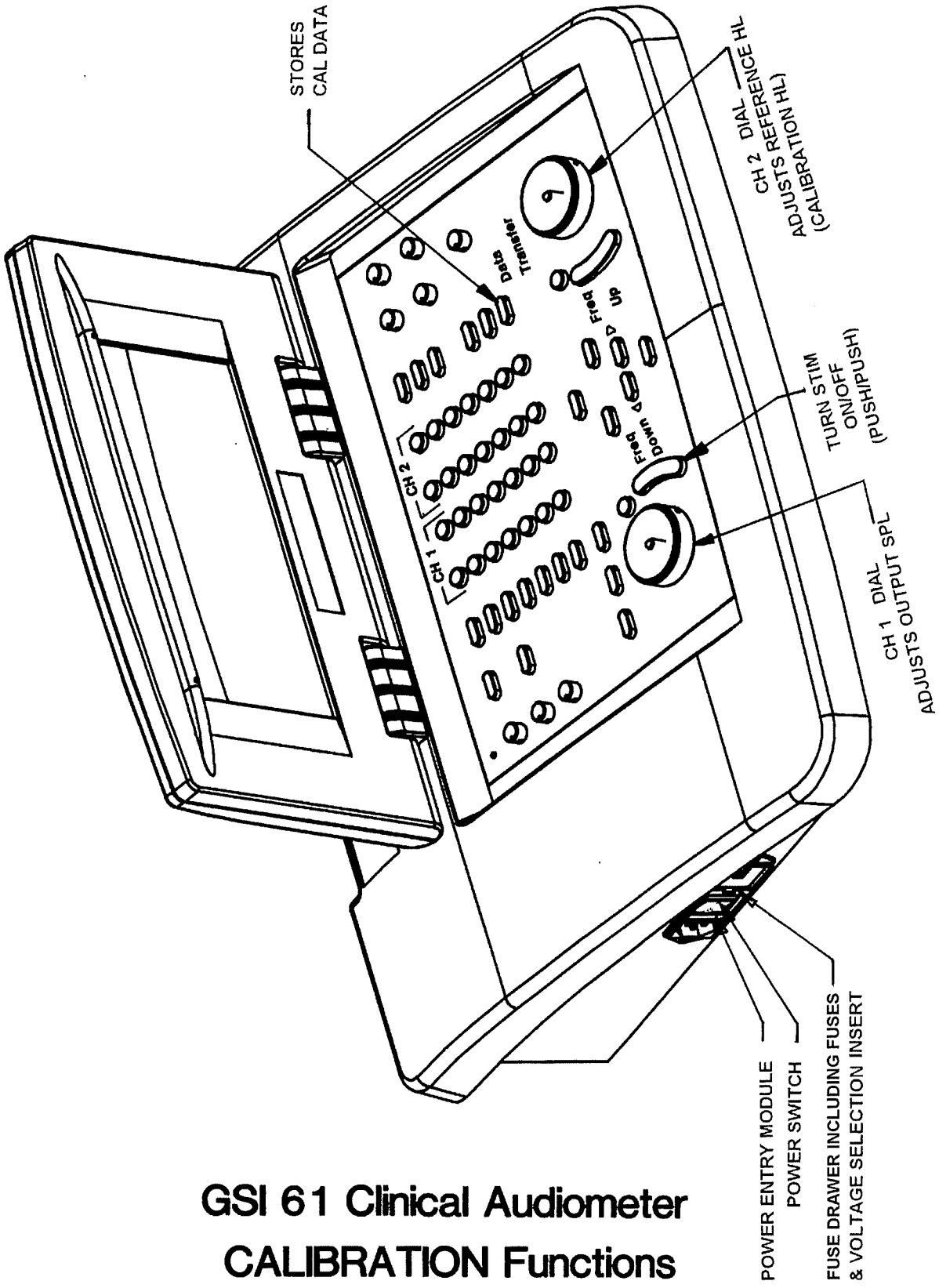
4

Reference threshold levels
(See definitions in notes below)

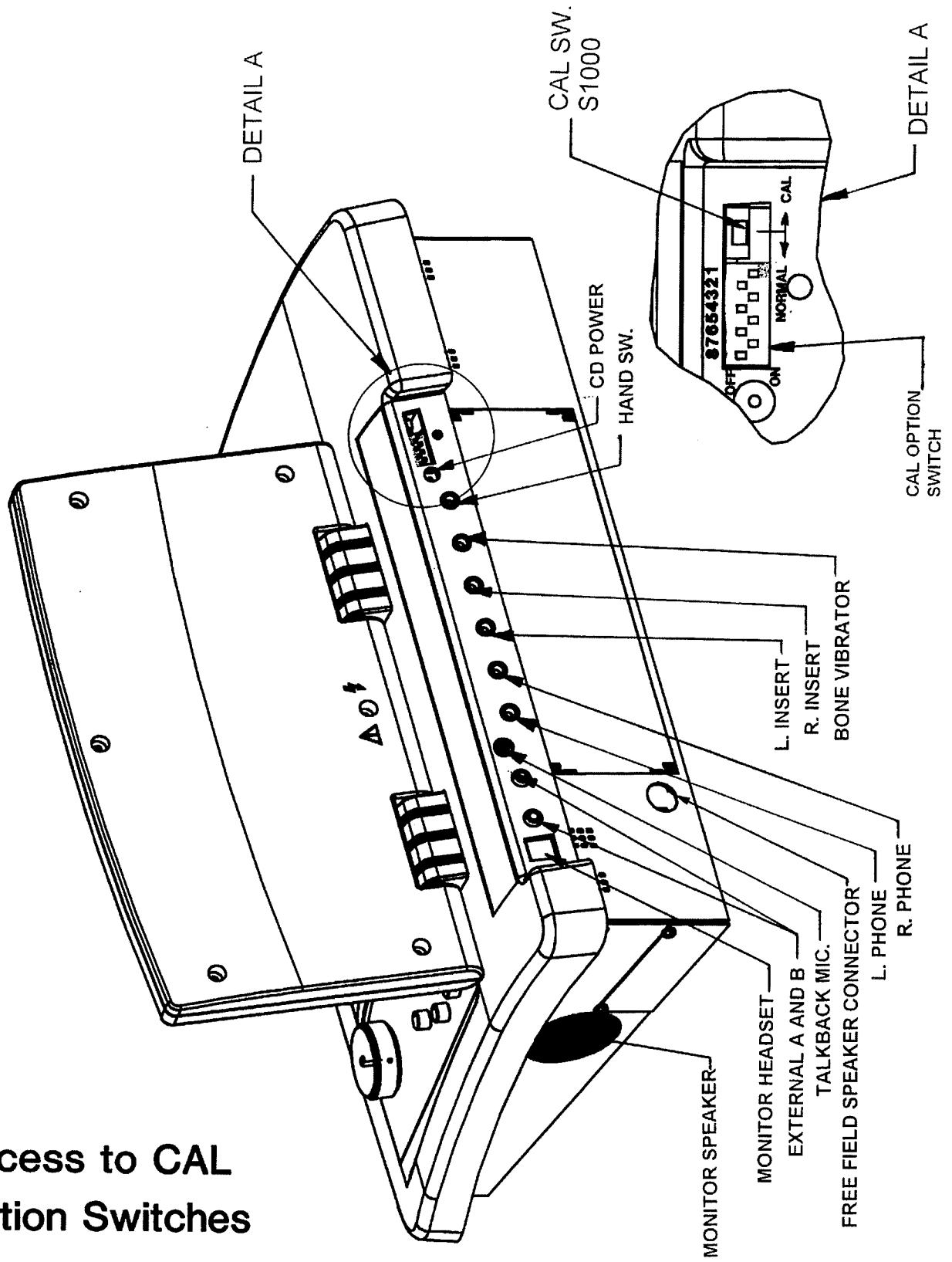
Freq (Hz)	"A" TDH50/ 303/9A	"B" TDH50/ 318	"C" B71/ Mastoid	"D" B71/ Forehead	"E" Sgl Ins/ 126/HA-2	"F" SPKR 0 Deg.	"G" SPKR 45 Deg.	"H" 3A/126 (HA-2)	"I" 3A/711 EAR SIM	"J" NBN/ ISO	"K" SENN HDA 200
125	47.5	45.0	---	---	---	24.0	23.5	26.0	28.0	4	29.5
250	26.5	27.0	67	79.0	23.5**	13.0	12.0	14.0	17.5	4	18.0
500	13.5	13.5	58	72.0	16.5**	6.0	3.0	5.5	9.5	4	9.5
750	8.5	9.0	48.5	61.5	10.5**	4.0	0.5	2.0	6.0	5	6.5
1000	7.5	7.5	42.5	51.0	9.0**	4.0	0.0	0.0	5.5	6	6.5
1500	7.5	7.5	36.5	47.5	9.0**	2.5	-1.0	2.0	9.5	6	5.5
2000	11.0	9.0	31.0	42.5	13.5**	0.5	-2.5	3.0	11.5	6	3.0
3000	9.5	11.5	30.0	42.0	9.5**	-4.0	-9.0	3.5	13.0	6	3.0
4000	10.5	12.0	35.5	43.5	1.5**	-4.5	-8.5	5.5	15.0	5	8.5
6000	13.5	16.0	40.0	51.0	0.5**	4.5	-3.0	2.0	16.0	5	9.5
8000	13.0	15.5	40.0	50.0	---	13.5	8.0	0.0	15.5	5	16.0
12000	17.5*	---	---	---	---	13.5	11.5	---	---	5*	27.5
Speech/ Spch Noise	20.0	20.0	55.0*	63.5*	21.5**	16.5	12.5	12.5	18.0		
9000						15.5	10.5			5	17.0
10000						15.5	11.0			5	21.5
11200						14.0	10.0			5	21.0
12500						13.0	11.5			5	27.5
14000						18.0	16.0§			5	37.5
16000						44.5	43.5			5	58.0
18000										5	83.0
20000										5	105.0

Definitions:

"A" Telephonics earphone TDH-50P re 20µPa calibrated in 9A coupler (ANSI 3.6)
"B" Telephonics earphone TDH-50P re 20µPa calibrated in IEC 318 coupler (ISO 389 -1991)
"C" Radioear bone vibrator B71 (unoccluded test ear) mastoid position Re 1un ISO 389-3 - ANSI 3.43
"D" Radioear bone vibrator B71 (unoccluded test ear) forehead position Re 1un ISO 389-3 - ANSI 3.43
"E" Single insert phone Re 20µPa calibrated in IEC 126 coupler
"F" Sound Field System @ 0 degree azimuth ISO 389-7
"G" Sound Field System @ 45 degree azimuth (Ref ISO 389-7)
"H" EAR 3A calibrated in IEC 126 coupler ISO 389 Amendment 1
"I" EAR 3A and Single Insert calibrated in IEC 711 coupler ISO 389 Amendment 1
"J" Reference levels for narrow band noise relative to pure tone per ISO 389-4. White noise reference levels equivalent to narrow band reference levels. White noise disabled above 12 kHz.
"K" Sennheiser HDA 200 High Frequency Earphones (option)
* = interpolated
** = values determined by GSI
§ = rounded from 16.1

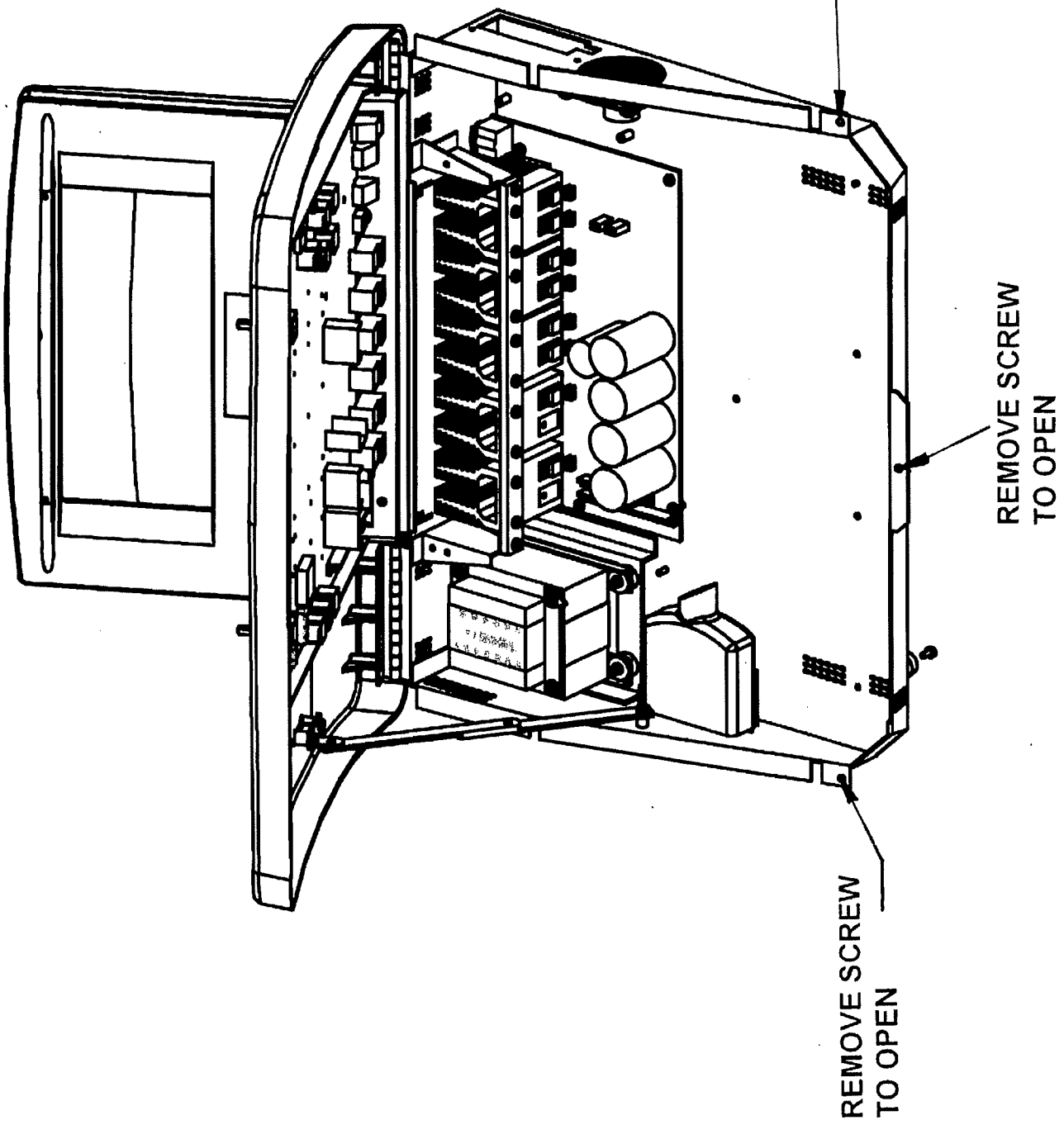


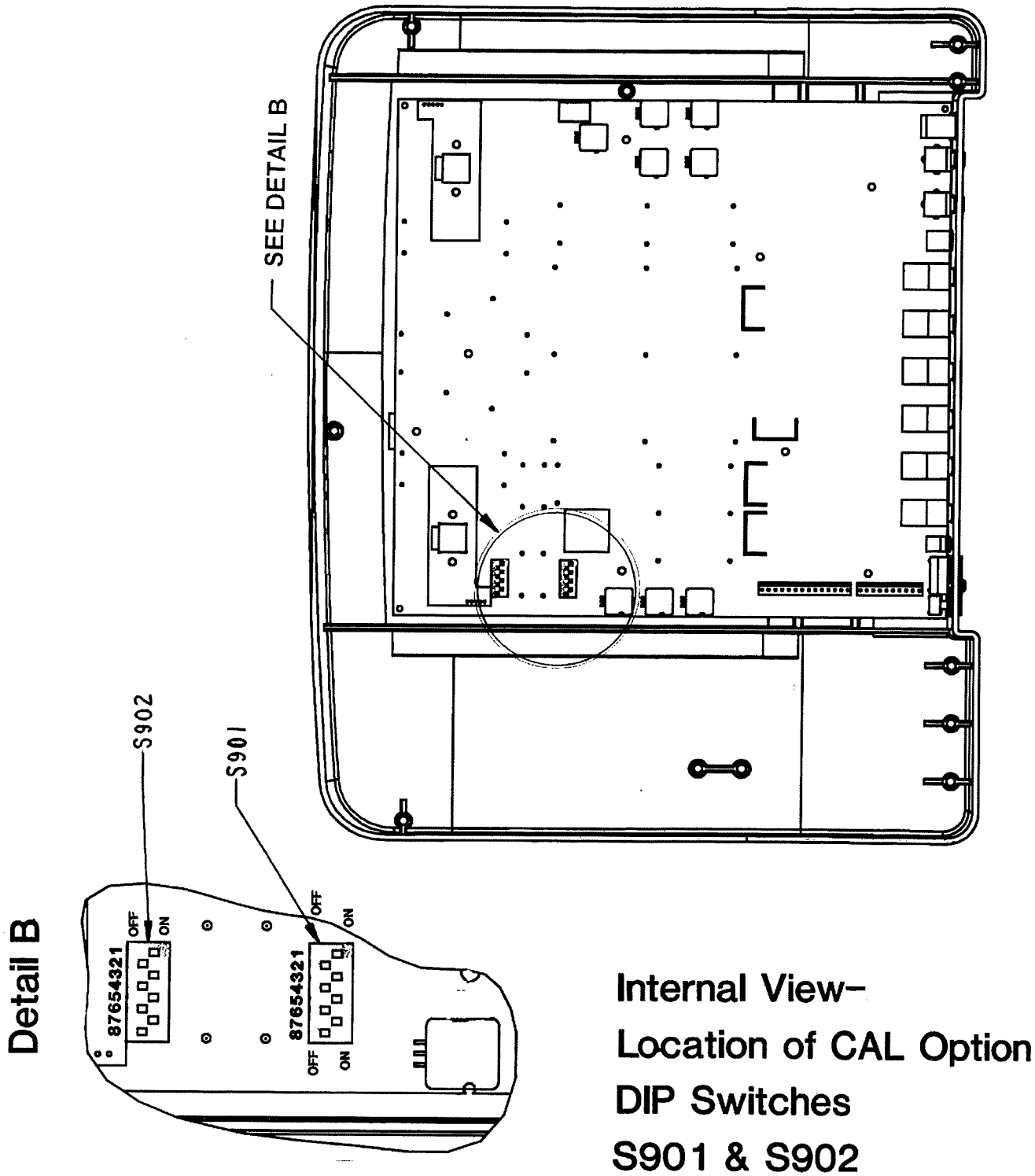
GSI 61 Clinical Audiometer
CALIBRATION Functions



Access to CAL Option Switches

Access to Internal CAL Option DIP Switches– S901 & S902





Internal View–
Location of CAL Option
DIP Switches
S901 & S902

Calibration Mode

The calibration mode provides a service person with an easy and efficient way to calibrate each transducer for every stimulus type. The transducer/routing combinations are: left phone, right phone, left insert phone, right insert phone, mastoid or forehead bone vibrator, left speaker at 0° or 45° azimuth, right speaker at 0° or 45° azimuth, left (high frequency) phone and right (high frequency) phone. The stimuli are: pure tones at each available frequency, narrow band noise at each available frequency, microphone, white noise, speech noise, Ext A and Ext B. Narrow band noise and white noise may be calibrated to either the ANSI / ISO standard offsets from the pure tone or custom programmed offsets. Speech stimuli can be calibrated to ANSI/ISO or optionally for custom calibration.

How To Enter

The calibration mode may be entered directly from power-up or from the Normal Mode. The calibration entry switch is slide switch **S1000** which is accessible at the rear panel of the unit. **The calibration mode option Dip Switches are read upon entry to the calibration mode.**
To enter the Calibration Mode; set the Dip Switches to the appropriate settings, ensure the **Cal / Diag Mode Dip Switch (S901-1)** is in the **Cal** position **(OFF)** and then move the **CAL / NORMAL (S1000) Slide Switch** to the CAL position.

Note: **The Channels must be OFF to enter the calibration mode.**

These Dip Switches are;

CALIBRATION MODE OPTION DIP SWITCHES

Dip Switch	Function	OFF	ON
S900-1	NBN Offset	Standard	Custom
S900-2	WTN Offset	Standard	Custom
S900-3	Insert Phone Type	E•A•RTONE™ 3A	Single
S900-4	Speaker Type	40W (GSI 16)	150W (GSI 10)
S900-5	Booster Amp In/Out	No Amp	Amp Installed
S900-6	Bone Vibrator Calibration	Mastoid	Forehead
S900-7	Self Calibration	Off	On
S900-8	Default Data	Off	Load
S901-1	Cal / Diag Mode	Cal	Diag
S901-2	Speech Filter	In	Out
S901-6	High Freq Phone Type	Sennheiser	Other
S902-2	Phone Coupler	IEC 318	NBS 9A / IEC 303
S902-3	Insert Phone Coupler	IEC 711	IEC 126 (HA-2)
S902-6	Speaker Azimuth	45 Degrees	0 Degrees
S902-8	Speech Calibration	Standard (Common)	Custom (Individual)

Note: The **S900** Dip Switches are easily accessible from the back panel. The **S901** and **S902** Dip Switches are internal and only accessible by a Qualified Service Person.

HL Calibration

Initialization and General Information

When HL calibration is entered the following parameters are not changed and will remain the same, with the noted exceptions:

Ch 1 Transducer
Ch 1 Routing
Ch 1 Stimulus
Ch 1 Interrupt
FM
Monitor Speaker
If the Ch 1 Routing was Left / Right, it defaults to Right.
If the Ch 1 Stimulus was NB Noise and custom NB noise calibration is not selected via the dip switch, it defaults to Tone.
If the Ch 1 Stimulus was White Noise and custom white noise calibration is not selected via the dip switch, it defaults to Tone.

Note: GSI 61s are shipped from the factory with default data loaded for L and R Speaker. These must be calibrated to extinguish the "Using Default Data" message on the LCD.

The following parameters are defaulted:

The frequency is defaulted to the lowest valid frequency for the selected Ch 1 Transducer.
Interlock = Off
Tracking = Off
dB STEP = 5.0
Signal Format = Steady or FM & Steady
If the Timer was running, it is stopped.

The calibration Reference HL is defaulted to an acceptable level for the selected transducer. The Target SPL level is automatically calculated and displayed in the CH 1 intensity field (ref HL plus RTL).

Each of the transducer/routing combinations that may be used should be calibrated: left earphone, right earphone, insert phone, mastoid or forehead bone vibrator, left speaker at 0 °or 45 °azimuth and right speaker at 0 °or 45 °azimuth. If insert phones or speakers, which are options, are not being used, they do not need to be calibrated. If E•A•RTONE™ insert phones are used then both the left and right insert phones should be calibrated. If the high frequency option is active, then the high frequency left and right phones should be calibrated.

If the stimulus is tone, then each frequency should be calibrated. If custom NBN is selected, after tone is calibrated, the NB Noise offset may be adjusted. If custom white noise is selected, the white noise offset should be adjusted. See pages 4-12 and 4-13, **S900-1 and S900-2**, **NBN Offset** and **WHN Offset**.

The Speech Noise, Mic, Ext. A and Ext. B stimuli share the same calibration data. Any **one** of these stimuli should be calibrated. However, usually the speech noise stimulus is calibrated. If custom Speech Calibration is selected the speech sources can be calibrated independently from each other. See page 4-18, **S902-1, LCD Type.**

During the HL Calibration, the Speech filter is always switched out, the High Pass filter is switched in and out as normally required. The 20 dB and 30 dB pads are always switched out.

HL Calibration Procedure for the Phone, Bone, Insert Phone and Speaker Transducers

Enter the Calibration mode and connect the selected transducer to the Sound Level Meter using the selected coupler. If the speakers are being calibrated, position the Sound Level Meter microphone at the expected patient head position, using the selected speaker azimuth. This must be no greater than 1 meter from the Speaker cones to insure the minimum published GSI maximum HL limits.

Next, select the appropriate CH1 routing/transducer combination, stimulus/ frequency, signal format and step size. Adjust the Reference HL level (CH2 HL Dial & Display) at which the calibration will be performed, and turn on the stimulus (**CH1 Tone Bar**). Adjust the attenuator (**CH1 HL Dial**) until the Sound Level Meter reads the Target SPL value displayed in the **CH1 Intensity field** and **store** the data into EEPROM by pressing the **DATA TRANSFER or SAVE** keys.

Note: **The Microphone & Artificial Mastoid frequency response correction must be added to or subtracted from the target SPL.**

The service person repeats this procedure until every transducer/routing combination and stimulus is calibrated.

HL Calibration Procedure for the Speaker Transducer

Place the sound level meter microphone at the patient's head position one meter from the speaker in the sound room. Select 1 dB steps.

Note: The RTL for speaker with speech noise at 45 degree azimuth is +12.5 dB.
The RTL for speaker with speech noise at 0 degree azimuth is +16.5 dB.

<u>For speakers without the booster amp:</u>

a) With both channels off and Speech Noise selected, select a Reference HL of 90 dB HL for 40W speaker and 96 dB HL for 150W speaker.

b) For the right speaker, with Speech Noise selected, adjust the **Ch 1 HL KNOB** until the Sound Level Meter reads either 102.5 dB SPL or 108.5 dB SPL (45 degree azimuth), depending on whether the speaker is 40W or 150W. Store the calibration data, using the **DATA TRANSFER or SAVE** keys. Repeat this procedure for the left speaker.

c) Enter the Normal Operating Mode and insure that the maximum HL limit for speech on the right speaker is either 90 dB HL or 96 dB HL, depending on whether the 40W or 150W speaker is used. Repeat this procedure for the left speaker.

d) Reenter the CAL mode and calibrate both speakers for all tones.

For speakers at 45 degree azimuth with the booster amp:

a) With both **channels off and the booster amp controls full CCW**, select 1.0 dB steps, Speech Noise, and set the **Reference HL** (CH 2 HL Display) level to 102 dB HL using the **Ch 2 HL KNOB**.

IMPORTANT NOTE: Only the 150W speakers may be used with the new GSI booster amp.

b) With Speech Noise selected for the right speaker, turn the **Ch 1 HL KNOB (Channel off!)** until the limit is reached, i.e. Channel 1 flashes. Store this point, using the **DATA TRANSFER or SAVE** keys. Repeat this procedure for the left speaker.

c) Using the booster amp controls, adjust the right speaker for Channel 1 until the Sound Level Meter reads 114.5 dB SPL. Repeat this procedure for the left speaker. Remove the booster amp controls or silicon glue the booster amp controls in place.

d) Enter the Normal Operating mode and insure that the maximum HL limit for speech on the right speaker is 102 dB HL. Repeat this procedure for the left speaker.

e) Reenter the CAL mode and calibrate both speakers for all tones.

For speakers at 0 degree azimuth with the booster amp:

a) With both **channels off and the booster amp controls full CCW**, select 1.0 dB steps, Speech Noise, and set the **Reference HL** (CH 2 HL Display) level to 102 dB HL using the **Ch 2 HL KNOB**.

IMPORTANT NOTE: Only the 150W speakers may be used with the new GSI booster amp.

b) With Speech Noise selected for the right speaker, turn the **Ch 1 HL KNOB (Channel off!)** until the limit is reached, i.e. Channel 1 flashes. Store this point, using the **DATA TRANSFER or SAVE** keys. Repeat this procedure for the left speaker.

c) Using the booster amp controls, adjust the right speaker for Channel 1 until the Sound Level Meter reads 118.5 dB SPL. Repeat this procedure for the left speaker. Remove the booster amp controls or silicon glue the booster amp controls in place.

d) Enter the Normal Operating mode and insure that the maximum HL limit for speech on the right speaker is 102 dB HL. Repeat this procedure for the left speaker.

e) Reenter the CAL mode and calibrate both speakers for all tones.

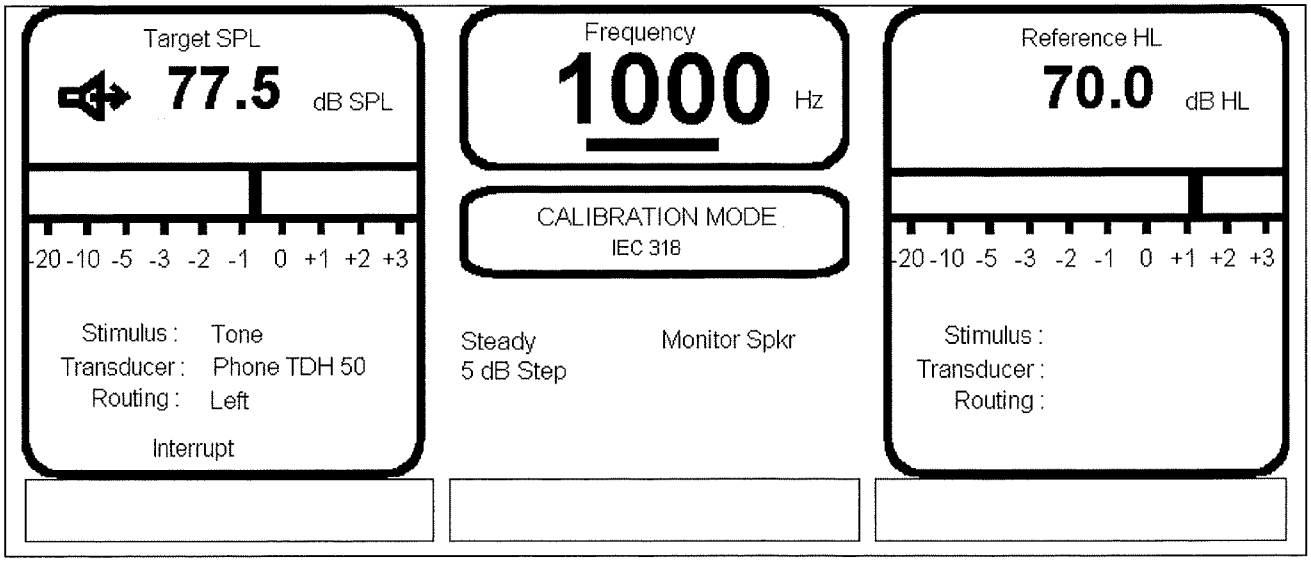
Description of Displays and Controls

Calibration Mode Display

The HL calibration screen is quite similar to the Status screen in the Normal operation mode of the instrument. The **Ch 1 Intensity field** displays either the **Target SPL**, which is the SPL that must be read on the Sound Level Meter for the instrument to be in calibration, or the NB or White Noise offset value. The **Ch 2 Intensity field** displays the **Reference HL**, which is the intensity level at which the calibration is performed. The Scorer / Timer area contains a label indicating that the instrument is in the Calibration Mode and also contains text describing the calibration dip switch setting selections for the current Ch 1 transducer.

The HL Calibration screen is available in English only.

An example of the HL Calibration screen:



Examples of various displayed setups:

If the TDH 50 (Low Frequency) Phones are being calibrated, then the coupler displayed will be either "IEC 318" or "NBS 9A / IEC 303", based on Dip Switch **S902 - 2**.

Note: The position of the Phone coupler dip switch does not apply to the high frequency phones.
The coupler type is always set to "IEC 318 with FP" as this is the only coupler recognized by the international standards.

If the high frequency Phones are being calibrated, then the coupler displayed is "IEC 318 with FP".

If either the single Insert Phone or EAR Insert Phone pair are being calibrated, then the coupler displays either "IEC 711" or "IEC 126 (HA-2)", based on Dip Switch **S902 - 3**.

If the speakers are being calibrated, then either "0 DEG" or "45 DEG" is displayed, based on Dip Switch **S902 - 6**.

If the bone vibrator is being calibrated, then either "MASTOID" or "FOREHEAD" is displayed, based on Dip Switch **S900 - 6**.

Transducer Display shows additional information relative to the transducer(s) being librated; i.e., TDH 50, HDA 200, 40W or 150W (Spkr), Pair or Insert (Phone).

Display Previous HELP Message

If an error code and subcode are stored in EEPROM during Normal Mode operation the numbers are displayed to the service person as a "HELP" message upon entry to the calibration mode. This reference HELP message is displayed without the normal rectangular border around it to distinguish it from an actual HELP message.

The prompt "Press Start to Proceed" is displayed in the Test Status area. The "HELP" message is displayed until the service person presses the START key, whereupon the error codes are erased from EEPROM and the load default data process is started.

While this prompt is displayed all other controls, including the Cal / Normal switch are disabled.

The Cal / Normal Switch - S1000

S1000 is accessible through the rear panel of the unit by removing the metal plate which covers the calibration entry slide switch and the calibration mode option switches. The metal cover is on the left side of the jack panel as you view the instrument from its front. The calibration mode is entered by switching **S1000** to the left, again, as you sit in front of the unit. The calibration mode Option Switches are read upon entry to the calibration mode.

The Options DIP Switches

As indicated previously, DIP switch **S900** is accessible through the rear panel of the GSI 61 whereas DIP switches **S901 and S902** are accessible inside the unit. **S900** contains the calibration option switches most often selected during routine calibration and installation, therefore, its external accessibility.

S900 - 1 Narrow Band Noise (NBN) Offset

This position gives flexibility in the calibration of Narrow Band Noise. The GSI 61 is shipped from the factory with **S900-1** set to the "Off" or "ISO" position. This indicates that NBN is calibrated per the ISO 389-4 standard. At GSI we put accuracy constraints on our calibration system which, although calibrated to ISO 389-4, guarantees calibration of NBN within the ANSI 3.6 standard. The calibration of NBN per both standards is to an RTL "offset" (dB) from that of the pure tone. As a result of this we can state that NBN is calibrated relative to pure tone offsets. Since these offsets are known, NBN is automatically calibrated per transducer as the pure tones are calibrated. This saves calibration time for the field service engineers.

If **S900-1** is set to the "On" or "custom" position, the **Ch 1 NB NOISE** selection becomes valid. When selected, the Ch 1 HL Display shows the current NBN offset for the current frequency. The Ch 1 HL attenuator is set based on this offset and the corresponding pure tone calibration data. The **Ch 1 HL KNOB** is then used to modify the offset through a typical range of 0 to +20 dB, in 0.5 dB steps. When the lower or upper limit is reached, the Ch 1 HL display will flash. As the offset is adjusted, the transducer output level is also adjusted via the Ch 1 HL attenuator so that the two track together within the valid range of the attenuator.

When the desired offset is selected, press the **DATA TRANSFER or SAVE** key to save the offset into EEPROM. The message "Saving Data" is briefly flashed in the Error Message field.

The NB Noise offsets may be adjusted at each frequency. However, this only needs to be done for one transducer/routing combination, since all transducers share the same noise offsets.

S900 - 2 White Noise (WHN) Offset

This position gives flexibility in the calibration of White Noise. The GSI 61 is shipped from the factory with **S900-2** set to the GSI or "Off" position. This indicates that White Noise is calibrated in effective masking, That is, the White Noise SPL is set to the level required to give it the appropriate amount of energy to effectively mask the stimulus selected when both are set to the same HL. When **S900-2** is set to the "GSI" position, WHN is calibrated automatically to predetermined offsets from the pure tone and speech calibration points. As with NBN this saves calibration time when "custom" calibration is not desired.

If **S900-2** is set to the "custom" or "On" position the **Ch 1 WHITE NOISE** selection becomes valid. When selected, the Ch 1 HL Display shows the current offset for the current input source. The Ch 1 HL attenuator is set based on this offset and the corresponding selected source's calibration data. The **Ch 1 HL KNOB** is then used to modify the offset through a range, typically of 0 to +40.0 dB for White Noise in 0.5 dB steps. When the lower or upper limit is reached, the Ch 1 HL display will flash. As the offset is adjusted, the transducer output level is also adjusted via the Ch 1 HL attenuator so that the two track together within the valid range of the attenuator.

When the desired offset is selected, press the **DATA TRANSFER or SAVE** key to save the offset into EEPROM. The message "Saving Data" is briefly flashed in the Error Message field.

The White Noise offsets may be adjusted at each frequency and with a Speech source. However, this only needs to be done for one transducer/routing combination, since all transducers share the same noise offsets.

Note: Ch2 sources are valid when **S900-2** is set to the "Custom" position. This is to allow for the selection of the source for which White Noise will be calibrated (Tone & Speech).

S900 - 3 Insert Phone Type

The GSI 61 allows the flexibility of calibrating the Insert Phone(s) to either a single receiver or to a pair of E•A•RTONE™ Insert Earphone sets. **S900-3** selects the single receiver when it is set to the "On" position. If **S900-3** is set to the "Off" position, the GSI 61 hardware is configured to accept a pair (L&R) of Insert phones. If **S900-3** is set to the "On" position, the GSI 61 hardware is configured to accept only one Insert phone and it **must** be **plugged into the LEFT INSERT phone jack** on the rear jack panel.

S900 - 4 Speaker Type & S900 - 5 Booster In/Out

The GSI 61 can be calibrated directly to speakers or through an external booster amplifier to speakers. In addition, GSI offers two types of speakers for use with the GSI 61 - GSI 16 (40 Watt) medium sensitivity or GSI 10 (200 Watt) high sensitivity speakers. GSI also offers a high power, 150 Watt per channel, low noise booster amplifier.

The Dip Switch selections of the 40 Watt speakers with a Booster Amp must not be allowed due to the possibility of damaging the speakers with the high power. To prevent this, the **Speaker Type Dip Switch (S900 - 4)** and **Booster Amp Dip Switch (S900 - 5)** are read upon entry to the CAL mode and if the GSI 16 (40 Watt) speaker is selected with a Booster Amp the error message "INVALID SELECTION" is flashed in the Error Message Field and the prompt "GSI 16 Speakers with GSI 150W Amp is Invalid. Correct to Proceed" is displayed in the Test Status Area. The Speaker Type and Booster Amp Dip Switches must be set to another combination before the calibration sequence will proceed.

While this prompt is displayed all other controls, including the Cal / Normal switch are disabled.

The DIP switch settings for Speaker type and Booster In/Out are;

S900-4 OFF = GSI 16 (40W)
S900-4 ON = GSI 10 (150W)
S900-5 OFF = NO BOOSTER
S900-5 ON = BOOSTER IN

S900 - 6 Bone Vibrator - Mastoid vs Forehead

This switch selects the RTL for either Mastoid or Forehead Bone Vibrator calibration. If it is set to the "Off" or "Mastoid" position, the CH1 intensity field will display the SPLs for Mastoid calibration. If it is set to the "On" or "Forehead" position, it will display the SPLs for Forehead Bone Vibrator calibration.

Note: The GSI 61 is shipped from the factory with **S900-6** in the Mastoid position.

S900 - 7 Self Calibration

If **S900-7** is set to "On" or "self cal" position upon entry to the calibration mode, the GSI 61 will be set to begin "Self Calibrating" various parameters, specified below, if the appropriate keys are selected. If self-calibration is selected via Dip Switch **S900-7**, the following prompt displays in the display's Test Status Field to allow the service person to avoid unintentionally performing self-calibration and losing several hours of work.

"Ready to do Self-Cal"
"Press CLEAR to Load Data"
"Press STOP to Bypass"
"Press START to Proceed"

If the service person presses the **CLEAR** key, the default data associated with self-calibration, but not associated with any particular transducer will be loaded. If the service person presses the **STOP** key, the self-calibration process is skipped entirely and the HL Calibration mode is entered. When the service person presses **START**, self-calibration begins. The message "Self Cal In Progress" displays in the Test Status area. Since self-calibration takes a while, the self-calibration message updates as the self-calibration progresses, providing feedback to the service person. While this prompt is displayed all other controls, including the **Cal / Normal switch** are disabled. If calibration was entered from the normal mode, not from power-up, the service person may listen to the self-calibration process if the monitor speaker is on prior to calibration mode entry. The VU meters will not be active during any of the self calibration process.

There are four parameters which are calibrated during self-calibration.

1. **Pure Tone Frequencies**
   Each frequency is set to within 0.2% by comparing the oscillator output to a very precise crystal. This process is performed two times. The status message "- Oscillator -" is displayed in the Test Status area and the Frequency field will show the frequency currently being calibrated.

2. **Source Output Levels**
   The sources (tone, narrow band noise, white noise and speech noise) are calibrated to within 0.25 dB of 0 VU. The status message "- Sources - " is displayed in the Test Status area. During the process, the Frequency field will show the frequency of the pure tone and narrow band noise sources and the Ch 1 Stimulus field will show the current source being calibrated.

3. **Power Limit**
   The power limit is established to prevent the input to the internal 10 watt amplifiers from overdriving the amplifier. The measurement is done at 1kHz. The status message " - Power Limit - " is displayed in the Test Status area. The Frequency field will display 125 Hz and the Ch 1 Stimulus field will show "Tone".

4. **Channel Gain Matching**
   The Channel 2 SISI attenuator and HL attenuator gains are matched to Channel 1 to allow the calibration data which is measured on Ch 1 to be used for Ch 2. The status message " - Channel Gain - " is displayed in the Test Status area. This calibration is performed at 1 kHz with the left Low Frequency Phone selected on Ch 1 and the right Low Frequency Phone selected on Ch 2. The Frequency, Ch 1 and Ch 2 Stimulus, Transducer and Routing fields will reflect these selections. Once the self-calibration process completes, the HL calibration mode is initialized.

S900 - 8 Default Calibration Data

If the load default calibration data option is selected via Dip Switch **S900 - 8**, the following prompt displays in the display's Test Status Field, allowing the service person to avoid unintentionally loading default calibration data and losing several hours of work.

"Ready to Load Defaults"
"Press STOP to Bypass"
"Press START to Proceed"

If the service person presses **STOP**, the load default data process is skipped entirely and the instrument proceeds to the next calibration process selected - HL or Self Cal. When the service person presses **START**, the default HL and RTL data loads for each transducer. While the default data is loading, the message "Loading Default Data" briefly flashes. Once default data is loaded, the instrument proceeds to the next calibration process selected - HL or Self Cal.

While this prompt is displayed all other controls, including the Cal / Normal switch are disabled.

If the load default calibration data is not selected, no default calibration data is loaded and execution proceeds to the next step. If default calibration data is loaded, a "using default calibration data" flag is set for each HL calibration or self-calibration data

value. If the service person returns to the normal mode and the "using default calibration data" flag is set for a particular transducer and stimulus, the warning "Using Default Data" will be displayed in the Default Cal Data Message field. To clear the flag and prevent having this "gentle" reminder displayed, the service person must enter the Calibration mode and must save valid calibration data. This should be done for all transducer and stimuli combinations.

Note: The Self-Calibration process must have been completed successfully.

Default calibration data is provided only for the default, factory selected calibration parameters as follows:

NBN Offset	=	Standard per ISO 389-4
WTN Offset	=	Per "GSI Effective Masking"
Insert Phone Type	=	E•A•RTONE™ 3A
Speaker Type	=	40 W (GSI 16)
Bone Vibrator Calibration	=	Mastoid
High Frequency Phone Type	=	Sennheiser
Phone Coupler Type	=	IEC 318
Insert Phone Coupler Type	=	IEC 711
Speaker Azimuth	=	45 Degrees
Speech Calibration	=	Standard with RTL = 20 dB for all speech sources

Note: The following DIP Switches, S901 and S902, are located inside the unit on the Main PCB. The DIP switches listed in Table 2 are read upon entry to the Calibration Mode. All other DIP switches which are not in Table 2 but are in Tables 3 and 4 are read at unit power-up.

TABLE 3 - S901 ASSIGNMENTS

Switch	**Function**	**OFF ON**
S901-1	Cal/Diag Mode	Cal Diag
S901-2	Speech Filter	In Out
S901-3	Language Selection Bit 0	S901-5 S901-4 S901-3
S901-4	Language Selection Bit 1	ON ON ON Spare (English)
		ON OFF ON Spare (English)
		ON OFF OFF Spanish
		OFF ON ON Italian
		OFF ON OFF German
		OFF OFF ON French
		OFF OFF OFF English
S901-6	High Freq Phone Type	Sennheiser Other
S901-7	Remote Compatibility Bit 0	S901-8 S901-7
S901-8	Remote Compatibility Bit 1	ON ON Spare (Test Battery)
		ON OFF GSI 16 Short Record
		OFF ON GSI 61 Short Record
		OFF OFF Test Battery Record

S901 - 1 Calibration / Diagnostic Mode

S901-1 selects the mode type when the Cal entry switch, **S1000,** is set to the Calibration Mode. This DIP switch, when set to "On" or "Diagnostic" works with DIP switch selections on **S902** (see Table 3) in determining the type of Diagnostic mode to initiate - Loopback, Push-button, Display or Hardware. That is, if **S901-1** is set to "On", the Diagnostic mode is entered and dependent on **S902-4 & S902-5** settings. If **S901-1** is set to the "Off" or "Cal" setting, the HL calibration mode will be entered when **S1000** is set to the "Cal" position.

S901 - 2 Speech Filter

The GSI 61 has filters available for channel 1 & 2. These filters when selected to be "in" **(S901-2 "Off")** contour the frequency response of the channels such that when Speakers are selected, the frequency response of the speakers is the same as the frequency response of the TDH earphones for Speech testing. If **S901-2** is set "On" or "Out", the filters are disabled.

S901 - 3, S901- 4, S901 - 5 Language Selection

There are 5 language selections available on the GSI 61 - English, Spanish, Italian, German and French. The language displayed on the LCD is selected by the combination of the settings of **S901-3, S901-4, S901-5**. Refer to **Table 3** for the switch assignments per language.

S901 - 6 High Frequency Phone Type

If **S901-6** is in the "Off" or "Sennheiser" position, the CH 1 intensity field will display target SPLs for the Sennheiser HDA 200 earphones. An IEC 318 Flat Plane coupler must be used in the calibration of these high frequency phones.
If **S901-6** is set to the "On" or "Other" position, the RTLs are set to 0 and an IEC 318 Flat Plane coupler should be used to calibrate the "Other" High Frequency phones to the desired output.

S901 - 7, S901 - 8 Remote Compatibility

The GSI 61 has a variety of Record types that can be selected when interfacing to the RS-232 remote Interface. These record types are described in detail in the Remote sections of the GSI 61 Instruction and Service Manuals. **S901-7 & S901-8** are used in conjunction to set the Record Type - See **Table 3** for settings.

TABLE 4 - S902 ASSIGNMENTS

Switch	Function	OFF	ON
S902-1	LCD Type (Reserved)	Optrex	2nd Source
S902-2	Phone Coupler	IEC 318	NBS 9A / IEC 303
S902-3	Insert Phone Coupler	IEC711	IEC126 (HA-2)
S902-4	Diag Mode Test Number Bit 0	S902-5	S902-4
S902-5	Diag Mode Test Number Bit 1	ON	ON Loopback
		ON	OFF Pushbutton
		OFF	ON Display
		OFF	OFF Hardware
S902-6	Speaker Azimuth	45 Degrees	0 Degrees
S902-7	High Frequency Option	Not Installed	Installed
S902-8	Speech Calibration	Standard	Custom

S902 - 1 LCD Type

Since technology changes so rapidly, we designed the GSI 61 with the flexibility of having multiple source LCDs. Since the LCD is a major component of the system and since there are unique software commands for each type, we pro-actively planned to have the GSI 61 be compatible with another source (supplier). This enables production to continue should there be a shortage of the initial supplier's LCD. If **S902-1** is set to the "On" or "2nd source" position, the GSI 61 software is "flagged" to write to that supplier's LCD per its unique requirements.

S902 - 2 Phone Coupler Type

If **S902-2** is set to "Off" or "IEC 318" coupler, the target SPLs displayed in the CH 1 intensity field will be for the reference HL + the RTL for TDH 50P on this artificial circumaural ear. The RTL for TDH 50P on an IEC 318 coupler is from the ISO 389-1991 calibration standard. If the DIP switch **S902-2** is set for "On" or "NBS 9A" coupler, the target SPLs displayed in the CH 1 intensity field will be for the reference HL + RTL for TDH 50P on a 6cc cylindrical coupler. The RTL for TDH 50P on a NBS 9A coupler is from ANSI 3.6 1989.

S902 - 3 Insert Phone Coupler Type

As with TDH phones there are Artificial ear couplers as well as cylindrical couplers for Insert Phones. If **S902-3** is set in the "Off" or "IEC 711" position, the target SPLs displayed in the CH1 intensity field will be for the reference HL + the RTL for the Insert Phone type selected via **S900-3** (single or E•A•RTONE™ 3A) per ISO 389-1991. The IEC 711 coupler is an Occluded Ear Simulator which matches the acoustic impedance of a human ear as measured on a 1/2" microphone. If **S902-3** is set to the "On" or "IEC 126 (HA-2)" position, the target SPLs displayed in the CH 1 intensity field will be for the reference HL + the RTL for the Insert Phone type selected per ISO 389-1991. The IEC 126 coupler is also known as an HA-2 coupler which is a 2cc cylindrical volume over a 1" microphone.

S902 - 4 & S902- 5 Diagnostic Mode Selectors

There are 4 Diagnostic Modes which are selectable on the GSI 61: Loopback, Pushbutton, Display and Hardware. **S902-4 & S902-5** work in conjunction with DIP switch S901-1 to select the diagnostic mode and the type mode desired. If **S901-1** is set to the "On" or "Diagnostic" position, the settings of **S902-4 & S902-5** select the mode - see Table 4 for modes / settings. Refer to the Diagnostic Mode description beginning on page 4-24 for more detail.

S902 - 6 Speaker Azimuth

If **S902-6** is set in the "Off" or "45 degree" position, the target SPLs displayed in the CH 1 intensity field will be for the reference HL + the RTL for Speakers set to and being calibrated for 45 degree azimuth. The 45 degree azimuth RTLs are per ISO 8253-2. When **S902-6** is set to the "On" or "0 degree" position the target SPLs displayed in the CH 1 intensity field will be for the reference HL + the RTL for Speakers set to and being calibrated for 0 degree azimuth. The 0 degree azimuth RTLs are per ISO 226-1.

S902 - 7 High Frequency Option

The GSI 61 is available with a high frequency option. If this option is purchased then **S902-7** must be set to the "On" or "High Freq Enabled" position. If **S902-7** is set to off, the oscillator range will be limited to 12 kHz. With **S902-7** set to "On", the oscillator is enabled to go to 20 kHz.

Note 1: High Frequency cannot be entered without either the High Frequency Y-cords plugged into earphone jacks or no cables plugged into jacks.

Note 2: In the Cal Mode the "High Freq" key must be selected to calibrate frequencies above 12 kHz.

S902 - 8 Custom Speech Calibration

If **S902-8** is set to the "Off" position, all GSI 61 Speech type sources (Mic, SPN, Ext.) will be calibrated to the same RTL. If **S902-8** is set to the "On" position, it enables the flexibility for calibration of the various GSI 61 Speech sources. The custom Speech Calibration allows the service person to calibrate the four Speech stimuli independently from each other using independent RTL values. With the standard Speech Calibration, all four speech stimuli are calibrated from the same calibration data using a fixed RTL value for each transducer.

Custom Speech Calibration is selected via **S902-8** before entering the Calibration Mode. Once in the Calibration Mode, when a Speech type source: MIC, EXT. A, EXT. B, or SPEECH NOISE is selected, the CH 1 HL Display will show the current Target SPL for that source calculated from the Reference HL level and the source and transducer's RTL value read from EEPROM. The default RTL value for each Speech source and transducer will be the values listed in the "Reference Threshold Levels" tables in the Product Specification for the default configurations.

The CH 2 HL Display will show the Reference HL level and the CH2 HL KNOB will change the Reference HL level as normal.

The CH1 HL KNOB will now perform two functions. When CH 1 is turned off, the CH 1 HL KNOB will adjust the RTL value up or down in 0.5 dB steps. The Target SPL display will be updated to reflect the new SPL and the transducer output level is also adjusted via the CH1 HL attenuator so that the two track together within the valid range of the attenuator. When CH 1 is turned on, the CH 1 HL KNOB will adjust only the transducer output level via the CH 1 HL attenuator. In either case, if the attenuator range is exceeded, the CH 1 HL display will flash. The range of RTL adjustment is +/- 20dB around the standard RTL for each transducer. When the desired RTL value is selected and the Target SPL level is achieved, the DATA TRANSFER or SAVE key is pressed to save both of these values into EEPROM. The message "Saving Data" is briefly flashed in the Error Message field.
All four Speech sources should be calibrated.

Transducer Selections

Select the transducer by pressing the CH1 transducer key: PHONE, BONE, SPKR or INSERT keys. Selecting PHONE will select either the Low Frequency TDH - 50 Phones or the High Frequency Sennheiser Phones based on the current frequency range. The CH2 Transducer keys are invalid.

Stimulus Selection

Select the stimulus by pressing the CH1 TONE, MIC, EXT. A, EXT. B and SPEECH NOISE keys. If custom white noise is selected, the WHITE NOISE key is available. If custom narrow band noise is selected, the NB NOISE key is available. All CH2 Stimulus keys are invalid, except in Custom White Noise Cal.

Routing Selection

Select the routing by pressing the CH1 RIGHT and LEFT keys. This will select the right or left transducer to be calibrated. If the mastoid Bone Vibrator or the Insert Phone is being calibrated, select either the left or right routing. In this case, only one of the routings needs to be calibrated. The CH1 LEFT/RIGHT key is invalid. The CH2 Routing keys are invalid.

Frequency Selection

The FREQUENCY UP or DOWN keys are used to select the frequency when TONE, custom NB NOISE or custom WHITE NOISE are selected. These keys work the same as in the Normal mode. If the stimulus is Mic, EXT A, EXT B or Speech Noise, no frequency is displayed and the FREQUENCY UP and DOWN keys are invalid.

Signal Format

The FM key turns on and off the FM of a pure tone stimulus. FM is normally used if the transducer is a speaker. However, when calibrating a pure tone at high frequency, FM should be selected. The selected signal format, FM or Steady, will be displayed in the Signal Format field. If SISI is pressed, then HL Calibration exits and SISI Calibration is entered. Refer to the SISI Calibration description, on page 4-22. Pressing the SISI key while in the SISI measurement, terminates the SISI Calibration and reenters HL Calibration. The PULSED and ALT signal format keys are invalid.

dB Step Size

The 1, 2, or 5 dB STEP SIZE keys are used to set the HL step size for selecting the calibration Reference HL using the Ch 2 HL KNOB. The selected step size is displayed.

Channel 1 HL

The Ch 1 HL KNOB is used to directly adjust the Ch 1 HL attenuator in 0.5 dB steps for adjusting the output level to achieve the target SPL. If the attenuator range is exceeded, the Ch 1 HL display flashes. The attenuator ranges from transducers maximum attenuation to the maximum power limit. If custom NB Noise or White Noise is selected, the Ch 1 HL KNOB is used to adjust the noise calibration offset value. This is the value used to calibrate NB noise or white noise by offsetting the pure tone calibration data to get the noise calibration data. If custom Speech Calibration is selected, see page 4-19, **S902 - 8 Custom Speech Calibration.**

Channel 1 Interrupt & Channel 1 Tone bar

The Ch 1 INTERRUPT key and Ch 1 TONE BAR determine the on or off state of the channel just as in the Normal Operating Mode. The "on" or "off" status of the channel is indicated by the CHANNEL ON display. The Ch 2 TONE BAR and INTERRUPT are invalid in the HL Calibration mode.

Channel 2 HL

The Ch 2 HL KNOB is used to select the Reference HL level at which the calibration is to be performed. Each change of the Ch 2 HL knob alters the HL level by the selected dB step size. The Ch 1 HL display is updated with the new target SPL value and the Ch 1 HL attenuator is adjusted so that the output level follows the Reference HL changes. The Reference HL level is limited to the calculated maximum HL limit down to the HL where the 30 dB pad would be required to be switched in. (The 30 dB pad is ALWAYS OUT during calibration). If the HL range is exceeded, the HL display flashes.

Data Transfer / Save

Press the DATA TRANSFER or SAVE key to store the necessary calibration data into EEPROM. This only needs to be done if the calibration data has changed or to clear the Using Default Data flag. The message "Saving Data" is briefly flashed in the Error Message field.

SISI Calibration Check

General Information

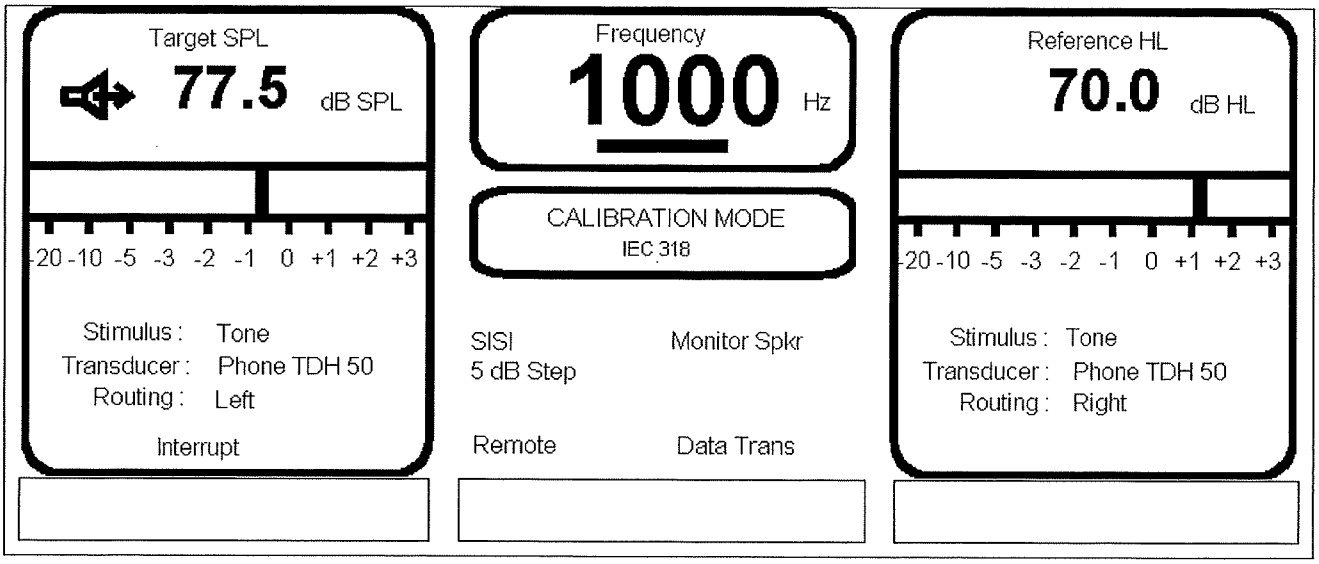
The SISI Calibration mode is not an actual calibration mode, but a measurement mode which provides a means to manually turn the SISI pulse increment on and off so that it may be measured without the use of an impulse meter. As it is possible to do SISI on either Channel 1 or Channel 2 in the Normal Operating Mode, the SISI pulse increment should be measured on both channels.

SISI Calibration Mode Entry

The SISI Calibration is entered by pressing the SISI key while in HL Calibration. When SISI is entered, the frequency remains at the frequency selected upon entry. The Ch 1 transducer is phone and the stimulus is tone. The Ch 1 routing will be unchanged if it was left or right. The Ch 2 transducer is phone and the stimulus is tone. The Ch 2 routing is the opposite of Ch 1, i.e. if Ch 1 routing is right, then the Ch 2 routing is left. The Ch 2 HL step size used to select the SISI baseline is set to 5 dB increments.

SISI Calibration Display and Controls

The SISI Calibration display is the same as the HL Calibration except that SISI is displayed and the Ch 2 Stimulus , Transducer and Routing are displayed. The SISI Calibration screen is available in English only.



The dB STEP keys are used to select the SISI pulse increment to be measured. The Ch 1 TONE BAR or INTERRUPT can be used to turn the SISI pulse on and off. Reverse the routing by pressing the Ch 1 ROUTING key. Press the Ch 2 TONE BAR or INTERRUPT key to turn the SISI pulse on Ch 2 on and off.

Note: Only one tone bar is serviced at a time. The first one pressed is acknowledged first. Pressing FM turns FM on and off. Pressing MONITOR SPEAKER turns the monitor speaker on and off.

The following keys are invalid while in SISI calibration:

ALT	AUDIOGRAM	CH 1 STIMULUS
CH 1 LEFT RIGHT	CH 1 TRANSDUCER	CH 2 STIMULUS
CH 2 TRANSDUCER	CH 2 ROUTING	CLEAR/CLEAR
CORRECT/START	DATA ERASE	DATA TRANSFER
INCORRECT/STOP	INTERLOCK	PRINT AUDIOGRAM
PULSED	SAVE	STATUS
SUBJECT RESPONSE	TALKFORWARD	TRACKING

The SISI Calibration Mode is exited back to the HL Calibration Mode by pressing the SISI key.

Calibration Mode Exit

The HL or SISI Calibration mode can be exited back to the Normal Operating mode at any time, providing that a stimulus is not being presented. When the Normal Operating mode is reentered, a Status screen is displayed.

The following parameters are defaulted:

Ch 1 HL = 0 dB
Ch 2 HL = -10 dB
Ch 2 Stimulus = NB Noise if Ch 1 Stimulus is a Tone type or Speech Noise if Ch 1 is a Speech type
Ch 2 Transducer = Phone
Ch 2 Routing = Opposite of Ch 1 or Left if no routing on Ch 1.
Ch 2 Interrupt = Present
Timer = 0:00
Scorer = 0 Correct, 0 Presentations

The following parameters are NOT defaulted, and remain the same:

Frequency range
Frequency selection
Ch 1 Stimulus
Ch 1 Transducer
Ch 1 Routing
Ch 1 Interrupt
Ch 1 Tone Bar
Signal Format
dB Step Size
Monitor Speaker

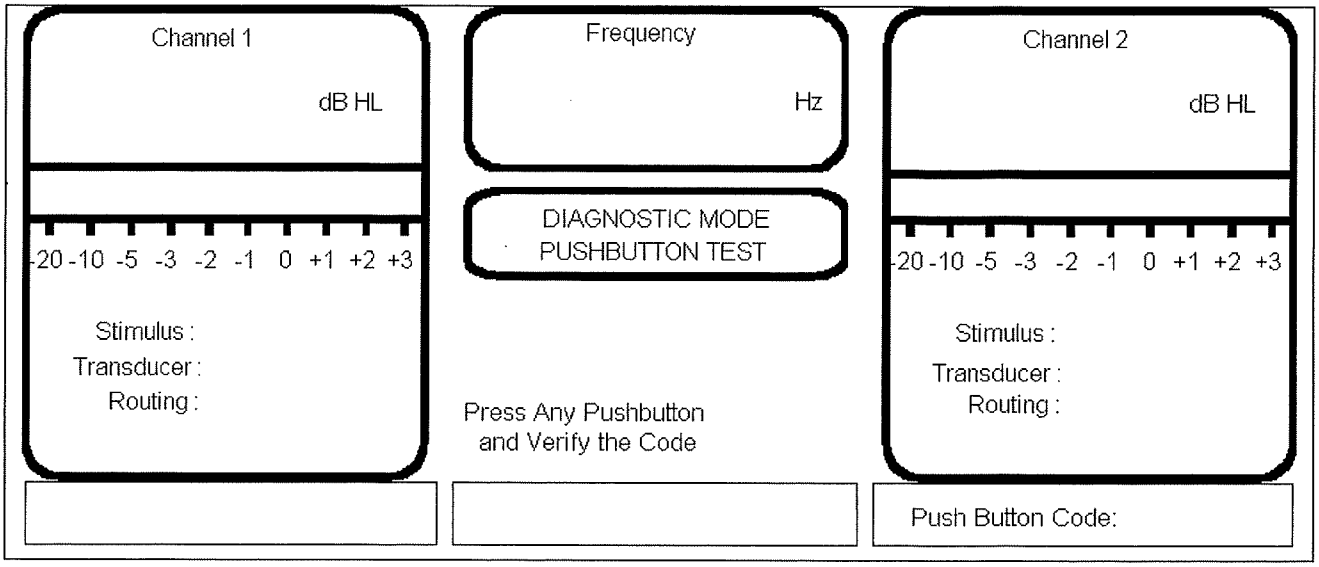
Diagnostic Mode

The diagnostic mode allows the service person to test some of the hardware, such as the display, the front panel keys, the serial interface, etc. To enter the diagnostic mode, the service person sets the Cal/Diag Mode dip switch S901 - 1 to the Diagnostic position, sets the Diagnostic Mode Test Number Dip Switches (**S902 - 4** and **5**) to the desired test number, and then moves the CAL / NORMAL Switch to the CAL position. The appropriate diagnostic test will be entered. To select another Diagnostic Test the instrument must first be set back to the Normal Operating Mode and then the new Diagnostic Test can be selected. The Diagnostic Mode test screens are available in English only.

Pushbutton Diagnostic Test

S901-1 ON
S902-4 OFF
S902-5 ON

The Pushbutton Diagnostic Test allows all software controlled keys, knobs and switches with the exception of the CAL / NORMAL Switch and all Dip Switches to be manually tested for proper operation. On entry, the Pushbutton Diagnostic Test screen is displayed.



When any control is operated, the logical keycode which is a unique number representing that control, is displayed in the Status Message field to the right of the "Key Code" label. This number is displayed until another control is operated.

The following Key Codes are displayed:

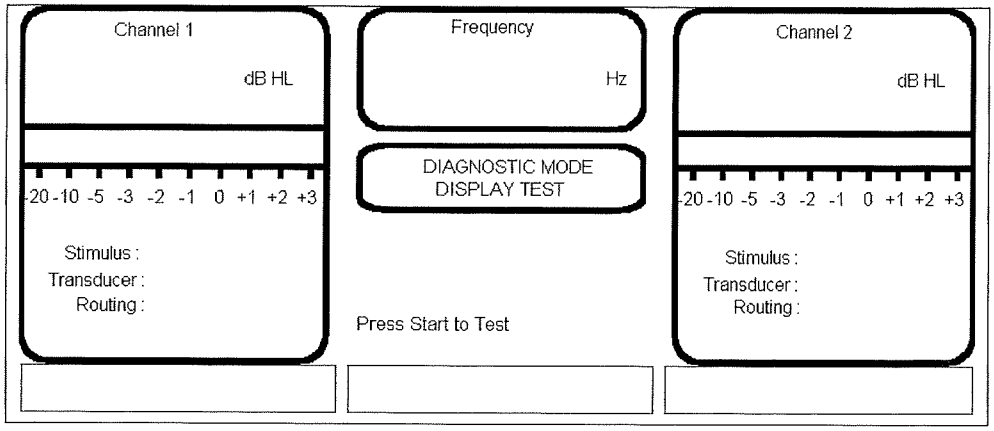
Key	Key Code
5.0 dB STEP	00
2.0 dB STEP	01
1.0 dB Step	02
SISI	03
ALT	04
PULSE	05
FM	06
CORRECT	07
INCORRECT	08
CLEAR	09
CH 1 WTN	10
CH 1 SPN	11
CH 1 NBN	12
CH 1 EXT. B	13
CH 1 EXT. A	14
CH1 MIC	15
CH 1 TONE	16
CH 2 WTN	17
CH 2 SPN	18
CH 2 NBN	19
CH 2 EXT. B	20
CH 2 EXT. A	21
CH 2 MIC	22
CH 2 TONE	23
CH 1 L / R	24
CH 1 Right	25
CH 1 Left	26
CH 2 L / R	27
CH 2 R	28
CH 2 L	29
CH 1 INSERT	30
CH 1 SPKR	31
CH 1 BONE	32

Key	Key Code
CH 1 PHONE	33
CH 2 INSERT	34
CH 2 SPKR	35
CH 2 BONE	36
CH 2 PHONE	37
MON. SPKR	38
TRACKING	39
INTERLOCK	40
DATA XFER	41
REMOTE	42
SAVE	43
ERASE	44
HIGH FREQ.	45
AUDIOGRAM	46
STATUS	47
PRINT AUDIO	48
CH1 HL KNOB	53
CH2 HL KNOB	54
FREQUENCY UP PRESSED	55
FREQUENCY DOWN PRESSED	56
FREQUENCY UP RELEASED	57
FREQUENCY DOWN RELEASED	58
CH 1 TONE BAR PRESSED	59
CH 1 TONE BAR RELEASED	60
CH 1 INTERRUPT	61
CH 2 TONE BAR PRESSED	62
CH 2 TONE BAR RELEASED	63
CH 2 INTERRUPT	64
TALK FORWARD PRESSED	65
TALKFORWARD RELEASED	66
SUBJECT RESPONSE PRESSED	68
SUBJECT RESPONSE RELEASED	69

Display Diagnostic Test

S901-1 ON
S902-4 ON
S902-5 OFF

The Display Diagnostic Test provides a means to visually test the LCD display system by exercising all the pixels of the LCD display and both video display RAM pages of the LCD controller. On entry, the Display Diagnostic screen is displayed.

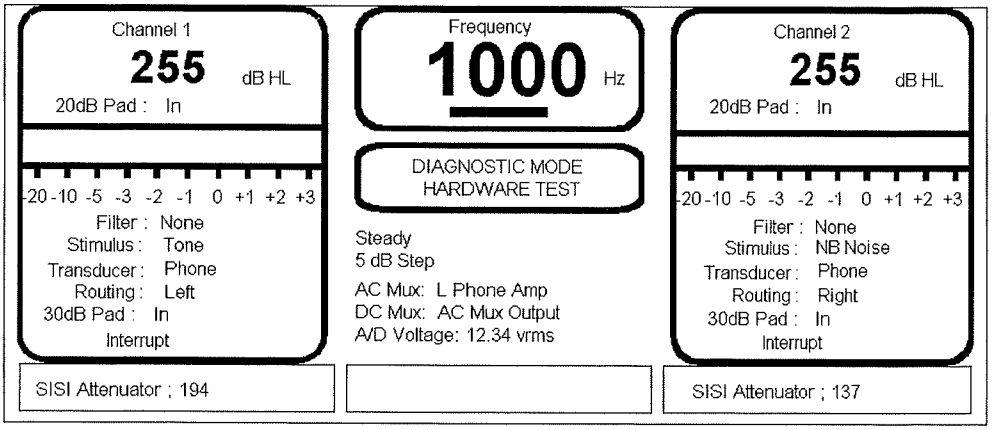


During the test, each step will last for 5 seconds to allow the tester sufficient time to observe the display. If the tester wishes to proceed to the next step before the 5 seconds are up, the START key may be pressed. When the START key is pressed to start the test, Page 1 of the LCD controller is first tested. All pixels are turned off (Black) for 5 seconds. All pixels are then turned on (White) for 5 seconds to check for pixels which do not turn on. A pattern of narrow vertical lines is then displayed to check for adjacent pixels which may be shorted. Page 2 of the LCD controller is then tested by repeating the above 3 display patterns. When the test is complete the Display Diagnostic mode screen is re-displayed. Other than the START key, all other controls will be ignored.

Hardware Diagnostic Test

S901-1 ON
S902-4 OFF
S902-5 OFF

The Hardware Diagnostic Test provides direct and independent control of the following hardware blocks.



The A/D Voltage value is an average of 8 measurements of the current A/D input and is updated every 2 seconds.

For the DC multiplexer inputs it is displayed in Volts DC. For other inputs it displays Volts RMS.

The Ch 1 and Ch 2 HL fields display the channel's HL attenuator setting in the range of 0 to 255.

The Ch 1 and Ch 2 Filter fields display the state of each channel's filter as either "None", "High Pass" or "Speech".

The Ch 1 and Ch 2 20 and 30 dB Pad fields display the current state of the channel's pads as either "In" or "Out".

The Ch 1 and Ch 2 SISI Attenuator fields display the current position of the channel's SISI attenuator in the range of 0 to 255.

The AC Mux field displays the current input to the A/D's AC multiplexer as either "L Phone Amp," "R Phone Amp", "L Speaker Amp+", "L Speaker Amp-", R Speaker Amp+" or "R Speaker Amp-".

The DC Mux field displays the current input to the A/D's DC multiplexer as either "AC MUX Output", "Channel 1 VU", "Channel 2 VU", "Talk Fwd Pot", "Ext. A Pot", "Ext. B Pot" or "Test Point".

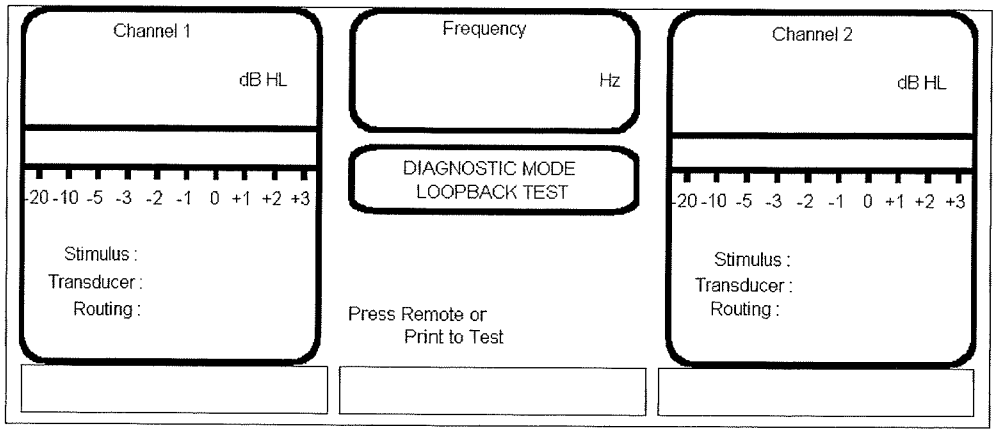
Key	Function
CLEAR/CLEAR	Toggle the Channel 1 +30 dB pad on/off
INCORRECT/STOP	Toggle the Channel 2 +30 dB pad on/off
DATA TRANSFER	Increment A/D DC Multiplexer to the next input.
REMOTE	Increment A/D AC Multiplexer to the next input
SAVE	Increment the Ch 1 filter selection to speech filter ON, high pass filter ON, both OFF
TRACKING	Increment the Ch 2 filter selection to speech filter ON, high pass filter ON, both OFF
ALT	Step the Ch 1 SISI attenuator down 1 step with wrap around 0 <-> 255.
PULSE	Step the Ch 1 SISI attenuator up 1 step with wrap around 0 <-> 255.
STATUS	Step the Ch 2 SISI attenuator up 1 step with wrap around 0 <-> 255.
AUDIOGRAM	Step the Ch 2 SISI attenuator down 1 step with wrap around 0 <-> 255.
CH 1 HL KNOB	Step the Ch 1 HL attenuator directly up / down through the range of 0 to 255 with the step size selected on the dB STEP keys.
CH 2 HL KNOB	Step the Ch 2 HL attenuator directly up / down through the range of 0 to 255 with the step size selected on the dB STEP keys.
DATA ERASE	Toggle the Ch 1 20 dB pad in / out
PRINT AUDIOGRAM	Toggle the Ch 2 20 dB pad in / out

The following controls are invalid: CORRECT/START, SISI

Loopback Diagnostic Test: Rev 2 Remote Board

S901-1 ON
S902-4 ON
S902-5 ON

The Loop back Diagnostic Test provides a means to verify the operation of the Remote and Printer serial interfaces. The hardware handshaking lines and data lines can both be tested. On entry, the Loopback Diagnostic screen is displayed as shown below.

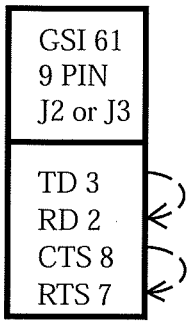


Before performing the test, the Loopback jumpers should be connected to the desired connector or cable.

Press the REMOTE key to initiate the Remote Loopback test on Connector J2.
Press the PRINT key to initiate the Printer Loopback test on Connector J3.

The test results are displayed in the Status Message field. When the Handshaking Dip Switch (**S1-6**) on the Remote Board is set to Hardware Flow Control, the handshaking lines are tested. If the CTS signal does not match the received RTS signal, the test fails.

The RD and TX data lines are tested by transmitting a known character string and then receiving it back. If the received string matches the transmitted string, the data line test is successful.



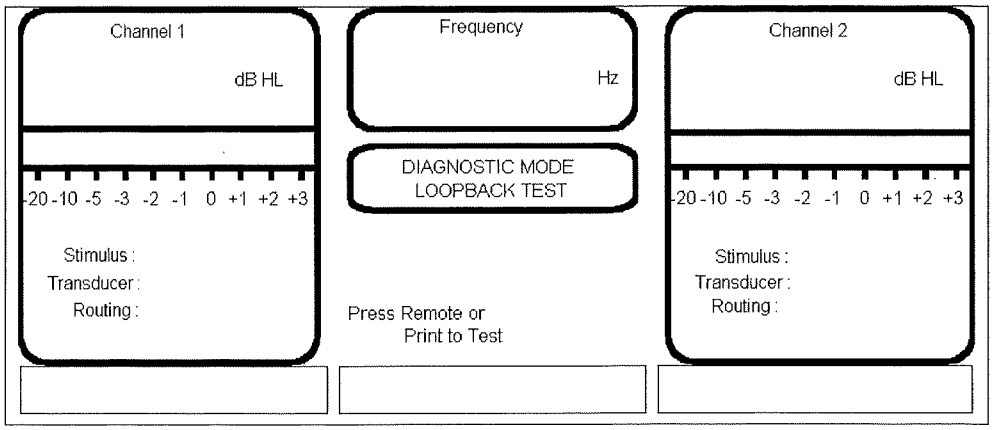
Each press of the REMOTE or PRINT key initiates another loopback test. All other controls, except for the CAL /NORMAL Switch are invalid.

The message "Passed" is displayed in the Status Message field when all Loopback tests pass. If the Loopback test fails due to failures of both the handshaking *and* data lines, the message "FAILED" is displayed. If the test failed due to the handshaking lines, the message "RTS/CTS FAILED" is displayed. If the test failed due to the data lines, the message "TX/RD FAILED" is displayed.

Loopback Diagnostic Test: Rev 3 Remote Board

S901-1 ON
S902-4 ON
S902-5 ON

The Rev 3 Remote Option Board can be tested by looping back the RS 232 transmit and CTS signals to the receive and RTS inputs. These signals can be jumpered with short pieces of wire directly on J2 of the Remote Option board. The Loopback Diagnostic Test provides a means to verify the operation of the Remote serial interface. (On the Rev 3 boards, there is no longer a printer serial interface to test.) On entry, the Loopback Diagnostic screen is displayed as shown below.

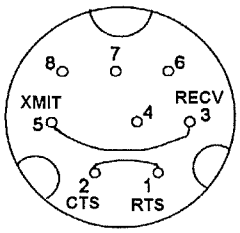


Before performing the test, the Loopback jumpers should be connected to the desired connector or cable.

Press the REMOTE key to initiate the Remote Loopback test on Connector J2.

The test results are displayed in the Status Message field. When the Handshaking Dip Switch (**S1-6**) on the Remote Board is set to Hardware Flow Control, the handshaking lines are tested. If the CTS signal does not match the received RTS signal, the test fails.

Loopback Jumper Connections on J2



Connect loopback jumpers between J2-5 and J2-3 (transmit and receive) and J2-1 and J2-2 (CTS and RTS).

The RD and TX data lines are tested by transmitting a known character string and then receiving it back. If the received string matches the transmitted string, the data line test is successful.

Each press of the REMOTE key initiates another loopback test. (The PRINT key will always fail since the handshaking and communication protocol for the printer port is different from the Remote port. Such failure is expected.) All other controls, except for the CAL/NORMAL Switch are invalid.

The message "Passed" is displayed in the Status Message field when all Loopback tests pass. If the Loopback test fails due to failures of both the handshaking *and* data lines, the message "FAILED" is displayed. Other test failures indicate which lines caused the failure.

Diagnostic Mode Exit

The HL or SISI Calibration mode can be exited back to the Normal Operating mode at any time, providing that a stimulus is not being presented. When the Normal Operating mode is reentered a Status screen is displayed.

The following parameters are defaulted:

Ch 1 HL	= 0 dB
Ch 2 HL	= -10 dB
Ch 2 Stimulus	= NB Noise if Ch 1 Stimulus is a Tone type or Speech Noise if Ch 1 is a Speech type
Ch 2 Transducer	= Phone
Ch 2 Routing	= Opposite of Ch 1 or Left if no routing on Ch 1.
Ch 2 Interrupt	= Present
Timer	= 0:00±
Scorer	= 0 Correct, 0 Presentations

The following parameters are NOT defaulted, and remain the same:

Frequency range
Frequency selection
Ch 1 Stimulus
Ch 1 Transducer
Ch 1 Routing
Ch 1 Interrupt
Ch 1 Tone Bar
Signal Format
dB Step Size
Monitor Speaker

Disassembly

5

General Description

This section covers disassembly of the GSI 61 and the procedures to replace different functional units.

The order of presentation is:

1. Opening the unit case and replacing the **Main PCB: 1761-4700ROT / SVC**
2. Opening the Display enclosure and replacing the **LCD: 1761-0496SVC**
3. Opening the Display enclosure and replacing the **LCD Inverter Board: 1761-2015SVC**
4. Opening the unit case and replacing the **Transformer: 1761-2000SVC**

1. Main PCB Removal/Installation Procedure

1. Turn off power (Mains) on GSI 61.

2. Remove three screws from the bottom of the front edge (#6-32 x .25" long).

3. Remove the blue rubber covers from the knobs on the front panel (on current units).

4. Remove the front panel knobs using an Allen wrench; (8) small knobs .050", (2) large knobs .0625" (1/16").

5. Open unit and make note of wire and cable positioning prior to disassembly. Disconnect the following cables from the Main board:
   - A) Analog Power ..... (10 pos.) J11
   - B) Digital Power ..... (14 pos.) J12
   - C) Main Board Ground Strap ..... (secured with one screw)
   - D) Left Power Amp ..... (3 pos.) J19
   - E) Right Power Amp ..... (3 pos.) J18
   - F) Display ..... (16 pos.) J20
   - G) RS-232/Printer ..... (J23) *option*

6. Compare dip switch settings between the replacement Main board and the defective board. Set dip switches on new PCB to match selections of old PCB.

7. Separate the front edge of the board from the plastic case first; this will allow the rear panel connectors to clear the plastic case.

8. Replace the Main board by removing nine screws.

9. Ensure that all conductive rubber switches are still held in place by the small protrusions in the plastic case.

10. Install the replacement board by inserting the rear panel connectors through the openings in the plastic case and securing with nine screws.

Note: Start all screws before tightening all of them.

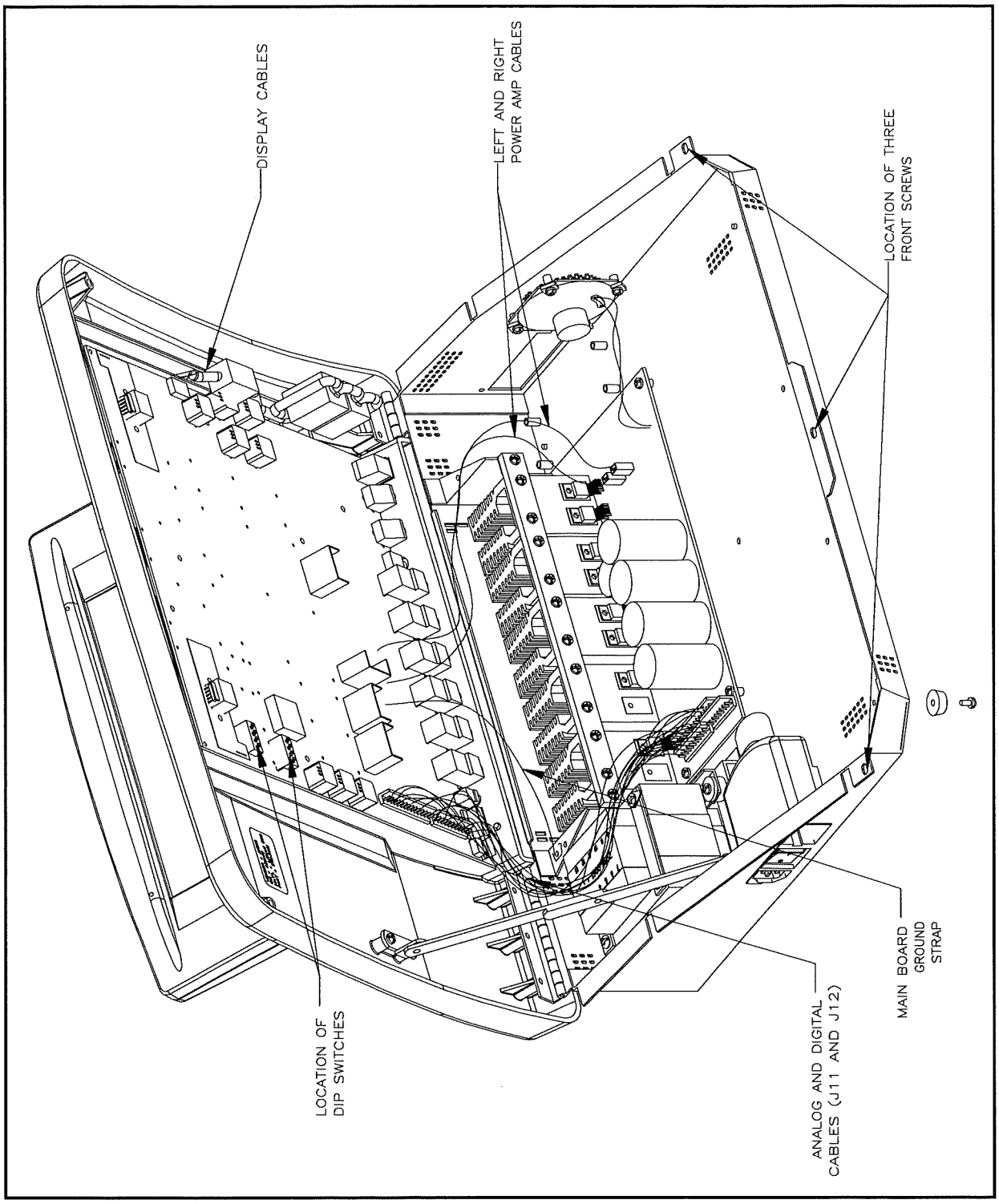
11. Replace all cables to the Main board (see list above).

12. Close unit and replace the three screws along the front edge.

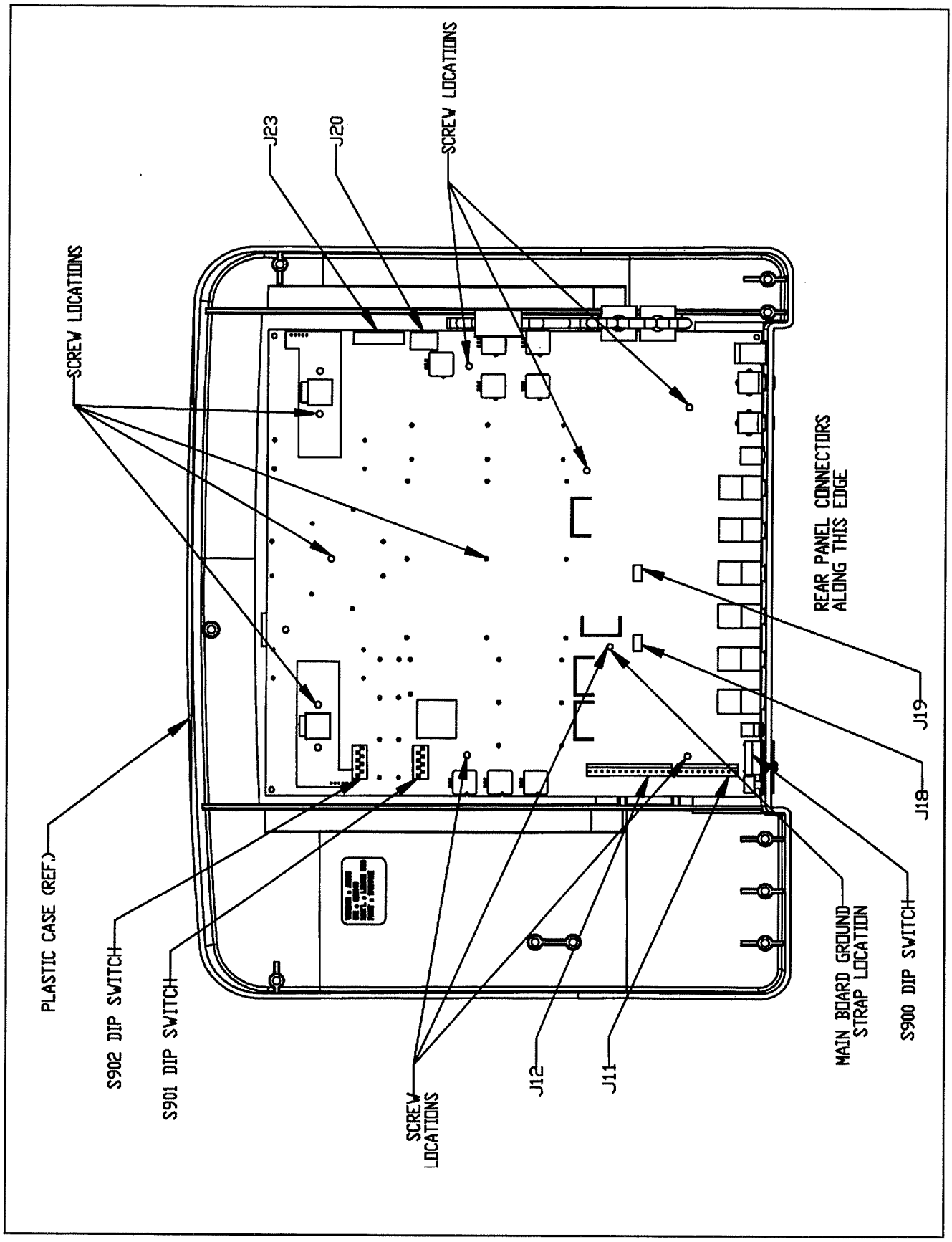
13. Replace all front panel knobs and their blue covers (if present).
    All knobs should be spaced up approximately 1/32" from the front panel label. To position the small knobs in the correct orientation, rotate the blue shaft clockwise until it stops, then locate the knob indicator between the 4 and 5 o'clock position. Locate the "Talkforward" knob at the 6 o'clock position. The position of the large knobs is arbitrary.

14. Refer to Calibration section of this Service Manual and perform a complete calibration.

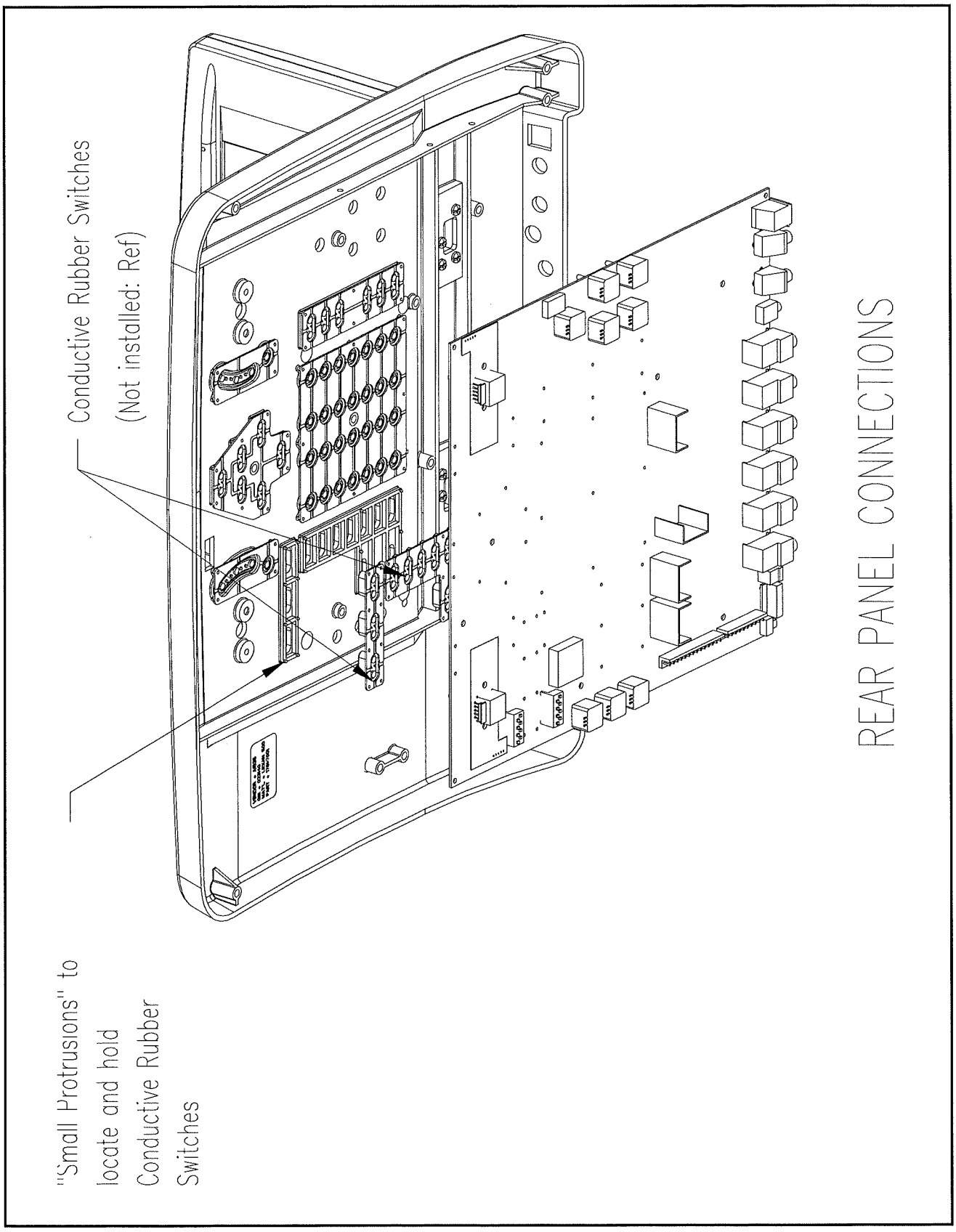
Main PCB Removal/Installation



Main PCB Removal/Installation continued



Main PCB Removal/Installation continued



2. LCD Removal/Installation Procedure

CAUTION: **High voltage may be present within the display enclosure! To ensure safety, turn unit Mains power off. Power Mains cord can remain attached to ensure chassis is grounded, thus minimizing ESD potentials.**

Note: The main portion of the unit does not need to be opened for this installation.

1. Turn off power (Mains) on GSI 61.
2. Fold the display down (forward) to the front panel.
3. Remove six screws (6-32 x .375" long) that secure the rear display cover.
4. Make note of wire and cable positioning prior to disassembly.
5. Disconnect three connectors:
   A) Red and black wires with locking connector.
   B) Two white wires with locking connector.
   C) Multi-colored wires (12 position).
6. Remove four screws that secure the LCD to the plastic case. (Three 6-32 x .25" long and one 6-32 x .375" long.)

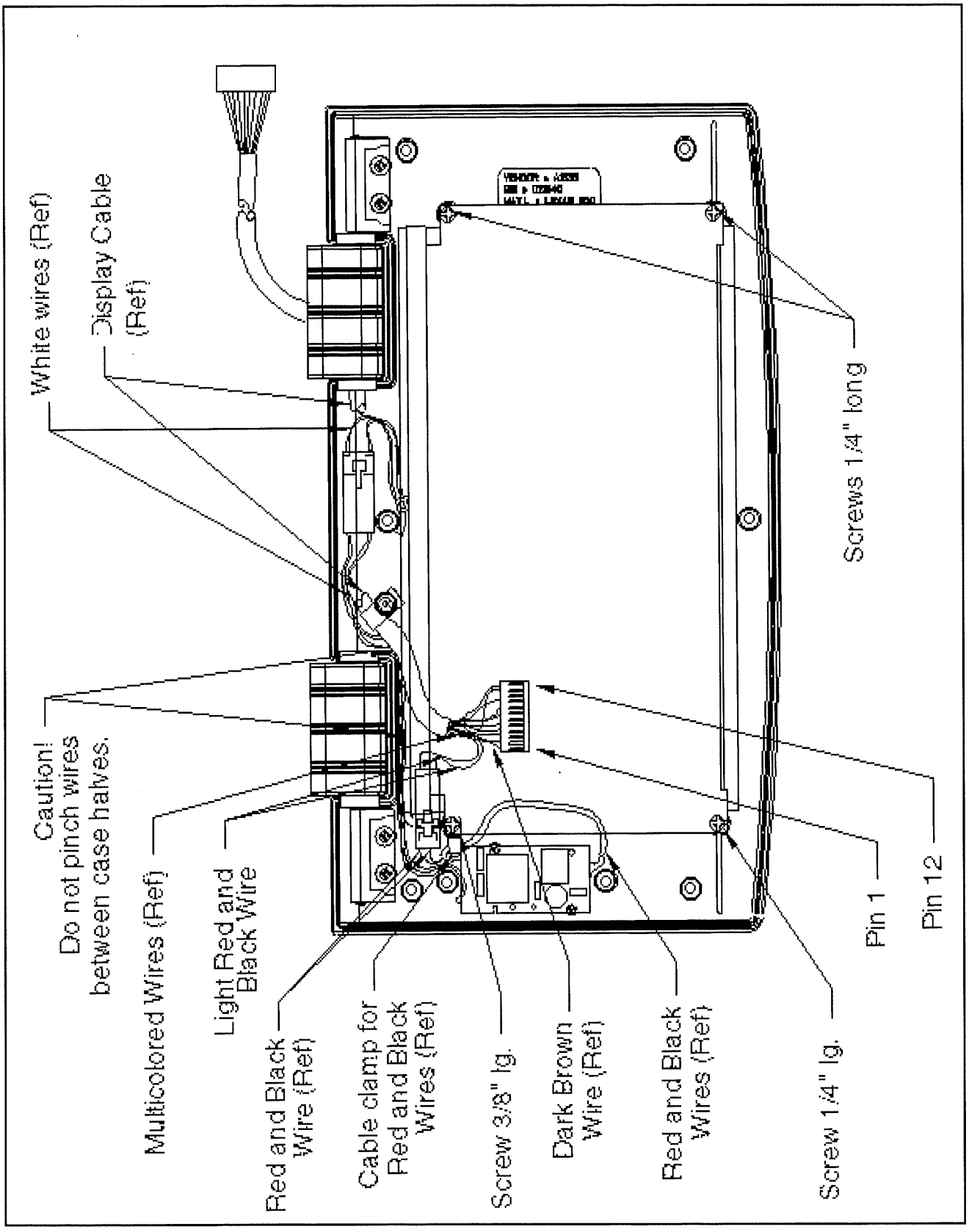
Note: Plastic lens does not need to be removed. If lens is removed for cleaning or replacement etc., the glossy side should face the LCD.

7. Remove protective plastic from replacement LCD glass.
8. Secure replacement LCD with four screws.

Note: Be sure to replace the cable clamp for the red and black wires using the longer screw. Also note the lens is held in place between the plastic case and LCD.

9. Reconnect the three cables (see A, B and C above). Position wires as shown.
10. Replace rear display cover with six screws. Use caution not to pinch wires when tightening screws.

LCD Removal/Installation



3. LCD Inverter Board Replacement

CAUTION: **High voltage may be present within the display enclosure! To ensure safety, turn Mains power off. Power Mains cord can remain attached to ensure chassis is grounded, thus minimizing ESD potentials.**

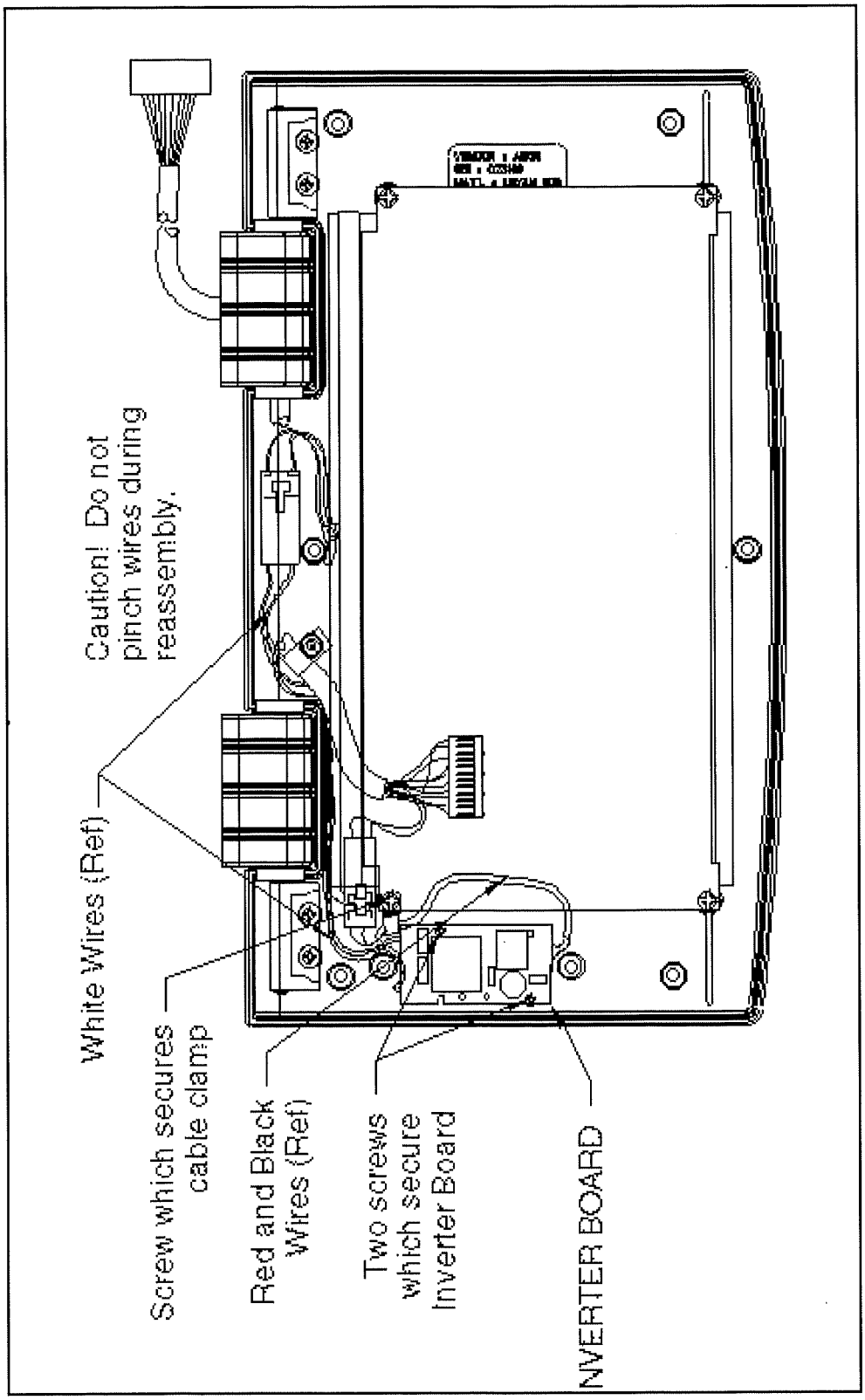
Note: The main portion of the unit does not need to be opened for this installation.

1. Turn off power (Mains) on GSI 61.
2. Fold the display down (forward) to the front panel.
3. Remove six screws (6-32 x .375" long) that secure the rear display cover.
4. **Make note of wire and cable positioning prior to disassembly.**
5. Disconnect two connectors:
   A) Red and black wires with locking connector.
   B) Two white wires with locking connector.
6. Remove the one screw that secures the cable clamp for the red and black wires.
7. Replace the Inverter board.

Note: Do not overtighten the two screws that secure the board to plastic case.

8. Position wires as shown and replace cable clamp for the red and black wires.
9. Reconnect the two connectors (see A and B above). Position wires as shown.
10. Replace rear display cover with six screws. Use caution not to pinch wires when tightening screws.

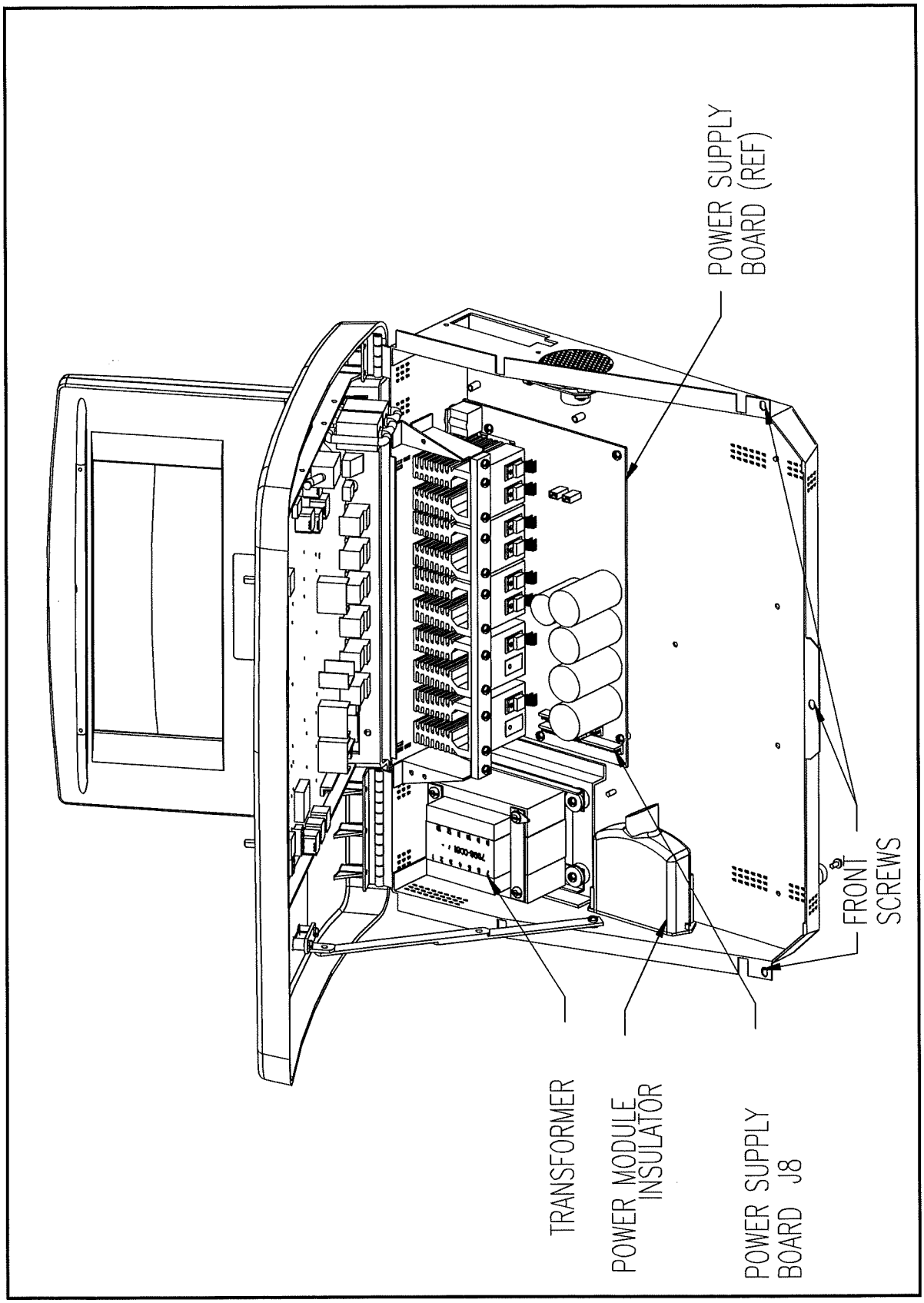
LCD Inverter Board Replacement



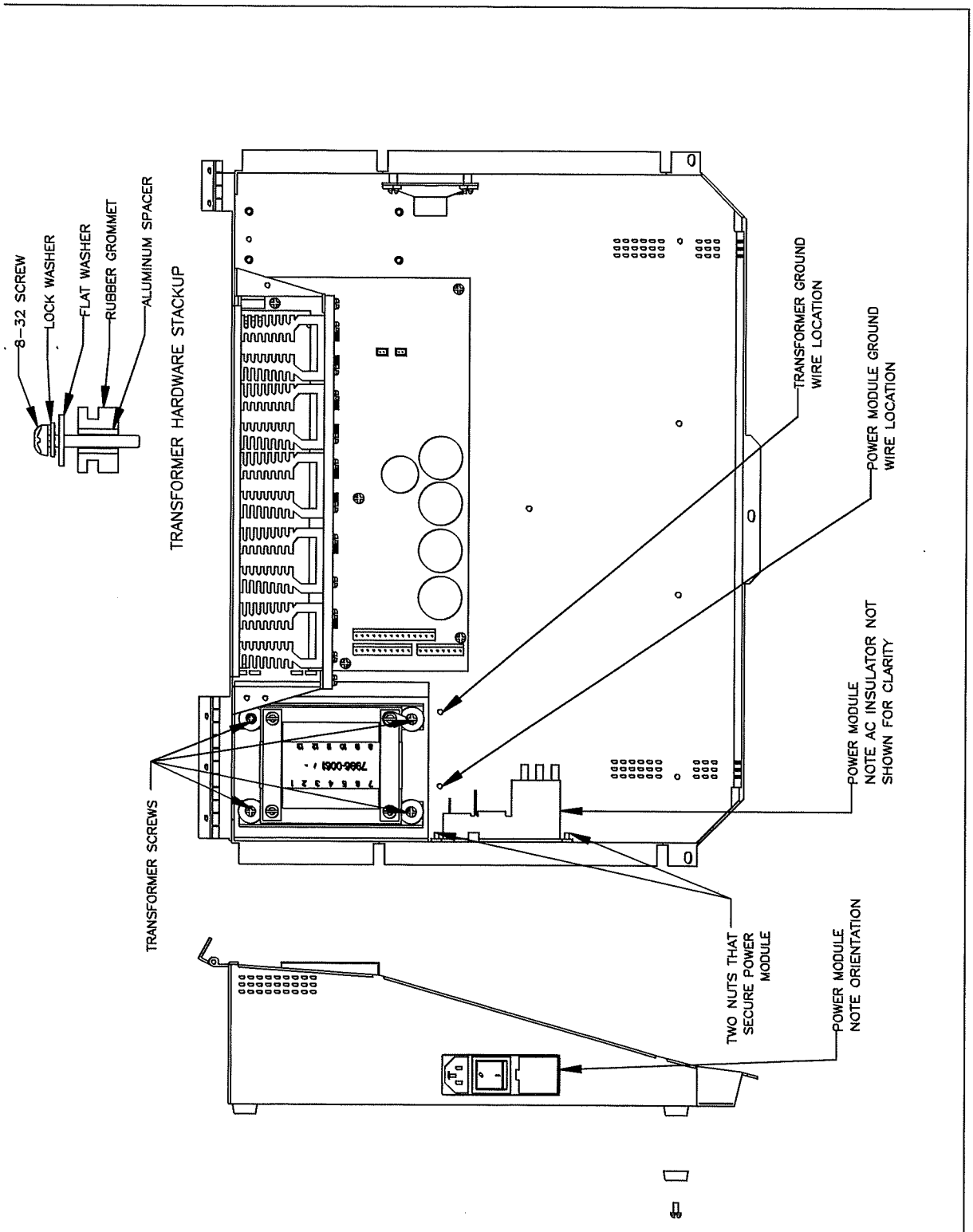
4. Transformer Replacement

1. Turn off power (Mains) on GSI 61.
2. Remove three screws from the bottom of the front edge (#6-32 x .25" long).
3. Open unit and make note of wire and cable positioning prior to disassembly.
4. Disconnect the transformer wires from the Power Supply board, J8.
5. Remove two nuts that secure the power entry module to the sheet metal base. Pull power entry module aside.
6. Remove two nuts that secure ground lugs to sheet metal base.
7. Remove four screws that secure transformer to sheet metal base.
8. Install replacement transformer using four screws. Note proper stackup of hardware and orientation of wires.
9. Secure two ground lugs to sheet metal base using two nuts.
10. Secure power module to sheet metal base using two nuts. Note proper orientation. Also note: if wires should become disconnected from power module, reconnect per connection chart.
11. Reconnect transformer wires to Power Supply board, J8.
12. Close unit and replace three screws along front edge.

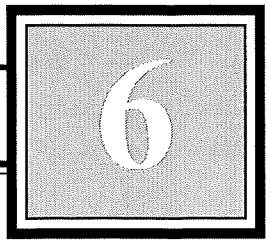
Transformer Replacement



Transformer Replacement continued



Troubleshooting



General Information

The Message "CAL"

The calibration for the GSI 61 is stored in the system's EEPROM memory, and this data is continually monitored. If an error should be found in the calibration memory, the message "CAL" is displayed in the appropriate channel's intensity area*. "CAL" is displayed when the faulted transducer and stimulus combination is selected. The channel is forced into an OFF condition and cannot be turned on until a new stimulus and transducer combination is selected.

*calibration data is stored for each transducer and stimulus combination.

When the message "CAL" appears in either Channel 1 or Channel 2, note the specific combination selected. Try the same combination on the alternate channel. Changing stimulus, routing (Left vs. Right) and transducer type will help isolate the calibration memory fault.

If the "CAL" message occurs with all possible transducers at the same frequency, it is most likely that the source level (VU level) data is faulted, or its frequency calibration data is faulted. Self-calibration is the only way to write over the source's calibration data. If the "CAL" message only occurs with a given transducer (i.e. Left Phone), it is most likely that the transducer's calibration data is faulted. Recalibrating that transducer is the only way to write over the specified transducer's calibration data. If the calibration data cannot be rewritten, it indicates a failure of the calibration memory read protocol. Typically this is the result of a defective EEPROM (U810).

The Message "HELP"

Should the message "HELP" appear in the message area of the display, the GSI 61 will enter a lockout mode which will disable all front panel operations. In addition to the message "HELP", code numbers will appear. These numbers are important, as they indicate the possible source of the problem. Help message indications with associated probable solutions are listed further on in this section.

If the word "Help" followed by an error code is displayed, **note the Help Code number.** Turn off the power to the GSI 61 and wait 30 seconds. Restart the instrument. Often, the error will be cleared by this action. If the error persists, contact your authorized Grason-Stadler service representative.

Line Voltage and Brownout Interruptions

The GSI 61 is designed to protect against abnormal AC power conditions by returning to the power-up initialization settings, thereby protecting the unit against unwanted conditions at the transducers. This will automatically occur when interference is not too severe. However, under extreme conditions the GSI 61 will enter a lockout mode which will not permit front panel operations. This can be rectified by simply powering down for approximately thirty seconds and then restarting operation.

Status Messages

The following is the list of status messages which will occur with operation of the GSI 61 Audiometer. These messages will be displayed in the center message area in either of the two display formats.

Using Default Data Indicates that the selected transducer and stimulus are not calibrated to standard specified (ANSI/ISO) levels.

Erasing Data Indicates that the GSI 61 is clearing stored test information.

Saving Data Indicates that the GSI 61 is saving test information into memory.

No Test Data Stored Indicates that there is no test data available to be erased or printed.

Check Hi-Freq Cables Indicates that the High Frequency function is enabled but the cables plugged into the L&R phone jacks are *not* the GSI specified type.

Invalid Selection Indicates that an incorrect selection, such as incompatible transducers, has been made.

Not Available Indicates an uninstalled option has been selected.

Loading Default Data A calibration message.

Self Cal in Progress A calibration message.

No Test Data Stored Indicates that there is no data available for printing, although the Print Audiogram button has been pressed.

Data Transfer Indicates that data is being transferred by a Data Transfer pushbutton operation.

Check Printer The GSI 61 verifies that the printer is connected and ready to receive data by checking the hardware flow control line. If printer is not ready this message appears.

Printing This message appears while the GSI 61 is sending data to the printer. It appears on the lower right section of the LCD.

No Printer Response If during the course of printing communications problems occur, this error message appears.

Communication Error Messages

The following communications errors may occur during data transmission through the RS-232 communications:

COMM ERROR:	parity -	Check GSI 61 and PC parity settings.
COMM ERROR:	framing -	Check GSI 61 and PC selections for number of stop bits and number of bits per command.
COMM ERROR:	overrun -	See 'framing.'
COMM ERROR:	multiple -	Check parity, baud rate, number of stop bits, byte size on GSI 61 and PC.
COMM ERROR:	spurious -	Soft error. Should not be repeatable; if so, problem could be anywhere in GSI 61 digital circuits or PC's communication circuits.
COMM ERROR:	break -	See 'spurious.'

Display Indicated Symptoms	(Result of Internal Diagnostics)
Symptom: **HELP Message appears on the display and unit is locked up**	**Probable Cause and Solution:** **HELP message (General Description)** Self-contained diagnostics have been designed into the GSI 61. These HELP messages, should they occur, will have numbers associated with them. These numbers will be displayed on the LCD in the center message area. The first number is called the Code Number, and the second is called the Subcode Number. In many cases, a HELP message can be caused by a temporary condition. In these situations, **it is important to first note the Code and Subcode Numbers and secondly to power down the GSI 61, wait 30 seconds, then power up again and see if the message clears.** In any event, the numbers should be noted for possible future reference. In some cases the numbers will indicate a firm failure and narrow the problem to a distinct component or at least a block of circuitry. When this occurs, the unit can be repaired by replacing the component or troubleshooting the designated circuit.

HELP Message Notes

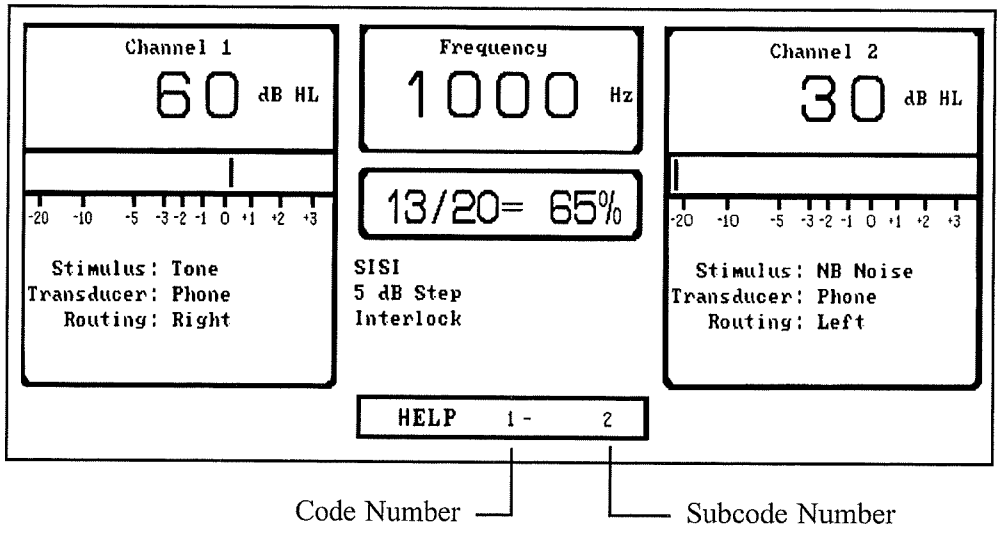
1. Some of the HELP messages (mostly in CAL mode) can take up to ten minutes to be displayed after the fault occurs. This is because the software will try to adjust the unit in an attempt to eliminate the fault. Some of these adjustments are to such fine resolution that it can take ten minutes to try all combinations.

2. Many times the Subcode Number field will indicate an unpublished number or the digit 0. This means that a subcode was not needed and all pertinent information is shown by the Code Number.

3. HELP messages with Codes 24, 25, 28, 38 or 39 will indicate a Subcode Number from 0 to 20 on the display. These numbers correlate to the failed frequency (i.e., 0 is 125 Hz, 1 is 250 Hz, ... 11 is 125 kHz, 20 is 20 kHz).

HELP Code Listing

The HELP messages will appear in a box on the bottom center of the display. An example is shown below.



	Code	Subcode	Description
HELP	**2-**	**-1**	Soft error - Power down/power up should clear the problem. If message recurs, replace microprocessor (U901) and/or PROM (U809).
HELP	**2-**	**-2**	Generally will occur only if too many front panel operations require too fast a display update. Would occur if display did not accurately indicate selection made. Typically transient and clears with power down/up. If repeatable, replace microprocessor (U901) and/or PROM (U809).
HELP	**2-**	**-3**	See HELP 2- -1
HELP	**2-**	**-4**	See HELP 2- -2
HELP	**3-**	**xx**	Soft Error - Power down/up to clear. If repeatable, replace latches U914 and/or U913. Message indicates invalid input operation - keyboard, HL dials, subject response handswitch, etc.
HELP	**4-**	**xx**	See HELP 2- -1
HELP	**5-**	**0 - 16**	Undefined Interrupt Error - this type of soft error should always be recoverable. It relates to an interrupt that the processor does not acknowledge or cannot execute. If nonrecoverable, the complete Main PCB should be exchanged.
HELP	**6-**	**1**	See HELP 2- -1
HELP	**6-**	**2**	See HELP 2- -2
HELP	**6-**	**3**	See HELP 2- -1

	Code	Subcode	Description		
HELP	**6-**	**4**	See HELP	2-	-2
HELP	**7-**	**1**	See HELP	2-	-1
HELP	**7-**	**2**	See HELP	2-	-2
HELP	**7-**	**3**	See HELP	2-	-1
HELP	**7-**	**4**	See HELP	2-	-2
HELP	**9-**	**1**	See HELP	2-	-1
HELP	**9-**	**2**	See HELP	2-	-2
HELP	**9-**	**3**	See HELP	2-	-1
HELP	**9-**	**4**	See HELP	2-	-2
HELP	**10-**	**1**	See HELP	2-	-1
HELP	**10-**	**2**	See HELP	2-	-2
HELP	**10-**	**3**	See HELP	2-	-1
HELP	**10-**	**4**	See HELP	2-	-2
HELP	**12-**	**1**	See HELP	2-	-1
HELP	**12-**	**2**	See HELP	2-	-2
HELP	**12-**	**3**	See HELP	2-	-1
HELP	**12-**	**4**	See HELP	2-	-2
HELP	**13-**	**---**	A/D Converter "BUSY LINE" failure - replace Latch U1030 and/or A/D Converter U1104.		
HELP	**14-**	**1**	See HELP	2-	-1
HELP	**14-**	**2**	See HELP	2-	-2
HELP	**14-**	**3**	See HELP	2-	-1
HELP	**14-**	**4**	See HELP	2-	-2
HELP	**15-**	**1**	See HELP	2-	-1
HELP	**15-**	**2**	See HELP	2-	-2

	Code	Subcode	Description		
HELP	**15-**	**3**	See HELP	2-	-1
HELP	**15-**	**4**	See HELP	2-	-2
HELP	**16-**	**1**	See HELP	2-	-1
HELP	**16-**	**2**	See HELP	2-	-2
HELP	**16-**	**3**	See HELP	2-	-1
HELP	**16-**	**4**	See HELP	2-	-2
HELP	**17**	**0**	RAM failure - Occurs at Power up - replace U808.		
HELP	**19**	**0**	PROM failure - Occurs at Power up - replace U809.		
HELP	**20**	**0**	EEPROM failure - Occurs in the Cal mode - replace U810.		
HELP	**21-**	**1**	See HELP	2-	-1
HELP	**21-**	**2**	See HELP	2-	-2
HELP	**21-**	**3**	See HELP	2-	-1
HELP	**21-**	**4**	See HELP	2-	-2
HELP	**22-**	**0**	See HELP	2-	-1
HELP	**22-**	**1**	See HELP	2-	-1
HELP	**22-**	**2**	See HELP	2-	-1
HELP	**23-**	**0**	See HELP	2-	-1

HELP 24- **Freq Code:**

Pure Tone VU Calibration error during SelfCal. Ch 1 gain/SISI VCA cannot be set for 1.25 V_{RMS} to achieve 0 VU at the frequency indicated by the Subcode. Problem could be caused by oscillator (U300, U301, U302, U303, U304, U305, U306), Ch 1 input selection U409, U410, U411) Ch 1 gain/SISI VCA and D/A converter (U501, U503, U504, U506, U509), DC multiplexer (U253) and associated amplifiers (U252, U253) or A/D converter (U1104).

See Note 3 on page 6-3.

HELP 25- 26- 27- **Freq Code:**

Narrow Band (HELP 25), White (HELP 26), or Speech Noise (HELP 27) cannot be set to 1.25 V_{RMS} during SelfCal. Similar to HELP 24 in that the same circuits could be at fault; however, HELP 24 should have occurred first. In these cases, since the Noise Generator develops all three noises, check this circuit (U1200, U1201, U1202, U1204, U1208 and U1209).

See Note 3 on page 6-3.

Note: For HELP 26 and 27, the subcode is always 0.

	Code	Subcode	Description
HELP	**28-**	**Freq Code:**	Pure Tone Oscillator frequency could not be set within 1% during SelfCal. Problem is most likely in oscillator (U300, U301, U302, U303, U304, U305, U306), or in frequency counter (U1200, U1201, U1202) circuit.
See Note 3 on page 6-3.			
HELP	**29-**	**0, 1 or 2**	Unable to set maximum power point during SelfCal. Ch 1 is routed to the left amplifier (U6, U7, U8, U601, U609) and the Ch 1 HL VCA circuit (U701, U704, U603, U605) is adjusted until 6.6 V_{RMS} is measured by the A/D converter within 6.5 dB of the attenuator range limit. If no change is detected, Subcode 0 is displayed. If 6.6 V_{RMS} can only be measured within the last 6.5 dB of the VCA, the Subcode will be 1. If the A/D measurement is in error the Subcode will be 2.
			General Description:
HELP	**30-**	**0 - 6**	This HELP message indicates that proper Ch 1 to Ch 2 gain matching could not be set during SelfCal.
		0	Indicates Channel 2 SISI VCA cannot be set to within ± $^1/_8$ dB of Ch 1's gain with the 1KHz tone. Each position of the D/A converter (255 steps) was checked in the attempt to match the channels.
		1	Channel 2 HL VCA cannot be set to within ± 1.0 dB of Ch 1's gain with 1KHz tone. Each position of the D/A converter (255 steps) was checked in the attempt to match the channels.
		2	Channel 2 SISI VCA was set to within ± $^1/_8$ dB of Ch 1 with 1KHz tone; however, it could not be accomplished within +6dB, -8dB of the D/A converter setting for Ch 1.
		3	Channel 2 HL VCA was set within 1dB of Channel 1 with 1KHz tone; however, it could not be accomplished within -7dB, -11dB of Ch 1's D/A converter setting.
		4	Ch 1 HL VCA not linear.
		5	Ch 2 HL VCA not linear.
		6	Ch 2 SISI VCA cannot be set to within ± $^1/_8$ dB of Ch 1's gain with 12KHz Narrow Band Noise. Each position of the D/A converter (255 steps) was checked in the attempt to match the channels.
			General Description:
HELP	**31-**	**0 - 5**	DC Voltage detected at the output amplifiers. Requires readjustment of Amp bias control or replacement of amplifier.
		0	Left Phone Amplifier - Adjust R102 for 0 VDC at U8 Pin 7 or replace U7 and/or U8.
		1	Right Phone Amplifier on Power Supply Board - Adjust R103 for 0 VDC at U16 Pin 7 or replace U15 and/or U16.
		2	Left Speaker Amplifier on Power Supply Board - The "push" section of the push/pull amplifier. Replace U10 and/or U11.
		3	Left Speaker Amplifier on Power Supply Board - The "pull" section of the push/pull amplifier. Adjust R108 for 0 VDC at U12 Pin 4 and/or replace U10, U12.

	Code	Subcode	Description
		4	Right Speaker Amplifier on Power Supply Board - The "push" section of the push/pull amplifier. Replace U20 and/or U21.
		5	Right Speaker Amplifier on Power Supply Board - The "pull" section of the push/pull amplifier. Adjust R166 for 0 VDC at U21 Pin 4 and/or replace U20, U22.
HELP	**32-**	**1**	See HELP 2- -1
HELP	**32-**	**2**	See HELP 2- -2
HELP	**32-**	**3**	See HELP 2- -1
HELP	**32-**	**4**	See HELP 2- -2
HELP	**33-**	**xx**	See HELP 2- -1
HELP	**34-**	**1**	See HELP 2- -1
HELP	**34-**	**2**	See HELP 2- -2
HELP	**34-**	**3**	See HELP 2- -1
HELP	**34-**	**4**	See HELP 2- -2
HELP	**35-**	**1**	See HELP 2- -1
HELP	**35-**	**2**	See HELP 2- -2
HELP	**35-**	**3**	See HELP 2- -1
HELP	**35-**	**4**	See HELP 2- -2
HELP	**37-**	**0**	See HELP 2- -1
HELP	**38-**	**Freq Code:**	Ch 2 Pure Tone level cannot be adjusted to 1.25 V_{RMS} during SelfCal. See HELP 24 message for list of Ch 1 components. Ch 2 equivalent components are listed there as well.
See Note 3 on page 6-3.			
HELP	**39-**	**Freq Code:**	Ch 2 Narrow Band Noise level cannot be adjusted to 1.25 V_{RMS} during SelfCal. See HELP 25 for Noise Generator component listing. Ch 2 equivalent components are listed there as well.
See Note 3 on page 6-3.			
HELP	**40-**	**Freq Code:**	Ch 2 White Noise level cannot be adjusted to 1.25 V_{RMS} during SelfCal. See HELP 26 for Noise Generator component listing. Ch 2 equivalent components are listed there as well.
See Note 3 on page 6-3.			
HELP	**41-**	**Freq Code:**	Ch 2 Speech Noise level cannot be adjusted to 1.25 V_{RMS} during SelfCal. See HELP 27 for Noise Generator component listing. Ch 2 equivalent components are listed there as well.
See Note 3 on page 6-3.			

	Code	Subcode	Description		
HELP	**43-**	**1**	See HELP	2-	-1
HELP	**43-**	**2**	See HELP	2-	-2
HELP	**43-**	**3**	See HELP	2-	-1
HELP	**43-**	**4**	See HELP	2-	-2

Block and Interconnection Diagrams

7

General Description - Digital Section of Main Board

The GSI 61 is an 80C188 microprocessor-based system. It runs at a clock speed of 18.432 MHz that is divided in half by the microprocessor and used as the system clock. The chip is mounted in a low profile PLCC which allows the IC to be removed and the system tested using an In Circuit Emulator.

The GSI 61 has three types of system memory: EEPROM, which contains the calibration data and is updated when a Self-Cal or Manual Calibration is performed; the PROM, which is programmed at GSI and contains the operating system for the microprocessor; and RAM, which is used as a real time storage space for software.

To visually interface with the user, a 640 x 200 pixel Liquid Crystal Display is utilized. Its multiplexed data/address lines and control/clock signals are generated by the LCD Controller. The LCD Controller uses its own RAM and receives Data directly from the microprocessor while its address lines are buffered.

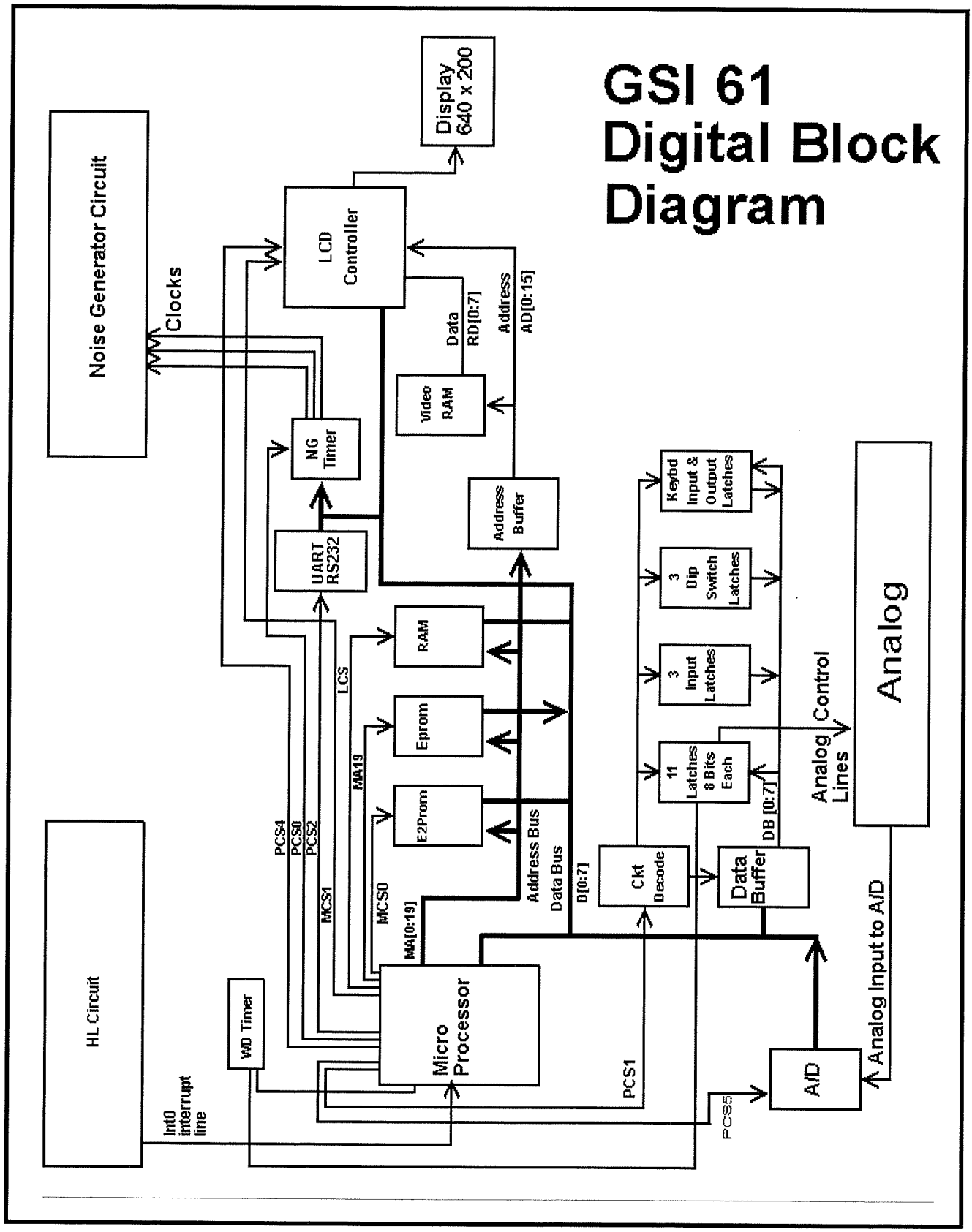
For masking purposes Narrow Band Noise, White Noise, and Speech Noises are generated by a clock/timer driving a digital noise source and then a Band-Pass filter used to shape the signal. The counter/timer used to generate the clock for Noise signal is also a counter that does the comparison to calibrate frequency.

I/O control is done by utilizing 3-to-8 bit decoder chips that enable latches at the appropriate times. The CPU scans the front panel keypad periodically; when the operator selects a certain function on the front panel, the CPU sees the change via the keyboard I/O latches and then outputs to the decoders the address specific for that function, and writes onto the data bus to set a particular latch pin to the appropriate state.

The Dip Switch latches output the switch settings to the microprocessor on system power up, or when switching between normal and calibration operation. The input latches are to send data to the microprocessor during some operator control manipulation such as: HL knob movement, Frequency Up/Down, Calibration Switch Norm/Cal etc. Additionally, the Baud rate from a peripheral device is read through an input latch.

The UART or Universal Asynchronous Receiver / Transmitter is used as an interface device for peripheral components. It performs the parallel to serial conversion to/ from the microprocessor and the serial to parallel conversion to/from the peripherals.

Signal monitoring is done by multiplexing rectified analog signals to a DC level and then monitoring them using an Analog to Digital convertor. The same circuit is used to read DC levels from the potentiometers located on the front panel; this allows the software to adjust system levels accordingly.


GSI 61
Digital Block
Diagram
Noise Generator Circuit
Clocks
Display
640 x 200
LCD
Controller
Data
RD[0:7]
Address
AD[0:15]
Video
RAM
NG
Timer
Address
Buffer
UART
RS232
RAM
Eprom
E2Prom
LCS
MA19
PCS4
PCS0
PCS2
MCS1
MCS0
MA[0:19]
Address Bus
Data Bus
D[0:7]
Keybd
Input &
Output
Latches
3
Dip
Switch
Latches
3
Input
Latches
11
Latches
8 Bits
Each
DB [0:7]
Ckt
Decode
Data
Buffer
Analog Control
Lines
Analog
HL Circuit
WD Timer
Micro
Processor
Int0
interrupt
line
PCS1
PCS5
A/D
Analog Input to A/D

General Description - Analog Section of Main Board

There are five possible signal sources; two are generated on the Main board, and the others are generated by external sources. The on-board sources are the noise generator (described in the digital section) and the oscillator. The pure tones are generated by a pure tone state variable oscillator, programmed by a 12 bit DAC. During Self-Cal the frequency is measured by a counter/timer (described in the digital section) utilizing the signal named OSCFQ. The Ext A, Ext B circuits are identical differential amplifiers and are used to buffer the input signal. To achieve 0 VU, the input signal must be in the range of 0.2 Vrms to 1.0 Vrms. The Test Mic Signal flows into the GSI 61 from the Headset jack. The gain is adjusted by a potentiometer on the front panel.

There are six inputs multiplexed for each channel; Speech/White Noise, Narrow Band Noise, Tone, Test Microphone, Ext A, and Ext B. The circuitry for Channel 1 and Channel 2 input selection is identical.

Following the input select circuitry, the first stages (CH 1 & CH 2 Gain/SISI VCA) of Channel 1 and Channel 2 are utilized to set the source VU levels during Self Cal. In normal operation, when SISI is selected on the front panel, they are manipulated by software every 4.8 seconds to increase the signal levels by 1, 2 or 5 dB depending on the front panel selection. The VU meter circuits are used to drive the meter bars on the LCD display and by the system to monitor CH1, CH2 Gain/SISI levels. In order to monitor these signals they are first rectified to DC voltages and then read by software via the Analog to Digital Converter.

The AC/DC multiplexer rectifies and selects various signals for the purpose of software monitoring, via the A/D converter. The AC mux is used to monitor the signals at the left/right power and speaker amplifiers. When an Amp signal has been selected, it is rectified to a DC level, and this DC value then is directed through the DC mux and is read by software via the A/D converter.

CH1VU and CH2 VU are the rectified levels of the SISI circuit; the software monitoring these signals sets the VU meter levels and also uses these levels for channel gain comparison to establish the SISI DAC levels during Self-Cal. The front panel EXTA, EXTB, and Talk forward adjustments are made when the software and A/ D periodically monitors each voltage as set by the front panel potentiometers. During normal mode operation, the A/D level is processed to establish VCA gain control levels accordingly.

The monitor mixer allows the operator to monitor the Channel 1, Channel 2 signals as well as listen to responses from the subject via the Talkback Microphone. The signal levels are adjusted directly from the front panel using potentiometers to control the output. The output to the monitor speaker is turned on and off as selected via the front panel control. Once these signals are summed, they are amplified to drive the Monitor Headset. The amplifier for the Monitor Speaker is located on the Power Supply Board.

The HL attenuators for Channel 1 and Channel 2 are identical and share the same 12 Bit Dual DAC to control the gain, set by software when a channel HL knob is turned. This stage also contains the 20 dB pad, used to extend the range of the VCAs. As these circuits are identical, comparisons can be made for troubleshooting purposes.

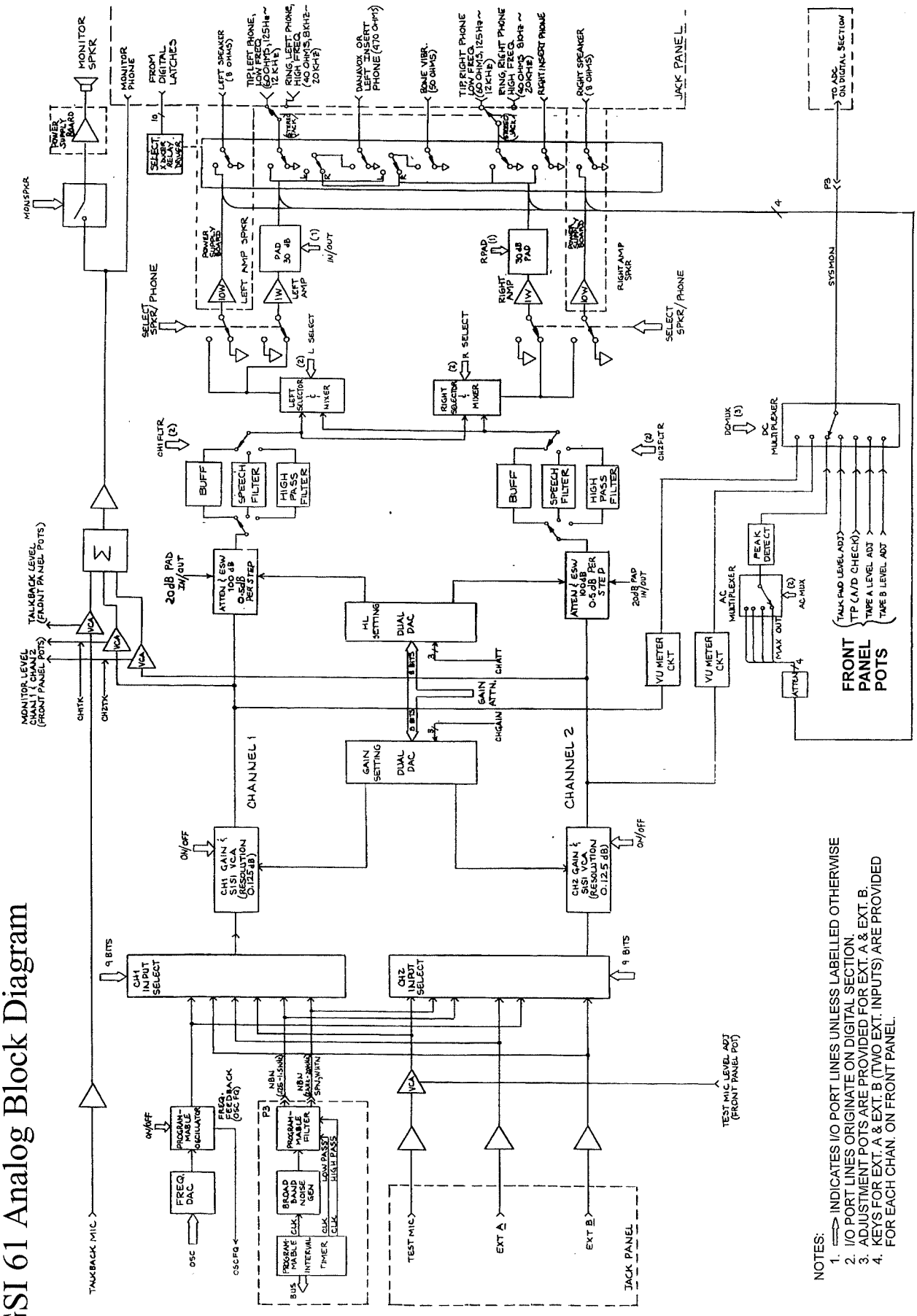
The filter stage follows the HL attenuator and is used to shape the signal depending on front panel selection; i.e., Speech Filter for external inputs, High Pass Filter for High Frequency. The circuits are identical for Channel 1 and Channel 2, therefore comparisons can be made for troubleshooting purposes.

The output mixer circuit directs the Channel 1 and Channel 2 signals left or right depending on front panel selection. Signals can be directed either out each side or out the same side.

As signals leave the Mixing/Routing circuit they are buffered and then directed to the final stage of amplification. For the final stage there are two possible alternatives, speaker or phones. If Speaker is selected then the signal goes directly to the power supply board with no further amplification. All other selections are amplified, then appear at the transducer select circuit. This circuit also contains the 30 dB pad to extend the range of the VCAs. A tap off of the output is utilized for the software to check the levels via the AC/DC mux and A/D converter.

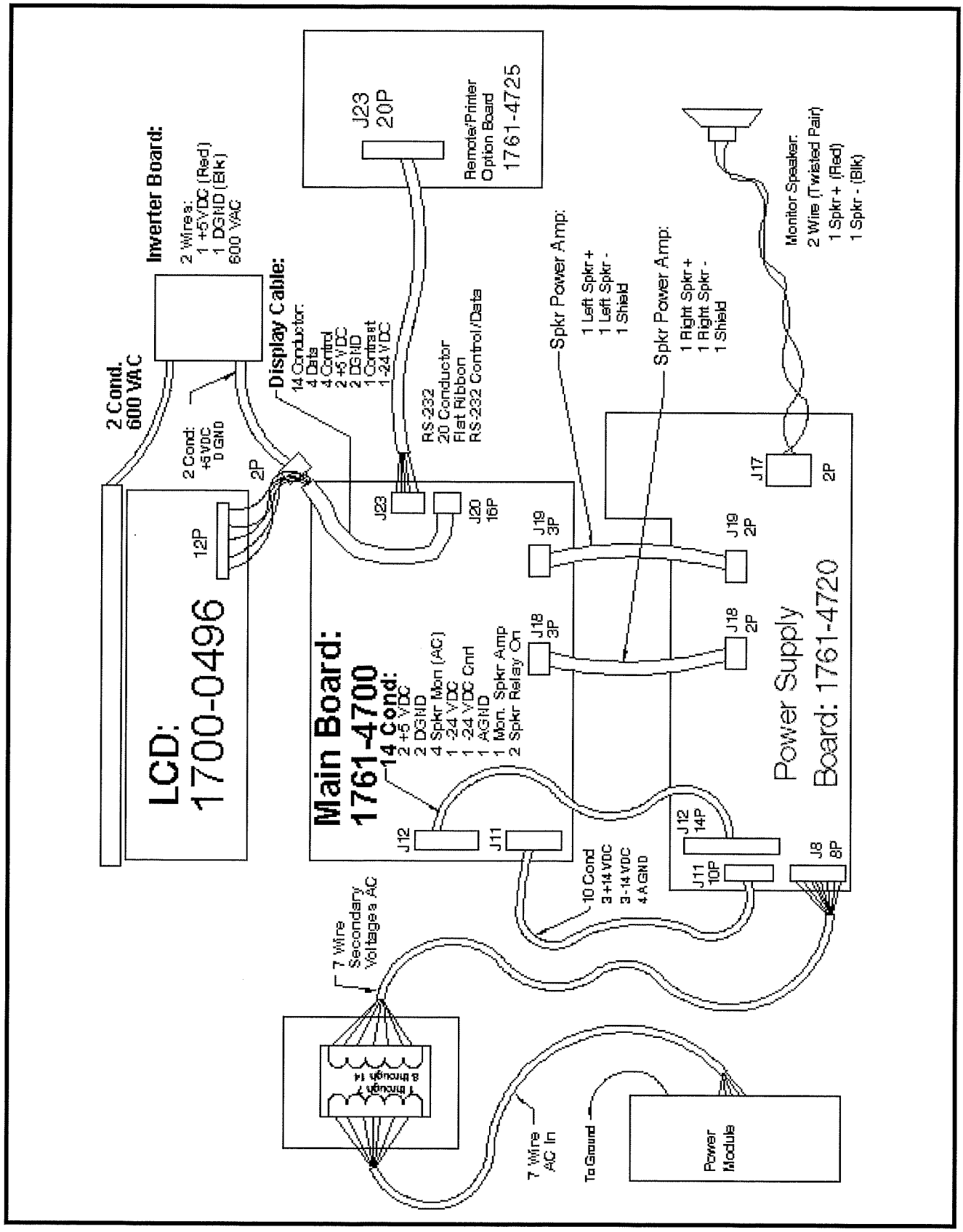
Transducer selection serves two purposes: one is to direct the signals to the various output transducers (i.e., Phone, Insert, Bone), and to separate the subject from any signals should a hard error occur. The Bone and Left Insert jacks also have a relay that directs the signals from the Left and Right Power amplifier circuits; this is due to single output operation. The Left Insert is single operation when the single insert phone option is selected and this requires both right and left operation out of a single jack. During high frequency operation, the signals are directed to either the ring or tip of the phone jacks.

GSI 61 Analog Block Diagram

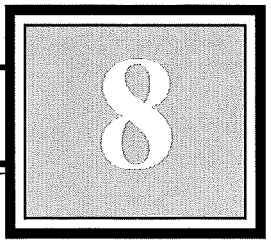


NOTES:
1. ⟹ INDICATES I/O PORT LINES UNLESS LABELLED OTHERWISE
2. I/O PORT LINES ORIGINATE ON DIGITAL SECTION.
3. ADJUSTMENT POTS ARE PROVIDED FOR EXT. A & EXT. B.
4. KEYS FOR EXT. A & EXT. B (TWO EXT. INPUTS) ARE PROVIDED FOR EACH CHAN. ON FRONT PANEL.

Interconnection Diagram



Main Board: 1761-4700



This Section is organized into several subsections, which refer to different sheets of the overall schematic diagram, as follows:

Theory of Operation: Analog Section

1) General Notes
2) Voltage Controlled Amplifier/Attenuators ..... (sheets 4, 5, 8)
3) Regulators ..... (sheet 7)
4) Oscillator Circuit ..... (sheet 2)
5) EXT A/EXT B/TEST MIC Pre Amps ..... (sheet 3)
6) Channel 1 and 2 Input Select ..... (sheet 3)
7) CH1/CH2 GAIN, SISI VCAs and VU Circuits ..... (sheet 4)
8) CH1/CH2 HL Attenuators ..... (sheet 5)
   8a) CH1/CH2 Buffers/Filters ..... (sheet 5)
9) Mixing/Routing ..... (sheet 6)
   9a) Left/Right Power Amps and 30 dB Pads ..... (sheet 6)
10) AC/DC Multiplexers ..... (sheet 2)
11) Monitor Mixer Circuit ..... (sheet 8)
12) Transducer Selection ..... (sheet 7)

Theory of Operation: Digital Section

1) CPU ..... (sheet 9)
2) Program and Data Memory ..... (sheet 10)
3) LCD Controller ..... (sheet 10)
4) HL Processing Circuit ..... (sheet 12)
   4a) Alternate HL Processing Circuit ..... (sheet 12)
5) Watchdog Timer Circuit ..... (sheet 1)
6) Analog to Digital Convertor ..... (sheet 12)
7) Clock Generator/Timer Circuit ..... (sheet 1)
8) Noise Generator Circuit ..... (sheet 1)
   8a) Alternate Noise Generator Circuit ..... (sheet 1)
9) Noise Filter Circuit ..... (sheet 1)
10) Frequency Calibration Circuit ..... (sheet 1)
11) Address Latch and Chip Select Decoder ..... (sheet 11)

In addition, this section describes the Theory of Operation for the UART and the Front Panel Keyboard interface.

General Notes

First seen, this board can be intimidating due to the amount of components (approximately 830). We at GSI have done what we could to make things easier for those who are working with this board. One thing of great importance is the use of modular circuits, so that a qualified technician can easily identify common components that make up each circuit.

There is a flow to the circuitry. When the GSI 61 is opened and you view the Main Board, you will notice that midway down the PCB just to the left of the four large POTS mounted on the right side of the board is where the oscillator circuit is located. Continuing down toward the external connectors and to the extreme right side of the board the input selectors are located (U406, U407, U408 etc.). Down further are both SISI attenuators, the U5XX series. Moving across the PCB to the left you will find the Main Attenuators, the speech and High Frequency filters then the Left and Right Power Amps.

When the Tone source is selected the path it follows starts at the oscillator and moves down toward the back panel through the input selectors and SISI VCAs. The source signal then flows left across the PCB through the Main Attenuators, the Filters, the Power Amps, and then finally turns down towards the back panel where it flows through the relays and out the appropriate connector. If you look to the left of the Power Amps you will see the Monitor Mixer then AC/DC mux. The A/D converter is located above and to the left of the AC/DC mux. The input amps for the Talkback, Ext A, Ext B and Headset are located near their respective back panel connectors.

If the Main Board or any components are replaced in the Analog section, GSI recommends that a Self Cal followed by a complete HL Cal be performed. At a minimum, a thorough calibration check should be performed and this should include: frequency, VU level, distortion, and HL values for all transducers.

Analog Section Detail

VCAs (sheets 4, 5, 8)

One of the main components used throughout this board are manufacturer's model number 2155/2180 Voltage Controlled Amplifiers. They were selected due to their high gain bandwidth product, with low noise, low distortion and low offset. Pin EC controls the gain of the device. At +118 mV the output current is 20 dB less than the input current, and at -118 mV the output current is 20 dB greater than the input current. From this relationship the gain of the device can be determined by the formula Av=(-EC/6.0) where EC is the voltage at pin 3 (in millivolts), and Av is the gain in Decibels. Symmetry adjustment (pin 4) is added due to small mismatches that occur between the internal output transistors; a potentiometer connected to pin 4 is adjusted for minimum distortion.

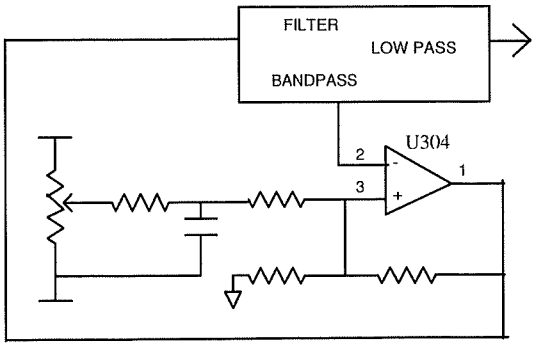
Regulators (sheet 7)

The unregulated +/- 14 VDC supplies from the power supply board feed four regulators on this board, two for +7 VDC (7V and 7VA) and two for -7 VDC (7VN and 7VNA). The purpose for the dual +/- regulators is to meet current requirements and the need to keep cross channel signals to a minimum.

Oscillator Circuit (sheet 2)

The oscillator consists of a second order State variable bandpass with positive feedback filter and a comparator, which is connected to the Band Pass output of the filter to generate a squarewave. The resonant frequency is programmable by changing the current flow into the integrating capacitors. These currents are controlled by VCAs U300 and U301 via DAC U306.

The circuit shown below represents the oscillator. With the biasing set for 50 to 70 mV, pin 3 goes to the bias voltage immediately on power up causing pin 1 to go to the positive 7V of the op-amp. As this positive voltage reaches pin 2 it becomes more positive than pin 3, driving pin 1 to the negative 7VN; the feedback then drives pin 2 back to negative, thus creating a square wave oscillator.



The main components of this filter are the VCAs U300 and U301. By varying the gain of the VCA, and therefore the feedback to the op-amp U304, the slew rate of the voltage changes and therefore the frequency changes. Software controls the gain through a 12-bit D/A Converter (U306).

The frequency is calibrated by sending the signal to the counter/timer U1200 (OSCFQ), through the buffer U305. As the software reads the value in U1200 it is compared to table values located in the PROM. If these numbers do not match then the DAC (U306) voltage is changed accordingly via the OSCD line.

The multiplexer U508 is used to switch capacitors for low frequency range and high frequency range operation.

There are two ways the oscillator can be halted; by removing JP300, or through software, by setting OSCENAB to low, which switches U507 pin 15 (Y) to pin 2 (Y0). U507 pin 2 (Y0) is tied to -7 VDC to provide a restart to the oscillator. During a software disable the -7 VDC from pin 2 charges C309. As OSCENAB goes high this reconnects the feedback loop; C309 then discharges through the feedback loop to drive pin 2 of U304 negative, which starts the square wave generator.

EXT A/EXT B/ Test Mic Amps (sheet 3)

The Ext A, Ext B circuits are identical differential amplifiers and are basically used to buffer the input signal. To achieve 0 VU the input signal must be in the range of 0.2 Vrms to 1.0 Vrms, to be within the adjustment range of the AUX A and B front panel potentiometers.

The Test Mic Signal comes into the GSI 61 from the Monitor Headset jack J15 and is labeled TESTMIC. The input signal initially passes through the ESD protection of

R450 and C422. R415, C410, and R421 provide the decoupling, load and power for the Electret type microphone. The signal then passes through a speech band filter and is amplified by U401. Amplitude control of the signal is accomplished by using VCA U403. The gain is adjusted by R445 on the front panel which varies the EC voltage of U403 via U402 (a more detailed explanation of the VCA is given on the previous page).

Channel 1 and 2 Input Select (sheet 3)

There are six possible inputs for each channel; Speech/White Noise, Narrow Band Noise, Tone, Test Microphone, Ext A, Ext B. The circuitry for Channel 1 and Channel 2 input selection is identical, each using two triple 2-Channel Analog Multiplexer/ Demultiplexers (to simplify this IC think of each channel as a single pole double throw relay), and one 8-Channel Analog Multiplexer (to simplify this one, think of it as a single pole 8 throw relay).

This paragraph describes the path of a signal through Channel 1 using Tone generated by the oscillator circuit (sheet 2). The signal first appears in the Input Select circuit at U411 pin 13 (X1). When TONE1 from U1017 pin 16 (sheet 11) drives U411 pin 11 (A) high, it enables a path from U411 pin 13 (X1) to U411 pin 14 (X). The next IC, U410, uses a 3-8 bit binary bus on pins 11 (A), 10 (B), and 9 (C); the logic for an address of 000 connects pin 13 (X0) to pin 3 (X) and an address of 111 connects pin 4 (X7) to pin 3 (X). So Tone requires that IN1SLA, IN1SLB, IN1SLC from U1017 (sheet 11) to be low for Tone to be selected. Finally the signal passes through U409 to be buffered for the next stage.

CH1/CH2 Gain, SISI VCAs and VU Circuits (sheet 4)

This is the first stage of Channel 1 and Channel 2. It is used to set the source to 0 VU levels during self calibration and, in the SISI test, is manipulated by software every 4.8 seconds to increase the signal levels by 1 dB, 2 dB or 5 dB depending on the Front Panel selection. The VCAs are adjustable for distortion using potentiometers R512 and R513. Any time these pots are adjusted, GSI recommends that a Self Cal followed by a complete HL Cal be performed. At a minimum, a thorough calibration check should be performed and this should include: frequency, VU level, distortion, and HL values for all transducers.

The VU circuits are used to drive the meters on the LCD display and by the system to monitor CH1, CH2 Gain/SISI levels. In order to monitor these signals they are first rectified by U504 and U505 to DC voltages. These levels are then read by software via the Analog to Digital Converter U1104.

CH1/CH2 HL Attenuators (sheet 5)

The HL attenuators for Channel 1 and Channel 2 are identical and share the same 12 Bit dual DAC (U701) that controls the gain. As these circuits are identical comparisons can be made for troubleshooting purposes.

For simplicity of explanation, only Channel 1 will be examined. The input to the attenuator comes from the SISI circuit and is then amplified or attenuated by the VCA U603. The VCA is controlled using the DAC (U701) set by software when the Channel 1 HL knob is turned. The resolution of this DAC/VCA design is 0.5 dB. There are two adjustment potentiometers, R609 and R621; R609 aligns the linearity, R621 adjusts distortion. Any time these pots are adjusted, GSI recommends that a Self Cal followed by a complete HL Cal be performed. At a minimum, a thorough calibration check should be performed and this should include: frequency, VU level, distortion, and HL values for all transducers.

The next stage consists of the op-amp U605 and supporting components used to buffer the signal and also contains the 20 dB pad. This pad is used to extend the range of the VCA. It is accomplished by changing the feedback resistance for U605. When APAD1 is low, R627 is the feedback value. When the software drives APAD1 (U601) high, this adds R629 in parallel with R627, reducing the feedback resistance by a factor of ten, or 20 dB. The signal then enters the filter stage.

CH1/CH2 Buffers/ Filters (sheet 5)

This stage follows the HL attenuator and is used to buffer the pure tone signal, filter out low frequencies or shape the noise/speech signals. The circuits are identical for Channel 1 and Channel 2 therefore comparisons can be made for troubleshooting purposes.

Only Channel 1 is examined here. Once the signal leaves the HL attenuator it is first multiplexed by U609, which is a 1-to-4 multiplexer. Pins 13 and 3 are used as the input. Software controls the multiplexer with the two bit binary bus connected to pins 10 (A) and 9 (B). When both lines are low X0 is selected, when both are high X3 is selected. When software selects a buffered signal such as during low frequency pure tone operation then X0 is selected for U609 and the signal passes through U611, a unity gain op-amp. Selecting X1 directs the signal to the Speech filter, used when the operator selects such functions as EXT A, EXT B, Test Mic etc. X3 is the HP filter selection, a high pass filter used when 12 kHz is selected in normal mode and when High Freq. is selected on the front panel.

Mixing/Routing (sheet 6)

This circuit selects one of three possible channel outputs to be routed to the right or left side. The combination is determined by the operator via the front panel.

To follow Channel 1 to the right phone amp: the same two bit binary bus (CH1SPCH, CH1HPFL) that selects the filter being used in the filter circuit is also used to select the channel output. If both are low then X0 is selected for U1 and U9, which are 1-to-4 multiplexers (to simplify this IC think of each channel as a single pole quadruple throw relay). CH1RT from U1012 pin 17 goes low to enable U9 to output the signal to U10. U10 is a 2-to-1 multiplexer (to simplify this IC think of each channel as a single pole double throw relay) and when a low is seen on pins 11 (A), 10 (B), and 9 (C), the signal is directed to the right side via pins 2 (Y0) and 5 (Z0).

Left/Right Power Amps and 30 dB Pads (sheet 6)

As signals leave the Mixing/Routing circuit they are buffered by U5 and U13 and then pass to the final stage of amplification via the two multiplexers U6 and U14. For the final stage there are two possible alternatives; speaker or phones/bone. If Speaker is selected then the signal goes directly to the power supply board via J18 (R) and J19 (L) with no further amplification on this board. All other selections are amplified by a gain of 2, then appear at the transducer outputs.

When a transducer is selected, such as Right Phone Out, then the signal passes through two amplifier stages. U15, an integrator, feeds the input of U16 whereas at the output the 30 dB pad is controlled by software. When RPADOUT is low then K3 is enabled and the output comes directly from U16; when RPADOUT is high then K4 is enabled so that the output from U16 passes through the voltage divider of R28, R29, and R30 which creates the 30 dB drop. R103 is used to set the DC at the amp output to <0.2 VDC.

The voltage divider of R32 and R33 is used to tap off of the output for the software to check the levels via the AC/DC mux and A/D converter U1104.

AC/DC Multiplexers (sheet 2)

The AC/DC multiplexer rectifies and selects various signals for the purpose of software monitoring, via the A/D converter. The AC mux is used to monitor the signals at the left/right power and speaker amplifiers. Software selects which channel will be monitored by controlling U250 via a 3-bit binary bus (ACMUX0-ACMUX2). Once the channel has been selected the signal passes through the mux as is, rectified by U251 and supporting components. This DC value then is directed through the DC mux using the 3-bit binary bus of DCMUX0- DCMUX2, and is then read by software via the A/D converter U1104.

CH1VU and CH2VU are the rectified levels of the SISI circuit; the software monitoring these signals sets the VU meter levels and also uses these levels for comparison to set the SISI DAC levels during self-cal. The front panel EXTA, EXTB, and Talk forward adjustments are made when the software periodically monitors each voltage as set by the potentiometers R343, R344, and R262 and then adjusts the signal levels accordingly.

Monitor Mixer Circuit (sheet 8)

The monitor mixer allows the operator to monitor the Channel 1 and Channel 2 signals as well as listen to responses from the subject via the Talkback Microphone. The signal levels are adjusted directly from the front panel using potentiometers to control the output of op-amps U114 and U116 that drive the gain control pins of the VCAs. The output of the monitor speaker is turned on and off with U106 (MSPKR) as selected via the front panel control. The Channel 1 and Channel 2 monitor VCAs can also be turned on and off by the software through CH1TK and CH2TALK control lines.

Transducer Selection (sheet 7)

Transducer selection serves two purposes. One is to direct the signals to the various output transducers, i.e., Phone, Insert Phone, Bone; the other is to separate the subject from any signals should a hard error occur. There are five relays used to separate the subject from the signals: K5 Left Phone, K7 Left Insert, K9 Bone, K10 Right Insert, K11 Right Phone. The Bone and Left Insert jacks also have a relay that directs the signals from the Left and Right Power amplifier circuits; this is due to single output operation. The Left Insert is single operation when the single insert phone option is selected and this requires both right and left operation out of a single jack. K6 directs right or left for the Left Insert, K8 directs right or left for the Bone. K12 is used for high frequency operation, directing the signals to either the rings or tips of the Phone jacks.

Digital Section Detail

CPU (sheet 9)

The CPU (U901) is an 80C188 CMOS high integration microprocessor. It provides Direct Memory Access, bus and interrupt controls. It utilizes an 18.432 MHz crystal that is divided in half by the CPU and becomes the 9.216 MHz system clock. The Address and Data buses are latched onto the system bus via U904 and U903. Int [0] (Interrupt) and Int [1] are used by the HL circuit and UART to allow the CPU to stop and process the data coming in from these circuits. The CPU uses MCS 0 through 3 for memory chip selecting, and uses PCS 0 for the Timer Clock, PCS 1 for latch decode enable, PCS 2 for the UART, PCS 3 is not used, PCS 4 for the LCD controller and PCS 5 for the A/D convertor chip selecting.

Program and Data Memory (sheet 10)

U809 is a 27C040 4 megabit PROM that is programmed at GSI. It contains the operating software instructions for the CPU. It is accessed by 19 address lines (MA 0-18), and selected by its CS (chip select) and OE (output enable). WE is a write enable line that is there for future utilization of a FLASH type reprogrammable device currently not used. This demands that JP801 must have pin 2 jumpered to pin 3 to allow for PROM use. The data bus is tied directly to the CPU.

U810 is a 28C64 64 KByte electrically erasable PROM (EEPROM) and is used to store data that is updated by the GSI 61 user, such as the calibration data entered in the cal mode. This data is nonvolatile and will remain in the EEPROM on power down and only changes once it is written over. It also is selected by its CS, OE, and WE pins and uses MA 0 through 12 for addressing with its data bus tied directly to the CPU.

Finally, U808 is the system RAM or Random Access Memory; it is used by the CPU as real time working space. It is a volatile memory and all data is lost on power down.

LCD Controller (sheet 10)

The LCD controller (U801) is a Yamaha YM6102 and controls the data and addressing for the LCD screen. LD 0-3 are multiplexed data and address lines buffered by U812. Also buffered are BSCK, BCLI, BM, BFLM which are the clock and control lines for the LCD. U802 is another RAM chip utilized by the YM6102 controller.

HL Processing Circuit (sheet 12)

Channel 1 and 2 hearing levels are controlled by optical encoders HL1 and HL2. As the encoders are turned they generate positive pulses on the signal lines labeled CH1CW, CH1CCW, CH2CW and CH2CCW, depending on:

1) which knob is turned and
2) which direction it is turned (CW=clockwise, CCW=counterclockwise).

When a knob is turned two things happen;

1) an INT0 (Interrupt) occurs telling the CPU to stop what it is doing and look at the HL circuit
2) the signal is read by the CPU via U1032 (Latch 3).

U1106 and U1107 act as latches to capture the individual signals which in turn are NOR'd by U22 which clocks U1109 for INT0.

Alternate HL Processing Circuit (sheet 12)

This alternate circuitry was designed as a contingency circuit should the original source become unavailable. The circuitry is identical except that with the detent-type wheel a jittery output occurs, so a comparator (U1105) was added to stabilize the HL pulses. The comparators provide a solid 0 and 5 VDC logic to the Flip-Flops.

Watch Dog Timer Circuit (sheet 12)

This is a safety circuit that disconnects all signals from the transducers upon system failure. The components involved are U1101, U1100, U1102. U1101 is a dual retriggerable monostable multivibrator, in which one section is set for a 50 mSec time out (time value determined by CR1101, R1101, C1100) and the other section is set for a 100 mSec time out (time value determined by CR1100, R1100, C1102).

The 50 mSec section, used in conjunction with U1100 (a D flip-flop) are the major components of this section. U1101 is triggered as the CPU pulses ALE that disallows U1100 to be reset. Should the CPU fail, ALE ceases to pulse. After 50 mSec U1101 resets U1100 which then changes state. During normal operation U1100 is High at pin 5. This, with the pulled-down input on U1102 pin 3, causes ANALOE to be low.

Another input control line used is WDRUNCS (watch dog run chip select). This signal must be pulsed low every 100 mSec, so that a High is maintained on the CLK input of U1100 or else a low is clocked through to the output, shutting off the relays.

RLYEN is NOR'd with ANALOE to give the CPU direct control of the relays. JP1105 is provided for troubleshooting purposes only; when it is jumpered, the high on U1102 keeps the output and ANALOE low.

Analog to Digital Converter (sheet 12)

U1104 is an AD7575 analog to digital convertor and is used to monitor the Analog signals for ongoing self diagnostics, calibration and control of the VU meters. During normal operation Talk Forward, EXT A, EXT B potentiometers as well as CH1 and CH2 VU signals are constantly being monitored through the DC multiplexer U253.

During Self-Cal the phone and speaker amp outputs are monitored for the CPU to compare to known good values and to store the values entered during operator Cal mode. This digital information is used by the CPU to set the Oscillator, SISI and Main Attenuator DACs controlling frequency and signal levels.

Control signals used for the A to D converter are PCS[5] from the CPU as chip select, VREF 12 (a 2.5 VDC reference) and RD (read) from the CPU. A/DBUSY lets the CPU know that the A to D converter is busy.

Clock Generator/ Timer Circuit (sheet 1)

This circuit serves two purposes; it is used by the CPU to do a comparison during frequency calibration to monitor the oscillator frequency and is the clock generator used by the noise generator.

U1200 is a high performance programmable counter that utilizes three 16 bit counters, each with its own clock input, gate input and output. Under software control U1200 can divide its clock inputs to provide a wide frequency range output and can be used to compare inputs by counting the number of pulses on more than one CLK input; once one counter is satisfied U1200 flags the CPU via CLK0 or CNTR0 the CPU then will make a comparison.

Noise Generator Circuit (sheet 1)

U1204 is a National Semiconductor MM5437 digital noise source. It is designed to produce a broad band noise signal with uniform noise quality and output amplitude. It uses a clock on pin 7, generated by U1200 that is controlled by software to vary the frequency according to the front panel selection (in most cases CLK freq =2 x freq. selected).

Alternate Noise Generator Circuit (sheet 1)

This alternate circuitry was designed as a contingency circuit should U1204 become unavailable. This circuit design is a pseudorandom noise generator. However, the ear cannot distinguish this pseudo random signal from one which is truly random since its periodicity is very low. The combination of shift registers and exclusive OR gates employed here will generate frequency-specific noise. The noise is generated by clocking two shift registers (U1206, U1207) which, through exclusive OR feedback, generates the series of pseudorandom pulses. This noise is then applied to the noise filters for shaping the frequency response as described in the next section.

Noise Filter Circuit (sheet 1)

U1208 and U1209 are dual high performance switched capacitive filters. They are used in conjunction with feedback resistors to form a tunable 2nd order filter providing High-pass, Bandpass and Low-pass filtering. The inputs to these devices are the digital noise source from U1204 producing broadband noise (white noise) and clocks from U1200 (used to set the filter frequency).

The 50/100 input from U1022 selects the ratio of the clock reference, a low selects a 100:1 ratio and a high selects 50:1. To find the approximate CLK frequency take the logic level value on pin 12 and multiply it by the frequency selected (for example, at 1 kHz pin 12 is low, so f=100 x 1000=100 kHz). These CLK frequencies are set at high values because, as the frequency is divided down, the percentage of error is reduced.

This configuration sets up high-pass and low-pass filtering which creates a bandpass filter for Narrow Band Noise. Tapping off from the filter before the last low-pass filter allows speech and white noise bandwidths.

Frequency Calibration Circuit (sheet 1)

U1200 is also used during self cal mode to monitor and calibrate the oscillator circuit. This portion of the circuit is controlled by FCAL which, when Low, turns off the clocks for the noise generator and routes OSCFQ to U1200 CLK 0. As OSCFQ passes through U1201 and U1202 it becomes a squarewave signal usable by the Counter function of U1200.

The comparison frequency is the 9.216 MHz from the CPU known as CPCLK; this becomes TMRCLK though JP1202. As this is a crystal driven signal, it is very stable and so is used as the standard to compare to the oscillator frequency.

First, the CPU programs CLK 0 to count X number of pulses. X is dependent on the frequency being calibrated; lower frequencies have a lower count than the higher frequencies. Once the number of pulses is received, Out 0 goes high disabling CLK 1 via Gate 1 and flags the CPU via CNTR0. Once the CPU receives CNTR0 it reads the value in CLK 1 to see how many pulses of the 9.216 signal occurred. The CPU then compares this to values located in a table to determine if the correct number was counted; if not, the CPU readjusts the oscillator DAC via the OSCD bus. Once the correct frequency is reached, the CPU stores the value used to adjust the oscillator DAC into the EEPROM to reuse this value each time the CPU selects a frequency.

UART Detail

The UART, or Universal Asynchronous Receiver/Transmitter, (U1103) is used in conjunction with the interface board to interface with peripherals. It converts the parallel data from the Microprocessor and transmits it out the serial port labelled SOUT. Information from the interface board is received into the SIN port and is converted to parallel form for the Microprocessor.

The Microprocessor controls the UART using addressing (MA0-2), chip select (/PCS[2]), read or write (/RD/WR), RESET (MR), and TMRCLK (XIN), divided in half by U1110. INT is used by the UART as an interrupt to the Microprocessor.

The control lines between the UART and the interface board are: Data Transmit Ready (DTR), Ready to Send (RTS), Data Set Ready (DSR), and Clear to Send (CTS).

Front Panel Keyboard Detail

The GSI 61 Front Panel Keys are part of individual pads that contain a group of switches that are captured between the plastic front panel and the main Printed Circuit Board. The switch contact consists of a carbon-impregnated rubber pill (part of switch) and a screened conductive ink pattern on the board. There is a life expectancy of several million actuations. There are two categories of switches on the panel; matrix and special. The special keys are the CH1 and CH2 Tone Bars, the Freq Up and Freq Down keys, the Subject Response switch and the Talkforward Key. All the others are in a matrix. The special keys were kept separate from the matrix keys because they are continuously "read" by the CPU for their status. Each matrix key is assigned an X-Y coordinate in memory so that when one is activated, its function is determined by the CPU via a lookup table.

Special Keys

CH1 and CH2 TONE BARS, FREQ UP/FREQ DOWN, Subject Response, and Talkforward.
One contact of each of these is tied to ground and the other is applied to I/O Port U1032 and U1030 (Latch 3 & Latch 1) of the main board. (See Sheet 10 of the schematics.) The U1032 and U1030 side of the keys are pulled up to +5 VDC by 47K Ohm resistors also located on the main board. Therefore, upon activation, a ground (0 VDC) is applied to the input of U1032 and U1030. The reason for individually "reading" these controls is that simultaneous operation of any of them can be "read" and processed. These lines at the input of U1030 and U1032 are read every 10 msec for 100 µsec. This is not true for the matrix keys.

Matrix Keys

Because simultaneous operation was not a requirement of the majority of the keys, they were designed into a matrix configuration. The matrix X and Y lines are applied to U913 and U914 (Latch 4 & Latch 19) on the main board. The Y lines are pulled up to +5 VDC by 10 K Ohm resistors. The X lines are sequentially pulled low every 10 msec for a period of 100 µsec. The CPU routinely "reads" the Y lines and a 100 µsec "low" is seen. It can determine which key had a closure since it knows which X line was low at the time. The one constraint on the matrix is that simultaneous key closures will not be recognized. In this case, the closure first seen will be the one processed. When two keys are pressed simultaneously and one of them is acknowledged, the other will not be acknowledged unless it is released and pressed again. This matrix "read" technique has often been referred to as "strobe then return" monitoring.

Address Latch and Chip Select Decoder (sheet 11)

The address decoding for latch and chip selects is provided by U1035, U1034, U1001 and U1002. These are 74HC138 3-to-8 bit decoders.

U1035 enabled by PCS (1) decodes MA 3-5 to chip select U1034, U1001 or U1002, which in turn provides the decoding to direct the flow of system control to and from the CPU.

U1034 is chip selected by U1035 and DT/R, and decodes MA0 - 2 to select:

Signal Name	IC and PIN	Description/Function	Logic
DIPCS[3]	U1034 12	Enables S902 to be read by the CPU via the data bus	low enable
DIPCS[2]	U1034 13	Enables S901 to be read by the CPU via the data bus	low enable
DIPCS[1]	U1034 14	Enables S900 to be read by the CPU via the data bus	low enable
KEYRCS	U1034 15	Key read chip select is used to read the front panel key pad	low enable

Input Latches to CPU

	IC#	Address	Description/Function	Logic
U1030 Latch 1	FREQ UP	2	frequency up from the keypad	active low
	FREQ DOWN	3	frequency down from the keypad	active low
	ADBUSY	6	from the analog to digital converter lets the CPU know it is busy	active low
	CAL SWITCH	7	Selects Calibration/Normal mode	Low = Cal mode
	CNTR0	9	Used by the counter/timer IC to let the CPU know it is done	active high
U1031 Latch 2	Baud [0] thru [7]	2 thru 9	Used for the printer/interface port to determine rate of data transfer	Data Bus
U1032 Latch 3	CH1CW	2	Is active when Channel 1 HL knob is turned in a clockwise direction	pulses high
	CH1CCW	3	Is active when Channel 1 HL knob is turned in a counterclockwise direction	pulses high
	CH2CW	4	Is active when Channel 2 HL knob is turned in a clockwise direction	pulses high

	IC#	Address	Description/Function	Logic
	CH2CCW	5	Is active when Channel 2 HL knob is turned in a counterclockwise direction	pulses high
	CH1TB	6	From the key pad when Channel 1 tone bar is depressed	active low
	CH2TB	7	From the key pad when Channel 2 tone bar is depressed	active low
	TLKFWD	8	From the keypad when talkforward is depressed	active low
	Subject Response	9	From the back panel jack when the subject switch is depressed	active low
U1011 Latch 8	U1001 uses chip selecting from U1035 pin 14 and /WR, decodes MA0-2 to select the following:			
	ACMUX 0,1,2	17,16,15	Used by the AC multiplexer to select which channel will be routed to the address A/D thru the DC mux	3 bit binary address
	DCMUX 0,1,2	14,13,12	Used by the DC multiplexer to select which channel will be routed to the A/D	3 bit binary address
U1012 Latch 9	CH1LFT	19	Routes Channel 1 to the Left Power Amp	low select
	CH2LFT	18	Routes Channel 2 to the Left Power Amp	low select
	CH1RT	17	Routes Channel 1 to the Right Power Amp	low select
	CH2RT	16	Routes Channel 2 to the Right Power Amp	low select
	LPADOUT	15	Controls the 30 dB pad in the Left power amp circuit	low=pad out
	RPADOUT	14	Controls the 30 dB pad in the Right power amp circuit	low=pad out
	CH1TK	13	Controls monitor mixer to enable CH1 to monitor output	low enable
	CH2TK	12	Controls monitor mixer to enable CH2 to monitor output	low enable

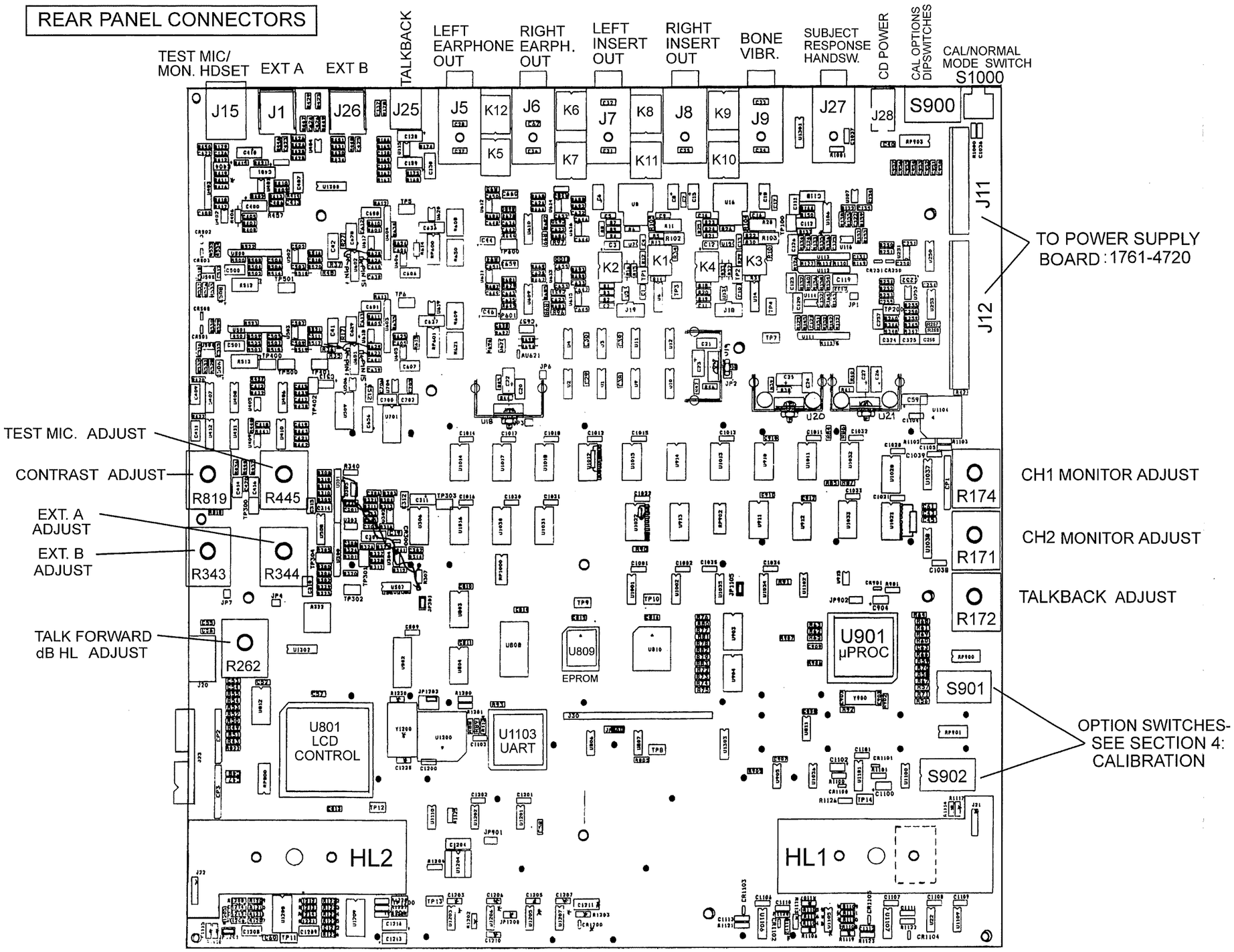
	IC#	Address	Description/Function	Logic
U1013 Latch 10	RPHON	19	Routes signal path to Right power amp	low select
	RSPKRON	18	Routes signal path to Right speaker amp on the power supply board for external speakers	low select
	LPHON	17	Routes signal path to Left power amp	low select
	LSPKRON	16	Routes signal path to Left speaker amp on the power supply board for external speakers	low select
	CH1HPFL	15	Directs Channel 1 thru the high pass filter	with CH1SPCH to combine for a 2 bit address
	CH1SPCH	14	Directs Channel 1 thru the speech filter	with CH1HPFL to combine for a 2 bit address
	CH2HPFL	13	Directs Channel 2 thru the high pass filter	with CH2SPCH to combine for a 2 bit address
	CH2SPCH	12	Directs Channel 1 thru the speech filter	with CH2HPFL to combine for a 2 bit address
U1014 Latch 11	ATSID 0 thru 7	12 - 19	Used as the data bus for the SISI and main attenuator DACs	8 Bit bus
U1015 Latch 12	AT1/2	19	Selects the main attenuator DAC outputs	Low = CH 1 High = CH2
	ATWR	18	Allows the main attenuator to write the ATSID bus data into it	low enable
	APAD1	17	Selects the 30 dB pad in the main attenuator CH1	low=pad out
	APAD2	16	Selects the 30 dB pad in the main attenuator CH2	low=pad out
	SI1/2	15	Selects the SISI DAC output High=CH2	Low=CH1
	SIWR	14	SISI write, tells the DAC to read the data on the ATSID bus	Active low

	IC#	Address	Description/Function	Logic
	SISI1OFF	13	Turns the signal off at the SISI Attenuator by setting U601 to Z0 which pulls SISISW1 low	Low=SISI1 off High=SISI1 on
	SISI2OFF	12	Turns the signal off at the SISI Attenuator by setting U602 to Z0 which pulls SISISW2 low	Low=SISI2 off High=SISI2 on
U1016 Latch 13	OSCD[0] - [7]	12-19	This is the data bus used by the oscillator to set the frequency	8 bit bus
U1017 Latch 14	IN1SLA,B,C	19,18,17	Used to select Channel 1 signal source	3 bit binary address
	TONE1	16	Selects the oscillator as signal source for Channel 1	High selects source
	NBN1	15	Selects Narrow Band Noise from the Noise Filter circuit as the signal source for Channel 1	High selects source
	SPN1	14	Selects Speech or White noise from the Noise Filter circuit as the signal source for Channel 1	High selects source
	TSTM1	13	Selects the Test Mic from the monitor headset as the signal source for Channel 1	High selects source
	EXTA1	12	Selects EXT A Pre-Amp circuit as the signal source for Channel 1	High selects source
U1018 Latch 15	IN2SLA,B,C	19,18,17	Used to select Channel 2 signal source	3 bit binary address
	TONE2	16	Selects the oscillator as signal source for Channel 2	High selects source
	NBN2	15	Selects Narrow Band Noise from the Noise Filter circuit as the signal source for Channel 2	High selects source
	SPN2	14	Selects Speech or White noise from the Noise Filter circuit as the signal source for Channel 2	High selects source
	TSTM2	13	Selects the Test Mic from the monitor headset as the signal source for Channel 2	High selects source

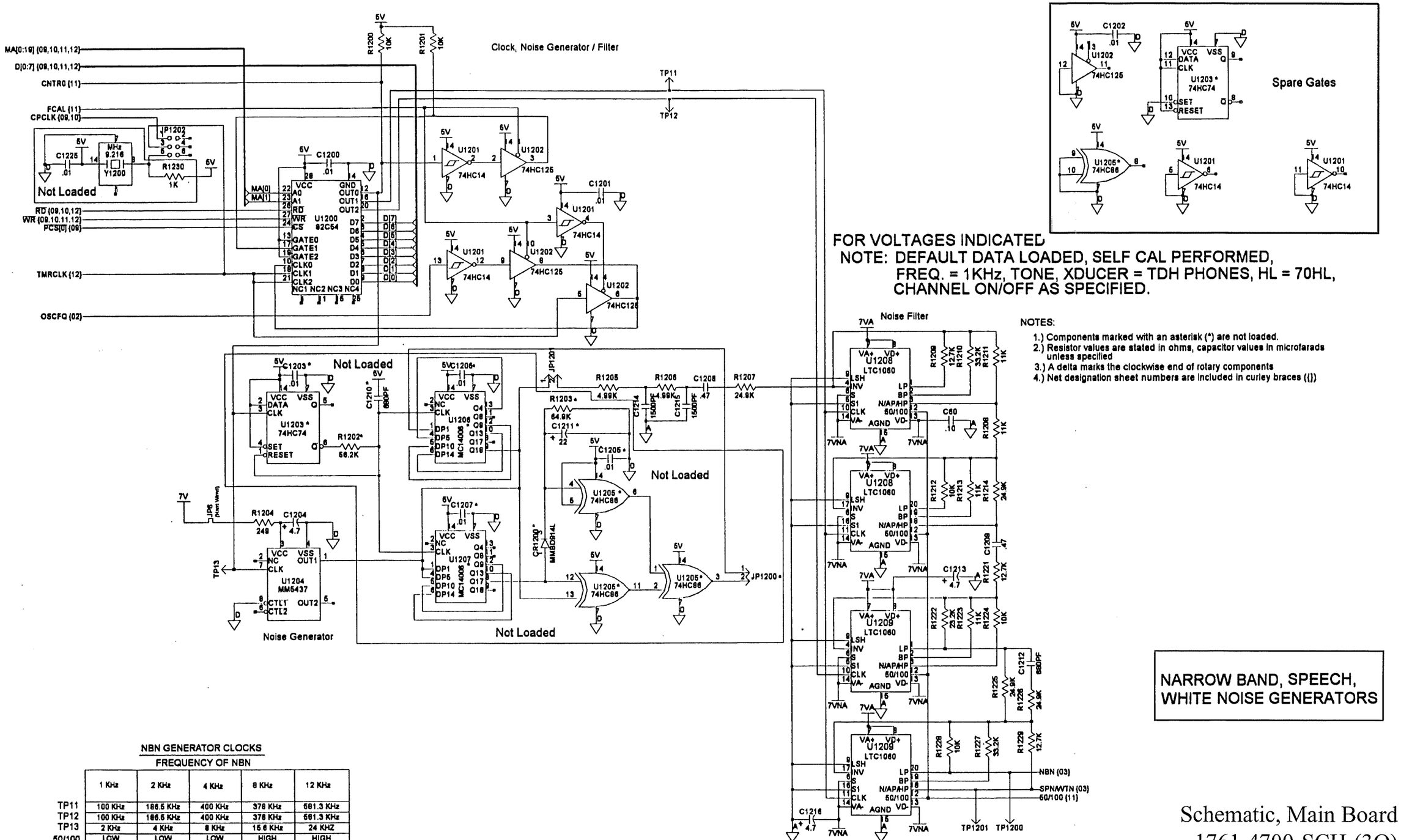
	IC#	Address	Description/Function	Logic
	EXTA2	12	Selects EXT A Pre-Amp circuit as the signal source for Channel 2	High selects source
U1021 Latch 16	DANARLY	19	A relay control signal via U1038 that selects LPHOUT or RPHOUT to be routed to the left phone insert relay	Low enables LPHOUT High enables RPHOUT
	BONLRRLY	18	A relay control signal via U1038 that selects LPHOUT or RPHOUT to be routed to the Bone Vibrator relay	Low enables LPHOUT High enables RPHOUT
	RLYEN	17	A signal that is OR'd with the watch dog timer circuit to become RLBL which allows the CPU to control Relays	low disables watch dog control
	HLREQ	16	Resets Int 0 in the HL circuit	Low = Int 0 low
	LFRNG	15	Selects the feedback capacitance value in the Oscillator circuit to determine low frequency or high frequency operation	Low = High Freq. High = Low Freq
	EXTB1	14	Selects EXT B Pre-Amp circuit as the signal source for Channel 1	High selects source
	EXTB2	13	Selects EXT B Pre-Amp circuit as the signal source for Channel 2	High selects source
	OSCENAB	12	Enables the Oscillator to start-up	High enables oscillation
U1022 Latch 17	FCAL	19	Enables the Counter/Timer IC to monitor the Oscillator signal to determine the internal frequency for calibration	Low enables OSCFQ
	MSPKR	18	Enables Channel 1, Channel 2 and talkback mic to be output to the monitor speaker and headset	Low enable
	RS232MUX	17	Selects printer or RS232 port	Low=RS232 port High=printer port
	50/100	16	Noise filter clock frequency ratio select	low=100:1 high=50:1
	OSCLSB	15	Tells the Oscillator DAC that the data on the OSCD Bus is the least significant byte	Active Low

	IC#	Address	Description/Function	Logic
	OSCMSB	14	Tells the Oscillator DAC that the data on the OSCD Bus is the most significant byte	Active Low
	OSCWR	13	Writes the data on the OSCD bus into the oscillator DAC	Low=write enable
	LCDON	12	Controls the -24 VDC on the power supply board thru U601 to prevent damage to the LCD when not in use	Low=supply off
U1028 Latch 18	LIFONRLY	19	A relay control signal via U1037 that turns on the Left Insert Phone Relay	Low=on
	RSPKRLY	18	A relay control signal via U1037 that turns on the right speaker relay on the power supply board	Low=on
	RPHONRLY	17	A relay control signal via U1037 that turns on the right phone relay	Low=on
	BONVBRLY	16	A relay control signal via U1037 that turns on the bone vibrator relay	Low=on
	LPHONRLY	15	A relay control signal via U1037 that turns on the left phone relay	Low=on
	LSPKRRLY	14	A relay control signal via U1037 that turns on the right speaker relay on the power supply board	Low=on
	RIFONRLY	13	A relay control signal via U1037 that turns on the right insert phone relay	Low=on
	HFRQRLY	12	A relay control signal via U1038 that routes the signal to the ring or tip of the left or right phone jacks	Low=ring or High Freq High=tip or Low Freq

REAR PANEL CONNECTORS



Component Layout,
Main Board
1761-4700-ASM (3/3Q)



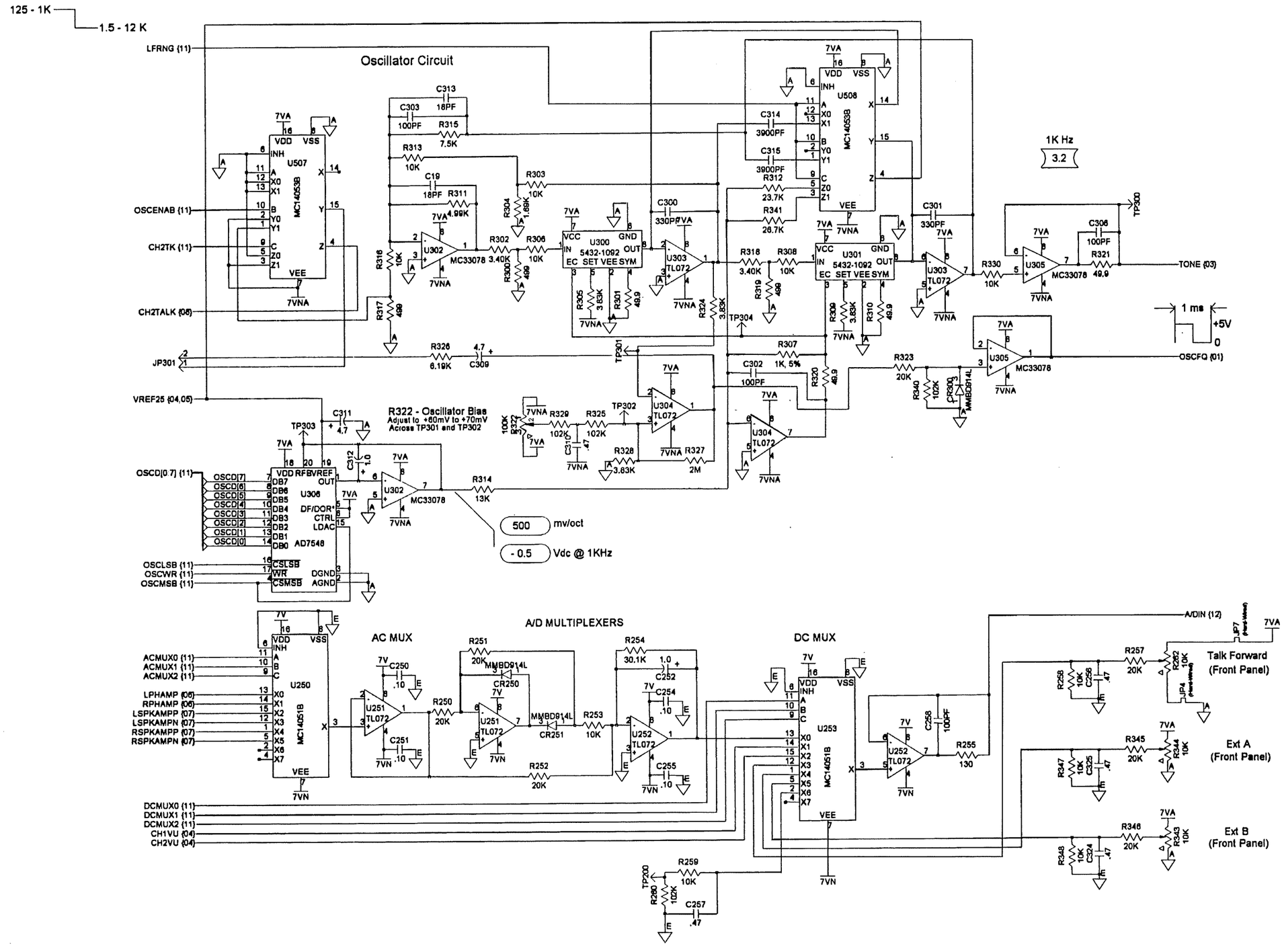
NBN GENERATOR CLOCKS

FREQUENCY OF NBN

	1 KHz	2 KHz	4 KHz	8 KHz	12 KHz
TP11	100 KHz	186.5 KHz	400 KHz	376 KHz	561.3 KHz
TP12	100 KHz	186.5 KHz	400 KHz	376 KHz	561.3 KHz
TP13	2 KHz	4 KHz	8 KHz	15.6 KHz	24 KHZ
50/100	LOW	LOW	LOW	HIGH	HIGH

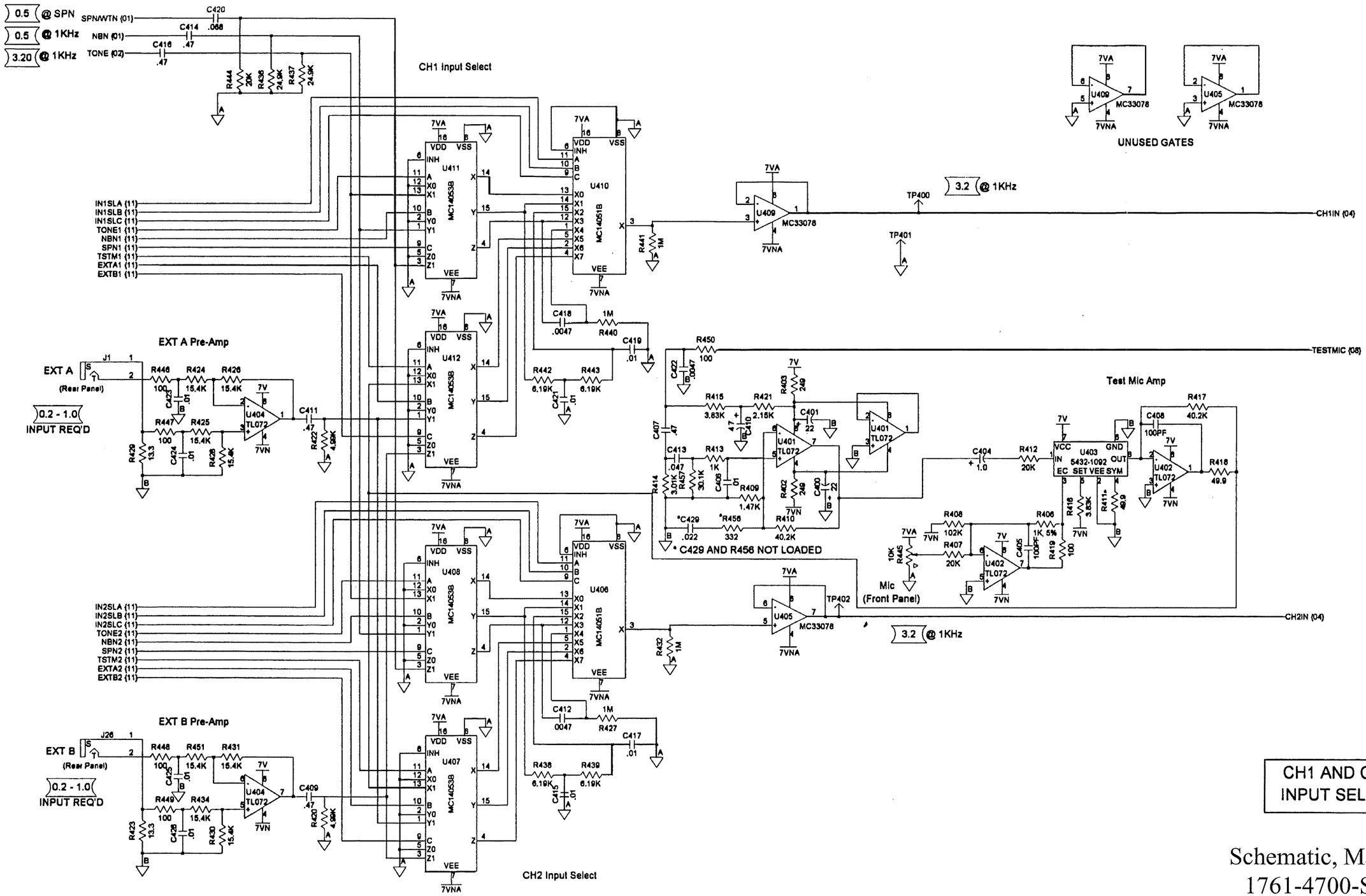
NARROW BAND, SPEECH, WHITE NOISE GENERATORS

Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 1 of 13

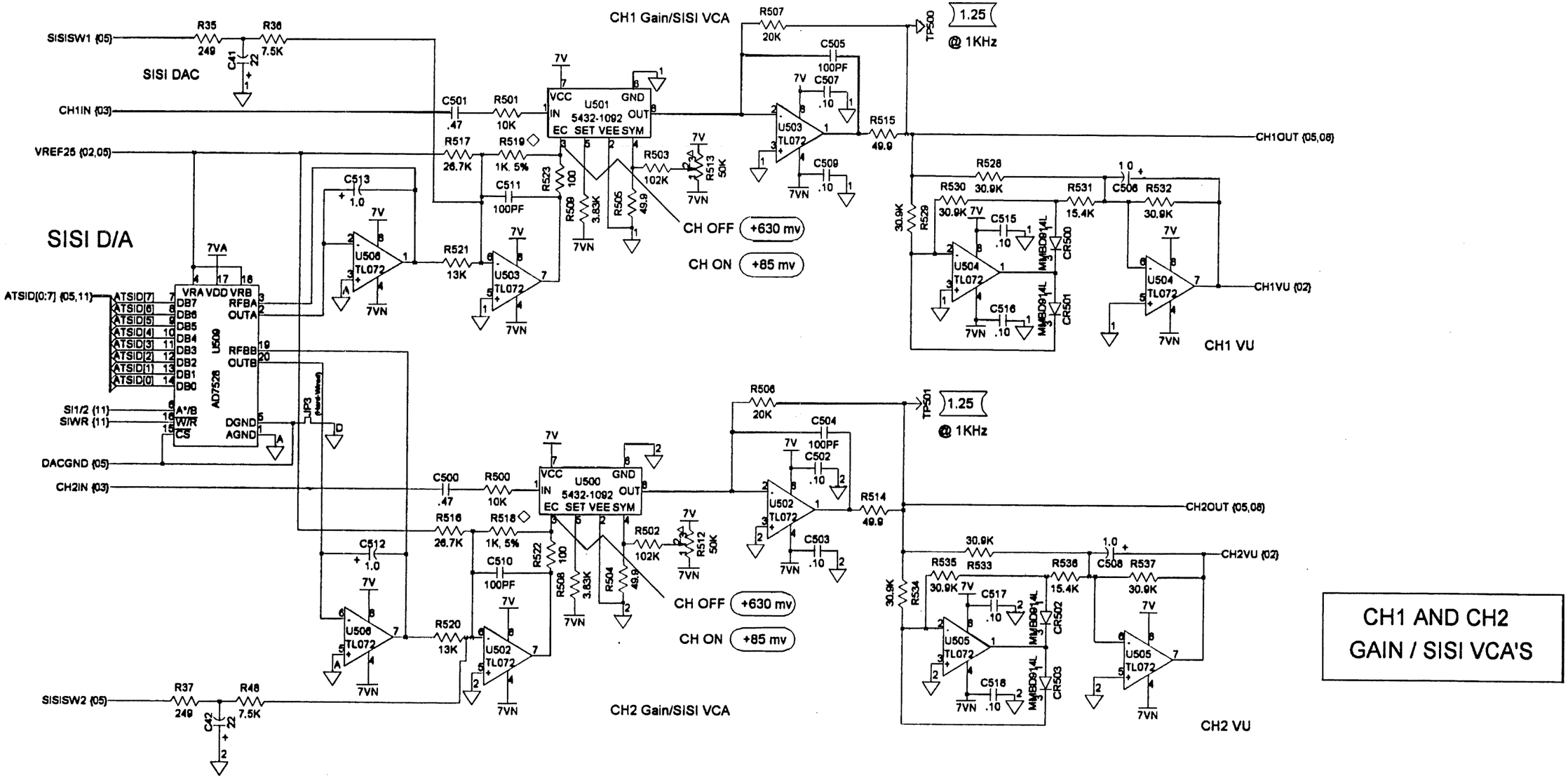


OSCILLATOR
A/D MUX

Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 2 of 13



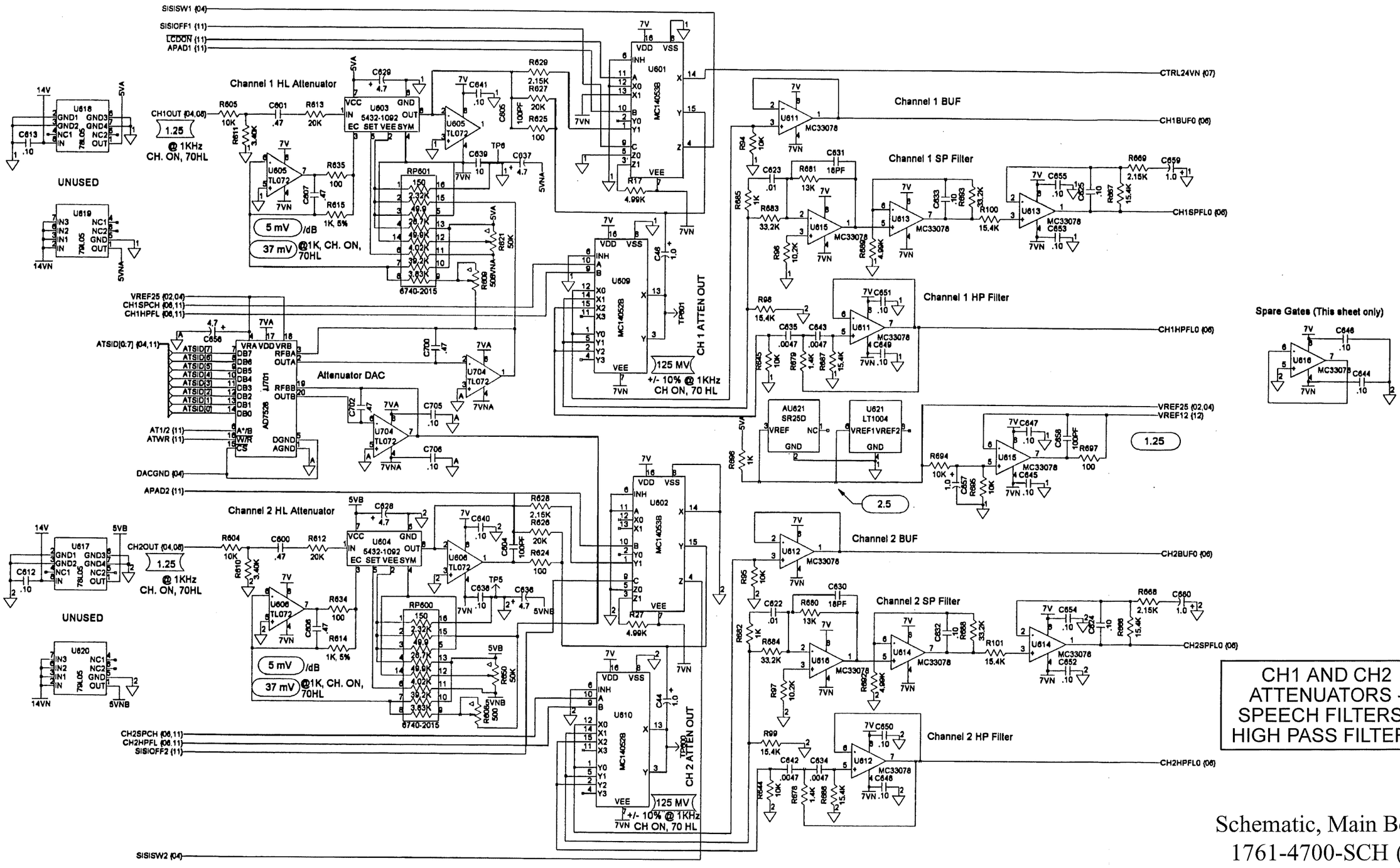
Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 3 of 13



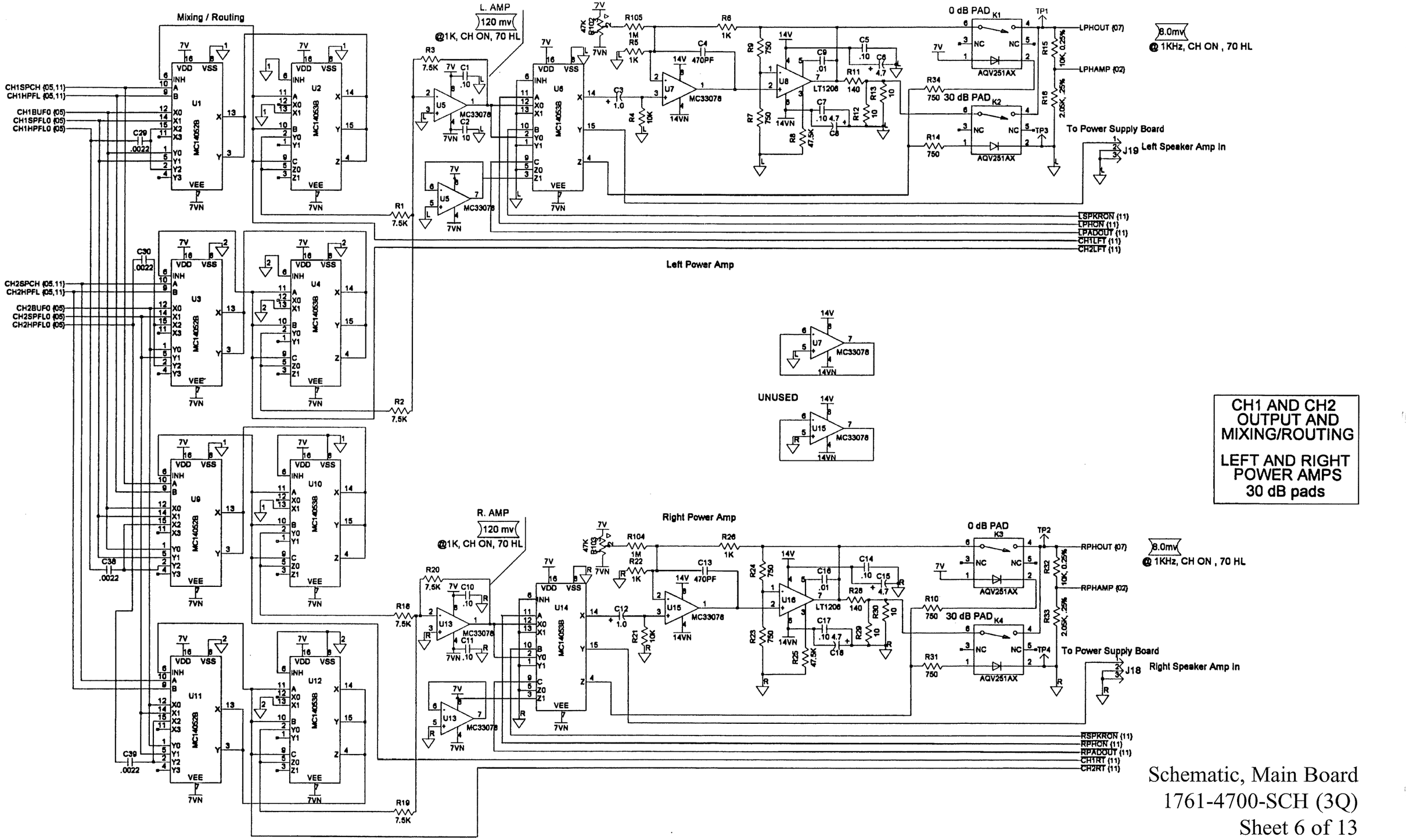
CH1 AND CH2
GAIN / SISI VCA'S

◇ = R518 AND R519 MATCH TO 1%

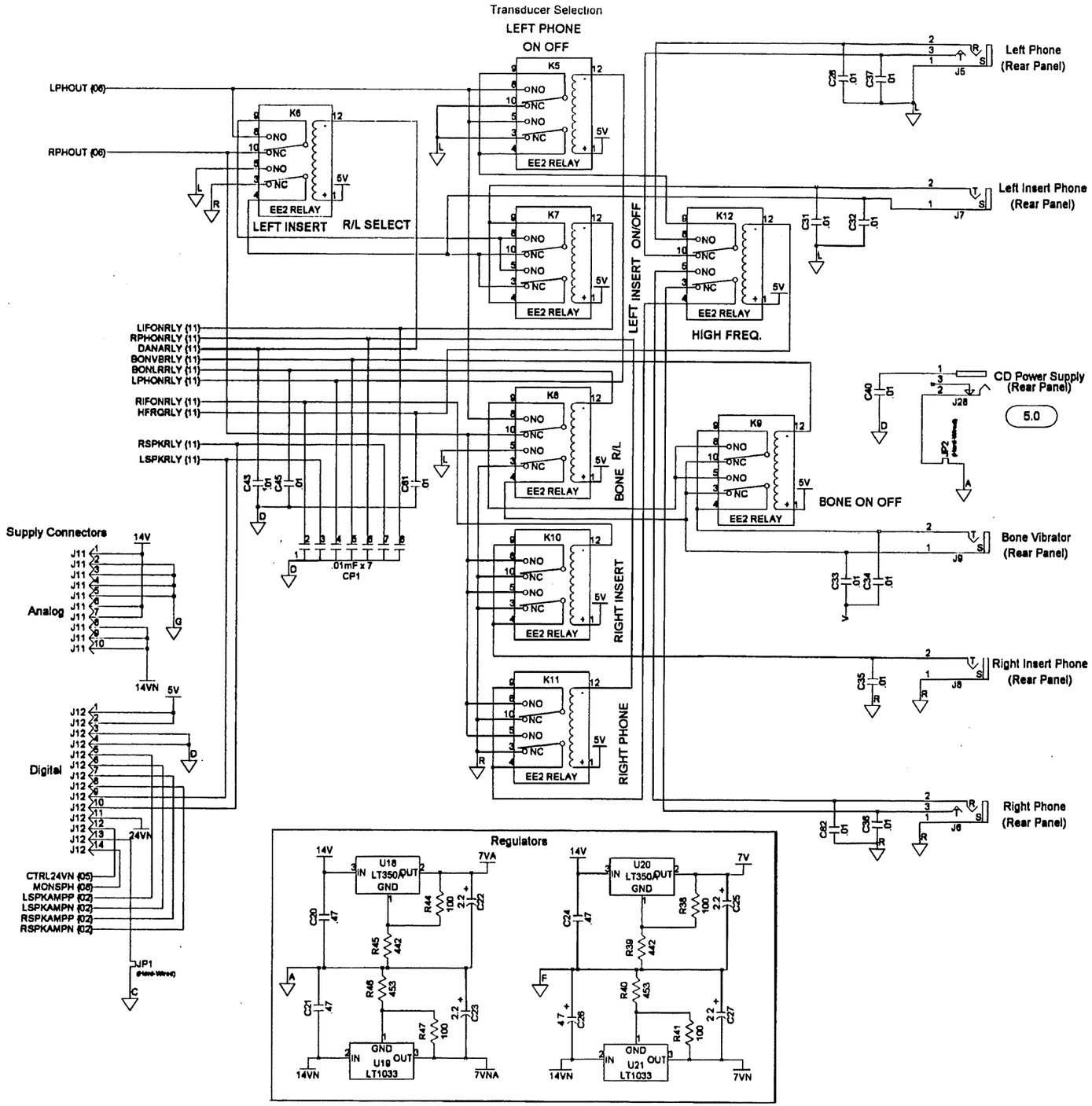
Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 4 of 13



Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 5 of 13

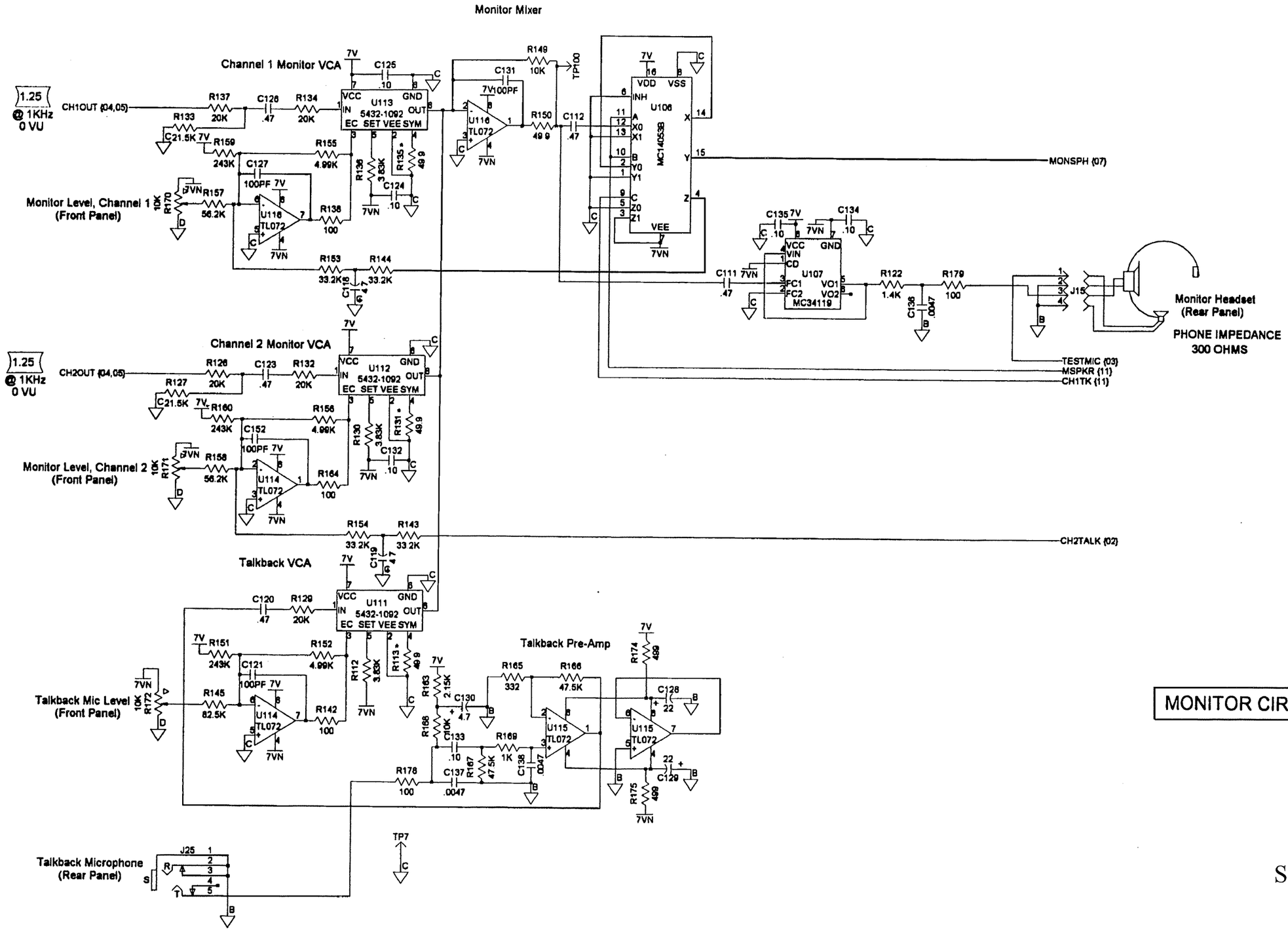


Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 6 of 13



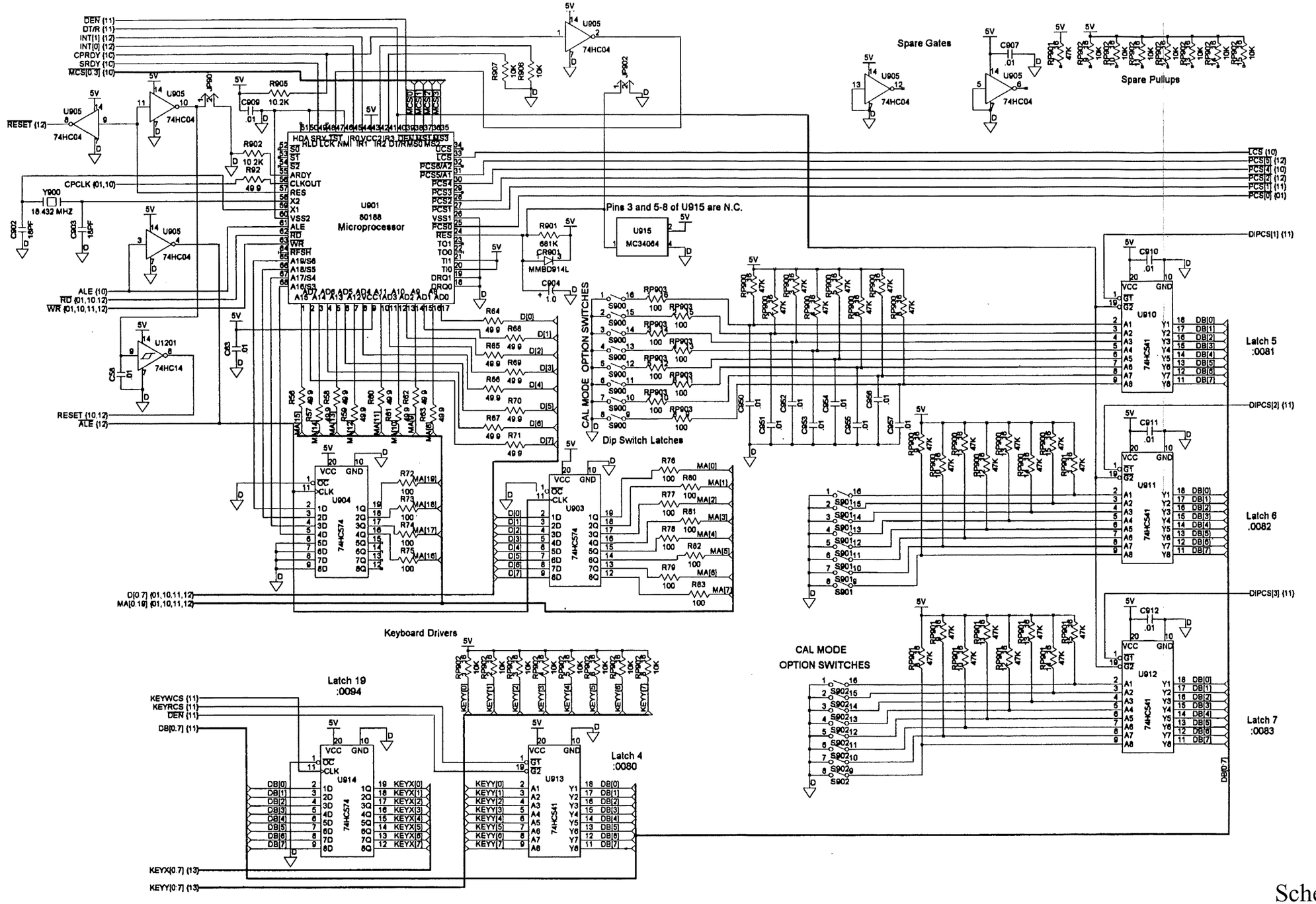
TRANSDUCER SELECTOR RELAYS

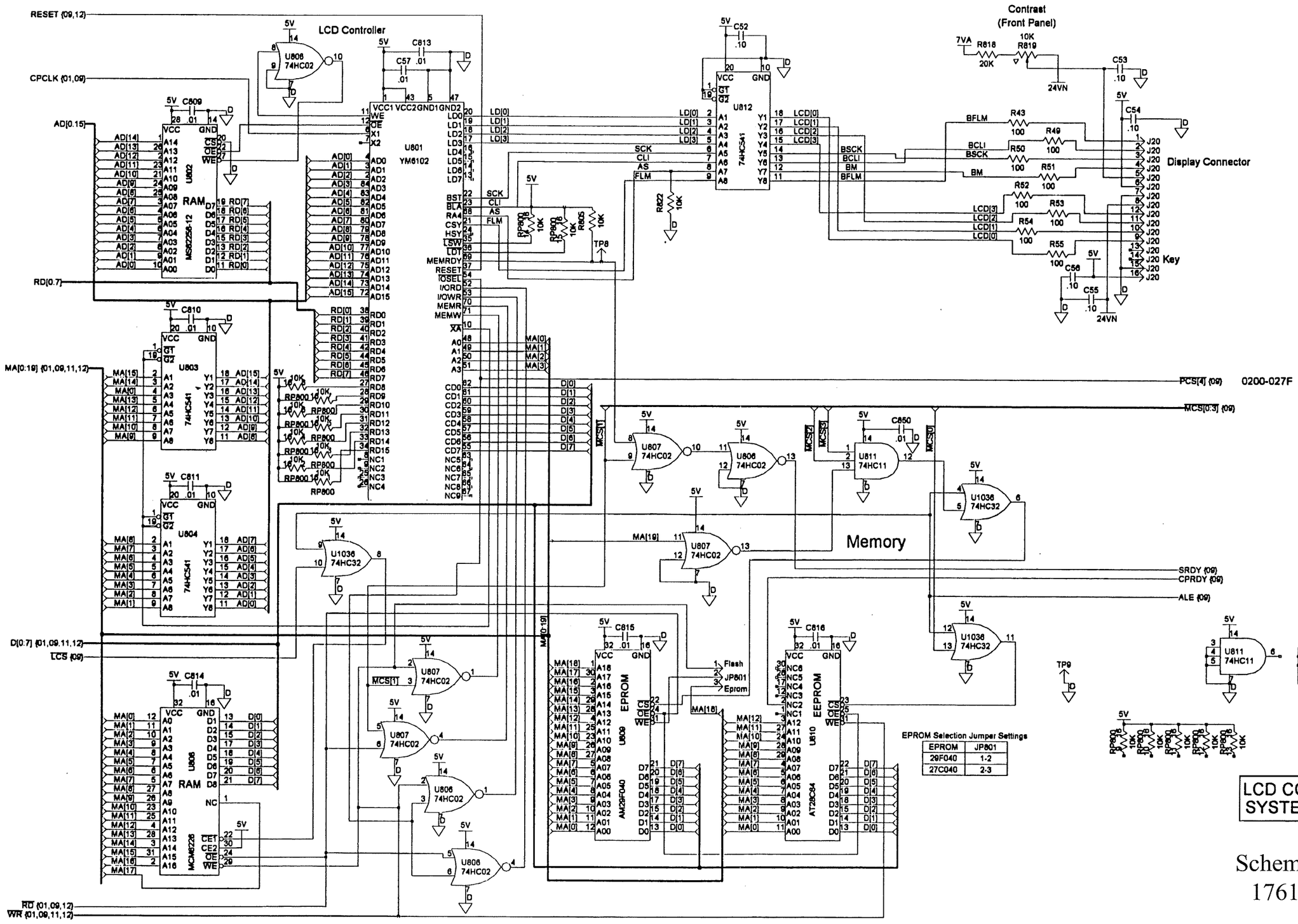
Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 7 of 13

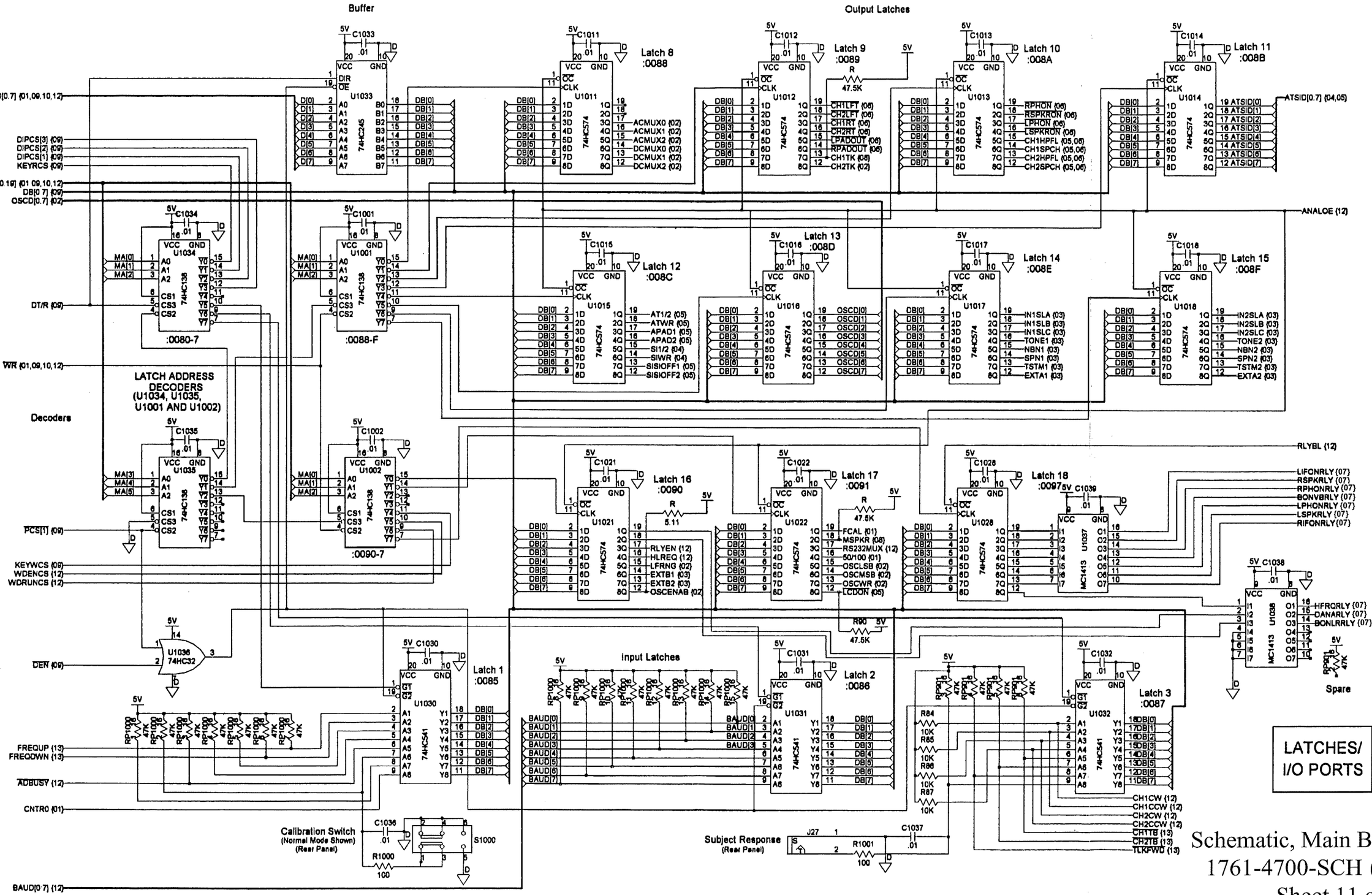


MONITOR CIRCUITS

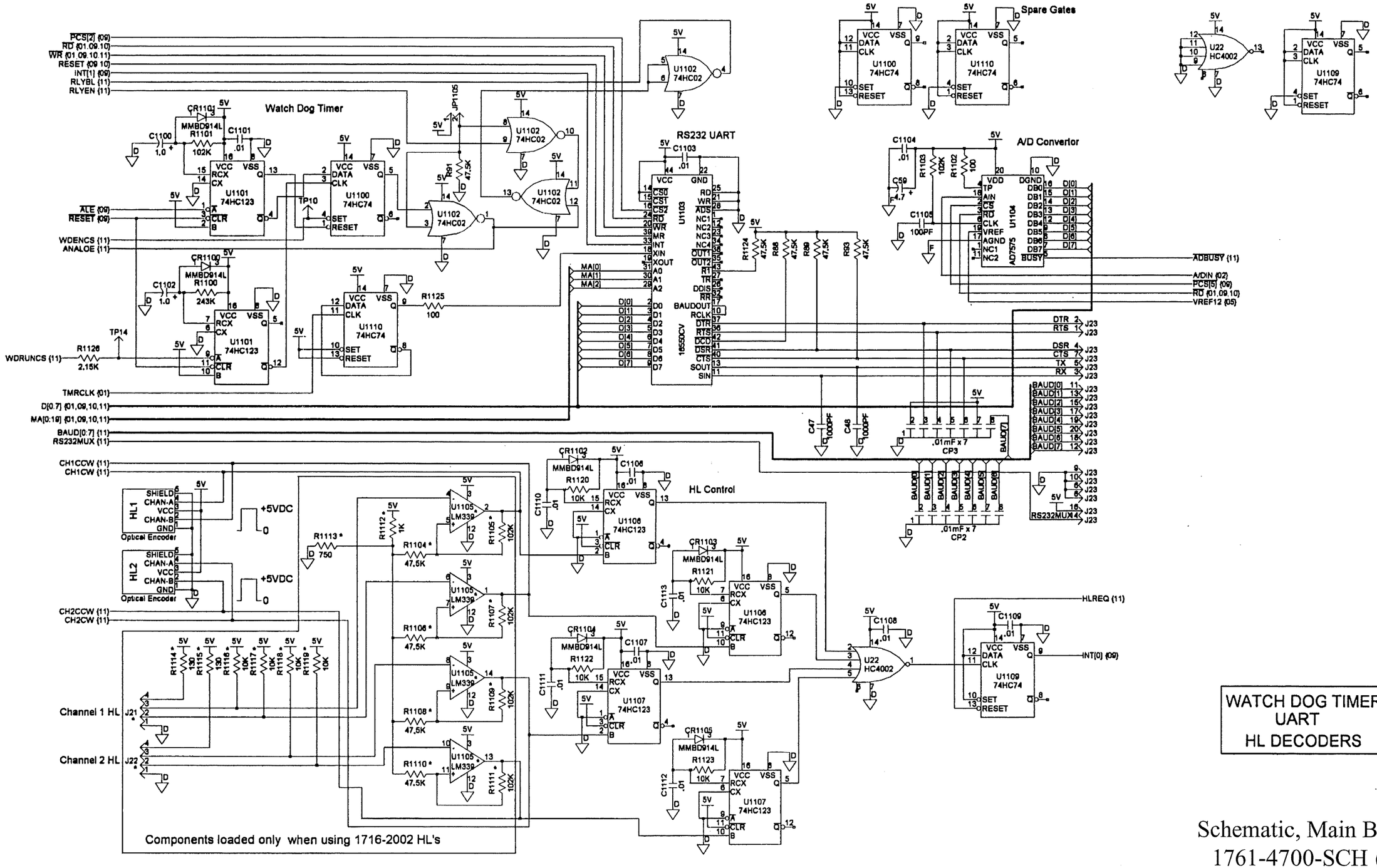
Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 8 of 13


Spare Gates
Spare Pullups
Pins 3 and 5-8 of U915 are N.C.
U901
80188
Microprocessor
Y900
16.432 MHZ
Dip Switch Latches
CAL MODE OPTION SWITCHES
Keyboard Drivers
CAL MODE
OPTION SWITCHES
Latch 5
:0081
Latch 6
.0082
Latch 7
:0083
Latch 19
:0094
Latch 4
:0080
MICROPROCESSOR
CAL OPTION
SWITCHES AND
KEYBOARD DRIVERS

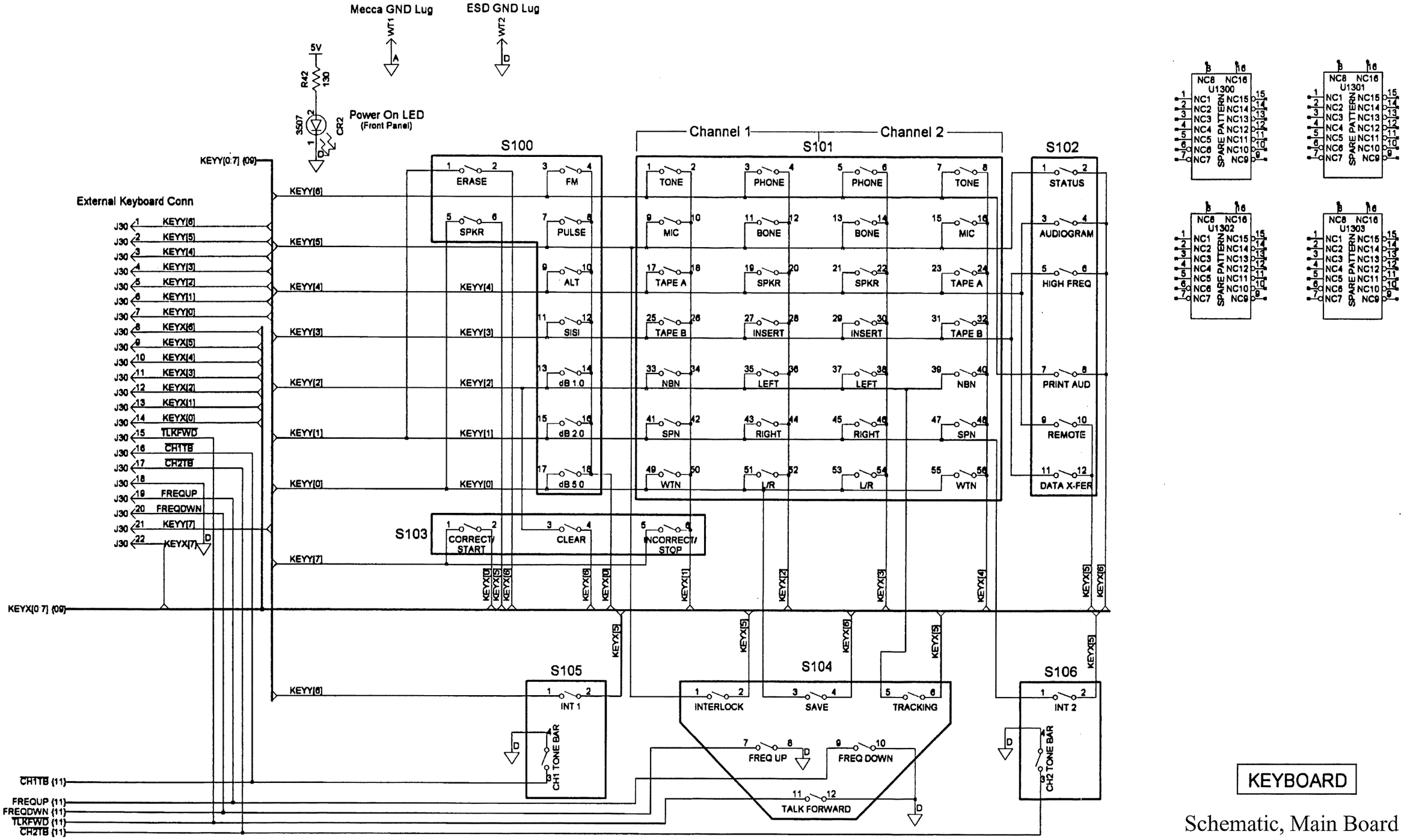

LCD Controller
Contrast
(Front Panel)
Display Connector
Key
Memory
RAM
EPROM
EEPROM
LCD CONTROLLER
SYSTEM MEMORY
EPROM Selection Jumper Settings
EPROM JP601
29F040 1-2
27C040 2-3
0200-027F
Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 10 of 13



Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 11 of 13



Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 12 of 13



KEYBOARD

Schematic, Main Board
1761-4700-SCH (3Q)
Sheet 13 of 13

THIS PAGE INTENTIONALLY BLANK.

GSI 61 Main Board Parts List (4/3Q)

(The Main Board replacement can be ordered as 1761-4700SVC or 1761-4700ROT.)

INTEGRATED CIRCUITS

Ref. Designation	Description	Part No.
U1, U3, U9, U11, U609, U610	IC, SMT, MC14052, DUAL 4 CHAN MUX	5904-4052
U2, U4, U6, U10, U12, U14, U106, U407, U408, U411, U412, U507, U508, U601, U602	IC, SMT, MC14053, TRI-2 CH M-D	5904-4053
U5, U7, U13, U15, U302, U305, U405, U409, U611, U612, U613, U614, U615, U616	IC, SMT, MC33078, QUIET OP AMP	5909-3078
U8, U16	IC, SMT, LT1206, VIDEO AMP	5909-1206
U18, U20	IC, LT350, VOLTAGE REGULATOR	5433-1021
U19, U21	IC, LT1033, VOLTAGE REGULATOR	5433-1022
U22	IC, SMT, HC4002, DUAL 4-INP NOR GATE	5905-4002
U107	IC, SMT, MC34119, LO PWR AUD AMP	5904-4119
U111, U112, U113, U403	IC, 2180LC, VOLT CONTROL AMP	5432-1093
U114, U115, U116, U251, U252, U303, U304, U401, U402, U404, U502, U503, U504, U505, U506, U605, U606, U704	IC, SMT, TL072, JFET OP AMP	5909-0072
U250, U253, U406, U410	IC, SMT, 14051B, ANALOG MPLXR	5904-4051
U300, U301, U500, U501, U603, U604	IC, THAT2155, VOLT CONTROL AMP	5432-1092
U306	IC, SMT, AD7548, 12 BIT DAC	5907-7548
U509, U701	IC, SMT, AD7528, DUAL 8 BIT D/A	5907-7528
U621	IC, SMT, LT1004CS, 2.5 V REF	5933-1004
U617, U618	IC, SMT, MC78L05, +5V REG	5908-7805
U619, U620	IC, SMT, MC79L05, -5V REG	5908-7905
U801	IC, SMT, CMOS, DISPLAY CONTROL	5929-6102
U802	IC, SMT, MS62256, 32Kx8 CMOS STATIC RAM	5904-2256
U803, U804, U812, U910, U911, U912, U913, U1030, U1031, U1032	IC, SMT, 74HC541, OCTAL BUFFER	5905-0541
U806, U807, U1102	IC, SMT, 74HC02, QUAD 2 IN NOR GATE	5905-0002
U808	IC, SMT, TC551001, 128 K x 8 ST RAM	5904-5510
U809	FIRMWARE, GSI 61	1761-0600
U810	IC, SMT, CMOS, 8K X 8 EPROM	5929-2864
U811	IC, SMT, 74HC11, TRIPLE 3-INP AND GATE	5905-0011
U901	IC, SMT, 80C188 MICROPROCESSOR	5929-0188

INTEGRATED CIRCUITS - continued

Ref. Designation	Description	Part No.
U903, U904, U914, U1011, U1012, U1013, U1014, U1015, U1016, U1017, U1018, U1021, U1022, U1028	IC, SMT, 74HC574, OCTAL LATCH	5905-0574
U905	IC, SMT, 74HC04, HEX INVERTER	5905-0004
U915	IC, SMT, MC34064, UNDRVLTG SEN	5933-4064
U1001, U1002, U1034, U1035	IC, SMT, 74HC138, 1OF8 DEC/DEM	5905-0138
U1033	IC, SMT, 74HC0245, 3 STATE BUS XCVR	5905-0245
U1036	IC, SMT, 74HC32, QUAD 2-INP OR GATE	5905-0032
U1037, U1038	IC, SMT, ULN2003, DRIVER ARRAY	5907-2003
U1100, U1109, U1110	IC, SMT, 74HC74, DUAL D F-F W/RESET	5905-0074
U1101, U1106, U1107	IC, SMT, 74HC123, RETRIG MULT-VIB	5905-0123
U1103	IC, SMT, PC16550, UART, HI-SPEED	5929-6550
U1104	IC, AD7575, 8 BIT ADC W/ TRK-HLD	5432-7002
U1200	IC, SMT, 82C54, PROG. TIMER	5929-8254
U1201	IC, SMT, 74HC14, HEX INVERTER	5905-0014
U1202	IC, SMT, 74HC125, QUAD 3 ST BUFF	5905-0125
U1204	IC, MM5437, DIG NOISE PWR SRC	5432-1101
U1208, U1209	IC, SMT, LTC1060CS, SWTCD FLTR	5904-1060

DIODES

Ref. Designation	Description	Part No.
CR2	LED, GREEN, MINI, .125 DIA	6084-1022
CR250, CR251, CR300, CR500, CR501, CR502, CR503, CR901, CR1100, CR1101, CR1102, CR1103, CR1104, CR1105	DIODE, SMT, MMBD914	6082-2002

RESISTORS & POTENTIOMETERS

Ref. Designation	Description	Part No.
No Ref Des	RES, FILM, 5.11K, 1%, .12W	6350-1511
No Ref Des	RES, COMP, 47K, 5%, .25W	6099-3475
R1, R2, R3, R18, R19, R20, R36, R48, R315	RES, SMT, 7.50K OHM, 1%, .12W	6650-1750
R4, R21, R84, R85, R86, R87, R94, R95, R149, R168, R253, R258, R259, R303, R306, R308, R313, R316, R330, R347, R348, R500, R501, R604, R605, R644, R645, R805, R822, R906, R907, R1120, R1121, R1122, R1123, R1200, R1201, R1212, R1224, R1228	RES, SMT, 10.0K OHM, 1%, .12W	6650-2100

Ref. Designation	Description	Part No.
R5, R6, R22, R26, R169, R413, R696, R682, R685	RES, SMT, 1K OHM, 1%, .12W	6650-1100
R7, R9, R10, R14, R23, R24, R31, R34	RES, SMT, 750 OHM, 1%, .12W	6650-0750
R8, R25, R88, R89, R90, R91, R93, R166, R167, R1124	RES, SMT, 47.5K OHM, 1%, .12W	6650-2475
R11, R28	RES, SMT, 140 OHM, 1%, 1W	6653-0140
R12, R13, R29, R30	RES, SMT, 10 OHM, 1%, .12W	6650-9100
R15, R32, R694, R695	RES, FILM, 10.0K OHM, .25%, .12W	6252-2100
R16, R33	RES, FILM, 2.05K OHM, .25%, .12W	6252-1205
R17, R27, R152, R155, R156, R311, R420, R422, R689, R692, R1205, R1206	RES, SMT, 4.99K OHM, 1%, .12W	6650-1499
R35, R37, R402, R403, R1204	RES, SMT, 249 OHM, 1%, .12W	6650-0249
R38, R41, R43, R44, R47, R49, R50, R51, R52, R53, R54, R55, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R138, R142, R164, R178, R179, R419, R446, R447, R448, R449, R450, R522, R523, R624, R625, R634, R635, R697, R1000, R1001, R1102, R1125	RES, SMT, 100 OHM, 1%, .12W	6650-0100
R39, R45	RES, SMT, 442 OHM, 1%, .12W	6650-0442
R40, R46	RES, SMT, 453 OHM, 1%, .12W	6650-0453
R42, R255	RES, SMT, 130 OHM, 1%, .12W	6650-0130
R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R92, R150, R301, R310, R320, R321, R418, R504, R505, R514, R515	RES, SMT, 49.9 OHM, 1%, .12W	6650-9499
R96, R97, R902, R905	RES, SMT, 10.2K OHM, 1%, .12W	6650-2102
R98, R99, R100, R101, R424, R425, R426, R428, R430, R431, R434, R451, R531, R536, R666, R667, R686, R687	RES, SMT, 15.4K OHM, 1%, .12W	6650-2154

RESISTORS & POTENTIOMETERS - continued

Ref. Designation	Description	Part No.
R102, R103	POT, SMT, 47K OHM ± 25%	6049-0600
R104, R105, R427, R432, R440, R441	RES, SMT, 1M OHM, 1%, .12W	6650-4100
R112, R130, R136, R305, R309, R324, R328, R415, R416, R508, R509	RES, SMT, 3.83K OHM, 1%, .12W	6650-1383
R122, R678, R679	RES, SMT, 1.40K OHM, 1%, .12W	6650-1140
R126, R129, R132, R134, R137, R250, R251, R252, R257, R323, R345, R346, R407, R412, R444, R506, R507, R612, R613, R626, R627, R818	RES, SMT, 20K OHM, 1%, .12W	6650-2200
R127, R133, R174, R175, R300, R317, R319	RES, SMT, 499 OHM, 1%, .12W	6650-0499
R127, R133, R163, R421, R628, R629, R668, R669, R1126	RES, SMT, 2.15K OHM, 1%, .12W	6650-1215
R143, R144, R153, R154, R683, R684, R688, R693, R1210, R1227	RES, SMT, 33.2K OHM, 1%, .12W	6650-2332
R145	RES, SMT, 82.5K OHM, 1%, .12W	6650-2825
R151, R159, R160, R1100	RES, SMT, 243K OHM, 1%, .12W	6650-3243
R157, R158	RES, SMT, 56.2K OHM, 1%, .12W	6650-2562
R165	RES, SMT, 332 OHM, 1%, .12W	6650-0332
R170, R171, R172, R262, R343, R344, R445, R819	POT, COND. PLASTIC, 10K ± 20%	6004-0095
R254, R457	RES, SMT, 30.1K OHM, 1%, .12W	6650-2301
R260, R325, R329, R340, R408, R502, R503, R1101, R1103	RES, SMT, 102K OHM, 1%, .12W	6650-3102
R302, R318, R610, R611	RES, SMT, 3.40K OHM, 1%, .12W	6650-1340
R304	RES, SMT, 1.69K OHM, 1%, .12W	6650-1169
R307, R406, R518, R519	RES, WW, TEMP SENS, 1K, 5%	6700-0001
R312	RES, SMT, 23.7K OHM, 1%, .12W	6650-2237
R314, R520, R521, R680, R681	RES, SMT, 13K OHM, 1%, .12W	6650-2130
R322	POT, COMP, 100K ± 20%	6049-0388

Ref. Designation	Description	Part No.
R326, R438, R439, R442, R443	RES, SMT, 6.19K OHM, 1%, .12W	6650-1619
R341, R516, R517	RES, SMT, 26.7K OHM, 1%, .12W	6650-2267
R327	RES, SMT, 2M OHM, 1%, .12W	6650-4200
R409	RES, SMT, 1.47K OHM, 1%, .12W	6650-1147
R410, R417	RES, SMT, 40.2K OHM, 1%, .12W	6650-2402
R414	RES, SMT, 3.01K OHM, 1%, .12W	6650-1301
R423, R429	RES, SMT,13.3 OHM, 1%, .12W	6650-9133
R436, R437, R1207, R1214, R1225, R1226	RES, SMT, 24.9K OHM, 1%, .12W	6650-2249
R512, R513	POT, COMP, 50K, +/- 20%	6049-0320
R528, R529, R530, R532, R533, R534, R535, R537	RES, SMT, 30.9K OHM, 1%, .12W	6650-2309
R608, R609	POT, CERMET, 500 OHMS ± 10%	6049-0502
R614, R615	RES, TEMP SENS, 1K, 5%, 3900 PPM	6700-0002
R621, R650	POT, CERMET, 50K	6049-0350
R901	RES, SMT, 681K OHM, 1%, .12W	6650-3681
R1208, R1211, R1213, R1223	RES, SMT, 11.0K OHM, 1%, .12W	6650-2110
R1209, R1221, R1229	RES, SMT, 12.7K OHM, 1%, .12W	6650-2127
R1222	RES, SMT, 23.2K OHM, 1%, .12W	6650-2232
RP903	RES, NETWORK, SMT, 100 OHM SER	6740-2010
RP800, RP902	RES, NETWORK, SMT, 10K PULL-UP	6740-2011
RP900, RP901, RP1000	RES, NETWORK, SMT, 47K PULL-UP	6740-2012
RP600, RP601	RES, NETWORK, SMT, CUSTOM x 8	6740-2015

CAPACITORS

Ref. Designation	Description	Part No.
C1, C2, C5, C7, C10, C11, C14, C17, C52, C53, C54, C55, C56, C60, C124, C125, C132, C133, C134, C135, C250, C251, C254, C255, C502, C503, C507, C509, C515, C516, C517, C518, C612, C613, C624, C625, C632, C633, C638, C639, C640, C641, C644, C645, C646, C647, C648, C649, C650, C651, C652, C653, C654, C655, C705, C706	CAP, SMT, CER, .1 uF, 10%, 50V	4500-1041
C3, C12, C44, C46, C252, C312, C404, C506, C508, C512, C513, C657, C659, C660, C904, C1100, C1102	CAP, SMT, TANT, 1.0 uF, 20%	4550-1052
C4, C13	CAP, SMT, CER, 470 pF, 5%, 50V	4500-4715
C6, C8, C15, C18, C26, C59, C130, C309, C311, C410, C628, C629, C636, C637, C656, C1204, C1213, C1216	CAP, SMT, TANT, 4.7 uF, 10%, 25V	4550-4751
C9, C16, C28, C31, C32, C33, C34, C35, C36, C37, C40, C43, C45, C57, C58, C61, C62, C63, C406, C415, C417, C419, C421, C423, C424, C425, C426, C622, C623, C809, C810, C811, C813, C814, C815, C816, C850, C907, C909, C910, C911, C912, C950, C951, C952, C953, C954, C955, C956, C957, C1001, C1002, C1011, C1012, C1013, C1014, C1015, C1016, C1017, C1018, C1021, C1022, C1028, C1030, C1031, C1032, C1033, C1034, C1035, C1036, C1037, C1038, C1039, C1101, C1103, C1104, C1106, C1107, C1108, C1109, C1110, C1111, C1112, C1113, C1200, C1201, C1202, C1225	CAP, SMT, CER, .01 uF, 10%, 50V	4500-1031
C19, C313, C630, C631, C902, C903	CAP, SMT, CER, 18 pF, 10%, 50V	4500-1801
C20, C21, C24, C111, C112, C120, C123, C126, C256, C257, C310, C324, C325, C407, C409, C411, C414, C416, C500, C501, C600, C601, C606, C607, C700, C702, C1208, C1209	CAP, SMT, CER, .47 uF, 20%, 50V	4500-4742

Ref. Designation	Description	Part No.
C22, C23, C25, C27, C118, C119	CAP, SMT, TANT, 2.2 uf, ±20%	4550-2251
C29, C30, C38, C39	CAP, SMT, CER, 0.0022 uF, 5%, 50V	4500-2225
C41, C42, C128, C129, C400, C401	CAP, SMT, TANT, 22 uF, 10%, 20V	4550-2261
C47, C48	CAP, SMT, CER, 1000 pF, 5%, 50V	4500-1025
C121, C127, C131, C152, C258, C302, C303, C306, C405, C408, C504, C505, C510, C511, C604, C605, C658, C1105	CAP, SMT, CER, 100 pF, 5%, 50V	4500-1015
C136, C137, C138, C412, C418, C422, C634, C635, C642, C643	CAP, SMT, CER, .0047 uF, 10%, 50V	4500-4721
C300, C301	CAP, SMT, CER, 330 pF, 5%, 50V	4500-3315
C314, C315	CAP, SMT, CER, 3900 pF, 5% 50V	4500-3925
C413	CAP, SMT, CER, 0.047mF, 10%, 50V	4500-4731
C420	CAP, SMT, CER, .068 uF, 10%, 50V	4500-6831
C1212	CAP, SMT, CER, 680 pF, 5%, 50V	4500-6815
C1214, C1215	CAP, SMT, CER, 1500 pF, 5%, 50V	4500-1525
CP1, CP2, CP3	CAP, NETWORK, SIP, .01mF	4000-0103

IC SOCKETS

Ref. Designation	Description	Part No.
XU809	SOCKET, SMT, LO-PRO, PLCC, 32 CONT.	7540-1032
XU901	SOCKET, SMT, PLCC, 68 CONT	7540-1067
XU1103	SOCKET, SMT, LO PRO, PLCC, 44 CONT.	7540-1044

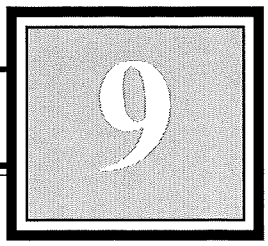
SWITCHES & RELAYS

Ref. Designation	Description	Part No.
S900	SWITCH, DIP, 8 POS, RT ANGLE	7874-0169
S901, S902	SWITCH, SMT, DIP, 8 B	7874-0168
S1000	SWITCH, RT ANGLE, TOGGLE	7874-0175
HL1, HL2	SWITCH, OPTICAL ENCODER, MODIFIED	1761-0520
K1, K2, K3, K4	RELAY, SMT, SPST, PHOTO MOS	6090-1600
K5, K6, K7, K8, K9, K10, K11, K12	RELAY, SMT, 2C	6090-1550

MISCELLANEOUS

Ref. Designation	Description	Part No.
	PRINTED CIRCUIT BOARD, MAIN BOARD	1761-0700
XU18, XU19, XU20, XU21	HEATSINK, TO-220	5415-1060
	NUT, HEX, LOCKING, 4-40	5814-0001
	SCREW, PAN HD, 4-40 x .250	7044-1102
	INSULATOR, MYLAR	1700-7074
J1, J26	JACK, PHONO, PC MT, 2 COND RT ANG	4214-0175
J5, J6	JACK, PHONE, 3-COND, DBL OPN CKT	4214-0170
J7, J8, J9, J27	JACK, PHONE, 2 COND, OPN CKT	4214-0165
J11	HEADER POST N-LOCK, GOLD, 10 PIN	4230-6510
J12	HEADER POST N-LOCK, GOLD 14 PIN	4230-6514
J15	JACK, TELEPHONE, RT ANG, 4 PIN	4220-7030
J18, J19	HEADER, SHROUDED, 1 ROW, 3 PIN	4230-2203
J20	HEADER DBL ROW 2mm, 16 PIN	4230-1542
J23	HEADER, LOCK & EJECT, 20 PIN	4230-7220
J25	JACK, AUDIO, 3.5mm	4214-0180
J28	JACK, DC PWR, PCB MOUNTED	4230-4032
J30, JP301, JP801, JP901, JP902, JP1105, JP1201, JP1202	CONNECTOR, STRIP-PINS, 36 CONT	4230-8069
XJP301, XJP801, XJP1105, XJP1201, XJP1202	SOCKET, SHORTING	4230-3810
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP11, TP12, TP13, TP14, TP100, TP200, TP300, TP301, TP302, TP303, TP304, TP400, TP401, TP402, TP500, TP501, TP600, TP601, TP1200, TP1201	JUMPER, TEST POINT, SMT	5080-0002
Y900	CRYSTAL, SMT, 18.432 MHz HC49	5075-0015

Power Supply Board: 1761-4720



This theory of operation applies to both Revision 2 and Revision 4 Power Supply boards. However, the Left and Right Speaker Amp Bias Ajdustment procedure applies only to Rev 4 boards, found in units with serial number 981737 and higher.

Theory of Operation

The Power Supply Board serves three functions:

1. Rectify AC voltages from the secondary of the transformer
2. Regulate power
3. Amplify free field and monitor speaker signals

The component layout shows the rectifiers in the upper left and then, moving in a counterclockwise direction, shows the +14 VDC regulator, the -14 VDC regulator, the -24 VDC regulator, and +5 VDC regulator, the monitor speaker amp, the right then left speaker power amps.

CR1 and CR2 rectify 16.3 VAC to 9.5 VDC, which supplies the unregulated voltage for U4 (the +5 VDC regulated supply). CR3 and CR5 rectify 39 VAC to +24.7 VDC, which supplies the unregulated voltage for U1 (the +14 VDC regulated supply). CR4 and CR6 rectify 39 VAC to -24.7 VDC, which supplies the unregulated voltage for U2 (the -14 VDC regulated supply). CR7 rectifies 54.8 VAC to -35.6 VDC, which supplies the unregulated voltage to U3 (the -24 VDC regulated supply).

Note: The unregulated voltages are approximate and will vary depending on Line Voltages, loading, etc. To read the regulated voltages accurately there must be a load on each of the supplies.

U105 is a differential amplifier that has a gain factor of 2 and is used for the monitor speaker. It receives its input from the main board via J12.

The two speaker push/pull amplifiers are identical and can be used for comparisons during troubleshooting.

The left speaker signal comes from the main board via J19, and passes through the differential amplifier U10 which amplifies the signal by a factor of 2. The signal is then inverted by the other side of U10 to create a push-pull effect. Each component of the signal then passes through the current driver stage of U11 and U12.

The output relay is used to physically separate the signal from the speakers when not in use. The relay is controlled by a logic level signal from the main board via J12 pin 9. A low turns the relay on, a high turns the relay off. The voltage dividers of R104, R105 and R117, R118 provide a tap for the signal to be monitored on the main board.

This table shows the voltage and current between U1, U2, U3, and U4 and their respective connections.

U#	Nominal Voltage	Voltage Tolerance	Current Capacity	Connector
U1	+14.0 V	– 0.5 V	2A	J11.6, J11.7
U2	-14.0 V	– 0.5 V	2A	J11.8, J11.9
U3	-24.0 V	– 1.0 V	1.5A	J12.11
U4	+5.0 V	– 0.1 V	4A	J12.1, J12.2

Left and Right Speaker Amp Bias Adjustment Procedure

This procedure lets you set the Speaker Amp Bias for the **Rev 4** Power Supply Board.

Equipment Required: DVM capable of measuring down to 10 µvolts DC.

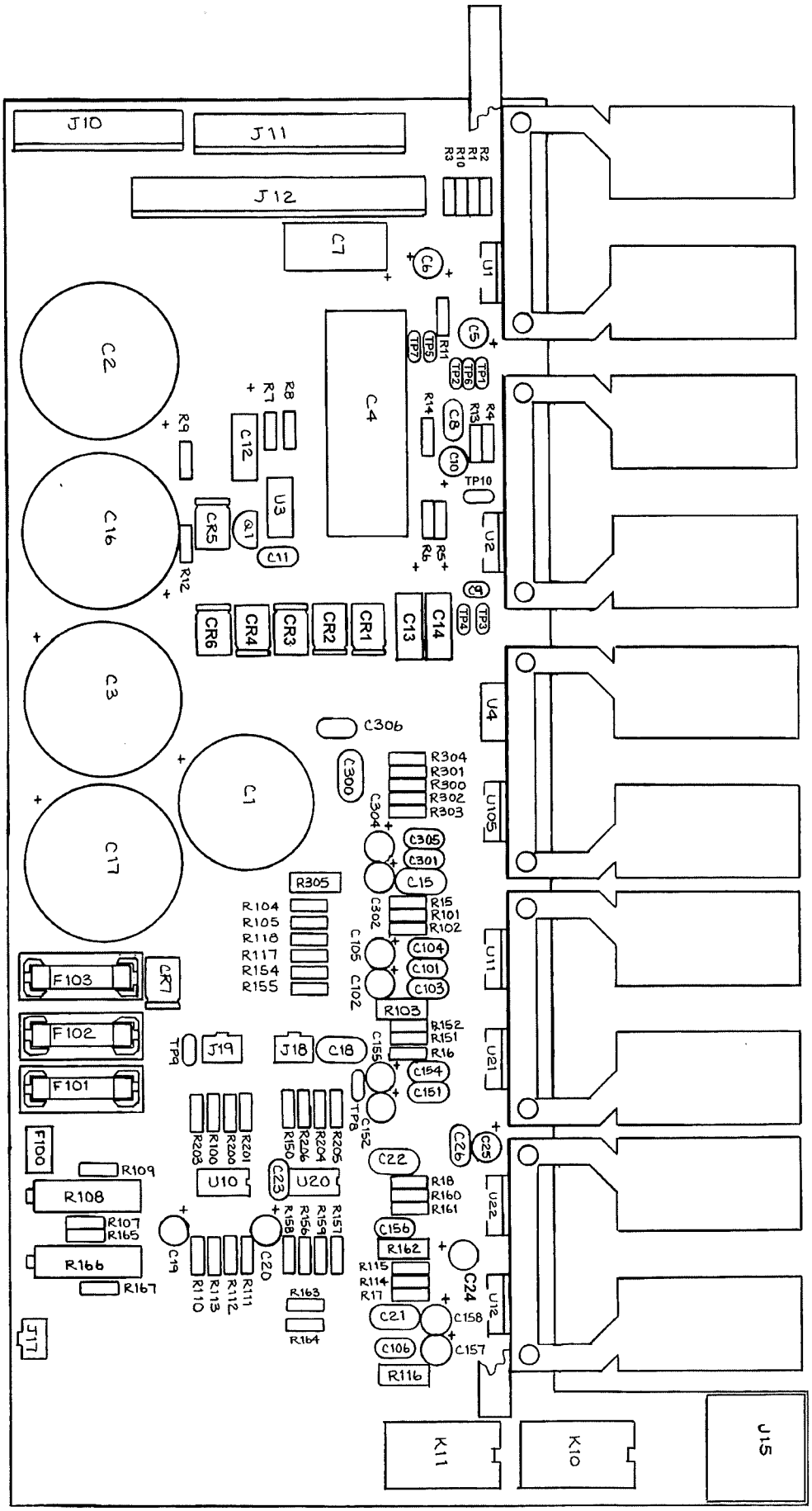
Note: Allow unit to warm up, with cover closed, for 30 minutes before adjusting.

1. Plug an appropriately wired DIN connector into speaker output jack J15. See Power Amp schematic for DIN connector pin assignments.

2. Connect the negative lead of the DVM to pin 2 of J15. This is the reference ground to adjust the two left and right push/pull amplifiers for 0 VDC at output.

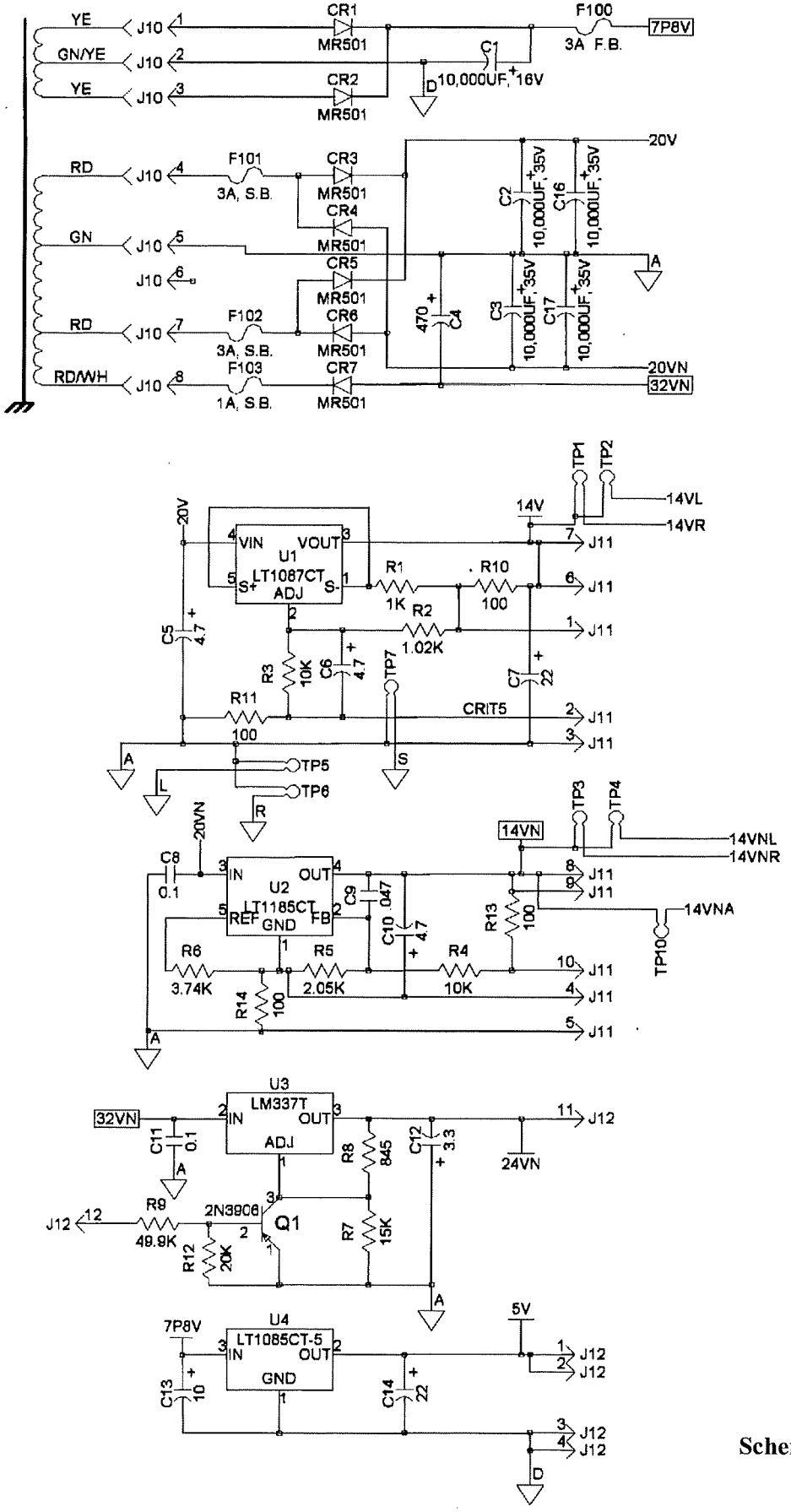
3. Connect the positive lead of the DVM to each of the following pins on the DIN jack and adjust the associated potentiometer to as close to 10 µV as possible.

DIN Pin #	Function	Potentiometer R#
J15 Pin 1	Left speaker high	R121
J15 Pin 4	Left speaker low	R124
J15 Pin 3	Right speaker high	R131
J15 Pin 5	Right speaker low	R134



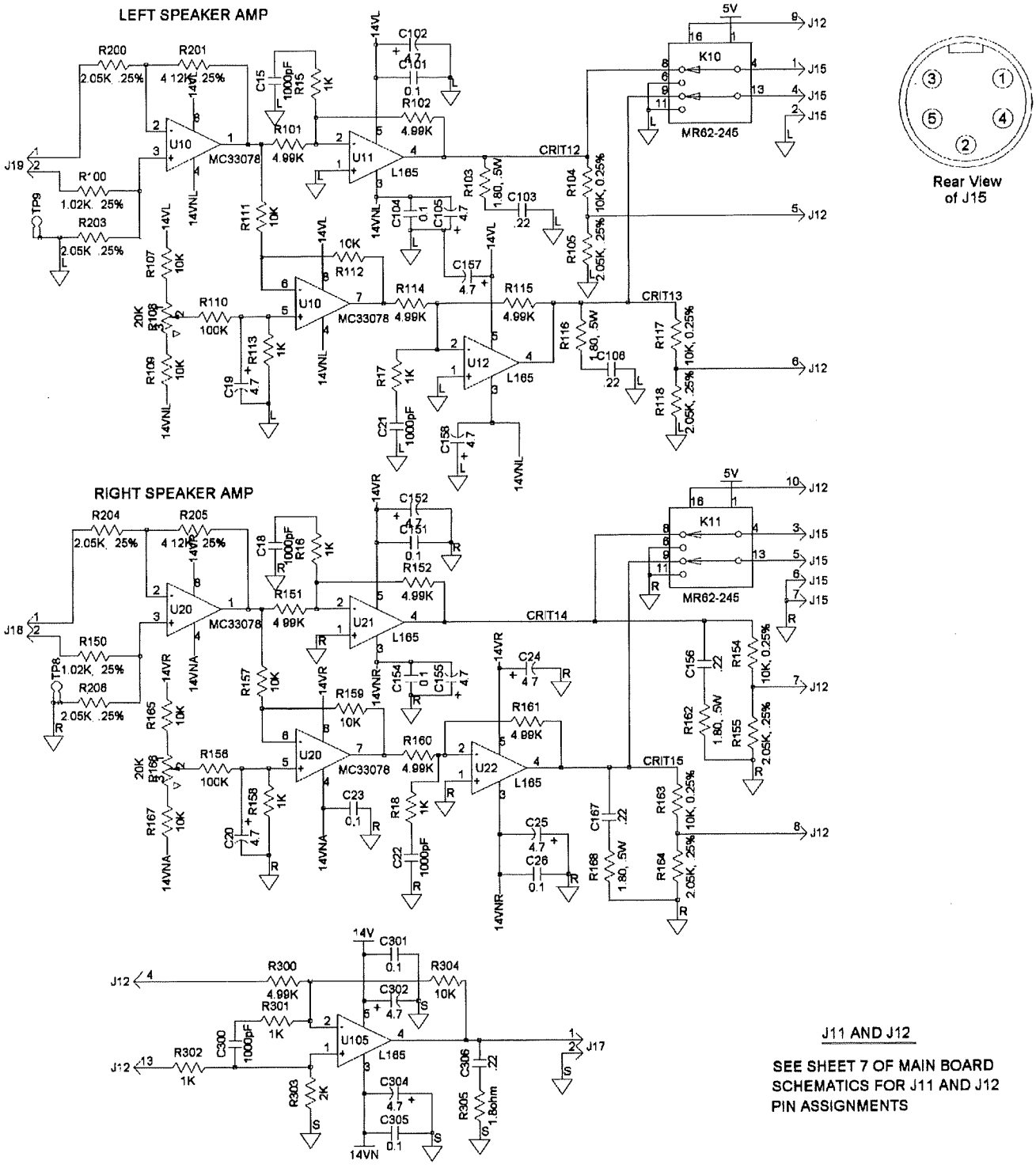
Rev 2 Board

Component Layout,
Power Supply Board
1761-4720 (3)
Sheet #1 of 1



Rev 2 Board

Schematic, Power Supply Board
1761-4720-SCH (2/2C)
Sheet # 1 of 2



Rev 2 Board

Schematic, Power Supply Board
1761-4720-SCH (2/2C)
Sheet # 2 of 2

Rev. 2 GSI 61 Power Supply Board Parts List: 1761-4720 (2/2C)

INTEGRATED CIRCUITS

Ref. Designation	Description	Part No.
U1	IC, REG ADJ. LT1087	5432-1187
U2	IC, REG NEG ADJ. LT1185	5432-1185
U3	REG, LM337, ADJ, 3 TERM	5433-0337
U4	IC, LT1085-5CT, +5 V REG	5432-1154
U10, U20	IC, MC33078 DUAL OP AMP	5432-1033
U11, U12, U21, U22, U105	IC, L165, PWR AMP, 18 V	5432-1089

TRANSISTORS

Ref. Designation	Description	Part No.
Q1	XSTR, 2N3906, PNP	8210-1112

DIODES

Ref. Designation	Description	Part No.
CR1, CR2, CR3, CR4, CR5, CR6, CR7	DIODE, MR501, 100 PIV	6081-1024

RESISTORS AND POTENTIOMETERS

Ref. Designation	Description	Part No.
R1, R15, R16, R17, R18, R113, R158, R301, R302	RES, FILM, 1.00K OHM, 1%, .25W	6350-1100
R2	RES, FILM, 1.02K OHM, 1%, .25W	6350-1102
R3, R4, R107, R109, R111, R112, R157, R159, R165, R167, R304	RES, FILM, 10.0K OHM, 1%, .25W	6350-2100
R5	RES, FILM, 2.05K OHM, 1%, .25W	6350-1205
R6	RES, FILM, 3.74K OHM, 1%, .25W	6350-1374
R7	RES, FILM, 15.0K OHM, 1%, .25W	6350-2150
R8	RES, FILM, 845 OHM, 1%, .25W	6350-0845
R9	RES, FILM, 49.9K OHM, 1%, .25W	6350-2499
R10, R11, R13, R14	RES, FILM, 100 OHM, 1%, .25W	6350-0100
R12	RES, FILM, 20.0K OHM, 1%, .25W	6350-2200
R100, R150	RES, FILM, 1.02 K OHM, .25%, .12W	6252-1102
R101, R102, R114, R115, R151, R152, R160, R161, R300	RES, FILM, 4.99K OHM, 1%, .25W	6350-1499
R103, R116, R162, R168, R305	RES, COMP, 1.8 OHM, 5%, .50W	6100-9185
R104, R117, R154, R163	RES, FILM, 10.0K OHM, .25%, .12W	6252-2100

R105, R118, R155, R164, R200, R203, R204, R206	RES, FILM, 2.05 K OHM, .25%, .12W	6252-1205
R108, R166	POT, COMP, 20K ±10%	6049-0190
R110, R156	RES, FILM, 100K OHM, 1%, .25W	6350-3100
R201, R205	RES, FILM, 4.12K OHM, .25%, .12W	6252-1412
R303	RES, FILM, 2.00K OHM, 1%, .25W	6350-1200

CAPACITORS

Ref. Designation	Description	Part No.
C1	CAP, ALUM, 10000 uF, +30 -10%, 16V	4384-0091
C2, C3, C16, C17	CAP, ALUM, 10000 uF, +30 -10%, 35V	4384-0090
C4	CAP, ELECT, 470 uF, +150 -20%	4450-6135
C5, C6, C10, C19, C20, C24, C25, C102, C105, C152, C155, C157, C158, C302, C304	CAP, TANT, 4.7 uF, 20%, 35V	4460-0027
C7	CAP, ELECT, 22 uF, 20%, 35V	4450-5612
C8, C11, C23, C26, C101, C104, C151, C154, C301, C305	CAP, CER, 0.1 uF, 20%, 50V	4400-2050
C9	CAP, CER, .047 uF, 20%, 50V	4400-2040
C12	CAP, ELECT, 3.3 uF, 10%, 35V	4450-4981
C13	CAP, ELECT, 10.0 uF, 20%, 20V	4450-5100
C14	CAP, ELECT, 22.0 uF, 20%, 15V	4450-5300
C15, C18, C21, C22, C300	CAP, CER, 1000 pF, 10%, 500V	4405-2108
C103, C106, C156, C167, C306	CAP, CER, .22 uF, 20%, 50V	4400-2052

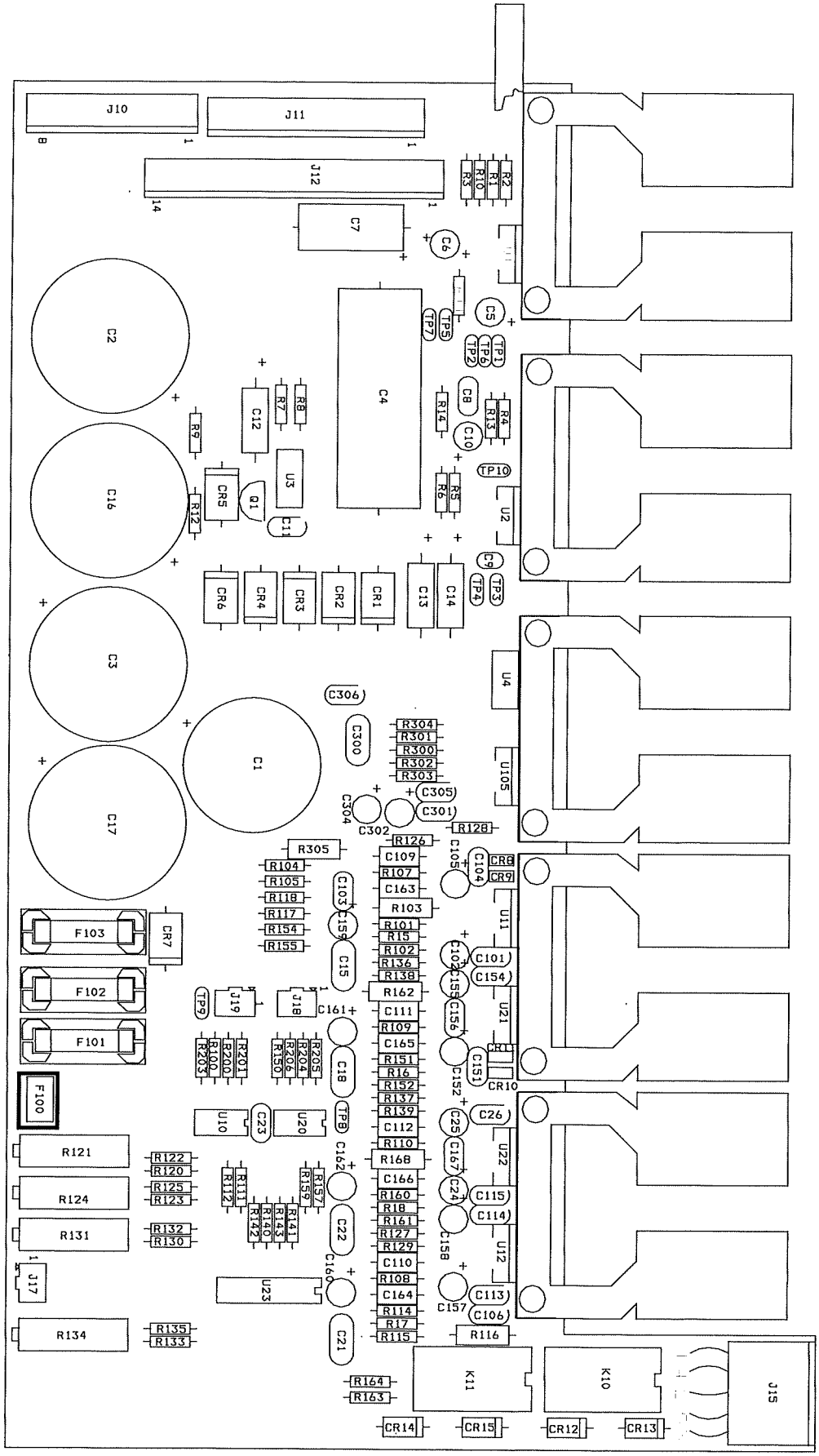
MISCELLANEOUS

Ref. Designation	Description	Part No.
	PRINTED CIRCUIT BOARD, POWER SUPPLY	1761-0720
	BRACKET, HEATSINK SUPPORT	1761-7025
HS1, HS2, HS3, HS4, HS5	HEATSINK, POWER SUPPLY	1761-8030
J10	POST HEADER ASSY, 8 PIN	4230-3203
J11	HEADER POST N-LOCK, GOLD,10 PIN	4230-6510
J12	HEADER POST N-LOCK, GOLD 14 PIN	4230-6514
J15	CONN, 5 PIN DIN, FEMALE	4220-3090
J17, J18, J19	HEADER, SHROUDED 1 ROW 2 PIN	4230-2202
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10	JUMPER, TEST POINT, .020 DIA	5080-0001
F100	FUSE, RADIAL LEAD, SQ., 3A	5330-6030
F101, F102	FUSE, 3.15A SLO-BLO, 20mm LG	5330-1104
F103	FUSE, 1.0A, SLO-BLO, 20mm LG	5330-1102

MISCELLANEOUS - continued

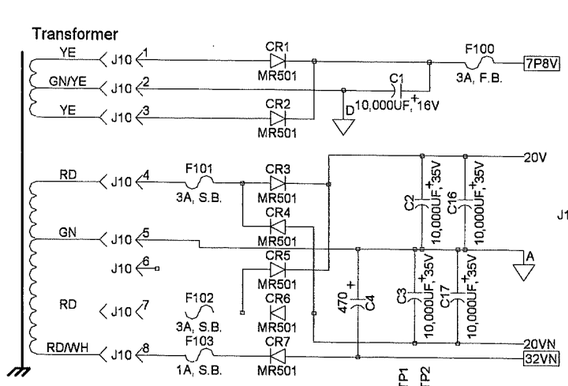
Ref. Designation	Description	Part No.
K10, K11	RELAY, DPDT, 5V	6090-1540
	SCREW, LOCKING, 6-32 x .375	7044-0037
	SCREW, LOCKING, 6-32 x .500	7044-0038
	SCREW, LOCKING, 4-40 x .250	7044-0042
	SCREW, PAN HD, .112-4 x .250	7044-1102
	INSULATOR, TEFLON	8150-3501
	BUSHING, SHOULDER, INSULATION	4104-0007
	FUSE CLIP, .28H, TIN PLATED, BRASS	5650-0200

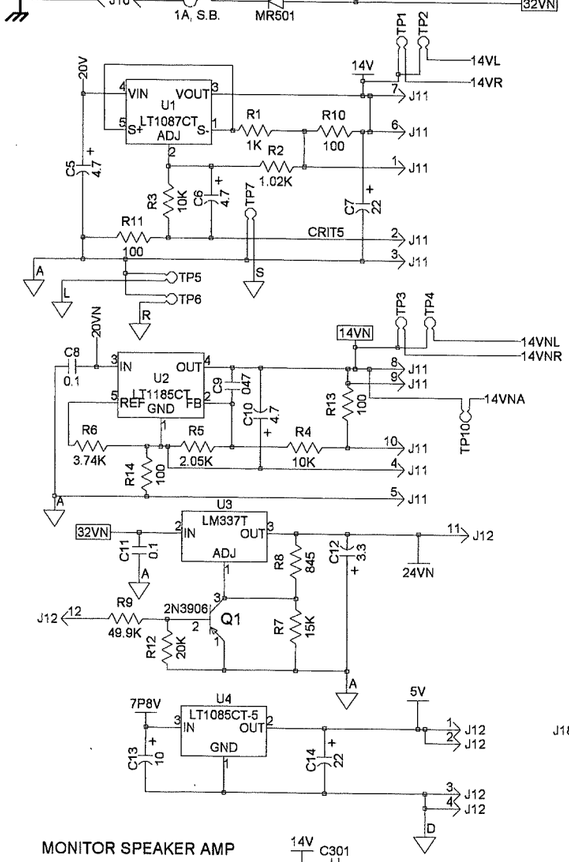
The Rev 4 Board Assembly, Schematic, and Parts List start on the following page.

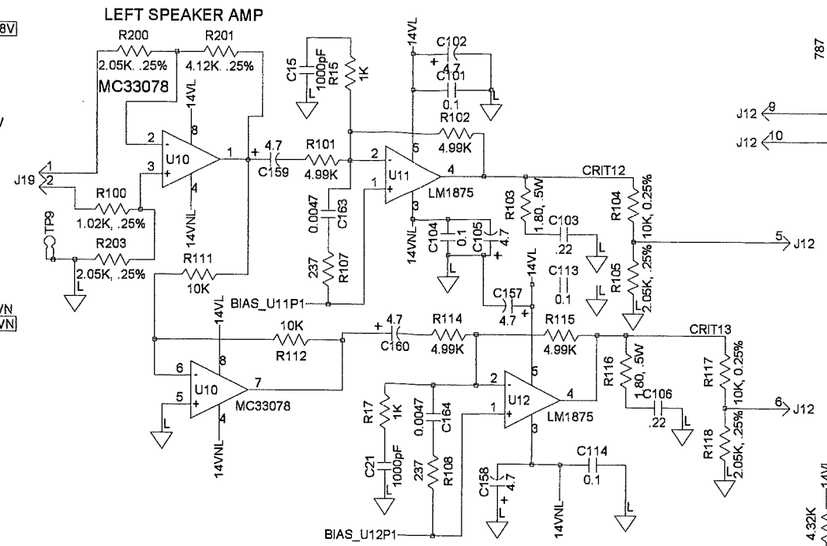


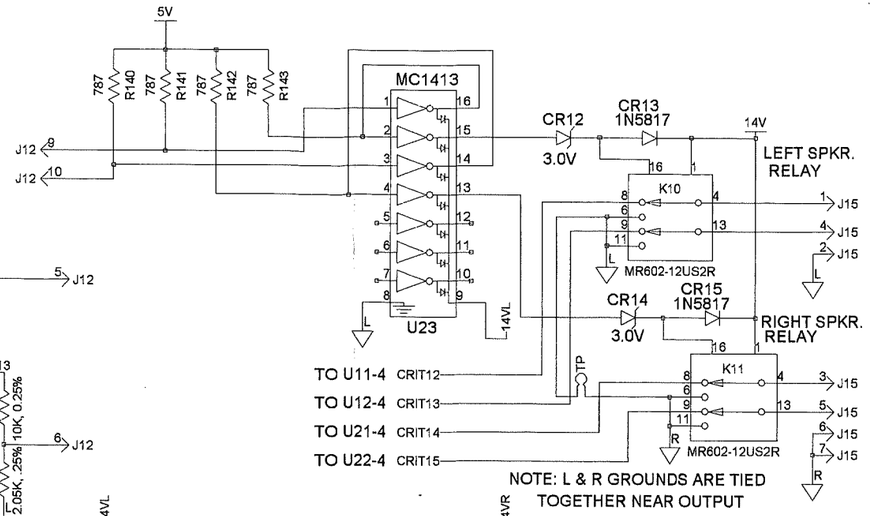
Rev 4 Board

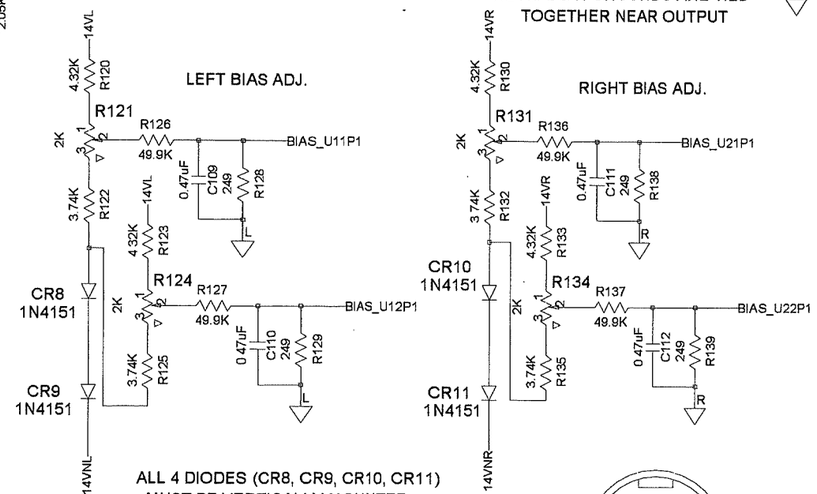
Component Layout,
Power Supply Board
1761-4720 (5)
Sheet #1 of 1

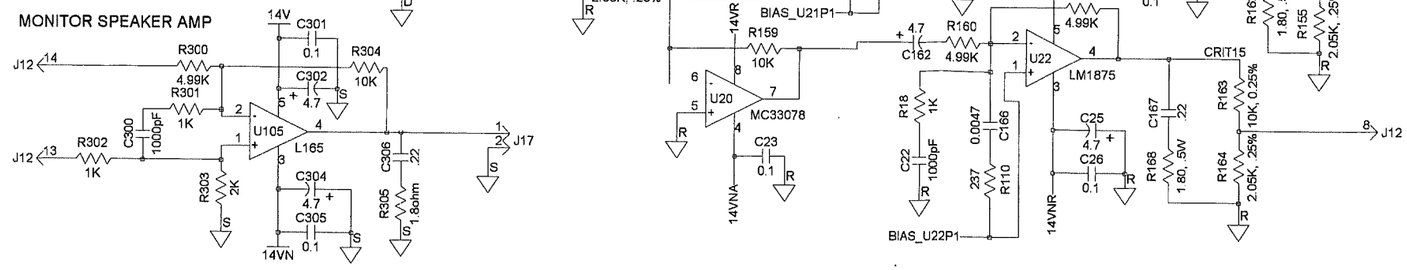


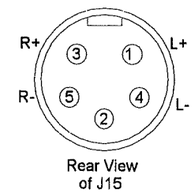












Schematic,
1761-4720-SCH
REV 4
Sheet 1 of 1

Rev. 4 GSI 61 Power Supply Board Parts List: 1761-4720 (5)

INTEGRATED CIRCUITS

Ref. Designation	Description	Part No.
U1	IC, REG ADJ. LT1087	5432-1187
U2	IC, REG NEG ADJ LT1185	5432-1185
U3	REG, LM337, ADJ, 3 TERM	5433-0337
U4	IC, LT1085-5CT, +5 V REG	5432-1154
U10, U20	IC, MC33078 DUAL OP AMP	5432-1033
U11, U12, U21, U22	IC, LM1875T, POWER AMP	5432-2200
U23	IC, MC1413, DRIVER ARRAY	5431-9683
U105	IC, L165, PWR AMP, 18 V	5432-1089

TRANSISTORS

Ref. Designation	Description	Part No.
Q1	XSTR, 2N3906, PNP	8210-1112

DIODES

Ref. Designation	Description	Part No.
CR1 — CR7	DIODE, MR501, 100 PIV	6081-1024
CR8 — CR11	DIODE, 1N4151, 75V, 50mA	6082-1001
CR12, CR14	DIODE, ZENER, 3.3V, 5%, 20mA	6083-1086
CR13, CR15	DIODE, 1N5817, 60V	6084-1017

RESISTORS & POTENTIOMETERS

Ref. Designation	Description	Part No.
R1, R15 — R18, R301, R302	RES, FILM, 1.00K OHM, 1%, .25W	6350-1100
R2	RES, FILM, 1.02K OHM, 1%, .25W	6350-1102
R3, R4, R111, R112, R157, R159, R304	RES, FILM, 10.0K OHM, 1%, .25W	6350-2100
R5	RES, FILM, 2.05K OHM, 1%, .25W	6350-1205
R6, R122, R125, R132, R135	RES, FILM, 3.74K OHM, 1%, .25W	6350-1374
R7	RES, FILM, 15.0K OHM, 1%, .25W	6350-2150
R8	RES, FILM, 845 OHM, 1%, .25W	6350-0845
R9, R126, R127, R136, R137	RES, FILM, 49.9K OHM, 1%, .25W	6350-2499
R10, R11, R13, R14	RES, FILM, 100 OHM, 1%, .25W	6350-0100
R12	RES, FILM, 20.0K OHM, 1%, .25W	6350-2200
R100, R150	RES, FILM, 1.02K OHM, .25%, .12W	6252-1102
R101, R102, R114, R115, R151, R152, R160, R161, R300	RES, FILM, 4.99K OHM, 1%, .25W	6350-1499
R103, R116, R162, R168, R305	RES, COMP, 1.8 OHM, 5%, .50W	6100-9185
R104, R117, R154, R163	RES, FILM, 10.0K OHM, .25%, .12W	6252-2100
R105, R118, R155, R164, R200, R203, R204, R206	RES, FILM, 2.05K OHM, .25%, .12W	6252-1205
R107 — R110	RES, FILM, 237 OHM, 1%, .25W	6350-0237

Ref. Designation	Description	Part No.
R120, R123, R130, R133	RES, FILM, 4.32K OHM, 1%, .25W	6350-1432
R121, R124, R131, R134	POT, COMP, 2.0K OHM, ±10%	6049-0187
R128, R129, R138, R139	RES, FILM, 249 OHM, 1%, .25W	6350-0249
R140 — R143	RES, FILM, 787 OHM, 1%, .25W	6350-0787
R201, R205	RES, FILM, 4.12K OHM, .25%, .12W	6252-1412
R303	RES, FILM, 2.00K OHM, 1%, .25W	6350-1200

CAPACITORS

Ref. Designation	Description	Part No.
C1	CAP, ALUM, 10,000 µF, +30 -10%, 16V	4384-0091
C2, C3, C16, C17	CAP, ALUM, 10,000 µF, +30 -10%, 35V	4384-0090
C4	CAP, ELECT, 470 µF, +150 -20%	4450-6135
C5, C6, C10, C24, C25, C102, C105, C152, C155, C157—C162, C302, C304	CAP, TANT, 4.7 µF, 20%, 35V	4460-0027
C7	CAP, ELECT, 22 µF, 20%, 35V	4450-5612
C8, C11, C23, C26, C101, C104, C113—C115, C151, C154, C301, C305	CAP, CER, 0.1 µF, 20%, 50V	4400-2050
C9	CAP, CER, .047 µF, 20%, 50V	4400-2040
C12	CAP, ELECT, 3.3 µF, 10%, 35V	4450-4981
C13	CAP, ELECT, 10.0 µF, 20%, 20V	4450-5100
C14	CAP, ELECT, 22.0 µF, 20%, 15V	4450-5300
C15, C18, C21, C22, C300	CAP, CER, 1000 pF, 10%, 500V	4405-2108
C103, C106, C156, C167, C306	CAP, CER, .22 µF, 20%, 50V	4400-2052
C109, C110—C112	CAP, CER, .47 µF, +80% -20%, 50V	4400-3001
C163—C166	CAP, CER, .0047 µF, 5%, 50V	4400-3010

SWITCHES AND RELAYS

Ref. Designation	Description	Part No.
K10, K11	RELAY, DPDT, 12V, MBB	6090-1010

FUSES

Ref. Designation	Description	Part No.
F100	FUSE, RADIAL LEAD, SQ., 3A	5330-6030
F101, F102	FUSE, 3.15A SLO-BLO, 20mm LG.	5330-1104
F103	FUSE, 1.0A SLO-BLO, 20mm LG.	5330-1102

MISCELLANEOUS

Ref. Designation	Description	Part No.
XF100	FUSE HOLDER	5650-6000
XF101—XF103	FUSE CLIP, .28H, TIN PLATED, BRASS	5650-0200
HS1—HS5	HEATSINK, POWER SUPPLY	1761-8030
XHS1—XHS5	BRACKET, HEATSINK SUPPORT	1761-7025
XHS1—XHS5	SCREW, LOCKING, 6-32 x .375	7044-0037
XHS1—XHS5	SCREW, LOCKING, 6-32 x .500	7044-0038

Ref. Designation	Description	Part No.
XHS1—XHS5	SCREW, LOCKING, 4-40 x .250	7044-0042
J10	POST HEADER ASSY, 8 PIN	4230-3203
J11	HEADER POST-N-LOCK, GOLD, 10 PIN	4230-6510
J12	HEADER POST-N-LOCK, GOLD, 14 PIN	4230-6514
J15	CONN, 5 PIN DIN, FEMALE	4220-3090
J17—J19	HEADER, SHROUDED, 1 ROW, 2 PIN	4230-2202
TP1—TP10	JUMPER, TEST POINT, .020" DIA	5080-0001
XU105	INSULATOR, TEFLON	8150-3501
XU105	BUSHING, SHOULDER, INSULATION	4104-0007
XU105	SCREW, PAN-HD, .112-4 x .250	7044-1102

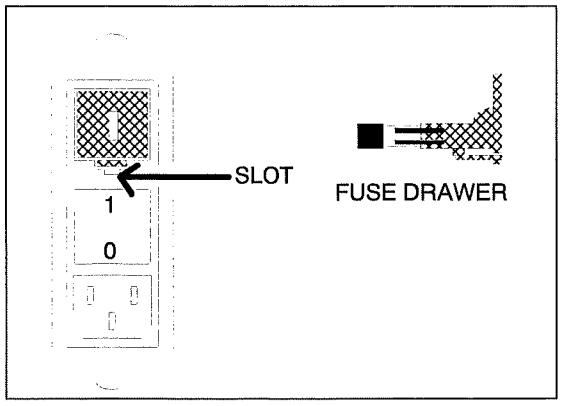
AC Power Supply

10

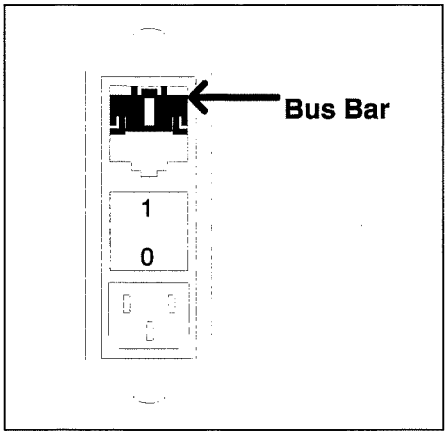
The GSI 61 can be converted to four (4) different VACs: 100, 120, 220 and 240 by reconfiguring the Power Entry Module. The Module is located on the left side of the instrument.

To reconfigure the Power Entry Module:

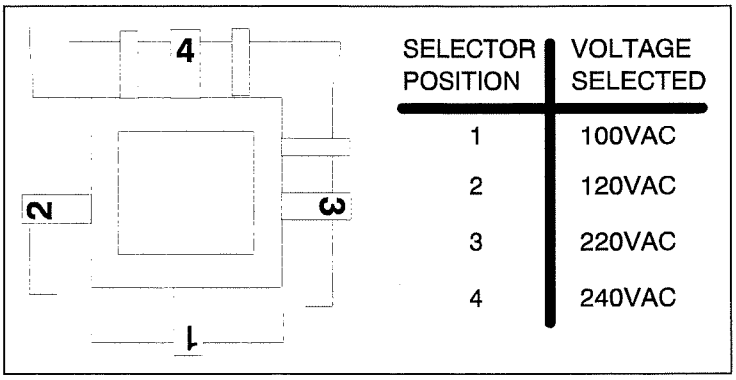
1. Insert a flat-tip screwdriver tip into the slot and gently pry it toward the front of the GSI 61.
2. Remove the fuse drawer.



3. With needle nose pliers, grasp the metal Bus Bar on the voltage selector and pull until the selector comes free.
4. Slide the selector completely out of the switch housing.

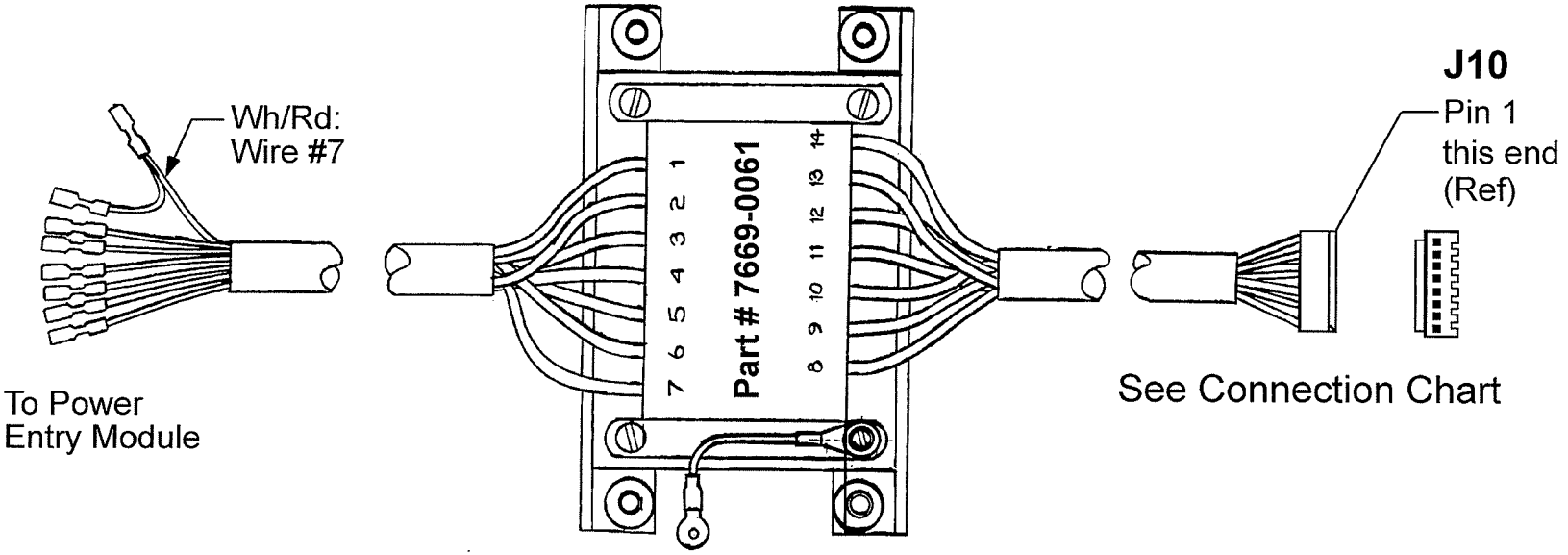


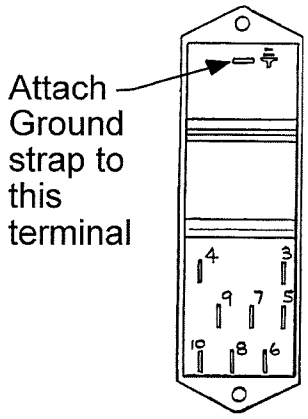
5. Using the following table, select the desired voltage and hold the voltage selector by the corresponding number between your thumb and forefinger. Slide the selector into the housing, pressing firmly until it locks into place.
6. Slide Fuse Drawer into housing until you hear a click.



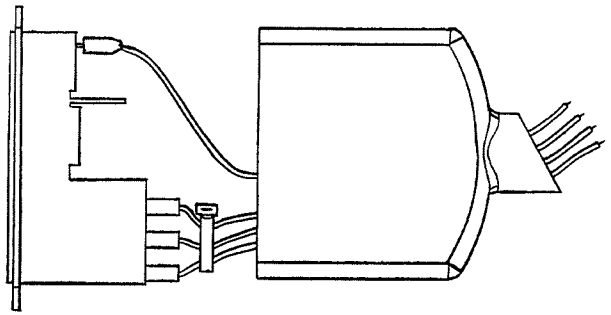
SELECTOR POSITION	VOLTAGE SELECTED
1	100VAC
2	120VAC
3	220VAC
4	240VAC

1761-2000SVC Mains Transformer Asm (4)





Power Entry Module



Power Entry Module consists of:

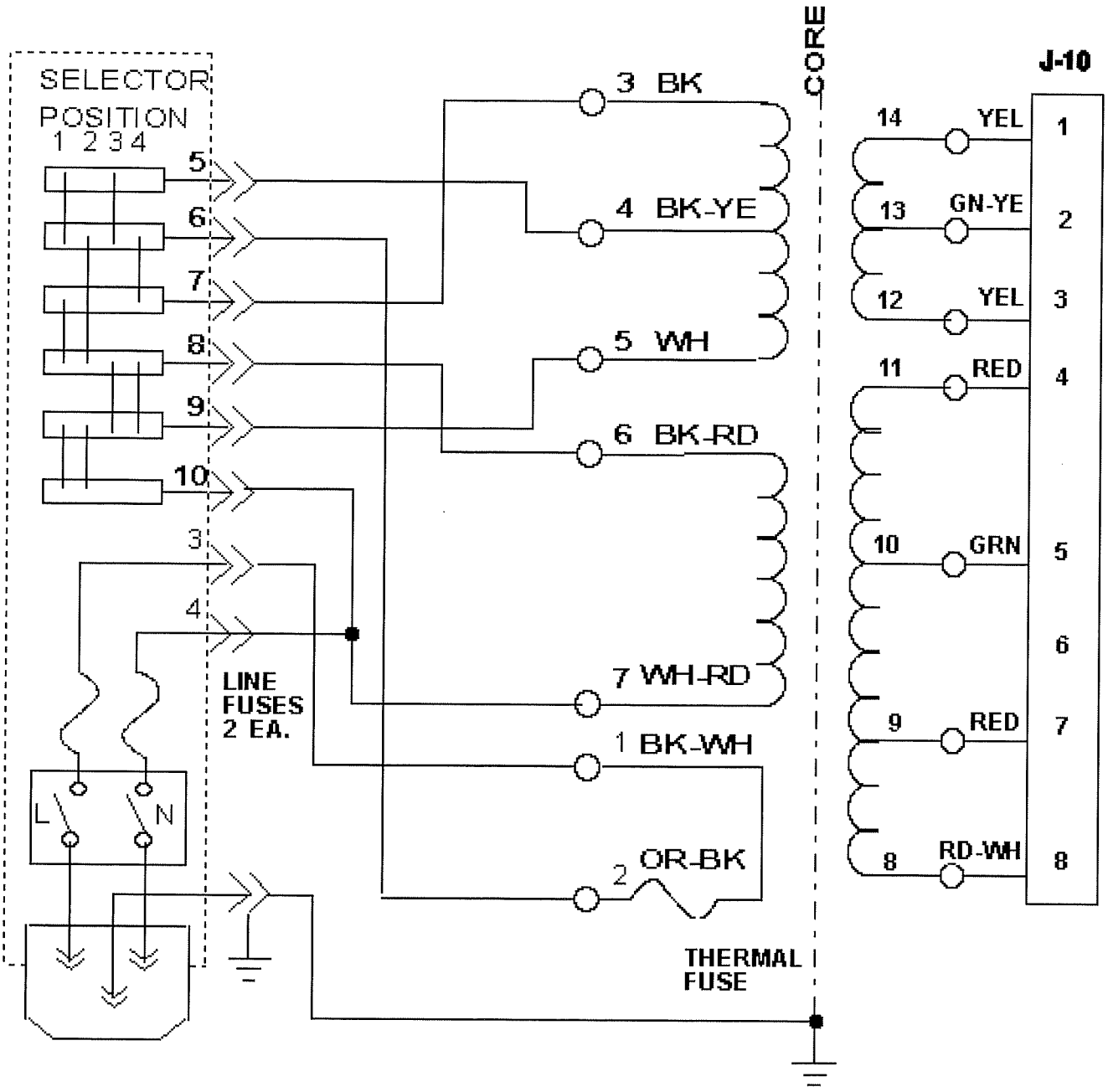
4230-8035 Module Case & Switch
4230-8036 Voltage Selector
4230-8037 Fuse Holder

Power Entry Module Wiring

POWER MODULE ENTRY WIRING								
TRANSFORMER WIRE #	1	4	2	3	6	5	ATTCHD 7	7
COLOR	BK-WH	BK-YE	OR-BK	BK	BK-RD	WH	WH	WH-RD
MODULE TERMINAL #	3	5	6	7	8	9	10	4

CONNECTION CHART	
TRANSFORMER	J10
*14 YEL	1
13 GN/YEL	2
*12 YEL	3
*11 RD	4
10 GN	5
----	6 (N/C)
*9 RD	7
8 RD/WH	8
* = Interchangeable with same color (RD-RD, YE-YE)	

GSI 61 Line Switch to Transformer Primary Schematic



SELECTOR POSITION	VOLTAGE SELECTED	LINE FUSE RATING	GSI PART NUMBER
1	100 VAC	1.25 A SLO-BLO	5330-1110
2	120 VAC	1.0 A SLO-BLO	5330-1102
3	220 VAC	0.63 A SLO-BLO	5330-1100
4	240 VAC	0.63 A SLO-BLO	5330-1100

Liquid Crystal Display: 1761-0496SVC

11

Theory of Operation: LCD

An LCD (Liquid Crystal Display) is utilized on the GSI 61, chosen for its low power consumption and compact size. This LCD is modular and so there is no troubleshooting involved in the field; it is simply replaced as a unit when diagnosed as a failure.

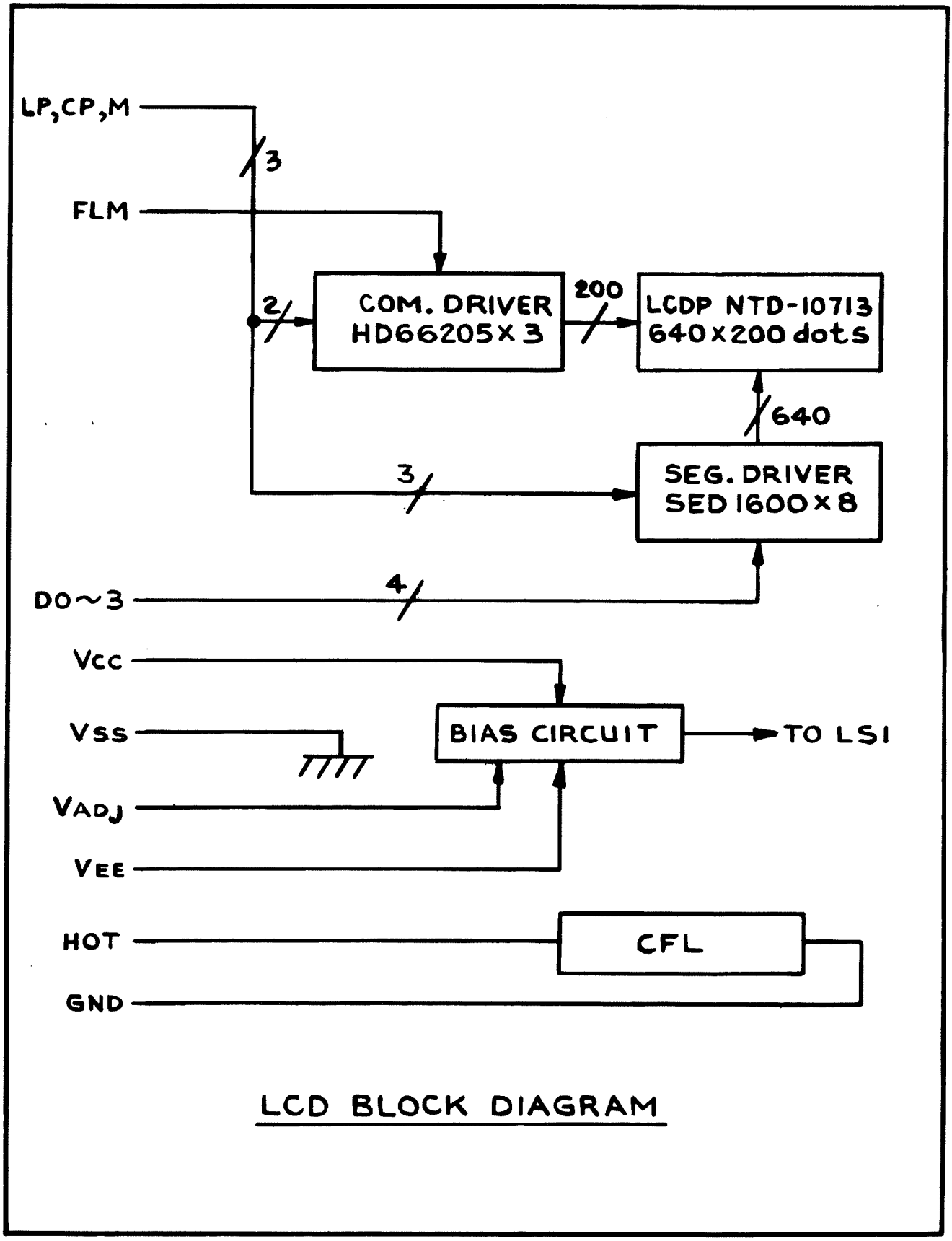
LCDs are a passive display technology which means they do not emit light. This one is transmissive and in order to see the screen, there must be a light source that will reflect light to the eye. This light source is called backlighting. On this particular LCD a Cold Cathode Fluorescent Lamp (CFL) is utilized as the backlighting source. This lamp is the only replaceable component on the LCD module. A defective lamp causes the LCD to be dark. To determine whether the lamp alone or the entire LCD is defective, turn the contrast control to maximum and look closely; if characters can be read, this indicates that the LCD is working properly and only the lamp is defective.

Theory of Operation: Inverter Board

The Cold Cathode Fourescent Lamp (CFL) requires 600 VAC to illuminate. A DC to AC inverter provides for this voltage. This device is located in the LCD housing to the right of the LCD when looking into the back of the housing. There are no serviceable parts on this module; if it is defective replace the entire module and return the old one to factory.

Caution!

BE SURE NOT TO TOUCH THIS MODULE; 600 VAC IS PRESENT THROUGHOUT THE BOARD.



LCD BLOCK DIAGRAM

Liquid Crystal Display: 1761-0496SVC

11

Theory of Operation: LCD

An LCD (Liquid Crystal Display) is utilized on the GSI 61, chosen for its low power consumption and compact size. This LCD is modular and so there is no troubleshooting involved in the field; it is simply replaced as a unit when diagnosed as a failure.

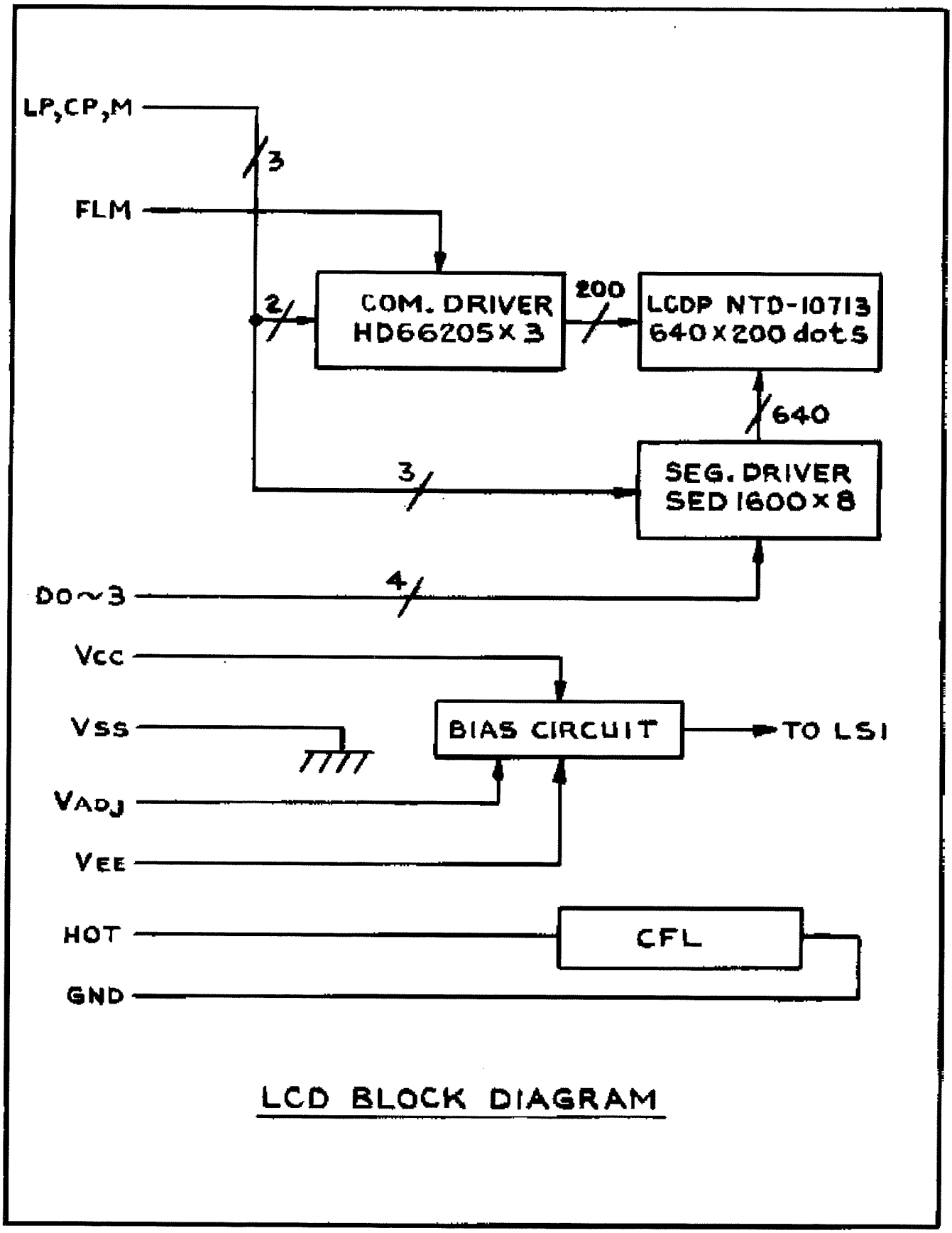
LCDs are a passive display technology which means they do not emit light. This one is transmissive and in order to see the screen, there must be a light source that will reflect light to the eye. This light source is called backlighting. On this particular LCD a Cold Cathode Fluorescent Lamp (CFL) is utilized as the backlighting source. This lamp is the only replaceable component on the LCD module. A defective lamp causes the LCD to be dark. To determine whether the lamp alone or the entire LCD is defective, turn the contrast control to maximum and look closely; if characters can be read, this indicates that the LCD is working properly and only the lamp is defective.

Theory of Operation: Inverter Board

The Cold Cathode Fourescent Lamp (CFL) requires 600 VAC to illuminate. A DC to AC inverter provides for this voltage. This device is located in the LCD housing to the right of the LCD when looking into the back of the housing. There are no serviceable parts on this module; if it is defective replace the entire module and return the old one to factory.

Caution!

BE SURE NOT TO TOUCH THIS MODULE; 600 VAC IS PRESENT THROUGHOUT THE BOARD.



LCD BLOCK DIAGRAM

Remote Board: 1761-4725 Rev 2

Uses a Serial/Parallel Conversion Box*

*See page 12-3.

12

Theory of Operation

Introduction

The RS232 Serial Interface provides optical isolation (2500 V) between the TTL-level serial and control signals from the GSI 61 and RS232 compatible interface via two standard PC DB-9 connectors. One connector, a PC DB9P is used for remote communications to and from a PC using RS232 standards. The other connector, a PC DB9S also uses RS232 standard signals to communicate with a serial to parallel box which converts the serial communications to standard Centronics parallel, capable of driving most printers. The serial remote channel is capable of speeds up to 19.2K baud, while the serial to parallel channel communicates with the serial to parallel box at a speed of up to 57.6K baud but with a lower throughput due to time lost with hand-shaking.

Remote interface data flow control is provided with Clear-to-Send (CTS) and Request-to-Send (RTS) signals. The Xon and Xoff software flow control protocol is supported as a software function.

Standard 9 pin male to 9 pin female or 9 pin male to 25 pin female PC serial cables can be used to connect to a PC's serial port. The parallel to serial box may be plugged directly into the printer and a standard 9 pin female to 25 pin male PC cable may be used to connect to the parallel to serial box. In addition to the Remote-Printer interface card and cable, a special communications program must be used on the PC to talk to the GSI 61. See your GSI representative for information about these programs.

Technical Overview

The only operator control is S2, a four-position DIP switch located next to J3, the printer output connector. It is accessible by the user from the outside of the GSI 61, allowing selection of various audiogram formats. Table 1 lists the control settings of this switch.

The remote baud rate, character length and parity settings are controlled by S1, an 8-position DIP switch. This switch is considered a service adjustment, and accessible only when the GSI 61 case is opened. Table 2 lists the control settings of this switch.

Both S1 and S2 are read directly by the GSI 61. Additionally, both S1 and S2 switches are on the non-isolated, patient side of the GSI 61 interface.

Data is transmitted from a UART inside the GSI 61 at TTL levels to the Remote Interface card where it is sent across optical isolators and is routed to the printer interface (the serial / parallel box) or out the serial interface as controlled by the GSI 61. Data to be sent to the parallel printer is transferred at the data rate selected by S2 and must be matched to the data rate selected by the dip switches on the parallel/ serial box.

Transmission speeds may be selected as high as 57.6K baud although the length of the cable should be considered. Remote data is transferred at the data rate selected by S1.

Remote Connector and Printer Connector

The remote connector J2 (female connector) is set up as a DCE (Data Communications Equipment) device; transmitted data goes out the RX line, and received data comes in the TX line. This is so that a one to one straight-through cable can be used to connect to a remote computer that has a 9 pin serial output. A 9 pin male to 25 pin female connector would be used for a computer that has a 25 pin serial output. A null modem cable should not be used to make this connection.

The printer connector J3 (male connector) is set up as a DTE (Data Terminal Equipment) device; transmitted data goes out the TX line the same as a computer. This is so that a typical 9 pin female to 25 pin male cable can be used to connect this port to the serial / parallel box. This cable is the same as that used to connect a modem to a computer.

Printer Interface and Control

The printer interface is a serial port, which requires parallel printers to use a GSI-provided serial-parallel converter device. The serial interface is a printer compatible RS-232 interface. The printer port J3 is configured as a DTE device and would normally connect to a serial printer or a Serial/Parallel Converter configured as a DCE device. Hardware handshaking (RTS / CTS) is provided to control the flow of data.

The configuration of the GSI 61 Printer Interface must be set to match the interface configuration of the external printer or serial/parallel converter device. A set of 4 dip switches, S3, is provided on the serial interface board to configure the interface for baud rate. These switches are read on power up and the hardware initialized appropriately. The configuration is selected as follows:

Baud Rate:

S3-2	S3-1	Selection
OFF	OFF	57600 Baud
OFF	ON	19200
ON	OFF	9600
ON	ON	Invalid Selection
S3-3	Not Used	
S3-4	Not Used	

The remaining serial interface configuration is set to the following:

Data Bits:	8
Parity:	No parity
Stop Bits:	1
Data Flow Control:	Hardware flow control (RTS/CTS)

Note: The factory setting is 57600 baud.

The switch settings of S3 must match those of the Serial/Parallel converter box. The configuration of the Converter box switches is as follows:

Dip Switch Bank on side of the Converter box:

	Flow Control		Baud Rate		Parity		# bits		Not Used	
Switch Number	1	2	3	4	5	6	7	8	9	10
Switch Setting	ON	OFF	OFF	ON	ON	ON	OFF	OFF	ON	OFF

Set the DCE/DTE switch on the side of the Converter Box to the DCE position.

Remote Serial Interface

Data from the GSI 61 UART is sent to the remote interface when the RS232MUX signal is a logic "low". In this mode, the transistor is turned OFF which causes the relays to be de-energized, routing the hardware flow control signals CTS and RTS, as well as the data RX and TX serial signals to the remote connector. All four of these lines are optically isolated prior to the relays routing them to the remote connector.

The serial interface is nothing more than a transparent interface between the GSI 61 and the Remote Interface and Printer. If the output device is serial, then serial data bits going in either direction are simply switched to their destination connecting the GSI 61 UART to the remote serial interface. If the output device is parallel, serial data from the GSI 61 is converted (by the serial/parallel box) into an equivalent parallel data format for the printer.

*** Notice of Obsolescence!**

GSI can no longer supply the **serial to parallel converter box** for units that have the optional RS-232 / Printer interface **and** are below serial number A0550. The part number of the kit (1761-9612) should be obsoleted from your sales and service records.

For those end users who already have the RS-232 / Printer interface and converter box in units below serial number A0550, if their converter box stops functioning and cannot be repaired, they must upgrade to the current revision Remote Board.

The RS-232 / Printer interface board is part number 1761-9680 and it will be required for those serial numbers below A0550.

To summarize:

GSI 61, serial number **A0550 or lower,** with **previously** installed RS-232 / Printer interface will require a **new** 1761-9680 RS-232 / Printer interface PCB to enable printer function, if either the board or the converter box becomes unrepairable.

Detailed Circuit Description

Refer to the schematic diagram, which appears near the end of this section.
Connector J1 provides the GSI 61 interface connections. A 20-pin PCB header, this connector carries serial send-and-receive data and flow control signals from the GSI 61 UART, +5 volt power, ground, data from switches S1 and S2, and RS232MUX, the signal that switches between the Remote and Printer interfaces. This option card draws about 50 mA of five volt logic power from the GSI 61.

Signal Paths

Transmitted data (TX) is sent from J1 pin 5 to U3 pin 4. U3 drives the optical isolator U5, a 6N136. The output of U5, now isolated from the GSI 61, is presented to U4 pin 3 which converts the signal to RS232 level signals and sends it through K1 to either the remote connector (DCE) on the RX line (J2 pin 2) or to the printer connector (DTE) on the TX line (J3 pin 3).

Data received from the Remote Interface arrives via J2 pin 3, the Remote Interface connector, and is passed through relay K1 on its way to U4 pin 10. U4 converts the RS232 levels to levels appropriate to drive the opto-isolator U7. The now isolated signal is presented to U3 pin 10. U3 converts the level to TTL levels and sends the signal to the GSI 61's UART via J1 pin 3 (labeled RX).

Isolated Power Supply

A matched set of IC's, Maxim Max250 and Max251, generates the isolated power. The Max 250 provides the square wave to transformer T1. This is coupled to the isolated side and rectified by D1 to produce a half wave rectified negative supply; a diode inside the Max 251 provides a half wave rectified positive supply. Capacitors C7 and C6 provide the filter for these rectified isolated power supplies. Internal to the Max 251 is a zener which clamps the voltage at pin 7 to 8 volts typical and 10 volts max.

Troubleshooting Suggestions

Most installation problems end up being connector or cable-related. We suggest that those doing new installations carefully check:

1. The GSI 61 input cable.
   Measure +5volts at the center-tap of transformer T1 and any convenient GSI 61 ground. If you find +5volts there, chances are good the input connector from the GSI 61 is connected correctly.

2. Next, check for the isolated DC power availability.
   Measure U4 pins 13 for negative voltage (approx. -10v) and U4 pin 2 for positive voltage (approx. +10v).

Table 1 - Printer Output Form Selections

Printer output forms are selected by switch S2, a four-switch DIP switch located next to the printer output jack. A switch position is "ON" when the switch toggle is in the UP position. See the GSI 61 User Manual for further information.

S2 Switch Position

1	ON - Overlaid Left & Right Audiograms OFF - Separate Left & Right Audiograms
2	ON - Black & White printing OFF - Color Printing
3	Not Used
4	Not Used

Table 2 - Remote Serial Interface Characteristics

This table lists the control settings for serial baud rate, word length and parity of the Remote Serial Interface provided by DIP switch S1.

These switches are read on power up and the hardware initialized appropriately.

The configuration is selected as follows: OFF = Logical 1 ON = Logical 0

Dip Switch	**Function**
S1-1	Baud Rate Bit 0
S1-2	Baud Rate Bit 1
S1-3	Baud Rate Bit 2

S1-3	S1-2	S1-1	Baud Rate Selection
ON	ON	ON	Invalid Selection
ON	ON	OFF	Invalid Selection
ON	OFF	ON	19.2 K
ON	OFF	OFF	600 (GSI 16 Compatible)
OFF	ON	ON	1200 (GSI 16 Compatible)
OFF	ON	OFF	2400 (GSI 16 Compatible)
OFF	OFF	ON	4800 (GSI 16 Compatible)
OFF	OFF	OFF	9600 (GSI 16 Compatible)

Dip Switch	Function
S1-4	Parity/Data Bits Bit 0
S1-5	Parity/Data Bits Bit 1

S1-5	S1-4	Parity Selection
ON	ON	Space Parity / 7 Data Bits
ON	OFF	Even Parity / 7 Data Bits (GSI 16 Compatible)
OFF	ON	Odd Parity / 7 Data Bits
OFF	OFF	No Parity / 8 Data Bits

Dip Switch	Function	OFF	ON
S1-6	Data Flow Control	Hardware Flow Control (GSI 16 Compatible)	Software Flow Control
S1-7	Stop Bits	1 Stop Bit	2 Stop Bits (GSI 16 Compatible)
S1-8	Not Used		

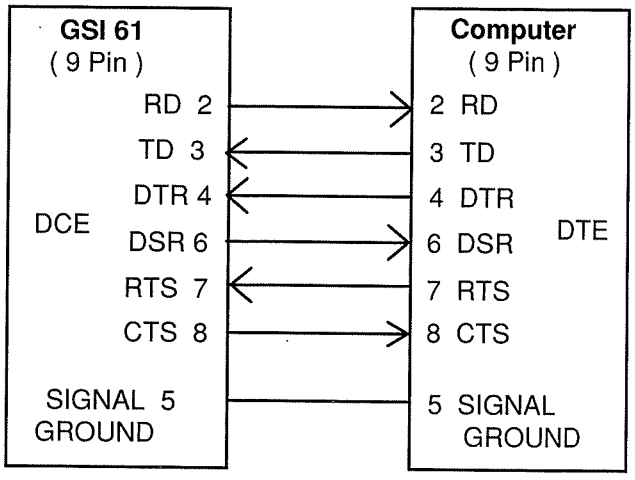
The factory setting is 9600 baud, no parity, 8 data bits, 1 stop bit and hardware flow control.

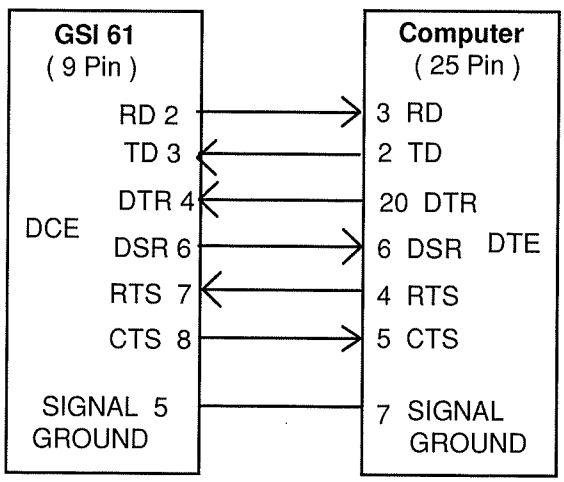
Cable Connections

The GSI 61 Remote interface provides a serial interface consisting of RxD (Received Data), TxD (Transmitted Data), RTS (Request To Send), CTS (Clear To Send) and ground signals at the end of the supplied DB-9 female connector (DCE).

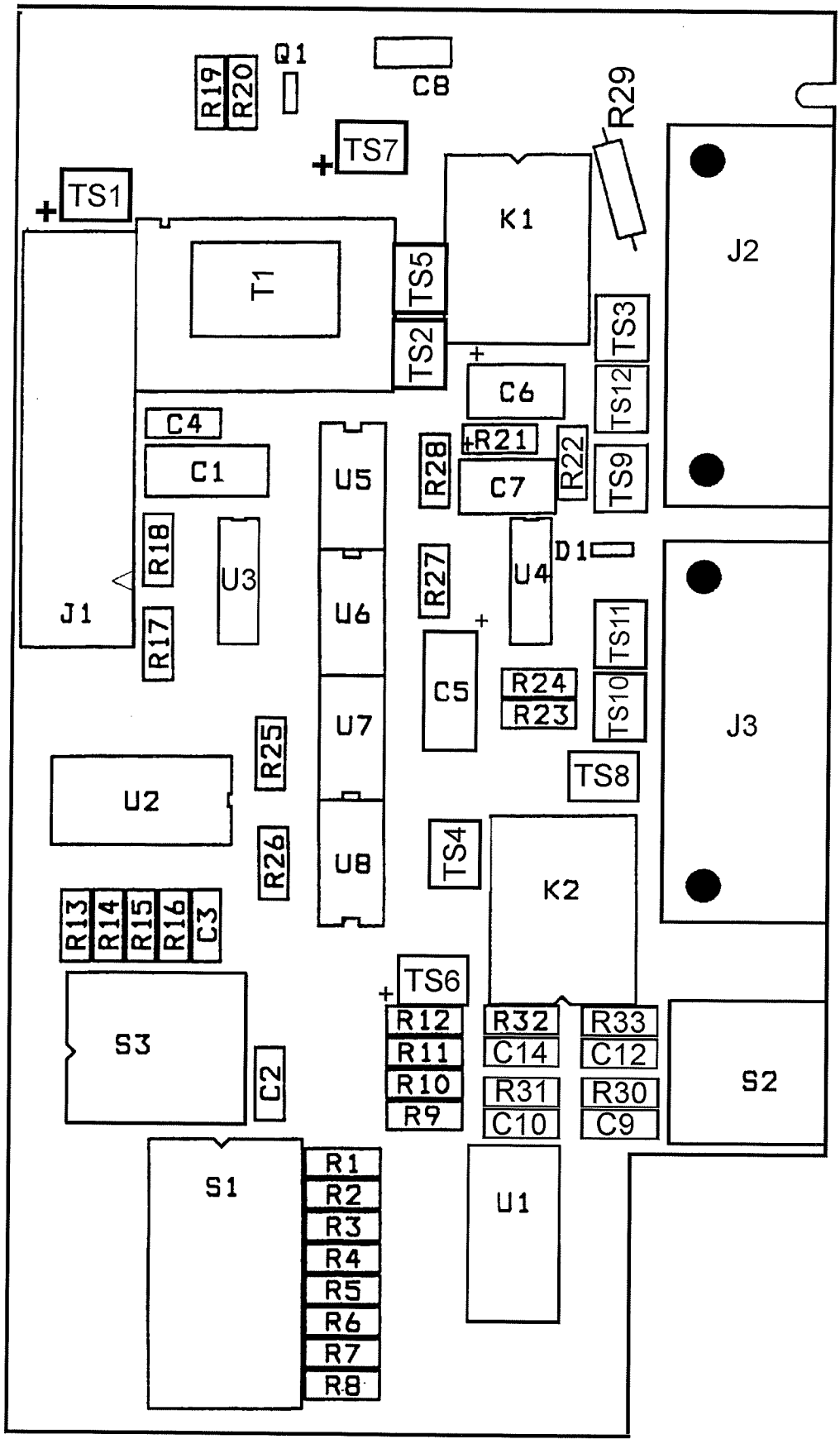
A straight-through cable can be used to connect to a 9-pin serial output of most IBM-compatible computers. A standard 9 pin to 25 pin cable adapter can be used to connect to nearly any 25-pin serial output of most IBM-compatible computers.

Note: Internal to the GSI 61, the DSR line is tied true, and DTR is ignored.

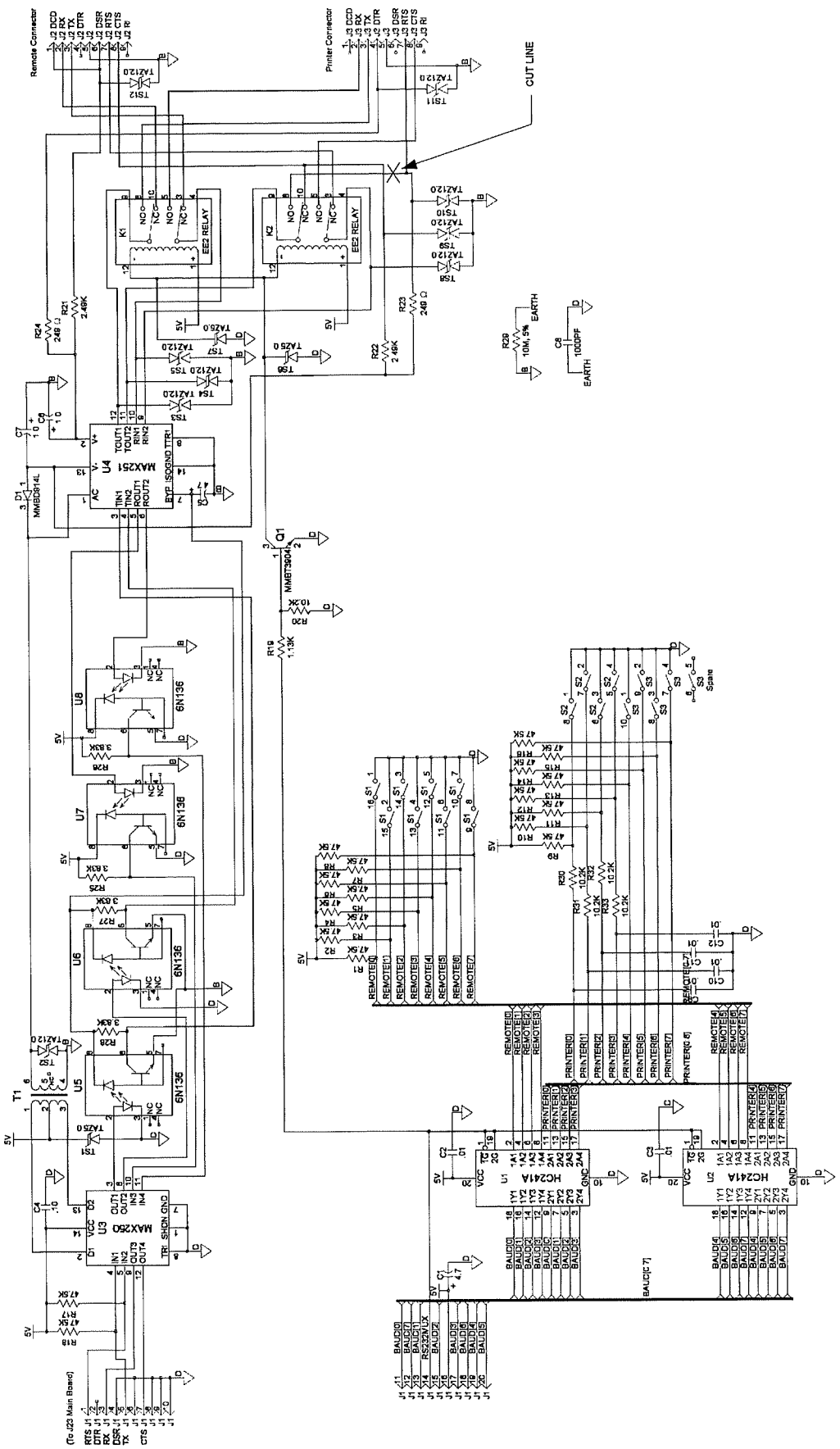




Component Layout, Schematics and Parts Lists begin on next page.

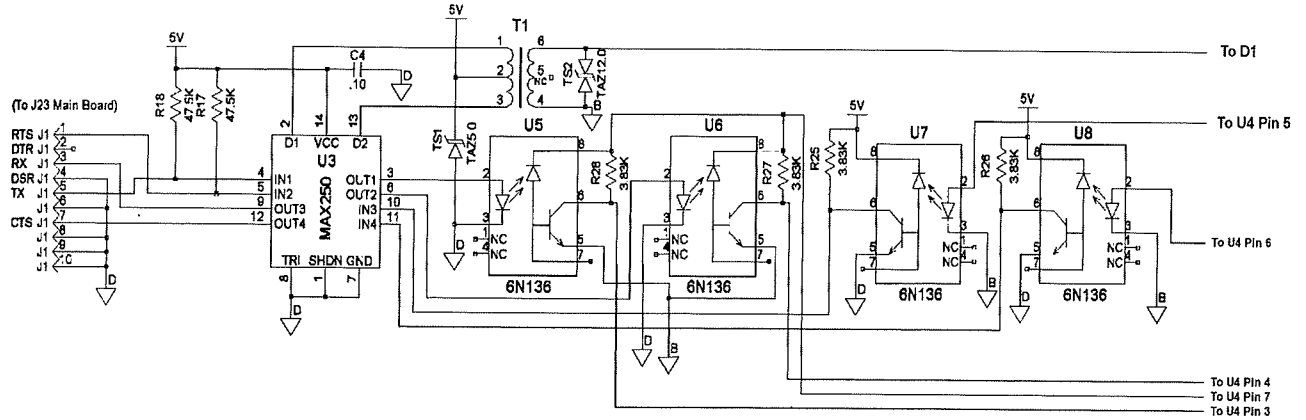


Component Layout:
1761-4725-ASM
Remote Board Rev. 2
(No Longer Available)

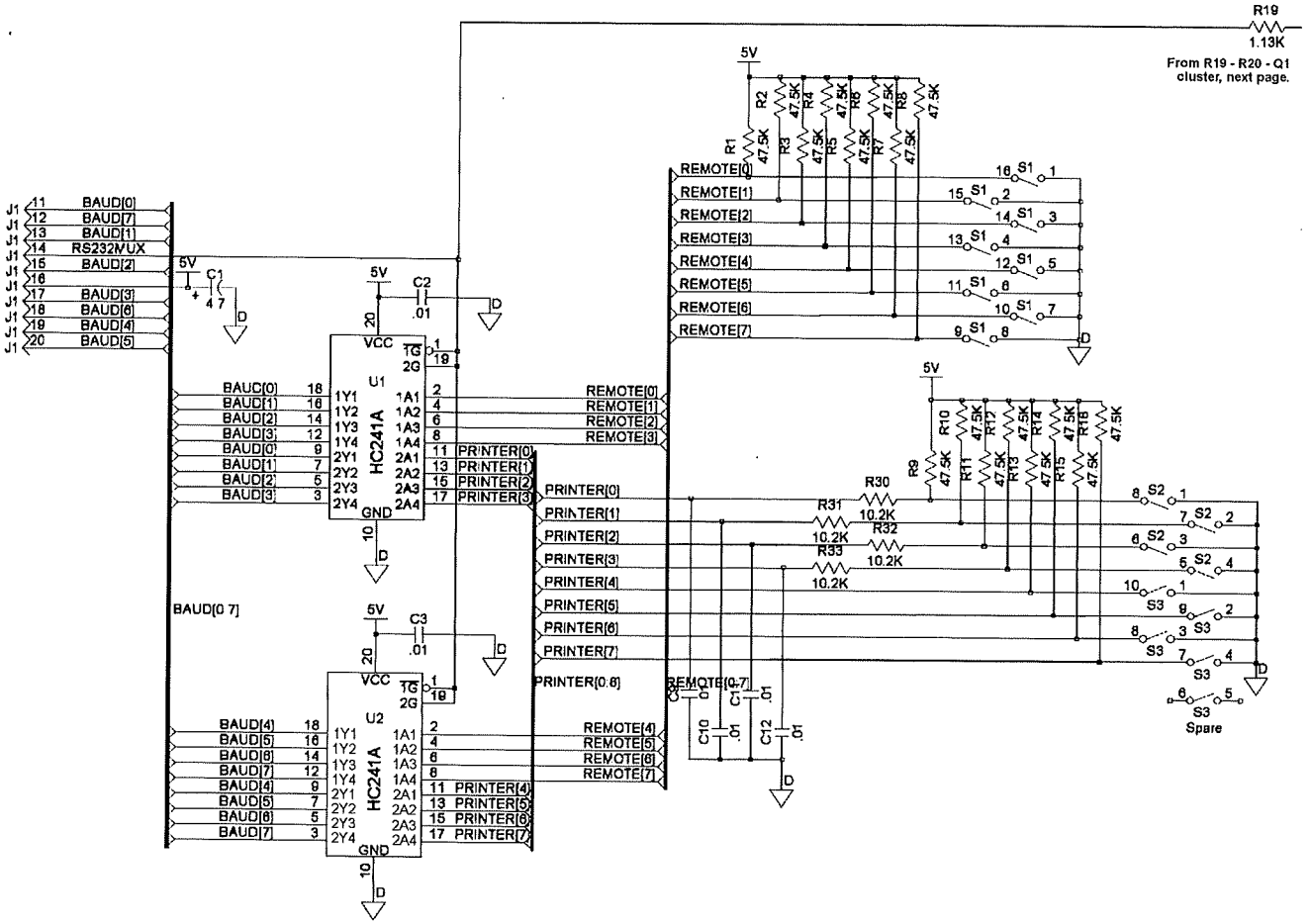


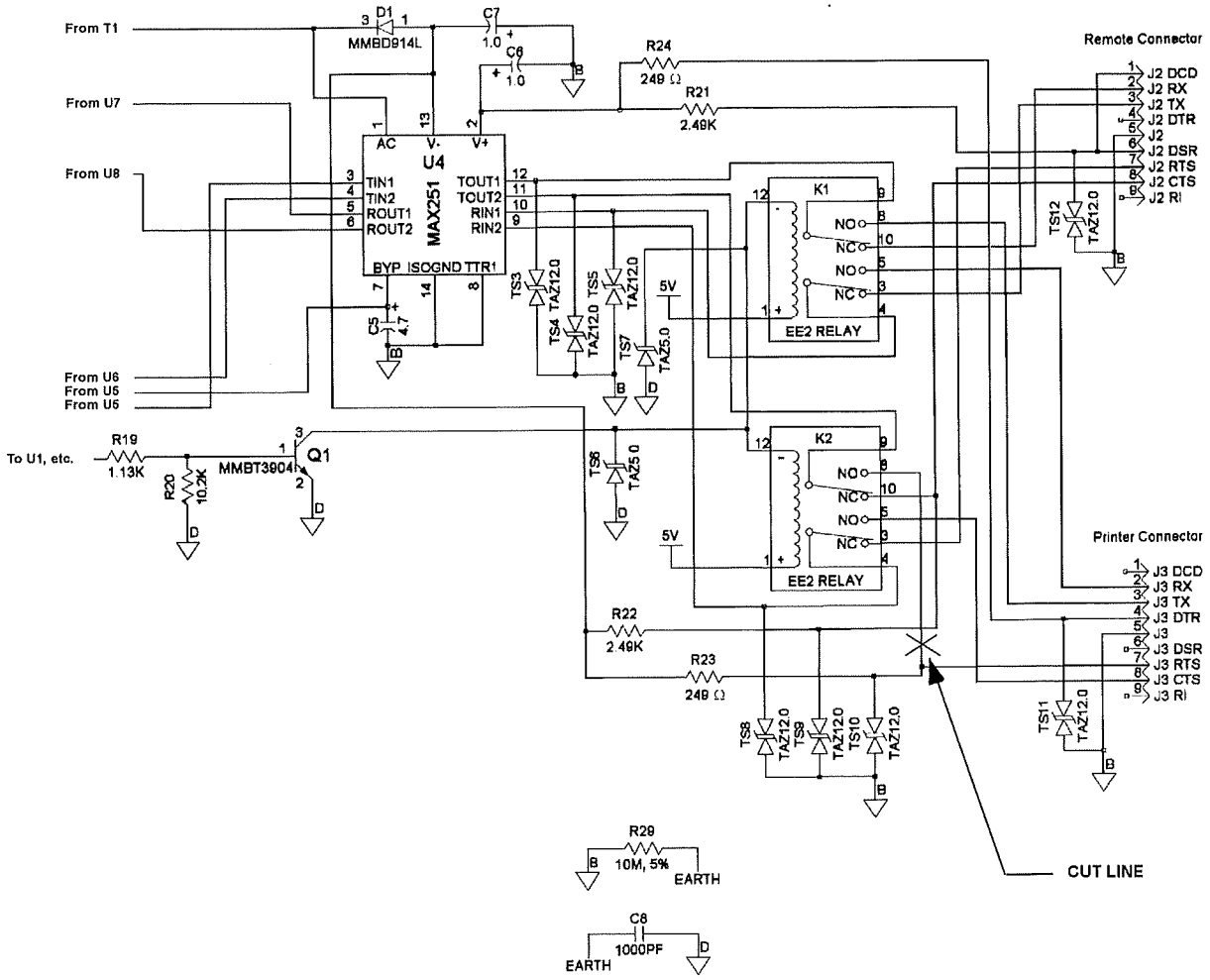
Schematic Diagram:
1761-4725-SCH (2/2A)
Remote Board Rev. 2
(No Longer Available)

Larger Detail Follows.



Refer to page 12-4; **Signal Paths** and **Isolated Power Supply** circuit descriptions.





Larger Detail of Schematic Diagram:
1761-4725-SCH (2/2A) Remote Board Rev. 2
(No Longer Available)

GSI 61 Remote Board 1761-4725 Rev 2 Parts List.

Note: This revision is no longer available. It has been modified and is now Rev 3 (or greater), and does not require the Serial to Parallel Converter Box. The replacement part number is 1761-4725SVC which has "on-board" serial to parallel conversion.

INTEGRATED CIRCUITS

Ref. Designation	Description	Part No.
U1, U2	IC, SMT, 74HC241A, OCT BUFFER	5905-0241
U3	IC, SMT, MAX250, RS-232 DRIVER	5905-0250
U4	IC, SMT, MAX251, RS-232 REC	5905-0251
U5 - U8	OPTO COUPLER, HIGH SPEED, 6N136	7874-0281

TRANSISTORS

Ref. Designation	Description	Part No.
Q1	TRANSISTOR, SMT, MMBT3904, NPN	8214-1035

DIODES & LEDs

Ref. Designation	Description	Part No.
D1	DIODE, SMT, MMBD914	6082-2002
TS1, TS6, TS7	DIODE, TRAN SUPPRESSOR, 5V, SMT	6083-1115
TS2, TS3, TS4, TS5, TS8, TS9, TS10, TS11, TS12	DIODE, TRAN, SUPPRESSOR, 12V, SMT	6083-1112

RESISTORS & POTENTIOMETERS

Ref. Designation	Description	Part No.
R1 - R18	RES, SMT, 47.5K OHM, 1%, .12W	6650-2475
R19	RES, SMT, 1.40K OHM, 1%, .12W	6650-1140
R20, R30 - R33	RES, SMT, 10.2K OHM, 1%, .12W	6650-2102
R21, R22	RES, SMT, 2.15K OHM, 1%, .12W	6650-1215
R23, R24	RES, SMT, 249 OHM, 1%, .12W	6650-0249
R25 - R28	RES, SMT, 3.83K OHM, 1%, .12W	6650-1383
R29	RES, COMP, 10M OHM, 5%, .25W	6099-6105

CAPACITORS

Ref. Designation	Description	Part No.
C1, C5	CAP, SMT, TANT, 4.7µF, 10%, 25V	4550-4751
C2, C3, C9 - C12	CAP, SMT, CER, .01µF, 10%, 50V	4500-1031
C4	CAP, SMT, CER, .1µF, 10%, 50V	4500-1041
C6, C7	CAP, SMT, TANT, 1.0µF, 20%, 35V	4550-1052
C8	CAP, SMT, CER, 1000pF, 5%, 50V	4500-1025

SWITCHES & RELAYS

Ref. Designation	Description	Part No.
S1	SWITCH, SMT, DIP, ANG.	7874-0168
S2	SWITCH, DIP, 4 POS, RT. ANG.	7874-0167
S3	SWITCH, SMT, DIP, 5 POSITION	7874-0138
K1, K2	RELAY, SMT, 2C	6090-1550

MISCELLANEOUS

Ref. Designation	Description	Part No.
T1	TRANSFORMER, PULSE	7996-0100
J1	CONN, DOUBLE ROW, 20 PIN	4230-8020
J2	CONN, 9 PIN, D-SHELL, FEMALE	4230-3797
J3	CONN, 9 PIN, D-SHELL, MALE	4230-3796
	PC BOARD, RS-232	1761-0725

Remote Board: 1761-4725 Rev 3

"On-Board" Serial/Parallel Conversion: (Introduced on Instrument Serial Number A0550.)

13

Theory of Operation

The GSI 61 Serial Interface provides optical isolation (2500 V) between the TTL-level serial and control signals from the GSI 61 and a Centronics-compatible interface via a standard PC DB-25S connector, and a serial remote channel capable of speeds up to 19.2 KBaud.

Remote interface data flow control is provided with Clear-to-Send (CTS) and Request-to-Send (RTS) signals. The Xon and Xoff software flow control protocol is supported as a software function.

Standard PC-to-Centronics printer cables may be used to connect printers to the interface. Standard McIntosh serial cables (MAC-to-Hayes Modem or equivalent) may be used to connect the remote output to most PC computer serial ports. In addition to the Remote-Printer interface card and cable, a special communications program must be used on the PC to talk to the GSI 61. See your GSI representative for information about these programs.

Jumper block J4, next to the internal microprocessor, provides a rapid field test of the microprocessor, remote interface, and the printer. When the shorting block is placed between the SELF-TEST and OPERATE pins, a test message is transmitted directly from the interface card to both the printer and remote interface. (If a printer is not connected or is actually busy, transmission to both the printer and the remote interface is halted until the busy is cleared.)

Technical Overview

The Centronics interface is based on TTL-level signals using only the eight data lines (transmitted upright), the STROBE (negative logic) and BUSY signals. Characters on the data lines are latched into the printer when the STROBE signal is toggled low (0 volts) and back high (+5 volts). The printer controls data flow by raising BUSY high when it cannot accept data.

The additional control signals present on the Centronix interface are not used by the GSI 61 board.

The only operator control is **S2**, a four-position DIP switch located next to **J3**, the printer output connector. It is accessible by the user from the outside of the GSI 61, allowing selection of various audiogram formats. Table 1 lists the control settings of this switch.

The remote baud rate, character length and parity settings are controlled by **S1**, an 8-position DIP switch. This switch is considered a service adjustment, and accessible only when the GSI 61 case is opened. Table 2 lists the control settings of this switch.

Both **S1** and **S2** are read directly by the GSI 61, and are not visible or used by the microprocessor on the serial interface board. Additionally, both **S1** and **S2** switches are on the non-isolated, patient side of the GSI 61 interface.

Data is transmitted from a UART inside the GSI 61 at TTL levels to the GSI 61 interface card where it is sent across optical isolators to a microprocessor that routes the data to the printer interface or out the serial interface as controlled by the GSI 61. Data to be sent to the parallel printer is transmitted at 57.6 Kbaud; Remote data is transfered at the data rate selected by **S1**.

Printer Interface and Control

The microprocessor converts the serial data to a parallel format and toggles the strobe signal to clock the data into the printer. The clear-to-send (CTS) signal going to the GSI 61 is cleared to stop additional characters from being sent until the printer indicates that it is ready for the next character by lowering the BUSY signal. Once the printer responds by setting the busy line, CTS to the GSI 61 is cleared and the interface is ready for the next character.

The CTS signal to the GSI 61 is controlled by the interface microprocessor to reflect the printer BUSY status when output is sent to the printer, and by the remote serial interface device when the remote serial interface in use.

The actual data transmission rate to the printer is variable. When a fresh block of data is sent to the printer, data flow will be rapid, with minimal busy timeouts, up to as many as 5760 characters per second. But when the printer buffer is filled, or when the printer is handling paper, doing other housekeeping chores, out of paper or has some other fault condition, the BUSY control line is set true by the printer to stop data transmission.

A typical audiogram is printed in about 60 seconds with most (if not all) delays a function of the printer in use at the time. Depending on the model of printer in use, it may take more (sometimes a lot more) or less time to print an audiogram.

Remote Serial Interface

Data from the GSI 61 UART is sent to the remote interface when the RS232MUX signal is a logic "high". In this mode, the microprocessor simply copies the serial data bits to the serial output drivers. Hardware flow control signals to and from the GSI 61 are provided by optically isolated versions of CTS and RTS signals. RTS is routed directly to the remote serial device, but CTS is sensed and processed by the interface microprocessor prior to sending it on to the GSI 61 since it may originate as either the Printer BUSY or Remote CTS signals, depending on which interface device is in use.

It should be noted that the serial interface is nothing more than a transparent interface between the GSI 61 and the Remote Interface and Printer. Data bits going in each direction are simply copied by the microprocessor and sent to their destination without any processing whatsoever; no extra flow control or data processing of any kind is applied to the data or flow control signals. The on-board microprocessor merely acts as a switch connecting the GSI 61 UART to the remote serial interface, or converting serial data from the GSI 61 into an equivalent parallel data format for the printer.

Detailed Circuit Description

A schematic diagram is included and should be referred to during this discussion. Sheet 1 presents the optical isolators and interface logic to the GSI 61, Remote Interface and the Printer. Sheet 2 shows the DIP switch and other buffer logic required for the GSI 61 processor to read switches S1 and S2 directly through J1.

Connector **J1** provides the GSI 61 interface connections. A 20-pin PCB header, this connector carries serial send-and-receive data and flow control signals from the GSI 61 UART, +5 volt power, ground, and data from switches S1, S2 and RS232MUX, the signal that switches between the Remote and Printer interfaces. This option card draws about 50 mA of five volt logic power from the GSI 61.

Signal Paths

Transmitted data (TX) is sent from **J1-5** through buffer **U4**, two sections of a 74HC08 AND gate. Both gate outputs are tied together and drive optical isolator **U10**, a 6N136, through resistor **R9** with about 8 mA of drive current. The output of U10, now isolated from the GSI 61 is presented to microprocessor **U5**, a PIC 16C55, on pin 6.

Data received from the Remote Interface arrives via **J2**, the Remote Interface connector, and is converted to TTL levels by RS-232 line receiver **U9**. The received signal is available for monitoring on a test pin next to the microprocessor labeled "RX_SIG" and is sent to optical isolator **U12**, another 6N136. The receive signal is further buffered by **U2**, a 74HC241, before being sent to the GSI 61 UART via **J2-3.**

The 6N136 is a high speed optical isolator used because of the high data rates being transmitted between the printer and the GSI 61 (57.6 Kbaud). Flow control signals are isolated with 4N26 optical isolators where speed and waveshape is not critical. For example, the multiplex command, RS232MUX, drives **U14**, a 4N26 via U2, which is also used to buffer the CTS and RTS signals.

Isolated Power Supply

Isolated power for the microprocessor and other logic on the isolated side of the interface is generated by a square-wave generator comprised of **U3**, **R3** and **C4**. The otherwise unused sections of U3 are connected in series to provide a delay line which is decoded into non-overlapping clocks by two AND gates from U3 to drive pulse transformer **T1**.

Running at a nominal 250 KHz, oscillator U3 produces a slightly asymetrical waveform. This is used to generate a slightly longer positive output pulse from transformer T1, and therefore more power for the positive power supply. Voltage output is controlled by adjusting the value of **R4** and **C6**.

Two rectifiers, **D1** and **D2**, serve the positive and negative power supplies. The negative supply is used only by **U7**, an MC14C88 RS-232 driver IC. Positive unregulated power (nominally about 7.5 volts) provides the positive rail for U7 and is fed through a low-power, low-dropout 5V regulator, **U9**. Regulator U9 provides Vcc for the microprocessor and other isolated logic.

Microprocessor

Microprocessor **U5** is a PIC 16C55 that is used to convert serial data to parallel, control data flow to either the printer or serial Remote Interface, pass printer and serial data flow control signals to and from the GSI 61, and to generate test messages. Several test and maintenance features are provided as a function of this part. (The PIC 16C55 may be substituted with a PIC 16C57, a larger version of the same processor family, depending on production requirements.)

The PIC is operated at 16 mHz, as established by crystal **Y1**. Clock operation may be viewed with a 10X oscilloscope probe on **U5**, pin 26. (The non-ground side of **C12** may be easier to probe.) This signal is a somewhat distorted sine wave of about 2-3V amplitude when powered on.

An MC34064 undervoltage sensing circuit is used to hold the microprocessor in a reset state whenever Vcc is less than 4.6 volts. This unit is necessary because some printer interfaces provide substantial power via the interface and internal IC ESD protection diodes, even when the GSI 61 is powered off. Without this safeguard, enough power may sometimes enter the system via the printer or remote interface to prevent either proper operation or a proper system reset when the GSI 61 is turned on.

Microprocessor Firmware

The flow chart on the next page shows system behavior. After power is applied and the system is operational, a scanning loop is maintained that:

1. Checks for the SELF_TEST jumper on J4. If it is set, operation jumps to step 6, below.

2. Checks the RS232MUX signal line to determine if output is for remote or printer. If remote is selected by the GSI 61, the loop then copies the remote CTS level to the GSI 61 for flow control, and copies data bits from the GSI 61 TX signal to the RS-232 output line driver, then loops back to step 1, above.

3. If the printer is selected, printer BUSY status is copied to the GSI 61 for flow control purposes.

4. The GSI 61 TX line is examined for a start bit; if one is not found, the scanner returns to step 1, above.

5. The incoming character detected in step 4 is received, placed on the printer output lines and a strobe generated to send it to the printer. The scan is restarted at step 1 above.

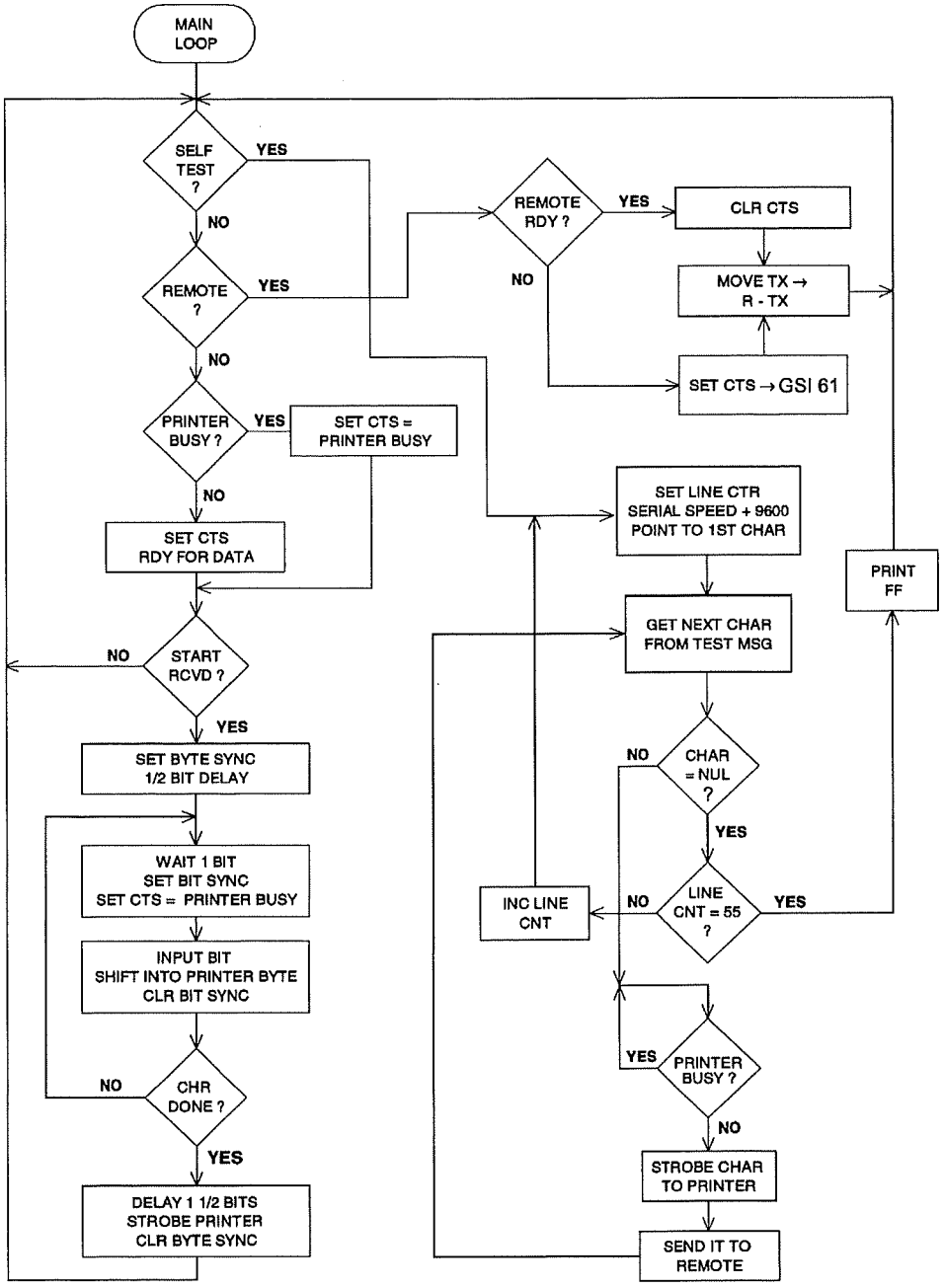
6. Some counters and variables are set to send data at 9600 baud, and a character pointer to a test message is set to the first character.

7. The line counter is examined; if it is greater than 55, the program scan is restarted to step 1, above.

8. A character is pulled out of the test message generator file and the character pointer incremented to point at the next character. If it is a printable character, it is sent to the printer interface, otherwise the program skips to step 9, below. If the printer is not busy, a strobe is sent to clock the character into the printer, then the character is sent

to the serial remote interface *regardless of the flow control signal settings.* The program loops back to the beginning of step 7.

9. If the character is a non-printable character, it signifies the end of a line of text. The line counter is incremented and the program scan is reset to step 7.



Troubleshooting Aids

A simple test message can be sent to both the printer and remote interface devices by placing a shorting jumper over the SEL_TEST and OPERATE pins on the test block **J4**, next to the microprocessor. If the GSI 61 and connected printer are both turned on, a test message is sent continously to both the printer and the remote serial port. The shorting jumper should be stored by connecting it to a single pin on J4.

The message provides an automatic top-of-form every 55 lines on the printout. Output to both the printer and remote serial port stops whenever the printer is BUSY or disconnected.

If a test message is needed for the remote serial port when a printer is not available, the printer "busy" signal can be forced to the "not-busy" state by jumpering the BUSY pin on **J4** to the OPERATE and SEL_TEST pin, or, if a printer cable is not connected to the interface, output connector **J3-11** can be jumpered with a short piece of wire or paper clip to signal ground, any pin on **J3** between 18 and 25.

The remote serial test message data is transmitted at a fixed rate of 9600 baud. The data rate cannot be changed.

The figure on page 13-8 shows an oscilloscope output detailing the relationship of all microprocessor operations needed to convert the serial data from the GSI 61 to a parallel byte sent to the printer.

GSI 61-transmitted data should be monitored on **U5-6**. When a start bit arrives, the BYTE_SYNC signal is raised (**U5-17**). This signal stays high until the end of the character. After 1.5 bit times have elapsed, eight bits are sampled as indicated by BIT_SYNC, **U5-16**, followed by a STROBE, sent to the printer and viewed on **U5-10**.

Little test holes are provided on the PCB for byte and bit sync probes next to microprocessor **U5**, opposite **J4**.

Troubleshooting Suggestions

Most installation problems end up being connector or cable-related, so we suggest that anyone doing new installations carefully check:

1. **The GSI 61 input cable.**
   Measure +5volts at the center-tap of transformer T1 and any convenient GSI 61 ground. If you find +5volts there, chances are good the input connector from the GSI 61 is connected correctly.

2. **Check that the isolated DC power is available.**
   Connect your meter ground clip to the **J4** "OPERATE" pin next to microprocessor **U5**. Measure +5 volts on the stripe (+) end of **C9**, and > -11 volts the non-stripe end of **C7**. If this test fails, check for oscillator output on either side of transformer **T1** centertap. (Be sure to move your meter/scope ground leads to the GSI 61 ground for this test!)

3. **Check for microprocessor action**
   by jumpering the OPERATE and SELF_TEST pins on **J4** while viewing the output on **U7-3**, remote transmit data. This should be a continuous stream of rectangular waves making up the characters in the test transmission.

Remember that characters are sent to the printer from the GSI 61 only when the printer BUSY signal is low, indicating that the printer is ready to accept characters. Continuous output usually takes place only when the images or messages are first started and the printer buffer is not full. Once the printer buffer is full, characters only "dribble" in as they are accepted.

Sample Problems

Problem: Data output starts out correctly, but the rest of the output is garbled, or parts are missing.

Cause: Characters can be "forced" out to the printer if flow control signals to the GSI 61 are frozen in the "enable" state. The effect of this would be a lot of missing characters or scrambled data, usually a short time after the output has begun. This is caused by the printer or remote device buffer overflowing. The situation can be caused by the control signal (R_CTS) from the remote device or BUSY from the printer not changing state (perhaps a cable problem) or the P_CTS output from the microprocessor not reaching the GSI 61. Possible causes in the interface board include faulty **U13**, open **R15**, bad **U8**, or bad microprocessor **U5**.

Problem: No data reaches the printer from the GSI 61, but the local test message (see Troubleshooting Aids, previous page) prints fine.

Cause: The fact that the local test message prints out OK means that the printer, cabling, and microprocessor are all working fine. The link to the GSI 61 may be broken. Check the interface cable attached to **J1** (careful, it might be partially unplugged!), buffer **U4**, **R9**, optical isolator **U10,** and **R6**.

Problem: No data reaches the Remote Device, but the printer works fine.

Cause: This problem can be caused by cabling (are TX and RX reversed on the remote device?), flow control (no CTS/RTS signals, or are they reversed?) or possibly, but highly unlikely, **U7** or **U8** could be defective.

Problem: Intermittant data errors on either the printer or remote device.

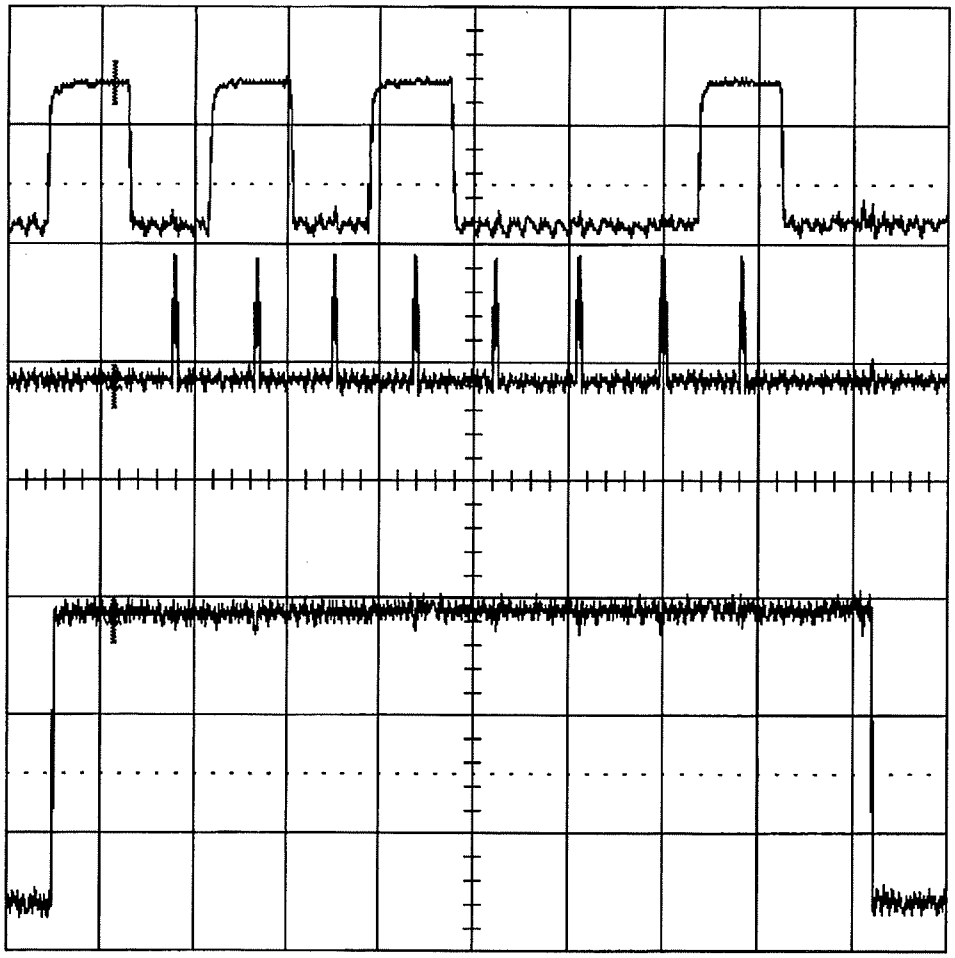
Cause: Intermittant problems often have easily discovered causes. Check for loose or partially disconnected cables. Check Vneg and Vpos levels. Check signal levels on **U10-6** (make sure low portion of the signal is no higher than 0.75 volt) and the same for **U12-6**. Lastly, check for sampling pulses in the center of the data bits as shown in the following figure. If these are not correct, crystal **Y1** could be out of frequency tolerance.

This figure shows the critical timing performed during a serial-parallel conversion of a character by the interface board microprocessor.

Top Trace:
(U5-6)

Middle Trace:
(U5-16)

Bottom Trace:
(U5-17)



The top trace shows a serial character as it arrives from the GSI 61 UART. As shown, a high is a one or start bit, and lows are zeros or a stop bit.

The microprocessor detects the leading edge of the start bit, raises the byte_sync signal (**bottom trace**), then delays 1-1/2 bit times, or about 24 μsecs.

At the end of the delay, a bit_sync pulse is raised (**middle trace**), the level of the incoming signal is read, and the bit_sync signal lowered. After a delay of one bit time, the process is repeated.

After eight bits have been read, another 1-1/2 bit time delay is processed, a strobe pulse clocks the (now parallel) signal to the printer (**bottom trace**), and the byte_sync line is lowered, signaling that a character has been received.

Table 1 - Printer Output Form Selections

Printer output forms are selected by switch S2, a four-switch DIP switch located next to the printer output jack. A switch position is "ON" when the switch toggle is in the UP position. See the GSI 61 User Manual for further information.

S2 Switch Position		
1	ON	Overlaid Left & Right Audiograms
	OFF	Separate Left & Right Audiograms
2	ON	Black & White Printing
	OFF	Color Printing
3		Not Used
4		Not Used

Table 2 - Remote Serial Interface Characteristics

This table lists the control settings for serial baud rate, word length and parity of the Remote Serial Interface provided by DIP switch S1. These switches are read on power up and the hardware initialized appropriately.

The configuration is selected as follows: OFF = Logical 1 ON = Logical 0

Dip Switch	Function
S1-1	Baud Rate Bit 0
S1-2	Baud Rate Bit 1
S1-3	Baud Rate Bit 2

S1-3	S1-2	S1-1	Baud Rate Selection
ON	ON	ON	Invalid Selection
ON	ON	OFF	Invalid Selection
ON	OFF	ON	19.2 K
ON	OFF	OFF	600 (GSI 16 compatible)
OFF	ON	ON	1200 (GSI 16 compatible)
OFF	ON	OFF	2400 (GSI 16 compatible)
OFF	OFF	ON	4800 (GSI 16 compatible)
OFF	OFF	OFF	9600 (GSI 16 compatible)

Dip Switch	Function
S1-4	Parity/Data Bits Bit 0
S1-5	Parity/Data Bits Bit 1

S1-5	S1-4	Parity Selection
ON	ON	Space Parity / 7 Data Bits
ON	OFF	Even Parity / 7 Data Bits (GSI 16 compatible)
OFF	ON	Odd Parity / 7 Data Bits
OFF	OFF	No Parity / 8 Data Bits

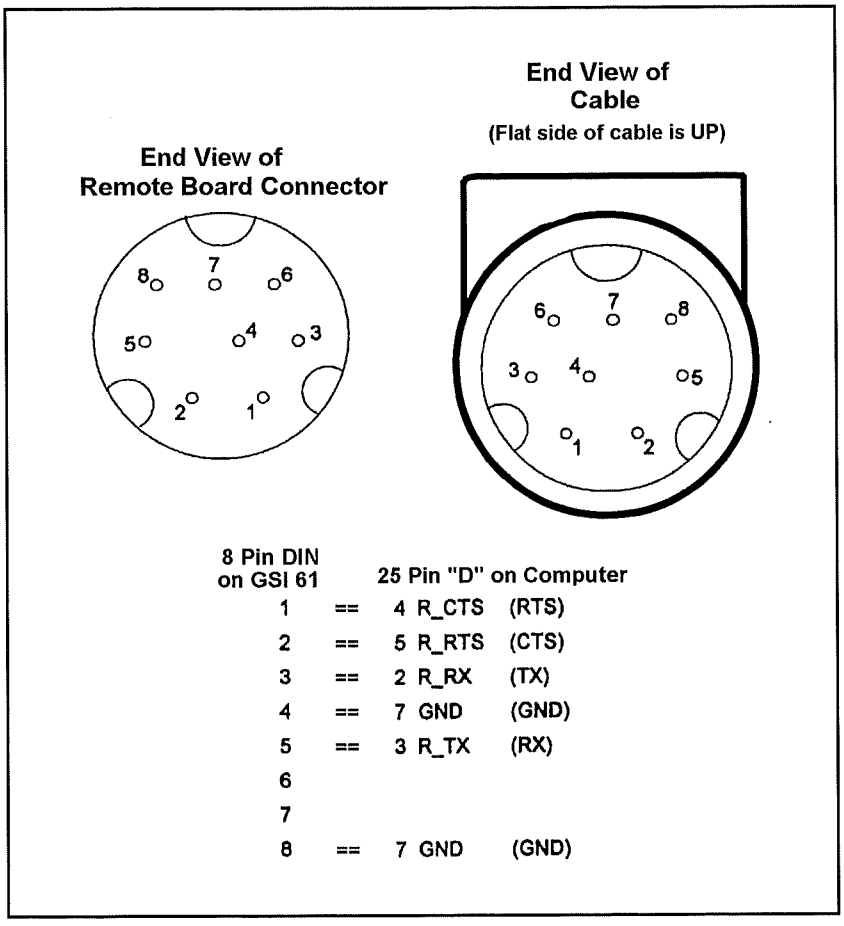
Dip Switch	Function	OFF	ON
S1-6	Data Flow Control	Hardware Flow Control (GSI 16 compatible)	Software Flow Control
S1-7	Stop Bits	1 Stop Bit	2 Stop Bits (GSI 16 compatible)
S1-8	Not Used		

The factory setting is 9600 baud, no parity, 8 data bits, 1 stop bit and hardware flow control.

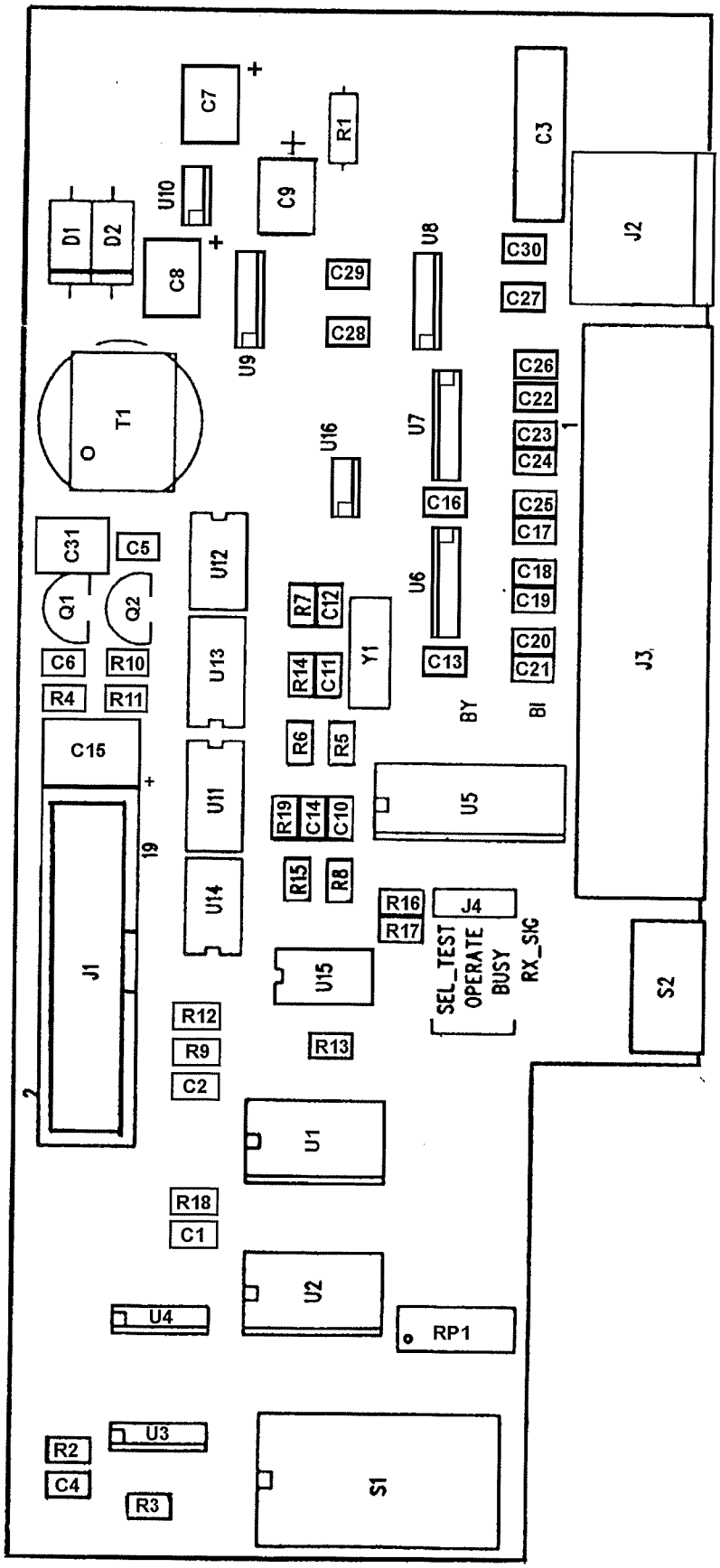
Cable Connections

The GSI 61 Remote interface provides a serial interface consisting of RxD (Received Data), TxD (Transmitted Data), RTS (Request To Send), CTS (Clear To Send) and ground signals at the end of the supplied DB-25 male connector. This cable can be purchased as an Apple "Hayes Modem" cable, available from Apple dealers. *(Important: Make sure this cable incorporates all the signals shown in the figure below!)*

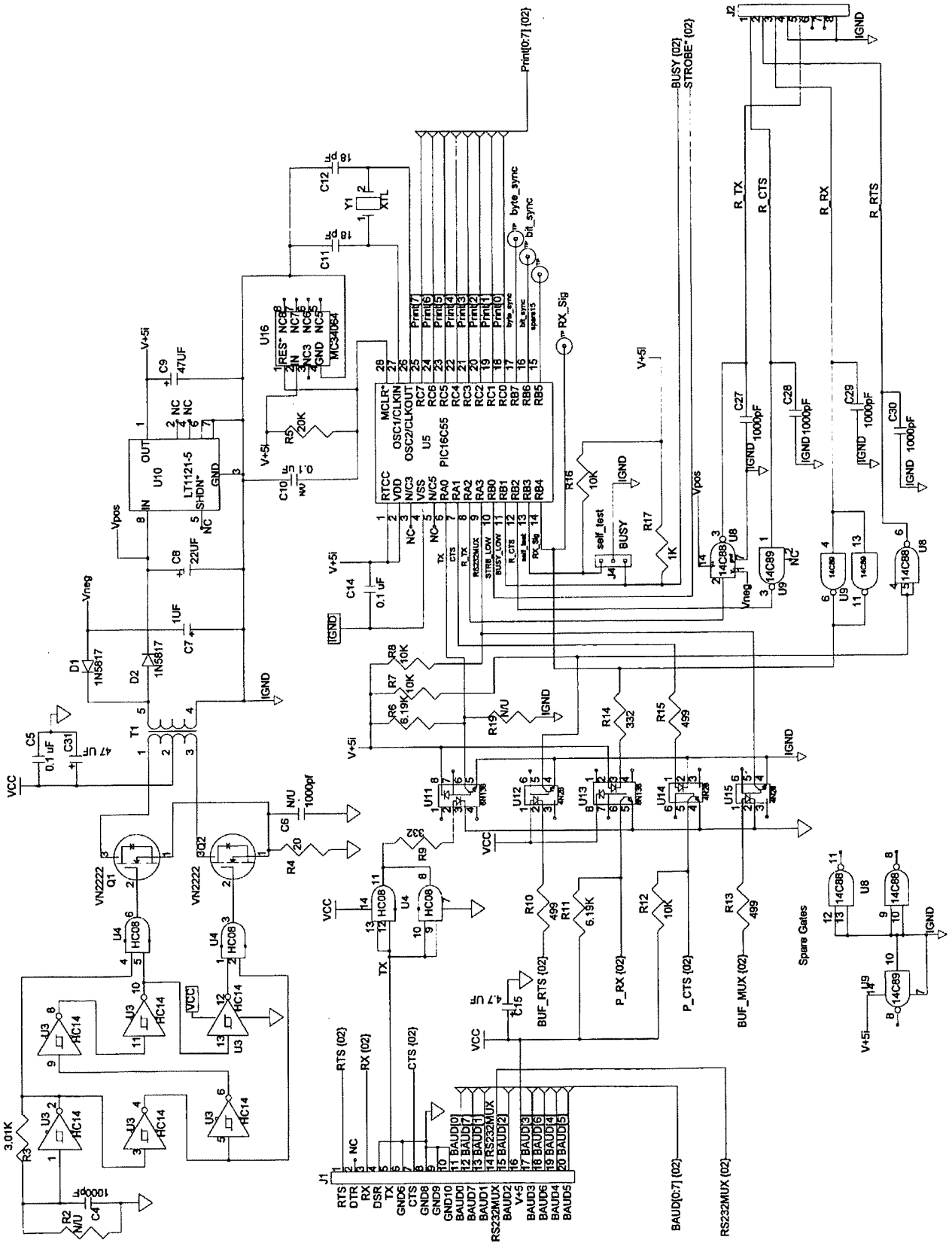
A 25-pin "gender-changer" must be added to this cable when connecting to a standard PC computer serial interface. The GSI 61 printer interface uses a standard PC printer cable available anywhere PC computer products are sold.



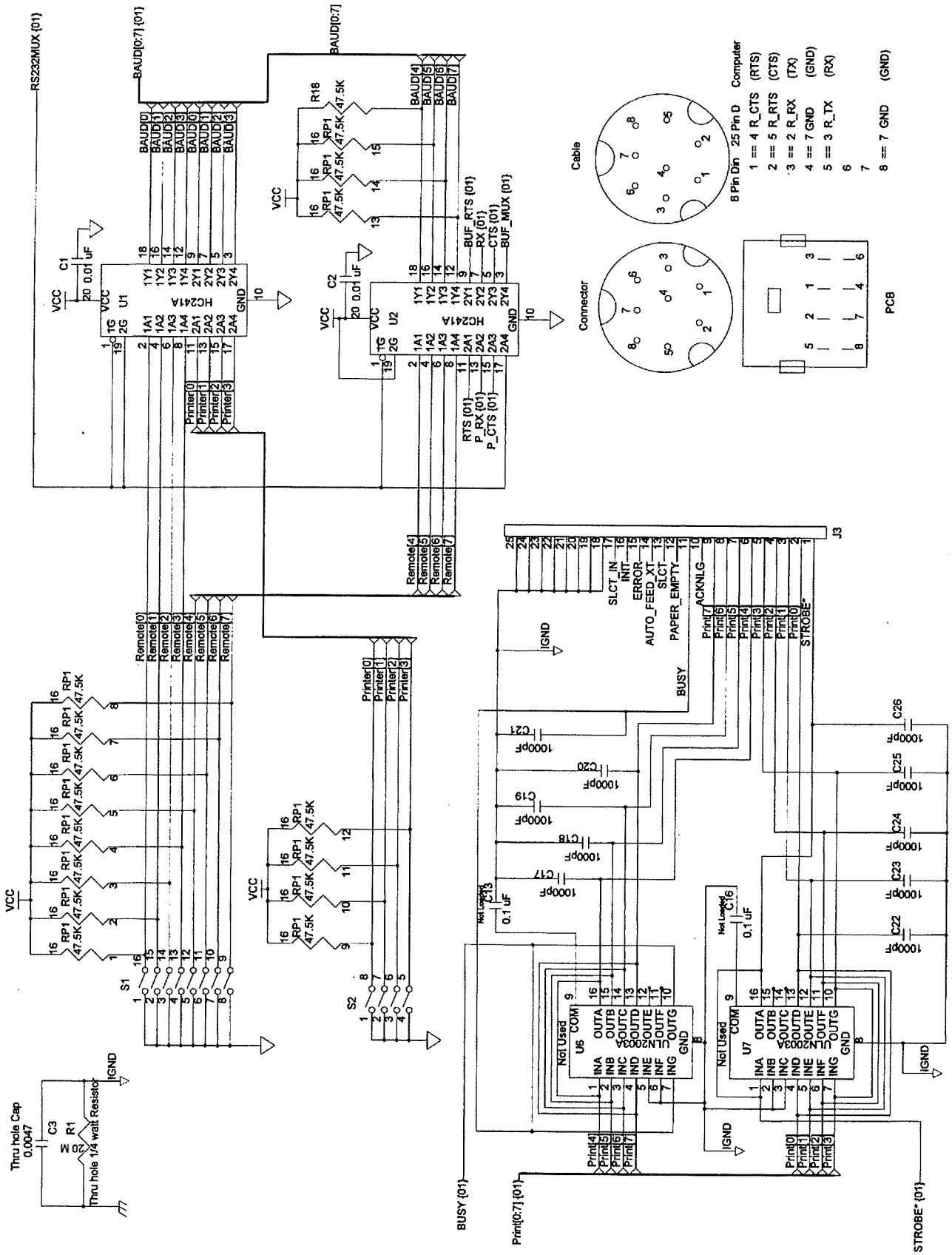
8 Pin DIN on GSI 61		25 Pin "D" on Computer	
1	==	4 R_CTS	(RTS)
2	==	5 R_RTS	(CTS)
3	==	2 R_RX	(TX)
4	==	7 GND	(GND)
5	==	3 R_TX	(RX)
6			
7			
8	==	7 GND	(GND)



Component Layout:
1761-4725-ASM
Remote Board (3)



Schematic Sheet 1 of 2:
1761-4725-SCH
Remote Board (3)



Schematic Sheet 2 of 2:
1761-4725-SCH
Remote Board (3)

GSI 61 Remote Board Parts List (5)
(The Remote Board replacement can be ordered as 1761-4725SVC)

INTEGRATED CIRCUITS

Ref. Designation	Description	Part No.
U1, U2	IC, SMT, 74HC241A, OCT BUFFER	5905-0241
U3	IC, SMT, 74HC14, HEX INVERTER	5905-0014
U4	IC, SMT, 74HC08, QUAD 2-INPUT AND	5905-0008
U5	PIC, 16C55, SMT, MICRO, PROGRAMMED	1761-0510
U8	IC, SMT, 14C88, QUAD CMOS DRIVE	5907-1488
U9	IC, SMT, 14C89, CMOS RECEIVER	5907-1489
U10	IC, SMT, LT1121-5, +5V REG	5908-1121
U11, U13	SWITCH, OPTO COUPLER, 6N136	7874-0281
U12, U14, U15	PHOTO X-STR, OPTO-ISOLATOR	7874-0215
U16	IC, SMT, MC34064, UNDRVLTG SEN	5933-4064

TRANSISTORS

Ref. Designation	Description	Part No.
Q1, Q2	TRANSISTOR, VN2222LL, FET TMOS	8210-1223

DIODES

Ref. Designation	Description	Part No.
D1, D2	DIODE, 1N5817, SCHOTTKY	6084-1017

RESISTORS & POTENTIOMETERS

Ref. Designation	Description	Part No.
R1	RES, COMP, 20M OHM, 5%, .25W	6099-6205
R3	RES, SMT, 3.01K OHM, 1%, .12W	6650-1301
R4	RES, SMT, 20 OHM, 1%, .12W	6650-9200
R5	RES, SMT, 20K OHM, 1%, .12W	6650-2200
R6, R11	RES, SMT, 6.19K OHM, 1%, .12W	6650-1619
R7, R8, R12, R16	RES, SMT, 10.0K OHM, 1%, .12W	6650-2100
R9, R14	RES, SMT, 332 OHM, 1%, .12W	6650-0332
R10, R13, R15	RES, SMT, 499 OHM, 1%, .12W	6650-0499
R17	RES, SMT, 1K OHM, 1%, .12W	6650-1100
R18	RES, SMT, 47.5K OHM, 1%, .12W	6650-2475
RP1	RES NETWORK, SMT, 47K PULL-UP	6740-2012

CAPACITORS

Ref. Designation	Description	Part No.
C1, C2	CAP, SMT, CER, .01µF, 10%, 50V	4500-1031
C3	CAP, CER, DISC, 4700pf, 1KV	4410-1470
C4, C17 - C30	CAP, SMT, CER, 1000pf, 5%, 50V	4500-1025
C5, C14	CAP, SMT, CER, .1µF, 10%, 50V	4500-1041
C7	CAP, SMT, TANT, 1.0µF, 20%, 35V	4550-1052

CAPACITORS - continued

Ref. Designation	Description	Part No.
C8	CAP, SMT, TANT, 22µF, 10%, 20V	4550-2261
C9, C31	CAP, SMT, TANT, 47µF, 20%, 10V	4550-4762
C11, C12	CAP, SMT, CER, 18pF, 10%, 50V	4500-1801
C15	CAP, SMT, TANT, 4.7µF, 10%, 25V	4550-4751

SWITCHES & RELAYS

Ref. Designation	Description	Part No.
S1	SWITCH, SMT, DIP, RT. ANG, 8 B	7874-0168
S2	SWITCH, DIP, 4 POS, RT. ANG	7874-0167

MISCELLANEOUS

Ref. Designation	Description	Part No.
Y1	CRYSTAL, 16.000 MHz	5075-0035
	INSULATOR, CRYSTAL	7574-0210
T1	TRANSFORMER, PULSE	7996-0100
J1	CONN, DBL ROW, 20 PIN LOCK	4230-8021
J2	CONN, PC, FEMALE, 8 PIN DIN	4230-4028
J3	CONN, 25 PIN D, METAL SHELL	4230-7007
J4	CONN, STRIP PINS, 36 CONT.	4230-8069
	PC BOARD, RS-232 (MIN. REV 3 ONLY)	1761-0725

RS-232 & Printer Protocol Selections and Data Stream Format

14

RS-232 Protocol

Description

The purpose of the interface option for the GSI 61 Clinical Audiometer is to provide the user with the capability to transfer test parameter information from the GSI 61 to a remote external computer and/or to remotely control the operations of the GSI 61 by an external computer. The RS 232 option can only be used with those instruments which have the Remote board installed.

There are two communication protocols available with the GSI 61. One is identical to the protocol used on the GSI 16 Audiometer, thus allowing the GSI 61 to be used in the same environment as that instrument. The other interface protocol adds the features found with the GSI 61 which include the ability to transmit complete audiogram information with a single push of the Data Transmit button, and High Frequency audiometry.

Operation

The GSI 61 RS 232 option will function in all operative test modes of the audiometer. A software link is enabled by pressing the Remote button on the instrument's front panel; a message to this effect can be observed on the LCD display. The link is disabled by depressing the Remote button again. Note that the word "Remote" will be erased. The Remote indicator must be displayed in order for the transfer of information to occur. Actual data capture and transfer will occur when the Data Transfer button on the front panel is pressed. When the Data Transfer button is pressed, all pertinent unit switch settings and display information is internally buffered by the GSI 61 for transmission through the RS 232 serial interface to an external computer. During the period of data capture and to the end of transmission of the data record, "Data Transfer" is displayed on the LCD panel (activation will be 0.5 seconds, minimum).

The GSI 61 is configured as a DCE (Data Communications Equipment) device and would normally connect to a remote device configured as a DTE (Data Terminal Equipment) device. Hardware handshaking (RTS/CTS) and software handshaking (xon/xoff) are provided to control data flow.

Configuration

The configuration of the GSI 61 Remote interface must be set to match the interface configuration of the computer. A package of eight dip switches (designated S1) is provided on the serial interface board to configure the interface for baud rate, parity, number of data bits, number of stop bits and data flow control. These switches are read on power-up and the hardware is initialized appropriately.

The configuration is selected as follows:

OFF = Logical 1 ON = Logical 0

Baud Rate:

Position # 3	2	1	Selection	
OFF	OFF	OFF	9600 Baud	(GSI 16 compatible)
OFF	OFF	ON	4800	(GSI 16 compatible)
OFF	ON	OFF	2400	(GSI 16 compatible)
OFF	ON	ON	1200	(GSI 16 compatible)
ON	OFF	OFF	600	(GSI 16 compatible)
ON	OFF	ON	19.2 K	
ON	ON	OFF	Invalid Selection	
ON	ON	ON	Invalid Selection	

Parity/Data Bits:

Position # 5	4	Selection	
OFF	OFF	No Parity	/8 Data Bits
OFF	ON	Odd Parity	/7 Data Bits
ON	OFF	Even Parity	/7 Data Bits (GSI 16 compatible)
ON	ON	Space Parity	/7 Data Bits

Data Flow Control:

Position #6 OFF = Hardware flow control used. (GSI 16 compatible)
ON = Software Flow control used.

Stop Bits:

Position #7 OFF = 1 Stop bit
ON = 2 Stop bits (GSI 16 compatible)

Position #8 This position is not used.

The default settings are 9600 baud, no parity, 8 data bits, 1 stop bit, and hardware flow control.

Data Flow Control

Hardware Flow Control

When hardware control is selected, RTS/CTS handshaking is used. The remote device may use the RTS signal to allow or inhibit data transmission for the GSI 61 to the remote device. When the RTS signal is set true by the remote device, the GSI 61 is enabled to transmit data. When the RTS signal is set false by the remote device, the GSI 61 is inhibited from transmitting data. The remote device should insure that RTS is set true prior to requesting data from the GSI 61. If the RTS signal is false at the start of a transmission, or goes false during a transmission, the GSI 61 will wait for 6 seconds for the signal to return true. If this does not occur, the transmission is aborted and the error message "No Response" will temporarily flash.

The GSI 61 uses the CTS signal to allow or inhibit data transmission from the remote device to the GSI 61. When the CTS signal is set true by the GSI 61, the remote device may transmit to the GSI 61. When the CTS signal is set false by the GSI 61, the remote device must not transmit to the GSI 61. Failure to comply with this condition may result in the loss of data transmitted to the GSI 61.

The GSI 61 will set the CTS line false to prevent data transmission by a remote computer. This occurs while processing a completed input command, while printing, while the GSI 61 is transmitting a record and whenever the remote device is not enabled through the Remote button.

Software Flow Control

When software flow control is selected, XON/XOFF handshaking is used. Software XON/XOFF flow control is available to allow software commands from the external computer to start and stop the flow of data from the GSI 61. The XOFF character used is the ASCII control character [DC3]. The XON character used is the ASCII control character [DC1]. Sending XOFF to the GSI 61 pauses its transmission; sending XON to the GSI 61 resumes the transmission. Once XOFF is received by the instrument, XON must be received within 6 seconds. If it is not received within this time constraint, the error message "No Response" is flashed on the front LCD panel.

Cable Connections

For GSI 61s having a Revision 2 or older Remote Board, refer to Section 12 of this manual. For those with Revision 3 boards, refer to Section 13.

Data Transfer

Record and Field Formatting

Communication with the remote device is performed by sending and receiving information in "records". Each type of information has its own record format. Each record is divided into "fields" which contain specific information. All records are formatted with a predefined, fixed length format. The generic format for all records is:

Record Prefix	Record Type	Data Fields	Checksum	Record Terminator

The record prefix consists of a ":" character and denotes the start of a record. Input records do not contain a checksum. The record terminator consists of a "CR", "LF" sequence. Each record consists of fixed length data fields with any unused or Zero data fields filled with a "0". All records consist of a sequence of printable ASCII characters from the set of "0" to "9", "A" to "G", "-", ":", ".", "_", "CR" and "LF". All multiple character ASCII fields will be right justified with unused character positions filled with "_" characters. Positive numeric values will not contain a "+" sign; this will be implied. Negative values contain a "-" sign in any character position to the left of the most significant digit of the number. Unless specified, the decimal point for non-integer numbers will not be included in the character sequence.

Checksums

Checksums will be calculated so as to maintain compatibility with the GSI 61 as the mod 256 sum of all preceding characters on the record, including the ":" prefix, and stored as two HEX ASCII characters.

Remote Input Operation

Validation

Each character is validated for parity, framing, overrun, and break interrupt errors. If an error is detected, an error message is displayed to indicate the type of error. For overrun errors, an error record is transmitted back to the remote. For parity and framing errors, no error record is transmitted since any transmission most likely will result in a similar error at the remote and the record would be unintelligible. If a spurious character is received, an error message is flashed on the LCD. When a complete input record is received, the record is validated and processed. If the record is invalid, an error record is transmitted back to the remote device. All input records are validated in the following manner:

must begin with a ":", and end with a carriage return or line feed sequence;
must contain all valid ASCII characters;
must contain a valid record type;
must contain a valid function code;
must contain a valid function subcode when required.

Acknowledgment

The GSI 61 will acknowledge the correct reception and processing of all input records by transmitting an ASCII ACK character after the record has been processed. This record acknowledgment will not be sent if the GSI 16 compatible record format has been selected.

Input Record Type

These records are sent by the remote device to control its functions.

Input Record Type 1 to 4

Reserved for the GSI 10.

Input Record Type 5 - Pushbutton Code Record

This record type provides the ability to remotely simulate the operation of all user controls. The record specifies the control operation using a function code which defines the group of controls and a sub-function code which defines the specific parameter to select of the function to perform. Control operations are processed in the same manner as if they had been manually entered. All parameter or functional defaults and restrictions will still apply.

Function Code	Function Group	Function Subgroup	Sub Code Pushbutton/Function
12	Reserved for GSI 10		
13	Reserved for GSI 10		
14	Reserved for GSI 10		
15	Reserved for GSI 10		
16	Test Frequency	"0" "1"	Decrement Frequency Increment Frequency
17	Reserved for GSI 10		
18	Channel 1 Tone Bar	"0" "1"	Release Press
19	Channel 2 Tone Bar	"0" "1"	Release Press
20	Channel 1 Intensity Control	"0" "1"	Decrease 1 step Increase 1 step
21	Channel 2 Intensity Control	"0" "1"	Decrease 1 step Increase 1 step
22	Channel 1 Interrupt	"0" "1"	Off On
23	Channel 2 Interrupt	"0" "1"	Off On
24	Reserved for GSI 10		
25	Remote Output Request	"0" "1"	Normal mode: Initiates a data record transfer of the current type selected on the remote dip switches. HL Calibration Mode: Stores the calibration data into EEPROM. All modes: Initiates a data record transfer of the current test type selected on the remote dip switches.
26	Pulsed	"0" "1"	Off On
27	ALTernate	"0" "1"	Off On
28	SISI	"0" "1"	Off On
29	Transducer Type	"0" "1"	Ch 1 Phone Ch 1 Bone

Function Code	Function Group	Function Subgroup	Sub Code Pushbutton/Function
01	Reserved for GSI 10		
02	Channel 1 Stimulus	"0" "1" "2" "3" "4" "5" "6"	Tone NB Noise White Noise Speech Noise Mic Ext A Ext B
03	Reserved for GSI 10		
04	Reserved for GSI 10		
05	Channel 2 Stimulus	"0" "1" "2" "3" "4" "5" "6"	Tone NB Noise White Noise Speech Noise Mic Ext A Ext B
06	Transducer Combinations		Channel 1 / Channel 2
		"0"	Bone / Bone
		"1"	Spk / Spk
		"2"	Spk / Phone
		"3"	Bone / Phone
		"4"	Phone / Phone
		"5"	Phone / Bone
		"6"	Phone / Spk
		"7"	Phone / Insert
		"8"	Bone / Spk
		"9"	Bone / Insert
		"A"	Spk / Bone
		"B"	Spk / Insert
		"C"	Insert / Phone
		"D"	Insert / Bone
		"E"	Insert / Spk
		"F"	Insert / Insert
07	Output Routing Combinations		Channel 1 / Channel 2
		"0"	Left / Right
		"1"	Right / Left
		"2"	Left / Left
		"3"	Right / Right
		"4"	Left/Right / Left/Right
08	Subject Trigger	"0" "1"	No Yes
09	FM	"0" "1"	Off On
10	Interlock	"0" "1"	Off On
11	Tracking	"0" "1"	Off On

Function Code	Function Group	Function Subgroup	Sub Code Pushbutton/Function
29 continued	Transducer Type	"2" "3" "4" "5" "6" "7"	Ch 1 Spk Ch 1 Insert Ch 2 Phone Ch 2 Bone Ch 2 Spk Ch 2 Insert
30	Routing	"0" "1" "2" "3" "4" "5"	Ch 1 Left Ch 1 Right Ch 1 Left/Right Ch 2 Left Ch 2 Right Ch 2 Left/Right
31	SISI/ HL Control Step Size	"0" "1" "2"	dB dB dB
32	Monitor Speaker	"0" "1"	Off On
33	Calibration Mode	"0" "1"	Exit to Normal Mode Enter HL Calibration Mode
34	Scorer/Timer	"0" "1" "2"	Correct/Start Clear/Clear Incorrect/Stop
35	Print	"0"	
	Data Erase	"0"	
37	Talk Forward	"0" "1"	Off On
38	Talk Forward Level	"0" "1" "2" "3"	45 dB 60 dB 75 dB 90 dB
39	Oscillator Control	"0" "1"	Turn Oscillator off Turn Oscillator on
40	Screen Display	"0" "1" "2"	Status display Audiogram display High Freq. Audiogram Display
41	Save	"0"	
42	Frequency range	"0" "1"	High Freq. (8000 - 20000 Hz) Normal Freq. (125 - 12000 Hz)
43	Transmit Unit ID record	"0"	

Function Code	Function Group	Function Subgroup	Sub Code Pushbutton/ Function
44	Transmit Unit configuration record	"0"	
45	Load Default Data	"0" "1" "2"	Load HL configuration default data Load Self Calibration default data Load all default data
46	Perform Self-Cal	"0"	
47	Data Transfer	"0" "1" "2" "3"	Transmit a data output record in the following format: (Spare format, currently defaults to "3") GSI 16 Compatible Short Data Record GSI 61 Short Data Record Test Battery Data Record
48	Enter Diagnostic Mode	"0" "1" "2" "3" "4"	Exit to Normal Mode Enter Push Button Diagnostic Enter Display Diagnostic Enter H/W diagnostic Enter Loopback diagnostic

Input Record Type 6 - Set Test Frequency Record

This record is used to set the frequency of the oscillator to the standard audiometric low and high frequencies in the Normal, HL Calibration and SISI Calibration modes. This record type is invalid in the Pushbutton diagnostic, Display diagnostic and Loopback diagnostic modes. Non-standard frequencies, frequencies outside the current range or frequencies invalid for the current transducer are invalid and will result in an error record being transmitted. Frequencies greater than 12 kHz are invalid if the GSI 16 compatible record format is selected and will also result in an error record being transmitted.

Character Offset	Number of Characters	Field Name	Field Description
0	1	Record Prefix	":"
1	1	Record Type	"6"
2	2	Function Code	"01"
4	5	Test Frequency	Format: Frequency value in Hz (i.e. 750 Hz = "_750") Range: Low Freq. - 125 Hz to 12 kHz High Freq. - 8 kHz to 20 kHz Resolution: Standard Audio frequencies
9	2	Record Terminator	"CR", "LF"

Input Record Type 7 - Set HL Record

This record varies based on the operating mode indicated below. This record type is invalid in the Pushbutton Diagnostic, Display Diagnostic and Loopback Diagnostic modes and will result in an error record being transmitted.

Character Offset	Number of Characters	Field Name	Field Description
0	1	Record Prefix	":"
1	1	Record Type	"7"
2	2	Function Code	"01"= Ch 1 "02"= Ch 2
4	4	HL Value	Format HL value with 1 implied decimal position (i.e., 20 dB HL = "_200") Range: Low Frequency: -10 to 120 dB HL High Frequency: -20 to 100 dB HL Resolution: 1 dB
8	2	Record Terminator	"CR", "LF"

Remote Output Operation

These records are sent by the GSI 61 to the remote computer to transfer parameter or status information. During the time that an output record is being sent and transmitted, the Data Transfer indicator is displayed on the LCD panel. The indication displays for a minimum of 0.5 seconds.

Output Record Type 1 - GSI 16 Compatible Short Data Record

Character Offset	Number of Characters	Field Name	Field Description
0	1	Record Prefix	":"
1	1	Record Type	"1"
2	1	Test Type	"0"= Tone test "1"=Speech test "3"=SISI test "4"=Alternate test
3	1	Ch 1 Stimulus	"1"=Tone "2"=NB Noise "3"=White Noise "4"=Speech Noise "5"=Mic "6"=Ext A "7"=Ext B
4	1	Zero Field	"0"
5	1	SISI	"0"=None/Off "1"=Reserved for GSI 10 "2"=On with 1 dB step size "3"=On with 2 dB step size

Character Offset	Number of Characters	Field Name	Field Description
5 continued	1	SISI	"4"=Reserved for GSI 10 "5"=On with 5 dB step size
6	1	Timing	"0"=None/Steady "1"=Reserved for the GSI 10 "2"=Pulsed 200/200 msec on/off
7	2	Zero Field	"00"
9	1	Ch 2 Stimulus	"1"=Tone "2"=NB Noise "3"=White Noise "4"=Speech Noise "5"=Mic "6"=Ext A "7"=Ext B
10	1	Transducer Type	Ch 1 / Ch 2 "1"=Bone Bone "2"=Spk Spk "3"=Spk Phone "4"=Bone Phone "5"=Phone Phone "6"=Bone Spk "7"=Bone Insert "8"=Spk Bone "9"=Spk Insert "A"=Phone Bone "B"=Phone Spk "C"=Phone Insert "D"=Insert Bone "E"=Insert Spk "F"=Insert Phone "G"=Insert Insert
11	1	Output Routing	Ch1 / Ch2 "0"=None None "1"=Left Right "2"=Right Left "3"=Left Left "4"=Right Right "5"=LR LR "6"=Left LR "7"=Right LR "8"=LR Left "9"=LR Right "A"=None Left "B"=None Right "C"=Left None "D"=Right None
12	1	Subject Response	"0"=Released "1"=Pressed
13	1	FM	"0"= Off "1"= On
14	1	Interlock	"0"= Off "1"= On

Character Offset	Number of Characters	Field Name	Field Description
15	1	Tracking	"0"= Off "1"= On
16	2	Zero Field	"00"
18	1	HL Step Size	"1"= 1 dB "2"= Reserved for GSI 10 "3"= 5 dB "4"= 2 dB
19	4	Ch 1 Numeric HL Display Data	"-100" to "1200" Range: -10.0 to 120.0 dB
23	1	Ch 1 Interrupt	"0"= Off "1"= On
24	4	Ch 2 Numeric HL Display Data	"-100" to "1200" Range: - 10.0 to 120.0 dB
28	1	Ch 2 Interrupt	"0"= Off "1"= On
29	5	Frequency Display Data	"__125" to "12000" Range: 125 to 12000 Hz in standard audiometric frequencies
34	6	Zero Field	"000000"
40	2	Checksum	See page 14-3; Checksums
42	2	Record Terminator	"CR", "LF"

Output Record Type 4 - Error Record

Contains information on the type of error which has occurred. The types of errors which would result in an Error Record are:

- System errors
- Input record which has an incorrect format or is invalid for the current operating mode
- Pushbutton operation commands which are invalid

Character Offset	Number of Characters	Field Name	Field Description
0	1	Record Prefix	":"
1	1	Record Type	"4"
2	2	Error Code	See next table; Error Codes
4	2	Checksum	See page 14-3; Checksums
6	2	Record Terminator	"CR", "LF"

Error Record Codes

Error Code	Error Description
01	Invalid ASCII character in an input record
02	Invalid number of characters in an input record
03	Invalid input record type
04	Invalid input record function code
05	Invalid input record function sub code
06	Reserved
07	Invalid Set Frequency record Frequency value
08	Invalid Set HL record HL value
09	Invalid machine conditions for GSI 61 compatible data
10	Generic NACK in response to an invalid input record
11	Invalid Start-of Record: when receiving unexpected characters
12	Overrun of GSI 61 UART
13	Invalid combination of Basic Speakers and Booster Amp
14	Invalid HL; requested HL cannot be provided due to attenuator limits.
15	Printing aborted by keypad.
16	Printing was unsuccessful due to communications or printer problem.

Output Record Type 5 - GSI 61 Short Data Record

Contains the current state of all instrument parameters, including the expanded frequency and HL ranges of the GSI 61. This record is not GSI 16 compatible.

Character Offset	Number of Characters	Field Name	Field Description
0	1	Record Prefix	":"
1	1	Record Type	"5"
2	1	Test Type	"0"= Tone test "1"= Speech test "2"= SISI test "3"= Alternate test
3	1	Ch 1 Stimulus	"1"= Tone "2"= NB Noise "3"= White Noise "4"= Speech Noise "5"= Mic "6"= Ext A "7"= Ext B
4	1	Zero Field	"0"
5	1	SISI	"0" = None/Off "1" = Reserved for GSI 10 "2" =On with 1 dB step size "3" =On with 2 dB step size "4"= Reserved for GSI 10 "5" =On with 5 dB step size
6	1	Timing	"0" = None/Steady "1" = Reserved for the GSI 10 "2" =Pulsed 200/200 msec on/off

Character Offset	Number of Characters	Field Name	Field Description
7	2	Zero Field	"00"
9	1	Ch 2 Stimulus	"1"= Tone "2"= NB Noise "3"= White Noise "4"= Speech Noise "5"= Mic "6"= Ext A "7"= Ext B
10	1	Transducer Type	Ch 1 / Ch 2 "1"= Bone / Bone "2"= Spk / Spk "3"= Spk / Phone "4"= Bone / Phone "5"= Phone / Phone "6"= Bone / Spk "7"= Bone / Insert "8"= Spk / Bone "9"= Spk / Insert "A" = Phone / Bone "B" = Phone / Spk "C" = Phone / Insert "D" = Insert / Bone "E" = Insert / Spk "F" = Insert / Phone "G" = Insert / Insert
11	1	Output Routing	Ch1 / Ch2 "0" =None / None "1" =Left / Right "2" =Right / Left "3" =Left / Left "4" =Right / Right "5" =LR / LR "6" =Left / LR "7" =Right / LR "8" =LR / Left "9" =LR / Right "A" =None / Left "B" =None / Right "C" =Left / None "D" =Right / None
12	1	Subject Response	"0" = Released "1" = Pressed
13	1	FM	"0" = Off "1" = On
14	1	Interlock	"0" = Off "1" = On
15	1	Tracking	"0" = Off "1" = On
16	2	Zero Field	"00"

Character Offset	Number of Characters	Field Name	Field Description
18	1	HL Step Size	"1" = 1 dB "2" = Reserved for GSI 10 "3" = 5 dB "4" = 2 dB
19	4	Ch 1 Numeric HL Display Data	"-200" to "1000" Range: -20.0 to 100.0 dB
23	1	Ch 1 Interrupt	"0" = Off "1" = On
24	4	Ch 2 Numeric HL Display Data	"-200" to "1000" Range: - 20. 0 to 100.0 dB
28	1	Ch 2 Interrupt	"0" = Off "1" = On
29	5	Frequency Display Data	"__125" to "20000" Range: 125 to 20000 Hz in standard audiometric frequencies
34	5	Timer Value	Elapsed time in seconds. Range: "____0" to "12000" seconds
39	3	Scorer # Correct Value Zero	Number of correct Speech Test responses. Range: "__0" to "100"
42	3	Scorer Total Value	Total number of Speech Test presentations. Range: "__0" to "100"
45	2	Checksum	See page 14-3; Checksums
47	2	Record Terminator	"CR", "LF"

Output Record Type 6 - Test Battery Data Record

Contains all left and right ear test data currently stored in the test data memory. This record is not GSI 16 compatible.

Character Offset	Number of Characters	Data Type	Field Name	Field Description
Record Prefix				
0	1	ASCII	Record Prefix	":"
1	1	ASCII	Record Type	"6"
Left Ear Test Data - Pure Tone				
2	4	slnt	Pure Tone Test - 125 Hz Air Conduction Threshold- Test Ear	-20 to 120 dB x 2 NR = 260 to 540 NT =32768 (0x8000)

Character Offset	Number of Characters	Data Type	Field Name	Field Description
6	4	slnt	Pure Tone Test - 125 Hz Air Conduction Threshold- Masking Ear	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0x8000)
10	4	slnt	Pure Tone Test - 125 Hz Bone Conduction Threshold- Test Ear	-20 to 120 NR = 260 to 540 NT = 32768 (0x8000)
14	4	slnt	Pure Tone Test - 125 Hz Bone Conduction Threshold- Masking Ear	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0x8000)
18	4	slnt	Pure Tone Test - 125 Hz Sound Field	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0x8000)
22	20		Pure Tone Test - 250 Hz	See Pure Tone Test - 125 Hz fields
42	20		Pure Tone Test - 500 Hz	See Pure Tone Test - 125 Hz fields
62	20		Pure Tone Test - 750 Hz	See Pure Tone Test - 125 Hz fields
82	20		Pure Tone Test - 1 kHz	See Pure Tone Test - 125 Hz fields
102	20		Pure Tone Test - 1.5 kHz	See Pure Tone Test - 125 Hz fields
122	20		Pure Tone Test - 2 kHz	See Pure Tone Test - 125 Hz fields
142	20		Pure Tone Test - 3 kHz	See Pure Tone Test - 125 Hz fields
162	20		Pure Tone Test - 4 kHz	See Pure Tone Test - 125 Hz fields
182	20		Pure Tone Test - 6 kHz	See Pure Tone Test - 125 Hz fields
202	20		Pure Tone Test - 8 kHz Low Freq	See Pure Tone Test - 125 Hz fields
222	20		Pure Tone Test - 12 kHz	See Pure Tone Test - 125 Hz fields
242	20		Pure Tone Test - 8 kHz High Freq	See Pure Tone Test - 125 Hz fields
262	20		Pure Tone Test - 9 kHz	See Pure Tone Test - 125 Hz fields

Character Offset	Number of Characters	Data Type	Field Name	Field Description
282	20		Pure Tone Test - 10 kHz	See Pure Tone Test - 125 Hz fields
302	20		Pure Tone Test - 11.2 kHz	See Pure Tone Test - 125 Hz fields
322	20		Pure Tone Test - 2.5 kHz	See Pure Tone Test - 125 Hz fields
342	20		Pure Tone Test - 14 kHz	See Pure Tone Test - 125 Hz fields
362	20		Pure Tone Test - 16 kHz	See Pure Tone Test - 125 Hz fields
382	20		Pure Tone Test - 18 kHz	See Pure Tone Test - 125 Hz fields
402	20		Pure Tone Test - 20 kHz	See Pure Tone Test - 125 Hz fields
422	2	uChar	Bone Vibrator Calibration	"_0" = Forehead "_1" = Mastoid

Speech Test

424	4	sInt	Speech Test - Test Ear Threshold	-20 to 120 dB x 2 NR = 260 to 540 NT= 32768 (0x8000)
428	4	sInt	Speech Test - Masking Ear Threshold	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0x8000)
432	2	uChar	Speech Test - Masking Type	"_0"= None "_1"= White Noise "_2"= Speech Noise "_3"= Ext A "_4"= Ext B
434	2	uChar	Speech Test - Number Presented	_0 to 100
436	2	uChar	Speech Test - Number Correct	_0 to 100

SISI Test

438	4	sInt	SISI Test - 125 Hz Test Ear Threshold	_-20 to 120 dB HL x 2 NR = 260 to 540 NT = 32768 (0x8000)
442	2	uChar	SISI Test - 125 Hz Pulse Height	"_0" = 5 dB "_1" = 2 dB "_2" = 1 dB
444	2	uChar	SISI Test - 125 Hz Number Presented	_0 to 100

Character Offset	Number of Characters	Data Type	Field Name	Field Description
446	2	uChar	SISI Test - 125 Hz Number Correct	_0 to 100
448	10		SISI Test - 250 Hz	See SISI Test - 125 Hz Fields
458	10		SISI Test - 500 Hz	See SISI Test - 125 Hz Fields
468	10		SISI Test - 750 Hz	See SISI Test - 125 Hz Fields
478	10		SISI Test - 1 kHz	See SISI Test - 125 Hz Fields
488	10		SISI Test - 1.5 kHz	See SISI Test - 125 Hz Fields
498	10		SISI Test - 2 kHz	See SISI Test - 125 Hz Fields
508	10		SISI Test - 3 kHz	See SISI Test - 125 Hz Fields
518	10		SISI Test - 4 kHz	See SISI Test - 125 Hz Fields
528	10		SISI Test - 6 kHz	See SISI Test - 125 Hz Fields
538	10		SISI Test - 8 kHz Low Frequency	See SISI Test - 125 Hz Fields
548	10		SISI Test - 12 kHz	See SISI Test - 125 Hz Fields
558	10		SISI Test - 8 kHz High Frequency	See SISI Test - 125 Hz Fields
568	10		SISI Test - 9 kHz	See SISI Test - 125 Hz Fields
578	10		SISI Test - 10 kHz	See SISI Test - 125 Hz Fields
588	10		SISI Test - 11.2 kHz	See SISI Test - 125 Hz Fields
598	10		SISI Test - 12.5 kHz	See SISI Test - 125 Hz Fields
608	10		SISI Test - 14 kHz	See SISI Test - 125 Hz Fields
618	10		SISI Test - 16 kHz	See SISI Test - 125 Hz Fields
628	10		SISI Test - 18 kHz	See SISI Test - 125 Hz Fields

Character Offset	Number of Characters	Data Type	Field Name	Field Description
638	10		SISI Test - 20 kHz	See SISI Test - 125 Hz Fields

Alternate (ABLB)

648	4	slnt	Alternate Test - 125 Hz Test Ear Threshold	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0x8000)
652	4	slnt	Alternate Test - 125 Hz Masking Ear Threshold	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0x8000)
656	8		Alternate Test - 250 Hz	See Alternate Test - 125 Hz fields
664	8		Alternate Test - 500 Hz	See Alternate Test - 125 Hz fields
672	8		Alternate Test - 750 Hz	See Alternate Test - 125 Hz fields
680	8		Alternate Test - 1kHz	See Alternate Test - 125 Hz fields
688	8		Alternate Test - 1.5 kHz	See Alternate Test - 125 Hz fields
696	8		Alternate Test - 2 kHz	See Alternate Test - 125 Hz fields
704	8		Alternate Test - 3 kHz	See Alternate Test - 125 Hz fields
712	8		Alternate Test - 4 kHz	See Alternate Test - 125 Hz fields
720	8		Alternate Test - 6 kHz	See Alternate Test - 125 Hz fields
728	8		Alternate Test - 8 kHz Low Frequency	See Alternate Test - 125 Hz fields
736	8		Alternate Test - 12 kHz	See Alternate Test - 125 Hz fields
744	8		Alternate Test - 8 kHz High Frequency	See Alternate Test - 125 Hz fields
752	8		Alternate Test - 9 kHz	See Alternate Test - 125 Hz fields
760	8		Alternate Test - 10 kHz	See Alternate Test - 125 Hz fields
768	8		Alternate Test - 11.2 kHz	See Alternate Test - 125 Hz fields

Character Offset	Number of Characters	Data Type	Field Name	Field Description
776	8		Alternate Test - 12.5 kHz	See Alternate Test - 125 Hz fields
784	8		Alternate Test - 14 kHz	See Alternate Test - 125 Hz fields
792	8		Alternate Test - 16 kHz	See Alternate Test - 125 Hz fields
800	8		Alternate Test - 18 kHz	See Alternate Test - 125 Hz fields
808	8		Alternate Test - 20 kHz	See Alternate Test - 125 Hz fields

Right Ear Test Data

816	814			See Left Ear fields

Record Terminator

1630	2	uChar	Checksum	See page 14-3; Checksums
1632	2	ASCII	Record Terminator	"CR", "LF"

Note: HL threshold values are transmitted as hexadecimal values scaled by 2.

Output Record Type 7 - Instrument Type

Contains the instrument type and software version information. This record is not GSI 16 compatible.

Character Offset	Number of Characters	Field Name	Field Description
0	1	Record Prefix	":"
1	1	Record Type	"7"
2	2	Instrument Type	"04"
4	5	Software Revision	"xx.xx"
9	2	Checksum	See page 14-3; Checksums
11	2	Record Terminator	"CR", "LF"

Output Record Type 8 - Unit Configuration Record

Contains the information on Dip Switch configuration selections. This record is not GSI 16 compatible.

Character Offset	Number of Characters	Field Name	Field Description
0	1	Record Prefix	":"
1	1	Record Type	"8"
2	1	NBN Offset	"0" = Custom Narrow Band Noise offsets in use "1" = Standard Narrow Band Noise offsets in use
3	1	WN Offsets	"0" = Custom White Noise offsets in use "1" = Standard White Noise offsets in use
4	1	Insert Phone Type	"0" = Paired EARTone "1" = single insert phone in use
5	1	Speaker Type	"0" = Basic "1" = High Performance
6	1	Booster Amp	"0" = Not in use "1" = Booster Amp in use
7	1	Bone Vibrator Calibration	"0" = Forehead "1" = Mastoid
8	1	Speech Filter	"0" = Not in use "1" = Speech filter on use
9	1	Language	"0" = English "1" = French "2" = German "3" = Italian "4" = Spanish
10	1	High Frequency Phone Type	"0" = Other "1" = Sennheiser
11	1	Phone Coupler Type	"0" = NBS 9A "1" = IEC 318
12	1	Insert Phone Coupler Type	"0" = IEC 126 (HA1/HA2) "1" = IEC 711
13	1	Speaker Azimuth Calibration	"0" = 0 degrees "1" = 45 degrees
14	1	High Frequency Option	"0" = installed "1" = Not installed
15	1	Speech Calibration	"0" = Custom "1" = Standard

Character Offset	Number of Characters	Field Name	Field Description
16	2	Checksum	See page 14-3; Checksums
18	2	Record Terminator	"CR", "LF"

Printer Protocol

Printer output forms are selected by switch **S2,** a four-switch DIP located next to the printer output jack.

A switch is "ON" when the switch toggle is in the UP position.

See the GSI 61 User's Manual for further information.

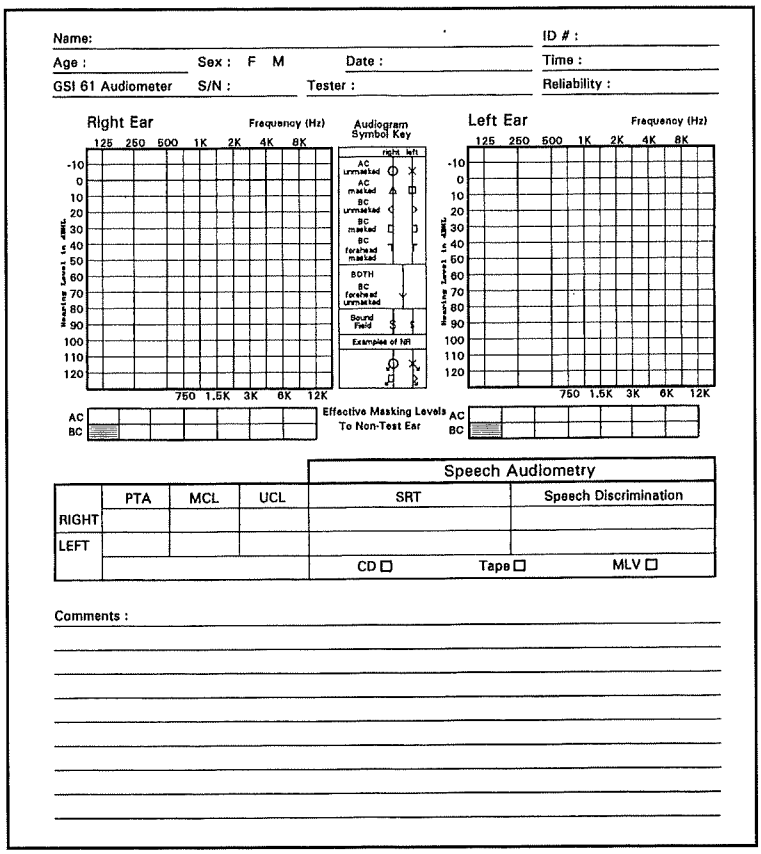
Table 1 - Printer Output Form Selections

S2 Switch Position

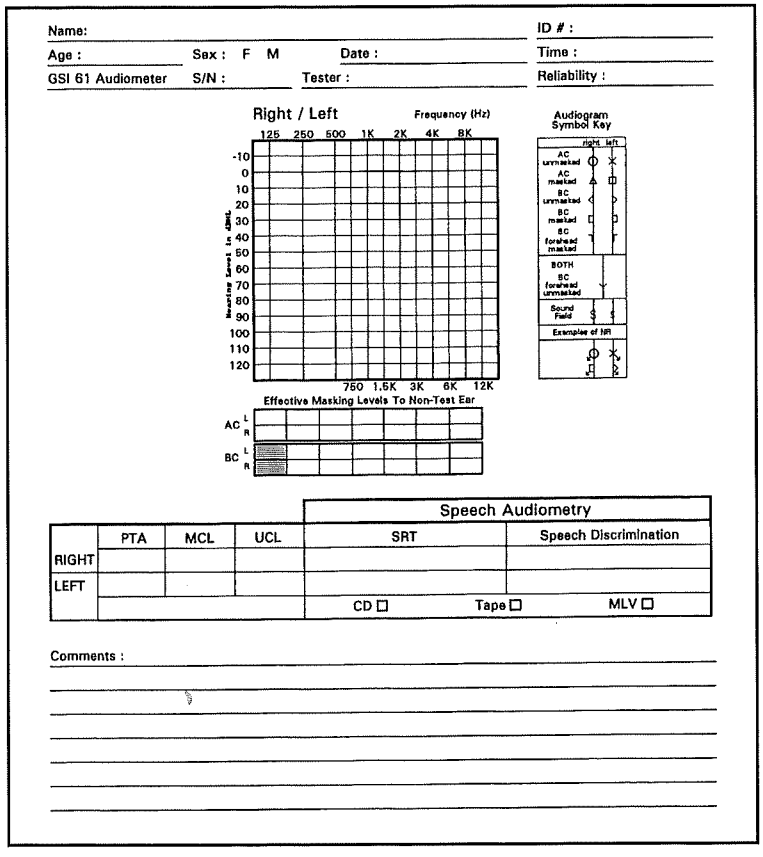
1	**ON** **OFF**	Overlaid Left & Right Audiograms Separate Left & Right Audiograms
2	**ON** **OFF**	Black&White Printing Color Printing
3		Not Used
4		Not Used

Printer Output Formats

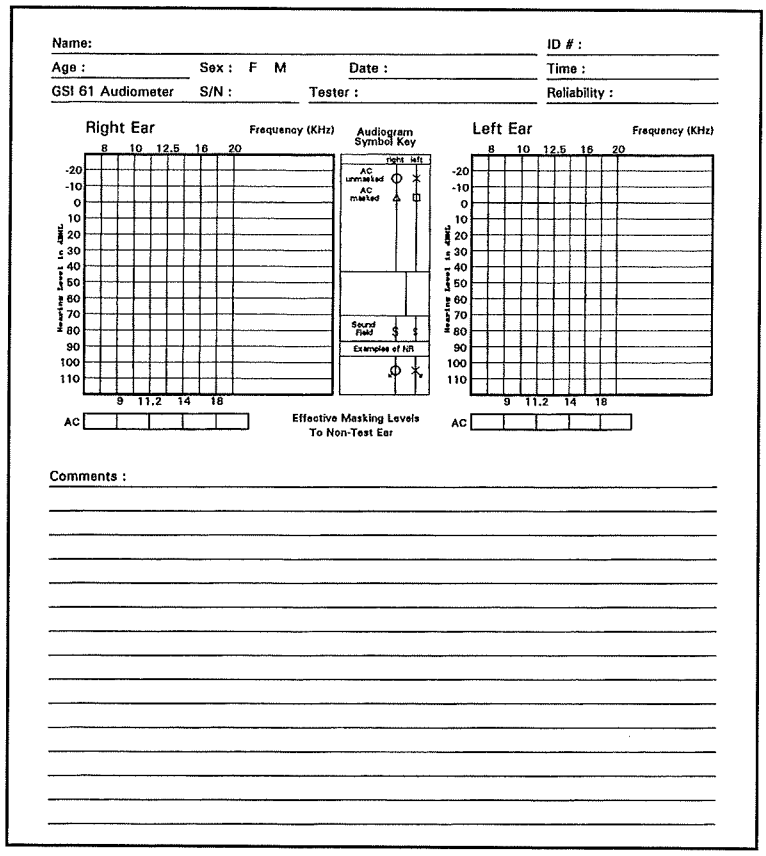
Low Frequency Dual Audiogram Format



Low Frequency Combined Audiogram Format



High Frequency Dual Audiogram Format



High Frequency Combined Audiogram Format