

**GPIB
INTERFACE
SEC - 1065
SER - 1066
SECTION**



PROGRAMMED TEST SOURCES, inc.
Littleton, Massachusetts, USA.

GPIB INTERFACE SECTION

Table of Contents

	Page
Condensed Programming Instructions	ii
Introduction.....	1
Functional Overview.....	1
Specifications.....	2
IEEE 488 Interface Function Capability Code.....	2
IEEE 488 Connector Pin Assignments.....	2
Installation.....	3
Setting the Listen Mode.....	3
Setting the Listen Address.....	3
Figure 1: Six -position Listen Mode and Address Selection DIP Switch.....	3
Table 1: Listen Address Switch Settings.....	4
Operation.....	5
Overview.....	5
Initialization.....	5
Programming Instrument Functions.....	6
Table 2: Common ASCII Codes.....	7
GPIB Data Rate and Instrument Switching Time.....	8
Phase Rotation Programming.....	9
Type 1 Instruments without Optional Phase Rotation.....	9
Type 1 Instruments with Optional Phase Rotation.....	9
Type 2 Instruments with Optional Phase Rotation.....	9
Table 3: Phase Rotation Programming.....	10
Programming Examples.....	11
Service.....	13
Maintenance.....	13
Troubleshooting.....	13
Parts Lists.....	14
Table 1: Listen Address Switch Settings.....	4
Table 2: Common ASCII Codes.....	7
Table 3: Phase Rotation Programming.....	10
Figure 1: Six -position Listen Mode and Address Selection DIP Switch.....	3
Figure 2: SEC 1065 Schematic.....	18
Figure 3: SER 1066 Schematic.....	19

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Condensed Programming Instructions

1. **General:** The SEC-1065/SER-1066 GPIB interface option provides remote control of PTS model 310 synthesizers via the GPIB bus. Frequently, signal level and phase rotation can be set via bus commands. This option replaces the standard BCD-TTL parallel remote control interface.

2. **Capability Code:** IEEE 488.1-1987; SH0, AH1, T0, L1, SR0, RL2, PP0, DC0, DT0, C0, E1

3. **Addressing:** Address switch selectable to any one of 31 standard listen addresses; switch selectable Listen Only or Addressed modes.

4. **Programming:** **Frequency** - A string starting with letter F (ASCII 70) or f (ASCII 102) followed by numerals. If less than 9 numerals are used, zero value is assumed for omitted high order digits.

Examples: F101 510 000 sets 101.51 MHz
 F125 400 sets 125.4 KHz

Signal Level - A string starting with letter A (ASCII 65) or a (ASCII 97) followed by 1 digit representing attenuation in 1 dB steps referenced from full output (+13 dBm, 1V into 50 ohms).

Examples: A9 sets -9 dB from full output
 A0 sets full output

Phase Rotation - A string starting with letter D (ASCII 68) or d (ASCII 100) followed by numerals. If less than 3 numerals are used, zero value is assumed for omitted high order digits.

Examples: D400 sets rotation 400 (according to option)
 D1 sets rotation 001

Other - Go to Local is implemented, but also as device-dependent command by transmitting ASCII code 1.

Terminator - All commands must be terminated by either LF (ASCII 10) or CR (ASCII 13).

5. **Transfer Rate:** Internally limited to 1 μ second per character. No internal limit for instrument switching speed; user must insert appropriate delay prior to next command.

6. **Connector:** IEEE 488 24 pin female connector.

Introduction

The GPIB interface section consists of the SEC-1065 (Serial Control) and SER-1066 (Serial Register) modules. These modules provide the necessary hardware and control logic to remotely program an instrument via the GPIB (General Purpose Interface Bus) in accordance with the ANSI/IEEE Std 488.1-1987.

The SEC and SER modules are unique and may not be interchanged with any other modules in the instrument. The two modules are piggy-backed and interconnected through a connector. Together, the boards are mechanically fastened to the instrument rear panel by four screws. The SEC module faces to the rear and contains a standard 24-pin GPIB connector and a six-position DIP switch for address and listen-mode selection. The SER module connects internally to the rest of the instrument through two header strips: one for frequency and amplitude control, and a second for phase rotation control.

Functional Overview

The basic data transfer on the GPIB is bit parallel, byte serial (one byte at a time), under the direction of a GPIB controller. The user typically provides the controller with information on the address of an instrument to be controlled, and any instrument-specific (also called device-dependent) instructions. The controller (or control program) will then generate a string of characters containing the ASCII codes for addressing the instrument and performing the instrument-specific function, and transmit these in conformance with the IEEE 488 timing and handshaking specifications.

A PTS synthesizer equipped with the GPIB interface acts as a **basic listener** device. The standard **LISTEN ONLY** and **ADDRESSED** modes of operation are supported. In the LISTEN ONLY mode, all valid commands are accepted without regard to device address; in the ADDRESSED mode, only commands preceded by the instrument's selectable address are executed.

In addition to LOCAL/REMOTE mode control, PTS's GPIB interface has the capability to perform three synthesizer-specific (or device-dependent) functions through appropriate commands issued over the GPIB: setting the output frequency, setting the output signal level, and setting phase rotation (for instruments equipped with a phase-rotation option).

SPECIFICATIONS

IEEE 488 Interface Function Capability Code

Code	Description	Capability
SH0	Source Handshake	None
AH1	Acceptor Handshake	Complete
T0	Talk	None
L1	Listen	Basic listener & Listen Only
SR0	Service request	None
RL2	Remote/Local	No local lockout
PP0	Parallel poll	None
DC0	Device Clear	None
DT0	Device Trigger	None
C0	Controller	None
E1	Driver type	Open collector drivers

IEEE 488 Connector Pin Assignments

PIN	SIGNAL	FUNCTION	BUS
1	DIO1	Data Bit 1	data bus
2	DIO2	Data Bit 2	data bus
3	DIO3	Data Bit 3	data bus
4	DIO4	Data Bit 4	data bus
5	EOI	End or Identify	management bus (inactive)
6	DAV	Data Valid	byte transfer bus
7	NRFD	Not Ready For Data	byte transfer bus
8	NDAC	Not Data Accepted	byte transfer bus
9	IFC	Interface Clear	management bus
10	SRQ	Service Request	management bus (inactive)
11	ATN	Attention	management bus
12	SHIELD	Shield	
13	DIO5	Data Bit 5	data bus
14	DIO6	Data Bit 6	data bus
15	DIO7	Data Bit 7	data bus
16	DIO8	Data Bit 8	data bus
17	REN	Remote Enable	management bus
18	GND	Ground return for DAV	
19	GND	Ground return for NRFD	
20	GND	Ground return for NDAC	
21	GND	Ground return for IFC	
22	GND	Ground return for SRQ	
23	GND	Ground return for ATN	
24	GND	Logical ground	

All functions are negative true, TTL logic compatible.

Levels: Low +0.8V max
 High +2.0V min

Installation

For remote synthesizer operation, connection to an operating GPIB bus and selection of a valid listen address are required. Connect the GPIB bus cable to the 24-pin GPIB connector located on the instrument rear panel. Tighten the connector interlocking screws to insure that the cable and connector are properly and fully engaged.

Setting the Listen Mode

The listen mode (LISTEN ONLY or ADDRESSED) is selected via switch 6 on the six-pin DIP switch located next to the GPIB connector. Set switch 6 to the desired listen mode; position **LON** corresponds to the **LISTEN ONLY** mode, and position **ADD** corresponds to the **ADDRESSED** mode. (See the **Operation** section for a discussion of the LISTEN ONLY and ADDRESSED listen modes.)

If it is necessary to change the listen mode, the instrument's power should be turned off, the listen mode changed, and then power reapplied. This will insure that the interface is properly reset to the new listen mode.

Setting the Listen Address

The listen address is selected via switches 1 through 5 on the six-pin DIP switch located next to the GPIB connector. Set switches 1 (labelled with binary weight **1**) through 5 (labelled with binary weight **16**) to the appropriate listen address according to **Table 1: Listen Address Switch Settings** (page 4). Note that address 31 is reserved for the "UNLISTEN" command, and must **not** be used as a Listen address. Be certain that the LISTEN ADDRESS selected is not assigned to any other instrument connected to the GPIB.

Figure 1: Six-position Listen Mode and Address Selection DIP Switch

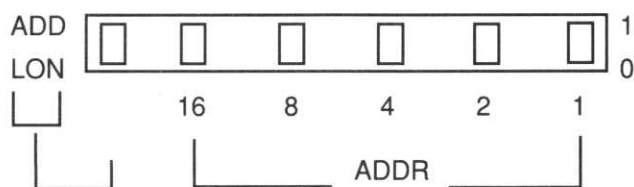


Table 1: Listen Address Switch Settings

User-Selected <u>ADDRESS</u> (5 bits)	Internal <u>MLA</u> (7 bits)	Equivalent <u>ASCII Character</u> (7 bits)	Switch Settings				
			16	8	4	2	1
0	32	SP	0	0	0	0	0
1	33	!	0	0	0	0	1
2	34	"	0	0	0	1	0
3	35	#	0	0	0	1	1
4	36	\$	0	0	1	0	0
5	37	%	0	0	1	0	1
6	38	&	0	0	1	1	0
7	39	'	0	0	1	1	1
8	40	(0	1	0	0	0
9	41)	0	1	0	0	1
10	42	*	0	1	0	1	0
11	43	+	0	1	0	1	1
12	44	,	0	1	1	0	0
13	45	-	0	1	1	0	1
14	46	.	0	1	1	1	0
15	47	/	0	1	1	1	1
16	48	0	1	0	0	0	0
17	49	1	1	0	0	0	1
18	50	2	1	0	0	1	0
19	51	3	1	0	0	1	1
20	52	4	1	0	1	0	0
21	53	5	1	0	1	0	1
22	54	6	1	0	1	1	0
23	55	7	1	0	1	1	1
24	56	8	1	1	0	0	0
25	57	9	1	1	0	0	1
26	58	:	1	1	0	1	0
27	59	;	1	1	0	1	1
28	60	<	1	1	1	0	0
29	61	=	1	1	1	0	1
30	62	>	1	1	1	1	0
31	63	?	RESERVED FOR UNLISTEN COMMAND				

NOTE: Address 31 is reserved for the "UNLISTEN" command, and must **not** be used as a Listen address.

Operation

Overview

The GPIB interface supports two listen modes of operation:

- (a) An "addressed" mode where only "addressed commands" (AC-class) and "device-dependent" commands (DD-class), preceded by the instrument's selectable listen address, are executed.
- (b) A "LISTEN ONLY" mode where any valid command is carried out without regard to address.

Only one listen mode is active at any one time, with the active mode selected during the system setup procedure.

In either listen mode, a message or command string must be transferred to the synthesizer to effect some action. In general, the command string must specify:

Instrument address	(if in ADDRESSED mode)
Code letter for desired function	
Numerical value for desired function	(if any)
Command terminator	

Initialization

At power up the settings for frequency and signal level are initialized to zero; when initially going into the remote mode, the user must program a valid frequency (i.e., a non-zero frequency within the instrument's range) to obtain an output signal.

For instruments equipped with standard or optional phase rotation, phase rotation initialization should be performed. For Type 1 instruments with standard phase rotation, the command string "D?00LF" will perform initialization; for Type 1 and Type 2 instruments with optional phase rotation, the command string "D000LF" will perform initialization (see **Phase Rotation Programming**, page 9). Without initialization, phase rotation will be arbitrarily set.

On instruments with front panel controls, the front panel level control must be in the fully counter-clockwise, or disconnected, position for proper operation of the GPIB amplitude function. Also, phase rotation is **not** user-controllable in the LOCAL mode, and is fixed at 0° when operating under local control.

Programming Instrument Functions

The PTS GPIB interface will respond to the following "ADDRESS" (AD-class) and "ADDRESSED COMMAND" (AC-class) interface messages (i.e., commands sent with ATN true):

<u>Mnemonic</u>	<u>Command</u>	<u>Class</u>	<u>ASCII Char.</u>	<u>Decimal Value</u>	<u>Resulting Action</u>
MLA	My Listen Address	AD	SP thru >	32 thru 62	Device listens and goes remote on 1st numeric character.
UNL	Unlisten	AD	?	63	Device unlistens, but stays in remote.
GTL	Go to Local	AC	SOH	1	Returns to local, if in remote; no action if in local.

The PTS GPIB interface will respond to the following "DEVICE-DEPENDENT" (DD class) messages (i.e., commands sent with ATN false):

<u>Function</u>	<u>Command String*</u>	<u>Notes</u>
Set frequency, all 9 digits	F f <9 numerals> LF CR	1st numeral is MSD
Set frequency, 6, 7, or 8 digits	F f < numerals> LF CR	sufficient leading zeros assumed to form 9 digit command
Set output level in -dBv, 10 dB range in 1 dB steps	A a <1 numeral> LF CR	output level = - 1 dB x numeral, referenced from full output
Set phase rotation, all 3 digits	D d < 3 numerals > LF CR	1st numeral is MSD
Set phase rotation, 1 or 2 digits	D d < numerals> LF CR	sufficient leading zeros assumed to form 3 digit command
Return to local mode	SOH LF CR	GTL also implemented as DD command

*where "|" notation separates alternatives and "<>" notation brackets material replaced by user-data; command string coded using ASCII code (see **Table 2: Common ASCII Codes**).

- NOTE:** (1) Each command must be terminated with a **LF** (linefeed) or **CR** (carriage return); this terminator character causes internal transfer of the data and command execution.
- (2) Only one command is permitted per command string, i.e., multiple commands may not be transmitted in the same command string and followed by a single command terminator.

(NOTES continued)

(3) If front panel controls are present, the front panel level control must be in the fully counter-clockwise, or disconnected, position for proper operation of the GPIB amplitude function.

Table 2: Common ASCII Codes

<u>ASCII Character</u>	<u>ASCII Code</u>
GTL	1
SOH	1
LF	10
CR	13
0	48
1	49
2	50
3	51
4	52
5	53
6	54
7	55
8	56
9	57
:	(corresponds to 10*) 58
;	(corresponds to 11*) 59
<	(corresponds to 12*) 60
=	(corresponds to 13*) 61
>	(corresponds to 14*) 62
?	(corresponds to 15*) 63
A	65
D	68
F	70
a	97
d	100
f	102

*Values 10 through 15 are required for programming phase rotation in PTS 310 instruments. Where phase rotation requires programming of a hexadecimal digit in the range 0 - 15, the values 10 - 15 are programmed as indicated in the table.

NOTE: Any ASCII characters not listed in this table are ignored by the GPIB interface. For readability, commas and decimal points may be freely inserted into command strings transmitted to the interface; these characters will be ignored.

GPIB Data Rate and Instrument Switching Time

The IEEE 488 standard allows a maximum **data rate** over the interface bus of 1,000,000 bytes per second. The PTS GPIB interface is capable of operating at this speed during transfer of a command string, with an internal transfer rate of 1 μ second per character received.

However, after receiving a command string terminator character (LF or CR), the instrument's normal **switching time** for the received command must elapse prior to transfer of the next command. For example, after specifying an output frequency switch, between 5 and 20 μ seconds switching time is required before the output signal frequency change is effected (dependent on the digit switched). Refer to specifications in the **System Section** of this manual for detailed information on instrument switching times.

The GPIB interface has an internal clock rate of 1 μ second per character. However, it does **not** include any other timing delays to insure that the switching times are observed; since switching times vary, this is not practical. In addition, there are conditions under which a user may intentionally operate the interface at a faster rate, as when specifying a frequency switch followed immediately by an output level change. In this case, since the output level settling time is significantly longer than the frequency switching time, the fact that the output frequency is not fully settled prior to issuing the level change command is of no consequence, as a longer switching time delay will need to be observed following the output level change.

Phase Rotation Programming

Phase rotation is programmed through the device-dependent phase rotation command (see **Programming Instrument Functions**), with the coding of the command contents as specified in **Table 3: Phase Rotation Programming**, and as shown in the examples below.

Type 1 Instruments without Optional Phase Rotation

These instruments include phase rotation of 0° , 90° , 180° and 270° as standard. Note that:

1. digit 1, which specifies the number of 90° increments to rotate phase (0, 1, 2, or 3), must be coded using hexadecimal **negative true** format (also known as 1's complement format);
2. **negative true** coded 0 = standard **positive true** coded 15;
negative true coded 1 = standard **positive true** coded 14, etc.

Examples	Phase Increment	Command String*	Notes
	0°	D?00	? = 15
	90°	D>00	> = 14
	180°	D=00	= = 13
	270°	D<00	< = 12

Type 1 Instruments with Optional Phase Rotation

These instruments provide phase rotation in 5° increments over the range 0° to 360° .

Examples	Phase Increment	Command String
	0°	D000
	45°	D009
	90°	D100
	180°	D200
	270°	D300
	325°	D311

Type 2 Instruments with Optional Phase Rotation

These instruments provide phase rotation in 0.225° increments over the range 0° to 360° .

Examples	Phase Increment	Command String*	Notes
	0°	D000	
	45°	D200	
	90°	D400	
	180°	D800	
	270°	D<00	< = 12
	325.125°	D>45	> = 14

*Refer to **Table2:Common ASCII Codes** for ASCII codes corresponding to numerals 10 - 15.

Table 3: Phase Rotation Programming

Type 1 Instruments without Optional Phase Rotation

Digit	Phase Increment	Valid Data Range
1 (MSD)	90 ⁰	0 thru 3, coded negative true
2	-	0
3 (LSD)	-	0

Type 1 Instruments with Optional Phase Rotation

Digit	Phase Increment	Valid Data Range
1 (MSD)	90 ⁰	0 thru 3
2	50 ⁰	0 thru 1
3 (LSD)	5 ⁰	0 thru 9

Type 2 Instruments with Optional Phase Rotation

Digit	Phase Increment	Valid Data Range
1 (MSD)	22.5 ⁰	0 thru 15*
2	2.25 ⁰	0 thru 9
3 (LSD)	.225 ⁰	0 thru 9

*Refer to **Table2:Common ACII Codes** for ASCII codes corresponding to numerals 10 - 15.

Programming Examples

Example 1: Assume we want to set a PTS 310 Type 2 instrument with optional 0.225° phase rotation at address 13 to a frequency of 123.456789 MHz, with signal level of -3 dBv, and rotate phase 90°. The complete ASCII string transmitted by the controller to the instrument would be:

	ASCII Data	ASCII Char	ATN	Function	Command Class
Byte 1:	45	-	TRUE	MLA	AD
Byte 2:	70	F	FALSE	DAB 1	DD
Byte 3:	49	1	FALSE	DAB 2	DD
Byte 4:	50	2	FALSE	DAB 3	DD
Byte 5:	51	3	FALSE	DAB 4	DD
Byte 6:	52	4	FALSE	DAB 5	DD
Byte 7:	53	5	FALSE	DAB 6	DD
Byte 8:	54	6	FALSE	DAB 7	DD
Byte 9:	55	7	FALSE	DAB 8	DD
Byte 10:	56	8	FALSE	DAB 9	DD
Byte 11:	57	9	FALSE	DAB 10	DD
Byte 12:	10	LF	FALSE	DAB 11	DD
Byte 13:	65	A	FALSE	DAB 12	DD
Byte 14:	51	3	FALSE	DAB 13	DD
Byte 15:	10	LF	FALSE	DAB 14	DD
Byte 16:	68	D	FALSE	DAB 15	DD
Byte 17:	52	4	FALSE	DAB 16	DD
Byte 18:	48	0	FALSE	DAB 17	DD
Byte 19:	48	0	FALSE	DAB 18	DD
Byte 20:	10	LF	FALSE	DAB 19	DD
Byte 21:	63	?	TRUE	UNL	AD

Management of the ATN line is typically left up to the controller or controlling software, not the end-user directly. Using a computer controller, the actual information transmitted is much more straightforward, as the following examples demonstrate.

Example 2: Example 1 implemented in BASIC on a PET computer/controller would require these program lines:

```
10    OPEN 200,13
20    PRINT#200, "F123456789"
30    PRINT#200, "A3"
40    PRINT#200, "D400"
```

A subsequent change in level to 0 dBv would be commanded as follows:

```
50    PRINT#200, "A0"
```

A return to local control would be commanded as follows:

```
60    PRINT#200, CHR$(1)
```

NOTE: In this example with the PET/BASIC language, the PRINT#200 statements automatically generate the appropriate MLA byte, append the terminator character LF, and transmit the UNL byte.

Example 3: Example 1 implemented in BASICA on an IBM-compatible* computer with the National Instruments Corp. GPIB-PC** package would require these program lines (the GPIB-PC talk address is 64 or ASCII @):

```
10    CMD$="?@-"      'REM: UNL MTA MLA
20    CALL IBCMD(BRD%,CMD$)
30    CMD$="F123456789" + CHR$(10)
40    CALL IBWRT(BRD%,CMD$)
50    CMD$="A3" + CHR$(10)
60    CALL IBWRT(BRD%,CMD$)
70    CMD$="D400" + CHR$(10)
80    CALL IBWRT(BRD%,CMD$)
90    CMD$="-?"      'REM: UNT UNL
100   CALL IBCMD(BRD%,CMD$)
```

*IBM is a trademark of International Business Machines Corp.

**GPIB-PC is a trademark of National Instruments Corp.

SERVICE

Maintenance

No preventive maintenance is required for the GPIB interface section modules. The presence of a proper output signal with frequency and signal level programmed over the GPIB indicates that the modules are operating properly.

Troubleshooting

If frequency, output level or phase rotation do not operate properly when programmed over the GPIB, return the instrument to local control and verify that the instrument operates correctly. If the instrument does not operate correctly under local control, another module is faulty; follow the **System Section** manual Troubleshooting procedure to locate the faulty module.

If the instrument does operate correctly under local control, either the remote programming commands are incorrect or the GPIB interface is faulty. **A careful and thorough examination of the programming procedure should be undertaken to insure that valid commands are being transmitted; the vast majority of interface-related problems arise because of programming errors.** Insure that a valid address has been assigned to the instrument, and insure that a command terminator (LF or CR) is being transmitted after **each** command. Note that most GPIB software packages do **not** automatically append these terminator characters; they must be appended by the user.

Repair of faulty interface modules in the field is not possible; a faulty module must be exchanged and sent to the factory for repair.

SEC-1065 PARTS LIST

Schematic Designation	Description	PTS P/N
CAPACITORS		
C1	10 nF, 80/20%, 50V, Z5V	23-0103
C2	100 pF, 10%, 500V, X5F	22-0470
C3	100 pF, 10%, 500V, X5F	22-0470
C4	6.8 μ F, El. Tant., 16V	30-5101
C5	47 μ F, El. Tant., 6V	30-5102
C6	50 nF, 80/20%, 50V, Z5V	23-0503
C7	50 nF, 80/20%, 50V, Z5V	23-0503
C8	50 nF, 80/20%, 50V, Z5V	23-0503
C9	50 nF, 80/20%, 50V, Z5V	23-0503
C10	50 nF, 80/20%, 50V, Z5V	23-0503
C11	50 nF, 80/20%, 50V, Z5V	23-0503
RESISTORS		
U10	Resistor network, 28 resistors	66-5001
R1	220 Ω , 5%, .25W	11-0221
R2	1.5K Ω , 1%, .25W	11-0152
R3	2.2K Ω , 5%, .25W	11-0222
R4	6.8K Ω , 5%, .25W	11-0682
R5	15K Ω , 5%, .25W	11-0153
R6	2.2 Ω , 5%, .25W	11-0220
R7	4.7K Ω , 5%, .25W	11-0472
R8	150 Ω , 5%, .25W	11-0151
R9	4.7K Ω , 5%, .25W	11-0472
R10	100 Ω , 5%, .25W	11-0101
R11	4.7K Ω , 5%, .25W	11-0472
R12	4.7K Ω , 5%, .25W	11-0472
R13	4.7K Ω , 5%, .25W	11-0472
R14	4.7K Ω , 5%, .25W	11-0472
R15	4.7K Ω , 5%, .25W	11-0472
R16	4.7K Ω , 5%, .25W	11-0472
R17	4.7K Ω , 5%, .25W	11-0472
R18	2.2K Ω , 5%, .25W	11-0222
R19	4.7K Ω , 5%, .25W	11-0472
R20	1K Ω , 5%, .25W	11-0102
CONNECTORS		
J1	24 contact GPIB, PC mount	78-1024
P1	18 pin header strip from 1 @ 26 pin	79-1003L

SEC-1065 PARTS LIST (Continued)

Schematic Designation	Description	PTS P/N
INTEGRATED CIRCUITS		
U1	7438	60-0038
U2	74LS08	63-0008
U3	74LS112	63-0112
U4	74LS123	63-0123
U5	74LS00	63-0000
U6	74LS14	63-0014
U7	74LS14	63-0014
U8	PAL20L8A	67-5109
U9	93L24	61-0024
U10	Resistor Network	66-5001
U11	74LS14	63-0014
SWITCHES		
S1 - S6	6 PST DIP	87-1008

SER-1066 PARTS LIST

Schematic Designation	Description	PTS P/N
CAPACITORS		
C1	6.8 μ F, El. Tant., 16V	30-5101
C2	6.8 μ F, El. Tant., 16V	30-5101
C3	50 nF, 80/20%, 50V, Z5V	23-0503
C4	50 nF, 80/20%, 50V, Z5V	23-0503
C5	50 nF, 80/20%, 50V, Z5V	23-0503
C6	50 nF, 80/20%, 50V, Z5V	23-0503
C7	50 nF, 80/20%, 50V, Z5V	23-0503
C8	50 nF, 80/20%, 50V, Z5V	23-0503
C9	50 nF, 80/20%, 50V, Z5V	23-0503
C10	50 nF, 80/20%, 50V, Z5V	23-0503
RESISTORS		
R1	470 Ω , 5%, .25W	11-0471
R2	634 Ω , 1%, .25W	14-5108
R3	845 Ω , 1%, .25W	14-5124
R4	1.21K Ω , 1%, .25W	14-5110
R5	2.0K Ω , 5%, .25W	11-0202
R6	4.7K Ω , 5%, .25W	11-0472
R7	100K Ω , 5%, .25W	11-0104
R8	365 Ω , 1%, .25W	14-5107
R9	301 Ω , 1%, .25W	14-5106
R10	243 Ω , 1%, .25W	14-5105
R11	1.0K Ω , 5%, .25W	11-0102
R12	1.0K Ω , 5%, .25W	11-0102
R13	2.2 Ω , 5%, .25W	11-1220
R14	2.2 Ω , 5%, .25W	11-1220
R15	1.0K Ω Pot, 10%, .75W	17-5104
RN1 - RN7	Resistor Network, 2.2K Ω , 2%	66-5002
CONNECTORS		
J1	18 socket female connector strip from 1 @ 20 socket	78-1004
P1	48 pin header strip from 2 @ 26 pin	79-1003
P2	16 pin header strip from 1 @ 26 pin	79-1003

SER-1066 PARTS LIST (Continued)

Schematic Designation	Description	PTS P/N
INTEGRATED CIRCUITS		
U1	74LS145	63-0145
U2	74ALS374	61-5105
U3	74ALS534	61-5106
U4	74ALS374	61-5105
U5	74LS164	63-0164
U6	74LS164	63-0164
U7	74ALS374	61-5105
U8	74LS273	63-0273
U9	74LS08	63-0008
U10	74ALS534	61-5106
U11	74ALS374	61-5105
U12	74LS164	63-0164
U13	74LS164	63-0164
U14	74ALS374	61-5105
U15	74ALS374	61-5105

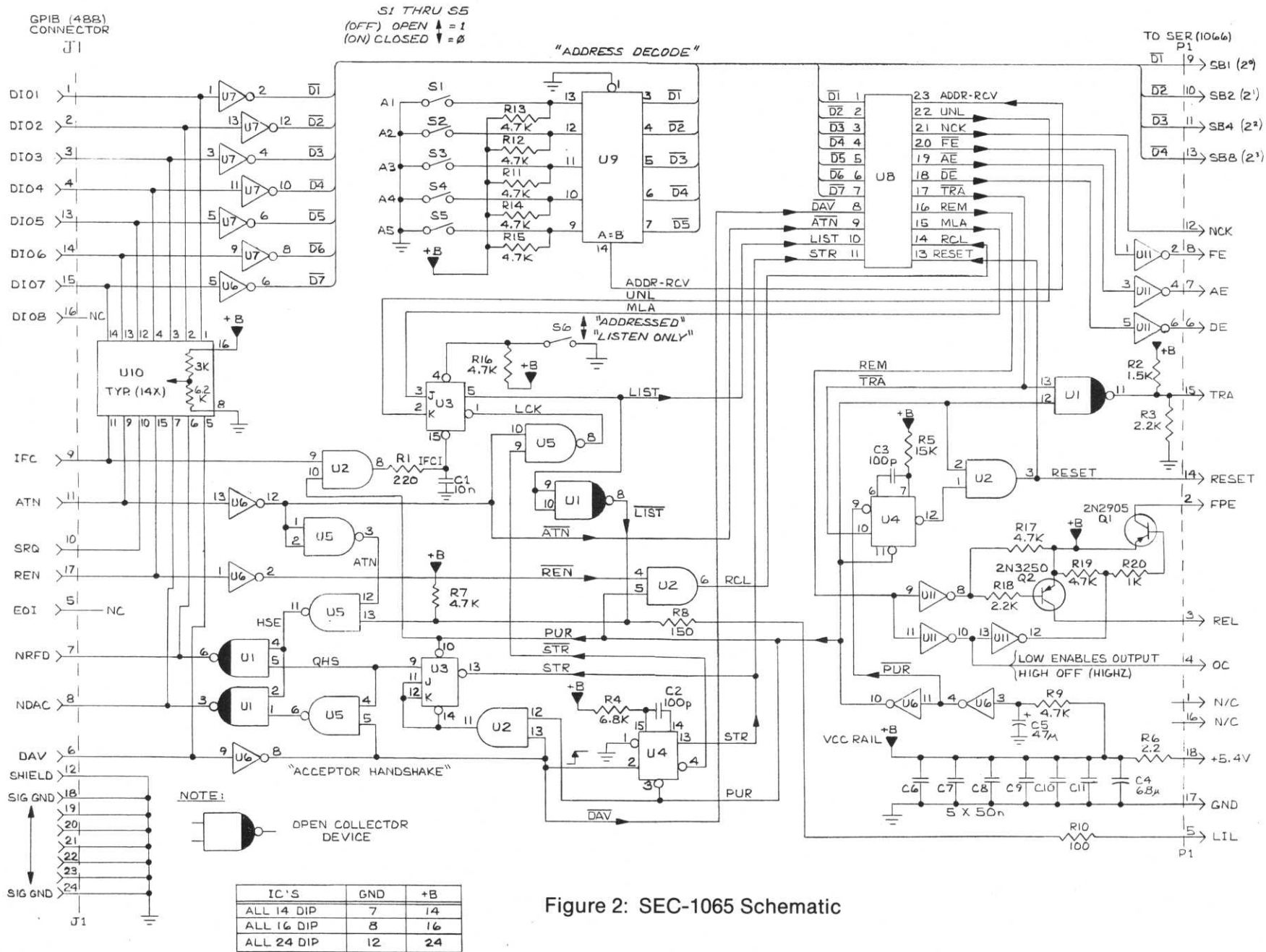


Figure 2: SEC-1065 Schematic

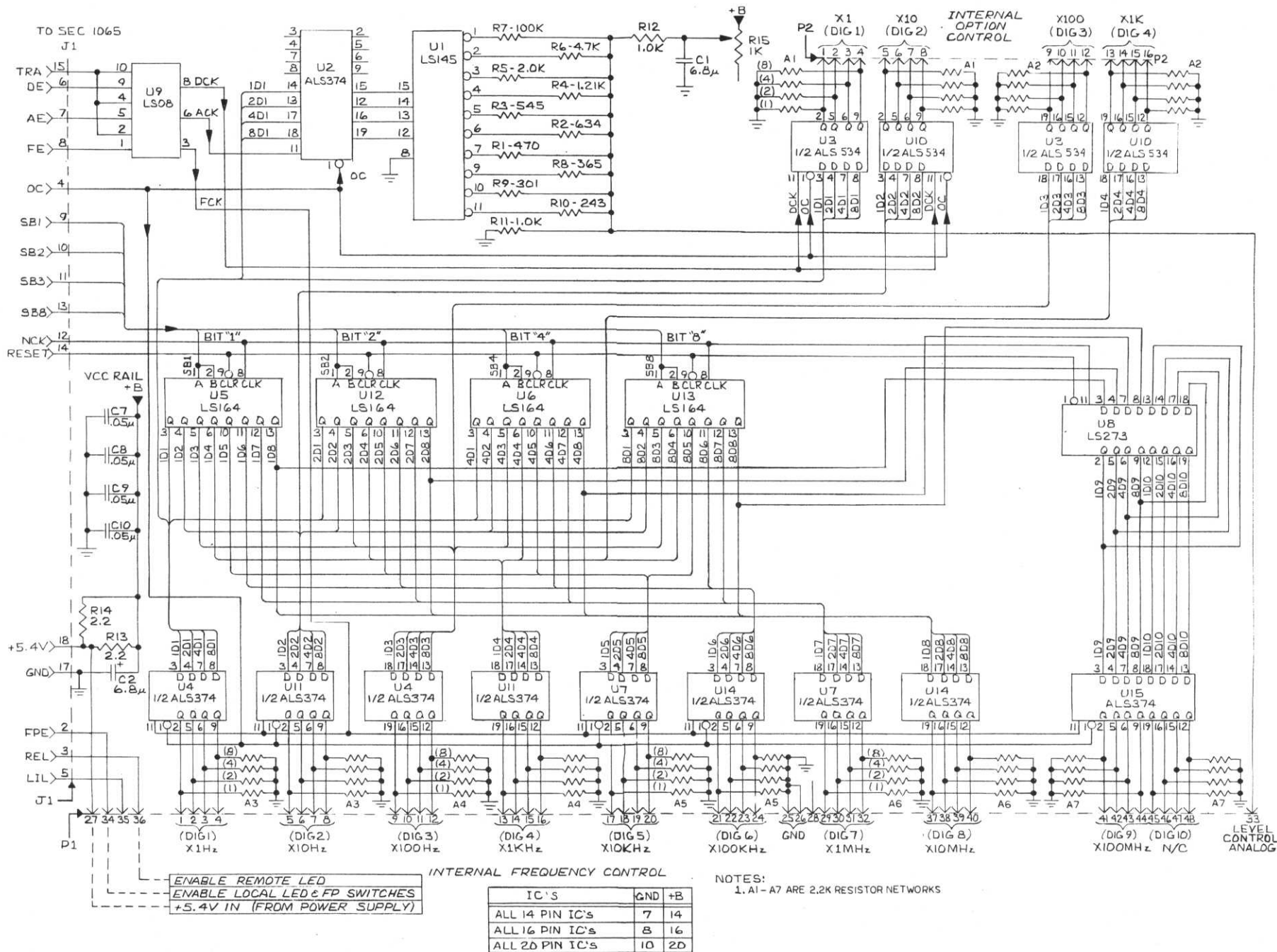


Figure 3: SER-1066 Schematic