

USER'S GUIDE

MODEL 5493A

DTMF MODEM



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1.0 GENERAL:

The Model 5493A DTMF MODEM is a Wescom 400/Tellabs Type 10 compatible plug-in pc card, which uses a single slot. Model 2452 Relay Card is an optional accessories and uses additional slots adjacent to the Model 5493A.

The Model 5493A was designed to permit the Signalcrafters monitoring software programs (Path Monitor and Status Monitor) to be able to decipher the DTMF signals into a form that a computer could understand. There's two ways to connect a computer to a Model 5493A, USB or RS-232.

A front panel keyboard allows local control of all functions. A LCD display indicates the function in progress and programming features during set up. Software updates can be downloaded via the front panel USB port utilizing Signalcrafters "Communication Program" software.

Path Monitor System:

The Model 5493A allows you to remotely test and diagnose telecommunications networks with the Model 5212A. You can test leased telephone lines and microwave paths, measuring signal strength, loss, noise level and sinad.

The Model 5493A provides a method for measuring the frequency response of both outbound and inbound paths from 404 to 2804 Hz. Correct levels in the communication link can sometimes be achieved by methods, which cause distortion. The Model 5493A provides an easy method to detect clipping distortion, rather than depend on methods, which only measure level.

Status Monitor System:

The Model 5493A allows you to remotely monitor status and analog points with the Model 2109.



2.0 SETUP:

2.1 BAUD RATE (PRGM, 1, ENTER):

RS-232 Baud Rate. 75, 150, 300, 600, 1200, 2400, 4800 and 9600.

2.2 MODES (PRGM, 2, ENTER):

Mode	Left	Right
1	No COM (USB or RS-232) Echo: DTMF input will not echo to COM port.	COM Echo DTMF: DTMF input will echo to COM port.
2	Keyboard Store and Forward: Pressing the keyboard will send DTMF after a 2 sec. timeout from not pressing keyboard.	Keyboard DTMF: Pressing the keyboard will send DTMF
3	RS-232: RS-232 will be operational.	USB: USB will be operational.
4	Push To Talk (PTT): ABC1A1, ABC1#1 has no effect on K2.	Line Seize: ABC1A1, ABC1#1 will control K2 relay for HOOK operation (Model 2945).

2.3 OUTPUT LEVEL (PRGM, 3, ENTER):

Level adjust from +7 dBm to -20 dBm in 1 dB steps.

2.4 IMPEDANCE (PRGM, 4, ENTER):

Impedance adjust, 600Ω or 900Ω.

Jumper Number	600Ω	900Ω
J8 (Rec In Load)	1 & 2	2 & 3
J9 (TX Out Load)	1 & 2	2 & 3

2.5 INTERDIGIT TIMER (PRGM, 5, ENTER):

0.1 sec to 1.5 sec.

The time between DTMF characters (Analog Input).

2.6 KEY-UP DELAY (PRGM, 6, ENTER):

0.0 sec to 1.5 sec.

The time after K2 is set before transmitting DTMF.

2.7 DTMF ON/OFF TIME (PRGM, 7, ENTER):

5 ms to 80 ms.

Signal ON time plus signal OFF time (hiatus period).

2.8 RESET TIMER (PRGM, 8, ENTER):

OFF, 0.0 min to 7.5 min.

The time to wait for ABC1#1 (Hang-up) command from Model 2109A before resetting Sezie Line Relay (K2) and Model 2452 Relay Card 1 Relay 1.

2.9 CONTRAST (PRGM, 9, ENTER):

By adjusting the Contrast the LCD will get brighter or dimer.

2.10 VERSION INFO (PRGM, 0, ENTER):

Will display current software version.

2.10 (PRGM, *, ENTER):

Not Used.

2.11 DEFAULT (PRGM, #, ENTER):

RS-232 BAUD RATE	2400
MODE	RLLL
LEVEL OUT	0 dBm
Z	600Ω
INTERDIGIT TIMER	0.1 sec
KEY-UP DELAY	0.0 sec
DTMF ON / OFF TIME	50 ms / 50 ms
RESET TIMER	OFF
CONTRAST	227

Table 1

3.0 OPERATION:

3.1 DTMF INPUT:

Each time a DTMF character is recognized, the ASCII conversion is sent to the RS-232 port and the interdigit timer is restarted. When the interdigit timer completes, the modem outputs a carriage return and line feed.

3.2 ASCII INPUT:

Each time a ASCII character is recognized, it is stored in a 32 character ASCII input buffer and the Interdigit Timer is restarted. The ASCII input message is terminated either by carriage return or Interdigit Timer completion. There are 6 digit commands which have special responses. When the Model 5493A receives ASCII or keyboard input, it executes these commands. Other messages are converted to DTMF.

Modem Commands	Description
ABCxAy:	SETS relay y in group x, RESETS the other 7 in the group x.
ABCx*y:	SETS relay y in group x.
ABCx#y:	RESETS relay y in group x.
ABCA03:	Generate a tone sequence from 404 to 2804 Hz (every 200 Hz except 2604) at 0 dB.
ABCA04:	Generate 1004 Hz for mid-band loss.
ABCA05:	Generate 1004 Hz at -13 dB.
ABCA08:	Generate a tone sequence from 404 to 2804 Hz (every 200 Hz except 2604) at -13 dB from output setting.
ABCA09:	Generate 2804 Hz for high frequency loss.
ABCA00:	Reset command, ends any function in progress.
ABCA0B:	Inbound tones measurement.
ABC1A1:	Seize Line (Set K2).
ABC1#1:	Un-Seize Line (Reset K2).

Table 2

3.3 LOOPBACK RECEIVER COMMANDS:

If the Model 5493A sees xxxx03, xxxx04, xxxx05, xxxx08, xxxx09 it sends that DTMF, then measures any inbound tones (Must have measurement option). If the inter-tone completes before the Model 5493A receives a 2804 Hz signal, the Model 5493A will send xxxx00 to reset the remote Model 5212A. If the Model 5493A receives ASCII xxxx0B, it sends that DTMF, then steps from 404 Hz to 2804 Hz at 0 dBm. After sending 2804 Hz, the Model 5493A measures the inbound noise level.

3.4 KEYBOARD INPUT:

To measure inbound tones from a Model 5212A programmed to and address of 1590, enter 159003. Upon timeout, the Model 5493A will send DTMF 159003 and measure any inbound tones. To measure outbound tone level send DTMF 15900#. To cause the remote Model 5212A to measure tones generated by the Model 5493A enter 15900#. The Model 5493A will generate DTMF 15900B and send tones for the remote Model 5212A to measure.

3.5 TRANSMITTER TEST FUNCTIONS:

Function ABCA03 and ABCA08 Step Tones (Function Duration set 0.1 sec. or greater):

Function 3 tone output is set to level set in Section 5.5.

Function 8 tone output is set to level set in Section 5.5 -13dB.

Tone Number	Frequency
1	404 Hz
2	604 Hz
3	804 Hz
4	1004 Hz
5	1204 Hz
6	1404 Hz
7	1604 Hz
8	1804 Hz
9	2004 Hz
10	2204 Hz
11	2404 Hz
12	2804 Hz

Function ABCA03 and ABCA08 Step Tones (Function Duration set 0.0 sec.):

Output frequency: 404 Hz

Function 3 tone output is set to level set in Section 5.5.

Function 8 tone output is set to level set in Section 5.5 -13dB.

Function ABCA04 and ABCA05:

Output frequency: 1004 Hz

Function 4 tone output is set to level set in Section 5.5.

Function 5 tone output is set to level set in Section 5.5 -13dB.

Function ABCA09:

Output Frequency: 2804 Hz

Function 9 tone output is set to level set in Section 5.5.

3.3 RELAY FUNCITONS:

Auxiliary Relay (K4, NO: pin-33, NC: pin-31, A: pin-29):

The Auxiliary Relay is a SPDT relay. Used as a PTT (Push to Talk) relay or to connect to a Model 2945 for PSTN operation for line seize.

Auxiliary Relay Control Examples:

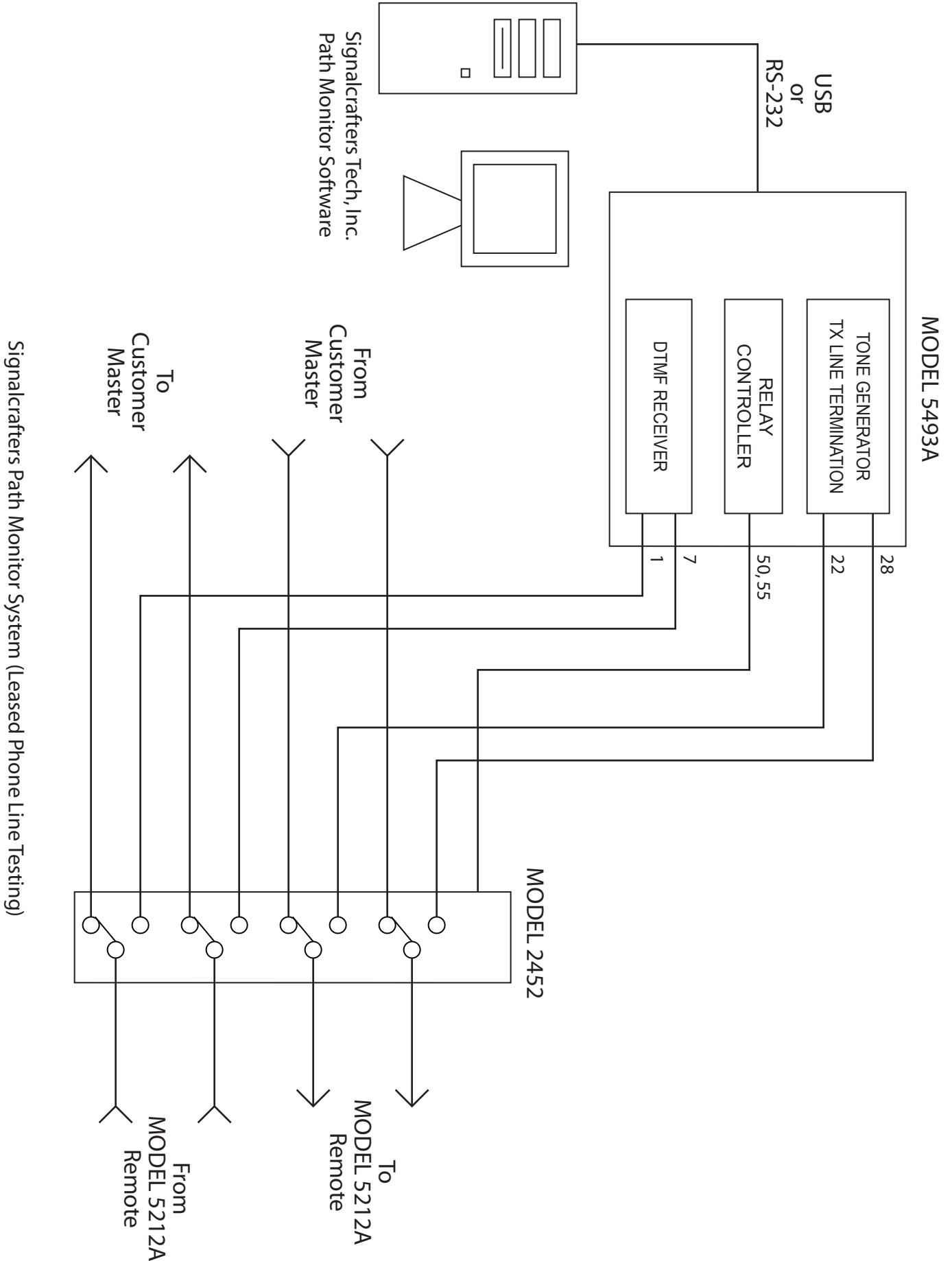
Set Relay Card 1 Relay 1: ABC1*1

Reset Relay Card 1 Relay: ABC1#1

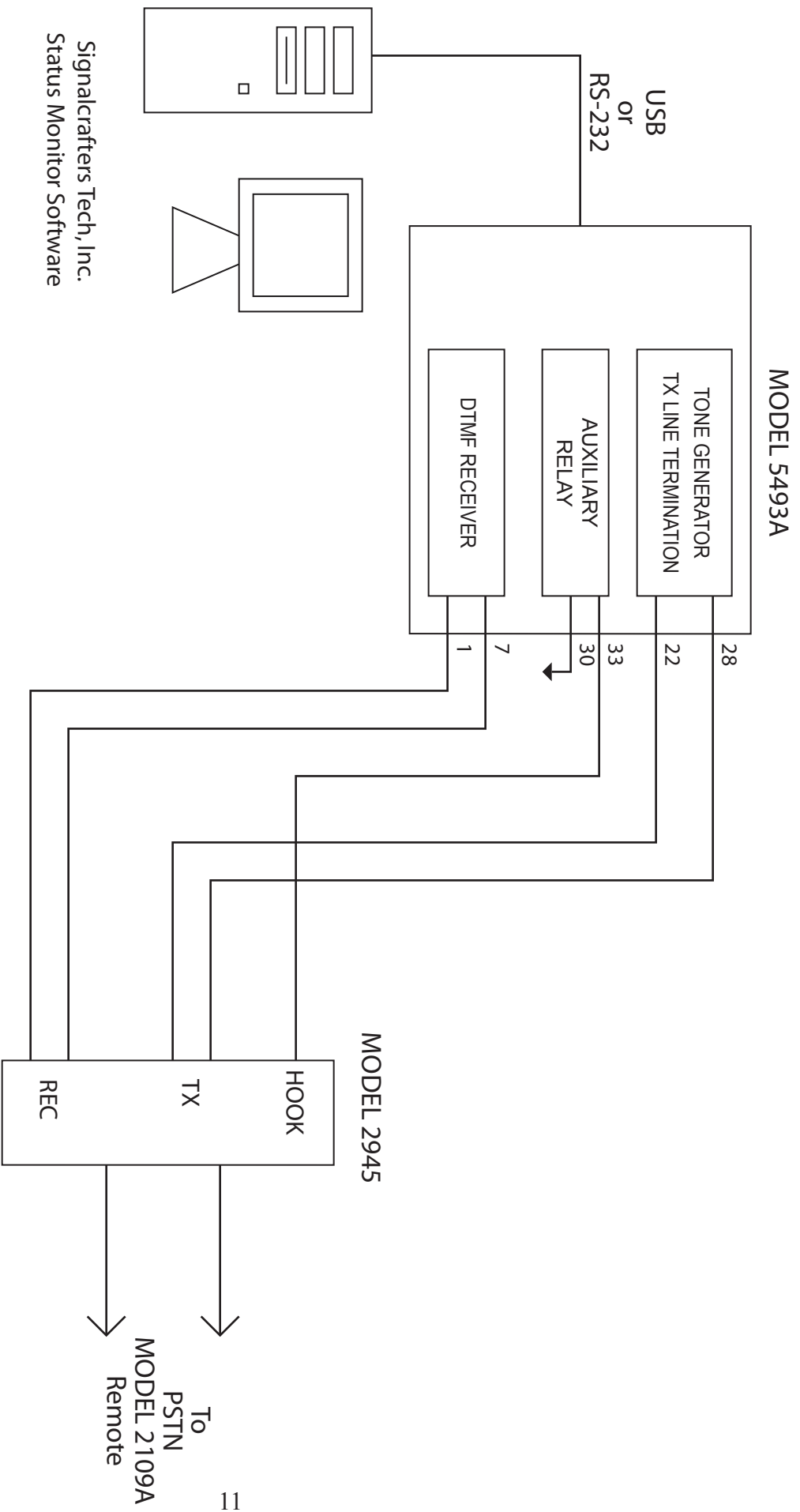
CONTROLLING 64 RELAYS FROM ONE MODEL 5493A

You can control 8 Model 2452 Relay Cards.

ADDRESS			RELAY CARD (1-8)	SET or RESET	RELAY (1-8)
A	B	C	1	*	1

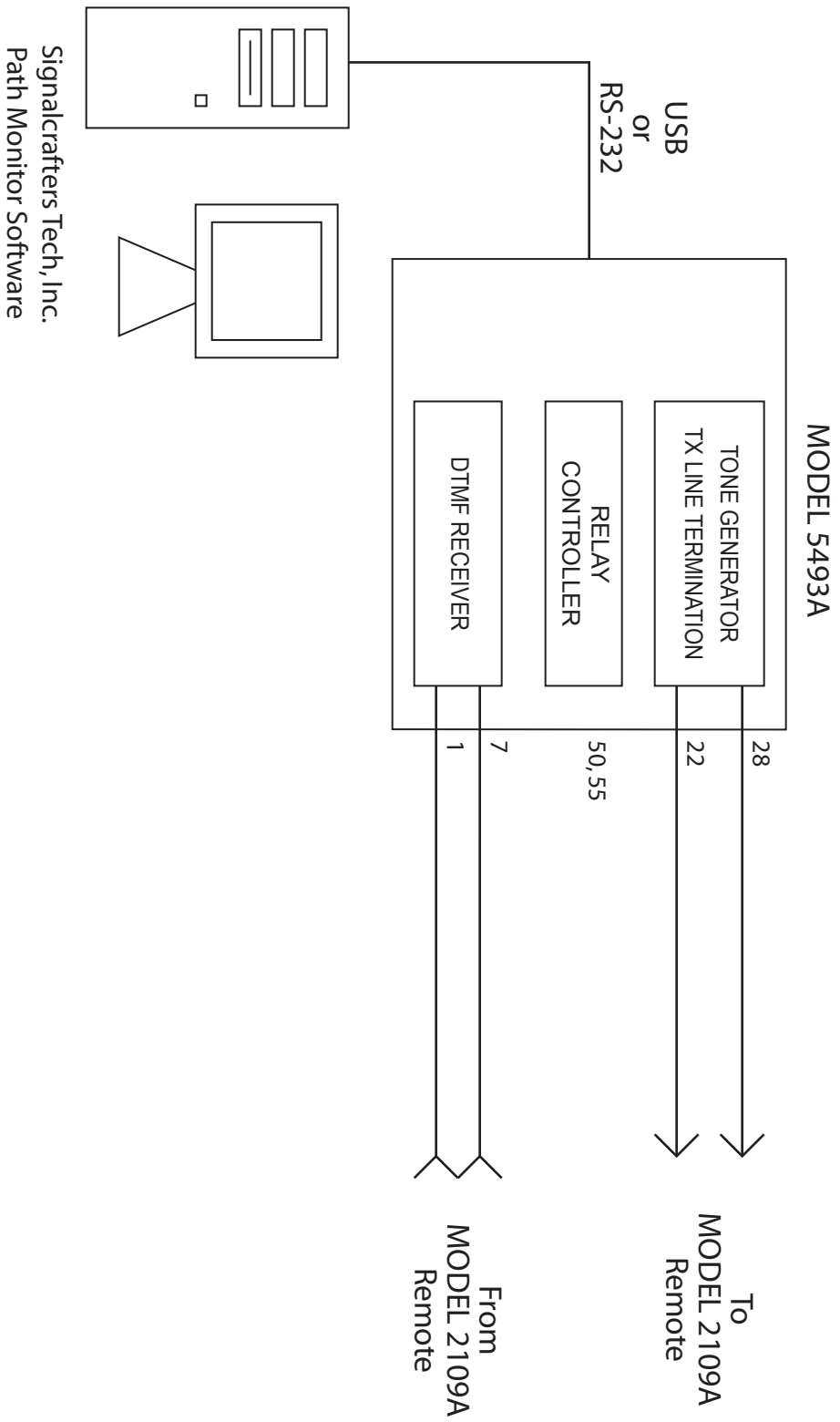


Signalcrafters Path Monitor System (Leased Phone Line Testing)



Signalcrafters Tech, Inc.
Status Monitor Software

Signalcrafters Status Monitor System (Data Acquisition)



Signalcrafters Path Monitor System (Leased Phone Line Testing)

4.0 PIN CONNECTIONS:

TERMINAL NUMBER	CONNECTION	TERMINAL NUMBER	CONNECTION
1	Tone Output Tip	2	
3		4	
5		6	
7	Tone Output Ring	8	
9		10	
11		12	
13		14	
15		16	
17	+DC Input (+12 , +24, +48 VDC)	18	
19		20	
21		22	Receive In Tip
23		24	
25		26	
27		28	Receive In Ring
29	RS-232 OUTPUT	30	AUX-1 Common
31	AUX-1 Normally Closed	32	
33	AUX-1 Normally Open	34	
35	- 24 VDC or 48 VDC Input	36	+DC Input (+12 , +24, +48 VDC)
37	AUX-2 Normally Closed Power Out	38	
39	AUX-2 Normally Open Power Out	40	
41	+DC Input (+12 , +24, +48 VDC)	42	+DC Input (+12 , +24, +48 VDC)
43	- 12 VDC Input	44	- 12 VDC Input
45	-5 VDC output; To Model 2452	46	-5 VDC output; To Model 2452
47	+ Ring Detector	48	
49	- Ring Detector	50	Relay Count Out; To Model 2452
51		52	
53		54	RS-232 INPUT
55	Relay Reset Out; To Model 2452	56	

Table 3

4.1 RS-232 CONNECTIONS:

	Model 5493A	RS-232 9-Pin
RS-232 OUTPUT	29	2
RS-232 INPUT	54	3
Common	35 or 43	5

5.0 PROGRAMMING:

5.1 HARDWARE JUMPER SETTINGS:

Jumper Number	12VDC & 24 VDC	48 VDC
J10 (Power Input)	1 & 2	2 & 3

	Software Controlled	Hardware Controlled
J2 (CPU Watchdog)	1 & 2	3 & 4

	600Ω	900Ω
J9 (TX Out)	1 & 2	2 & 3

	600Ω	900Ω	HI-Z
J8 (Rec In)	1 & 2	2 & 3	1

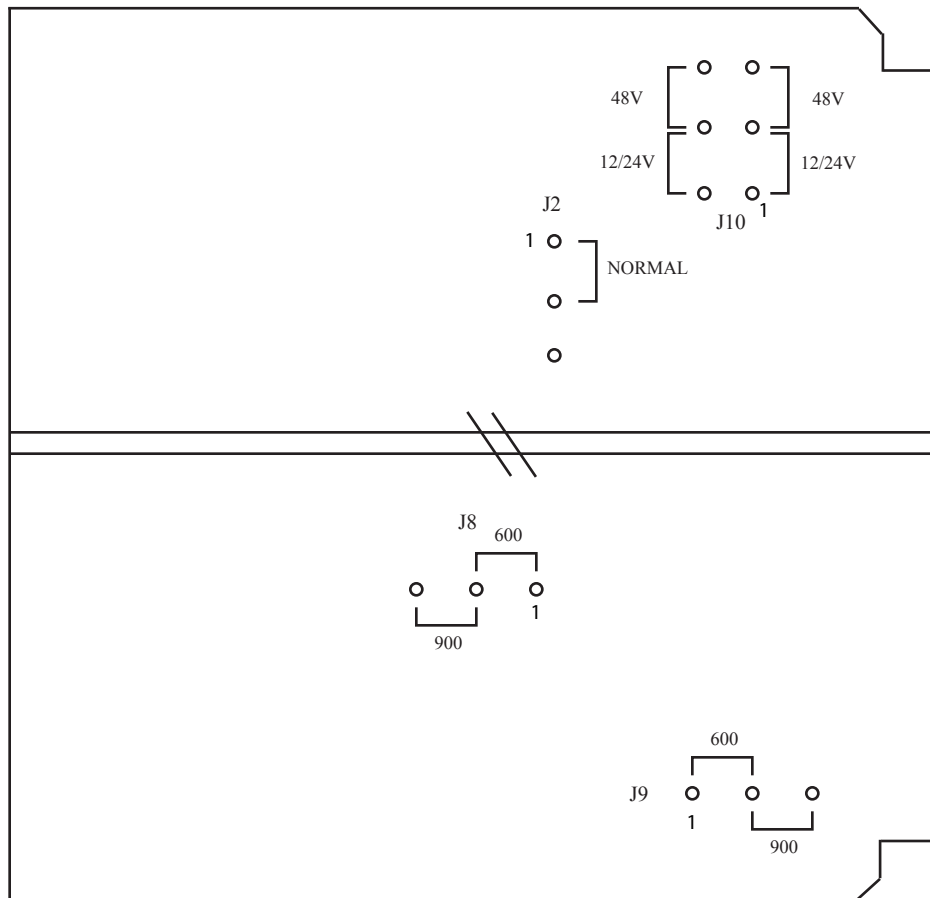


Figure 1

5.2 Front Panel Programming:

Once in program mode, **PRGM**, you can perform multiple set-ups without pushing **PRGM** each time. The LCD Display background color will change to amber to indicate the Model 5493A is in program mode.

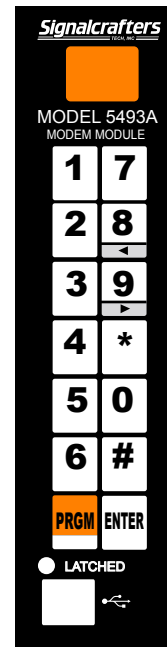
To end programming push the **PRGM** key again.

Both the scrolling keys, ◀ (the 8 key) and ▶ (the 9 key) are only active when adjusting **Contrast**.

Except for **Contrast** the scroll key ◀ (the 8 key) is never active. You cannot backspace to make changes.

When programming, the cursor will automatically move to the next location when you perform character changes. The exception to this is the last character in the program, where the cursor will remain until the screen is closed.

Note: If you have selected the wrong program key and have not press the ENTER key you can press another program key and ENTER to get to the desired program screen.



Button	Description	
1	Baud Rate	75, 150, 300, 600, 1200, 2400 , 4800 and 9600
2	Mode	LLLL to RRRR
3	Output Level	+7dBm to -20dBm
4	Output Impedance	600Ω or 900Ω
5	INTERDIGIT TIMER	0.1 sec to 1.6 sec
6	KEY-UP DELAY	0.0 sec to 1.5 sec
7	DTMF ON/OFF TIME	5 ms to 80 ms
8	RESET TIMER	0.0 sec to 7.5 sec
9	Contrast Adjust	200 to 255
*	NOT USED	
0	Software Verison Number	
#	Default	
PRGM	Enter Program Mode	
ENTER	Entering in Data	

Table 4

5.3 Baud Rate:

Press **PRGM** (if not already in PRGM mode)

Press **1**

Press **ENTER**

Press **▶** (the 9 key) to increase Baud Rate

Press **◀** (the 8 key) to decrease Baud Rate

When finished press **ENTER** until the **LATCHED** LED comes on (after 3 seconds) or **PRGM**.

5.4 Mode:

Press **PRGM** (if not already in PRGM mode)

Press **2**

Press **ENTER**

To change the Left to a Right or Right to a Left press * otherwise scroll ahead by pressing **▶** (the 9 key)

When finished press **ENTER** until the **LATCHED** LED comes on (after 3 seconds) or **PRGM**.

5.5 Output Level:

Press **PRGM** (if not already in PRGM mode)

Press **3**

Press **ENTER**

To change the sign press * otherwise scroll ahead by pressing **▶** (the 9 key)

Either enter a number or continue to scroll

Note: the Model 5212A can only be set from +7dB to -20dB, if you enter a number outside this range the unit will default to an allowable value.

When finished press **ENTER** until the **LATCHED** LED comes on (after 3 seconds) or **PRGM**.

5.6 Output Impedance:

Press **PRGM** (if not already in PRGM mode)

Press **4**

Press **ENTER**

To toggle between the 600 and 900 ohm impedance press *

When finished press **ENTER** until the **LATCHED** LED comes on (after 3 seconds) or **PRGM**.

Set the four impedance jumpers, J8, J10-J12, to match entered impedance.

5.7 Interdigit Timer:

Press **PRGM** (if not already in PRGM mode)

Press **5**

Press **ENTER**

Press 0-9, Press 0-9.

When finished press **ENTER** until the **LATCHED** LED comes on (after 3 seconds) or **PRGM**.

5.8 Key-Up Delay:

Press **PRGM** (if not already in PRGM mode)

Press **6**

Press **ENTER**

Press 0-9, Press 0-9.

When finished press **ENTER** until the **LATCHED** LED comes on (after 3 seconds) or **PRGM**.

5.9 DTMF ON/OFF Time:

Press **PRGM** (if not already in PRGM mode)

Press **7**

Press **ENTER**

Press **▶** (the 9 key) to increase ON TIME

Press **◀** (the 8 key) to decrease ON TIME

Press *****

Press **▶** (the 9 key) to increase OFF TIME

Press **◀** (the 8 key) to decrease OFF TIME

Pressing ***** repeatedly cycles between ON TIME/OFF TIME screens.

When finished press **ENTER** until the **LATCHED** LED comes on (after 3 seconds) or **PRGM**.

5.10 Reset Timer:

Press **PRGM** (if not already in PRGM mode)

Press **8**

Press **ENTER**

Press 0-9, Press 0-9.

When finished press **ENTER** until the **LATCHED** LED comes on (after 3 seconds) or **PRGM**.

5.11 Contrast Adjust:

Press **PRGM** (if not already in PRGM mode)

Press **9**

Press **▶** (the 9 key) to increase Contrast

Press **◀** (the 8 key) to decrease Contrast

When finished press **ENTER** until the **LATCHED** LED comes on (after 3 seconds) or **PRGM**.

5.12 Software Version:

Press **PRGM** (if not already in PRGM mode)

Press **0**

Version will display on LCD screen.

When finished press **ENTER** until the **LATCHED** LED comes on (after 3 seconds) or **PRGM**.

5.13 Default:

Press **PRGM** (if not already in PRGM mode)

Press **#**

Press **ENTER**

Returns Model 5493A to it's default settings (see table 1).

6.0 SPECIFICATIONS:

CONTROLS & INDICATORS: 12 button keypad for local mode select with LCD display to indicate selected function and a LED to indicate function is running or Auxiliary state.

POWER SUPPLY: 12, 24 or 48 VDC

Current Drain:

DC Voltage	Idle	Activated
12 VDC (9.6 VDC to 14.4VDC)	155mA	XXXmA
24 VDC (19.2 VDC to 28.8 VDC)	90mA	XXXmA
48 VDC (38.4 VDC to 56 VDC)	100mA	XXXmA

Additional current due to each Relay expansion card:

	12VDC	24VDC	48VDC
LED annunciator power Switch ON	24mA	13mA	13mA
LED annunciator power Switch Off	1mA	1mA	1mA
Relay card without LED's	1mA	1mA	1mA

TEMPERATURE RANGE: -30°C to +70°C operating; -55°C to +85°C storage

DIMENSIONS: Height 5.58" (14.17 cm); Width 1.42" (3.61 cm); depth 5.53" (14 cm)

DTMF:

DTMF Character	Low Tone (Hz)	High Tone (Hz)	Decoder Hex Code
1	697	1209	1
2	697	1336	2
3	697	1477	3
4	770	1209	4
5	770	1336	5
6	770	1477	6
7	852	1209	7
8	852	1336	8
9	852	1477	9
0	941	1336	A
*	941	1209	B
#	941	1477	C
A	697	1633	D
B	770	1633	E
C	852	1633	F
D	941	1633	0

Table 5

ENCODER SPECIFICATIONS:

SIGNALING SPEED:

Each character must be minimum 40 ms in duration; maximum 2 seconds between characters.

OUTPUT IMPEDANCE:

600Ω or 900Ω, balanced and transformer isolated.

FREQUENCY ACCURACY:

1004 Hz test tone: ±200ppm

Step tones: ±200ppm

DTMF: ±200ppm

ENCODER DISTORTION:

Distortion (function 04): 0.5% maximum THD.

Distortion other modes: 1% maximum THD.

TONE OUTPUT LEVEL: Tone output level from +7 dBm to -20dBm into 600Ω or 900Ω.

DTMF ID OUTPUT LEVEL:

DTMF Tone Twist: ±0.1 dB maximum difference between low and high tone.

SWEEP (functions 03 and 08):

Sweep rate: Sequence takes about 90 seconds. Sweep rate tone present for 1.5 seconds with a 1 second pause between tones. Sequence takes about 30 seconds.

LEVEL ACCURACY:

±0.1 dB at 25°C.

±0.3 dB from +70°C to -30°C.

DECODER SPECIFICATIONS:**INPUT TONE LEVEL RANGE:**

3.0 Vrms to 3.0 mVrms, each DTMF component tone (NOT composite level).

INPUT IMPEDANCE:

When in normal mode, the DTMF receiver provides $>20\text{ k}\Omega$, in parallel with the customer's equipment – connected between pins 18 and 19 – to terminate the line at pins 21 and 27. During test modes: 600Ω or 900Ω balanced and transformer isolated.

CTCSS REJECTION:

The decoding process will not be inhibited by any tone from 67 to 440 Hz and no more than 6 dB above the weaker DTMF component tone.

SINAD:

16 dB or better signal.

INTERDIGIT TIMING:

2.4 seconds.

7.0 OPTIONAL MEASUREMENT FUNCTION:

This appendix provides technical data for the Model 5493A Measurement Function.

7.1 GENERAL

7.1 MEASUREMENT TEST FUNCTION: Model 5493A can measure the level and frequency of a 300-3000 Hz tone, by the Model 5212A and Signalcrafters Path Monitor Software.

7.3 The remote Model 5212A sends DTMF ABCA03, which will start a base located Model 5212A (address ABCA, with ONLY Mode 4 to the right) into its step tone sequence. The remote Model 5212A wait for the tone to disappear and then transmit the reading back in a DTMF burst.

7.4 Levels higher than 0 dBm are indicated in ten's complement notation:

95DB means +5 dBm

96DB means +4 dBm

97DB means +3 dBm

98DB means +2 dBm

99DB means +1 dBm

7.5 The measurement function remains enabled until the Model 5212A does not see a tone for 2.5 seconds or the Model 5212A received a return to normal command (for example, 159000).

Note: Remote Model 5212A can't use address ABC with Model 5493A.