CPI

MODEL 824

AUTOPATCH

MANUAL

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DISCONTINUED PRODUCT

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824 AUTO PATCH

THEORY OF OPERATION

I. Mobile to Phone Line

To make a call from the field, the mobile operator keys up and transmits the *tone. At the Repeater this signal is fed from the receiver to the auto phone patch. When the *button is released by the mobile operator, the *output (U7-10) of the tone detector switches from a low to a high state. This high level, gated by diodes CR-17 and CR-18 and buffered by transistors Q1 and Q2, turns on relays K1, K2 and K3. Relay K1 connects transformer T1 to the phone line, relay K2 keys the repeater transmitter and relay K3 pulls in for auxiliary use. Since the *output is now high, the # output line (U7-12) is now low. The low state enables the switching logic consisting of U4B, C, and D. This logic block, controlled by the status of the C.O.S. input, will now determine the direction in which the audio signal will travel through the phone patch. For example, when the mobile operator releases the *button, his transmitter unkeys; this causes the C.O.S. line to switch from a high to a low state. The low C.O.S. input to do the switching logic causes it to enable audio gate U2A. Thus the dial tone from the phone line will pass through U2A to amplifier U3D and then be coupled by T2 to the modulation input of the repeater transmitter. The mobile operator will now hear the dial tone. As he keys up to dial a phone number, the C.O.S. line will go high, causing the switching logic to disable U2A and enable U2D. As the phone number is dialed, the DTMF tones from the receiver output will pass through U2D to amplifier U3C and be coupled to the phone line by T1. When dialing is completed and the mobile transmitter unkeys, U2D will be switched off and U2A will again be switched on, allowing the mobile operator to hear the phone ring on the other end of the line. Every time the mobile operator keys up, the receiver-to-phone line path will be completed through U2D. Note that this "switching" procedure may occur at any time regardless of the status of the C.O.S. line, thus giving the mobile operator control over the conversation at all times. At the end of the conversation, the mobile operator will key up and press the "#" button. Releasing the button will cause the *line to go low, turning off K1 and K2 - unkeying the repeater transmitter and releasing the phone line. As the *line goes low, the # line goes high, disabling the switching logic circuit and preventing the completion of either of the audio paths. A one minute timer, U7D can also initiate the shutdown procedure. Every time the C.O.S. line goes high, U7D is reset; it begins timing when the C.O.S. line goes low. Thus if no conversation from the mobile unit (and hence no C.O.S. activity) is received in a one-minute period, U7D will automatically terminate the connection.

II. Phone Line to Mobile

When a telephone caller dials up the line assigned to the phone patch, the ringing pulses on the phone line will be detected by the circuit of U6 and fed to the ring timer circuit. A high level # output from the tone detector (indicating that the mobile operator is not already trying to make a call) will allow the ring timer to output a pulse to gates U9A and D. Depending on the status of the C.O.S. line the ringing circuit will either enable U9A (to start timer U5A) or U9D (to set latch U5B). If the C.O.S. is high (indicating activity on the channel), latch U5B will be set, seizing the phone line and gating the output of the beeper as a "busy" signal through U2C to phone line driver U3C. After approximately 10 seconds, the ring timer will reset U5B if the caller has not hung up by that time. The ring select circuit has a C.O.S. delay of approximately 5 seconds to keep a phone call from "ringing in" between breaks in an established conversation. If the C.O.S. line is low (for more than 5 seconds) when a phone call comes in, the ring selector will start timer U5A. This will key the repeater transmitter and gate the output of the beeper through U2B to the modulation circuit. The mobile operator hears this time and answers by keying his transmitter and sending the *tone. The conversation will then take place and terminate in the same manner as in a mobile-to-phone line call. If the mobile operator does not respond to the beeper signal, timer U5A will unkey the repeater transmitter and switch off U2B in 3 seconds if the telephone caller has not already hung up.

MONITOR AMPLIFIER

Monitor amplifier U1, connected to a tap on phone line transformer T1, allows local monitoring of both sides of a conversation. R3 sets the level of U1's output.

3 MINUTE TIMER

After approximately 150 seconds of continuous operation, a tone signal from U10A and D will beep for a few seconds. This is switched on by U15 and its associated circuitry which turns on gates U2C and U2B. Therefore, whichever party is receiving audio at this time will hear the beeper. This signal will occur once more at approximately 170 seconds. At 180 seconds, U15 will automatically terminate the connection.

ADJUSTMENTS

R23 - Modulation Output
R14 - Receive Input
R39 - 1209 Hz Detector
R35 - 941 Hz Detector
R28 - 1477 Hz Detector

JUMPERS

J1-5 to J1-6
J1-11 to J1-15
J2-5 to J2-6
J3-12 to J3-13

NOTES

R45 and C40 Determine length of 3 minute timer

R43 and C37 Determine length of 1 minute timer

R32 and C30 Determine Ring-trip Sensitivity

CP824 AUTO PATCH

*SPECIFICATIONS

TYPE OF SIGNALING:	DTMF from mobile to repeater. OPTIONAL: DTMF to rotary dial pulse converter
SUPPLY VOLTAGE:	12 to 16V DC @ less than 500 mA
TEMPERATURE RANGE:	0°C to +60°C
CONNECTIONS:	Terminal board screw type
FREQUENCY RESPONSE @ 1000 Hz REFERENCE:	±3db, 300-3000 Hz
OUTPUT TO PHONE LINE:	Less than 0 dbm (-5 dbm typical)
OUTPUT TO TRANSMITTER:	600 ohm, high level (can be modified for high Z, low level.)
AUDIO LEVEL FROM RADIO RECEIVER RX IN:	High level typically 1.5V RMS. Can be jumpered for low level (200 mV RMS)
RECEIVER ACTIVITY INDICATION (C.O.S.-CARRIER OPERATED SIGNAL):	Can be low or high logic level
TRANSMITTER P.T.T. RELAY:	SPST contacts rated at 1 amp @ 125 VAC
TONE SQUELCH DISABLE:	SPDT relay contacts provided
SPEAKER:	Provides 500 mW into 8 ohms
3 MINUTE TIMER:	Disconnect autopatch after 3 minutes (an alert tone is sent out before the autopatch disconnects)
NON-ACTIVITY TIMER:	Disconnects autopatch if no mobile activity occurs within one minute
MOUNTING:	Desk top, metal case, or rack mount

DIMENSIONS

824 (board only):	1.5" H x 4.5" W x 8.5" L
824-C (metal case):	2.5" H x 5" W x 9.5" L
824-RM (rack mount):	3.5" H x 5.5" W x 19" L

*Specifications subject to change without notice.

824 - CONNECTIONS

16 PIN BARRIER STRIP CONNECTIONS

TERMINAL	CONNECTION
1	Phone Line
2	Phone Line
3	+12 to 16 VDC
4	Common
5	Auxiliary relay - common contact
6	Auxiliary relay - normally closed contact
7	Auxiliary relay - normally open contact
8	Transmitter key (common relay contact)
9	Transmitter key (normally open relay contact)
10	Modulation output (mic high)
11	Mic low (ground this terminal)
12	Speaker terminal 8 OHM, 500 mW
13	Spare - no connection
14	Receive audio
15	*C.O.S. - carrier operated signal (active high)
16	*C.O.S. - carrier operated signal (active low)

*C.O.S. - CARRIER OPERATED SIGNAL

The C.O.S. signal is an idication of receiver activity. It is used to control the direction of audio through the autopatch and perform functions for control purposes. The 824 requires either a switched voltage level at terminal 15, or a ground at terminal 16, whenever a signal is being received. Normally, terminal 15 will have no voltage present until a signal is received. Terminal 16 will be at a high impedance state (+8V) until a signal is received.

824 AUTO PATCH

Occasionally a perfectly good phone patch and perfectly working repeater, when interfaced together, will not reliably connect or disconnect. The most common cause of this problem is frequency roll-off or "Twist", which can be corrected with frequency compensation/equalization. A simple test can be used to check the frequency response of the system:

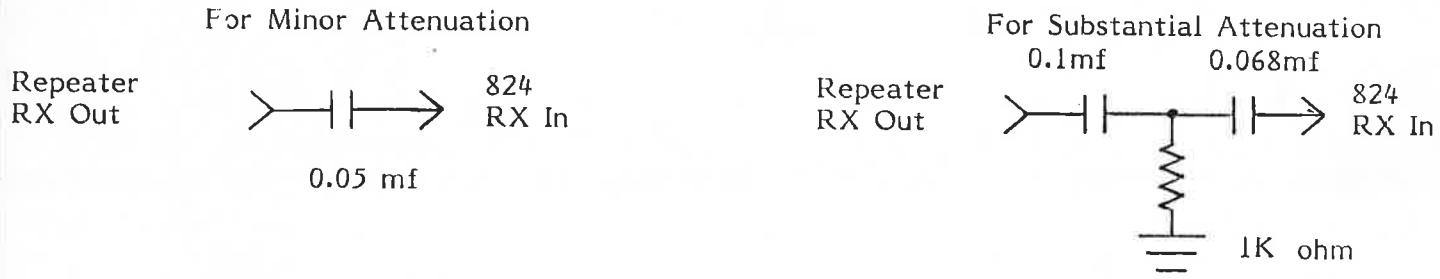
First make sure the modulation levels etc. have been properly set. Have a mobile operator send two digits in row one such as "1" and "2". this will send a frequency of approximately 700 Hz. Record this level as seen on the modulation input of the patch, this is our reference level. Now have the mobile operator send two digits in column three such as "3" and "6", this will send a frequency of approximately 1477 Hz. Record this level. Calculate the twist by the following formula:

$$\frac{\text{1477 Hz Level}}{\text{700 Hz Level}} = \text{Twist}$$

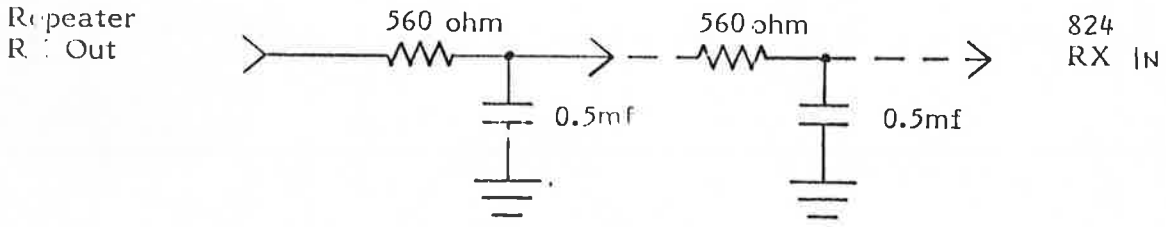
0.5 - 1.5 should give acceptable results. Below 0.5 means unsatisfactory high frequency loss, above 1.5 means unsatisfactory low frequency loss.

The following circuits can be used to help equalize this mismatch, the ideal situation would be a twist of one.

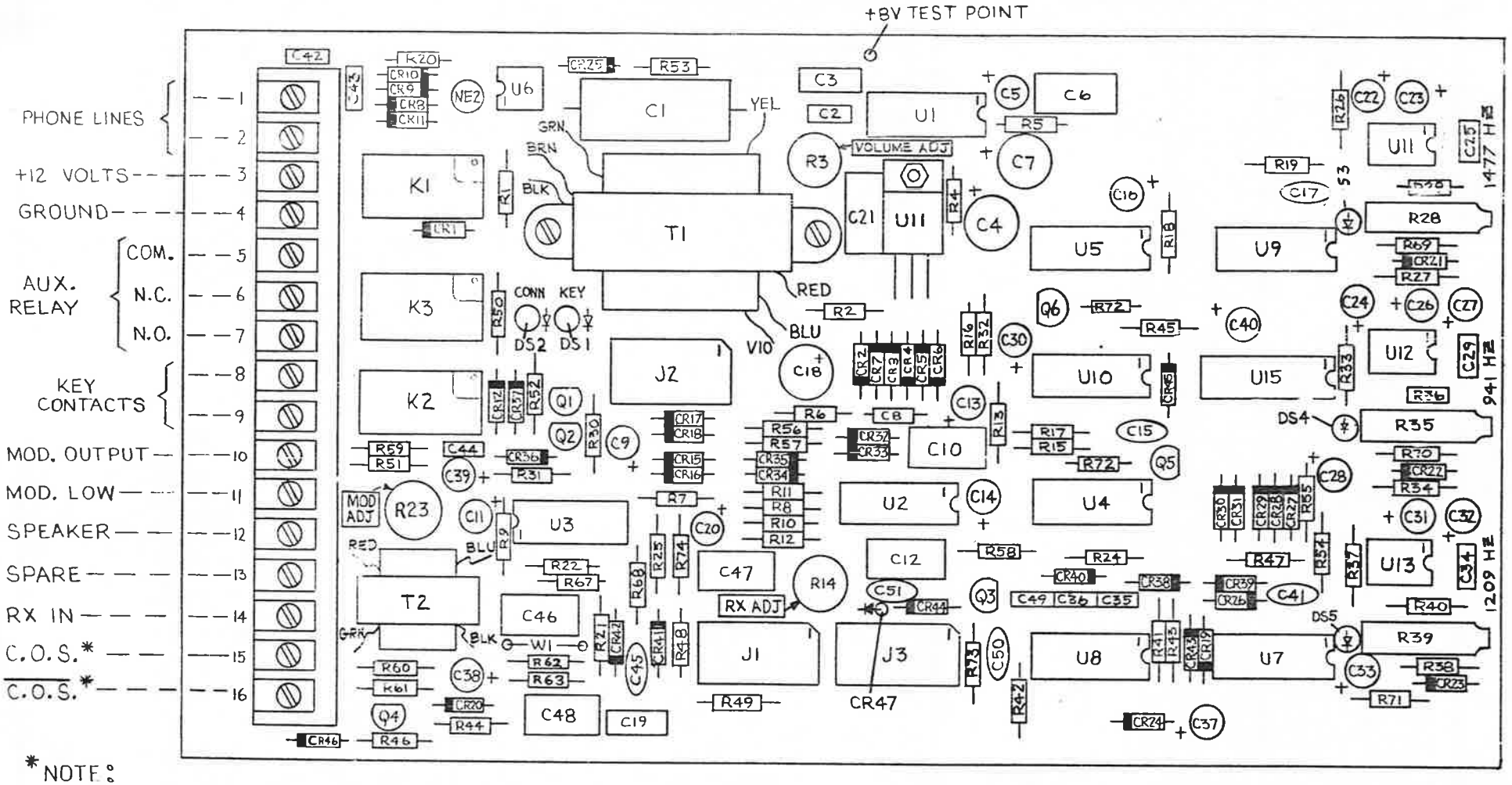
TO REDUCE EXCESSIVE LOW FREQUENCIES:



TO REDUCE EXCESSIVE HIGH FREQUENCIES:



This circuit can be cascaded for further attenuation.

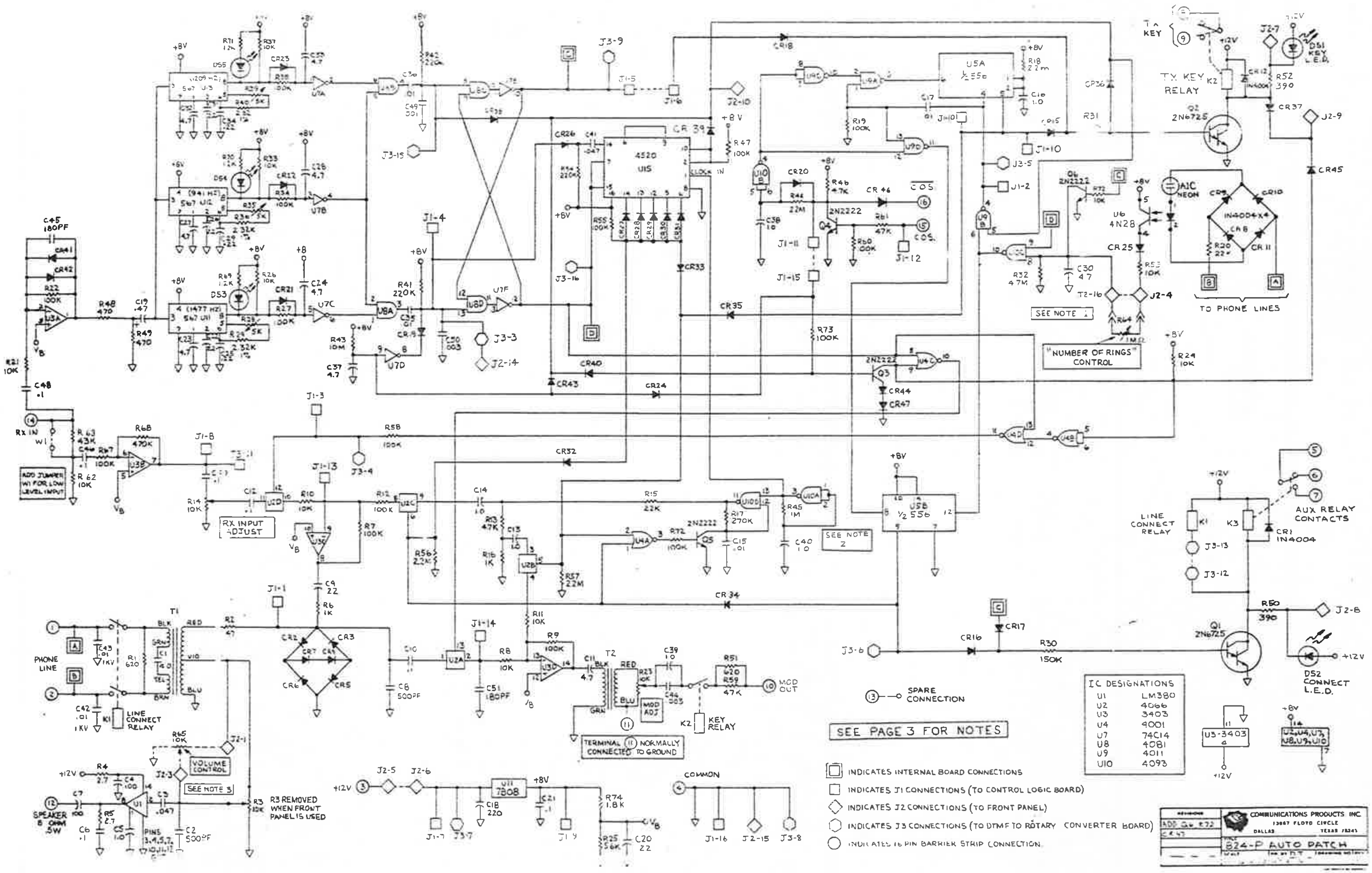


*NOTE:

CONNECT CARRIER OPERATED SIGNAL TO EITHER TERMINAL 15 OR 16. SEE INSTRUCTIONS FOR DETAILS.

SOCKETS FOR PLUG-IN OPTIONS:
J1 = SOCKET FOR CONTROL LOGIC BOARD
J2 = SOCKET FOR FRONT PANEL CONNECTIONS
J3 = SOCKET FOR DTMF TO ROTARY CONVERTER BOARD

REVISIONS	COMMUNICATIONS PRODUCTS, INC.			
ADD Q6, R72	13667 FLOYD CIRCLE			
CR 47	DALLAS, TEXAS 75243			
	TITLE: 824-P AUTO PATCH - PARTS LAYOUT			
	SCALE	DR. BY DJ	DRAWING NO.	REV
	DATE: 12-4-83	CKD. BY		


RX INPUT ADJUST
ADD JUMPER W1 FOR LOW LEVEL INPUT
PHONE LINE
LINE CONNECT RELAY
SPEAKER 8 OHM .5W
VOLUME CONTROL
SEE NOTE 3
R3 REMOVED WHEN FRONT PANEL IS USED
TERMINAL (11) NORMALLY CONNECTED TO GROUND
MOD ADJ
MOD OUT
KEY RELAY
COMMON
SEE NOTE 2
SEE NOTE 1
"NUMBER OF RINGS" CONTROL
TO PHONE LINES
T.X. KEY RELAY
T.X. KEY
DS1 KEY L.E.D.
AUX RELAY CONTACTS
DS2 CONNECT L.E.D.
SPARE CONNECTION
SEE PAGE 3 FOR NOTES
INDICATES INTERNAL BOARD CONNECTIONS
INDICATES J1 CONNECTIONS (TO CONTROL LOGIC BOARD)
INDICATES J2 CONNECTIONS (TO FRONT PANEL)
INDICATES J3 CONNECTIONS (TO DTMF TO ROTARY CONVERTER BOARD)
INDICATES 16 PIN BARRIER STRIP CONNECTION
IC DESIGNATIONS
U1 LM380
U2 4066
U3 3403
U4 4001
U7 74C14
U8 4081
U9 4011
U10 4093
COMMUNICATIONS PRODUCTS INC.
13867 FLOYD CIRCLE
DALLAS TEXAS 75243
824-P AUTO PATCH