MODEL 520D INTELLIGENT INTERCONNECT
REVISION B

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CES MODEL 520D INTELLIGENT INTERCONNECT
Revision B

The CES Model 520D Intelligent Interconnect is a FULLY AUTOMATIC. FULL DUPLEX telephone interconnect. Designed for installation at either the repeater site. or at a duplex base station. the 520D uses modern microcomputer technology for sophisticated control operations. Many features that are standard on the CES 520D are extra cost. or not available. on other interconnects. Because of microcomputer technology and single board construction. the CES Model 520D Intelligent Interconnect is the most cost effective interconnect on the market.

*** STANDARD FEATURES ***

ACCESS CODES - Single * and #. or multi-digit codes are user switch programmable. If the patch receives a disconnect code when it is in a disconnect state. the ID will be transmitted to let the mobile know it is within range.

TOLL RESTRICT - Toll restrict provides positive long distance lock-out. but allows a secret code to override and enable toll calling when desired.

RING DETECT - The telephone ring detector transmits a sequence of mobile alert tones (if enabled) either one time. or every 10 seconds. when an incoming call is received.

HOLD OFF - When an incoming call is received. the 520D will not transmit if the channel is active. The mobile alert tones are sent as soon as the channel is clear.

CALL LIMIT - The call timeout and mobile activity timeout provide unique beeps. followed by a delayed disconnect. The call limit timer can be disabled or programmed to reset with "*".

DIAL SELECT - Rotary or DTMF dialing may be switch selected.

CW ID - The CW IDer. when installed. sends the station call upon disconnect. The station call letters are factory programmed into an integrated circuit which can be customer installed.

*** OPTIONAL FEATURES ***

FIGURE C shows a maximum configuration utilizing validation and end-to-end two-tone sequential or DTMF signaling.

MODEL 520ETT - End to end signaling board enables selectively calling a mobile from the telephone. Regenerated DTMF tones are transmitted to the selected mobile station. The mobile operator must connect in a normal manner to initiate two-way voice communication. After connect, the 520D board takes over the interconnect control and the 520ETT is idle until disconnect. Requires +12V at 70MA. supplied by the 520D board.

MODEL 520TTS - The two-tone signaling option converts two-digit DTMF inputs to one of 99 two-tone sequential outputs which are transmitted when the receive channel is clear. The 520TTS option facilitates calling a selected mobile from the telephone, mobile to mobile calls, and unassisted mobile self-test. Requires +12V at 230MA. supplied by the 520D board.

MODEL 1000 ANI VALIDATOR - For full ANI capability, the validator stores up to 250 four digit codes. Codes can be easily added or deleted. An optional printer logs the ANI, telephone number dialed, and duration of call. Requires +12V at 100MA, supplied by the 520D board. Also, the model 1000 printer unit requires 120VAC at 100MA.

MODEL 270 COUPLER - The model 270 is an FCC Registered telephone line coupler. The coupler can be added when required to comply with part 68 of FCC regulations for direct telephone interfaces. This option is not necessary on local networks which satisfy part 68 regulations, or when using voice connecting arrangements provided by the telephone company.

NOTE

DTMF signals are commonly referred to by the registered trade names "Touchtone" and "Teltone".

*** INSTALLATION ***

(Refer to the Model 520D Assembly Drawing)

FIGURE A shows the standard duplex base station connections.

FIGURES B & C show the connections required for the 520D repeater configurations. NOTE that the repeater transmitter should receive its audio from the 520D patch and not the receiver.

*** TRANSMIT CABLE (red band) ***

Shield - Transmitter ground
Yellow - Transmit audio - TO BASE or RELAY NO
Orange - PTT. Logic
Black - Relay common - TRANSMITTER INPUT AUDIO
Brown - Relay NC - REPEATER AUDIO
Green - Relay NO - 520D TRANSMIT AUDIO

The transmit ground and audio must be connected. The orange wire is normally connected to the transmitter push-to-talk (PTT). If the PTT voltage exceeds +24VDC. uses AC, or requires a positive going PTT. use the auxiliary relay contacts for PTT. For duplex base installations. the the transmit cable black and green wires can be used when the LOGIC PTT (orange wire) connection should not be used. For repeater configurations requiring relay PTT control, wire J1-15 and J1-17 on the 520D board to the transmitter PTT signal and PTT return. The relay is rated for up to 2 Amperes at 125 VAC.

*** RECEIVE CABLE (white band) ***

Shield - Receiver ground/Power ground
Green - Squelched audio from receiver
Red - +12 VDC power to 520D (Without special options = 300MA.)
Brown - COR- NOTE: Connect either COR-
Orange - COR+ or COR+, but not both

The receive ground and audio must be connected. The red wire connects to the +12 VDC power. The power ground must be connected to the receive ground point. If the receiver COR (The Carrier Operated Relay signal is sometimes called "mobile present detect".) signal goes low when receive signals are present, connect it to the brown wire: otherwise, connect it to the orange wire. NOTE: The COR signal should be a voltage which switches between ground and at least +2.5 VDC. If the receiver does not provide a suitable output, contact CES customer service and request the "FILT" option.

*** JUMPER PROGRAMMING ***

Refer to FIGURE D to locate the board jumper locations. Verify that the board jumpers meet the system requirements. NOTE: On some 520D boards, a push-pull switch is used in place of the "D" jumper.

JUMPER	FUNCTIONS
A	Reverse autopatch enable beep (TO MOBILE)
B	Repeat tone sequence every ten seconds
C	Enable toll restrict
D	Half duplex audio
E	Enable answer beep (TO TELEPHONE)

During ring detect, the 520D brings up the transmitter with a sequence of eight short tone beeps. If JUMPER B is in place, this eight beep sequence will repeat every ten seconds as long as the ring continues. If jumper B is cut, the sequence of eight beeps occurs only once. If jumper A is cut, the telephone ring will not initiate any beeps to mobile units.

When TOLL RESTRICT is active, the telephone connection will be disconnected if a tenth digit is dialed. Cut JUMPER C to eliminate toll restricted numbers and enable unlimited DTMF digits for all calls.

When the transmitter system is designed to repeat the mobile receive audio on the transmit channel, cut JUMPER D (or pull the switch).

For systems with the ETT option, the beep back to the telephone line can be disabled by cutting JUMPER E.

COR = CARRIER OPERATE RELAY COS = CARRIER OPERATED SWITCH

*** ADJUSTMENTS ***

Refer to the FIGURE D to make the following on line adjustments.

HYBRID BALANCE - To adjust the HYBRID BALANCE (half-duplex audio requires no adjustment), bring up the patch and dial a telephone number. Ask the person answering for a quiet line. Unmute the repeater receiver and listen to the audio. There should be noise being transmitted when no signal is being received. Adjust the HYBRID BALANCE (R37) for minimum noise. If a more complete balance is desired, a capacitor can be added across the two printed circuit pads labeled CX (located to the left of the balance control). The optimum value of CX will differ, depending on the characteristics of your particular telephone line. Typical values of capacitance are: 0.01uF, 0.1uF, 0.22uF, and 0.47uF.

RECEIVE AUDIO - Adjust the R59 (Receive Level) for normal audio level into the phone line. The strobe LED in the center of the 520D board should go on whenever a valid DTMF receive signal is present.

TRANSMIT AUDIO - Adjust R38 (Transmit Level) for adequate transmitter deviation. The transmit level should be set to not exceed the maximum system deviation (5KHZ typically). DTMF tones should not generate more than 2.5KHZ to 3.0KHZ of transmitter deviation.

* NOTE *

All CES tone decoders meet Bell System standards. Although inexpensive decoders often do respond to distorted tones, it is imperative that the 520D not respond to false tones caused by voice transmissions. Most 520D decode problems occur because the DTMF audio levels to the transmitter have been set too high!

BEEPER LEVEL - R42 sets the warning beeper level to the transmitter. This is normally set to mid-range (half-turn). The volume can be increased by turning R42 clockwise.

MONITOR SPEAKER - Adjust TX BAL (R51) and RX BAL (R52) for equivalent volumes to the MONITOR SPEAKER.

SPECIAL REQUIREMENTS - Some receivers may have a low audio output level that requires the 520D gain to be increased. Located R53 (47K) on the 520D board. Parallel another resistor with R53: another 47K resistor would double the gain.

HI-Z MICROPHONES - Some radio systems, such as the Johnson CR1000, use high impedance microphones for the transmit audio input. For such systems, a 47K resistor should be connected in series with the yellow wire in the transmit cable. When such systems are used with the 520ETT and 520TTS options, the 1K resistor on the bottom of the 520ETT board must be removed.

*** SWITCH PROGRAMMING ***

DO NOT CHANGE ANY OF THE SWITCH SETTINGS (See FIGURE D) UNTIL THE PATCH HAS BEEN TESTED. FACTORY SETTINGS ARE:

Patch on/off ----------73
One call toll defeat digit ---------- 3
Patch timer ---------- 3 MIN
Activity timer ----------30 SEC
TDCD ----------ON
Toll restrict digits ----------0&1
Tone to pulse ----------OFF
Restrict 1st & 2nd ----------ON
Reset * ----------On
ID enable ----------OFF

All references to switch numbers are the numbers etched on the printed circuit board. DISREGARD THE NUMBERS ON THE SWITCHES.

PATCH ON/OFF

The patch ON code is "*" followed by two digits. The OFF code is "#" followed by the same two digits. The DTMF A, B, C, and D tones can be used as either of the two digits when using a 16 key pad. Locate the PATCH ON/OFF programming switches. Four are labeled 1st digit and four are labeled 2nd digit. Each switch is labeled 1, 2, 4, or 8. Using the chart below, set the appropriate switches ON for the the desired code. If all switches are OFF, the up code will be the single digit "*" and the down code will be the single digit "#". For this reason the code "DD" cannot be programmed. When using the Model 1000 option, set all eight switches ON.

Example: To program the ON/OFF to 73, set the 1St DIGIT switches labeled 1, 2, and 4 to ON, and the 2ND DIGIT switches labeled 1 and 2 to ON.

DESIRED DIGIT (S5)															
1	2	3	4	5	6	7	8	9	0	A	B	C	D		
1	2	1	4	1	2	1	8	1	2	1	2	1			
	2		4	4	2		8	8	4	4	2				
					4				8	8	4				
												8			
SET SWITCHES "ON" AS INDICATED															

PATCH TIMER & RESET *

Refer to the programming chart to set the switches for the desired patch time-out. The timer can be disabled by setting all four switches to the ON position. The timer can be reset with the "*" if the RESET * switch is ON. The * reset feature does not function if the connect code is the single digit "*". Time-out warning beeps will be transmitted starting when the patch is 20 seconds from time-out. When the patch times out, four beeps are transmitted.

MINUTES (S3)							
.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
	1	2	1	4	1	2	1
			2		4	4	2
							4

SET SWITCHES "ON" AS INDICATED

MINUTES (S3)							
4.5	5.0	6.0	7.0	8.0	10	15	OFF
8	1	2	1	4	1	2	1
	8	8	2	8	4	4	2
			8		8	8	4
							8

SET SWITCHES "ON" AS INDICATED

ACTIVITY TIMER

The ACTIVITY TIMER is running any time the mobile is not transmitting and is reset every time mobile carrier is received. The timer disconnects the patch if the mobile is out of range or fails to respond to the interconnect after a reasonable wait. Short beeps warn the mobile operator to transmit ten seconds prior to disconnect. Four beeps will be sent after the timeout. SEE TABLE BELOW

SECONDS (S3)							
20	30	40	50	60	70	80	90
	1	2	1	4	1	2	1
			2		4	4	2
							4

SET SWITCHES "ON" AS INDICATED

NOTE: THIS TIMER CANNOT BE DISABLED.

TOLL RESTRICT DIGITS & RESTRICT 1St & 2ND

There are ten switches labeled 0 thru 9. Any combination of numbers can be restricted from being the 1st dialed digit (RESTRICT 1ST "ON"), 2nd dialed digit (RESTRICT 2ND "ON"), or both. In many areas it will only be necessary to use the restrict 1st switch. Some areas do not dial a 1 as the first digit of a long distance call. In those areas the RESTRICT 2ND will be used since all area codes have either a 0 or a 1 for the second digit. Since no area codes have a 1 or 0 for the first digit, the restrict 1st switch should also be switched ON to prevent the operator from being dialed. Most systems are configured with 0, 1, RESTRICT 1ST, and RESTRICT 2ND on; 2 through 9 are off. If a TOLL RESTRICT disconnect occurs, the CW ERROR message (eight beeps) will be transmitted.

ONE CALL TOLL DEFEAT 1ST DIGIT & TDCD

The 520D has a secret code sequence to defeat the toll restrict from a remote location. The first DTMF digit sent must be a "*", then the switch selected code (SEE TABLE), and the code "7". To enable this feature, set the switch labeled TDCD to the on position. The "*" "x" "7" toll defeat sequence should be followed by the normal "*" "x" "x" connect sequence. After the dial tone is heard, the long distance number can be dialed. Each long distance call made must be preceded by the "*" "x" "7" and connect sequence. The REMOTE TOLL RESTRICT DEFEAT does not function if the connect code is the single digit "*".

CODE DIGIT							
1	2	3	4	5	6	7	8
1	2	1	4	1	2	1	ALL
	2		4	4	2	OFF	
					4		

SWITCHES SET TO ON POSITION

TONE TO PULSE (S1)

For rotary dialing, switch ON the TONE TO PULSE switch. Do not use PULSE dialing on a TONE line, since this sends both pulses and tones to the telephone line.

ID ENABLE (S1)

This switch must be OFF for all current 520D options. The ID is enabled by plugging into U21 a programmed PROM.

* CAUTION *

The ID PROM (U21) is positioned opposite the direction of the other board integrated circuits. Refer to the assembly print before insertion.

*** OPTIONAL FCC REGISTERED COUPLER INSTALLATION ***

If you have purchased the Model 2700 FCC Registered coupler, remove the telephone cord from the 520D, and insert the 6 conductor cable from the coupler. Plug the 6 wires into E1 thru E6 as follows.

GREEN	E1	ORANGE	E4
BLUE	E2	BLACK	E5
WHITE	E3	RED	E6

*** OPTIONAL 520ETT END TO END SIGNALING BOARD INSTALLATION ***

SWITCH PROGRAMMING

Switch A - ON Keeps transmitter PTT on between digits (3S)
OFF Keeps PTT on 30S for BUSY CHANNEL LOCKOUT

Switch B - ON Enables PTT delay, as selected by Switch A
OFF Keeps PTT active as long as trunk is held on

Switch C - ON Inhibit 2-tone sequential operation
OFF Enable 2-tone sequential operation

ADJUSTMENTS

There are three adjustments on the mobile signaling board. Use the assembly drawing to locate these adjustments.

Call the interconnect from another telephone. The call will be answered and the transmitter will come on; the caller should hear a series of beeps.

Adjust the PTT TIMER (R25), to hold the transmitter on for the desired length of time. This also determines the trunk hold time (up to 33S).

Send tones from the telephone. Tones should be transmitted but there will be no voice path. (FFC regulations require this.)

Adjust AUDIO IN (R22) for reliable decoding as indicated by tones being transmitted for all the digits on the telephone.

Adjust AUDIO OUT (R33) for the desired transmitter deviation. (Nominally 3KHZ for the DTMF "*" signal.)

* CAUTION *

Revision B 520ETT boards must be connected to Revision B or higher 520D systems. Be sure to specify the 520D system serial number when ordering the 520ETT option to upgrade existing systems.

*** OTHER OPTIONS ***

Operation and installation manuals are available for the Model 520TTS Two Tone Signaling Option and the Model 1000M Code Validator. Contact CES, Inc. for additional information.

INSTALLATION OF CES MODEL # 1206 COUPLER BOARD IN 520D

The model # 1206 Coupler Board has been incorporated into CES Model 520D Interconnects to increase isolation from the telephone line when in the disconnected state to protect the unit from potential damage due to voltage surges caused by electrical storms. Along with this instruction sheet are drawings to help simplify field retrofit of the # 1206 Coupler Board.

If this sheet is included with a complete manual on the 520D and the schematic and board layout drawing have the red overprint the coupler has been installed at the factory and this is just for your information.

MODIFICATION AND INSTALLATION:
(See drawing and schematic for location and detail)

Mount the #1206 board in the housing in the space provided.

Remove relay K1 from the 520D and add wire jumpers in place of the relay as shown on layout drawing to connect what would have been the normally open ontacts.

Remove resistor R18 from the board.

Remove capacitors C12 and / or C11 from the board and replace with wire jumper. Some later model units have both capacitors and some have only C11 and not C12

520E OPTION BOARD (if equipped):

Remove the Ferrite Bead Jumpers from the board near relay K1 and connect wires from relay wipers (holes nearest the relay where jumpers were removed) to the lugs on the #1206 board.

Wiring is as follows:
Wire from #1206 Board to 520D Board

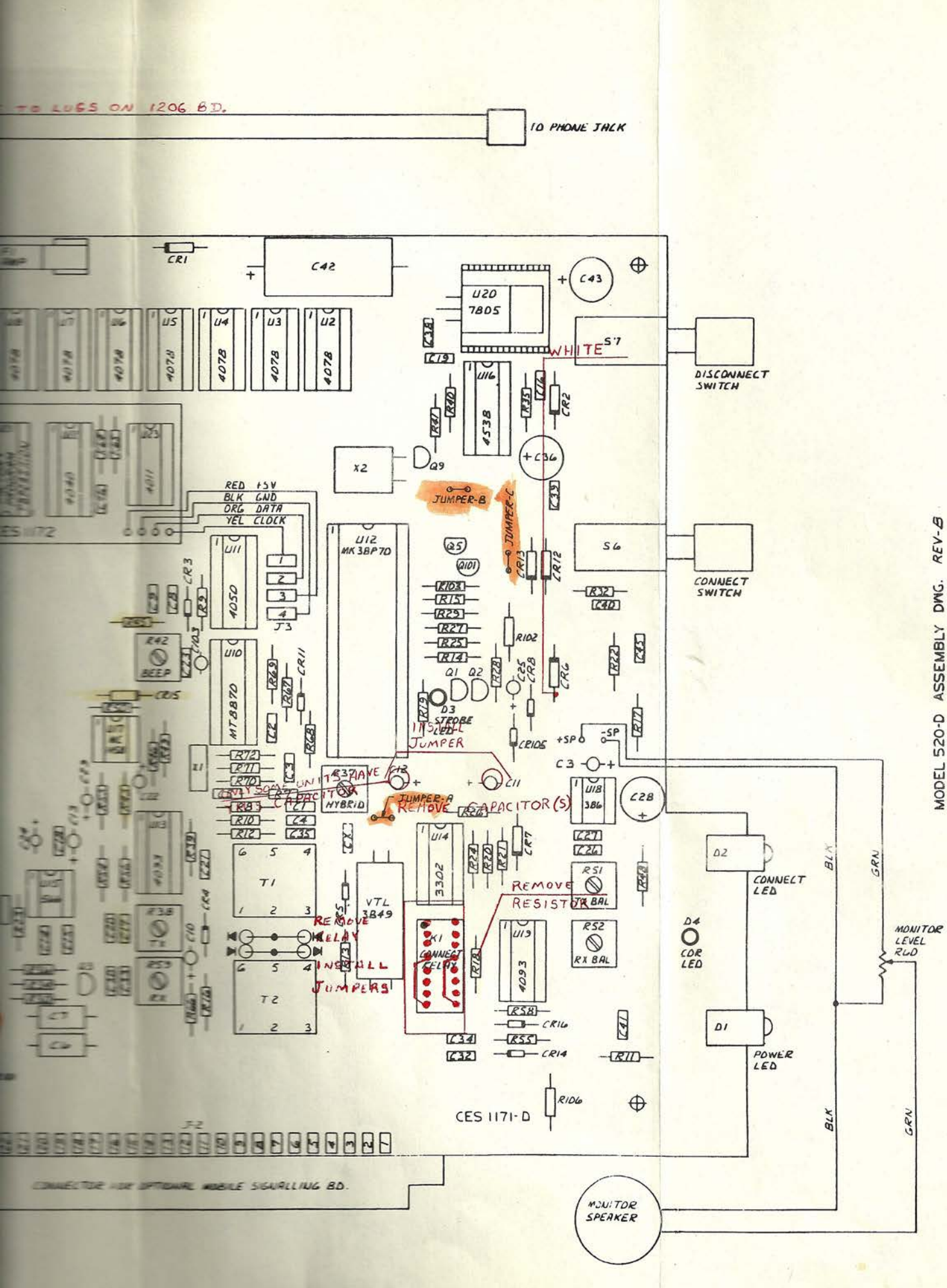
Blue	-	E1
Green	-	E2
Orange	-	E4
Red	-	E6
White	-	Anode of CR6

Phone line wires no longer go to E1 and E2 on the 520D board. Connect phone line to the lugs on the #1206 baord.

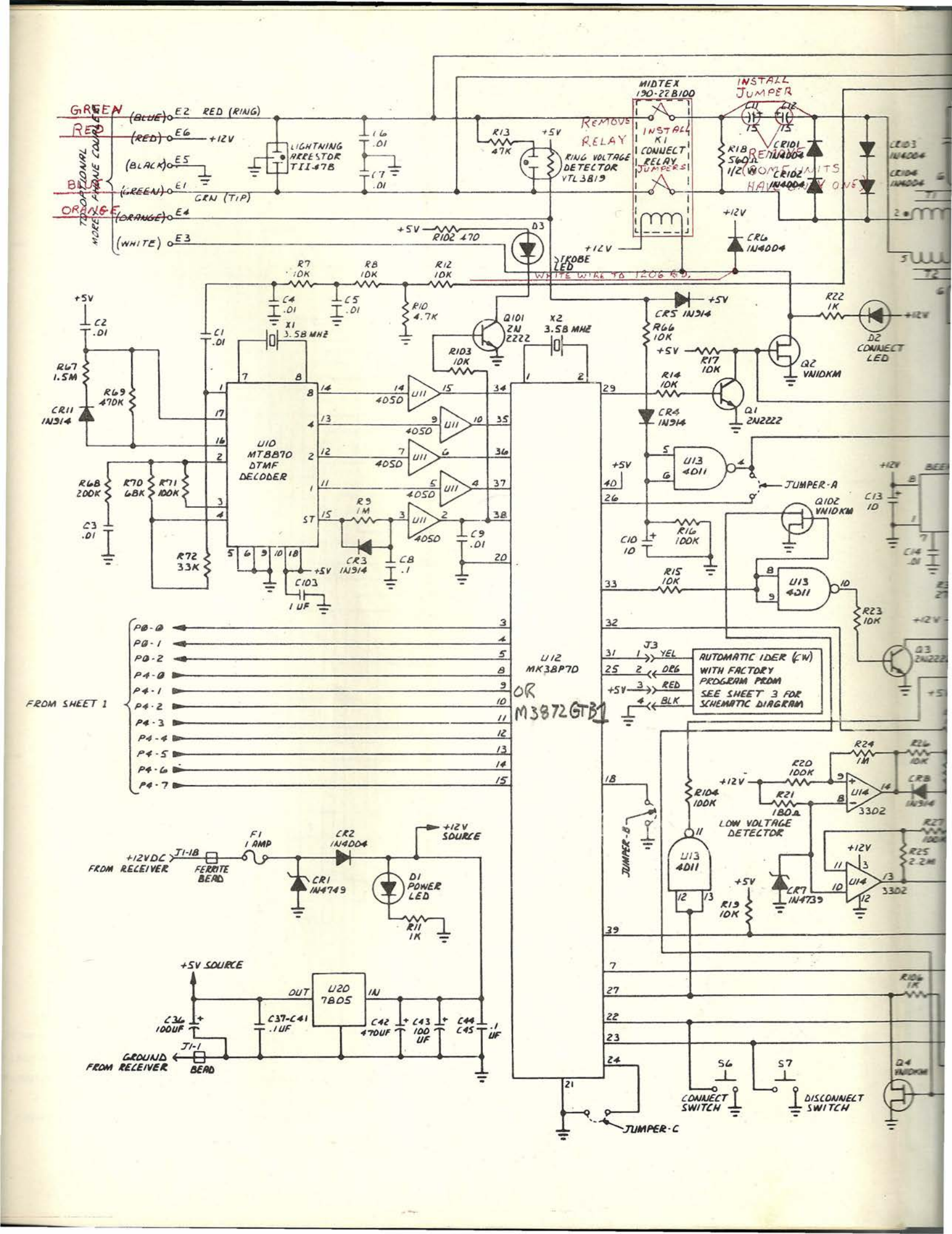
With the # 1206 board installed there is no longer any direct path from the phone line to the 520D except through the coupler.

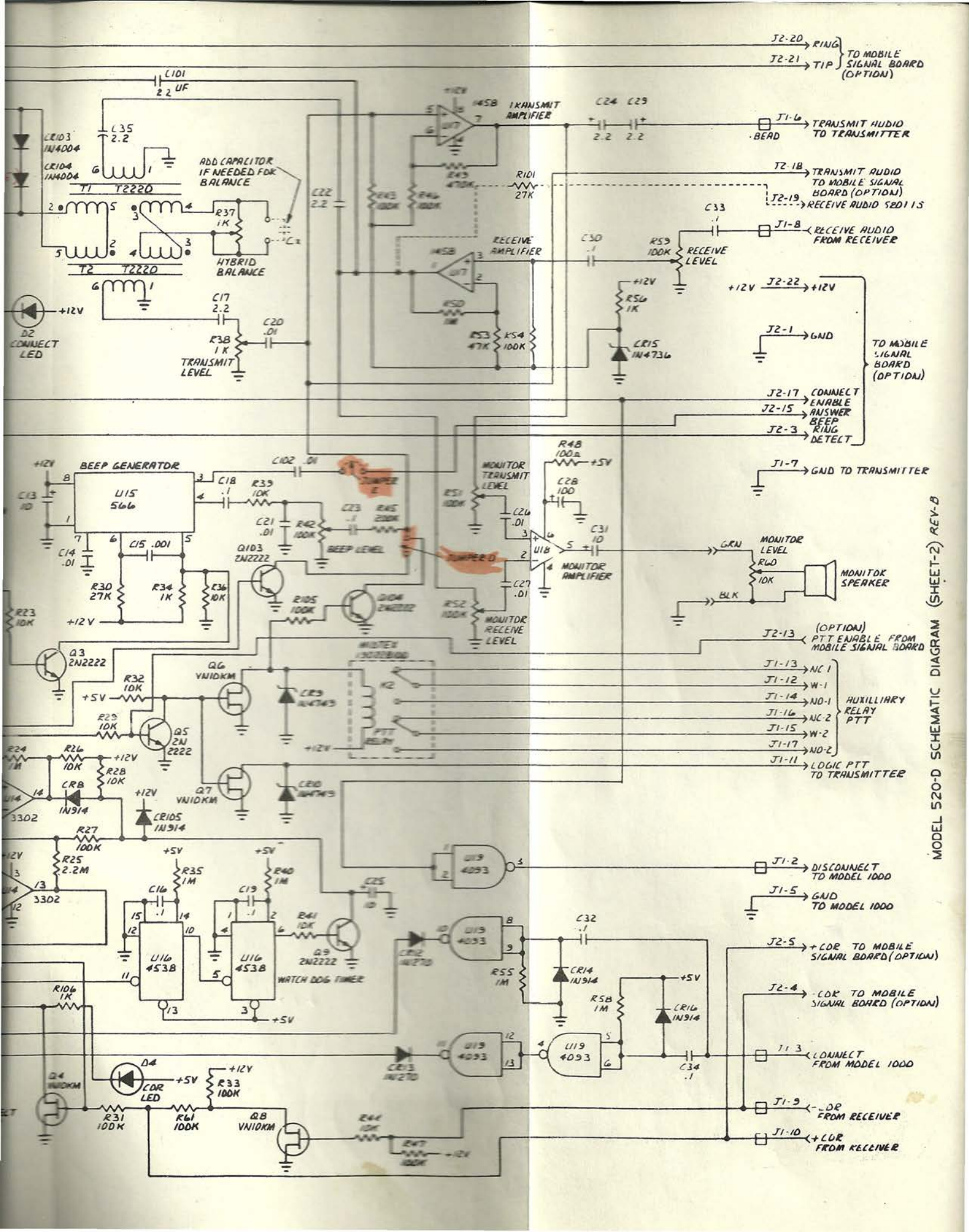
IMPORTANT: AUDIO LEVELS AND HYBRID BALANCE MUST BE READJUSTED PER INSTRUCTIONS IN 520D MANUAL.

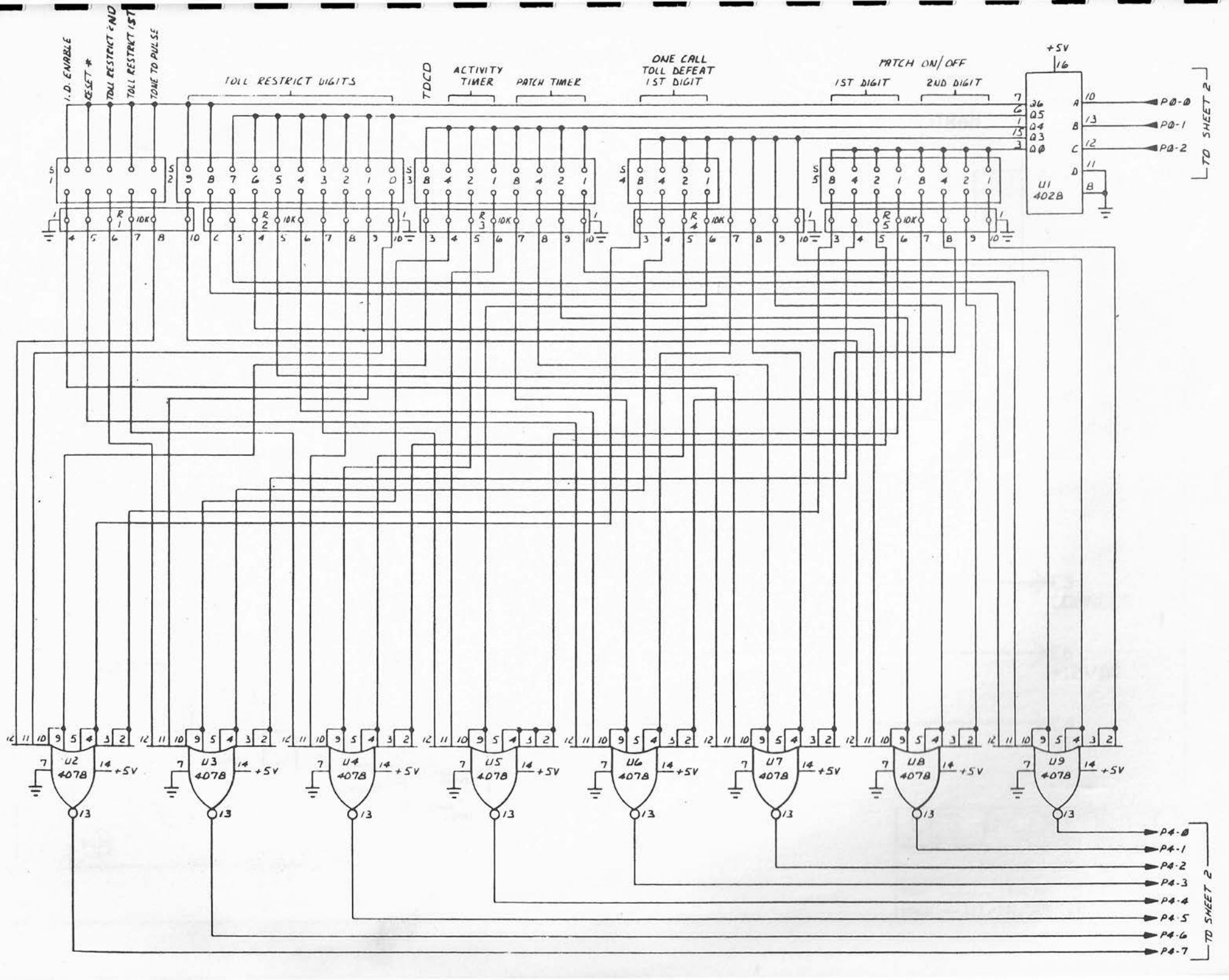
SHIELD (J1-1) RECEIVER GROUND
GREEN (J1-8) RECEIVER AUDIO
BROWN (J1-9) -COR
ORANGE (J1-10) +COR
RED (J1-18) +12VDC
SHIELD (J1-7) TRANSMITTER GROUND
YELLOW (J1-6) TRANSMITTER AUDIO
ORANGE (J1-11) LOGIC PTT
BLACK (J1-12) RELAY PTT W-1
BROWN (J1-13) RELAY PTT NC-1
GREEN (J1-14) RELAY PTT NO-1
RECEIVER CABLE WHITE BAND
TRANSMITTER CABLE RED BAND
P-1
-KEY-
J-1
GND
MODEL 1000 DISCONNECT
MODEL 1000 CONNECT
KEY SLOT
GND
TRANSMIT AUDIO
GND
RECEIVE AUDIO
-COR
+COR
LOGIC PTT
RELAY PTT W-1
RELAY PTT NC-1
RELAY PTT NO-1
N.C.
N.C.
N.C.
+12 VDC
CONNECT PHONE LINE TO LUGS ON
ORANGE
RED
GREEN
GREEN
BLUE
RED
F1 1 AMP
E1
E6
E2
E3
E4
E5
TIP 478
U1 4028
U9 4078
U8 4078
U7 4078
4078
S5
2ND DIGIT
PATCH ON/OFF
1ST DIGIT
OFF ON
R5
U21
FACTORY PROGRAM TBP24S10N
U22 4040
CES 1172
S4
ONE CALL TOLL DEFEAT 1ST DIGIT
R4
S3
PATCH TIMER
ACTIVITY TIMER
TDCD
R3
BEAD
BEAD
S2
TOLL RESTRICT DIGITS
R2
BEAD
BEAD
BEAD
BEAD
Q8
Q4
R47
R44
S1
TONE TO PULSE
RESTRICT 1ST
RESTRICT 2ND
RESET #
ID ENABLE
OFF ON
R1
K2 PTT RELAY
R67
R31
R33
CR10
CR9
Q102
JUMPER D
Q103
Q104
R104
R105
JUMPER E
R101
Q6
Q7
U15 566
C24
C13
C23
R23
C14
C15
R31A
R34
R30
Q3
C7
C6
U17 MC 1458
R50
CONNECTOR FOR



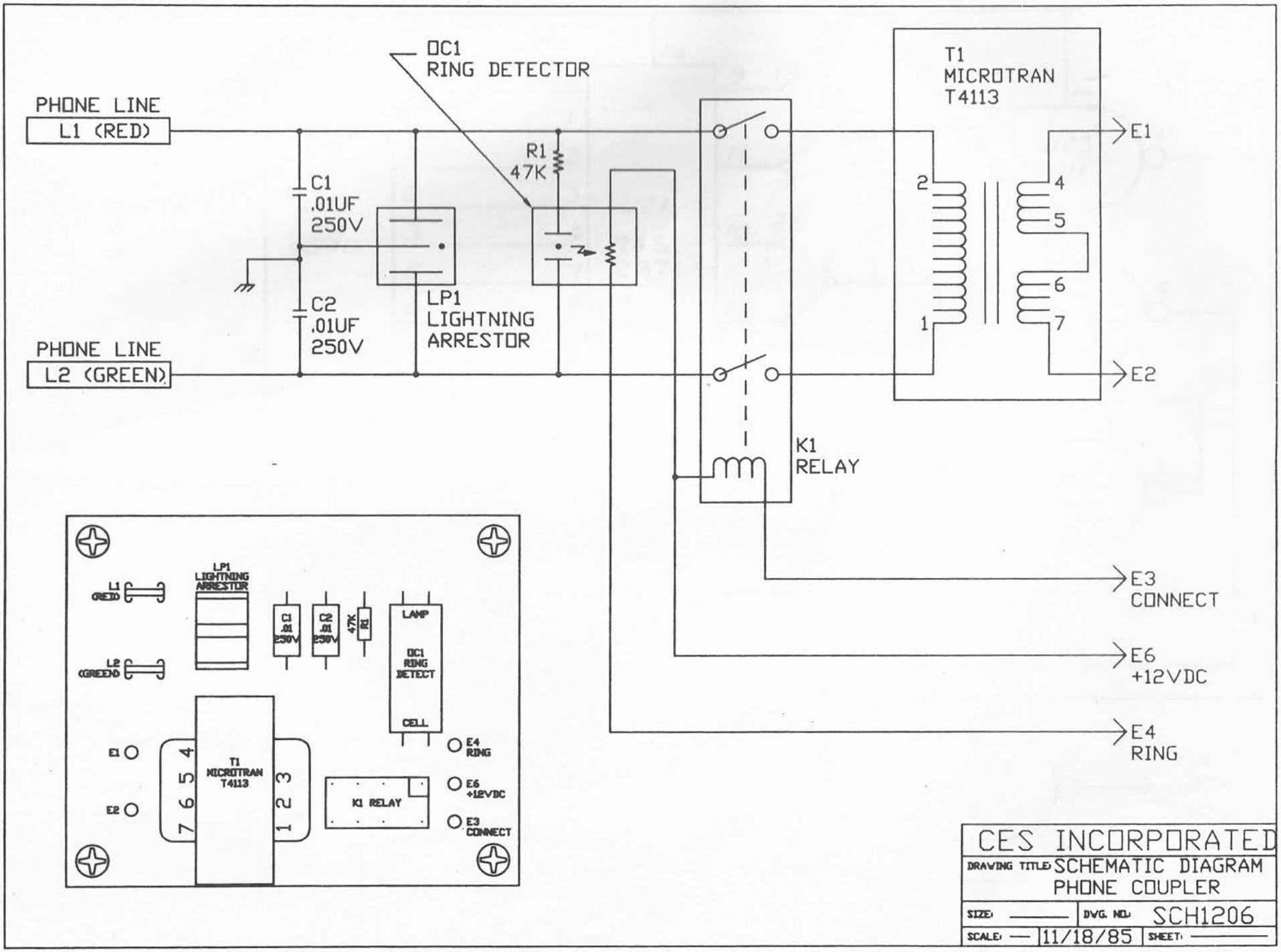
MODEL 520-D ASSEMBLY DWG. REV-B


GREEN
RED
BLACK
ORANGE
TRADITIONAL TELEPHONE COLORS
(BLUE) E2 RED (RING)
(RED) E6 +12V
(BLACK) E5
(GREEN) E1 GRN (TIP)
(ORANGE) E4
(WHITE) E3
LIGHTNING ARRESTOR TII-47B
C6 .01
C7 .01
R13 47K
+5V
RING VOLTAGE DETECTOR VTL3819
MIDTEX 130-22B100
REMOVE RELAY
INSTALL K1 CONNECT RELAY JUMPERS
INSTALL JUMPER
C11 15
C12 15
R18 560Ω 1/2W
CR101 IN4004
CR102 IN4004
CR103 IN4004
CR104 IN4004
(SOME UNITS HAVE ONLY ONE)
+12V
CR6 IN4004
+5V R102 470
D3 TROUBLE LED
WHITE WIRE TO 1206 BD.
R7 10K
R8 10K
R12 10K
C4 .01
C5 .01
R10 4.7K
X1 3.58 MHZ
Q101 ZN 2222
X2 3.58 MHZ
R103 10K
CR5 IN914
R66 10K
R22 1K
D2 CONNECT LED
R17 10K
Q2 VN10KM
R14 10K
Q1 2N2222
CR4 IN914
C2 .01
C1 .01
R67 1.5M
R69 47DK
CR11 IN914
U10 MT8870 DTMF DECODER
U11 4050
U13 4011
JUMPER-A
Q102 VN10KM
C13 10
C14 .01
R68 200K
R70 68K
R71 100K
C3 .01
R72 33K
R9 1M
CR3 IN914
C8 .1
C9 .01
C10 10
R16 100K
R15 10K
R23 10K
C103 1 UF
P0-0
P0-1
P0-2
P4-0
P4-1
P4-2
P4-3
P4-4
P4-5
P4-6
P4-7
FROM SHEET 1
U12 MK38P70 OR M3872GTB1
J3
YEL
ORG
RED
BLK
AUTOMATIC IDER (CW) WITH FACTORY PROGRAM PROM SEE SHEET 3 FOR SCHEMATIC DIAGRAM
R24 1M
R26 10K
R20 100K
R21 180Ω
CR8 IN914
U14 3302
LOW VOLTAGE DETECTOR
R104 100K
JUMPER-B
R27 100K
R25 2.2M
CR7 IN4739
R19 10K
R106 1K
+12VDC FROM RECEIVER
J1-18
FERRITE BEAD
F1 1 AMP
CR2 IN4004
+12V SOURCE
CR1 IN4749
D1 POWER LED
R11 1K
+5V SOURCE
U20 7805
OUT
IN
C36 100UF
C37-C41 .1 UF
C42 470UF
C43 100 UF
C44 C45 .1 UF
J1-1
GROUND FROM RECEIVER
BEAD
S6 CONNECT SWITCH
S7 DISCONNECT SWITCH
Q4 VN10KM
JUMPER-C

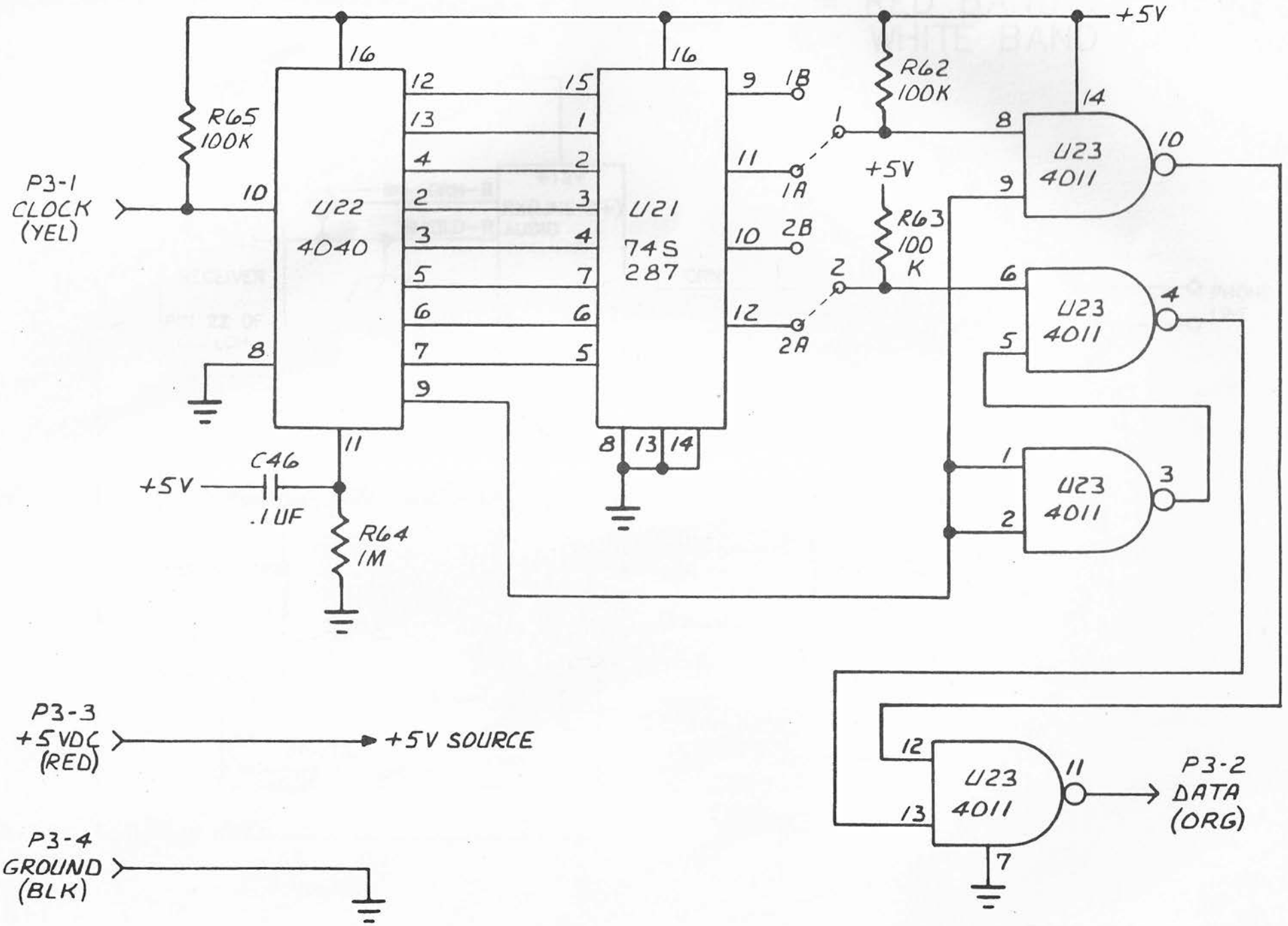

J2-20 RING
J2-21 TIP
TO MOBILE SIGNAL BOARD (OPTION)
C101 2.2 UF
CR103 IN4004
CR104 IN4004
L35 2.2
T1 T2220
T2 T2220
ADD CAPACITOR IF NEEDED FOR BALANCE
R37 1K
HYBRID BALANCE
+12V
D2 CONNECT LED
C17 2.2
R38 1K TRANSMIT LEVEL
C20 .01
1458 U17
TRANSMIT AMPLIFIER
C24 2.2
C29 2.2
J1-6 BEAD
TRANSMIT AUDIO TO TRANSMITTER
C22 2.2
R43 100K
R46 100K
R49 470K
R101 27K
J2-18 TRANSMIT AUDIO TO MOBILE SIGNAL BOARD (OPTION)
J2-19 RECEIVE AUDIO SEE D11 S
C33 .1
J1-8 RECEIVE AUDIO FROM RECEIVER
RECEIVE AMPLIFIER
C30 .1
R59 100K RECEIVE LEVEL
R50 1M
R53 47K
R54 100K
R56 1K
CR15 IN4736
+12V J2-22 +12V
J2-1 GND
TO MOBILE SIGNAL BOARD (OPTION)
J2-17 CONNECT
J2-15 ENABLE ANSWER BEEP
J2-3 RING DETECT
BEEP GENERATOR
U15 566
C13 10
C14 .01
C15 .001
C18 .1
R39 10K
C21 .01
R42 100K
C23 .1
R45 220K
BEEP LEVEL
C102 .01
JUMPER E
JUMPER D
Q103 2N2222
R105 100K
Q104 2N2222
R30 27K
R34 1K
R36 10K
R23 10K
MONITOR TRANSMIT LEVEL
R51 100K
R48 100Ω
+5V
C28 100
C26 .01
C31 10
U18 MONITOR AMPLIFIER
C27 .01
R52 100K MONITOR RECEIVE LEVEL
J1-7 GND TO TRANSMITTER
GRN
BLK
MONITOR LEVEL
R40 10K
MONITOR SPEAKER
J2-13 (OPTION) PTT ENABLE FROM MOBILE SIGNAL BOARD
Q3 2N2222
R32 10K
Q6 VN10KM
CR9 IN4749
K2
PTT RELAY
R29 10K
Q5 2N 2222
J1-13 NC 1
J1-12 W-1
J1-14 NO-1
J1-16 NC-2
J1-15 W-2
J1-17 NO-2
AUXILLIARY RELAY PTT
J1-11 LOGIC PTT TO TRANSMITTER
R24 1M
R26 10K
R28 10K
CR8 IN914
U14 3302
Q7 VN10KM
CR10 IN4749
CR105 IN914
R27 100K
R25 2.2M
U19 4093
J1-2 DISCONNECT TO MODEL 1000
J1-5 GND TO MODEL 1000
R35 1M
R40 1M
C16 .1
C19 .1
C25 10
U16 4538
WATCH DOG TIMER
Q9 2N2222
R41 10K
CR12 IN270
C32 .1
R55 1M
CR14 IN914
R58 1M
CR16 IN914
J2-5 +COR TO MOBILE SIGNAL BOARD (OPTION)
J2-4 -COR TO MOBILE SIGNAL BOARD (OPTION)
J1-3 CONNECT FROM MODEL 1000
J1-9 -COR FROM RECEIVER
J1-10 +COR FROM RECEIVER
CR13 IN270
C34 .1
R106 1K
D4 COR LED
R33 100K
Q4 VN10KM
R31 100K
R61 100K
Q8 VN10KM
R44 10K
R47 100K
MODEL 520-D SCHEMATIC DIAGRAM (SHEET-2) REV-B



MODEL 520-D SCHEMATIC DIAGRAM (SHEET-1)

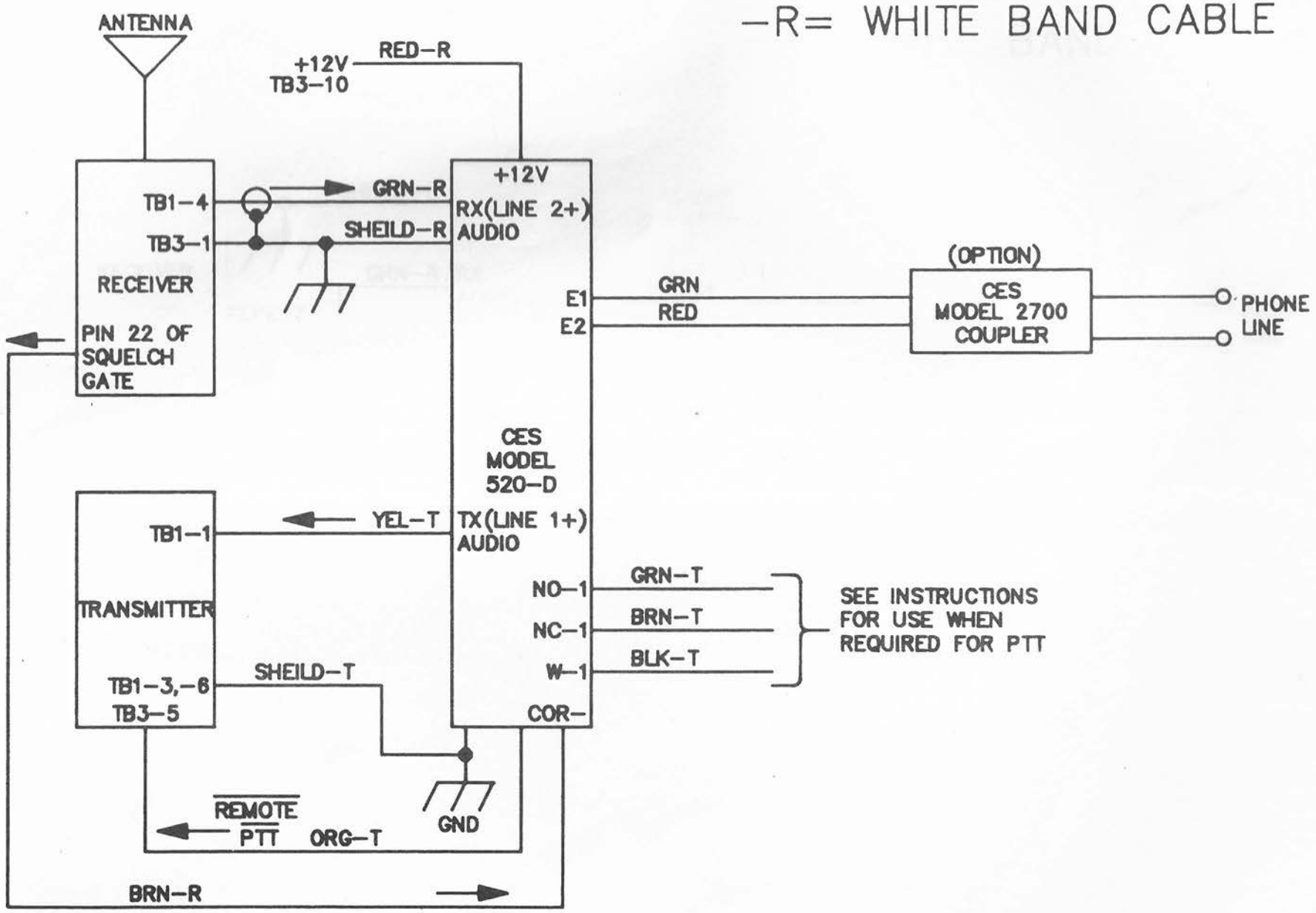


CES INCORPORATED		
DRAWING TITLE: SCHEMATIC DIAGRAM PHONE COUPLER		
SIZE:	DWG. NO: SCH1206	
SCALE: —	11/18/85	SHEET:



MODEL 520-D AUTO IDENTIFIER

-T= RED BAND CABLE
-R= WHITE BAND CABLE

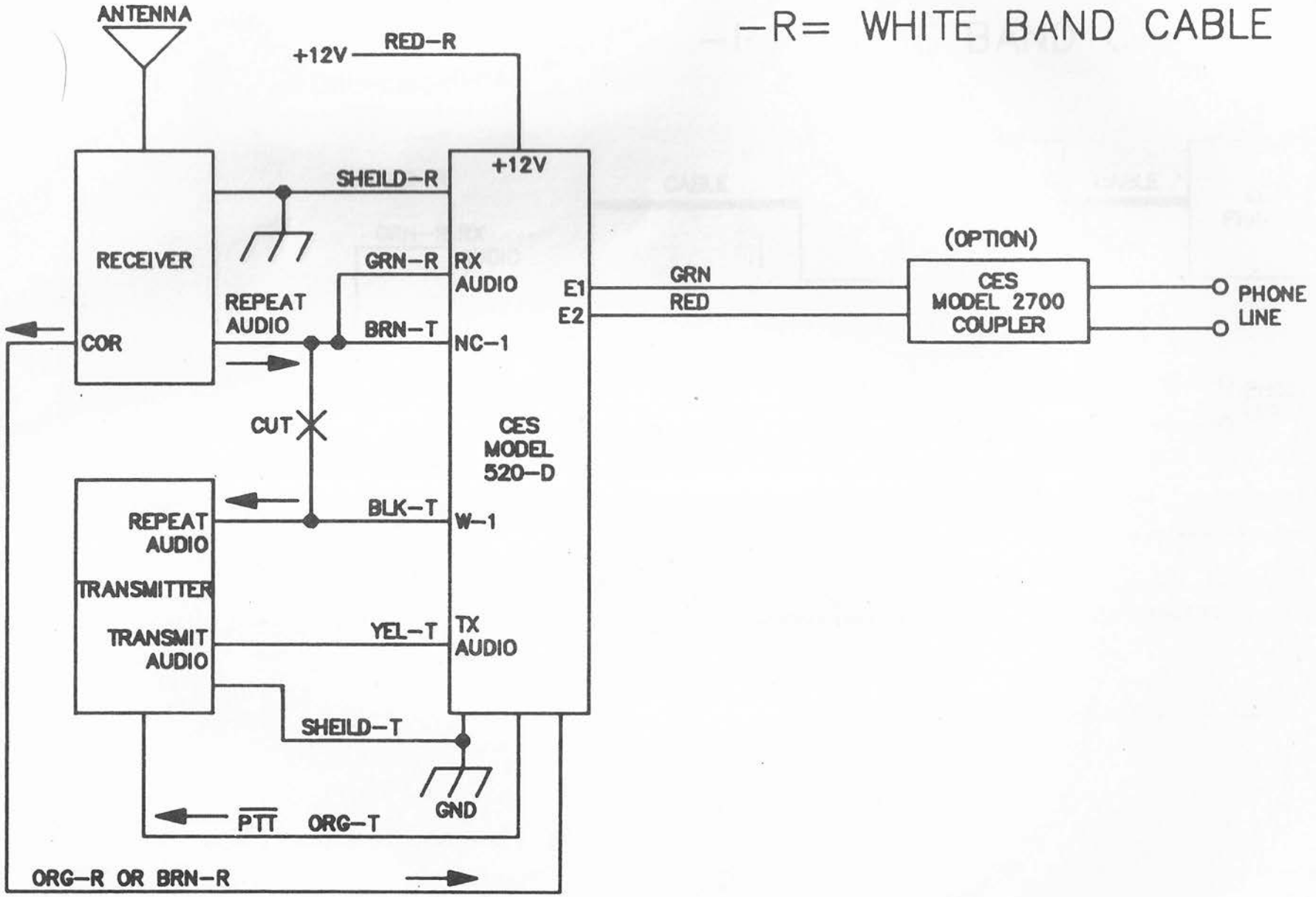


BASIC 520-D MICOR BASE CONNECTION

REV	A	FIGURE-A

-T= RED BAND CABLE

-R= WHITE BAND CABLE

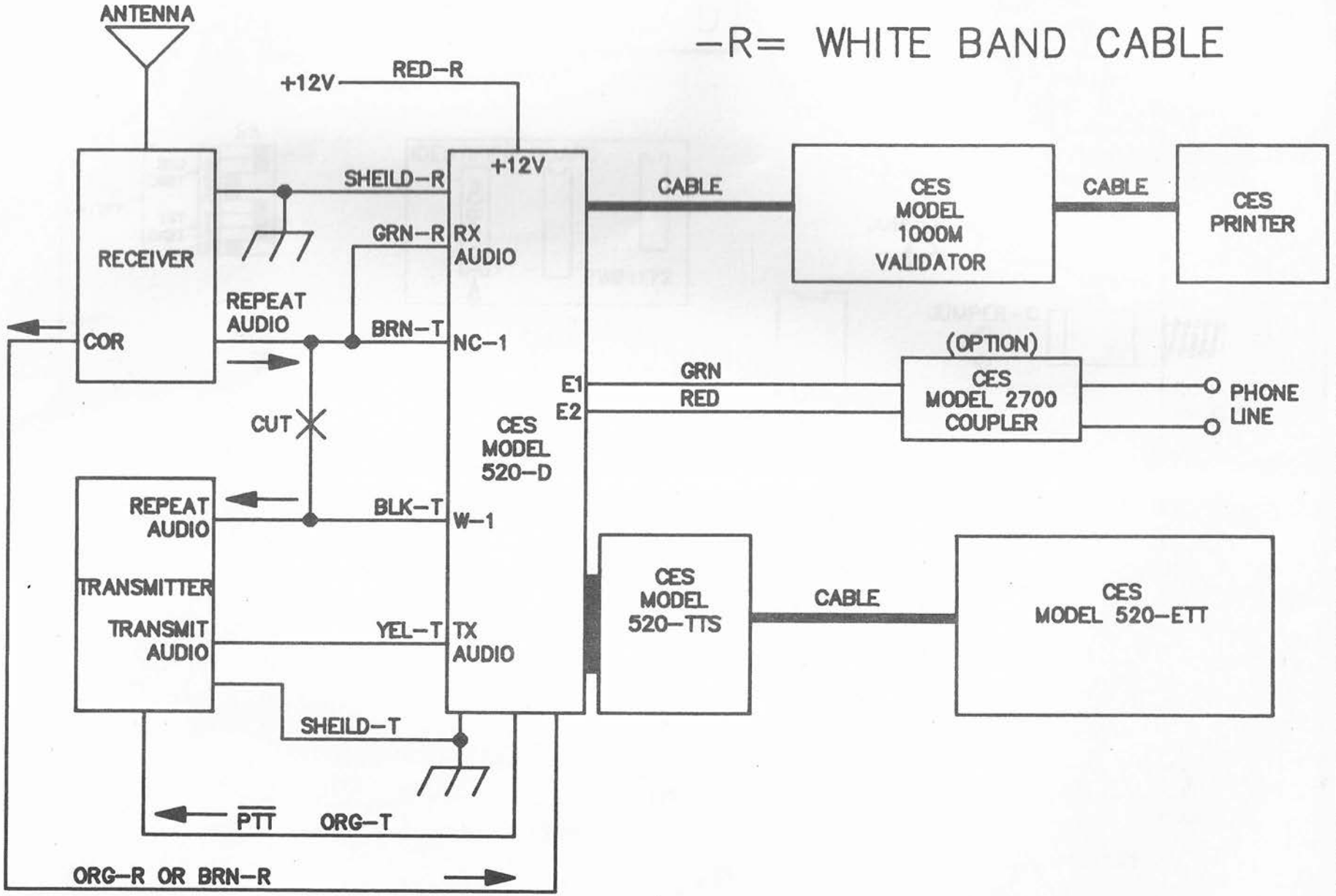


BASIC 520-D REPEATER CONNECTION

REV	A	FIGURE-B

-T= RED BAND CABLE

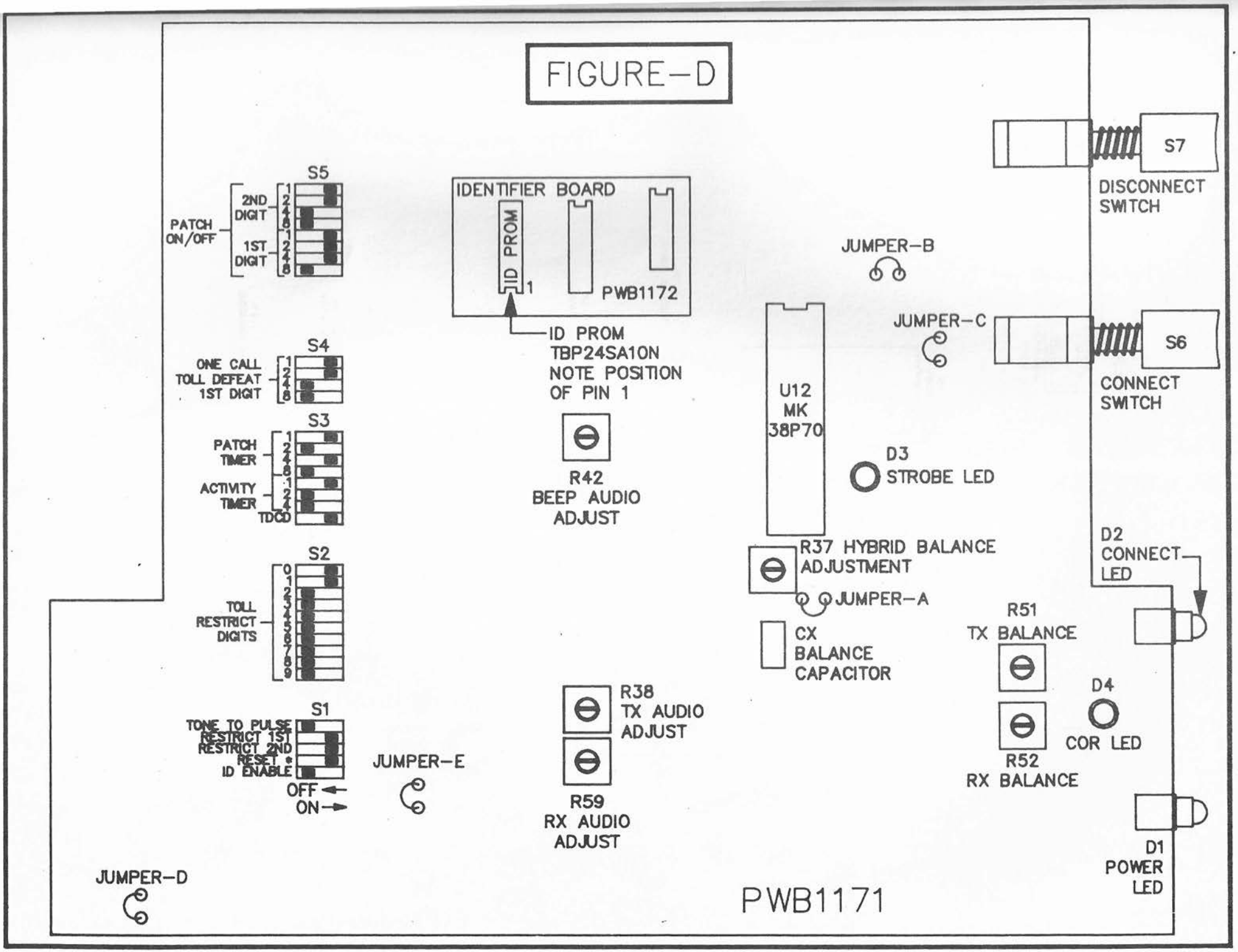
-R= WHITE BAND CABLE

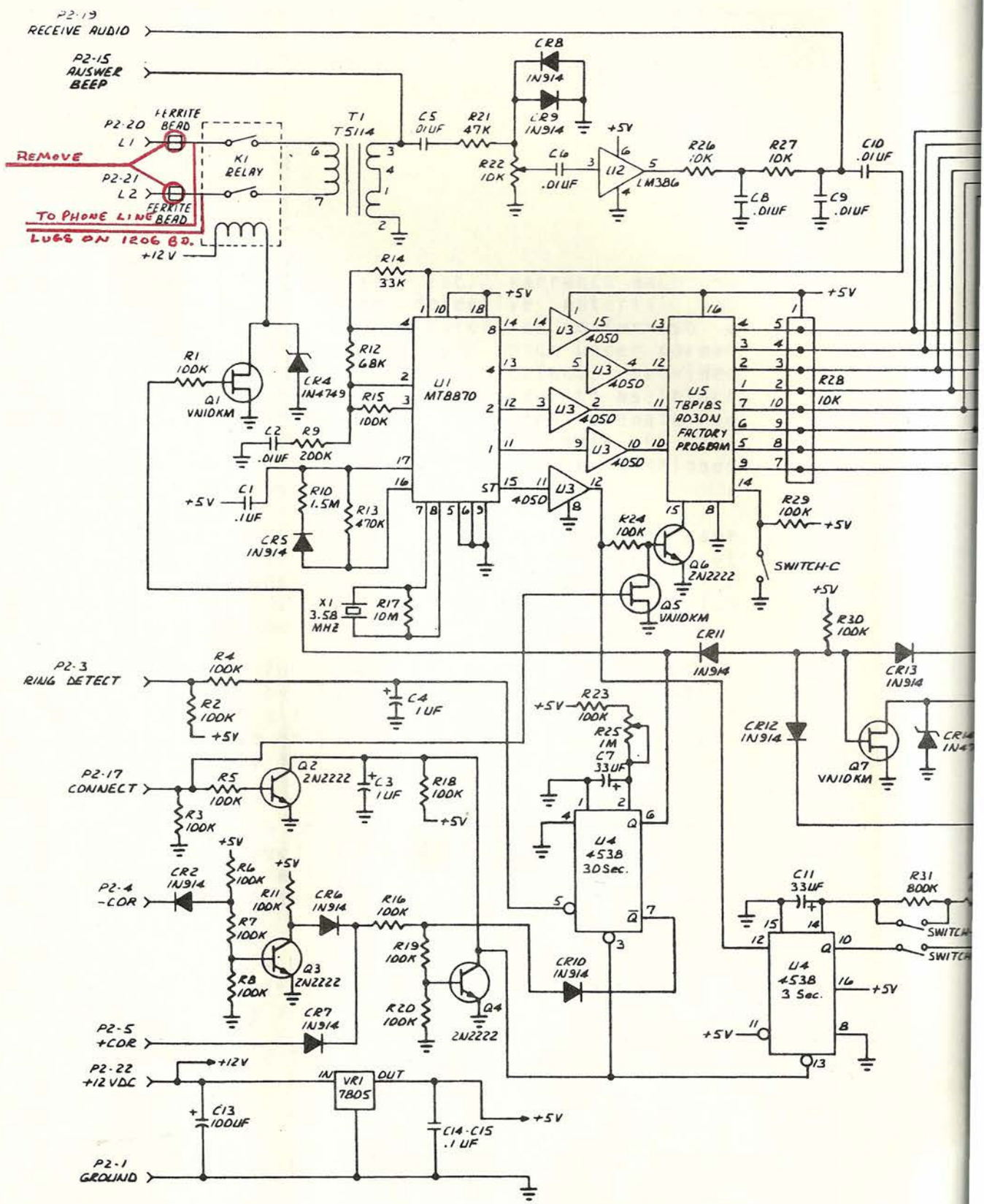


MOBILE TO MOBILE FOR 2 TONE SEQUENTIAL / WITH VALIDATION

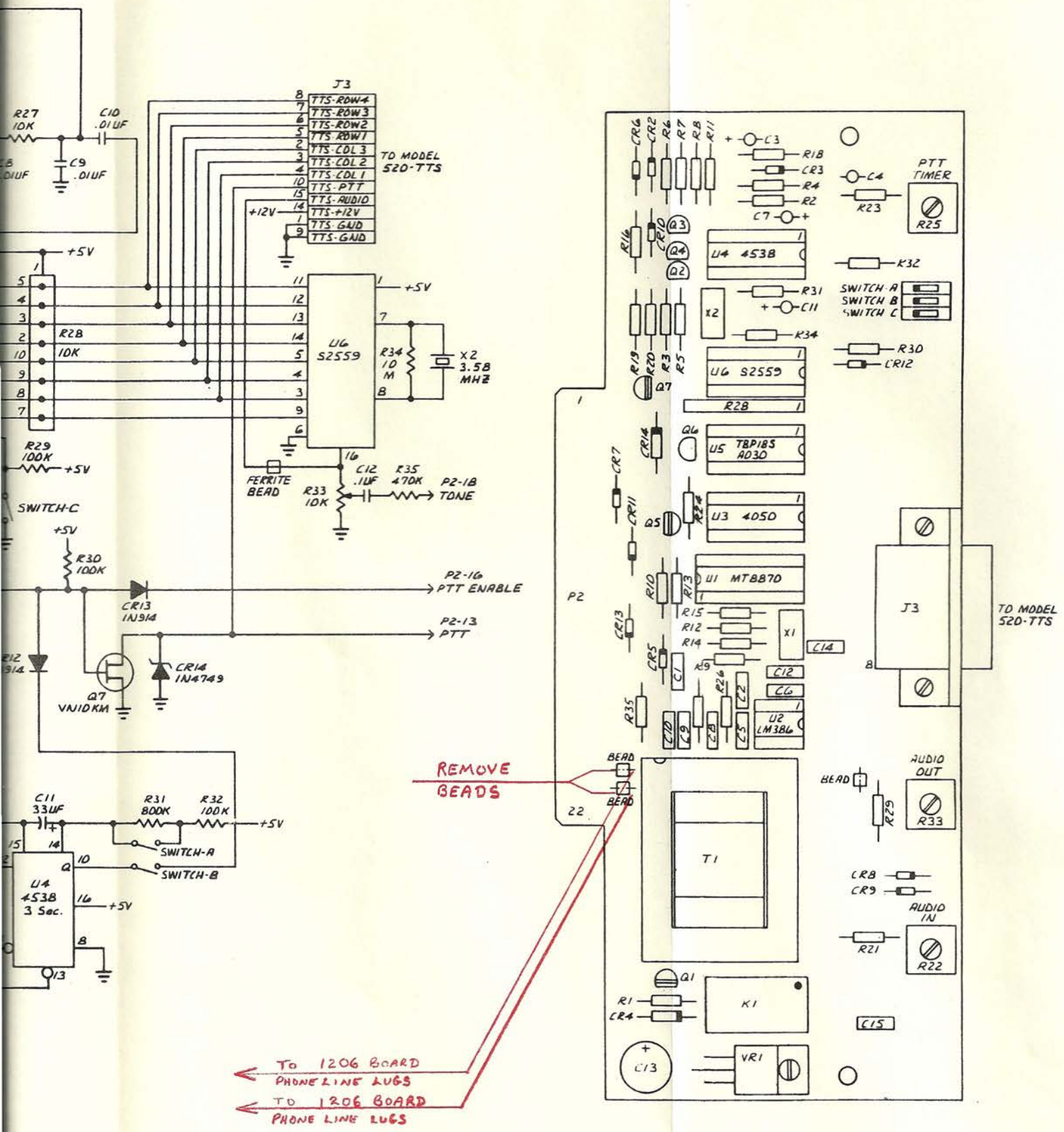
REV	A	FIGURE-C

FIGURE–D


S5
PATCH ON/OFF
2ND DIGIT
1ST DIGIT
1
2
4
8
S4
ONE CALL TOLL DEFEAT 1ST DIGIT
S3
PATCH TIMER
ACTIVITY TIMER
TDCD
S2
TOLL RESTRICT DIGITS
0
1
2
3
4
5
6
7
8
9
S1
TONE TO PULSE
RESTRICT 1ST
RESTRICT 2ND
RESET *
ID ENABLE
OFF
ON
JUMPER–E
JUMPER–D
IDENTIFIER BOARD
ID PROM
1
PWB1172
ID PROM TBP24SA10N NOTE POSITION OF PIN 1
R42 BEEP AUDIO ADJUST
R38 TX AUDIO ADJUST
R59 RX AUDIO ADJUST
U12 MK 38P70
D3 STROBE LED
R37 HYBRID BALANCE ADJUSTMENT
JUMPER–A
CX BALANCE CAPACITOR
JUMPER–B
JUMPER–C
S7
DISCONNECT SWITCH
S6
CONNECT SWITCH
D2 CONNECT LED
R51 TX BALANCE
D4 COR LED
R52 RX BALANCE
D1 POWER LED
PWB1171



SCHEMATIC DIAGRAM MODE



SCHEMATIC DIAGRAM MODEL 520-ETT (REV-A)

LIMITED WARRANTY

Communications Electronics Specialties, Inc. warrants each new product sold by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit which under normal installation, use, and service discloses such defect, provided the unit or part, is delivered by the original owner to us intact for our examination with all transportation charges prepaid to our factory, within six months from the date of sale to the original purchaser and provided that such examination discloses in our judgment, that it is thus defective.

This warranty does not extend to any of our products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of the instructions furnished by us, and does not extend to units which have been repaired or altered outside of our factory.

Any part of a unit approved for remedy or exchange hereunder, will be remedied or exchanged by CES without charge to the owner. This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with sale of our products.

Batteries are not included in the Limited Warranty. On units which are returned to us and need only a battery, there will be a charge of $7.50 per unit for replacing the battery and shipping it back to you. Leaking batteries, sprays and lubricants, will void warranty.

CES reserves the right to make any improvements to its products which it may deem desirable without obligation to install such improvements in its previously sold products.

This warranty will not be valid if it is not registered.

CES Inc.
803C South Orlando Ave.
Winter Park, Florida 32789

Since many users are probably familiar with the old part numbering system of 3870 Family single chip microcomputers, the following cross reference guide shown in Table 2-1 is provided as an aid in determining the new part number from the old designation. Also, the list shown in Table 2-2 is provided as a summary of devices which are now available or soon to be available in the MK3870 single chip microcomputer family.

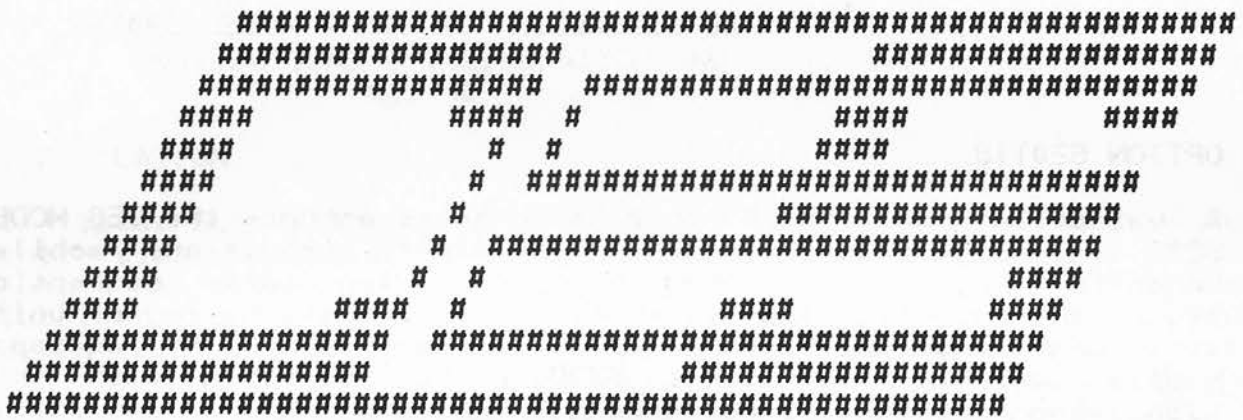
3870 FAMILY PART NUMBER CROSS REFERENCE
Table 2-1

Old Part Number	New Part Number	ROM	Executable RAM	Parallel I/O	Special I/O	Technology
MK3870	MK3870/20	2K	0 bytes	32 bits	-	NMOS
MK3872	MK3870/42	4K	64 bytes	32 bits	-	NMOS
MK3872 w/standby	MK3875/42	4K	64 bytes	30 bits	V_{SB},V_{BB}	NMOS
MK3873	MK3873/20	2K	0 bytes	29 bits	SI,SO, SRCLK	NMOS
MK3874 MK97400, MK97401	MK38P70/02	Ext.	64 bytes	32 bits	-	NMOS P-PROM pkg.
MK3876	MK3870/22	2K	64 bytes	32 bits	-	NMOS
MK3876 w/standby	MK3875/22	2K	64 bytes	30 bits	V_{SB},V_{BB}	NMOS

3870 SINGLE CHIP MICROCOMPUTER FAMILY

Table 2-2

Device	ROM (bytes)	Scratchpad RAM	Executable RAM	Parallel I/O	Special I/O	Technology
MK3870/10	1K	64 bytes	0 bytes	32 bits	-	NMOS
MK3870/12	1K	64 bytes	64 bytes	32 bits	-	NMOS
MK3870/20	2K	64 bytes	0 bytes	32 bits	-	NMOS
MK3870/22	2K	64 bytes	64 bytes	32 bits	-	NMOS
MK3870/30	3K	64 bytes	0 bytes	32 bits	-	NMOS
MK3870/32	3K	64 bytes	64 bytes	32 bits	-	NMOS
MK3870/40	4K	64 bytes	0 bytes	32 bits	-	NMOS
MK3870/42	4K	64 bytes	64 bytes	32 bits	-	NMOS
MK3873/10	1K	64 bytes	0 bytes	29 bits	SI,SO SRCLK	NMOS
MK3873/12	1K	64 bytes	64 bytes	29 bits	SI,SO SRCLK	NMOS
MK3873/20	2K	64 bytes	0 bytes	29 bits	SI,SO SRCLK	NMOS
MK3873/22	2K	64 bytes	64 bytes	29 bits	SI,SO SRCLK	NMOS
MK3875/22	2K	64 bytes	64 bytes	30 bits	V_{SB},V_{BB}	NMOS
MK3875/42	4K	64 bytes	64 bytes	30 bits	V_{SB},V_{BB}	NMOS
MK38C70/10	1K	64 bytes	0 bytes	32 bits	-	CMOS
MK38C70/20	2K	64 bytes	0 bytes	32 bits	-	CMOS
MK38P70/02	Ext.	64 bytes	64 bytes	32 bits	-	NMOS P-PROM pkg.
MK38P73/02	Ext.	64 bytes	64 bytes	29 bits	SI,SO SRCLK	P-PROM pkg.
MK38CP70/02	Ext.	64 bytes	64 bytes	32 bits	-	CMOS P-PROM pkg.



MODEL 520TTS

TWO TONE SIGNALLING OPTION

CES INC.
PO. BOX 2930
WINTER PARK, FL 32790
305-645-0474

CES TWO TONE SEQUENTIAL SIGNALLING OPTION - MODEL 520TTS

OPTION 520TTS

A versatile signalling adapter designed to enhance the CES MODEL 520D Intelligent Interconnect. The 520TTS signals any mobile, handheld, or pager, using a standard two tone sequential signalling format. The system provides for signalling of units from DTMF equipped telephones as well as from DTMF equipped mobile radios. The model 520D, when equipped with this signalling option will serve as a complete and highly versatile exchange system.

APPLICATIONS

Signalling of pocket pagers, mobile to mobile signalling, landline to mobile signalling as well as signalling related to emergency services when equipped with group call.

STANDARD FEATURES

99 number capacity

Group call (reduces capacity to 89 numbers)

Standard rack cabinet

Front panel display

Signalling not limited to any specific code plan

Easy installation

ACCESSORIES

CES MODEL 520D - Intelligent Interconnect (required)

CES MODEL 1000M - 256 customer validator and billing unit

CES MODEL 1000P - system and billing printer

WARRANTY CARD

The MODEL 520TTS is covered by the standard CES six month warranty. Details of the coverage can be found on the warranty sheet included with this manual. Failure to complete your warranty card or to mail the card to CES will result in a voided warranty.

INSTRUCTIONS - INSTALLATION AND OPERATION OF 520TTS

INSTALLATION

On later 520D interconnects the installation of the signalling unit simply consists of inserting the associated 520ETT board into the accessory connector of the 520D and connecting the supplied cable between the 520TTS and the data connector of the 520ETT board. If you are installing the 520TTS to an older 520D it may be necessary to modify the 520D. Make the changes indicated in dotted lines on the enclosed 520D schematic. Any 520D may be returned to our factory for installation of the 520TTS option.

ADJUSTMENT

To adjust the input level of the 520ETT board you should attach the probe of your scope to pin 12 of U3. Turn the PTT timer control fully counter clockwise (max). Dial the number of the phone line attached to the 520D. Dial any digits with the calling phone while watching the scope. Pin 12 of U3 will go high upon receipt of valid DTMF signals. Adjust R22 so that the gain is in the middle of the working range for all DTMF digits. Check pin 5 of U2 of the 520ETT. There should be no distortion of the DTMF signals. Turn the audio out control to midpoint. Turn Switches A and B on, and Switch C off.

OPERATION

To signal a unit simply dial the number of the interconnect with another telephone. You should hear approximately .75 sec of ringing followed by a click. Dial the two digits of the unit you intend to signal followed by a "#". You should hear the tones on your service monitor. If adjustment of the tone level is necessary you should use the audio out adjust of the 520ETT. Some of the tones used for signalling are quite low in frequency. Many transmitters do not pass such tones without severe attenuation. Any harmonic content, no matter how slight will be passed with much greater emphasis. The result will be severe harmonic distortion. Distortion caused by this factor typically results in tones that have the appearance of a hump in the middle. If you have this problem you can remove R35 of the 520ETT and connect the tone output directly to the subaudible input of your transmitter. This problem can usually be avoided by using direct FM transmitting equipment or equipment designed specifically for paging. The 520TTS also has the capability of mobile to mobile signalling. To use this feature a mobile simply dials a two digit number followed by "#". This causes a two tone sequential signal to be generated. Group call can be accomplished by dialing the first digit of the signal code twice, followed by "#". (Example: 22#).

SIGNALLING

DTMF signalling is accomplished by generating two tones and adding them linearly to form a composite signal. There is a potential error when used with FM equipment. It is possible to adjust the DTMF levels so that they are affected by the limiters employed in FM transmitters. These limiters are followed by a filter which would mask the damage to the signal. The correct procedure for adjusting the DTMF level would be to set the limiters on a hard voice signal. Press the three on the DTMF pad and adjust the encoder level for 2/3 system deviation (3.3KC in a 5KC system). To test for damage to the signal press buttons one and three simultaneously. Measure the deviation and write down the value. Call this value "A". Now press buttons 3 and 9 simultaneously and record the measured deviation as "B". Add the values of A and B. Call the result C. Now measure the deviation of the DTMF digit 3. The value should be very close to C above. Please note that the value B should be very close to twice the value A. The two signals differ by one octave. The transmitter pre-emphasis should cause twice the gain for B. The same test when applied at the receiver should yield A=B; A+B=C.

LIMITED WARRANTY

Communications Electronics Specialties, Inc. warrants each new product sold by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit which under normal installation, use, and service discloses such defect, provided the unit or part, is delivered by the original owner to us intact for our examination with all transportation charges prepaid to our factory, within six months from the date of sale to the original purchaser and provided that such examination discloses in our judgment, that it is thus defective.

This warranty does not extend to any of our products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of the instructions furnished by us, and does not extend to units which have been repaired or altered outside of our factory.

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