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CES 510SA Smart Patch Installation and Programming Instructions

Obsolete Product - No Longer Supported

INTRODUCTION

The information that follows is for the CES Model 510SA "Smart Patch" sold from 1987 to about 1992 by CES. This information is provided to assist previous purchasers of this product, and those individuals that purchase the 510SA second-hand.

If you purchased, or are considering purchasing the 510SA second-hand you should be aware that some parts and components used in this product are no longer available. Specifically, the microprocessor (CES Part Number MK38P70, or U3870) is no longer available either from CES, or from anyone else (as far as we know).

If the 510SA you purchased or are trying to install has been hit by a lightning or voltage surge, there is a good chance that the microprocessor has been damaged. As anyone who services electronic products regularly knows, it is not unusual for integrated circuits used in decade+ old designs to become obsolete. If you decide that you wish to purchase a new telephone interconnect, please consider the CES Model 4700VP, which lists for under USD$300.00 (is available through distribution for even less) and has a complement of standard features never before offered on a telephone interconnect in this price range.

You may find that the best way to obtain technical support for older products is via e-mail, we will make every effort to answer your questions the same day excluding weekends and holidays, of course.

510SA - "Smart Patch"

The CES MODEL 510SA SMART PATCH is a microprocessor controlled telephone interconnect. It is intended to provide any DTMF equipped mobile radio with the ability to make or receive telephone calls using ordinary simplex FM base station equipment. Complete and immediate Controls extended to the mobile through the use of our uniquely enhanced sampling process.

STANDARD FEATURES

- Single * and # or multi-digit control codes - user programmable.

- Sophisticated TOLL RESTRICT for positive long distance lock-out, with secret code to disable for one toll call.

- TIME-OUT and COR ACTIVITY timers with unique warning beeps and digital programming.

- TIME-OUT timer can be disabled or reset with the *.

- User Selectable Tone or Rotary Dialing Phone line in use detector prevents interrupting a Call in progress, and sends a CW message.

- Secret code allows full access for emergency calls.

- Reverse autopatch logic enables a unique CW message either one time or every 10 seconds, (user selectable) when an incoming call is received.

- SMART PATCH however will not transmit on top of someone, it will waitfor carrier to drop. Digital programming of sample rate and sample time, along with the noise gate sensitivity control, allow for easy interfacing with most transceivers. Connections to the transceiver are simple and direct.

- CW identifier: The original 510SA included a mail-in card to receive a complementary CWID chip (U22) factory programmed with the station identifier string. This part is no longer available from CES. If you are in possession of a blank TBP24SA10N (or equivalent) chip, CES does offer programming of the chip at our factory for a nominal fee. Call (407-679- 9440) or e-mail (sales@cesusa.com) CES for more details.

CHOOSING A BASE STATION

The 510-SA Smart Patch will work with any FM transceiver. However, the duration of the required sample window is determined by the time it takes for the transceiver to switch from transmit to receive and then back tin transmit

determined by the time it takes for the transceiver to switch from transmit to receive and then back till transmit. When choosing the base station it is important to understand that a fast switching transceiver will produce shorter interruptions (sample windows) in the transmitted audio and therefore "sound better" to the mobile operator. Some microprocessor controlled transceivers switch very slowly and require excessive window settings to function properly. Typical window times are less than 85 milliseconds.

OPERATION

Normally the base station is held in the receive mode. When the connect code is received from the mobile the base station will transmit the CWID (if enabled) and then connect the phone line) and begin to transmit phone line audio back to the mobile. The carrier will be interrupted about once? every Second as the base is switched back to receive to determine if the the mobile is transmitting. If the mobile is transmitting during Sample window, the base will lock into receive and mobile audio will be coupled to the phone line. The mobile operator should remember that after keying, he must pause long enough for the next sample window before dialing or speaking. When the mobile stops transmitting, the base will resume transmitting and sampling. When a conversation is over, the disconnect code is used to disconnect the patch from the phone line.

When the 5I0-SA receives and in-bound call from the telephone line it will transmit the CWID (if enabled) and pause for the mobile to transmit the connect code. The mobile operator then transmits the Connect Code instructing the 510-SA that he wishes to accept the call. The510-SA then connects the telephone line and the conversation Commences. To terminate the conversation the mobile operator transmits the Disconnect Code and the interconnect disconnects the telephone line and reverts the transceiver back to a receive condition.

There are five connections that must be made between the 510SA and the transceiver. Most connections (except for discriminator audio see note below) can usually be made through the transceiver accessory jack, otherwise connections will have to be made directly to the transceivers circuitry. When installing wires inside the radio, keep all wires as short as possible. Do not route wires near coils or the transmitter power amplifier. The required connections are as follows:

```
RED-----------+ 12 VDC
VIOLET--------GROUND
YELLOW-------PUSH-TO-TALK
BLUE----------DISCRIMINATOR AUDIO (SEE NOTE)
GRAY----------MICROPHONE AUDIO
```

(Wire colors not listed are not used)

*DISCRIMINATOR AUDIO: Connect the BLUE wire to the receiver discriminator output. THIS MUST BE CONNECTED DIRECTLY TO THE DISCRIMINATOR OUTPUT BEFORE ANY FILTERING. SMART PATCH CANNOT DETERMINE THE PRESENCE OF MOBILE CARRIER IF THIS CONNECTION IS NOT MADE PROPERLY. The SMART PATCH audio section provides the necessary de-emphasis.

POWER: Connect the VIOLET wire to a good ground and the RED wire to switched and filtered +12VDC.

PUSH-TO-TALK: Connect the YELLOW wire to the PTT line located at the microphone connector. Transceivers with the PTT voltage lower than the supply will cause the PTT LED on the patch to glow slightly.

MICROPHONE AUDIO: Connect the GRAY wire to microphone audio located at the microphone connector.

Note: A ground lug is provided on the rear of the cabinet . This lug MUST be grounded to a good earth ground with 12 gauge or larger wire. Without this earth ground the internal lightning suppressor provides NO lightning protection. There may also be RF pickup from AM and FM radio stations if the ground is not used.

Refer to the assembly drawing to locate the following adjustments

NOISE: Adjust R13 NOISE LEVEL CONTROL) to cause the front panel noise indicator to just come ON" , then turn the control 1/8 turn farther. The next step is important for proper operation of the interconnect. Using another radio to transmit, verify that the noise indicator is "ON when the second radio is not transmitting, and "OFF when it is transmitting. THE NOISE INDICATOR SHOULD NOT BE ON WHEN A MOBILE IS TRANSMITTING, EVEN IF MODULATION IS PRESENT. Using a dummy load, transmit a variety of audio levels and DTr1F tones from the mobile. The noise level adjustment is correctly set when the noise LED illuminates only when the mobile is not transmitting.

RECEIVE AUDIO: Make a call and have the person on the other end listen to the audio level. Adjust R62 (RECEIVE LEVEL) for normal audio level into the telephone line. This level affects the DTMF decoder Verify that the DTMF Strobe LED, near the rear of the patch, illuminates whenever DTMF digits are sent.

TRANSMIT AUDIO: Adjust R50 (TRANSMIT LEVEL) for adequate transmitter deviation. To allow the patch to drive a low impedance mic input, change C26 and C101 to 2.2 uF. Change R6 to 560 ohms if sufficient audio cannot be obtained.

BEEP LEVEL: Adjust R51 (BEEP LEVEL) to the desired level as compared to the transmit audio level.

PL LEVEL: R26 (CTCSS LEVEL) is not normally used. This adjustment is provided for future expansion or specialized applications of the 510-SA.

PROGRAMMING

PROGRAMMING

Referring to the assembly drawing, become familiar with the location of the programming switches and jumpers. All programming charts are shown as viewed from the front of the patch.

DO NOT CHANGE ANY SWITCH SETTINGS UNTIL THE PATCH HAS BEEN TRIED!

The 510SA interconnect has been factory programmed as shown below. Try all functions before changing any switches.

```
CWID---------------------------OFF
*RESET-------------------------ON
TOLL RESTRICT------------------1 AND O RESTRICTED in the 1 ST AND 2ND DIGITS
TONE/PULSE---------------------OFF
TOLL DEFEAT CODE DISABLE---ON
SECRET CODE-------------------*14
ACTIVITY TIMER----------------30
SEC PATCH TIMER--------------3 MIN
SAMPLE WINDOW--------------80 MS
SAMPLE RATE-------------------1 SEC
CONNECT CODE----------------*73
```

Note Changing the programming switches while in the connect mode has no effect on the operation of the 51O-SA until the next call.

PROGRAMMING THE CONNECT/DISCONNECT CODE

The Connect Code is a "*" followed by two digits. The Disconnect Code is "#" followed by the same two digits. The

"*" and "#" cannot be used as either of the two digits. Locate the Connect/Disconnect programming switches. Four are labeled "1ST DIGITAL and four are labeled"2ND DIGIT". Using the chart below, set the switches for your desired code. If all switches are "OFF" the codes will be the single digits "*" and "#". (The code "DD cannot be programmed.)

SEE PATCH CODE SWITCH SETTING CHART AT END OF MANUAL

PROGRAMMING THE SAMPLE WINDOW:

When the 510-SA is in the connect mode, and is transmitting telephone audio the Interconnect periodically switches the transceiver to receiver in order to look for a mobile carrier. This momentary period is caged the "sample window". These sample windows occur at regular intervals (determined by the sample rate), and because they interrupt the telephone transmission, sound like "breaks" in received audio to the mobile operator. The key objectives in programming the sample window are to minimize the length of the window in order to reduce the "breaks", and to keep the window of sufficient duration to allow the transceiver to switch from transmit to receive. Longer windows make it easier for mobiles to capture the interconnect, but are more likely to make objectionably long breaks. Shorter windows sound more desirable to the mobile operator but may not allow sufficient time for the transceiver to switch (from receive to transmit) and then lock on to the mobile carrier.

Setting the Sample Window is a subjective matter which trades-off the length of the interruptions to the mobile operator, against the switching speed of the transceiver. Setting the sample window is best accomplished by setting the dip switches to 80 milliseconds (see the Sample Window Programming chart at end of manual) then testing if the mobile is able to capture the interconnect. If the mobile can not capture the interconnect then the sample window needs to be lengthened. If the mobile can capture the interconnect then you may wish to experiment with shorter settings to reduce the breaks in received audio to the mobile operator.

SEE SAMPLE WINDOW SWITCH SETTING CHART AT END OF MANUAL NOTE:

Changing programming switches while in the connect mode has no effect until the next call. You MUST disconnect or power down before changing the switch settings.

PROGRAMMING THE SAMPLE RATE

The sample rate can be programmed for .4 to 2 seconds between samples If your transceiver is very fast switching (less than 50 milliseconds) as determined by the sample window setting, you may want to use one of the fast rates. However to minimize loss, a slower rate is desirable with slower switching radios. The sample rate is a matter of personal preference. One second is recommended to start. Use the chart on page 10 to aid in setting the switches. Do not set all switches on, as this disables the sampling.

SMART PATCH monitors telephone line audio. When audio is present, the time between samples will be 4 times the programmed time. As soon as the person on the telephone stops talking, the sample interval returns to the programmed time. This is desirable with slow switching radios to further minimize loss on an initial connect, dial tone will be transmitted with the fast sample interval since SMART PATCH knows that you have not yet dialed a telephone number. After dialing, SMART PATCH will start responding to telephone audio, and lengthen the sample interval if a busy signal is reached, or you wish to interrupt the telephone party you will have to transmit the time of the long sample interval to capture. This feature may not be desired with fast switching transceivers. This function can be enabled or disabled by adjusting the VOX SENSITIVITY control (R59).

SEE SAMPLE RATE PROGRAMMING CHART AT END OF MANUAL

PROGRAMMING THE CALL LIMIT TIMER

The Call Limit Timer will "time-out" the interconnect and automatically terminate each call if the call exceeds the programmed limit. Refer to the programming chart to set the Dip switches to the desired call limit time. The timer can be disabled by setting all four switches to the ON position. The timer can be reset by the mobile operator with transmission of the star "*' if the "RESET *" switch is 'ON". The "*RESET" feature will transmit beep messages if the connect code is the single digit " Time-out warning beeps will be transmitted starting 30 seconds before time-out. Time-out of the 510-SA will be acknowledged with the Morse Code transmission of "TO".

SEE PATCH TIMER PROGRAMMING CHART AT END OF MANUAL

PROGRAMMING THE MOBILE ACTIVITY TIMER

The Mobile Activity Timer "times-out' the 510-SA if mobile transmissions are not received by the 510-SA within its programmed time interval. The purpose of this timer is to time-out the interconnect if the mobile should drive out of range, or go off the air thereby losing control of the interconnect. The Mobile Activity Timer begins timing at the end of every mobile transmission and is reset with each mobile transmission. Warning beeps will be transmitted ten seconds prior to time-out alerting the mobile operator to key the mobile transmitter to re-set the timer. Actual time-out is acknowledged with the transmission in Morse Code of "TO."

SEE ACTIVITY TIMER PROGRAMMING CHART AT END OF MANUAL

PROGRAMMING THE TOLL RESTRICTIONS

There are 10 switches labeled O through 9. Any combination of numbers can be restricted from being the 1st dialed digit, the 2nd dialed digit, or both. In most areas the 1 and O will be the only switches ON . There are two other switches associated with the TOLL RESTRICT. These are RESTRICT 1st digit and RESTRICT 2nd digit. In most areas it will only be necessary to turn on the RESTRICT 1st switch, however, some areas do not dial a 1 as the first digit of a toll call. In those areas the RESTRICT 2nd switch should be turned "ON" since all area codes have either a 1 or O for the second digit. Also no area codes have a 1 or O for the first digit so the RESTRICT let switch should be "ON" to prevent the operator from being dialed. Attempted dialing of toll restricted digits will cause the 510-SA to automatically disconnect, then transmit a series of beeps.

REMOTE TOLL RESTRICT DEFEAT

The 510-SA Smart Patch has a secret code to allow select mobile operators to defeat the programmed toll restrictions. The secret code is determined by the setting of the sample rate and sample window switches. DO NOT CHANGE THE SETTING OF THE SWITCHES JUST READ THEM. The first digit of the secret code is determined by the setting of the sample window switches. The second digit is determined by the sample rate Switches. Use the chart below to determine the secret code. Note that only three of the four switches are read. To enable this feature, set the switch labeled "8" of the activity timer switches to the "ON" position. With the front panel toll restrict switch "ON" a toll call can be made by sending "*" followed by the secret code, then '*" followed by the connect code. The toll restrict is automatically rearmed on disconnect. Calls made with the Remote Toll Restrict Defeat feature are not subject to the Telephone in Use Detector and will connect the mobile operator to the telephone line even if it is already in use. This feature does not function if the connect code is the single digit "*".

SEE SECRET CODE PROGRAMMING CHART AT END OF MANUAL

TONE OR ROTARY DIALING If you have rotary dialing in your area, switch "ON" the TONE/PULSE switch. You can use pulse dialing even if your telephone line is a tone line if this gives you more reliable dialing.

CWID ENABLE

If your station call sign is programmed into the CWID PROM (U22), switch "ON" the ID ENABLE switch. If you are installing the ID PROM, refer to the assembly drawing for proper installation. Setting the ID Enable switch to the "ON" position without a CWID Prom in the prom socket will cause a long delay prior to connect. (Please note that installation of a programmed CWID prom requires that the prom be inserted with its "notch" orientation opposite to that of other IC's on the printed circuit board.

REVERSE AUTOPATCH

Interconnection of a call initiated from the telephone line is reverse autopatch. Upon receipt of an in-bound telephone call the 510-SA keys the transmitter, broadcasts a series of E's in Morse code (or the CWID if enabled) every ten seconds, and waits for a mobile operator to enable interconnection by transmitting the connect code. When the mobile operator transmits the connect code the 510-SA makes the interconnection.

NOTE: The 510SA Telephone Interconnect is designed to work reliably with the public switched telephone networks and requires that line levels and voltages be like those of the public networks. The 510SA, like other telephone interconnects may not function properly with in house PBX systems since these systems may use proprietary voltages or levels. To disable the Reverse Autopatch feature locate and remove resistor "R-27". To lint the Morse

Code ring-out alert to only one transmission locate and cut jumper "B".
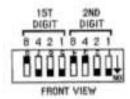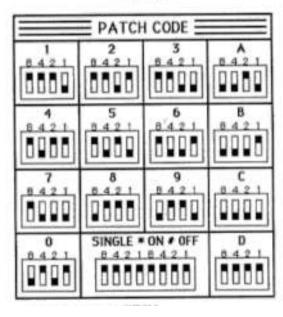
TELEPHONE IN USE DETECTOR

The 510-SA SMARTPATCH will not connect if the telephone line is in use, and will send the Morse Code message "EEEEEEEE" to the mobile operator. To defeat this locate and cut jumper "A". If the FCC registered coupler is used, the telephone in use detector will not function, and jumper "A" must be cut.
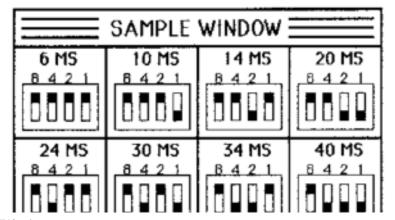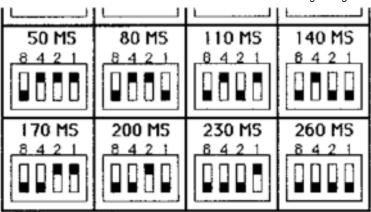
AUXILIARY DISCONNECT

A jack has been provided on the rear of the cabinet for use with a secondary control link. With a plug inserted in this jack, power to the 510-SA will be interrupted. This plug should be wired to normally closed relay contacts.

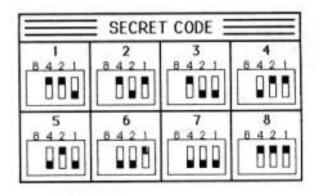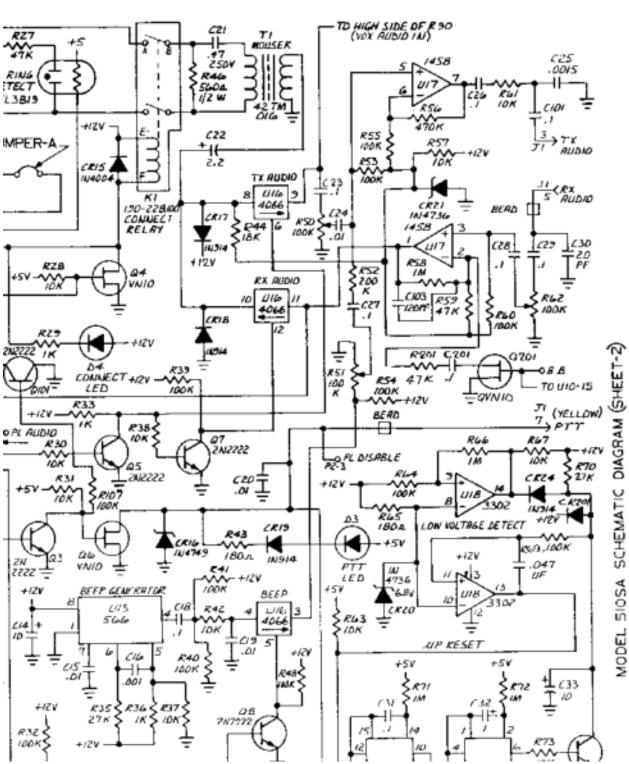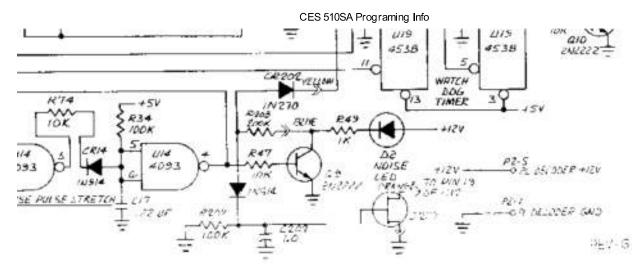Specifications and descriptions are subject to change without notice.

50 MS	80 MS	110 MS	140 MS
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1

170 MS	200 MS	230 MS	260 MS
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1

SAMPLE RATE

.4 SEC	.6 SEC	.8 SEC	.9 SEC
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
1.0 SEC	**1.1 SEC**	**1.2 SEC**	**1.3 SEC**
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
1.4 SEC	**1.5 SEC**	**1.6 SEC**	**1.7 SEC**
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
1.8 SEC	**1.9 SEC**	**2.0 SEC**	**OFF**
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1

PATCH TIMER

.5 MIN	1.0 MIN	1.5 MIN	2.0 MIN
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
2.5 MIN	**3.0 MIN**	**3.5 MIN**	**4.0 MIN**
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
4.5 MIN	**5.0 MIN**	**6.0 MIN**	**7.0 MIN**
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
8.0 MIN	**10 MIN**	**15 MIN**	**DISABLE**
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1

ACTIVITY TIMER

20 SEC	30 SEC	40 SEC	50 SEC
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
60 SEC	**70 SEC**	**80 SEC**	**90 SEC**
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1

MODEL 510SA SCHEMATIC DIAGRAM (SHEET-2)

NOISE FILTER

510SA PARTS LIST

REFERENCE DESIGNATOR	DESCRIPTION	CES PART NUMBER
C103	100 PF 16V CAP.	CC101
C30	22 PF 16V CAP.	CC22P
C39,C44	100 UF 16V ELECTROLYTIC CAP.	CE100
C38	470 UF 16V ELECTROLYTIC CAP.	CE470
VT-86	OPTIC ISOLATOR	CLM10
VT-30.4	OPTIC ISOLATOR	CLM34
C9,C12,C16,C25	.001 UF 63V CAP	CM102
	.01 UF 63V CAP	CM103
	.1 UF 63V CAP	CM104
C17	22 UF 63V CAP	CM224
C8,C102	270 PF 16V CAP	CM271
R68	.047 UF 63V CAP	CM473
C10,C11	.01 UF 100V MYLAR CAP	CP.01
C21	.47 UF 100V MYLAR CAP	CP.47
C32	1 UF 16V TANT CAP	CT1
C33,C34,C13,C14	10 UF 16V TANT CAP	CT10
C22	2.2 UF 16V TANT CAP	CT2.2
CR3-7,CR15	IN4004 DIODE	D4004
CR13,CR20,CR21	IN4736 DIODE	D4736
CR10,CR1,CR16	IN4749 DIODE	D4749
CR25,CR26	IN752 DIODE	D752
CR19,CR24,CR18, CR17,C9101,CR27, CR8,CR9,CR14,CR2, CR11,CR12	IN914 DIODE	D914
	FERRITE BEAD	FERBD
	HEAT SINK	HSINK
Q1,Q2,Q3,Q5, Q7-12,Q101	2N2222 TRANSISTOR	Q2222
Q6,Q4	VN10KM TRANSISTOR	QVN10
R43,R65	180 Ω 1/4 WATT RESISTOR	R180R
R91	330 Ω 1/4 WATT RESISTOR	R330R
R29,R30,R33,R36, R49,R25,R82	1K Ω 1/4 WATT RESISTOR	R1K
	10 Ω 1/4 WATT RESISTOR	R10K
R44	18K Ω 1/4 WATT RESISTOR	R18K
R35	27K Ω 1/4 WATT RESISTOR	R27K
R101,R83	33K Ω 1/4 WATT RESISTOR	R33K
R17,R105,R57,R27	47K Ω 1/4 WATT RESISTOR	R47K
	100K Ω 1/4 WATT RESISTOR	R100K
R102,R103	200K Ω 1/4 WATT RESISTOR	R200K
R106,R56	470K Ω 1/4 WATT RESISTOR	R470K
R58,R71,R8,R66,R72	1M Ω 1/4 WATT RESISTOR	R1M
R104	1.5M Ω 1/4 WATT RESISTOR	R1.5M
R16	2.2M Ω 1/4 WATT RESISTOR	R2.2M
R80	10M Ω 1/4 WATT RESISTOR	R10M
R46	560 Ω 1/2 WATT RESISTOR	R56G1
R1-R5	RESISTOR STRIP NETWORK	R51P
	100KΩ POT	RV104

U13,U15,U17,U2	8 PIN SOCKET	SOC08
U2-U9,U16,U14,U24, U18	14 PIN SOCKET	SOC14
U11,U22,U23,U19,U1	16 PIN SOCKET	SOC16
U10	18 PIN SOCKET	SOC18
U12	40 PIN SOCKET	SOC40
	SURGE ARRESTOR	SURAR
T1	TRANSFORMER	TRAN1
U20	7805 REGULATOR	U7805

510SA PARTS LIST

REFERENCE DESIGNATOR	DESCRIPTION	CES PART NUMBER
X1,X2	3 S 8 MHZ CRYSTAL	XTAL3
E1-E6	PHONE LINE JACK	CON12
J3	MINIATURE JACK	CON14
	1N914	D914
F1	FUSE CLIP	FCLIP
F1	1 AMP FUSE	FUSE1
D1-D5	LED	LED2
D1-D4	LED MOUNT	LEDM1
K1	RELAY	RELAY
S1	5 SELECTION DIP SWITCH	SWD05
S3-S5	8 SELECTION DIP SWITCH	SWD08
S2	10 SELECTION DIP SWITCH	SED10 *SWD10*
S6-S9	4 SECTION SWITCH ASSEMBLY	SW4
U10	IC	~~U345A~~ *U3870*
U18	IC	U3302
U12	– IC	*U3870*
U24	IC	U4011
U1	IC	U4028
U23	IC	U4040
U11	IC	U4050
U16	IC	U4066
U2-U9	IC	U4078
U14	IC	U4093
U19	IC	U4538
U13,U17,U21	IC	U4558
U15	IC	U566
	PHONE CORD	CRDPH
	FRONT LABEL	FPNL6

REPLACED WITH
U9T5(1)
+
U27G4
COMBO

NO LONGER AVAILABLE
AS OF 1/1/96

MODEL 510 SA ASSEMBLY DWG.

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