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CES 510SA II Smart Patch Installation and Programming Instructions

Obsolete Product - No Longer Supported

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1.0 MODEL #510SA-II GENERAL DESCRIPTION

The CES Model 510SA-II Programmable Interconnect is a fully automatic microprocessor controlled telephone interconnect for use in land mobile radio systems. The Model 510SA-II is designed as an interface controller between the Public Switched Telephone Network and land mobile radio base station equipment. This interface allows mobile radio stations to originate and receive telephone calls from the Public Switched Telephone Network when equipped with a standard DTMF signalling encoder for interconnect control. The CES Model 510SA-II is capable of operating full duplex, half duplex or simplex.

- * Remotely programmable from any DTMF telephone
- * Si-nngle digit "*" and 11#11 connect and disconnect codes
- * Programmable global multi-digit connect and disconnect codes
- * DTMF or regenerated pulse dialing
- * Intelligent toll restriction
- * Programmable call limit and mobile activity timers
- * Time out warning signals
- * Morse code station identifier
- * Busy channel transmit lockout
- * Spare relay contact closures for custom applications
- * Repeater control function with programmable transmitter hang time and time out timer
- * Regenerated DTMF land line to mobile selective signaling
- * Dial-up remote control for simplex or repeater applications

The Model 510SA-II is field programmable by DTMF signaling through the telephone line connected to the unit, or by a DTMF encoder connected to the local programming input on the front panel. Programming the Model 510SA-II allows the unit to be

customized to suit the particular requirements of the interconnected system. All programming data is stored in an E squared prom that maintains data integrity without power for a minimum of 100 years.

The Model 510SA-II is enclosed in an attractive steel cabinet with noise, transmit, connect and power LEDs mounted on the front panel. Front Panel power and connect/disconnect switches provide for local operator control.

2.0 SYSTEM OPERATION

2.1 Initiating a Mobile To Land Line Call

A mobile to land line call can be initiated by using the following sequence of operations:

Key the proper global connect code, I* plus two programmable numbers", or single digit 11*11. Unkey the transmitter and wait for dial tone. After dial tone is received, dial the desired phone number. After the call is complete, dial the appropriate disconnect code, which is a single digit "#"; or 11#11 plus two programmable numbers.

2.2 Initiating a Land Line To Mobile Call with Auto-Answer

Dial the phone number of the line connected to the CES Model 510SA-II. The interconnect will answer on the programmed ring and return a "tone" to the phone line. If the channel is busy, the interconnect will answer and give a series of "tones" and disconnect the calling party. If the channel is not busy, enter the number of the desired mobile; 1 to 5 DTMF digits terminated by a 11#11. The interconnect will regenerate this number out to the mobiles. The mobile must answer with a 11*11, followed by the same number that was dialed from the phone line. After the communication is completed, the call may be terminated with the global disconnect from the mobile or the phone line. If the mobile does not answer, the call will be terminated after the programmed wait period.

2.3 Initiating a Land Line To Mobile Call Without Auto-Answer

Dial the phone number of the line connected to the CES Model 510SA-II. The interconnect will detect the ring on the phone line and signal the mobiles that the line is ringing. Any mobile may answer with the global connect code. The call may be terminated from the phone line or the mobile.

2.4 Initiating A Dial-Up Remote Call

Dial the phone number of the line connected to the CES Model 510SA-II. The interconnect will answer on the programmed ring and return a double "tone" to the phone line. If the channel is busy, the interconnect will answer and return a series of "tones" and disconnect. If the channel is not busy, enter the security code and proceed as a normal dispatch call. After communications are complete, the call may be terminated with the global disconnect code from the mobile or the phone line.

Example: To initiate a dial up remote call using security code 11842111, dial the interconnect phone number. When the interconnect answers, dial 118421#11. At this time the interconnect will key the transmitter and transmit any audio present on the phone line. There will be no tone to indicate that the unit is transmitting. The land line caller should remember that on simplex systems there will be a delay of up to 1 second (or the length of time of the programmed Sample Rate) before the mobile can capture the interconnect and talk after the person on the phone finishes speaking.

3.0

INSTALLATION

This section describes each interface connection required by the Model 510SA-II Interconnect. This section also describes optional jumpers on the circuit board that can be used to customize the Model 510SA-II to your particular transmitter-receiver combination. The last part of this section provides instructions on how to properly adjust all level settings.

Installation of the Model 510SA-II should be done by a qualified two-way radio technician. Since the interconnect is prone to static damage while the top cover is removed, be sure to use static protection techniques during the installation and level adjusting procedure. During the installation, be sure that no power is applied to the interconnect.

Shielded audio cable should be used for all audio signal line connections to the transceiver. To prevent hum and noise due to ground loops, terminate the cable shield only at the interconnect terminal block. The other end of the shield must be left unconnected. Other connections to the Model 510SA-II can be made using standard hook-up wire with sufficient current rating. The best location for the interconnect is as close as possible to the radio, thus allowing the shielded cables and wires to be as short as possible.

3.1 Terminal Block Connections

First, remove the top cover of the Model 510SA-II to access the screw terminal block, PBl, at the rear of the enclosure. Use the following instructions to make all connections to the terminal block:

3.1.1 PBl-2 + VDC

This connection supplies DC power to the interconnect. This connection should be made DIRECTLY to the +12 VDC power supply that powers the radio equipment. If this is

not available, any other source of regulated +12 VDC power with a current rating of at least 500 MA. may be used.

3.1.2 PBL-I GROUND

This connection is the main negative ground return for the interconnect. The GROUND connection, and chassis ground are common. This connection should be a DIRECT return to the "Common Ground Return" at the DC power supply.

3.1.3 PBl-3 PTT OUTPUT

This connection is used for controlling the transmit function in the associated transmitter. The PTT OUTPUT should be connected to the PTT line on the transmitter. As shipped from the factory, the PTT OUTPUT will provide a relay contact pull to ground to key the transmitter. If a pull to positive voltage is required to key the transmitter, then move iP10 on the interconnect circuit board (near the PTT relay K2), to JP10B.

3.1.4 PBl-10 RECEIVER DISCRIMINATOR AUDIO

This connection supplies unfiltered discriminator audio from the receiver to the interconnect for processing. This connection must be made DIRECTLY to the discriminator output in the associated receiver. Because the 510SA-II has its own internal squelch circuits, and needs to detect carrier for proper operation, do not connect the RECEIVER DISCRIMINATOR AUDIO line after any de-emphasis circuits, or any squelch circuits. Improper operation of the interconnect will result. Be sure to use shielded cable with the shield terminated at the interconnect. Radios with external discriminator outputs usually do not provide raw discriminator audio and signals taken from this location may not function on the 510SA-II.

3.1.5 PBl-5 TRANSMIT AUDIO

This connection supplies the transmitter with processed audio from the telephone line. This connection should be made to the transmitter microphone voice audio input. The TRANSMIT AUDIO is normally shipped from the factory with a low impedance audio output. If the voice audio input on your transmitter is high impedance, then remove JP11 on the interconnect circuit board (near T2), to convert the TRANSMIT AUDIO output to high impedance, and to match your transmitter impedance more closely. This will permit the level adjustment to be less sensitive. Be sure to use shielded cable.

3.1.6 PBl-6, PBl-7, PBl-8 AUXILIARY RELAY CONTACTS

These spare contacts are active when the interconnect keys the PTT line. The contact arrangement can be used for switching logic signals, or audio signals. The most common use for these contacts is to allow the interconnect to switch between "Interconnect Transmit Audio" and "Repeat Transmit Audio" that is derived from a repeater panel connected in the system. See the Typical Installation

Diagram for details on how to use these spare contacts.

3.1.7 PBl-9 CTCSS-DCS DECODE INPUT

This connection is optional, and can be left unconnected if not used. The purpose of the CTCSS-DCS DECODE INPUT is to inhibit the interconnect when the proper CTCSS tone or digital coded squelch (DCS) is not present. Typically, this input is connected to a bank of CTCSS decoders, which, upon a decode from one of the CTCSS decoders will allow the CTCSS DECODE INPUT to change, and thus permit access to the interconnect. This type of connection denies access and control to the interconnect if a mobile station does not have the proper CTCSS tone. Three internal jumpers must be set to use this input. First, determine whether your input signal is high true or low true when CTCSS is present. Jumpers JP5 and JP6 should be in position A for high true and position B for low true. Jumper JP13 must be in B for CTCSS control. Next, determine the midpoint between the high and low signals. Set the voltage at junction of R68 and R69 to the midpoint by adjusting R68.

Example: D.C. voltage with no CTCSS = .7v
D.C. voltage with CTCSS = 1.9v

High true JP5 and JP6 in A
Set voltage @ Junction R68 and R69 to 1.3v

3.1.8 PBl-12 CONTROL OUTPUT

This output may be jumpered by JP7 to the transistors open collector outputs Q13 or Q14. These outputs are controlled by the OVERRIDE code. Either of these outputs may be used for a customer defined purpose, i.e., selection of a second telephone line.

JP7=A Q13 goes low true after receipt of the OVERRIDE code. Returns high after receipt of next disconnect code.

JP7=B Q14 goes low true after receipt of OVERRIDE code followed by the connect code. Returns high after receipt of next disconnect code. Toll defeat and temporary toll defeat must both be on for Q14 to work.

3.2 Telephone Line Connections

The Model 510SA-II interfaces directly with a "loop start" telephone line. Connection to the telephone line is accomplished by plugging the modular telephone cord supplied with the interconnect into your telephone company supplied RJ11-C jack. Please note that the telephone line interface on the interconnect is not polarity sensitive, and therefore the Tip and Ring connections can be reversed without any system degradation.

4.0 LEVEL ADJUSTMENTS

Now that all connections have been made to the model 510SA-II, the next step is to perform all level adjustments required for proper operation in your system. An FM service monitor, an oscilloscope or AC RMS voltmeter, and the DTMF encoder,--provided

with the 510SA-II are required for level adjustments.

4.0.1 Noise Control R33

The noise control is used for muting the audio (squelch noise), when no carrier exists on the radio channel. This condition is indicated by the NOISE DETECT LED on the front panel of the Model 510SA-II. When the LED is illuminated, this indicates the absence of a carrier.

To adjust the Noise Control, use a small alignment tool, and rotate the adjustment, R33, from a fully clockwise position, in the counterclockwise direction until the LED turns on. Continue rotating the adjustments about 1/8 of a turn farther. Please note that the Noise Control can be turned even further counter clockwise in order to inhibit very weak and noisy signals from accessing the interconnect. Use your own judgement as to the quality of transmissions from mobile stations required to use your system. If you can not adjust R33 so that the LED illuminates then re-check the Receiver Discriminator Audio connection (Section 3.1.4).

4.0.2 Receive Audio Level R18

The RX AUDIO LEVEL controls the signal level from the radio receiver to the telephone line and DTMF level to DTMF decoder. To adjust the RX AUDIO LEVEL, set your service monitor to generate an 800 Hz. audio signal at 4.0 Khz. deviation on the receive frequency of your system. Push the connect button on the front panel of the 510SA-II. Connect an oscilloscope or AC RMS voltmeter to pin 7 of U11, and carefully adjust the RX AUDIO LEVEL adjustment, R18, for a 3.0 volt peak to peak reading sine wave (1.0 Vrms). Adjusting R18 beyond this level will result in a distorted and clipped signal. This completes the RX VOICE LEVEL adjustment.

4.0.3 Transmit Voice Level R47

This adjustment is used to set the signal level from the telephone line to the radio transmitter. To adjust the TRANSMIT VOICE LEVEL, adjust your service monitor to listen to the output frequency of the transmitter. Have another person-dial the telephone number connected to the Model 510SA-II. When the 510SA-II answers and sends a tone to the telephone line, have the person on the phone dial the security code to connect the phone line. This will connect the Model 510SA-II to the telephone line, key the transmitter PTT, and allow the telephone line audio to pass straight through to the Transmit Audio Output. The calling party should now talk. Adjust the Transmit Voice Level, R47, while the calling party is speaking, to 4.0 Khz deviation. The calling party should remain on the line for further adjustments. If you encounter difficulty setting this level because the potentiometer is overly sensitive then remove JP11 as explained in the Terminal Block Connection section (PBl-1 Transmit Audio) of this manual.

4.0.4 Hybrid Balance R12

The Hybrid Balance adjustment is used in "full duplex" systems only (where mobile stations are capable of receiving and transmitting simultaneously). If your system is "half duplex" or simplex, (where a mobile can only transmit, or receive at a given time), then this adjustment is not required. This adjustment cannot be made unless the interconnect is programmed for "full duplex" operation.

If your system is operated in the full duplex mode set your service monitor to generate an 800 Hz. audio signal at 4.0 kHz deviation on the receive frequency of your system, allowing the signal to pass through the hybrid circuit and

back out through the TRANSMIT AUDIO OUTPUT. The calling party will also hear this tone. Now while watching the deviation level of the signal generated by the Model 510SA-II, adjust the HYBRID BALANCE adjustment, R12, for a minimum signal, or "null" in the deviation level. This adjustment is critical, and if a sharp null is not found by turning the HYBRID BALANCE through a complete rotation, then an additional compensation capacitor may be required to match the telephone line impedance. Install a value from .047uf to .15uf in the location next to the HYBRID BALANCE adjustment labeled C49. After the capacitor is installed, try again to adjust the HYBRID BALANCE for a null. If the null is still not satisfactory then repeat this capacitor substitution process until until an acceptable null is achieved.

4.0.5 Tone Output Level R53

Set your service monitor to receive on your transmit frequency. Dial the phone number of the telephone line connected to the 510SA-II. After the 510SA-II answers and returns a tone to the telephone line, overdial a 5 digit DTMF number terminated with the #. Set R53 to 3.0 - 3.5 kHz. peak deviation on the regenerated tones.

This level adjustment sets the level for the Morse code ID messages as well as the level of the DTMF tones. At any particular setting the DTMF tones will be twice the level of the ID messages. Therefore it is important to use DTMF tones for setting the level, and not the ID tones.

4.0.6 Repeat Audio Level R29

This adjustment cannot be made on the factory default program. If the repeat function is to be used, the adjustment must be made after programming.

Generate a signal on the receive frequency modulated by an 800 hz tone at 4.0 kHz deviation. Adjust R29 to 4 kHz deviation on the transmitter frequency.

4.0.7 VOX Sensitivity R61

The CES Model 510SA-II monitors telephone line audio. When audio is present, the sample rate may be programmed to be one half, one quarter, one eighth or remain the same as the programmed sample rate. When phone line audio ceases, the sample rate returns to the programmed rate. On the initial connect, dial tone audio is ignored and the sample rate will be at the programmed rate. After dialing, the Model 510SA-II will begin responding to telephone line audio and decreasing the sample rate.

To adjust the VOX Sensitivity, first set R61 fully counter clockwise. Then dial the telephone number of the line connected to Model 510SA-II. After the Model 510SA-II answers the telephone and generates a tone, dial the security code and speak into the telephone in a normal voice. Monitor the DC voltage at pin 1 of U15 while adjusting R61 in a clockwise direction. Advance R61 until the voltage at pin 1 goes low with voice audio and returns high with no audio.

An easy way to make this adjustment is to call (from the mobile or handheld) a local recording such as Time and Temperature. While listening to the message turn R61 clockwise until you hear the sample rate change.

4.0.8 Telephone In Use Detector JP1

The CES 510SA-II will not connect if the telephone line is in use, and will send the Error Code to the mobile

operator. To defeat this feature remove JPl. With JPl in place, the telephone in use detector can also be defeated with the override code. If a person is talking on a phone which has a common phone line with the interconnect, and a mobile sends the override code, the phone conversation will be transmitted.

Before going on to program the CES 510SA-II, you must have properly completed the previous installation section and have the interconnect connected to the radio and telephone line.

4.1 PROGRAMMING THE MODEL 510SA-II

It is not necessary to program every parameter in the Model 510SA-II to get your interconnect properly set up and tested. In that interest two short programming procedures are listed for simplex and half/full duplex. It is suggested that you select and follow the appropriate short procedure for your application. Then review the factory programmed default values and selectively program only the required changes. Detailed programming instructions for the remaining parameters can be found at the end of this section.

This section describes the procedures used to program the 510SA-II to meet the needs of your particular system. The 510SA-II can be programmed remotely through the telephone line or locally through the front panel with the use of the handheld DTMF encoder provided. In either case, the programming sequence is identical, and only the method by which programming access is obtained differs.

The Program Summary Table lists all of the programmable features of the Model 510SA-II interconnect. All of the features have factory programmed values which are listed in the center column.

5.0 PROGRAM SUMMARY TABLE

| PROGRAM CODE | | | DESCRIPTION | FACTORY SETTING | PG No |
|--------------|----|-----|---|-----------------|-------|
| *0 | | | Connect Code | 73 | 22 |
| *1 | | | Sample Rate (Simplex) | 1 sec. | 15 |
| *1 | | | Repeater Time Out Timer/Full or Half Duplex | | 15 |
| *2 | | | Sample Window (Simplex) | 60 ms. | 17 |
| *2 | | | Repeater Hang Time (Half or Full Duplex) | | 17 |
| *3 | | | Call Limit Timer | 3 min. | 24 |
| *4 | | | Mobile Activity Timer | 20 sec. | 24 |
| *5 | ON | OFF | | | |
| 00 | 1 | 0 | Toll restrict on number 7 | off | 25 |
| 01 | 1 | 0 | Toll restrict on number 6 | off | 25 |
| 02 | 1 | 0 | Toll restrict on number 5 | off | 25 |
| 03 | 1 | 0 | Toll restrict on number 4 | off | 25 |
| 04 | 1 | 0 | Toll restrict on number 3 | off | 25 |
| 05 | 1 | 0 | Toll restrict on number 2 | off | 25 |
| 06 | 1 | 0 | Toll restrict on number 1 | on | 25 |
| 07 | 1 | 0 | Toll restrict on number 0 | on | 25 |
| 10 | 1 | 0 | Toll restrict on number 8 | off | 25 |
| 11 | 1 | 0 | Toll restrict on number 9 | off | 25 |
| 12 | 1 | 0 | Landline to mobile signaling | on | 20 |
| 13 | 1 | 0 | Vl*vl Call Limit Reset | on | 24 |
| 14 | 1 | 0 | Simplex enable | on | 15 |
| 15 | 1 | 0 | Toll restrict on 1st digit | on | 25 |
| 16 | 1 | 0 | Toll restrict on 2nd digit | on | 26 |
| 17 | 1 | 0 | Pulse dialing | off | 25 |
| 20 | 1 | 0 | Toll Restriction Override | on | 26 |
| 21 | 1 | 0 | Single digit connect | off | 22 |
| 22 | 1 | 0 | single digit disconnect | on | 22 |
| 23 | 1 | 0 | Sample at 1/2 rate on VOX detect | on | 15 |
| 23 | 1 | 0 | Repeat enable (Half/Full Duplex) (If repeat enabled, simplex enable (*5-14-0) must be disabled) | | 17 |
| 24 | 1 | 0 | Sample at 1/4 rate on VOX detect | | |

| PROGRAM CODE | | | DESCRIPTION | FACTORY PG -SETTING | No |
|--------------|---|---|---|---------------------|-----|
| ANSWER MODES | | | | | |
| 25 | 1 | 0 | Answer on 1,2,4 or 8 rings | 2 | 20 |
| 26 | 1 | 0 | This Code Used Together With #25. | | 20 |
| 27 | 1 | 0 | Interconnect enable | on | 25 |
| 30 | 1 | 0 | Landline to Mobile Signalling Wait Time | 30 sec. | 20 |
| 31 | 1 | 0 | This Code Used Together With Code--#30 | | 20 |
| 32 | 1 | 0 | Ringout enable | on | 29 |
| 33 | 1 | | Toll restrict | on | 25 |
| 34 | 1 | | Auto I.D. | on22,23,28 | |
| 35 | 1 | | Auto answer | off | 19 |
| 36 | 1 | 0 | Half/Full Duplex Enable | off | 17 |
| 37 | 1 | 0 | Repeat Enable | off | 17 |
| *6 | | | Remote programming code | 975310 | 21 |
| *7 | | | override code (affects toll restrict and phone line in use detectors) | | |
| | | | | ON | OFF |
| | | | Control Function #1 Code | 35 | 25 |
| | | | Control Function #2 code | 36 | 26 |
| | | | Interconnect Enable Code | 37 | 27 |
| | | | Repeat Enable Code | 38 | 28 |
| | | | Auto I.D. Interval | | 28 |
| *8 | | | Security code | 8421# | 21 |
| *9 | 0 | | Connect I.D. Message | "ONv1 | 23 |
| | 1 | | Disconnect I.D. Message | "OFF" | 23 |
| | 2 | | Time out I.D. Message | "TO" | 23 |
| | 3 | | Error I.D. Message | "EEEE" | 23 |
| | 4 | | Station I.D. Message | "STATIONv1 | 23 |

Also see the Program Summary Table.

5.1 Entering The Program Mode

The program mode may be entered in one of two ways:

With the handheld keypad supplied with the interconnect plugged into the phono jack on the front of the interconnect, dial "0" and then immediately press the connect button on the front panel of the interconnect. (In order to hear acknowledgement tones when locally programming the 510SA-II, you will need to have a service monitor or receiver tuned to the transmit frequency being used).

Dial the telephone number of the line connected to the interconnect. When the interconnect answers and sends a "tone" to the phone line, enter the programming code.

Each individual program function is started by entering it's Program Code according to the following instructions. These entries are timed and will time out within 6 seconds for all entries except I.D.s, which are 10 seconds. When changing modes (i.e. simplex to 1/2 Duplex) make certain than any commands pertaining to control functions in the exited mode are turned off.

The programming Mode is exited by pressing 11#11 twice.

5.2 SIMPLEX SAMPLING PROGRAMMING PROCEDURE

5.2.1 Simplex Enable (*5 14 1)

After entering the program mode, enter 11*511 to select the Program Code on/off routine; 111411 to select Simplex Enable and then 11111 to turn the function on. The interconnect will key and send a tone to acknowledge each step.

Example: *5 "tone" 14 "tone" 1 "tone"

5.2.2 Half/Full Duplex Enable (*5 36)

This function must be turned off if the interconnect is to operate in a Simplex mode. Enter 11211 to turn off this function.

Example: *5 "tone" 36 "tone" 2 "tone" (OFF)

5.2.3 Sample Rate (*1)

The sample rate is the rate at which the interconnect unkeys the transmitter and listens for a mobile. The default value for this function is once each second. This value should be set to your liking, keeping in mind that the mobile cannot "capture" the interconnect until a sample window occurs. This function is programmed in 0.1 second steps by entering a three digit multiplier.

Example: If you wished to set this value at 1.5 seconds enter the following sequence:

*1 "tone" 015 "tone"

Note: The multiplier code entered must be three digits.

5.2.4 Sample Rate Multiplier (*5 23 AND 24)

When phone line audio is present, the sample rate will automatically be slowed down to provide less interruptions in the phone line audio. Program Code 23 multiplies by 2, Program Code 24 multiplies by 4, and Program Codes 23 and 24 together multiply by eight.

Example: The sample rate has been set to one sample per second and it is desired that it be once every two seconds when phone line audio is present. Enter the following:

*5 "tone" 23 "tone" 1 "tone" (1/2 ON)
*5 "tone" 24 "tone" 0 "tone" (1/4 OFF)

5.2.5 Sample Window (*2)

The sample window is the length of time the transmitter is unkeyed allowing the receiver to listen for a mobile. The default value for this is 60 ms. The sample window should be set as short as possible while still allowing the mobile to capture the interconnect. The function is programmed in 2.5 ms. steps by entering a three digit multiplier, i.e., 010 would give 25 ms (10 X 2.5 = 25), and 100 would give 250 ms.

Example: *2 "tone" 040 "tonell(100 Ms)

This is the end of required programming for Simplex operation. Review the remaining factory set values for any further changes you may wish to make.

5.3 HALF/FULL DUPLEX PROGRAMMING PROCEDURE

5.3.1 Simplex Enable (*5 14)

This function must be turned off to operate half/full duplex. Dial 11*511 to select the Program Code on/off routine, 111411 to select the Simplex Enable routine and "011 to turn the function off.

Example: *5 "tone" 14 "tone" 0 "tone"

5.3.2 Half/Full Duplex Enable (*5 36)

Enter 11111 to turn on this function.

Example: *5 "tone" 36 "tone" 1 "tone" (ON)

5.3.3 Repeat Enable (*5 37)

This function provides a repeat audio path with PTT when the interconnect is inactive. Two timers are also provided, PTT hang time, and repeater time out; 11111 turns the function on and "011 turns it off.

Example: *5 "tone" 37 "tone" 1 "tone" (ON)

5.3.4 Repeater Time-Out Timer (*1)

This function is programmed in 1 second steps by entering a 3 digit multiplier. To set the time out for 3 minutes:

Example: *1 "tone" 180 "tone"

5.3.5 Repeater PTT Hang Time (*2)

This function is programmed in 0.1 second steps by entering a 3 digit multiplier. To set the PTT hang time to 3 seconds:

Example: *2 "tone" 030 "tone"

This is the end of required programming for half/full duplex. Review the remaining factory set values for any further changes you may wish to make.

6.0 OPTIONAL PROGRAMMABLE FEATURES

| | Function Code | Prgm. | Page |
|-----|-------------------------------|----------|------|
| 1. | Auto Answer Function | *5-35 | 20 |
| | Land line to Mobile Signaling | *5-12 | 20 |
| | Wait Time | *5-30-31 | 20 |
| | Dial Up Remote Security Code | *8 | 22 |
| | Remote Programming Code | *6 | 21 |
| 2. | Auto I.D. | *5-34 | 28 |
| -3. | Connect Code | *0 | 22 |
| | Multidigit *5-21-1 | *0 | 22 |
| | Single digit *5-21-0 | *5-21 | 22 |
| 4. | I.D. Codes | *9 | 23 |
| | Connect | *9-0 | 23 |
| | Disconnect | *9-1 | 23 |
| | Time Out | *9-2 | 23 |
| | Error | *9-3 | 23 |
| 5. | Call Limit Timer | *3 | 24 |
| 6. | Interconnect Enable | *5-27 | 25 |

| | | | |
|----|-------------------------------------|----------|----|
| 7. | Tone to Pulse Dialing | *5-17 | 25 |
| 8. | Toll Restrict | *5-00-11 | 25 |
| | Restrict on 1st, 2nd or both | *5-15-16 | 25 |
| | Temporary Toll Defeat Enable | *5-20 | 26 |
| | Temporary Toll Defeat Override Code | *7 | 27 |
| 9. | Control Codes | Various | 27 |

6.1 Auto-Answer

The Auto-Answer provides three separate functions:

- a. Land line to mobile selective signaling
- b. Dial up remote control
- c. Remote programming capability. When auto answer is turned on, remote control and remote programming are always active while selective signaling and Ring-out may be turned on or off.

6.2 Auto Answer: *5 35

To program auto answer on
 *5 "tone" 35 "tone" 1 "tone"
 To program auto answer off
 *5 "tone" 35 "tone" 0 "tone"

6.3 Ring Counter: *5 25, *5 26

To program the interconnect to answer an inbound telephone call on the 1st, 2nd, 4th, or 8th ring use Program Codes 25, and 26. These codes are derived from the table that follows. Find each numeral to be programmed in the column under the desired number of rings.

| | 1ST | 2ND | 4TH | 8TH |
|-------|-----|-----|-----|-----|
| *5 25 | 0 | 1 | 0 | 1 |
| *5 26 | 0 | 0 | 1 | 1 |

Example: To answer on 2nd ring enter a 11111 for Program Code *5 25; and a "011 for Program Code *5 26.

*5 "tone" 25 "tone" 1 "tone"
 *5 "tone" 26 "tone" 0 "tone"

6.4 Land line To Mobile Signalling (*5 12)

This Program Code Enables DTMF selective signalling to the mobiles by "overdialing" a DTMF ANI code from the telephone.

*5 "tone" 12 "tone" 1 "tone" (ON)
 *5 "tone" 12 "tone" 0 "tone" (OFF)

6.5 Land line To Mobile Signalling Wait Time (*5 30,31)

This is the length of time the interconnect will wait for a called mobile to answer before disconnecting the land line.

| | Time in seconds | | | |
|-------|-----------------|-----|-----|-----|
| | 15s | 30s | 45s | 60s |
| *5 30 | 0 | 1 | 0 | 1 |
| *5 31 | 0 | 0 | 1 | 1 |

Example: To program a 30 second wait time enter a "1" and "011 for Program Codes *5 30, and *5 31.

*5 "tone" 30 "tone" 1 "tone"
 *5 "tone" 31 "tone" 0 "tone"

6.6 Security Code (*8)

The Dial-Up-Remote feature is always active when auto answer is on. There is a programmable security code that must be dialed after auto answer to access the radio transmitter and receiver. This code can be 1 to 6 digits in length. If you try to enter more than 6 digits the first six will be the Security Code. Enter the desired digits terminated by a #. The 11#11 is not counted as part of the Security Code.

Example: To program a security code of 9654 enter the following:

```
*8 "tone" 9654# "tone"
```

6.7 Remote Programming Code (*6)

When the Auto Answer function is on, the interconnect can be remotely programmed from the telephone line by entering a programmable Remote Programming Code after the interconnect answers. This code can be 1 to 6 digits in length. If you try to enter more than six digits, only the first six will be recognized. Enter the desired digits terminated by a 11#11. The "#" is not counted. If the desired code is less than six digits enter a 11#11 after the last desired digit. The 11#11 is used to tell the interconnect that the previous digit is the last to be entered. An additional 11#11 exit the Programming Mode.

Example: To enter programming code 5742 enter the following:

```
*6 "tone" 5742# "tone"
```

6.8 Automatic C.W.I.D. (*5 34)

When Automatic CWID is turned on (see Page #18), the interconnect will I.D. automatically at programmed intervals only when the interconnect sees activity. If this function is turned on, you must also program the Station I.D. under I.D. codes, and I.D Interval under control codes.

Example: *5 "tone" 34 "tone" 1 "tone" (ON)
*5 "tone" 34 "tone" 0 "tone" (OFF)

6.9 Courtesy Beep (*5 24)

When set up and programmed for Repeater Operation the #510SA-II can be programmed to generate a "Courtesy Beep" one second after the end of each transmission. This tone is useful for prompting the other party to begin speaking and takes the place of the phrase: "Over". Program this function as follows:

Example: *5 "tone" 24 "tone" 1 "tone" (ON)
*5 "tone" 24 "tone" 0 "tone" (OFF)

6.10 Connect and Disconnect Codes: (*0)

A Global 2 digit Connect and Disconnect Code can be enabled as follows. This Program Code establishes two numerals that must always follow the 11#11 sign to connect, and the 11#11 sign to disconnect.

Example: To program the code 116511 enter the following:
*0 "tone" 65 "tone"

6.10.1 Single Digit 11*11 Connect Code: (*5 21)

When turned ON this code overrides the Double Digit Code and makes it necessary only to transmit the 11*11 sign to connect. To enable or disable the single digit connect code this function is turned on or off as follows:

```
*5 "tone"21 "tone" 1 "tone" (ON)
*5 "tone"21 "tone" 0 "tone" (OFF)
```

6.10.2 Single Digit 11#11 Disconnect: (*5 22)

When this code is turned on only the "#" sign is required for disconnect. To enable or disable the single digit disconnect code this function is turned on or off as follows:

```
*5 "tone" 22 "tone" 1 "tone" (ON)
*5 "tone" 22 "tone" 0 "tone" (OFF)
```

When this feature is off ! the unit will disconnect with the pound 11#11 and same 2 digits as the connect code.

6.11 I.D. CODES (*9)

Five separate user programmable Morse Code I.D.Is are available in the CES 510SA-II. These are:

```
Connect I.D.      *9  0
Disconnect I.D.   *9  1
Time Out I.D.     *9  2
Error I.D.        *9  3
Station I.D.      *9  4
(see ID programming table below)
```

NOTE:

Never remove the Error I.D.. This I.D. is essential to the operation of several functions and a programmed message must be present. It' characters may be changed, but do not remove them all.

All I.D.Is (*9) must be terminated with a stop bit (110811). If an I.D. is removed, a stop bit (110811) must be entered in its place.

I.D.Is are programmed by selecting the two digit codes from the following table which represents the alpha numeric characters.

I.D.s are limited to eleven characters each. Example: To remove the connect I.D. -- *9 "tone" 0 "tone" 08
litonell

Example: To program "OFF" in the disconnect I.D. enter the following:
*9 "tone"11 "tone"63 "tone"33 "tone"33 "tone"08"tonell

Remember when programming the I.D.Is not to forget the enter the stop bit: 1108".

6.11.1 I.D. PROGRAMMING TABLE

| CHAR. | CODE | CHAR. | CODE | CHAR. | CODE |
|-------|------|-------|------|-------|------|
| 0 | 00 | I | 43 | 'A | 37 |
| 1 | 10 | i | 51 | x | 38 |
| 2 | 20 | K | 52 | E | 39 |
| 3 | 30 | L | 53 | | 47 |
| 4 | 40 | m | 61 | | 44 |
| 5 | 50 | N | 62 | | 45 |
| 6 | 60 | 0 | 63 | CH | 35 |
| 7 | 70 | p | 71 | AR | 07 |
| 8 | 80 | Q | 02 | ERROR | 48 |

| | | | | | | |
|---|----|---|----|---------------|----|----|
| 9 | 90 | R | 72 | COMMA | 16 | |
| A | 21 | s | 73 | DASH | | 66 |
| B | 22 | T | 81 | PERIOD | | 46 |
| c | 23 | u | 82 | SLANT BAR | | 36 |
| D | 31 | v | 83 | ? | | 94 |
| E | 32 | w | 91 | SPECIAL ERROR | | 96 |
| F | 33 | x | 92 | SPACE | 05 | |
| G | 41 | y | 93 | STOP | | 08 |
| H | 42 | z | 03 | | | |

Letters with emphasis are used in non-English language applications.

6.12 Call Limit Timer (*3)

This function is programmed in 10 second steps up to a total of 100 minutes, by entering a 3 digit multiplier. Time out will be preceded with double warning tones ("tone tone") once every three seconds.

Example-. To program the Call Limit Timer to 1 minute
enter the following sequence (6 X 10 seconds = 1 minute)
*3 "tone" 006 "tone"

6.13 Reset of The Call Limit Timer (*5 13)

This Program Code enables the mobile operator to reset the Call Limit Timer by transmitting a "*" DTMF digit.

Example: *5 "tone" 13 "tone" 1 "tone" (ON)
*5 "tone" 13 "tone" 0 "tone" (OFF)

6.14 Mobile Activity Timer: (*4)

This timer will time-out the interconnect if the mobile does not transmit at least once during the programmed time interval. This timer is used to disconnect the telephone line if the mobile should drive out of range, or if the mobile radio should go off the air. Actual time out is preceded with single warning tones, once every three seconds. This function is programmed in 1 second steps up to a total of 16.7 minutes, by entering a 3 digit multiplier.

Example: Program the activity timer for 30 seconds
*4 "tone" 030 "tone"

6.15 Interconnect Enable: (*5 27)

This enables or disables the interconnect function and can be used to turn the interconnect function on or off without effecting the repeater control function (if used).

Example: *5 "tone" 27 "tone" 1 "tone" (ON)
*5 "tone" 27 "tone" 0 "tone" (OFF)

6.16 Tone To Pulse Dialing: (*5 17)

This Program Code enables or disables tone to pulse dialing.

Pulse dialing would be used wherever the local telephone company does not offer DTMF circuits to the interconnect location. Pulse Dialing can also be used on DTMF circuits to increase the reliability of dialing out from the mobile.

Example: *5 "tone" 17 "tone" 1 "tone" (ON)
*5 "tone" 17 "tone" 0 "tone" (OFF)

6.17 Toll Restrict Enable: (*5 33)

Numbers selected as restricted may be restricted on the 1st and/or 2nd digit. This Program Code tells the interconnect that restrictions apply; Codes *5 15 and *5 16 identify the numerals to be restricted, and whether they should be restricted when they are the first or second dialed digit (or both).

To program the interconnect for restrictions enter a 11111 for this Program Code. Enter a "0" if no restrictions are to apply.

*5 "tone" 33 "tone" 1 "tone" (ON)
*5 "tone" 33 "tone" 0 "tone" (OFF)

6.18 Toll Restrict On The First Dialed Digit: (*5 15)

Use this Program Code if toll restrictions are to apply to the first dialed digit.

*5 "tone" 15 "tone" 1 "tone" (ON)
*5 "tone" 15 "tone" 0 "tone" (OFF)

6.19 Toll Restrict On The Second Dialed Digit: (*5 16)

This Code is used to select numerals to be toll restricted when they are the second dialed digit.

Numerals specified in Program Code *5 15 are also restricted from the second digit unless Command *5 16 is used to turn them OFF.

*5 "tone" 16 "tone" 1 "tone" (ON)
*5 "tone" 16 "tone" 0 "tone" (OFF)

| | | NUMBERS TO BE RESTRICTED | | *5 |
|----|----|--------------------------|-----|----------|
| | | ON | OFF | |
| *5 | 00 | 1 | 0 | NUMBER 7 |
| *5 | 01 | 1 | 0 | NUMBER 6 |
| *5 | 02 | 1 | 0 | NUMBER 5 |
| *5 | 03 | 1 | 0 | NUMBER 4 |
| *5 | 04 | 1 | 0 | NUMBER 3 |
| *5 | 05 | 1 | 0 | NUMBER 2 |
| *5 | 06 | 1 | 0 | NUMBER 1 |
| *5 | 07 | 1 | 0 | NUMBER 0 |
| *5 | 10 | 1 | 0 | NUMBER 8 |
| *5 | 11 | 1 | 0 | NUMBER 9 |

Example: To have number 1 toll restricted enter the following sequence:

*5 "tone"06 "tone" 1 "tone" (ON)

6.20 Toll Restriction override: (*5 20)

This code allows one toll call, even if the call violates the Toll Restrictions. After the call, the programmed restrictions

are automatically rearmed.

```
*5 "tone" 20 "tone" 1 "tone" (ON)
*5 "tone" 20 "tone" 0 "tone" (OFF)
```

6.21 Control Codes: (*7)

These codes allow the user to define the 2 digit codes to be used from the mobile that control:

- A, The Toll Restriction/ Phone Line In Use Override.
- B, The two Control Functions (see next paragraph), and
- C, Enable or disable of the repeater (if in Repeater Mode and utilizing the Repeater Control feature of the #510SA-II).

These codes are all programmed in one string command. Therefore, to change one, the others must also be changed or re-entered. The two digit codes entered for the 2 Control Functions, the Interconnect Enable, and Repeat Enable, also automatically generate "Off" codes. These "Off" codes are derived by subtracting 10 from the programmed "On" code. For example, if the Control Function #1 On Code is 114811, the Control Function 1 "Off" Code is automatically established as 1138".

To simplify the programming of the codes you should use the following Programming Table. This Table records the desired "on" codes, simplifies calculation of the "Off" codes, and serves as a written record in the event that a code should be forgotten. Descriptions of the Codes, and their use are listed below:

6.21.1 Toll Restriction override Code:

This is the code that will allow special users to defeat the programmed toll restrictions and place toll calls. This code is two digits in length.

6.21.2 Control Functions:

The Control Functions are available at pins on the microprocessor. These Control Functions are have no use in the #510SA-II's normal operation and are intended to be used for customized applications. The Control Function #1, and #2 outputs are taken from the microprocessor.

```
Function 1 = Pin 16
Function 2 = Pin 33
```

Both of these Control Functions can be turned ON and OFF by DTMF command from the mobile operator. To use these Control Function outputs a line from pins #16 and 33 should be run to an external transistor for switching. Since the function outputs pulse once per second, an electrolytic capacitor of some value should be tied to the transistor bases, to smooth the pulses.

6.21.3 Interconnect Enable:

This code is used in conjunction with Program Code *5 27. *5 27 configures the #510SA-II to be capable of interconnecting calls. This Control Code enables the system operator to remotely turn the interconnection capability on and Off from the telephone by using DTMF signalling.

6.21.4 Repeater Enable:

This code is used in conjunction with Program Code *5 23. *5 23 configures the interconnect to be capable of of enabling a repeat audio path when a telephone call is not being processed. This Control Code enables the system operator to to remotely turn the repeat capability On and off from a the telephone using DTMF signalling.

6.21.5 Station Identification Interval:

This Program Code establishes how often the Station I.D. is transmitted. Some consideration should be given to the use of the various ID messages. This Program Code determines when the Station ID is transmitted automatically; but if desired the call sign could also be programmed into any of the other ID message locations.

Use the values from the following table for programming the interval:

AUTO ID INTERVAL TABLE

| Interval Time In Minutes | Prgm. Code |
|-----------------------------|---------------|
| 1 | 60 |
| 3 | 21 |
| 4 | 81 |
| 6 | 42 |
| 8 | 09 |
| 9 | 63 |
| 20 | 87 |

6.21.5.1 Control Code Worksheet

| | On Code | Off Code | Refer To |
|---|------------|-------------|---------------------|
| Toll Restrict/Phone Line In Use Override | | -N/A- | Resets Upon Hang-up |
| Control Function #1 | | | Section #7.20 |
| Control Function #2 | | | Section #7.20 |
| Interconnect Enable | | | Section #7.20.3 |
| Repeater Enable | | | Section #7.20.4 |
| Station I.D. Interval | | | Section #7.20.5 |

To use the Programming Log for the Control Codes simply follow these steps:

Fill in the desired "On" codes in the first column of blanks next to each control feature.

Derive the "Off" codes by subtracting 10 from each "On" code.

Check to make-sure that there are no "Off" codes that are the same as and "On" codes.

Transfer all the "on" codes to the appropriate blanks

in the following Program String. Then enter this entire string as one set of characters. The #510SA-II will key the transmitter and send a "tone" after each two digit entry.

```
*7      1
  Toll      Control Function Intercon. Repeat Station
  override  #1      #2      Enable      Enable      I.D.
```

6.22 Automatic Ring Out:(*5-32)

This Program Code determines whether the #510SA-II will be able to accept a land line initiated call and then "ring-out" to the mobiles notifying them that a call is coming in. This code works closely with the Auto-Answer Program Code. If the Auto-Answer feature is on, and the "Ring-out" feature is also On, then the Ring Count (Program Code #5-25 and 5-36) must be set to something other than one (1) ring. The ring-out will occur at one less ring than the programmed number of rings.

For example: If Ring out and Auto Answer are enabled, and bits 25 and 26 are set for 8 rings, the ringout will occur 7 times before the 510SA-II answers.

```
*5 "tone" 32 "tone" 1 (on)
*5 "tone" 32 "tone" 0 (Off)
```

6.23 Continuous Ring Out:

For the interconnect to continuously ring out; until either a mobile answers or the land line caller hangs up, Automatic Ring Out (Program Code #5 32) must be turned on, and Auto Answer (Program Code *5 35) must be turned off.

7.0 MODEL 510SA-II CIRCUIT DESCRIPTION

7.1 General

The CES Model 510SA-II consists of a microcomputer digital circuit system, and an analog circuit system. These two systems are separated on the circuit board, and have separate ground returns in order to minimize cross talk. The Model 510SA-II is totally controlled by the microcomputer program memory.

7.2 Microcomputer Control System

The CES 510SA-II is controlled by the Microcomputer Chip U1. All operating parameters are controlled by the microcomputer program memory and are executed by U1.

7.3 Customer Programmable Memory

All customer programmable parameters are stored in Electrical Erasable Prom U2. This CMOS chip is 4096 bit serial prom, internally organized as two 256 x 8 pages. Data retention is specified to be greater than 100 years.

7.4 DTMF Encoding and Decodin2

DTMF encoding and decoding is done by the DTMF Encoder-Decoder circuit, U4. This microprocessor controlled peripheral generates and decodes all 16 DTMF digits. DTMF data is passed to and from U4 via the audio circuits and the Microprocessor Control System. The Analog Switches control the path of encoding and decoding in the Model 510SA-II depending on its current state of operation. DTMF encoding signals are generated on pin 8. U4 also contains a call Progress Tone Detector. Pin 13 provides an output on U4 that is fed into the Microprocessor for call progress tone detection. LED CR31 provides DTMF strobe that is lit when U4 is receiving a DTMF signal.

7.5 Power Supply-

The Primary Power Supply for the Model 510SA-II consists of a 5.0 volt regulator, U16. This regulator is used to power the Microcomputer Control System. U17, which is also a 5.01-volt regulator, is used to power the Analog System in Model 510SA-II. Separate power supplies are used to provide isolation between the two systems. The inputs to these regulators are connected together, and receive power from an external 12.0 volt power supply.

The Model 510SA-II has a "Power on Reset" circuit, coupled with a "Watchdog Timer" that consists of Q16, Q17, U8 and U3. This circuit monitors the input voltage to the Model 510SA-II, and also provides a "Reset" pulse to the Microcomputer Control System in the event there is a voltage drop, in order to maintain system integrity.

7.6 Telephone Line Circuit

The telephone line is connected directly to the back of the Model 510SA-II via a cable with a modular jack. A ring detect circuit consisting of U10, CR1, C1, R1 and R3 provides a square wave output at the ring voltage frequency to oneshot U3. U3 provides a single pulse for each ring to the microcomputer. CR2 and CR5 and U9 detect an "off hook" condition on the telephone line. Q1, Q2, Q3 and diodes CR6 through CR9 provide an electronic holding coil to sink off hook current. Line transformer TI couples telephone and radio audio. This single transformer provides 35dB of isolation as a full duplex hybrid.

Audio from the radio receiver is filtered by a high pass filter, U12, that removes frequencies below 300 Hz. The level of audio is adjusted by R18 and is de-emphasized by U11A. Receive audio is then amplified and directed into the hybrid by U11B. Where de-emphasis of RX audio is required, JP12 is placed in the "All position, which places C18 into the circuit.

Audio from the phone line is amplified and limited by U14B. The level to the transmitter is controlled by R47 and is then amplified and buffered by U14A.

Repeat audio level is controlled by R29 and returned to the transmitter by U14A.

7.7 VOX Detect Circuit

U15B amplifies telephone line audio and drives a detector network that gives a peak DC reading on the amount of audio present. This DC voltage is fed to comparator U15 which provides a logic level output to the microcomputer.

7.8 Noise Circuit

The noise circuit consists of U12A and U13. Audio from the receiver is coupled to U12A, which is a high pass filter with cutoff of 8 Khz. This filter eliminates all voice signals and allows the noise

circuit to monitor channel.noise only. The level of noise on the radio channel indicates the presence or absence of an RF carrier. The noise level is adjusted by R33 and sent to a network that gives a peak DC reading of the amount of noise on the channel. This signal is sent to a comparator that provides a logic level signal to the microcomputer.

7.9 CTCSS Level Comparator

U8B is a comparator with adjustable threshold which is used to convert the DC voltage from the radio decode circuit to the proper logic level for the microcomputer.

This concludes the Model #510SA-II Telephone Interconnect User's Manual. Revision Date: November 23, 1988.,03:09:08 PM

8.0 OPERATING THE #510SA-II AS A REPEATER CONTROLLER

The #510SA-II can be configured to function as a repeater controller when wired to a full duplex base station, separate transmitter and receiver, or an existing repeater. The #510SA-II will control the transmitter with programmable hangtime and timeout functions. The repeat audio path provides internal squelching, subaudible tone filtering, automatic gain control, and courtesy tone if desired. There is also a provision for CTCSS control. A programmable Morse code station identifier is provided specifically for this mode. If a telephone line is available, the interconnect or phone patch mode can also be used to take full advantage of all features included with the unit.

8.1 Installation and Set Up

Installation as a repeater controller is essentially the same as with the simplex installation. The main exception is that a single transceiver generally can not be used. A transceiver that is capable of full duplex operation, or has been modified to so that the transmitter and receiver work independently of each other will usually work. Two transceivers may be used by making the appropriate connections to each. Also, the #510SA-II can be wired in place of the COR board in most repeaters.

Before adjustments can be made, all connections to the associated radios must be complete, and the repeat mode enabled. See page #17 to enable the repeat mode. However, Before enabling the repeat mode you must make sure that the mobile detection circuit (noise LED) is functioning properly. This is critical to any operation of the #510SA-II if noise squelch is to be used. Refer to page #8 to make any necessary changes to the Voice Control R33.

If CTCSS is desired, a connection to a subaudible decoder or repeater tone panel will be necessary. See CTCSS control on page #6 for jumper configuration and threshold adjustment. once you have made the adjustments and established that the front panel noise LED is functioning properly (normally illuminated, extinguished when a mobile is detected) programming changes and the final adjustments can begin. There are 6 repeater mode parameters to be programmed.

| Function | Setting | Reference |
|-------------------------|-----------|-----------------|
| Repeater Enable | OFF | *5-23, Page #15 |
| Repeater Time Out Timer | 7 Seconds | *3, Page #17 |
| Repeater Hang Time | None | *2, Page #17 |
| Courtesy Tone | OFF | *5-24, Page |
| Station I.D. | "Station" | *9, Page 23 |
| Station I.D. Interval | None | Page #28 |

Determine how you want these to function and refer to the programming section of this manual to make the desired changes.

There is only one audio level adjustment necessary for repeater operation. This is the Repeat Audio Level (R29). To adjust, simply transmit a known audio level (usually a 1khz. tone at 3.3 kHz. deviation) to the receiving radio. Then adjust R29 so that the retransmitted audio level is the same. A communications monitor or FM deviation meter will aid greatly in making this adjustment.

13.0 510SA-II PARTS LIST

| REFERENCE DESIGNATOR | DESCRIPTION | CES PART NUMBER |
|---------------------------------------|---|--------------------|
| U1 | INTEGRATED CIRCUIT Note: This part no longer available | U38P70 |
| U1A | INTEGRATED CIRCUIT | U2532 |
| U2 | INTEGRATED CIRCUIT | U2404P |
| U3 | INTEGRATED CIRCUIT | U4538 |
| U4 | INTEGRATED CIRCUIT | U8880 |
| U6 | INTEGRATED CIRCUIT | U4001 |
| U7,18 | INTEGRATED CIRCUIT | U4066 |
| U8,11,12,13,14,15 | INTEGRATED CIRCUIT | UC272 |
| U9,10 | INTEGRATED CIRCUIT | U4N25 |
| U16 | INTEGRATED CIRCUIT | U7805 |
| U17 | INTEGRATED CIRCUIT | MC78L05 |
| | FERRITE BEADS | FERBD |
| Yi | CRYSTAL 3.58 MHZ | XTAL3 |
| Si | SWITCH | |
| S2 | SWITCH | |
| ii | PROGRAM JACK | CON14 |
| K1,2 | RELAY-CONTACTS 2 A. AC OR DC | RZ12 |
| F1 | FUSE 1 AMP | FUSE1 |
| | FUSE CLIPS | FCLIP |
| T1 | T220 TRANSFORMER | T2220 |
| Q1,2 | TRANSISTOR | MPAS45 |
| Q3,7,15-17 | TRANSISTOR | 2N2222 |
| Q4-6,8-14 | TRANSISTOR | QVN10 |
| CR31 | DIODE LED RED | LED2 |
| CR1-9,16,21,23 | 1N4004 DIODE | D4004 |
| CR10-13,22 | 1N476 DIODE | D746 |
| CR14,15,17-20 | DIODE | D103A |
| CR24-27 | DIODE LED RED | LED4 |
| CR28 | LM336 DIODE | D336 |
| CR29 | 1N4125 DIODE | D4125 |
| CR30 | 1N752A DIODE | D752A |
| C48 | 10UF 50V CAP | CE106 |
| ci | .47UF 250V 10% POLY CAP | CP474 |
| C11,24 | .47UF 250V 10% CER CAP | CM.47 |
| C2,51,53 | 1UF 35V TANT CAP | CT1 |
| C3 | 2.2UF 250V 10% POLY CAP | CP225 |
| C4,8,9 | 100PF 25V CER CAP | cmioi |
| C5-7,10,25,26 | .01UF CER CAP | CM.01 |
| C14 | 1000PF CER CAP | CM.001 |
| C12 | 22PF 16V DISC CAP | CC22P |
| C13,15,16,20-22, 49,50,52 | 1UF 50V CER CAP | CM.1 |
| C19,30,33,48 | 10UF 16V TANT CAP | CT10 |
| C27,28,31,34-42, 45,46,47,17 | .22UF 63V CAP | CM.22 |
| C23 | 1UF NONPOLAR CAP | CE105NP |
| C29,43,44,22 | 100UF CAP | CE107 |
| C18 | .0047UF CER CAP | CM.0047 |
| C54 | 470PF CAP | CC471 |
| R1,3 | 3.3K 1W RESISTOR | R3.3K |
| R20,35 | 27K 1/4W RESISTOR | R27K |
| R5,34,50 | 2.2K 1/4W RESISTOR | R2.2K |
| R2,4 | 270K 1/4W RESISTOR | R270K |
| R7,8,17,23,28,6, 63-66,69-73,75,82 | 10K 1/4W RESISTOR | R10K |
| R9,62,67,77 | 1K 1/4W RESISTOR | R1K |

| | | |
|------------------------------|------------------------|-----------|
| R74,38,41,49,51, 58,80 | 100K 1/4W RESISTOR | R100K |
| R11 | 10 1/2W RESISTOR | |
| R13,14 | 560 1/4W RESISTOR | R560R |
| R39 | 390K 1/4W RESISTOR | R290K |
| R16,83 | 150K 1/4W RESISTOR | R150K |
| R19,21,22,36,44, 45,52,30 | 47K 1/4W RESISTOR | R47K |
| R24,40,42,57,86 | 22K 1/4W RESISTOR | R22K |
| R25,26 | 330K 1/4W RESISTOR | R330K |
| R27 | 330 1/4W RESISTOR | R330R |
| R78,60 | 4.7K 1/4W RESISTOR | R4.7K |
| R32,85 | 68K 1/4W RESISTOR | R68K |
| R37 | 82K 1/4W RESISTOR | R82K |
| R46,84,6 | 470K 1/4W RESISTOR | R470K |
| R59,10,54,76 | 1mhz. 1/4W RESISTOR | R1M |
| R60 | 5K 1/4W RESISTOR | R5K |
| R81 | 56K 1/4W RESISTOR | R56K |
| R15 | 220K 1/4W RESISTOR | |
| R79 | 5.6K 1/4W RESISTOR | R5.6K |
| R12 | 1K POT | RVLK |
| R18,29,33,47,53, 61,68 | 100K POT | RV104 |
| TB1 | 12 POSITION TERM BLOCK | TERM.BLOK |
| E1-6 | PHONE LUG | CON12 |
| | HEAT SINK | HSINK |
| | 40 PIN IC SOCKET | SOC40 |
| | 20 PIN IC SOCKET | SOC20 |
| | 16 PIN IC SOCKET | SOC16 |
| | 14 PIN IC SOCKET | SOC14 |
| | 8 PIN IC SOCKET | SOC8 |
| | 6 PIN IC SOCKET | SOC6 |

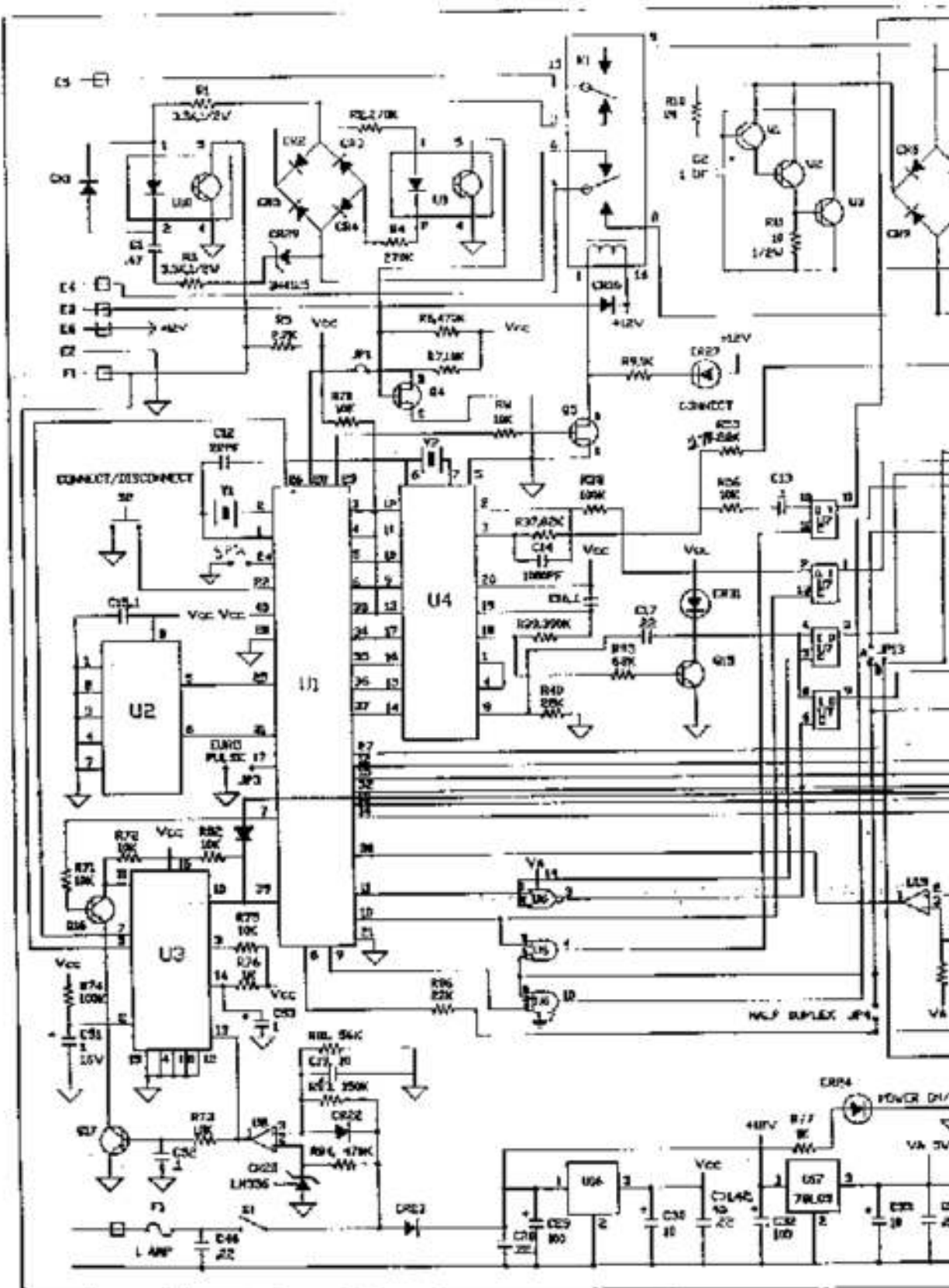
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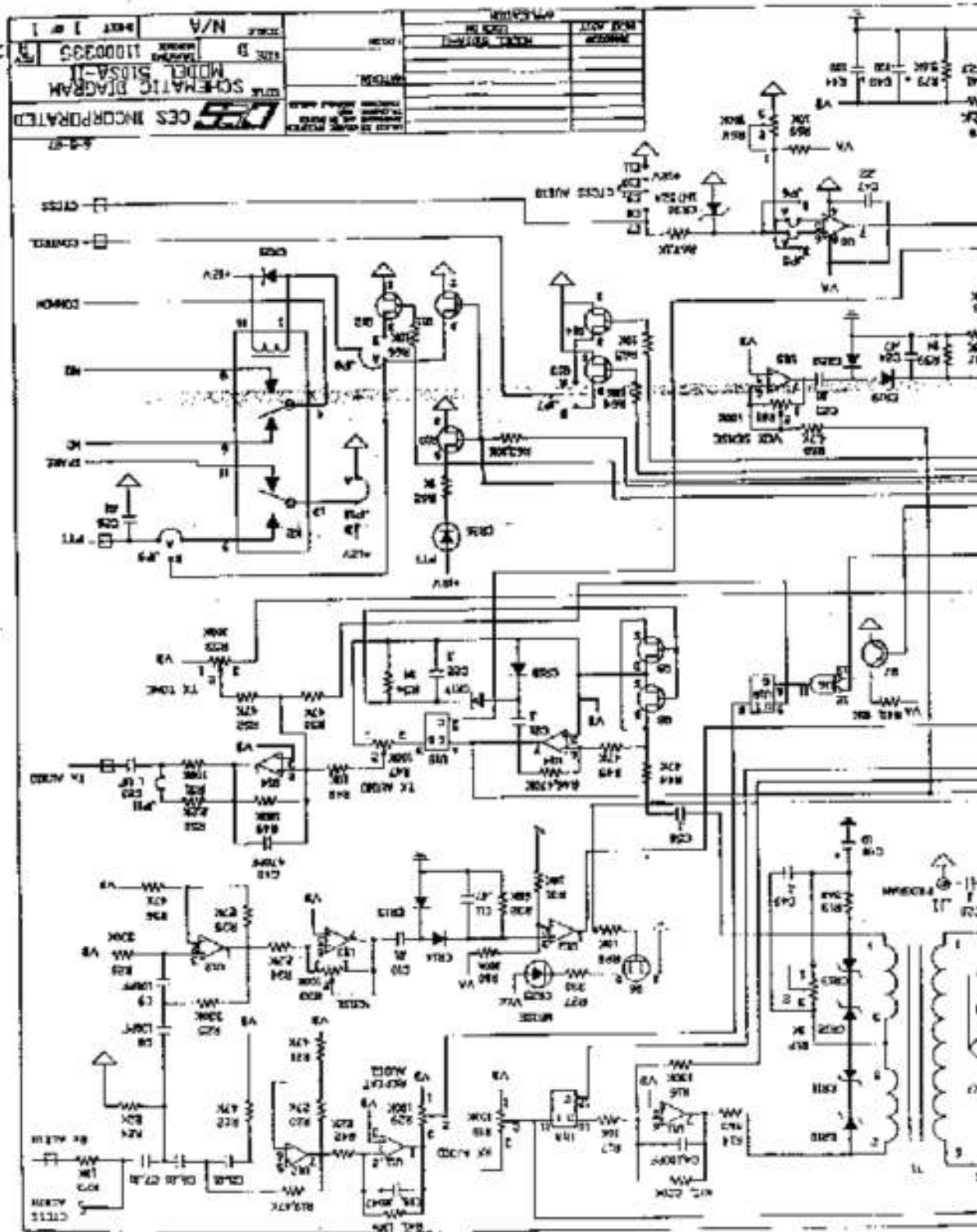
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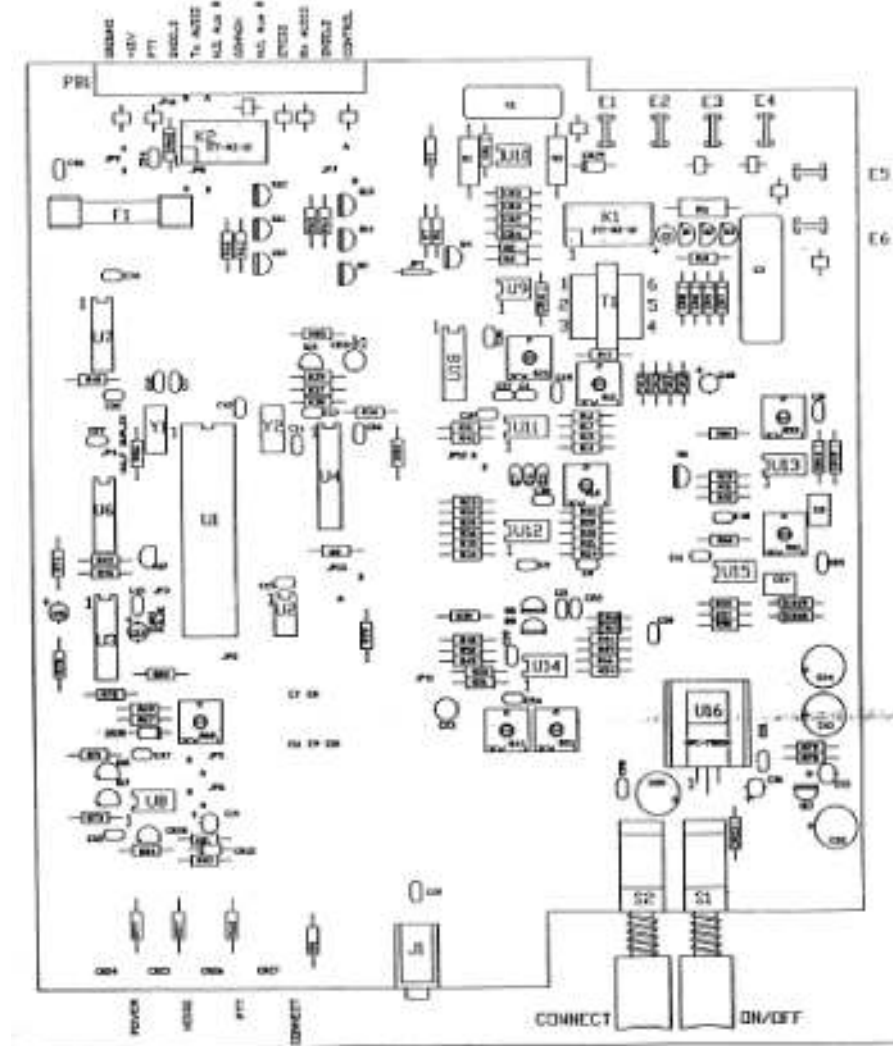
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MODEL 510SA II JUMPER SUMMARY

| JUMPER | POSITION | FUNCTION | REFERENCE |
|--------|----------|--|-----------|
| JP 1 | In | Telephone in use detector enabled. | P 11 |
| | Out | Disable telephone in use detector. | |
| JP2 | | Not used | |
| JP3 | In | Euro Pulse- for use in European countries. | |
| | Out | Standard U.S. pulse. | |
| JP4 | Up | Simplex or full duplex operation. | |
| | Down | 1/2 duplex operation. | |
| JP5 | A | CTCSS high true. | P6 |
| | B | CTCSS low true. | |
| JP6 | A | CTCSS high true. | P6 |
| | B | CTCSS low true. | |
| JP7 | A | Control output - true low with receipt of the over ride code. | P6 |
| | B | Control output - true low with over ride code followed by the disconnect code. | |
| JP8 | A | Control Relay K2 to follow PTT | |
| | B | Control Relay K2 to follow connect. | |
| JP9 | A | Relay PTT. | |
| | B | PTT controlled by G11 (pulling low). | |
| JP10 | A | PTT line required to be grounded. | P5 |
| | B | PTT line required to go high. | |
| JP11 | Up | Low gain on transmit. | P5 |
| | Down | High gain on transmit. | |
| JP 12 | A | De-emphasis required, Rx audio. | |
| | B | Flat response required, Rx audio. | |
| JP13 | A | Non CTCSS control. | P6 |
| | B | CTCSS control. | |







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