Model CS-950

Tone to Pulse

SIMPLEX INTERCONNECT

USER'S INSTRUCTION MANUAL

CONGRATULATIONS! You now own the most technically advanced, feature packed, and capable simplex interconnect product available. Years of trouble free, high" quality mobile telephone service are now yours.

Your CS-958 can serve you in a variety of ways. From the mobile you can initiate and receive telephone calls fully automatically. But also, your calls can be initiated and received in your office by a dispatcher. The dispatcher can then manually connect your mobile unit with your call.

Our digitally processed "FAST VOX" and simplex loop yield a degree of communications quality found in no other simplex interconnect. You merely take turns talking. Our digital processor will allow you to talk at your normal pace. No prompt tones are required to let you know when it is ok to talk.

The three digit access code will prevent unauthorized persons from making calls. But more important, the sophisticated dial restrict logic will keep the "authorized" users from making unauthorized long distance calls.

ACCESS CODE

The access code consists of a "*" and two user defined digits. The user defined digits are denoted as A and B. A and B are factory programmed 1 and 2 respectively. Therefore to access the CS-959 you send *12 (*AB). The disconnect (off) code is the first two of the three digit sequence, *1 (*A). The "*" alone is used for two purposes:

1. Resetting the three minute timer for additional talk time.

2. Answering a ringout (when someone calls you).

A DIP terminal strip labeled "Access Code" may be found between integrated circuits U37 and U7 on the printed circuit board. This is where the access code is programmed. (The DIP terminal strip may be removed from its socket for easy programming.) Your two user defined digits can be any combination of the ten digits or *. There are 121 code combinations to choose from! The code sequence goes in the order *AB. Therefore, if you connect the A to 1, and B to 2 the code is *12, as factory supplied. See Figure 1 for clarification. The three examples in Figure 1 should make clear the programming procedure.

Dial your commands no slower than 1 digit per second (very slow) nor faster than 15 digits per second (very fast). Both accessing and phone number dialing may be accomplished with most speed and/or auto-dialers if desired.

There are no unusable code sequences. Even *** is a valid code.

DIAL RESTRICT

Calls to phone numbers beginning with any first digits you choose are positively locked out when the front panel switch is in the "Dial Restrict" position.

The CS-959 is factory programmed and delivered with 0 and I as the restricted first digits. This precludes calling the operator, and out of area code dialing in most u.s. localities.

A set of pads labeled "Dial Restrict" will be found between integrated circuits U37 and U7 on the printed circuit card. This is where the desired restricted digits are strapped.

Any two numbers can readily be restricted by connecting separate jumper wires from the desired digits to each of the pads labeled "R".

A single digit may be restricted by placing a wire from the desired digit to either of the "R" pads. Leave the other "R" pad open.

If it is desired to restrict more than two digits, diodes (IN4148) will be required instead of jumper wires.

Several examples are shown in figure 2. The examples should make the dial restrict programming clear.

OPERATION

Learning to use the **CS-950** commands and modes will seem a little involved at first. But soon you will use it as naturally as driving your car.

THE COMMANDS: *AB will refer to your private access code, while *12 will refer to the factory installed access code. To make a call, you will need a line connect. Send *12 (*AB). Should you misdial your number, send the connect code again. No need to send the disconnect (off) command first. When through, send the disconnect (off) command *1 (*A). Your CS-950 will automatically "time out" (causing a disconnect) after three minutes. (Time out disconnect may be changed to six minutes by connecting the board strap from the "3" position to the "6" position at a location on the circuit board between integrated circuits 031 and 01O, labeled "TIMER"). Prior to "time out" disconnect, warning beeps will warn four separate times during the last minute that "time out" is imminent. Send A "*" to reset the timer which will gain another timer period. You can send the reset "*" as often as you like (resetting the three minute timer remotely may not be permissible in some radio services). The "*" serves also for answering calls if Ringout mode is selected. Ringout will be covered in detail later on.

Commands can only be sent when the interconnect is receiving. Simplex by definition means one way at a time. You must wait until the interconnect stops transmitting before a new command may be issued. For example:

1. You call a number and there is no answer. You wish to disconnect. Send the disconnect sequence *1 (*A) between rings while the interconnect is "listening".
2. You have successfully completed a call and talked two minutes. Suddenly you hear "time out disconnect" warning beeps on top of your party. You now wish to send the reset command "*" for additional talk time. But you must wait until your party finishes talking and the CS-950 returns to the "listening" state before you can successfully send the "*" to reset the timer.

TO MAKE A CALL: Send the connect code *12 (*AB). The **CS-950** will acknowledge with several tone beeps followed by a dialtone. After two seconds, the dialtone will disappear. The **CS-950** has gone into the receiving mode to pass your dialing instructions on to the phone line. Press the push to talk button on your mobile or handheld radio and dial the number you wish to connect with. You must start dialing within five seconds after the dialtone disappears. Also, you must not pause to long between digits. Otherwise your interconnect will assume you are finished dialing. The next thing heard will either be a ringing or busy signal.

If the dial restrict switch was on and a call was attempted to a phone number beginning with a restricted digit, you will not hear anything. Your **CS-950** has disconnected and is in the stand-by mode awaiting further use.

When your party answers be sure to explain to them that you must take turns talking. Often, "first timers" do not understand this and confusion results. When you are finished, wait for your party to hang up before sending the disconnect command *1 (*A). The act of hanging up will generate audio on the phone line. The **CS-950** will assume this is your party speaking and come on the air for about one half second. If you are sending a command when this occurs, the **CS-950** may miss your digits and not respond to your command. Therefore, it is best to wait for your party to hang up first before transmitting commands. A few phone companies will revert to dial tone after your party hangs up. This will cause disconnect difficulty. Either disconnect before your party hangs up, or use the "interrupt control window" or "talk off disconnect" features covered next.

INTERRUPT CONTROL WINDOW(S): The **CS-950** 25 second activity timer logic guarantees that full control is never far away. Each time the VOX senses phone line activity (such as a busy signal) which causes the transmitter to activate, the 25 second timer starts running. At the end of 25 seconds the base radio is "forced" out of transmit and into receive for three seconds. During this three second interval, the mobile may:

1. Send a two digit disconnect if finished.
2. Send a three digit connect code to dial a new number.
3. Use the opportunity to reverse the talk direction.
4. Or simply ignore the window altogether.

If you miss the first window, another will come every twenty-five seconds. The "windows" seldom cause loss of intelligence due to the fact that phone line responses typically do not exceed 10-20 Seconds.

Develop a communications posture that encourages interactive conversation. By talking back and forth say 2-15 seconds each, the activity timer will be constantly reset.

TALK OFF DISCONNECT: An alternate to "interrupt control windows" is "talk off disconnect". This feature is made functional simply by adding a board strap between the two pads labelled "TOD" adjacent to U24, clearly marked on the board. With the "TOD" strap in place, the **CS-950** will automatically "disconnect" after 25 seconds of continuous phone line activity. This feature is useful for automatically disconnecting on busy signals, however if you call someone who tends to be "longwinded" disconnect will also occur!

TO USE SIMPLEX: The **CS-950** will function on both carrier squelch and PL (CTCSS) squelch systems. However it is preferable for the mobile to turn off receiver PL (if used) and operate carrier squelch for the duration of interconnect usage. The mobile squelch should be set just beyond quiet threshold. When set as described, the mobile squelch will open as quickly as possible. On the other hand it is best to set the base station squelch a bit tight so as to minimize the squelch tail heard on the telephone end.

TO USE THROUGH REPEATERS: The **CS-950** will operate through either a carrier operated (COR) or PL (CTCSS) repeater. The mobile should turn off receiver PL (if used) and set the squelch to just beyond quiet threshold. Most satisfactory results will be obtained if the repeater has at least a two second dropout delay (4-6 seconds is preferable). If the repeater does not drop out between talk exchanges, their will be no front end word loss.

As usual, when operating through repeaters, squelch tails are different than when operating simplex. In simplex, when the interconnect stops transmitting, the squelch you hear closing is your own. But when through a repeater, the squelch you hear is at the repeater. You do not hear your own squelch close until the repeater drops out. The point is, you cannot control the **CS-950** unless it is listening. The **CS-950** is listening immediately after any squelch tail even though the repeater is still transmitting. Suppose you dial a number, and there is no answer. You wish to make another call or disconnect. the **CS-950** will transmit during each ring and for half a second afterward. After you hear the squelch tail but before the next ring, send the command (connect or disconnect) you desire. the **CS-950** will respond immediately to your commands.

RINGOUT: Ringout allows you to receive incoming telephone calls. This feature may be turned on and off at the rear panel. When turned on, (ringout position) phone calls coming into your interconnect phone line will cause the CS-959 to come on the air and transmit three seconds of tone beeps. Only one ringout signal will occur. If the channel is busy, or has had activity within the last 15 seconds, the **CS-950** busy channel monitor logic will not allow the ringout signal to be transmitted. This feature will be appreciated by your co-channel users as inadvertent interference is avoided. After the ringout tone beeps are sent, the interconnect will stop transmitting. Now send the ringout connect command "*" to answer your phone call. You may now respond to the caller. If your party has hung up before you answer, you will get a dial tone upon answering. After 25 seconds, control will be returned via the "Interrupt Control Window". Or, automatic disconnect will occur if the "TOO" (Talk Off Disconnect) feature has been strapped.

After answering your call with a ringout connect code (*) the call proceeds just as though you had initiated the call yourself. The "time out disconnect" tone beep warnings and three minute time out timer features are functional. You may send the reset code "*" for additional talk time. When you are finished you must send a disconnect command *1 (*A) to terminate the call (hang-up) .

MANUAL OPERATION: The front panel Connect/Disconnect switch permits full dispatch operation. If you wish to receive only pre-screened calls, turn off the rear panel ringout switch. When someone calls your office, and your secretary determines the call is important, she merely presses the switch momentarily toward "Connect". Now all three parties are connected. After briefly introducing the caller, the secretary hangs up leaving the caller and mobile conversing. When the call is completed the mobile may send a disconnect *1 (*A) or the secretary can press the switch momentarily toward "disconnect".

Another use for "manual connecting" is for placing calls. Suppose you are in heavy traffic or in some awkward or dangerous driving situation. Merely ask your secretary by radio to make the call for you. She dials your intended number. As soon as the phone starts to ring, she presses the "Connect Switch" and then hangs up her own phone. When the called party answers, the mobile responds and communication is established.

THE CONNECTIONS

The **CS-950** normally requires only three direct connections into the base radio. These are: 1. Audio in 2. PTT 3. Audio out. A fourth connection to the squelch circuit (COS) is not required in most installations. See Figure 3.

Use a good grade of audio shielded wire for each connection. A male RCA plug (provided) is used on the CS-959 end. The other end connects to points within the radio. In each case connect the shield to chassis ground. The center wires connect as follows:

1. Audio in. Connect to the "top" of the volume control (clockwise end) in most installations.
2. PTT. Connect to the transmitter PTT line.
3. Audio out. This connection is not necessarily straight forward. The **CS-950** should be connected in a fashion that will not load down the local microphone. If the radio has a point provided to inject tone audio from an external encoder, try injecting the **CS-950** audio here. Since no two radios will be alike we can only suggest injection interfaces in general terms. Refer to figure 4. Many radios use integrated operational amplifiers as microphone pre-amps. If the circuit resembles figure 4 try injecting the audio through a resistor (Rinject) into the summing node as shown. Rinject should be equal in value to MIC input resistor "R". The added resistor must be physically adjacent to the op amp.

You might be able to get away with connecting the **CS-950** "audio out" directly across the local MIC input. There will be loading, but it might be acceptable.

The last resort which will always work is to add a microphone input switching relay as shown in Figure 5. A diode must be inserted in the PTT line as shown. The diode permits the **CS-950** to "throw" the relay and activate the PTT line, but the local microphone PTT cannot operate the relay. Install the relay and diode inside the radio. Care must be exercised in wiring the relay so that hum and/or RF feedback is not introduced into the MIC pre-amp.

4. COS (carrier operated squelch). A connection into the receiver squelch will only be required if one or both of the following are true:

A. The receiver volume control is before the squelch circuit. Look at the top of the volume control with an oscilloscope. Open the squelch so that noise is heard and seen on the scope. Now close the squelch control. If the noise seen on the scope remains the volume control is before the squelch and connecting cas is mandatory. Fortunately, the volume control is after the squelch in most radios.

B. Your system uses CTCSS (PL) and you wish for the busy channel ringout inhibit to be functional.

There is no performance improvement to be had by making the COS connection if it is not needed. Incidentally, the busy channel ringout inhibit will function automatically in non-PL (carrier operated) systems.

To make a COS connection to the receiver squelch, a point must be found that changes in DC level considerably when the squelch control is opened and closed. Such a point exists directly at the output of the noise rectifier. Another good point in some receivers is the collector of a transistor used for switching the audio on and off. The **CS-950** will not load or change the characteristics of the "tapped" squelch.

COS polarity "COS POL" and busy channel ringout "BCRO" straps are discussed under "Adjustments"

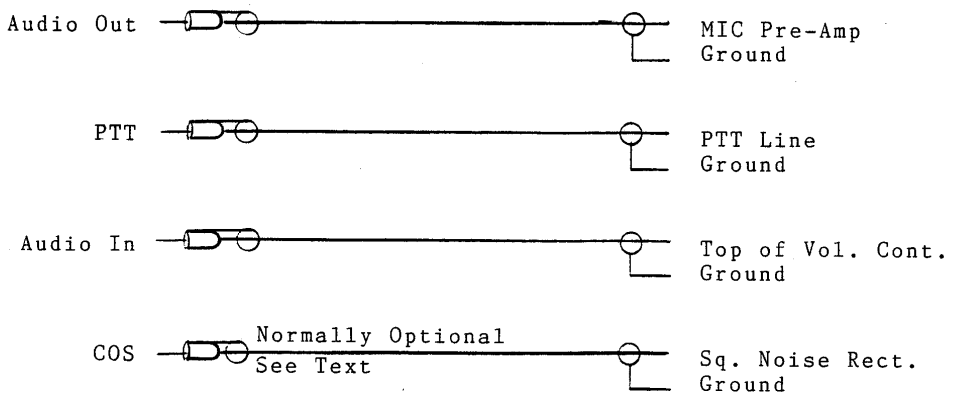


Figure 3

Interconnect/Transceiver

Interface

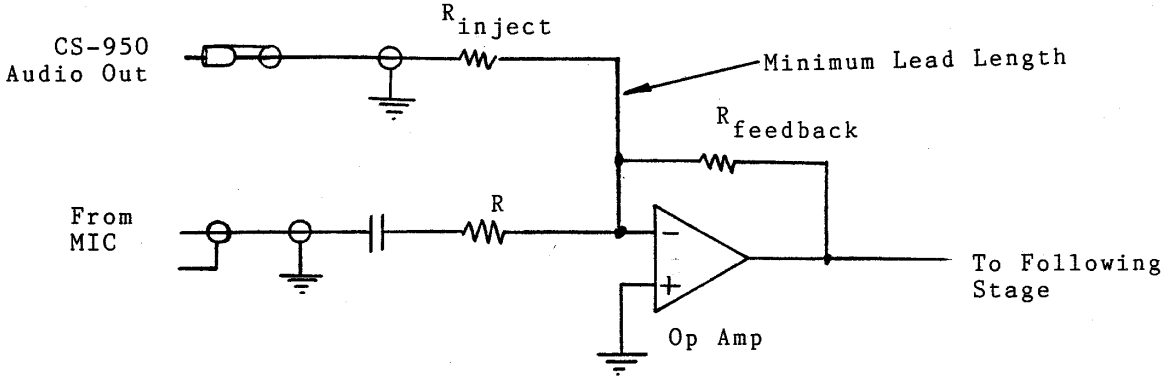


Figure 4
TYPICAL MICROPHONE PRE-AMP
Resistor Summing Injection Method

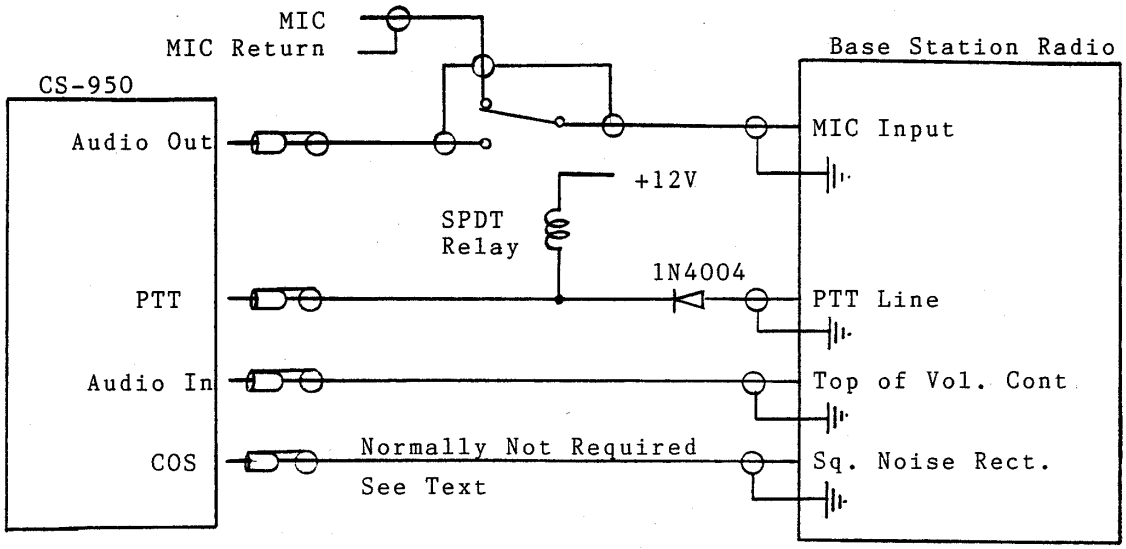


Figure 5
Relay Switching Method

ADJUSTMENTS

It will be necessary to remove the cover to make internal adjustments and to strap the appropriate options. Before removing the cover, be sure to unplug the power cord. Make all the necessary connections to the Base Radio and the phone line. Plug in the AC cord and turn on the power switch. **WARNING,** there are dangerous electrical voltages on the transformer end of the printed circuit board. If not qualified, obtain professional help when working inside the unit.

The following set-up procedure assumes that the touch tones are operating properly in your mobile, handheld or what have you. The frequencies must be correct, and touch tone deviation level of your transmitter should be set to about 4 KHZ if using straight tone dialing. The tone deviation (level) is not critical if using tone to pulse dialing.

The controls are clearly identified with silk screening on the printed circuit board. Due to a fully digital timing and logic design, there are no timing adjustments in this product. This greatly eases the burden of set-up. The potentiometers and their function are as follows:

PI COS DC threshold
P2 Receiver noise gate
P3 phone line VOX sensitivity
P4 Phone line-to-transmitter audio level
P5 Receiver-to-phone line audio level

INITIAL SETTINGS: Rotate P2 "Rx noise gate" to full clockwise (max setting). Adjust P3 "VOX sensitivity" to about 2 o'clock (2/3 of max setting). Rotate P5 to full counterclockwise (Min).

COS ADJUSTMENTS: Move on to "audio out level adjustment" if it was determined that a COS connection was not required.

A COS take off point has already been established and connected. Measure the voltage (A DC coupled scope or VTVM will do) of this point with the squelch open and again with the squelch closed. Note both of these voltages. Now, using the same instrument put the probe on the "COS TP" (test point) located between transformer T2 and Potentiometer P2. Adjust PI until the "COS TP" voltage reads precisely midway between the two voltages previously noted. For example if the COS take off point changes from I volt to 3 volts when the squelch is opened and closed. The COS test point in this case would be adjusted to read 2 volts.

Next, the COS polarity strap must be installed. (Be sure to unplug the CS-950 AC cord when soldering board straps.) If the voltage at the COS take off point increases when the squelch is opened connect the center PAD to the so PAD. If the voltage decreases, connect the center PAD to the SO PAD.

Note: The SO pad is closest to C55.
The SO pad is closest to C58.

If all is ok so far, the LED D27 will light whenever the squelch is opened or a carrier is received. Be sure the LED threshold agrees with the noise threshold point on the squelch
control.

Next, change the BCRO (Busy channel ringout) strap from the "A" position (audio controlled) to the "c" position (carrier controlled). This will permit the busy channel ringout inhibit to operate if a COS connection has been made.

If it is desired that busy channel ringout inhibit shall not function, merely remove the BCRO strap altogether.

This completes COS and BCRO adjustments and strapping.

Note: in summary, if COS connection is not required the "COS POL" should have no straps. The BCRO strap should be in position "A". And LED D27 will always be lit. If COS connection is required, the correct "COS POL" strap must be installed (SO or SO) The BCRO strap must be moved to the "c" position. And LED 27 will only light when the squelch is opened or a carrier is received.

AUDIO OUT LEVEL ADJUSTMENT: Connect the CS-950 to the phone line. Momentarily press the "Connect switch". The base radio should now be transmitting a dial tone. Adjust P4 to achieve a level of 5 KHZ deviation on the base transmitter.

If a deviation meter is not available adjust P4 until the dial tone sounds loud but free of distortion as heard on a receiver. If insufficient drive is available when P4 is fully clockwise it will be necessary to change the value of feedback resistor R37. Change R37 to I megohm. If still not enough audio is available, try 2.2 megohms, then 3.9 megohms. Generally the only radios which will require this change are the variety using "amplified microphones".

RX AUDIO LEVEL CONTROL: The CS-950 audio pre-amp can accommodate take-off levels anywhere from 20 millivolts to 3 volts. First turn P5 to full counterclockwise (min). Transmit a signal from your mobile or handheld radio and simultaneously press any digit, *, or # on the touch tone keyboard. Advance P5 until LED Dl2 lights. Go just a bit beyond. Dl2 should now light when any digit is pressed.

You should now be able to control the CS-950 remotely and make phone calls. Make a call to a phone where you can get some help. After your party answers determine if P5 is too soft or too loud. The person you have called can tell you whether to adjust P5 up or down. Do not go too hot. It is not permissible to put excessive audio energy onto the phone line.

Note: Since the CS-950 can accommodate a very wide input range (20 millivolts to 3 volts), the setting of P5 may be somewhat critical.

RX NOISE GATE: P2 can be thought of as a receiver VOX. The proper setting for P2 in most installations is fully clockwise (max). However, in simplex operation if the receiver has a leaky squelch (a bit noisy when squelched) P2 may have to be turned down a bit. In repeater operation, if the repeater does not fully quiet the base "control point radio" P2 may have to be turned down a little. The symptom is that you will not be able to hear the party on the phone after you finish speaking! P2 is at full CW in 99% of all CS-950 installations.

VOX SENSITIVITY ADJUSTMENT: Our digitally processed "FAST VOX" (Patent Pending) represents as fine a VOX as has ever been designed. But the VOX level control P3 will require a little experimentation over a period of several calls for totally optimum results. 2/3 rotation (about 2 O'clock setting) is a very good starting point. If the sensitivity is too low, the VOX will not attack fast on weak voices. (By the way, you should instruct the person you are speaking with to talk directly into the handset microphone). If the sensitivity is too high (CW), background noises such as TV sets playing may either trip or hold the VOX. A compromise must be achieved. Once set correctly, the VOX will perform splendidly. Our VOX always responds (keys the PTT line) in under 10 milliseconds. 6 milliseconds is typical.

HALF DUPLEX

The **CS-950** is capable of superb half duplex operation. All that is required is turning off the VOX by rotating P3 to full counterclockwise. And a strap must be added between two pads each labeled "HD". One of these pads is between U10 and U9. The other is adjacent to Q7.

Otherwise the set-up instructions followed thus far are applicable.

The major difference in operation is that you do not need to take turns talking. The mobile can interrupt and control at any time. When the dial tone comes on be sure to start dialing within six seconds. Otherwise the pulse converter will switch out. If this occurs it will be necessary to re-access and get a new dial tone. You can hear the pulse converter working when you complete your dialing. This is your assurance that your dialing was successful. All the commands covered under the operation section are functional in half-duplex.

Half duplex can only be used if the base station receives and transmits on separate frequencies. Additionally the base (or repeater) must be able to transmit and receive simultaneously.

WARRANTY

We guarantee the CS-950 to be free from defects in material and workmanship for one year from purchase. Tampering, misuse or modification shall void this agreement.

The quality of components used in the CS-950 are excellent. It should give many years of trouble-free service. Should it fail, we shall repair it at our factory, and return it to you within 1 day if possible.

We reserve the right to not repair units which have been "modified".

This warranty does not cover damage caused by external overloads such as lightning or power line surges. Further, the warranty does not cover damage caused by any acts of God.

The **CS-950** utilizes two metal oxide varistors connected from phone line to ground. These "MOV's" should protect the CS-950 from all but the most severe lightning strikes. In the unlikely event of lightning damage, we have a flat rate repair charge. We reserve the right not to repair a unit which in our opinion us too extensively damaged. Further the warranty of a unit which has been hit by lightning is terminated. This is because of latent damage which may surface at a later time.

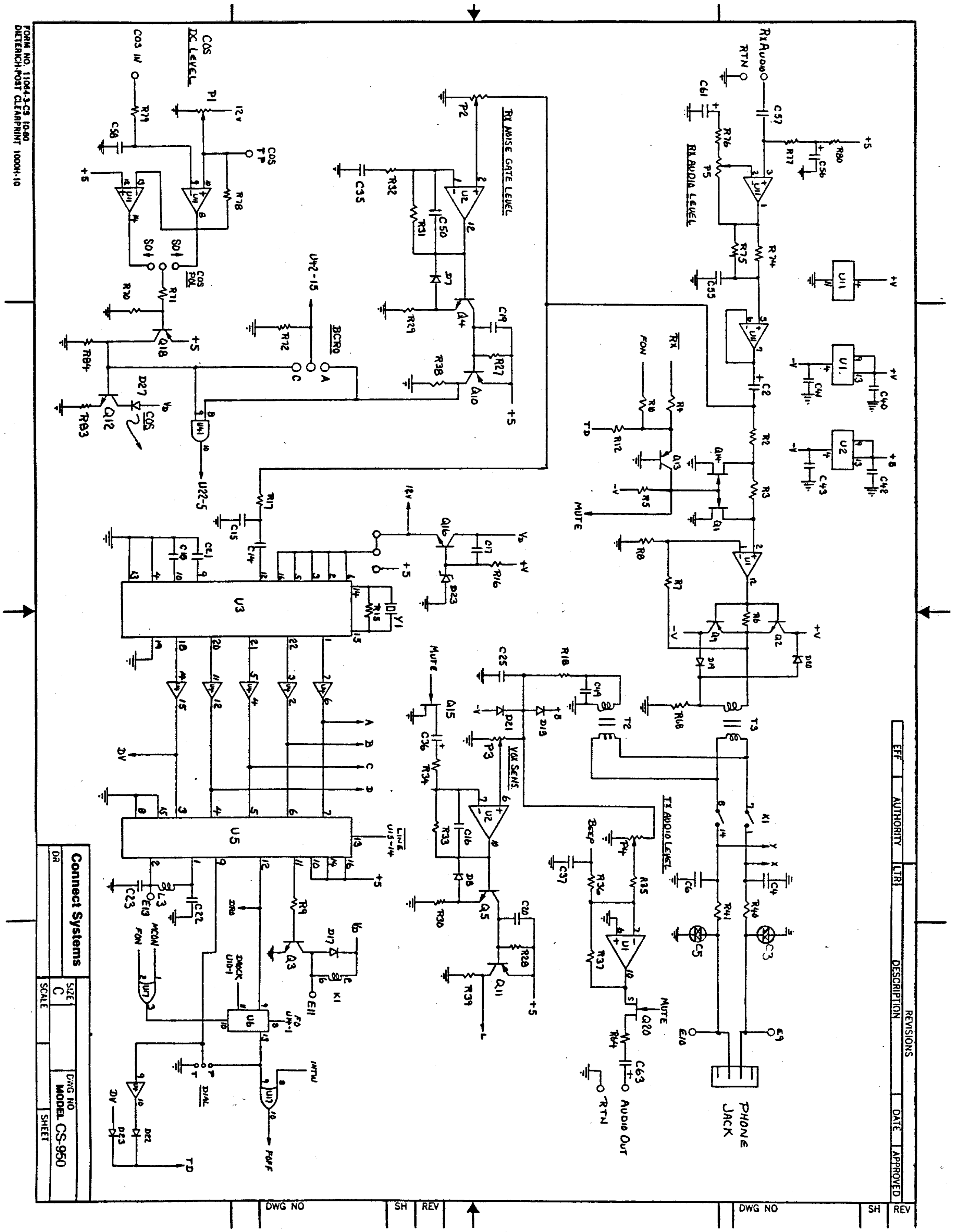
NOTES

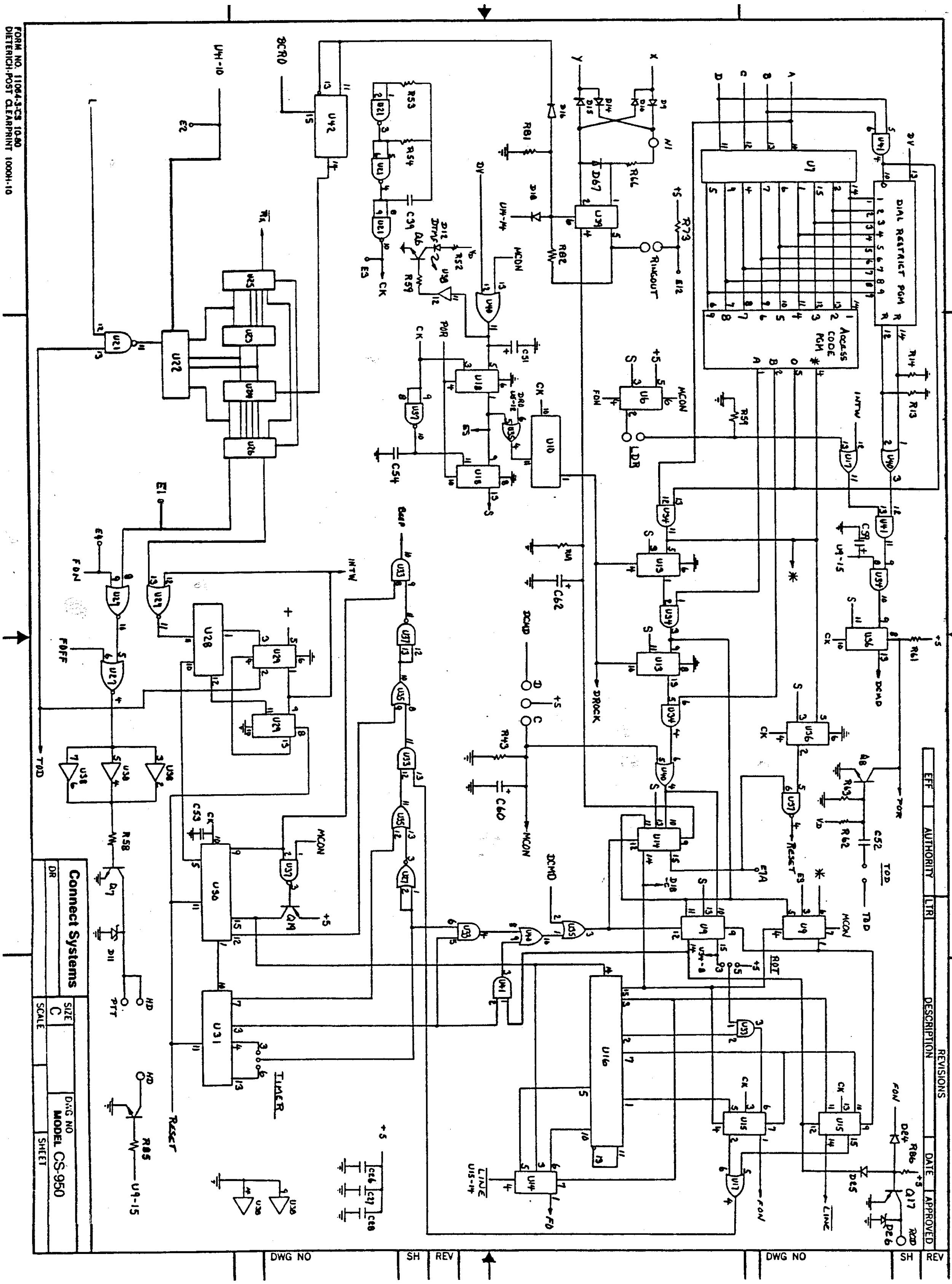
1. The **CS-950** is normally delivered "strapped" for tone to rotary type dialing. The board strap for "straight tone" or "pulse" dialing is adjacent to integrated circuit U17. It is labeled "dial" and has a P and T side. A strap from the center pad to the "P" pad is for pulse. Conversely, a strap from the center pad to the "T" pad is for tone dialing. We recommend tone to pulse dialing, as this mode solves telephone company signaling problems. The tone decoder and logic in your interconnect is much more sophisticated than phone company equipment. Therefore when using tone to pulse, you can dial your number even when you are so distant you are noisy. Also you can dial up to 15 digits per second with speed dialing equipment. On average, it only takes three seconds longer to convert to pulse over straight tone dialing. Should you desire or require straight tone dialing be sure your mobile and/or handheld is transmitting touch tones at a high level. About 4 KHZ deviation should be used because the phone company requires loud tones. When changing to tone dialing, diode D23 will have to be removed. D23 prevents mobile tones from appearing on the phone line. This is the **CS-950** "Tone Block" feature.

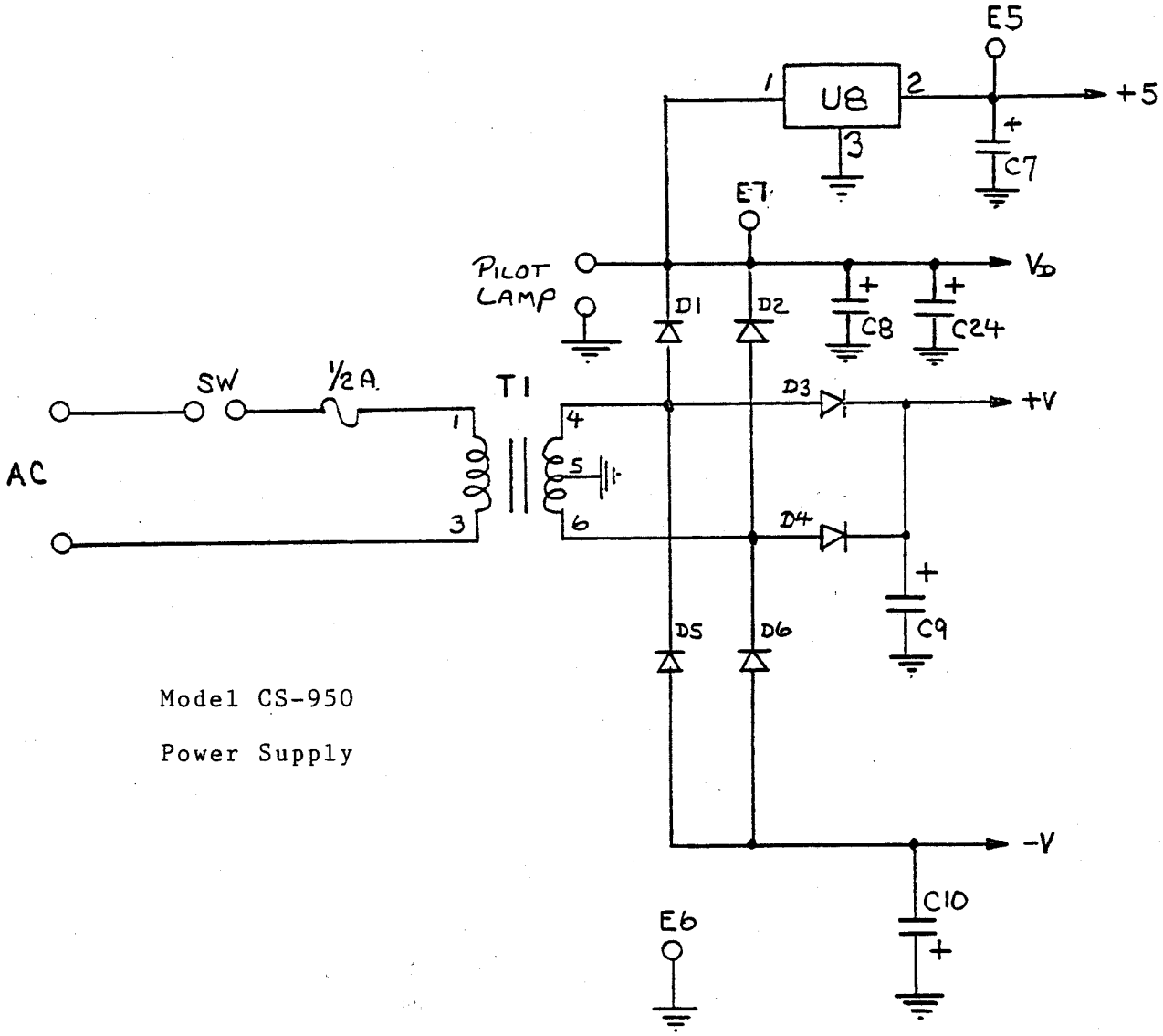
2. If the volume control is located before de-emphasis in the receiver, merely remove resistor R74 in the **CS-950**. Now de-emphasis will be accomplished in the **CS-950**.

3. **Ringout drive:** An open collector (NPN) driver is provided to activate an external tone encoder. The driver will be on (conducting) during the three second ringout period. A decoder in the mobile will now indicate that a call has been received. The decoder can also be used to honk the horn etc. The "ROD" signal is located on a PAD adjacent to IC U5. The "ROD" can directly sink up to 25 MA. Or may be used to operate a relay.

4. **Ringout time:** FCC rules limit ringout to a single occurrence of three seconds duration. Users exempt from this rule may change the "ROT" (ringout time) strap from the three second to the five second position. The "ROT" strap is adjacent to IC U33.


Connect Systems
MODEL CS-950


Connect Systems
MODEL CS-950
DIAL RESTRICT PGM
ACCESS CODE PGM



Model CS-950

Power Supply

PARTS LIST

INTEGRATED CIRCUITS

U1,U2	MC1747
U3	SSI 201
U4	MC14050
U5	MC14408
U6	MC14013
U7	MC14028
U8	LM78L05
U9	MC14027
U10	MC14040
U11	LM324
U13	MC14013
U14	MC14027
U15	MC14027
U16	MC14017
U17	MC4071
U18	MC14013
U21	MC14011
U22	CS7800
U23	CS6402
U24	CS6570
U25	CS9330
U26	CS4760
U27	MC14001
U28	MC14040
U29	MC14013
U30	MC14040
U31	MC14040
U33	MC14081
U34	MC14081
U35	MC14071
U36	MC14013
U37	MC14011
U38	MC14050
U39	4N25A
U40	MC4071
U41	MC4081
U42	MC14017

Transistors

Q1	2N5639
Q2	PN2222
Q3	MPSAl3
Q4-6	PN2222
Q7	PN2907
Q8	PN2222
Q9-11	PN2907
Q12	PN2222
Q13	PN2907
Q14	2N5639
Q15A	2N5639
Q15B	MPSA13
Q16	PN2222
Q17	2N5639
Q18	PN2907
Q19	PN2907
Q20	2N5639

DIODES

D1-6	1N4004
D7,8	1N4148
D9,10	1N4004
D11	1N5248
D12	LED
D13	lN4148
D14	lN4004
D15	lN4004
D16	lN4148
D18	lN4148
D19	lN4004
D20	lN4004
D21	lN4148
D22	lN4148
D23	lN9648
D24	lN4148
D25	lN4148
D26	1N5248
D27	LED
D67	lN4148

Resistors

R2	l8K
R3	18K
R4	l8K
R5	l00K
R6	470
R7	5.lK
R8	2.2K
R9	18K
R10	18K
R12	5.lK
R13	lOOK
R14	lOOK
R15	10M
R16	470
R17	10K
R18	5.1K
R27	220K
R28	470K
R29	5.lK
R30	100K
R31	100K
R32	2.2K
R33	220K
R34	470
R35	220K
R36	10M
R37	220K
R38	100K
R39	100K
R40	10 ½ W
R41	10 ½ W
R43	100K
R52	1K
R53	100K
R54	33K
R58	470
R59A	2.2K
R59B	l00K
R61	l00K
R62	l00K
R63	7.5K 1%
R64	1K
R66	10K ½ W
R68	470
R69	18K
R70	10K
R71	5.lK
R72	l00K
R73	470
R74	5.lK
R75	100K
R76	1K
R77	l00K
R78	10M
R79	l00K
R80	10K
R81	10M
R82	220K
R83	470
R84	10K
R8S	33K
R86	33K

Varistors

C3	Vl50Lal0
C5	Vl50LA10

Capacitors

C2	1.O 5OV
C4	390pf lKV
C6	390pf 1kv
C7	2.2 50V
C8	1000 25V
C9	1000 25V
C10	1000 25V
C14	.01 Mylar
C15	.01 Mylar
C16	.001 Disk
C17	.01 Disk
C18	.01 Disk
C19	.1 Mylar
C20	.1 Mylar
C21	.01 Disk
C22	.033 Mylar
C23	.033 Mylar
C24	1000 25V
C25	.001 Disc
C26	.1 Disc
C27	.1 Disc
C28	.1 Disc
C3S	.1 Disc
C36	1.0 50V
C37	.1 Disc
C39	.01 Mylar
C40	.1 Disc
C41	.1 Disc
C42	.1 Disc
C43	.1 Disc
C49	.001 Disc
C50	.001 Disc
C51	3.3 50V
C52	.001 Disc
C53	390pf 1KV
C54	.001 Disc
C55	.01 Mylar
C56	2.2 50V
C57	.1 Disc
C58	.1 Disc
C59	6.8 25V
C60	1.0 50V
C61	2.2 50V
C62	10uf 25V
C63	l 50V

Misc.

N1	NE2B
P1	1OOK
P2	1K
P3	100K
P4	100K
P5	100K
Y1	3.58MHZ XTAL

MOREY COUPLER

US customers wishing to make direct connection to the common user telephone system must use an FCC approved telephone coupler. A coupler is not required on private phone systems.

You may either use your own coupler, or we offer the Morey coupler factory installed. Please affix the enclosed compliance label to the rear of the interconnect if you purchased this option.

When requesting a "line, the following information must be given the phone company:

FCC registration AB3985-62455-PC-E

Ringer equivalence no. O.4A,l.OB

You must notify the phone company when discontinuing use. Also, connection to coin or party lines is prohibited. If your interconnect contains the Morey coupler, do not plug anything into the rear panel modular phone jack. Use the phone cord which exits from the rear panel.