CES

MODEL ACI-35

AUDIO CONTROLLED INTERCONNECT

USER/SERVICE MANUAL

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REV 2/92

01000703

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CES MODEL ACI-35 GENERAL DESCRIPTION

The CES Model ACI-35 is a telephone interconnect that can be used in either base station, or control station applications. The ACI-35 also has the capability to operate the base station from any DTMF telephone much like "Tone Remote" systems, without the added expense of adding Tone Remote Equipment. The ACI-35 uses state of the art microprocessor technology to provide an extremely high level of performance and reliability.

Operating decisions are made by the microprocessor based on parameters from the telephone line and radio system. Telephone line audio is analyzed to determine the presence of speech, dial tone, busy signal or ring tone. Separate inputs are maintained for phone in use and ring detect.

Radio system activity is monitored for COR (also called COS), CTCSS and Rx audio. The inputs are used to make the optimum control decisions based on system status.

Phone line audio is used to control a VOX-PTT circuit. Other system parameters are also checked to insure that PTT is appropriate (i.e. is the phone audio a dial tone or a busy tone, is a mobile currently transmitting?)

EVD (Electronic Voice Delay) is employed to prevent loss of syllables at the beginning of transmissions from the phone line. Phone line audio is delayed for 500ms to provide ample time for the transmitter to stabilize.

Front panel and printed circuit board LED indicators are provided to indicate the system status as an aid in installation and system troubleshooting. The front panel LEDs indicate Power, Mobile Detect, Connect, and PTT. The PC board LED's are for DTMF Strobe, Telco Audio AGC, and COR. Front panel controls include power, connect/disconnect, toll restrict and ring detect functions.

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:

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

2.2 Initiating a Land Line To Mobile Call with Auto Answer

From a Touch Tone telephone dial the phone number of the line connected to the CES Model ACI-35. The interconnect will answer on the programmed ring, and return two short tones to the phone line. The ACI-35 then waits 10 seconds for the land line caller to dial either the number of the mobile being called, or Special Codes such as the Remote Base Access Code. In ether case, the numbers entered are ended with the "#" key. If the land line caller dials a mobile number, and the channel is busy, the interconnect will then generate three long beep tones and disconnect. If the channel is not busy, or if the caller has dialed one of the Special Codes, the interconnect will then signal the mobile, or begin operation according to the Special Code.

If a mobile number was dialed, the interconnect will regenerate this number as DTMF tones out to the mobiles. The mobile must answer with a "*", followed by the same number that was dialed from the phone line. After the conversation 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. This automatic termination will be signified by three short beeps preceeding the termination.

2.3 Initiating a Land Line To Mobile Call Without Auto Answer

Dial the phone number of the line connected to the CES Model ACI-35. 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 by sending the disconnect code.

2.4 Initiating A Dial-Up Remote Call

Dial the phone number of the line connected to the ACI-35. The interconnect will answer on the programmed ring and return a double beep tone to the phone line. Enter the Remote Base access code appended with the "#" key. The ACI-35 then immediately connects the telephone line to the base station and the land line caller can then transmit and receive as though he were using a tone remote. 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 "8421", dial the interconnect phone number. When the interconnect answers, dial "8421#". 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.

2.5 Operation As A Control Station Interconnect

When used on a Control Station the ACI-35 has several features that ensure excellent operation. Whether on a conventional system or a trunked radio system, it's operation is essentially the same.

Initiating calls either from the land line, or from the mobile is the same as described above. The Electronic Voice Delay will accommodate the cumulative rise times of the station's and the repeater's transmitters and tone modules. Some consideration should be given to the repeater hangtime. If the hangtime is short enough to drop between mobile and land line exchanges it will cause annoying squelch tails. Hangtimes of 4 to 5 seconds will work much better than 1 or 2 seconds. The ACI-35's Refresh feature can be used to shorten the hangtime, without incurring the squelch tails by periodically keying the transmitter, even in the absence of voice audio.

Another consideration when operating the ACI-35 at a Control Station is how well the repeater quiets the Control Station. Without full quieting the proper adjustment of R161 (Receive Audio Detect, section 4.2) may not be possible. This could result in improper operation and misdialing.

INSTALLATION

3.1 General Methodology

This section describes each connection required by the ACI-35 and where to properly wire each connection for operation. This section also describes optional jumpers on the circuit board that can be used to customize the ACI-35 to your particular system. The last part of this section provides instructions on how to properly adjust all level settings.

Installation of the Model ACI-35 consists of the following five steps in order:

1) Make all required Terminal Block connections.
2) Proceed to the Level Adjustments Section,
3) Configure the Jumpers for the desired operation,
4) Set the switches for the desired operation, and
5) Program the ACI-35 with your system parameters.

Installation of the ACI-35 should be done by a qualified two-way radio technician. Since the interconnect is prone to static damage while the top cover is removed, the installer should be sure to use static protection techniques during the Installation and Level Setting procedures. During 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 base station. To prevent hum and noise due to ground loops, terminate cable shields ONLY at the interconnect terminal block. The shield at the other end of the cable should be left unconnected. Other connections to the ACI-35 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 base station, thus allowing the shielded cables to be as short as possible.

3.2 Terminal Block Connections

All connections to the ACI-35 are made at the Terminal Block (TB-1) via the 48" multi-conductor shielded cable supplied, to the locations listed below.

ACI-35 Terminal Block Connections

1. Ground
2. +12 Volts D.C.
3. Telephone line
4. Telephone Line
5. Special Connect Out
6. Receive Audio In
7. Transmit Audio Out
8. Auxiliary Relay #1 N.O.
9. Auxiliary Relay #1 N.C.
10. Auxiliary Relay #1 Wiper
11. Auxiliary Relay #2 N.O.
12. Auxiliary Relay #2 N.C.
13. Auxiliary Relay #2 Wiper
14. Function #2 Out
15. Function #1 Out
16. Carrier Operated Relay
17. Logic Push to Talk
18. Auxiliary Ringout

3.2.1 TB1-1 Ground

This connection is the main ground return for the ACI-35. The ground connection and chassis ground are common. This connection should be a direct return to the "Common Ground Return" of the power supply of the base station radio.

3.2.2 TB1-2 +12 Volts Direct Current

This connection supplies DC power to the interconnect. It should be made directly to the +12 Vdc power supply that powers the base station. If this is not available, any other source of regulated DC power with a current rating of at least 500 mA. may be used.

3.2.3 TB1-3 Auxiliary Telephone Line

Both Terminal #3 and Terminal #4 are used in applications where the ACI-35 is connected to two telephone lines. Refer to the section "Custom Applications" for information regarding the installation and operation of the ACI-35 with two telephone lines.

3.2.4 TB1-4 Auxiliary Telephone Line

See TB1-3

3.2.5 TB1-5 Special Connect Code Output

This terminal is provided for customized applications. It is an open collector output which pulls to ground when activated. Current capacity is 50 mA. The operation of this output is determined by Jumper JP2 which can make the output pull to ground either when the Special Connect Code is received (JP2-A); or only after both the Special Connect Code and the Connect Code are received (JP2-B). In either case the output reverts to normal when a disconnect code is received.

See the section "Custom Applications" for examples and suggestions of use.

3.2.6 TB1-6 Receive Audio

The ACI-35 has the capability to sense received audio for mobile detection. Ideally the receive audio should come from a squelched audio point that doesn't vary with the volume control. Usually the high side of the volume control will provide such a point. In cases where the high side of the volume control is unsquelched, an additional connection to the receivers squelch circuit will be necessary (COR). Speaker audio is not recommended due to its inferior audio quality and its ability to be changed by the volume control. Be sure to use shielded cable with the shield terminated only at the interconnect.

If unsquelched audio is used for the receive audio pick up point, S6 must be closed (down).

3.2.7 TB1-7 Transmit Audio

This connection supplies the transmitter with processed audio from the telephone line. This connection should be made to the transmitter microphone input, or transmitter voice audio input.

3.2.8 TB1-8 Auxiliary Relay #1 Normally Open
3.2.9 TB1-9 Auxiliary Relay #1 Normally Closed
3.2.10 TB1-10 Auxiliary Relay #1 Wiper
3.2.11 TB1-11 Auxiliary Relay #2 Normally Open
3.2.12 TB1-12 Auxiliary Relay #2 Normally Closed
3.2.13 TB1-13 Auxiliary Relay #2 Wiper

These are used for special applications. See JP4, JP7 and JP8 for configuring them for your custom use. Also see "Custom Applications", Function Codes and the Special Connect Code.

3.2.14 TB1-14 Function Code Output #2

3.2.15 TB1-15 Function Code Output #1

These two connections are open collector outputs which pull to ground when activated. Current capacity is 50mA. Each output is controlled by its own Function Code. When the Function Code is sent from the mobile or handheld radio the output pulls to ground until the Function OFF Code is transmitted. These functions can not be controlled from the telephone line; only from the radio transmitter. The Function Code Outputs can be used to control a sub audible encoder/decoder, tape recorder, switch between alternative telephone lines, or any other customized application.

3.2.16 TB1-16 Carrier Operated Relay

This is also called Carrier Operated Switch (COS). This connection to the radio's squelch circuit will be necessary if one or both of the following conditions exist:

1) The Receive Audio source is unsquelched.
2) The radio system uses CTCSS and it is desired that the Busy Channel Ringout Inhibit Feature be functional.

The Carrier Operated Relay connection is best made to a point in the receiver's squelch circuit that changes in DC voltage when the squelch control is opened and closed. Such a point usually exists at the output of the Noise Rectifier. The collector of a Busy Lamp Driver, if so equipped, should also provide an adequate COR signal. It will be necessary to adjust R8 (COR Adjust) before COR will function properly. See R8 in the Level Adjustments Section of this manual.

3.2.17 TB1-17 Push To Talk

This connection controls push to talk and should be made to the PTT line in the transmitter. An easy way to accomplish this is to make the connection to the PTT pin of the radio's microphone connector.

3.2.18 TB1-18 Auxiliary Ringout

This connection is provided for applications where a mobile selective signalling decoder, such as DTMF or two tone sequential is being used. The output from this terminal is open collector that pulls to ground for 500 milliseconds once for every incoming call. This output is only active if the channel is not in use and no carrier has been detected for the previous five seconds. Also the output will not function if the ACI-35 is programmed to Auto Answer on the first ring. The front panel Ring Detect Switch must be ON for this function to operate, and "Mobile Ringout" (*4 34) must be off.

3.3 Telephone Line Connections

The ACI-35 interfaces directly with a "loop start" telephone line. Connection of the telephone line to the ACI-35 is easily completed by using the telephone cord supplied with the interconnect. Simply plug one end into J1 and the other end into your telephone company supplied RJ11-C jack. Please be aware that the connection to the Public Switched Telephone Network is not polarity sensitive, and therefore the Tip and Ring connections can be reversed without any system degradation.

Connections to a second telephone line, to be used in specialized systems, are made using terminals #8, #9, #11, and #13 of TB1. Refer to the "Custom Applications" section in the back of this manual for specific information about this installation.

LEVEL SETTING ADJUSTMENTS

Now that all connections have been made to the ACI-35, the next step is to perform all level setting adjustments required for proper operation in your radio system. An FM Service Monitor, an Oscilloscope or AC RMS Voltmeter, and the on-board DTMF encoder are all that is required for the installation.

Before beginning the adjustments, open this manual and fold out the Assembly Drawing to help you locate the level adjusting controls. The controls are also identified on the printed circuit board. For all of the controls, and switches, the printed circuit board coordinates are listed in parenthesis to help you rapidly find them on the board.

4.1 Receive Audio Level

Control R137; (5E,C4)
This control adjusts the audio level into the telephone line. DTMF levels, as well as voice are controlled by this adjustment. To set this level have a mobile operator place a call to a telephone at the site. Adjust the control for normal sounding voice levels as heard on the telephone. Disconnect the call and have the mobile operator place another call. This level setting should not be critical, and a wide latitude is acceptable provided that the mobile's deviation is adjusted properly.

4.2 Receive Audio Detector

Control R161; (5B, C5)
This control has been set at the factory to the fully counter clockwise (maximum input) direction. This setting should be ideal for virtually all applications. However if the receiver is not fully quieted you may need to turn this control down (clockwise) until the front panel "Mobile Detect" LED illuminates only in the presence of voice audio. The LED should not remain illuminated during repeater hangtime. Also see Section 6.1.

4.3 Transmit VOX Sensitivity

Control R80; (5G, C0)
This control sets the transmit audio AGC and the VOX threshold. This is a noncritical adjustment and usually the factory setting of 50% is adequate. Make a few telephone calls to optimize this adjustment. Audio from the telephone line is being detected to key the transmitter. If the transmitter occasionally drops out causing parts of the conversation to be lost, increase R80 slightly (clockwise) until the telephone transmission is consistent. If the transmitter stays keyed because of background noise then decrease this level.

4.4 Delayed Transmit Audio

Control R132; (6F, B8)
This control sets the level of transmitted audio from the telephone line to the mobile. Simply adjust for adequate transmitter deviation. If R132 is difficult to adjust because of too much audio, cut JP11. This control also affects the settings of the Transmit Message Level (R127) and should always be set before that level.

4.5 Transmit Message Level

Control R127; (5H, B8)
This control sets both the level of the various Messages transmitted by the ACI-35, and the level of the DTMF overdial tones transmitted by the ACI-35 for selective signalling. This control should be set after the Transmit Audio Level (R132) has been set. To set this level call into the interconnect from a telephone and Overdial a DTMF mobile ANI consisting of 6 of the same digits (ie-"111111). While monitoring with an FM deviation meter adjust R127 for about 3.3 kHz. deviation. Repeat this procedure as many times as necessary to obtain the desired level.

Another method of setting this level, if the Selective Signalling feature is not going to be used, is by depressing the front panel Connect/Disconnect switch twice. This action will connect, then disconnect the interconnect causing the "OFF" message to be transmitted. Then, while monitoring the channel set the level of these tones to a comfortable level. However, be aware that if this method is used the deviation of Overdialed DTMF Mobile numbers may not be correct and may not activate mobile decoders.

4.6 COR (COS) Threshold Adjustment

Control R8; (8A, C0)
Because some decoders only provide a small voltage change when detecting carrier, this control enables the installer to set the reference of the voltage comparator to midpoint between the high and low signals from the decoder. First determine the decoders output when carrier is detected and set JP1 accordingly (see Jumper Configuration). Next set the voltage at TP1 to the midpoint of the high and low level transition by adjusting R8.

Example: D.C. voltage from COR input with no carrier = .7V
D.C. voltage from COR input with carrier = 1.9V

1.9V - .7V = 1.2V (output change)
1.2V / 2 = .6V (midpoint of change)
.7V (low end) + .6 (midpoint) = 1.3V

Set the voltage at TP1 to 1.3V and place JP1 between E20 and E21 since this output goes high with the presence of carrier.

4.7 CTCSS Audio Level

Control R141; (5I, C5)

This control sets the level of the receive audio to an optional CTCSS decoder. No adjustment is necessary if a CTCSS decoder is not installed in the ACI-35. The factory setting is usually appropriate for most decoders but the level of receive audio sent to E17 can be adjusted by R141 to meet the requirements of most CTCSS decoders.

JUMPER CONFIGURATION

There are eleven Jumpers that configure the operation of the ACI-35. Their position and function are listed in the following paragraphs. The numbers in parenthesis following the jumper number indicates its position on the parts placement drawing.

5.1 JP1 Carrier Operated Relay Polarity (COR)

The position of JP1 (7G, B8) is determined by the Carrier Operated Relay (also COS for carrier operated switch) voltage swing in the radio base station. If COR is not being used (refer to Section 3.2.16) install the jumper on only one pin. If COR is being used and the voltage rises when the squelch control is opened, install JP1 between E20 and E21. If the COR voltage drops when the squelch control is opened, install JP1 between E21 and E22.

5.2 JP2 Special Connect Code Selection

The position of this jumper (7G, B9) determines when the Special Connect Code activates the Special Connect Code Output which is available at TB1-5. See section 3.2.5 for further information about the operation of this output. To make the output pull to ground after only the Special Connect Code is received place the jumper between E24 and E25. To configure the output so that it is pulled to ground after both the Special Connect Code and the regular Connect Code are received place the jumper between pins E23 and E24.

5.3 JP3 Modified Pulse Dialing Ratio

The ACI-35 is designed to generate dial pulses with a 40:60 make to break ratio. In many foreign countries the ratio used with the Telephone Networks is 34:66. This is generally known as Europulse Dialing. If you know that the telephone network requires this modified signalling format then install this jumper between E5 and E6 (7H, C3).

5.4 JP4 Auxiliary Relay Connect Control

As shipped from the factory this jumper is in place between E26 and E27 (7E, B8). In this configuration the Auxiliary Relay toggles whenever the ACI-35 connects and disconnects. If for special applications you wish to isolate the operation of the relay from the connect logic then cut this jumper.

5.5 JP6 Phone in Use Defeat

This jumper is installed between E30 and E31 (6I, C2). When in place this jumper activates the "Telephone Line in Use"

logic and prevents a mobile from gaining access to the telephone line if it is already in use. Cutting this jumper will allow access to the telephone line at all times.

5.6 JP7 Auxiliary Relay PTT Control

This jumper, like JP4, also controls the operation of the Auxiliary Relay. As shipped from the factory this jumper is installed between E34 and E35 (6G, C1). As long as this jumper remains in place the Auxiliary Relay toggles whenever PTT is active (assuming JP4 is cut). To isolate the relay from the PTT logic cut this jumper.

5.7 JP8 Auxiliary Relay Coil

This jumper provides the connection to the low side of the Auxiliary Relay coil. To free up the relay to use the Function Code or the Special Connect Code for control cut JP8 between E32 and E33 (4J, D0) and make the connection to the appropriate logic signal needed to control the relay.

5.8 JP9 Audio De-Emphasis

When shipped from the factory this jumper is in place between E36 and E37 (5G, C8). This provides a flat audio frequency response from 300 Hz. to 3,000 Hz. from the receiver to the telephone line. If the Receive Audio pick-up point (refer to Section 3.2.6) is before de-emphasis cut this jumper.

5.9 JP10 Electronic Voice Delay Interval

As shipped from the factory this jumper is installed between E38 and E39 (7D, B1). With this jumper installed the Electronic Voice Delay will be 500 ms. To reduce the delay to 250 ms. cut this jumper. The shorter delay is desirable and more pleasing to the mobile operator. However, in systems with multiple transmitter and tone board rise times the 250 ms. delay may not be long enough for the cumulative rise times resulting in clipping of the first spoken word from the telephone line.

5.10 JP11 Transmit Audio Output Impedance

When installed between E40 and E41 (6G, B7) this jumper provides a low impedance transmit audio output. If the local microphone for the base station is either high impedance or 500 Ohm dynamic then cut JP11 so that the ACI-35 will not load down the local microphone.

SWITCH SELECTIONS

There are six switches in the ACI-35 that configure its operation, or are used for local control. Four of these are located on the front panel, the other two are located inside the cabinet and should only be used during the initial installation and set-up of the unit.

6.1 Internal Switches

The ACI-35 normally uses a carrier operated relay (COR), signal to detect a mobile transmission. It also has an additional input (E15) for CTCSS that can be used for additional discrimination of a valid carrier. The ACI-35 needs to see activity from both of these signals at the microprocessor in order to recognize a mobile, and then operate as instructed by the mobile. These inputs are connected to pins 19 and 20 of the processor and both go low when active. If CTCSS isn't going to be used as a criteria for recognizing a valid mobile transmission then close switch S5. This will short pin 19 to pin 20 and allow COR to provide the necessary logic signal to both pins. Alternatively, you may wish to use only CTCSS and defeat the COR logic. Closing switch S5 will also accomplish this. If in your system you desire to use both inputs, then leave S5 open.

The CTCSS input also shares an optional, built in, audio detect logic. In the absense of either a CTCSS or COR signal receive audio alone can provide the logic input to either pin 19, or both pin 19 and 20 of U1. Receive audio detect is enabled by opening switch S6.

Normally you wouldn't want the ACI-35 to transmit on a busy channel. The COR input is the determining input for the ACI-35 to detect that the channel is busy. In an application where something other than COR is used (ie-CTCSS only) the ACI-35 could consider the channel clear if it sees the CTCSS signal drop for 5 seconds. Under these conditions, if a call came in from the landline and a non CTCSS conversation were in progress on the channel, then the ACI-35 would transmit on top of that conversation. For that reason it is strongly suggested that you use both the CTCSS and COR signals for controlling the interconnect.

6.1.1 Internal Switch Selection Table

Mobile Detect Logic	SW5	SW6	Busy Channel Transmit Logic
Carrier Squelched Audio Only	ON	OFF	Functional
CTCSS Squelched Audio Only	ON	OFF	Nonfunctional
CTCSS Squelched Audio with COR	OFF	OFF	Functional
Unsquelched Audio With COR	ON	ON	Functional
Unsquelched Audio with CTCSS Logic	ON	ON	Nonfunctional

Note: SW5 and SW6 are push-pull board mounted switches. These switches are in the ON (closed) position when down; and in the OFF (open) position when pulled up.

The Busy Channel Transmit Logic operates only when the ACI-35 sees a carrier on the channel via the COR input.

OPTIONAL CTCSS DECODER

Internal CTCSS Decoder

Space has been set aside for the addition of an optional CTCSS decoder. The installation list below is for the C.E.S. Model 5732 CTCSS high speed decoder (although most CTCSS decoders will work without any problem). Connect the five wires and set the 5732 for the proper CTCSS tone according to the Frequency Selection Table. Open S5 on the ACI-35, and follow any operating instructions sent with the 5732 decoder.

5732 WIRE	CONNECTION IN ACI-35
Decode output (yellow)	E15
Tone Input (green)	E17
+12 Vdc (red)	E18
Ground (black)	E14
Disable (orange)	E16

7.0.1 CTCSS FREQUENCY SELECTION TABLE

NO.	FREQ	CODE	SWITCH # 5 4 3 2 1	NO.	FREQ	CODE	SWITCH # 5 4 3 2 1
1	67.0	XZ	0 0 0 0 0	17	118.8	2B	1 0 0 0 0
2	71.9	XA	0 0 0 0 1	18	123.0	3Z	1 0 0 0 1
3	74.4	WA	0 0 0 1 0	19	127.3	3A	1 0 0 1 0
4	77.0	XB	0 0 0 1 1	20	131.8	3B	1 0 0 1 1
5	79.7	SP	0 0 1 0 0	21	136.5	4Z	1 0 1 0 0
6	82.5	YZ	0 0 1 0 1	22	141.3	4A	1 0 1 0 1
7	85.4	YA	0 0 1 1 0	23	146.2	4B	1 0 1 1 0
8	88.5	YB	0 0 1 1 1	24	151.4	5Z	1 0 1 1 1
9	91.5	ZZ	0 1 0 0 0	25	156.7	5A	1 1 0 0 0
10	94.8	ZA	0 1 0 0 1	26	162.2	5B	1 1 0 0 1
11	97.4	ZB	0 1 0 1 0	27	167.9	6Z	1 1 0 1 0
12	100.0	1Z	0 1 0 1 1	28	173.8	6A	1 1 0 1 1
13	103.5	1A	0 1 1 0 0	29	179.9	6B	1 1 1 0 0
14	107.2	1B	0 1 1 0 1	30	186.2	7Z	1 1 1 0 1
15	110.9	2Z	0 1 1 1 0	31	192.8	7A	1 1 1 1 0
16	114.8	2A	0 1 1 1 1	32	203.5	M1	1 1 1 1 1

1= switch turned on 0= switch turned off

PROGRAMMING THE MODEL ACI-35

This section describes the procedures used to program the ACI-35 to meet your particular system requirements. The ACI-35 can be programmed remotely through the telephone line, or locally with the on-board 12 button keypad. In either case the programming sequences are the same and only the method for entering the Program Mode is different.

The following table summarizes the programmable features of the ACI-35. Listed in the table are the Features, the Program Codes, and Page References for detailed descriptions of each programmable parameter. A similar table, located in the back of this manual, has the factory settings and a space to write down any changes from the factory setting for reference.

8.1 Program Summary Table

8.2 Entering The Programming Mode

The ACI-35 can be programmed either from the telephone line, or through the on-board DTMF pad. During installation the on-board pad will be used to set-up and configure the unit. If subsequent changes are desired, the system operator can "call up" the interconnect from any DTMF telephone and reprogram whatever parameters he chooses. The method of entering the Program Mode from the telephone line is slightly different from entering the Program Mode with the on-board encoder.

8.2.1 Entering the Program Mode - On-Board

To enter the Programming Mode locally remove the top cover of the interconnect. Turn the power on by using the front panel switch. Verify that only the Power LED is illuminated. Illumination of the other LEDs indicates that either the interconnect is improperly installed, or that level adjustments are not correct. The only exception is the Mobile Detect LED. If this LED is illuminated it indicates that the channel is in use. In this case Programming can still be accomplished, but the acknowledgement beeps will be transmitted over the air. To avoid transmitting the Beeps on top of a cochannel user simply disconnect the PTT line.

Depress the "0" key of the on-board encoder, then immediately press the front panel connect button. You should see the PTT LED light momentarily. If a second receiver (or your service monitor) is being used to monitor the channel you will hear one short tone transmitted when the PTT LED flashed. The Program Mode has now been accessed, and the ACI-35 is ready to accept Programming Commands.

8.2.2 Entering The Program Mode - Remotely

In order to Remotely Program the ACI-35 the unit must be previously programmed to Automatically Answer an incoming landline call.

To enter the Program Mode remotely call the seven digit telephone number of the line connected to the interconnect. When the interconnect answers the line two prompting tones will be heard. Within 30 seconds dial the Remote Programming Code. This code is factory set to be "2580#". If you have re-programmed this code, then enter the new code that you programmed. If you have entered an incorrect code you will be immediately disconnected. When the correct Program Code is entered you will hear two acknowledgement tones and the ACI-35 will immediately enter the Program Mode.

8.3 Programming Methodology

While programming the ACI-35 you will be entering various sequences of digits. These sequences will range from one digit to six digits. These Programming Sequences must conform to the following rules:

Begin each sequence with the "*" tone.

An acknowledgement tone will be heard after each Program Command is terminated. Some commands require a "#" tone to terminate a series. This acknowledgement will be transmitted over the air when programming locally; it will be generated to the telephone line when programming remotely.

All Program Commands are timed and will time out after six seconds. The only exceptions to this are the Program Commands for the Morse Code Messages; these Commands have a ten second limit; and the interval between entering a "*" and a Program Command which is limited to three seconds.

When finished programming enter a "#" tone. The "#" tone will exit the Program Mode and return the ACI-35 to its normal operation. If the last programming entry made is one that requires a "#" to terminate that entry, then a second "#" is needed to exit the Program Mode.

Be certain to use the Program Code Summary Table included in the back of this manual. This table is the perfect place to write down any codes that you change so that they won't be forgotten. The table also helps you analyze the codes that you create, so that you don't inadvertently create codes that conflict with each other.

8.4 Program Commands

8.4.1 Control Codes

8.4.1.1 Multidigit Connect/Disconnect Code (*1 0)

Multidigit Connect and Disconnect codes are more secure than the single digit "*" or "#" codes. The trade off is that they might also be easier to forget. The choice is yours. Keep in mind however that when using single digit Connect/Disconnect codes you can not use the Function Codes, or Control Codes.

To program the ACI-35 for a multidigit Connect/Disconnect Code dial "*1 0", then two digits. This two digit Code is always prefixed with the "*" for connect or "#" for disconnect, leaving two additional numerals assignable by you.

Example: To program for a Connect/Disconnect Code of: "*21" key in the following sequence: "*1 (Tone) 0 (Tone) 21" (Tone). You can now connect from the mobiles by transmitting: "*21", or Disconnect with: "#21".

8.4.1.2 Special Connect Code (*1 1)

The Special Connect Code can be used by authorized individuals to overide the toll restrictions, or overide the telephone in use detector. The Special Connect Code must always be transmitted prior to the standard Connect Code. The Special Connect Code is a two digit code which is always prefixed with the "*". To change the Special Connect Code enter "*1 1" then the two digits of the code. The "*" is automaticaly inserted and shouldn't be included in the programming sequence. Note that this code also drives the Special Connect Output at TB1-5.

Example: To reprogram the Special Connect Code to be: "*88" enter the following sequence: "*1 (Tone) 1 (Tone) 88 (Tone)". The toll restrictions can now be overidden by transmitting "*88" prior to the normal Connect Code.

8.4.1.3 Function 1 Code (*1 2)

The two Function Codes control the Two Function outputs. They have no direct effect on the ACI-35's operation. These are available for the users own custom application to control other equipment. The outputs are the open collector of a transistor without any pull-up. When a Function Code is sent, the output transistor provides a low impedance path to ground. When the Function is turned off, it is a high impedance.

To program this code you will determine the ON code. The OFF code for this function will always be 10 less than the ON code. For example: if you program "53" to be the ON code, then "43" is the OFF code.

To Program The Function #1 Code enter "*1 2" then the desired two digit code.

Example: To Program the Function #1 Code of "53" enter this sequence: "*1 (Tone) 2 (Tone) 53 (Tone)". Transmitting "*53" while the ACI-35 isn't in the connect mode will turn on Function 1 Output. "*43" will turn it OFF.

8.4.1.4 Function 2 (*1 3)
This works the same as Function 1 above. The only differences between the two are the programming code and the outputs they control.

8.4.1.5 Ringout On/Off Code (*1 4)
Ringout is sometimes referred to as Reverse Autopatch. This Code is used to turn this feature ON or OFF from the air. If Ringout is ON, and a call comes in from the telephone line the ACI-35 will transmit the Ringout Message every time the line rings. However, if the programmed message is longer than the interval between rings then the message will only be transmitted after every other ring. If the channel is busy when the call comes in, the ACI-35 will not transmit the message until no carrier has been detected for five seconds. If Auto Answer is enabled the Ring Out Messages will cease when the interconnect answers automatically on the programmed ring count.

To program this code you will determine the ON code. The OFF code for this function will always be 10 less than the ON code. For example: if you program "96" to be the ON code, then "86" is the OFF code.

To Program The Ring Out Code enter "*1 4" then the desired two digit code.

Example: To Program a Ringout Enable Code of "96" enter this sequence: "*1 (Tone) 4 (Tone) 96 (Tone)". Transmitting "*96" then will enable reverse autopatch operation, "*86" will turn it OFF.

8.4.2 Call Limit Timer (*2)
The Call Limit Timer limits the maximum duration of all interconnected calls. This timer is very useful in controlling loading of the system, and monopolization of the system by long winded individual users.

The Call Limit Timer is programmed with three digits that represent the desired limit in ten second increments. It can be set for any time interval from 10 seconds to 42.5 minutes. To program the Call Limit Timer enter "*2" then the three digits for the time.

Example: To program the timer for three minutes (180 seconds) enter the three digit code "018" into the following sequence: *2 (Tone) 018 (Tone). The code is easily derived by dividing the desired number of seconds by 10 (180/10=18, or 018).

When the call limit is about to be exceeded by a user he will hear a double tone every 5 seconds for the last 30 seconds warning him that he is about to be disconnected. A final warning of three tones in a row will be sent after the thirty seconds of warning, then the transmitter will unkey for 5 seconds and disconnect. If "*" Reset (code *4 36) is enabled the mobile operator can reset the Call Limit Timer at any time during the warnings by transmitting the "*" tone.

8.4.3 Mobile Activity Timer (*3)

This timer is used to disconnect the interconnect if the mobile should drive out of range, forget to disconnect after a call, or if the mobile radio should fail during a call. This timer resets everytime the mobile begins transmissions. It is programmable from 1 second to 4 minutes and 10 seconds. The Mobile Activity Timer is also programmed with three digits. Simply enter the number of seconds for the desired interval.

Example: To program the timer for thirty seconds enter "*3 (Tone) 030 (Tone)".

When the programmed time is about to be exceeded by a user he will hear a tone every 3 seconds for the last 30 seconds warning him that he is about to be disconnected. A final warning of three tones in a row will be sent after the thirty seconds of warning, then the transmitter will unkey for 5 seconds and disconnect. The mobile operator can reset the timer at anytime during the warning periods by keying his transmitter.

8.4.4 Optional Program Commands (*4)

8.4.4.1 Toll Restrictions (*4 00 through *4 14)

If you wish to restrict all users (except those who know the Special Connect Code) from making toll calls then program these restrictions. Attempted dialing of a toll restricted telephone number will result in the Error Message being transmitted, and then immediate disconnect. (For toll restriction to work, the Toll Restrict switch on the front panel should be pushed in.)

When programming the toll restrictions you first need to determine what numerals dialed as either the first or second digit of a telephone number would result in a toll call. These might be "1", "0", or "9" if the ACI-35 is installed on an in-house telephone system. When programming you will "Flag" these numerals as restricted

numerals. You then program the unit to check for these "flagged" numerals in either the first, second, or both positions of the dialed number. Use the following table to "Flag" the numerals:

NUMBERS TO BE RESTRICTED

Code		ON	OFF	Numeral
*4	00	1	0	Numeral: 7
*4	01	1	0	Numeral: 6
*4	02	1	0	Numeral: 5
*4	03	1	0	Numeral: 4
*4	04	1	0	Numeral: 3
*4	05	1	0	Numeral: 2
*4	06	1	0	Numeral: 1
*4	07	1	0	Numeral: 0
*4	10	1	0	Numeral: 8
*4	11	1	0	Numeral: 9

Example: To have the numeral "1" toll restricted enter the following sequence: "*4 (Tone) 06 (Tone) 1". To have number 9 restricted enter this sequence: "*4 (Tone) 11 (Tone) 1"

8.4.4.2 Restricted Digits (*4 12,13)

To have these numbers restricted from being the first dialed digit use Program Code "*4 12". Use Code "*4 13 " for the second digit. You will program either a "1" or a "0" to turn the restriction ON or OFF as follows:

Restrict From		Program Sequence
First Digit	ON	"*4 12 1"
First Digit	OFF	"*4 12 0"
Second Digit	ON	"*4 13 1"
Second Digit	OFF	"*4 13 0"

Example: To restrict the "flagged" numerals from being the first digit dialed enter this sequence: "*4 (Tone) 12 (Tone) 1".

8.4.4.3 Toll Restriction Re-Arm (*4 14)

When turned ON this feature will automatically rearm the toll restrictions twenty-five seconds after they have been overridden by the Special Connect Code. If turned off, then toll restrictions are not rearmed until a disconnect code is received by the ACI-35. Rearming the toll restriction will prevent a toll number from being dialed if the central office returns a new dial tone when the called party hangs up.

8.4.4.4 Auto Answer (*4 15)

Without this feature turned ON the ACI-35 will not answer the telephone line. Instead it will ring out onto the channel until any mobile "Accepts" the call by transmitting the Connect Code. (The Ring Detect switch on the front panel should be pushed in for this to function.) Without this feature turned on the interconnect can not selectively signal, be remotely programmed, or operate as a remote base station. Each of those operations requires that the interconnect automatically answer the line and look for a Code (ie-Remote Base Code, Programming Code, or Mobile ID).

To program this function enter either of the following sequences:

"*" 4 (Tone) 15 (Tone) 1 (Tone) for ON
"*" 4 (Tone) 15 (Tone) 0 (Tone) for OFF

8.4.4.5 Ring Counter (*4 16 & 17)

The ACI-35 can be programmed to answer the telephone line on the 1st, 2nd, 4th, or 8th ring. If the interconnect is sharing a line with an extention telephone you would probably want to set it for 4 or more rings to allow persons in the room to answer first. If the unit is on its own line you would probably set it for 1 or 2 rings.

For this feature to work Ring Out Enable (*4 34) must be turned on. Program the Ring Counter by entering either a "1" or a "0" as derived from the following table for both Program Codes *4 16 and *4 17.

	1st	2nd	4th	8th
*4 16	0	1	0	1
*4 17	0	0	1	1

Example: To answer on the second ring enter a "1" for Program Code *4 16, and a "0" for Program Code *4 17.

*4 (Tone) 16 (Tone) 1 (Tone)
*4 (Tone) 17 (Tone) 0 (Tone)

8.4.4.6 Auto Answer Priority (*4 20)

This determines in part the function of S3 (the front panel ringout detect switch). If Auto Answer Priority is turned off, S3 will manually turn on or off the Auto Answer Mode, (if enabled), as well as the Mobile Ringout, (if enabled). If Auto Answer Proirity is turned on, S3 will control the Mobile Ringout only.

"*" 4 (Tone) 20 (Tone) 1 (Tone) for ON
"*" 4 (Tone) 20 (Tone) 0 (Tone) for OFF

8.4.4.7 Remote Base Priority (*4 21)

This command controls whether priority is given to carrier detect, or Remote Base operation. When turned OFF Remote Base calls will be delayed until no carrier has been detected for five seconds. When turned ON Remote Base will have priority over carrier detect.

"*" 4 (Tone) 21 (Tone) 1 (Tone) for ON
"*" 4 (Tone) 21 (Tone) 0 (Tone) for OFF

8.4.4.8 Selective Ring Out (*4 22,23)

These Program Codes are used together to turn ON or OFF the DTMF Selective Signalling, and to specify a prefix to be automatically appended to any overdialed DTMF signalling code. When disabled DTMF Selective Signalling of an overdialed mobile number will not be possible. When enabled all signalling codes can be automatically prefixed with a "*", "#", or no prefix at all.

22	23	
1	1	Disables Selective Signalling
1	0	"#" prefix automatically added
0	1	"*" prefix automatically added
0	0	No prefix is added to the DTMF digits over dialed from the telephone.

Example: To enable DTMF Selective Signalling, with a "*" tone transmitted prior to the DTMF digits over dialed from the telephone line enter the following:

"*" 4 (Tone) 22 (Tone) 1 (Tone)
"*" 4 (Tone) 23 (Tone) 0 (Tone)

When enabled DTMF Selective Signalling tones are transmitted by the ACI-35 at the rate of five digits per second (100ms. ON, 100 ms. OFF).

8.4.4.9 Selective Signalling Wait Period (*4 24,25)

After the DTMF Selective Signalling Code is transmitted the ACI-35 must wait for the called mobile to "answer" the call by transmitting back to the base the over dialed code. The period of time that the interconnect waits for the mobile to answer the call is programmable. A short wait period would require mobiles to answer promptly, and would tend to decrease channel loading. A longer wait period would give the mobiles more time to answer the call; which might be especially appropriate if the mobiles are using "horn honk" to signal persons outside the vehicle.

24	25	
0	0	15 second wait period
1	0	30 second wait period
0	1	45 second wait period
1	1	60 second wait period

Example: To set the wait period for 45 seconds enter the following:

"*" 4 (Tone) 24 (Tone) 0 (Tone)
"*" 4 (Tone) 25 (Tone) 1 (Tone)

If the mobile does not answer the call within the programmed wait period the interconnect will then send two short beeps then disconnect.

8.4.4.10 Single Digit "*" Connect Code (*4 26)
This Program Code is used to establish a single "*" tone as the Connect Code. When enabled the mobile operator only needs to transmit only the "*", then listen for dial tone before dialing a telephone number. If you have programmed a multidigit Connect/Disconnect Code this command will override the multidigit Connect code. The mobile operator then would connect with the "*", and disconnect with the multidigit code. Note that using a single "*" to connect will eliminate the use of all of the other function and control codes which start with the "*".

"*" 4 (Tone) 26 (Tone) 1 (Tone) ON
"*" 4 (Tone) 26 (Tone) 0 (Tone) OFF

8.4.4.11 Single Digit "#" Disconnect (*4 27)
This Program Code is used to establish a single "#" tone as the Disconnect Code. When enabled the mobile operator can disconnect with only the "#" tone. If you have programmed a multidigit Connect/Disconnect Code this command will override the multidigit Disconnect code. The mobile operator then would Connect with the multidigit code and disconnect with the "#" tone.

"*" 4 (Tone) 27 (Tone) 1 (Tone) ON
"*" 4 (Tone) 27 (Tone) 0 (Tone) OFF

Using the single digit "#" Disconnect Code makes it easy for co-channel users to disconnect the interconnect if another mobile operator forgets to disconnect after completing a call. A drawback to this though is that discourteous co-channel users can easily Disconnect each other.

8.4.4.12 Refresh Enable (*4 30)
Refresh (when turned ON) programs the ACI-35 to automatically key the transmitter at programmed intervals. Refresh only keys the transmitter when there have been no mobile or base transmissions within the programmed interval. This feature is particularly useful in trunked radio systems where the channel will be lost if activity is not periodically apparent to the trunking logic. On conventional systems the Refresh Feature can be used to key the repeater, resetting the repeater's

hang-time. In this application refresh eliminates unnecessary squelch tails caused by the repeater's hang time release. To program Refresh use Program Code *4 30 to enable the feature; and Program Code *4 31 to set the interval.

"*" 4 (Tone) 30 (Tone) 1 (Tone) ON
"*" 4 (Tone) 30 (Tone) 0 (Tone) OFF

8.4.4.13 Refresh Interval (*4 31)
This Program Code is used to establish the interval at which Refresh will key the transmitter. Refresh transmissions are 500 milliseconds long and can occur once very 1.5 or 3 seconds. Program this interval with either of the following sequences:

"*" 4 (Tone) 31 (Tone) 0 (Tone) : 1.5 Seconds
"*" 4 (Tone) 31 (Tone) 1 (Tone) : 3.0 Seconds

8.4.4.14 DTMF Regeneration (*4 32)
When turned ON this code enables the ACI-35 to regenerate the DTMF tones being transmitted by the mobile into the telephone network. This feature greatly increases reliable dialing into DTMF telephone systems, particularly if the mobile is in a weak signal area. If the telephone network will not accept DTMF signalling then program the ACI-35 for Dial Pulse Dialing (next Program Command). If both codes 32 and 33 are off, then the interconnect will not regenerate the DTMF tones, but, pass the mobiles tones through as any other audio.

"*" 4 (Tone) 32 (Tone) 1 (Tone) ON
"*" 4 (Tone) 32 (Tone) 0 (Tone) OFF

8.4.4.15 Dial Pulse Dialing (*4 33)
Program this code ON if the ACI-35 is being installed on telephone network equipment that will not accept tone dialing. This feature is also sometimes used to improve dialing reliability in areas where the telephone network itself is noisy and does not reliably handle DTMF signalling. If this is turned on, DTMF regeneration needs to be turned OFF for programming code 32.

"*" 4 (Tone) 33 (Tone) 1 (Tone) ON
"*" 4 (Tone) 33 (Tone) 0 (Tone) OFF

8.4.4.16 Ring Out Message Enable (*4 34)
When enabled, this code programs the ACI-35 to transmit the Ring Out Message when a land line initiated call rings into the interconnect. With Auto Answer OFF, the Ring Out Message will be transmitted each time the landline rings. With Auto Answer ON the message will transmit up to one less than the number of rings the ACI-35 is set to answer on. This Ring Out Message is a global signal to all

co-channel mobiles that a call is waiting to be answered. This message would not normally be used in systems where Selective Signalling is used. Enabling this function will disable the Auxiliary Ring Out (TB1-18).

"*" 4 (Tone) 34 (Tone) 1 (Tone) ON
"*" 4 (Tone) 34 (Tone) 0 (Tone) OFF

The table below summarizes the relation between Ring Out Enable (ROE) and other functions that are affected by it.

ROE	Front Panel Ringout SW	Remote Ringout Enable	Ringout Activity	Auxiliary Ringout
1	ON	-	YES	NO
1	OFF	OFF	NO	NO
1	OFF	ON	YES	NO
0	ON	-	NO	YES
0	OFF	OFF	NO	NO
0	OFF	ON	NO	YES

8.4.4.17 Ring Out Priority (*4 35)

In its normal operating configuration the ACI-35 will not Ring Out to the radio channel until it has seen the absence of carrier for five seconds. This feature prevents the interconnect from interrupting a mobile to mobile call already in progress. When Ring Out Priority is turned ON this carrier detect feature is defeated and Ring Out is given priority over carrier detect. When Ring Out Priority is turned OFF, carrier detect is given priority over Ring Out.

"*" 4 (Tone) 35 (Tone) 1 (Tone) for ON
"*" 4 (Tone) 35 (Tone) 0 (Tone) for OFF

8.4.4.18 "*" Call Limit Reset (*4 36)

The Call Limit Timer limits the duration of each call to a programmed interval. The Call Limit Timer starts when the "*" tone is transmitted by the mobile who is placing or answering a call. The "*" Call Limit Reset Feature enables the mobile to reset the Call Limit Timer at any time during a call by simply transmitting the "*" tone. If this feature is turned OFF then there is no way to reset the timer and the call will absolutely be limited to the programmed interval.

"*" 4 (Tone) 36 (Tone) 1 (Tone) for ON
"*" 4 (Tone) 36 (Tone) 0 (Tone) for OFF

8.4.4.19 Call Waiting Indication (*4 37)

In applications where the interconnect is sharing a telephone line this feature can be used to alert the land line that a mobile wishes to make a call. If for instance the landline is in use, and a mobile attempts to place a

call, the parties engaged in the land line conversation will hear two tones each time the mobile attempts to connect. These tones will not interrupt the land line conversation, but will let those persons know that a mobile is waiting to make a call.

"*" 4 (Tone) 37 (Tone) 1 (Tone) for ON
"*" 4 (Tone) 37 (Tone) 0 (Tone) for OFF

8.4.5 Programming The Morse Code Messages (*5)

The ACI-35 can be programmed for five separate Morse Code Messages. These messages, their Program Codes, and their Factory settings are:

Message	Factory Setting	Prgm Code
Connect Message	"ON"	*5 0
Disconnect Message	"OFF"	*5 1
Time Out Message	"TO"	*5 2
Error Message, and	"EEEEEEEE"	*5 3
Ring Out Message	"RING"	*5 4

By using the following Programming Instructions you can program each Message to be a Morse Code Message, or establish your own tone patterns. When programming the messages be sure to follow these simple rules:

All messages (*5) must be terminated with a stop bit ("08"). If a message is removed, a stop bit ("08") must be entered in its place.

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

The messages are programmed by selecting the two digit codes from the following table which represents the alpha numeric characters.

Morse Code messages are limited to eleven characters each.

Example: To program "CALL" in the Ring Out Message enter the following sequence:

*5 (Tone)	Command for messages
4 (Tone)	Specifies Ring Out message
23 (Tone)	Code for the letter "C"
21 (Tone)	Code for the letter "A"
53 (Tone)	Code for the letter "L"
53 (Tone)	Code for the letter "L"
08 (Tone)	Stop

Example: To program "BYE" in the Disconnect Message enter the following:

*5 (Tone)	Command for messages
1 (Tone)	Specifies Disconnect message
22 (Tone)	Code for the letter "B"
93 (Tone)	Code for the letter "Y"
32 (Tone)	Code for the letter "E"
08 (Tone)	Stop code.

8.4.6 MORSE CODE PROGRAMMING TABLE

CHAR.	CODE	CHAR.	CODE	CHAR.	CODE
0	00	I	43	a	37
1	10	J	51	a	38
2	20	K	52	e	39
3	30	L	53	u	47
4	40	M	61	n	44
5	50	N	62	o	45
6	60	O	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	/	36
D	31	V	83	"?"	94
E	32	W	91	Special	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.

8.4.7 Remote Program Code (*6)

This code is used to gain assess to the Program Mode from a DTMF telephone. You can not remotely program the ACI-35 without knowing this code.

If you wish to change this code the procedure is very simple. First determine what your new code will be. It can be any number of digits up to six. Write down the new code for future reference. Remember without the new code you will not be able to enter the program mode remotely.

Example: To program the Remote Program Code to be "7734" enter the following sequence:

*6 (tone) 7 7 3 4 "#"

The "#" terminates the string, and the Program Command.

8.4.8 Remote Base Access Code (*7)

This is the Code that accesses the Remote Base function of the interconnect from a telephone. The code can be 1 to 6 digits in length. It's factory setting is "0852". This code is programmed like the Remote Program Code.

Example: To program the Remote Base Access Code to be "6688" enter the following sequence:

*7 (tone) 6 6 8 8 "#"

The "#" terminates the string, and the Program Command.

8.4.9 Telephone Transmit Hang Time (*8)

Telephone Transmit Hang Time is the amount of time that the interconnect will stay on the air after telephone line audio was last detected. The ACI-35 is shipped from the factory with a 500 ms Electronic Voice Delay. This means that the Telephone Transmit Hang Time has to be at least 500 ms for audio from the telephone line to reach the transmitter before the Telephone Transmit Hang Time shuts down the transmitter.

Ideally the Telephone Transmit Hang Time should be 100 to 300 ms longer than the Electronic Voice Delay interval. As shipped from the factory it is set to 700 ms; or 200 ms more than the factory setting for the EVD. If you have shortened the EVD to 250 ms (See JP10) you should shorten this interval to about 450 ms.

The Telephone Transmit Hang Time is programmed in 50 ms. intervals. A three digit multiplier is entered to represent the number of 50 ms increments.

Example: The desired hang time is 450 ms. There are 9 50 second increments in 450 ms (450/50=9). The program value then is "009".

Example: The desired hang time is 700 ms. The program value then is "014" (700/50=14).

*8 (Tone) 014 (Tone)

This concludes the instructions for installing, adjusting, programming and using the Model ACI-35 in typical installations. The following section "Custom Application" provides additional information on using the Function Outputs, Special Connect Output, and the Auxiliary Relay.

CUSTOM APPLICATION

This section has specific information to configure the ACI-35 for special application. The use of the Function Code/Output, Auxiliary Relay and Special Connect Code/Output aren't limited to the use described in this section, but may be used for any purpose imaginable.

9.1 Connecting Two Phone Lines

The auxiliary relay is used to select one of the two lines. Control the relay by using one of the Function Codes or the Special Connect Code.

If a Function Code is used, the phone line last used is the active line. This means that all calls out will be on this line until it is changed again. Also, all land line to mobile calls will have to come in on only the active line. The disconnected line will give the caller a busy signal.

If the Special Connect Code is used to switch the phone line, it can be set up so that line "A" is the default active line. All mobile calls are made on the default line unless the mobile chooses line "B" by sending the Special Connect before sending the normal Connect Code. The phone line will automatically switch back to the default line at the end of the call. All land line calls are to call in on only the default line "A". The draw back with this is that using the Special Connect Code also defeats toll restriction.

1. Connect phone line "A" to the back terminal TB1-9 and TB1-12.

2. Connect phone line "B" to TB1-8 and TB1-11.

3. Remove JP8 from between E32 and E33.

4. Connect E13 to one of the following:
   E11 to use Function 1
   E12 to use Function 2
   E4 to use the Special Connect Code

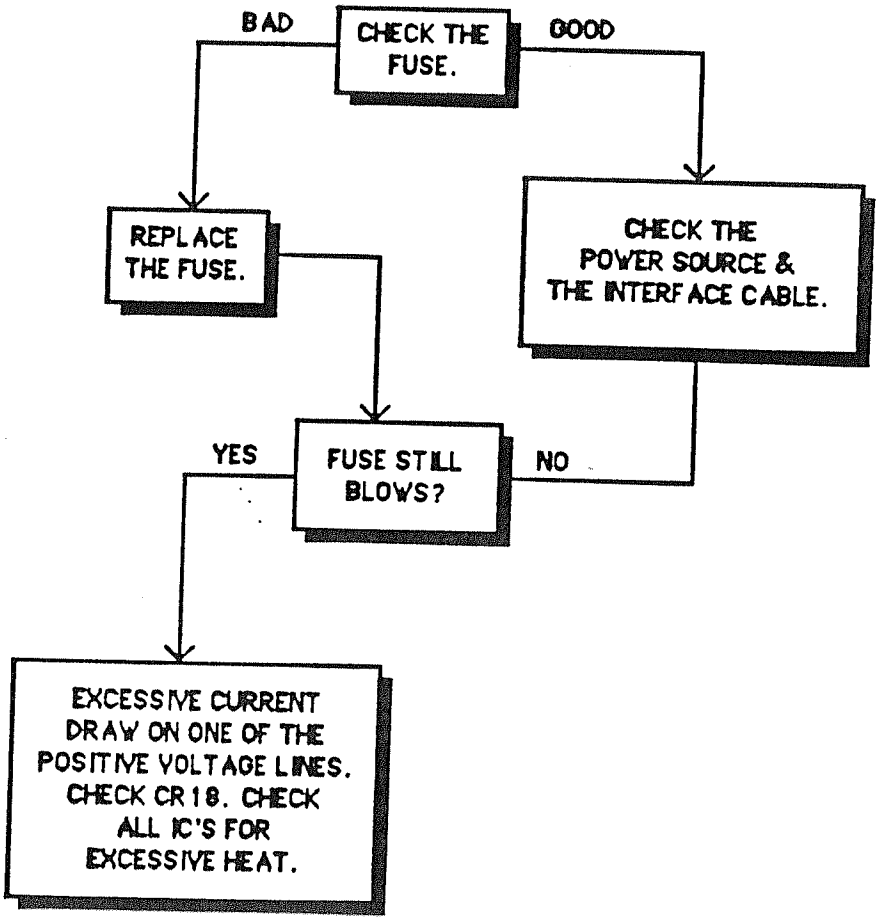
5. Connect the wipers of the relay to the normal phone line input one of two ways:

   > Connect E40 to E1 and E41 to E2. J1 (the phone jack) should not be used. Or...

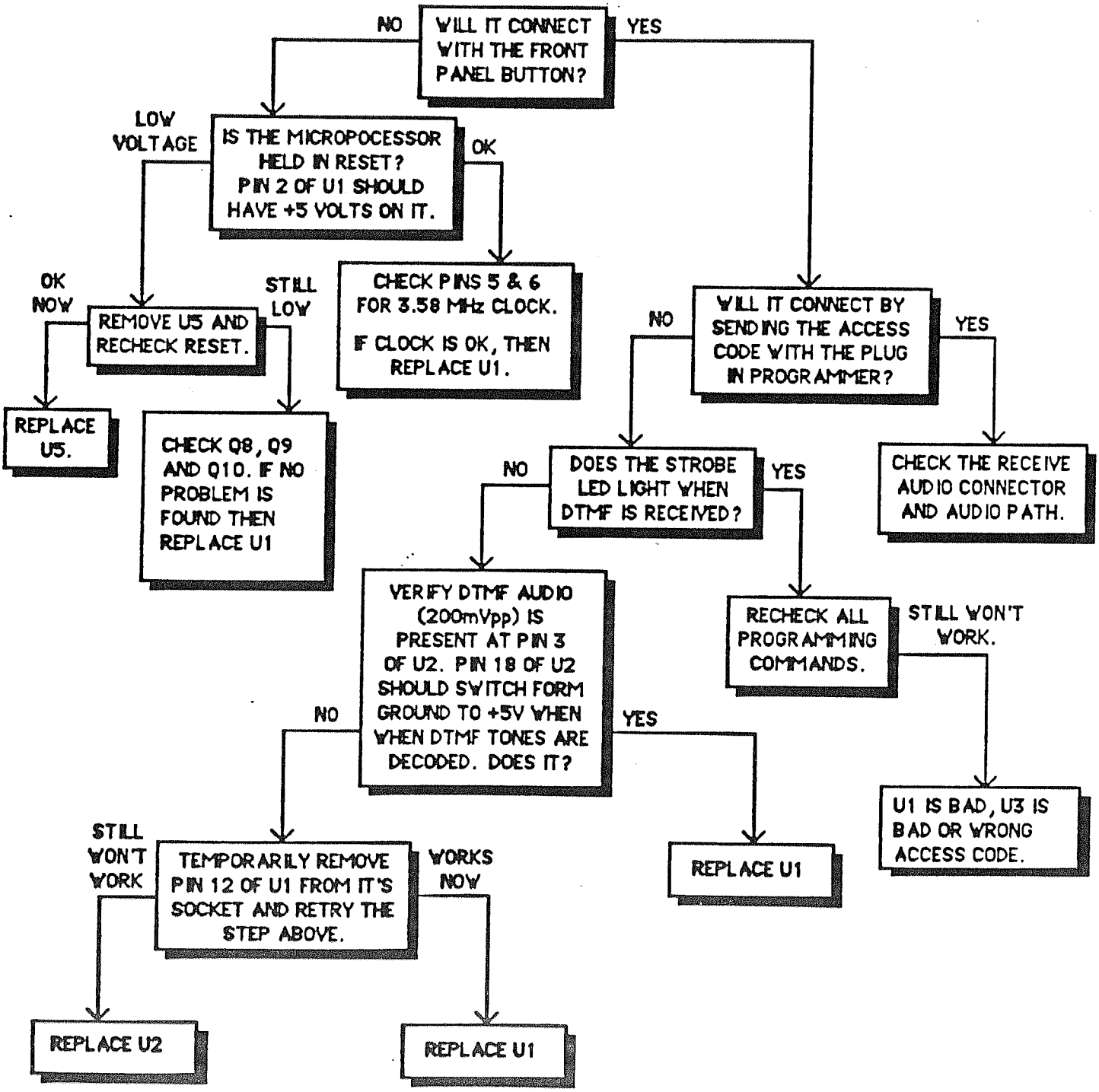
   > Cut about six inches from one end of the phone cable supplied with the ACI-35, and connect the red and green wires to TB1-10 and TB1-13 (in any order). The modular connector is plugged into J1 in the back panel.

TROUBLE SHOOTING FLOW CHART

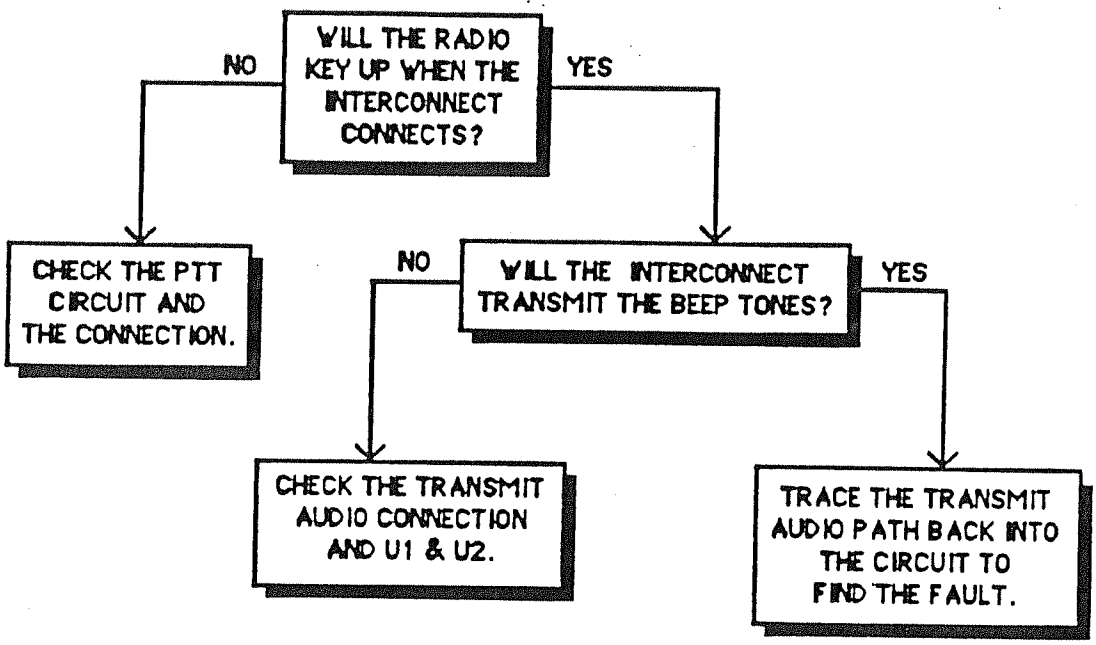
NO POWER



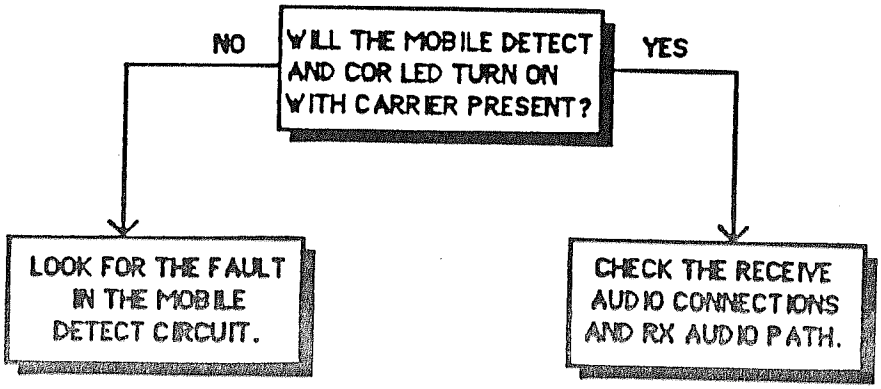
UNIT WILL NOT CONNECT



NO TRANSMIT AUDIO



NO RECEIVE AUDIO



ACI-35 PARTS LIST

The part numbers inside parentheses are included only on the ACI-35s which do not have the Audio Delay circuit on a separate printed circuit board.

REFERENCE DESIGNATOR	DESCRIPTION	CES PART NUMBER
CR11	1N5234B 6.2V	D5234B
CR1	LED, Red, rectangular	LED4
CR2, 3, 4	LED, Green, rectangular	LED5
CR9, 10, 14, 17, 20 (27-32), 32, 37	1N914 Diode " "	D914
CR5, 7, 36	LED, Red	LED1
CR15, 19, 21-25 39-44	1N4004 Diode " "	D4004
CR38	1N752 5.6V	D752
CR16, 18, 45	1N4749A 24V	D4749
F1	FUSE 1 AMP	FUSE1
J1	6 Pin Mod. Jack; PCB	CON38
JMP1, 2	Shorting Block	CON13
JMP1, 2	Pin Headers	CON13A
K1, 2	RELAY RZ12	RELAY1
L1	Choke, 100uH	CHOKE
Q1-5, 7-10, 12-16 18-20, 23, 26, 27 29-31	2N2222	Q2222
Q6, 11, 17, 21, 22 28, 32	VN10KM FET, N chan.	QVN10
Q24	MPSA12	QA12
S1, 2, 3, 4	SWITCH SET of 4	SW5
S5, 6	SWITCH, PUSH/PULL	SWPP
	FUSE CLIPS	FCLIP
T1	TRANSFORMER	TRAN10
TB1	9 PIN TERMINAL BLOCK	TB01
Y1, (Y2)	CRYSTAL 3.58 MHZ	XTAL3
Z1	SURGE ABSORBER	SURAR
OC1, 2	OPTIC ISOLATOR	U4N25
OC3	" "	CLM40

Integrated Circuits

U1	MC68705U3S Microcomputer	U68705
U2	DTMF Transceiver	U8880
U3	EEprom	U2404
U5, 21	Dual Retriggerable One Shot	U4538
U6	8V Regulator	U2930
U7	5V Regulator	U7805
(U8)	Filter	U3528
(U9, 14)	Audio Delay	U3005
(U10)	Quad Nand Gate	U4093
U12, 15, 19	Quad Bilateral Switch	U4066

U16, 24	CMOS Dual Op Amp	UC272
U(11), 13, 17	Duel Op Amp	U1458
U20, 22	Duel Op Amp	U1458

Resistors by Value

The part numbers inside parentheses are included only on the ACI-35s which do not have the Audio Delay circuit on a separate printed circuit board.

Value	Ref. No. All resistors are 1/4 Watt, 5% unless noted.
12 Ohm	177, 178
100 Ohm	(101)
150 Ohm	95
330 Ohm	5
470 Ohm	7, 16, 147, 168
560 Ohm	51
680 Ohm	142 (1/2 Watt)
820 Ohm	81, 136
1K	71, 72, 87, 92, 96, 97, (108), 135, 176
1.2k	25, 26, 83
3.9K	(36), (174)
4.7K	(106), (110), (119), 165
10K	1-4, 6, 10, 11, 18, 22, 24, 27, 32-34, 39, 40, 42, 46-50, 54, 56, 60, 62, 64, 66, 67, 76, 85, 89, 91, 100, 139, 162, 169, 175, 181, 182, 183 22K 19, 54, 103
10K Pot	132, 161
10K Sip	52
27K	13, 37, 41, (116-118), 128, 130
33K	(107), (114), (120)
47K	84, 93, (109), 131, 134, 171, 179
68K	(115)
82K	38
100K	9, 12, 53, 55, 57-59, 65, 68-70, 74, 75, 77-79, 82, (94), (98), (102), (103), (111-113), 121, 122, (123), 126, 129, 133, 138, 143, 150, 163, 164, 166
100K Pot	8, 80, 137, 141
150K	23, 125, 144, 145
200K	(104)
270K	21, 167
330K	172
470K	148, 149
680K	73
1M	14, 30, 31, 86, 140, 184
1M Pot	127
1.5M	88, 90
2.7M	146
10M	(99)

Capacitors by Value

The part numbers inside parentheses are included only on the ACI-35s which do not have the Audio Delay circuit on a separate printed circuit board.

Value	Ref. No.
22pF	2, 12, 69, 87
56pF	76
100pF	(34), 65
220pF	(31), (44)
390pF	81
470pF	(42), (45), 50, 72, 88
.001uF	16, 17, (30), 54, 58, 82, 83, 84
.0018uF	59-61
.003uF	80, 90
.0033uF	51
.0047uF	(39), (40)
.01uF	5-7, 78
.1uF	1, 3, 4, 8, 9, 20, 21, 23, 25, 27, 29, (33), (35), (41), (43), (46), 48, 49, 55, 56, 64, 66, 67, 70, 71, 73, 74, 86
.22uF	10
.47uF	79
1uF	11, 13, 15, 26, 28, (32), 91
2.2uF	52, 53, 63, 68, 77, 89
4.7uF	36
10uF	18, 37, 38, 57, 62
100uF	22, 24, 75
1000uF	19
.01uF	92, 93 (250V)

Audio Delay Board Parts

Theses parts are included for the added Audio Delay Board only.

R1	Resistor	8.2K	Ohm	1/4W	C8	68pF
R2, 8	"	1M	"	"	C7	33pF
R3	"	3.9K	"	"	C4	56pF
R4	"	6.8K	"	"	C1, 2, 5	.1uF
R5	"	1K	"	"	C6, 9, 11	.1uF
R6, 7	"	10K	"	"	C3, 10	10uF
R9	"	100	"	"		
R10	"	47K	"	"	Q1	VN10KM
R11	"	100K	"	"	Y1	1MHz
R12	"	10K	"	POT		

U6	Dual Op Amp	UC272
U3	Memory - 64Kx1 SRAM	81C71A-35P
U4	CVSC Codec	MX609
U5	Quad Nand Gate	U4093
U1, 2	12 Stage Counter	U4040
U7	5V Regulator	U78105

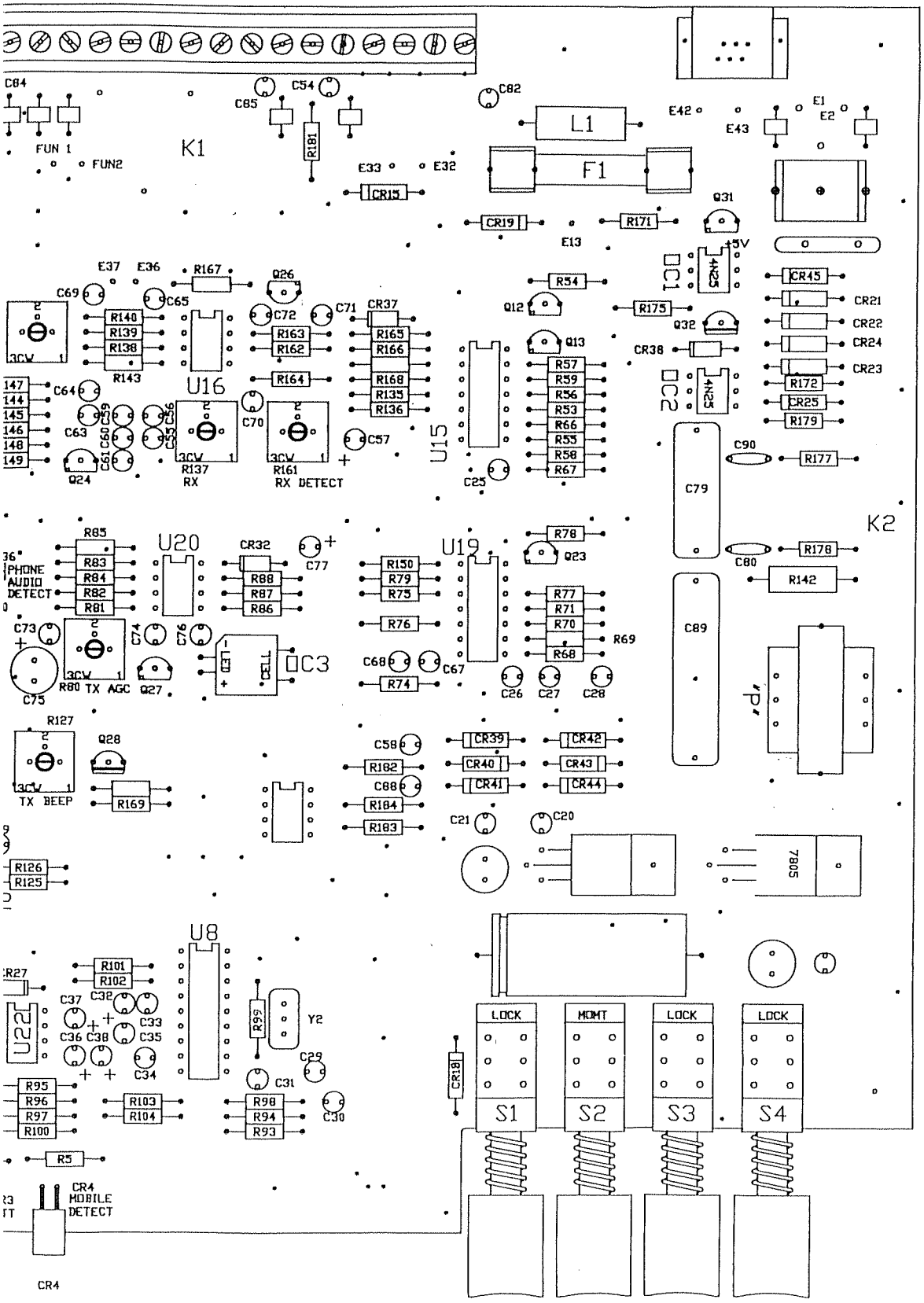
Index

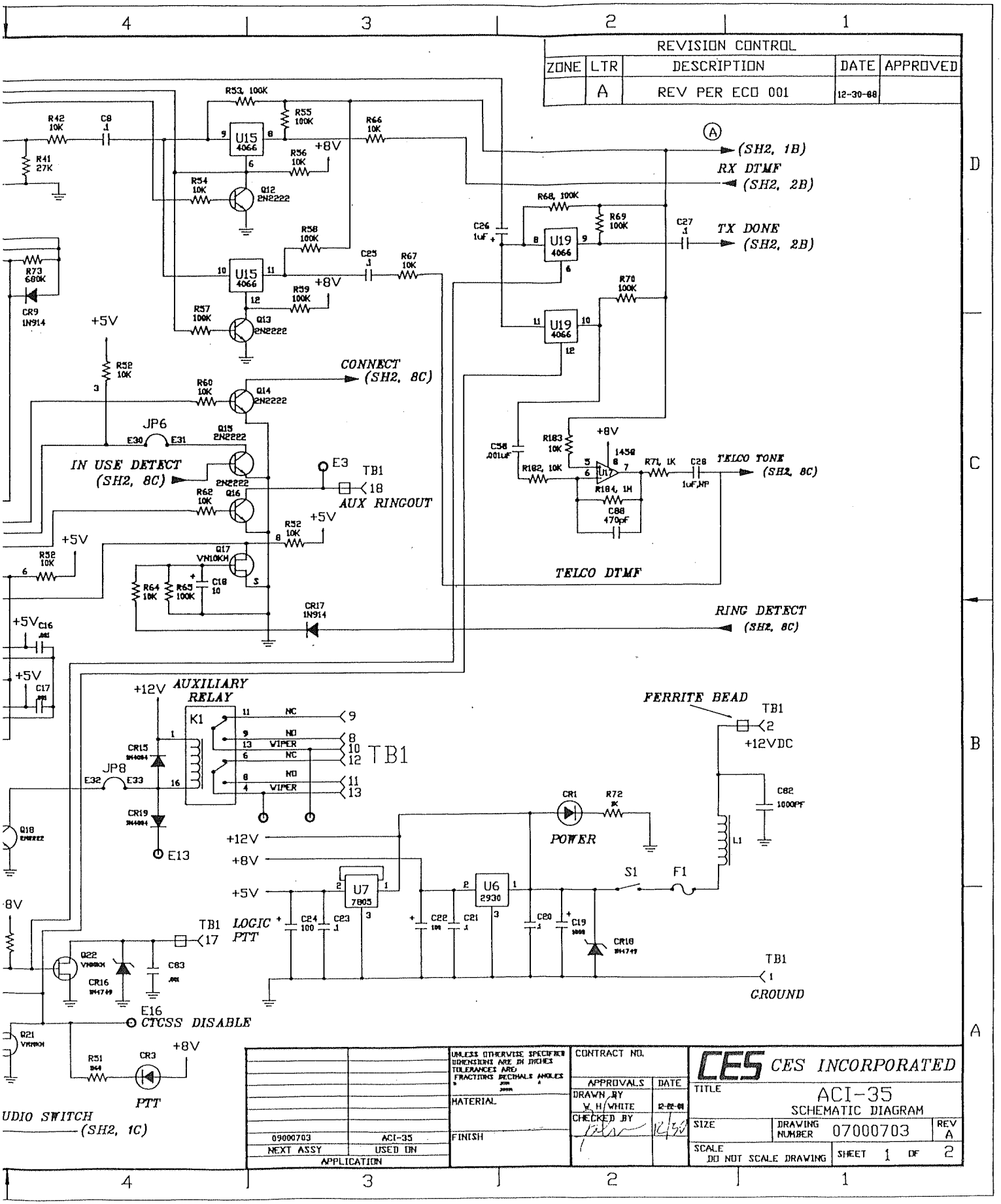
A

C

D

RCONNECT P/N 09000703




REVISION CONTROL
ZONE | LTR | DESCRIPTION | DATE | APPROVED
A | REV PER ECO 001 | 12-30-08
R53, 100K
R55 100K
R42 10K
C8 .1
R41 27K
U15 4066
R56 10K
+8V
R54 10K
Q12 2N2222
R66 10K
(A)
(SH2, 1B)
RX DTMF
(SH2, 2B)
R68, 100K
R69 100K
C26 1uF
U19 4066
C27 .1
TX DONE
(SH2, 2B)
R58 100K
C25 .1
R67 10K
R73 680K
CR9 1N914
R59 100K
R57 100K
Q13 2N2222
R70 100K
+5V
R52 10K
CONNECT
(SH2, 8C)
R60 10K
Q14 2N2222
JP6
E30 E31
Q15 2N2222
IN USE DETECT
(SH2, 8C)
E3
TB1
18
AUX RINGOUT
R62 10K
Q16 2N2222
C58 .001uF
R183 10K
+8V
R182, 10K
U17 1458
R71, 1K
C28 1uF,MP
TELCO TONE
(SH2, 8C)
R184, 1M
C88 470pF
TELCO DTMF
R64 10K
R65 100K
C18 10
Q17 VN10KM
CR17 1N914
RING DETECT
(SH2, 8C)
+5V C16
+5V C17
+12V
AUXILIARY RELAY
K1
NC
NO
WIPER
NC
NO
WIPER
9
8
10
12
TB1
11
13
CR15
JP8
E32 E33
CR19
E13
FERRITE BEAD
TB1
2
+12VDC
C82 1000PF
CR1
R72
POWER
L1
S1
F1
+12V
+8V
+5V
U7 7805
U6 2930
C24 100
C23 .1
C22
C21 .1
C20 .1
C19
CR18
TB1
LOGIC
PTT
17
Q22
CR16
C83
TB1
1
GROUND
E16
CTCSS DISABLE
Q21
R51
CR3
+8V
PTT
UDIO SWITCH
(SH2, 1C)
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES
MATERIAL
FINISH
CONTRACT NO.
APPROVALS | DATE
DRAWN BY W. H. WHITE | 12-22-08
CHECKED BY
09000703 | ACI-35
NEXT ASSY | USED ON
APPLICATION
CES CES INCORPORATED
TITLE
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SCHEMATIC DIAGRAM
SIZE
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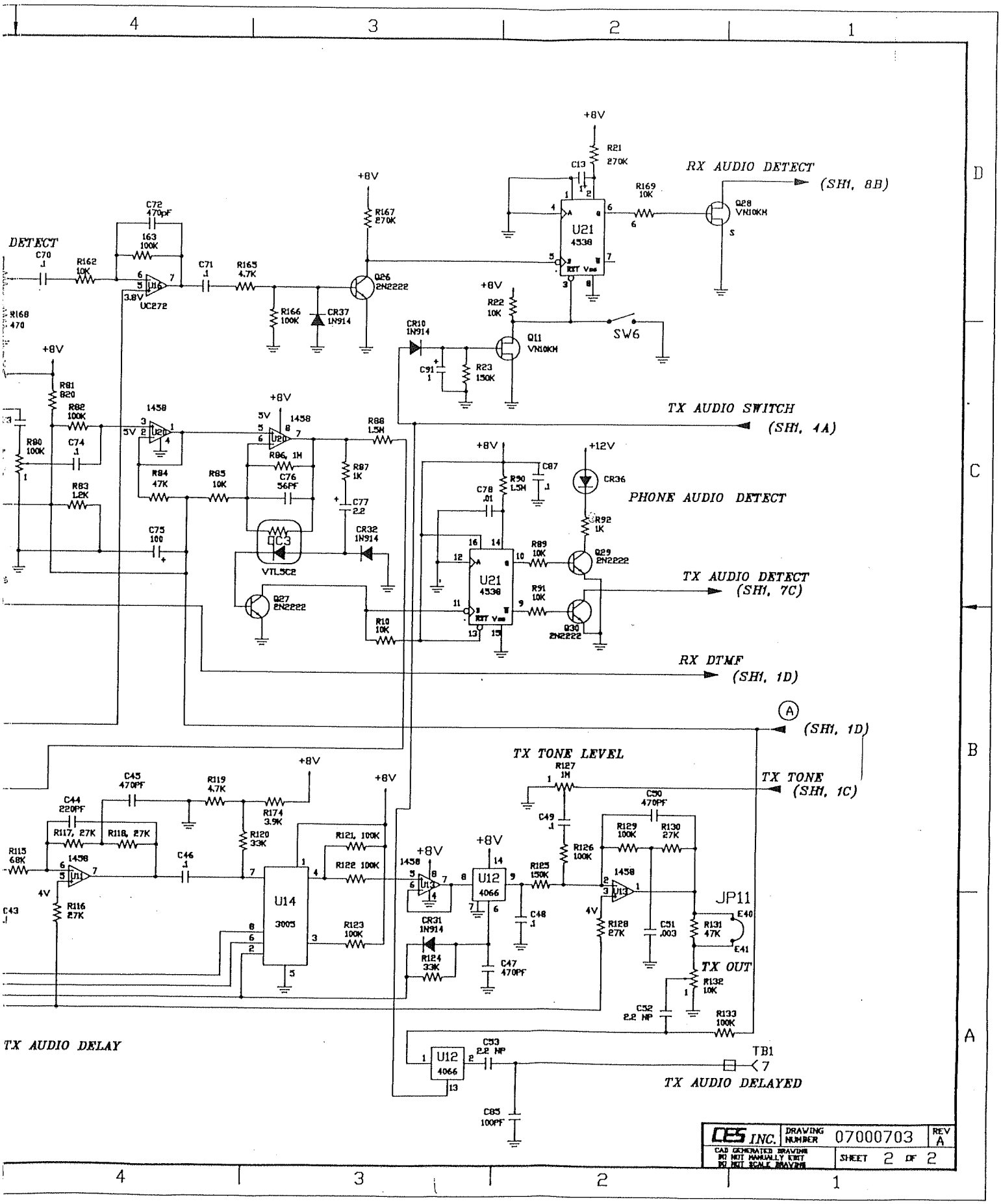
REV A
SCALE DO NOT SCALE DRAWING
SHEET 1 OF 2



CES INC.	DRAWING NUMBER	07000703	REV A
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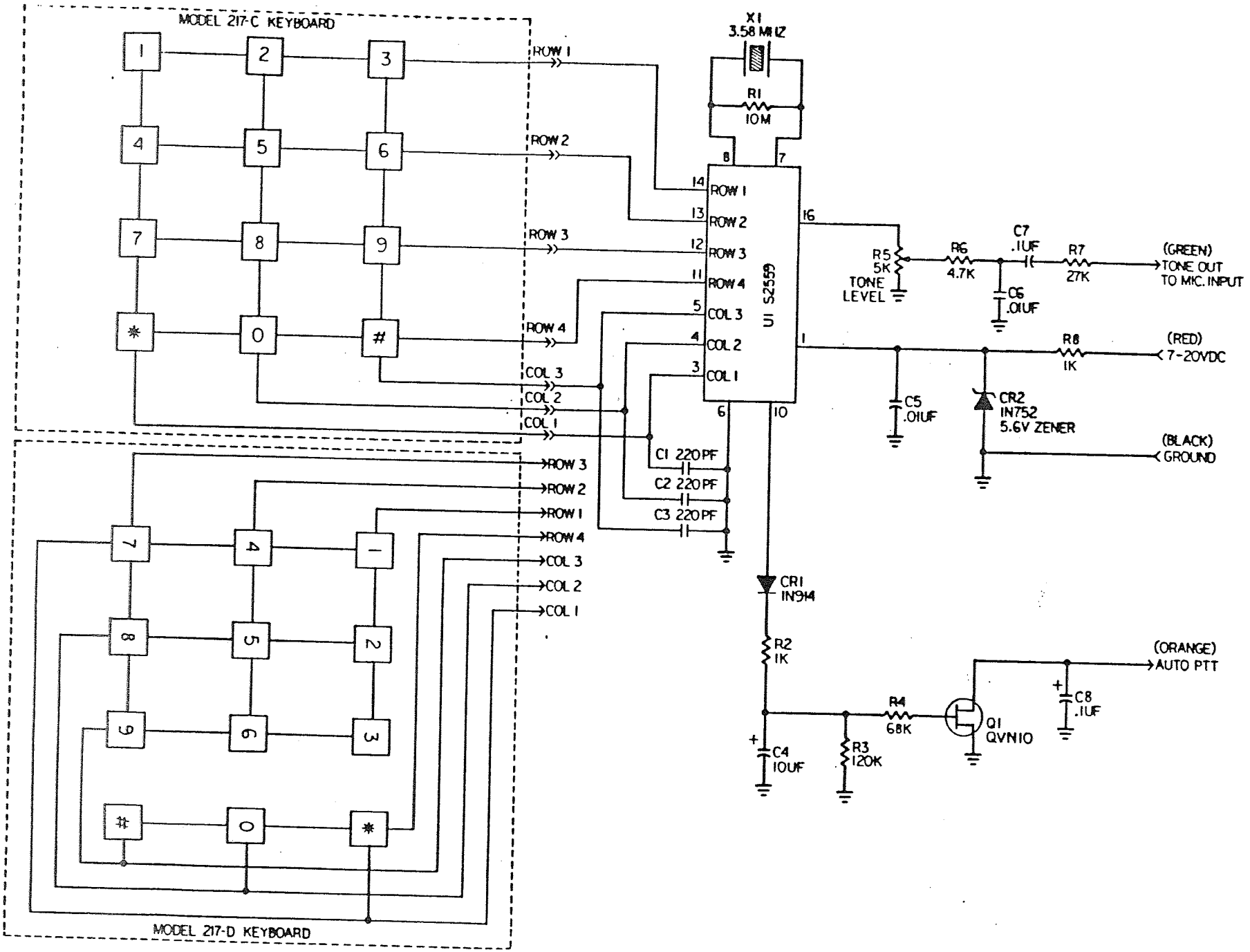

SCHEMATIC DIAGRAM FOR MODEL 217-C AND 217-D
DWG. NO. 04000380 REV. A