RC-100

Manual of Operations

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Jan. 8, 1994
REV 2.5

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1.0 Introduction

The RC-100 is a repeater controller for use with a receiver and transmitter operated in a repeater mode. The controller is all that is needed to control the repeater functions including a CW ID and control functions. A remote base feature is also included with 13 TTL frequency control lines. The controller interface requires receiver audio and COS, the transmitter audio and PTT, and the remote base receiver audio, COS, transmitter audio, PTT and if frequency control is desired 13 frequency control lines.

1.1 Definitions

The following is a list of terms used in this manual.

Repeater...a unit which receives a radio transmission on one frequency and retransmits the transmission on another frequency.

Control code...DTMF code for enabling and disabling function within the controller.

User code...DTMF code for accessing various function.

DTMF...registered trade mark of AT&T employing eight audible tones two at a time for remote signaling.

DTMF pad...device for generating DTMFs.

Remote Base...transceiver for linking a repeater to another frequency.

Crossband repeater...repeater operating on two separate bands where an input on one band will transmit on the other band. This mode uses transceivers.

CW...international Morse code employing short and long tones for sending alphanumeric characters.

COS...carrier operated squelch used by the controller for sensing when the repeater receiver has an input.

PTT...push to talk used by the controller to key the transmitter.

EEPROM...Electrically Erasable Programmable Read Only Memory.

1.2 Controller Details

The RC-100's design is state of the art which is why it is small requiring the least number of components. The heart of the controller is an Intel 87C51 microcomputer which contains a microprocessor, uvEPROM containing the controller instructions and operating system, RAM for temporary storage of data and the necessary I/O for monitoring and outputting the controller signals. The DTMF decoder, U3, is a Mitel 8870 containing all the necessary stages for decoding directly from audio to TTL digital DTMF signaling tones. The other various components act as buffers, amplifiers, audio switches and drivers for controlling and interfacing to the repeater.

The RC-100 is DTMF programmable meaning the control and user codes, CW ID and repeater parameters (time-out, etc) are set up using DTMF. This programmed data is stored in an EEPROM (U8) which is a surface mounted device mounted on the solder side of the controller. This memory will retain its data for at least 10 years without the need for a battery.

If a component fails the only part not easily obtainable is the 87C51 due to the program inside the IC was developed by Micro Computer Concepts. Thus to replace the 87C51 one must obtain it preprogrammed from the developer. This can be done for $35.00 which includes reprogramming with any updates. If the owner wishes to supply his own 87C51 Micro Computer Concepts will program the device for $20.00 once the IC is received by MCC.

2.0 Power Up Conditions

When power is applied to the controller it initializes itself placing the repeater into a know state. This state is controlled by the controller software and the state stored in the EEPROM memory. The features of the controller can be changed with DTMF codes and when this is done the state is stored in the EEPROM.

As received from MCC the RC-100 is in the repeater enabled mode with remote base enabled, but off, CW ID set to "INIT ID/R", all codes except programming codes erased, time-out set to 3 minutes, tail timer set to 3 seconds and a climbing tail beep.

3.0 Repeater Operation

The RC-100 contains the necessary interface and control for providing repeater operation. The interface includes the audio interface and control between the repeater receiver and transmitter. The audio interface allows for direct connect from unsquelched or squelched audio and the repeater COS active high receive indicator inputs. The outputs include buffered and amplified transmitter audio and a open collector PTT. All receiver audio is adjustable providing separate level controls for each path to the transmitter and DTMF decoder.

3.1 Controller Connections

To control the interface between the repeater receiver and transmitter the required connections are the receiver audio, receiver COS, transmitter audio and transmitter PTT. These connections permit the controller to sense a receiver input and passing the receiver audio to the repeater transmitter. The transmitter can then be keyed when conditions are right.

The receiver to transmitter audio level is adjustable with LA-3. It is also switched by the audio switch U2b and passed when the proper access is provided by the receiver. Op-amp U1 amplifies and buffers all transmitted audio.

The receiver COS active state is high (above 1 volt). The controller will see this input and take the necessary control actions in keying the transmitter and unmuting the receiver to transmitter audio.

The transmitter PTT is an open collector transistor active low output. It is controlled by the controller and is the only source for keying the transmitter by the controller.

For a detailed description of the controller connections see Section 12 Controller Installation.

3.2 Access Modes

The repeater access mode is carrier or DTMF access. In the carrier mode any input to the controller COS will cause transmitter keying and receiver audio to pass to the transmitter.

In the DTMF access mode a three digit *XX DTMF code must be entered for repeater access. Once this code has been entered the control will function in the carrier mode until at least 20 seconds of no repeater input. Then for repeater access the code must be re-entered.

3.3 Repeater Time-out

The repeater time-out is programmable from 20 seconds to 42 minutes. The time-out timer is reset with the repeater tail beep or DTMF digit one (1). If a user transmits for the time-out period or more the repeater will generate a series of beeps indicating time-out and unkey the transmitter until the user unkeys at which time the repeater transmitter will rekey. If the user timing out the repeater can be overridden by another user that user can reset the time-out timer with a DTMF one (1). This reset digit 1 will reset the time-out timer any time it is entered.

3.4 Tail Timing

The repeater tail timer is programmable from .2 to 25 seconds. The tail timer is provided for keeping the transmitter keyed after the receiver input drops. This prolongs the transmitter's relay life and prevents unwanted transmitter PTT chattering. Within the tail are the various tail tones which are provided for user signaling. See section 10, Tail Beep Control.

3.5 DTMF Muting

Whenever the COS input is active the controller normally unmutes the transmitted audio. However, to prevent the passing of DTMF codes over the repeater the controller will mute all DTMFs once a valid DTMF is decoded by the DTMF decoder, U3. The muting will continue for one (1) second after the release of the incoming DTMF.

This muting action can be prevented if the first digit entered is a 5 or the muting is disabled with a control code. If the first digit is a 5 the muting will remain off for the duration of the users transmission. Also, the muting control code will toggle the enabling/disabling of muting. When disabled no muting of DTMFs will take place. Their is only one control code for enabling and disabling the muting with this single code toggling the mute state. See section 15 for programming this code.

3.6 Anti-Kerchunker

To help keep distant stations and noise burst from bringing up the repeater an anti-kerchunker can be turned on. When on a continuos carrier must exist on the repeater input before the repeater is accessed. This required time can be programmed from .2 to 25 seconds. Once the required input has occurred the repeater will function in normal carrier access until at least 20 seconds of no repeater input occurs.

4.0 AUTOPATCH

The RC-100 will control an external autopatch. Their is no autopatch phone line interface hardware on the RC-100 requiring the user to supply it. The interface is meant to use AUX 14 as the signal to close a phone line interface relay and use AUX 15 to control audio to and from the interface.

Their are four touch tone codes which select and control the autopatch. These are "AUTOPATCH SELECT", "AUTOPATCH ENABLE/DISABLE", "AUTOPATCH ON" AND "AUTOPATCH OFF".

As received from MCC the autopatch feature is deselected. In the deselected mode AUXs 14 & 15 are not affected as if no autopatch exist. Using the "AUTOPATCH SELECT" control code the patch software can be turned on and off. When ON AUXs 14 & 15 will be controlled by the autopatch software.

The "AUTOPATCH ENABLE/DISABLE" control code allows for control operator control of the autopatch.

*The "AUTOPATCH ON" code is a *XX user code for accessing the patch for giving dial tone. When this code is entered AUX 14 will go high commanding the phone interface to seize the phone line. After the patch is accessed AUX 15 will go low when an input to the repeater COS is active (receiver has input) and go high with no input. AUX 15 controls phone audio between the repeater and phone line.*

The "AUTOPATCH OFF" code is the same as the "CLEAR ALL" code. This code will terminate the patch forcing AUXs 14 & 15 low causing the phone relay off and muting the phone audio.

A 3 minute patch time-out timer is provided. This time-out timer will automatically terminate the patch after 3 minutes. The time-out timer can be reset with touch tone 4. Ten seconds prior to time-out a series of beeps will warn of time-out.

WARNING: WHEN USING THE AUTOPATCH AUXS 14 & 15 MUST BE FREE FROM THE AUX MOMENTARY MODE (OFF). IT ALSO USES AUXS 14 & 15.

The autopatch code are as follows:

AUTOPATCH SELECT	*4136*	*D* __ __		*(toggle)*
AUTOPATCH ENABLE/DISABLE	*4137*	*D* __ __		*(toggle)*
AUTOPATCH ON	*4076*	* __ __		
AUTOPATCH OFF	*4063*	# __		*(clear all)*

5.0 Control and User Codes

The RC-100 contains a DTMF decoder, interface to the repeater receiver and control software for receiving DTMF commands and performing control operator and user functions. The control operator codes are three digit with an A or D as the first digit. Optional use of two digit # codes permits replacement of the A or D enabling control using a 12 digit DTMF pad. The user codes are two digit # and three digit * codes. All DTMF decoding is performed by U3 and interface directly to U4, the microcomputer controller.

The control and user codes are programmable using DTMF. They are stored in the EEPROM (U8). See section 15 for programming these codes.

5.1 Control Operator Codes

The control operator codes are used to enable and disable various repeater functions such as the repeater and remote base. They also allow selection of various operational parameters such as the tail beep.

The A & D control code access can be enabled and disabled with the "CONTROL EN/DIS" code. This is one code with the entry of the code turning ON access to the codes if OFF and OFF if ON (this means toggle).

Below is a list of the control codes and their function:

Master Enable/Disable — Enables/Disables all operation

Master Enable/Disable does not enable or disable any function, but rather unkeys transmitter and turns OFF the remote base/tape. When re-enabled the various repeater functions will be in the state when the master was disabled.

NOTE: EN=enable,DIS=Disable

Repeater EN/DIS	Enables/Disables repeat function
Remote Base EN/DIS	Enables/Disables remote base/tape
Freq. Programming EN/DIS	Enables/Disables freq. prog.
Force Controller Reset	Forces the controller to the power upcondition. CW ID will run on entry.
Control EN/DIS	Enables/Disables A & D codes.
Aux Outputs ON	Forces Aux output high (2.4 V)
Aux Outputs OFF	Forces Aux output low (.6V) Their are fifteen Aux Outputs

Continuos ID	*En/Dis IDing every ID interval.*
Tape Select	*Forces remote base I/O for tape*
Remote Base Select	*Forces I/O for remote base*
Crossband Select	*Forces control to crossband mode*

For the following programming codes to function the programming must first be enabled.

Program CW ID	*places into CW ID entry mode*
Program Disable	*Disables programming of control*
Programming Code 1	*First code enabling programming*
Programming Code 2	*Second code enabling programming*
Master First Digit	*toggles master first digit*

A equivalent code	*two digit # code replacing A in code*
D equivalent code	*two digit # code replacing D in code*

(A/D equivalent or A/D digits may be used in codes)

5.2 User Codes

The user codes are as follows:

Tape start	*same as remote base OFF code*
Remote base	*Turns ON remote base if enabled*
Remote base OFF	*Turns OFF remote base*
Remote Base Freq. Prog.	*#0 allows entry of frequency*
Pad tester ON	*#8 - Turns ON DTMF pad tester*
Pad tester OFF	*Same as all clear code*
Force CW ID	*#9 - Forces CW ID*
All Clear	*Turns off DTMF pad tester, patch cleans up internal functions*
Remote Base XMT cntrl	*#*=xmt on/## rcv only mode*

5.3 Control Action Indicator

Whenever a control code is entered via the repeater receiver the controller will respond at the end of the control operators transmission with a single short beep followed by a second high or low pitched tone indicating a function was acknowledged. If a function was enabled or turned ON the second beep will be high pitch. If the entered control code disabled or turned OFF a function the second tone will be low pitch. This is meant to signal the control operator of the acceptance of the entered code.

5.4 Master First Digit

In the event the RC-100 is employed on a repeater which is part of a large system where each repeater must have separate control codes, and to insure no conflict in control, a "MASTER FIRST DIGIT" for ALL DTMF codes can be required. As received from MCC this feature is disabled.

When enabled this first digit must proceed any DTMF code. As an example if the first digit is set to a 6 then the force CW id code of #9 will become 6#9. All DTMF codes will require this 6 to be entered.

The first digit can be programmed for any of the 16 DTMF digits. This digit is programmed using the "FIRST DIGIT" programming.

The first digit is enabled/disabled (toggled) with a DXX code. As shipped from MCC the first digit defaults to #. See section 15 for programming the first digit and control code.

6.0 Tape Function

The RC-100 can be used to add a tape player to the repeater for announcing group functions on command by entering the remote base OFF code. The inputs and outputs provided are shared with the remote base I/O. The I/O use will depend on the DTMF codes used to exercise the I/O. For the I/O to function for tape use the tape must be selected with the "Tape Select" control code.

NOTE: If the tape function is used the remote base function cannot be used. This is due to the same inputs and outputs are used for both.

The I/O provided for tape playback is tape run (active low). The tape audio muting is controlled by the CPU and U2b and is the same as the remote base mute. The audio input for the tape is the same as the remote base receiver input.

A tape end signal is provided to signal the controller the tape has ended. This is an active high signal requiring at least 1 volt to indicate tape end. When the tape is running the tape end signal must be low. The tape end signal is the same connection as the remote base COS input.

The tape function is enabled/disabled using the "Remote Base Enable/Disable" codes. When disabled the tape run will remain low (OFF) and muted.

6.1 Tape Operation

When enabled the tape can be accessed and forced to run using DTMF remote base OFF code. When accessed the tape run output will go low turning on the tape and the transmitter will be keyed. This output is an open collector transistor meant to drive the tape player motor. The tape run output will remain low and the repeater transmitter keyed until a high is received on the "tape end" input indicating the tape has ended. If a tape end signal is NOT received within one (1) minute after tape start the tape will automatically time out placing the tape function in the off mode. This will prevent long transmitter key ups in the event the tape player should malfunction.

Tape muting occurs when the tape is off or disabled and whenever a repeater input occurs. This gives priority to the repeater users over the tape message.

7.0 REMOTE BASE

Two outputs and two inputs are provided for controlling a transceiver for linking to another repeater or frequency. The two outputs are remote base PTT (low for key) and remote base transmitter audio. The inputs are remote base receiver COS for sensing the remote base receiver input (high for an active input) and remote base receiver audio. The PTT, COS and receiver audio input lines are shared for use with a tape player (see section 6.0). See assembly drawing for remote base connections.

7.1 Remote Base Operation

The operation of the remote base is turned ON using a three digit *XX user code. When turned ON a remote base receiver input will force keying of the repeater transmitter and remote base audio transmitted. When no remote base input is present the remote base receiver audio will be muted.

The remote base transmit is OFF when the remote base is first turned on (receive mode only). This is indicated by the low tone (500 Hz) additional tail beep. To turn on the transmit the DTMF code #* must be entered and the additional tail beep will become a high tone (1 kHz). The receive only mode can be returned to using DTMF code ##.

When the remote base is OFF or disabled the remote base will be unkeyed and the receiver muted.

The remote base will be turned OFF if the repeater is disabled. When the repeater is re-enabled the remote base will be in the state when the repeater was disabled.

7.2 Remote Base ON Tail Beep

When the remote base is ON a special tail beep at the end of a repeater users transmission will be generated. This beep will occur after the normal tail beep, if selected. If the remote base transmit is OFF the additional beep will be a low tone (500 Hz) and if ON the tone will be high (1 kHz).

The repeater tail beep will not occur at the end of a remote base transmission. This is useful in determining if a repeated signal is from the repeater receiver or remote base receiver.

7.3 Remote Base Frequency Programming

If desired the remote base transceiver's frequency can be DTMF controlled using AUX outputs 1 thru 13 via U4 and U5. If, however, these outputs are not desired for frequency control they may be used as independent AUX outputs (see section 14 for details of the AUX outputs).

Programming of the remote base's frequency can be enabled and disabled with control codes. When enabled the frequency programming can be turned on and the frequency entered. When disabled any attempt to program a frequency will be ignored with the existing frequency in place remaining. Whenever the frequency is programmed it is stored and on power up the last frequency programmed is on AUX 1 thru 13.

The frequency outputs are in four sets with each set controlling a digit of the remote base frequency. Within the four sets there are three sets of 4 and one set of one output. The four sets allow for control of MHz, 100 kHz, 10 kHz and 0/5 kHz. The MHz, 100 kHz and 10 kHz each contain four lined in a binary coded decimal (BCD) format. The 0/5 kHz output is a single line being at a logic 0 state for 0 kHz and logic 1 for 5 kHz.

Along with the frequency the offset, direction of offset can be entered. (offset refers to the difference of the transmit frequency to the receive frequency and offset direction refers to transmit frequency being above, below or the same as the receive frequency).

7.31 Programming

If the frequency programming is enabled the remote base frequency can be changed. To program a remote base frequency first enter the programming DTMF code #0 followed by the MHz value, 100 kHz, 10 kHz, 0 or 5 kHz, offset direction and offset value in MHz and 100 kHz. The offset value is limited to MHz and 100 kHz and will not affect the 10 and 0/5 kHz.

When programming the frequency and offset the only data changed on any programming sequence will be the data entered. Thus, if the frequency only is to be changed enter #0 followed by the frequency and the offset direction and offset value will remained unchanged. Normally the offset value is never changed due to the offset being established by the band of the remote base operation.

To select the offset direction of plus, no offset or minus use DTMF digits 1 for plus, 2 for no offset and 3 for

minus. Then when the remote base is in transmit the controller will change the remote base frequency by the offset value. If an offset value of 0.0 MHz is programmed there will be in effect no offset regardless of offset direction selected.

As an example of frequency programming if the desired frequency to be selected is 6.760 MHz with a negative offset of 0.6 MHz the following DTMF sequence is entered.

 # 0 6 7 6 0 3 0 6

The #0 forced frequency programming mode. The 6 7 6 0 set the frequency to 6.760 MHz. The 3 selected a minus offset forcing the remote base frequency to become 6.760 minus 0.6 (6.160) during transmit set up by the last two digits of 0 6. Now the remote base frequency will be 6.760 MHz in receive and 6.160 MHz in transmit. If the frequency is now to be changed to 6.970 MHz with the same offset direction and value use the following code sequence.

 # 0 6 9 7

Since the 0/5 kHz, offset and direction were not changed the last 4 digits of the 8 digit programming sequence need not be entered.

*During programming the frequency entry can be terminated by either using DTMF digit * or simply not entering a digit for 2 seconds. When entering the frequency care must be taken to insure a 2 second pause between digits does not occur or programming entry will terminate leaving the remaining data unchanged.*

The remote base frequency will change after 2 seconds of no DTMF. Thus the frequency will not actually change until programming is complete.

7.34 Remote Base Frequency Connection.

Thirteen outputs are provided for controlling the remote base frequency. These consist of 4 for MHz, 4 for 100 kHz, 4 for 10 kHz and one for 0/5 kHz. All of these are TTL lines meaning when each is at a low or zero level it will be 0 to .6 volts and when high or one level it will be 2.4 to 5 volts. If a remote base is used requiring other levels proper buffers must be used between the remote base and RC-100 controller.

The connections for the frequency are shown on the assembly drawing.

8.0 DTMF Pad Tester

The controller can be forced to read back in CW an entered DTMF digit for testing DTMF pads. The tester is turned ON with the two digit #8 code. When ON the user can enter a single digit and if decoded the controller will send in CW the DTMF digit at the end of the users transmission. The user can enter all of the 16 DTMF digits listening for the CW response after each digit.

The pad tester will automatically turn OFF if no repeater input occurs for 15 seconds. It can also be turned off with the "All Clear" code.

9.0 Repeater Identification

The controller has a CW ID control program for identifying the repeater system. The ID takes place at the time interval programmed by the user (see section 15). For Amateur Radio use this is required by FCC regulation every 10 minutes max and at 20 words per minute (wpm) or less. The CW ID can also be forced with DTMF code #9.

An external ID can be used using AUX 13 as the strobe for starting this ID. The ID can be another CW ID, a tape, voice IC device, etc. (see section 9.2 below).

When the repeater is in use the ID waits for the end of a users transmission preventing competing with the user. This is known as a smart ID.

Timing of the ID is controlled by the controller through the stored ID table in the EEPROM. The ID tone and speed are programmable and also stored in the EEPROM. The ID level is adjusted with pot LA-1.

9.1 Continuous CW ID

Normally the CW ID is sent only when the repeater is in use and with a final trailing ID. However, the controller can be forced to ID on every ID time interval using the "CONTINUOUS ID" control code. This single control code will toggle the state of the continuous IDing. When enabled the controller IDs at every ID time interval regardless of repeater usage.

9.2 External ID

AUX 13 can be selected to start an external ID. This ID must be supplied by the user and can be any form such as voice IC, tape, etc. To aid in remote recording of the

external ID AUX 12 functions as a record/playback control (high for playback).

NOTE: WHEN THE EXTERNAL ID IS ENABLED AUXS 12 & 13 ARE BOTH USED FOR THE EXTERNAL ID FEATURE. ANY OTHER FEATURE WILL NOT CONTROL THESE TWO AUX OUTPUTS.

When both the CW ID AND external ID are enabled and the time to ID occurs the controller examines the control for activity in the previous 10 seconds. If their was activity the internal CW ID is use. If no activity the external ID is strobed. However, if only the CW ID is enabled only the CW ID is used or if only the external ID is enabled only the external ID is used.

When the external ID is strobed AUX 13 goes low for about .5 seconds and then back high. The external ID must respond to this signal by both sending the ID and keying the repeater transmitter. The RC-100 only keeps the ID timing and does not key the transmitter during the external ID.

For remote recording a record control code will control AUXs 12 (record/playback) and AUX 13 (start). To record an external ID the user is to enter the "ID Record" DTMF code and drop the repeater input. On the tail beep rekey and enter the message. This forces the controller to start the record sequence. AUX 12 will go low (record state) and stay low until the user releases the repeater input.

The DTMF codes used to control the external ID is the "EXTERNAL ID ENABLE/DISABLE" control code. The record code is "ID Record" code and functions only if the external ID is enabled.

10.0 Tail Beep Control

The controller provides a tail beep TO signal other users of the end of transmission. The tail beep tones and time it occurs in the repeater tail are programmable and stored in EEPROM.

At the beginning of the beep the repeater time-out timer is reset.

The tail beep consist of four segments each segment programmable to have either a tone of 1000 Hz/n or no tone. For programming the tail beep see section 15.

11.0 Crossband Mode

The RC-100 can be used to control a crossband type repeater. This mode uses the repeater side of the control to interface to a transceiver and the remote base side to interface to another transceiver. When an input is detected on either side of the control the other side will be keyed. This operation differs from normal repeater operation in that if an input is detected from either the repeater side or, if on, the remote base side the repeater transmitter is keyed requiring the repeater to be full duplexed (transmit and receive at the same time). In the crossband mode only the transmitter on the other side of the active receiver is keyed.

The crossband mode can be forced with the "CROSSBAND" control code. This control code will toggle the crossband state. When in crossband mode the state of the remote base is ignored providing crossband operation at all times except if the master control code is used to disable operation.

When in crossband mode the CW IDing will be transmitted on both transmitters.

All DTMF control must be performed from the repeater side of the control. Thus all programming and control is only from the repeater port, P1.

12.0 Controller Installation

Installation of the controller requires little effort. Due to the low power required the controller can often be powered by a repeater's 12 volt power supply. Installation of the controller requires the connection of 12 volts DC, receiver COS and audio, transmitter PTT and audio.

12.1 Controller Power

The controller is powered from a 10 to 15 volt input at 100 ma. Two regulator circuits of a 7805 +5 volt regulator (U8) for the logic circuits and an 8 volt zener diode (D1) for regulation of the audio circuit voltage.

12.2 Programming Codes and CW ID

After connecting the controller to the repeater it can be programmed using DTMF. However, prior to programming the controller will have a CW ID of "INIT ID/R", timeout of 3 minutes, have a tail beep and a tail timer of 3 seconds. Once the connections have been made refer to secion 15 for programming details.

12.3 Repeater Connections to the Control

A minimum of six connections must be made to the controller. These are the receiver COS and audio, transmitter PTT and audio and 10 to 15 VDC and ground.

12.31 Repeater Receiver

Two inputs are provided for connection to the repeater receiver; COS and audio.

The COS is a DC signal going high with a valid repeater receiver input. The active state of the COS input is high (above 1 volt). The receiver audio input drives the controller DTMF decoder and the transmitter audio buffer. Each of these are adjustable.

NOTE: The repeater receiver audio should pass through the controller and should not go directly to the transmitter. This permits DTMF muting and muting in response to the COS in the event unsquelched audio is used.

Connection of the COS and receiver audio should be made at the designated points on P1 as shown on the assembly drawing.

12.32 Repeater Transmitter

Two transmitter outputs are provided on the controller; PTT and audio. The PTT is an open collector transistor, Q3. The PTT output goes to ground when the transmitter is to be keyed.

WARNING: If the transmitter employs relays in its keying circuit care must be taken to insure relay turn off spikes do not feed back into the controller when the transmitter unkeys. This can be prevented by placing a diode accross the transmitter relay coil with the cathode to the relay supply side and the anode to the PTT side of the relay. If this is not done damage to the control may occur or wierd operation will occur.

The transmitter audio output is an op-amp buffered amplifier capable of driving 1000 ohms. Due to the op-amp gain and if the mike input is used as the audio input a divider circuit may be required. This will be indicated if the CW ID tone level, LA1, is set at about 1/3rd up from fully counter-clock-wise and the ID audio level is much more than desired. If this occurs it is recommended an attentuator be inserted between the control and transmitter audio input. Although the specific values for this attentuator cannot be stated here a good start is to insert a 10k in series with the audio and a 2k to ground at the transmitter input. By increasing the 10k or decreasing the 2k will decrease the audio.

12.4 Audio Adjustments

There are four (4) level adjustments on the controller. Two adjust receiver audio (LA-2 & 3), one adjust remote base/tape receiver audio (LA-4) and one adjust ID and tone levels (LA-1). The following is the procedure for adjusting each.

12.41 CW ID Level Adjustment, LA-1.

The CW ID level is adjusted with LA-1. This adjustment should be adjusted with the CW ID running. The ID is sent whenever the controller is powered up. The recommended level is 2 kHz deviation. If the DTMF level is set so as to allow DTMF decoding entering #9 will force the CW ID.

12.42 Receiver to Transmitter Level, LA-3

The receiver to transmitter audio level is controlled by LA-3 and should be adjusted for the same level coming into the repeater receiver as going out the repeater. Using an oscilloscope accross a monitor receiver speaker terminals is a good indicator. In this setup one should sample a transmission from a users inpuy, then tune the receiver to the repeater output and with the same user transmitting adjust LA-3 for the same repeater output level. In this procedure a single continous tone should be used. This is often easy to obtain by pressing two side by side DTMF pad digits at the same time forcing the pad to generate a single tone. A complete DTMF may cause muting of the transmitter audio due to the controller muting action. This can be prevented by turning LA-2 CCW preventing DTMF decoding.

12.43 Receiver to DTMF Decoder Level, LA-2.

The receiver DTMF decoder level is adjusted by LA-2. When the decoder detects a DTMF pin 15 of U3 goes high until the tone is removed. Using a voltmeter monitor U3-pin 15 and provide a repeater receiver input with DTMF digit 8. From the fully CCW position slowly adjust LA-2 in the CW direction until pin 15 goes high (3 to 5 volts). Note this setting of LA-2. Continue to adjust LA-2 CW until pin 15 returns low (near 0 volts) and note this setting. If LA-2 is adjusted all the way CW and pin 15 remains high use this fully CW point for the high limit setting. Now adjust LA-2 to the point half way between the two noted setting.

If one has access to an oscilloscope adjusting LA-2 for 1.5 volts peak-to-peak on U3-pin3 using DTMF audio will most often be all the adjustment of LA-3 needed.

Either methods should provide for a wide range of levels for the DTMF decoder to operate. Normally the decoder will accept a 10 db range providing more than typically necessary for accepting many different users.

12.44 Remote Base Receiver to transmitter audio, LA-4.

If the remote base transceiver is in place LA-4 is used to control its receiver to the repeater transmitter level. This level must be made with the remote base on for the remote base is muted when off and when an acitve input exist at the repeater receiver.

As with the repeater receiver to transmitter level adjust the remote base receiver to transmitter level should be adjusted for the same input to output level. See remote base for additional details.

14.0 Aux Outputs

Their are 15 AUX outputs for controlling various user definded functions. These outputs are labled "AUX 1" thru "AUX 15". Each output can be controlled independly with DTMF codes. AUX 12 thru 15 can be placed into momemtary mode each going high when a single DTMF digit is active and low otherwise. AUXs 1 thru 8 can be gained to form a 1-of-8 output. Also, AUXs 9 thru 12 can be accessed with a single DTMF code with their outputs forming a four bit hexdecimal output.

On power up all AUX outputs will be forced to the state they were in when power was lost. The controller saves the AUX output states whenever changed.

AUX 1 thru 13 outputs are also used for remote base frequency control. If these outputs are used for contolling the remote base frequency the DTMF codes will not affect outputs 1thru 13. If the remote base frequency programming is not desired AUX 1 thru 13 outputs can be controlled. To place these AUX outputs under DTMF control use the remote base frequency programming code #2 and set the frequency to 0.000 MHz by entering six zero. Then each AUX output 1 thru 13 can be controlled with DTMF. On power up or control code forced reset the remote base frequency is forced to 0.000 MHz thus allowing control of AUX 1 thru 13. Also on reset AUX 1 thru 13 are forced low.

AUX outputs 14 and 15 can be controlled regardless of the remote base frequency programming mode. On power up these two outputs are forced low.

The one-of-eight outputs on AUXs 1 thru 8 are accessed by entering the "AUX One-of-Eight" DTMF code followed by a single digit of 0 thru 8. If 0 is entered AUXs 1 thru 8 go low. If the digit entered is 1 thru 8 them the AUX with the same number as the digit entered will be latched high and the remaining 7 outputs will be forced low. This operation will not affect AUXs 9 thru 15. If one of the AUX latched command codes is entered that AUX will be turned on or off overriding the one-of-eight command.

The hexdecimal control of AUXs 9 thru 12 is controlled with the "AUX HEX" DTMF code followed by a fourth digit. This fourth digit will be transferred to AUXs 9 thru 12 with AUX 9 being msb. This operation will only affect AUXs 9 thru 12 and not distrub the remaining AUXs.

14.1 AUX Outputs Control Codes.

AUX outputs 1 thru 15 are controlled by the following DTMF codes. If, however, AUX outputs 1 thru 13 are used for remote base frequency control their associated DTMF codes will not affect the outputs.

Function	ON Code	OFF Code
AUX 1	*01	*21
AUX 2	*02	*22
AUX 3	*03	*23
AUX 4	*04	*24
AUX 5	*05	*25
AUX 6	*06	*26
AUX 7	*07	*27
AUX 8	*08	*28
AUX 9	*09	*29
AUX 10	*10	*30
AUX 11	*11	*31
AUX 12	*12	*32
AUX 13	*13	*33
AUX 14	*14	*34
AUX 15	*15	*35

Output ON means output at 2.4 volts or more.
Output OFF means output a .6 volts or less.

The codes for forcing AUX 12 thru 15 to momentary are as follows.

AUX	12	D	__	__	1	then	AUX	12	high	during	a 1
AUX	13	D	__	__	2	then	AUX	13	high	during	a 2
AUX	14	D	__	__	3	then	AUX	14	high	during	a 3
AUX	15	D	__	__	4	then	AUX	15	high	during	a 4

Re-entering the code will toggle the momentary mode off. As a example if the "AUX momentary" code were programmed to be D45 then entering D45 followed by a 3 will force AUX 14 into the momentary mode and each time DTMF digit 3 is entered AUX 14 will go high as long as the 3 is entered. If D453 is entered again AUX 14 will return to the latched low state.

15.0 RC-100 Programming

The RC-100 contains an EEPROM which stores control codes, user codes, CW ID and operational parameters. This data will be retained for at least 10 years and does not require any battery or power to retain data. The data is programmed into the EEPROM by using DTMF control and software within the 87C51 CPU (U4). The following are the procedures for programming or entering the controller data.

15.1 EEPROM Initialization

If you received the RC-100 from MCC with the EEPROM installed the initialization need not be performed for it was done by MCC and tested. If you are upgrading a REV 1.5 or earlier software revision the initialization must be done as follows.

The initialization clears the EEPROM of all codes and data, forces the CW ID to "INIT ID/R" and forces programming control codes to know values.

The procedure for initialization is as follows.

1. Ground pin 5 of the 87C51 CPU (U4).
2. With pin 5 grounded enter DTMF code "AAA". If accepted controller will respond with the tone/high tone acceptance signal.

In performing steps 1 and 2 above if the tone/high tone response is not received the initialization was not successful.

The following control codes and parameters are forced when the initialization is complete:

1. All control and user codes are cleared.
2. Programming Enable Code 1 is set to D7B.
3. Programming Enable Code 2 is set to D7C.
4. Programming Disable Code is set to D7A.
5. CW ID is set to "INIT ID/R" (#9 will force CW ID).
6. Repeater parameters are as follows:
   a. time-out is 3 minutes
   b. tail timer is 3 second.
   c. tail beep set to four tones.
   d. tail beep sent .7 seconds into tail.
   e. CW ID speed is 15 wpm and tone 500 Hz.

The programming code is used with a select code selecting the code to be programmed...more about this later.

15.2 Enabling Programming

Whenever power is lost the programming of the EEPROM is disabled by both the EEPROM itself and the 87C51 control software. Thus, any attempt to change the codes or CW ID will require enabling the programming mode.

To enable programming the "Programming Enable Codes 1 and 2" must be entered. As received from MCC these two codes are D7B and D7C. However, these codes can be changed as desired. Due to others having RC-100s it is strongly advised these codes be changed (see section 15.3, Control Code Programming for details).

To enable programming follow this procedure:

1. *Enter programming code 1 D7B.*
2. *Wait at least 3 seconds.*
3. *Enter Programming code 2 D7C.*

Programming codes 1 and 2 are separate codes requiring the 3 second delay between them. Also the two codes must be entered using code 1 first followed by code 2.

If accepted the tone/high tone response will be heard after D7C. If not accepted no response will be sent. If no tone is received the problem may be due to DTMF decoding level or defective EEPROM or installation. It will do no good to continue programming if the tone/high tone is not sent by the RC-100 after the D7C code. In the case of DTMF decoding use the pad tester (#8).

NOTE: THE PROGRAMMING CODES OF ABOVE (D7A, D7B AND D7C) ARE INITIALIZED AT MCC. DUE TO OTHERS OBTAINING THE CONTROL IT IS STRONGLY ADVISED THESE CODES CHANGED SO AS TO PREVENT ANOTHER PARTY FROM ENABLING PROGRAMMING AND ALTERING REPEATER PARAMETERS. THIS IS DONE USING THE SAME PROCEDURE IN SECTION 15.3.

15.3 Control and User Code Programming

The programming of the user codes follows a sequence of entering the four digit select code followed by the code to be programmed. Table 15.1 identifies the select code for each control and user code. Other repeater parameters (repeater time-out) are programmed in this same manner. However, the CW ID follows a different method to be explained in section 15.5.

When programming any code after entering the code and if accepted the controller will send in CW "RR". If not accepted no response will be heard.

When programming any code no more than 1 second can be left between any DTMF digit or programming of the code will be aborted requiring restarting the entry with the programming code. If a mistake is made simply stop entry and start over after about 3 seconds.

15.3.1 Control Code Programming

The control codes are the A _ _ and D _ _ codes. These are three digit code with the first digit being A or D (the A and D are fixed and cannot be altered).

When programming an A or D code only the second and third digit is to be entered when programming. To program a control code get the select code of the code to be programmed from Table 15.1 and follow the procedure of entering select code followed by the second and third digits to be programmed.

As an example of programming a control code let us take the "REPEATER ENABLE" code to be programmed. Let us say we wish the code to be A12. From Table 15.1 the select code is "4100". To program this code enter:

4100 12 Repeater Enable Code of A12

NOTE: The 4100 is the repeater select code from Table 15.1. and 12 sets the code to A12. The repeater enable code will now be A12 again with the A being fixed part of the code.

All of the A and D control codes are programmed in this same manner. After programming any of the codes the controller will respond with CW "RR" if accepted.

15.3.2 User Code Programming

*The user codes are the * (star) and # (pound) codes. The * codes are three digits with the first digit always being *. The # codes are two digits with first digit #.*

*When programming a * code only the second and third digit is to be entered since the * if fixed. To program a * code enter the select code followed by the second and third digit to be programmed. The select codes are listed in Table 15.1.*

*As an example if the "REMOTE BASE ON" code to be programmed is *56. One would enter the following:*

*4070 56 Remote Base ON Code of *56*

If the code was accepted the control will respond with CW "RR".

NOTE: The 4070 select code came from Table 15.1. The 56 is the code to be programmed.

When programming a # code two digits must be entered with first digit always being a zero (0) followed by the desired second digit of the code.

*When programming a # code the second digit of the code CANNOT be a 0, 8, 9 * or # for these are used for other controller functions.*

As an example let us say we wish to make the "REMOTE BASE OFF" code #7. The remote base off code select code from Table 15.1 is 4060 and for programming we would enter:

4060 07 Remote Base OFF Code of #7

NOTE: The 4060 is the select code for remote base off from Table 15.1. Even though only the 7 is used with the # the two digits of 07 must be entered. If something other than the 0 were to be entered the code would then be inoperative. If desired this allows for the code to omitted preventing its use.

15.4 Repeater Parameters Programming

The repeater parameters which can be programmed are the tail beep, when tail beep is sent within the tail, tail timer limit, repeater time-out, CW ID time interval, tone and speed. See Section 15.5 for ID parameter details.

15.4.1 Tail Beep Programming

The tail beep is formed in four .1 second segments. Each segment can be programmed for no tone or a tone of 1 kHz/N tone. The value of N is programmed with 0 for no tone and 1 and up for the desired tone. To program a tail beep enter the select code 4050 followed by four digits; one digit for each segment.

As an example of programming a tail beep say we wish to program in a single .2 second 500 Hz tone. The entry would be:

4050 2200 tail beep=500, 500, no tone, no tone

The 4050 was the tail beep select code (Table 15.1) with the 22 programming two segments of 500 Hz each and 00 programming two segments of no tone.

As another example say we wish for 75 Hz, 330 Hz, 500 Hz and 1000 Hz tail beep. The entry would be:

4050 4321 tail beep=75, 330, 500, 1000 Hz

If no tail beep is desired entry of 4050 0000 will produce such a tail beep.

15.4.2 Tail Beep Time Programming

The time the tail beep occurs within the tail timer after the user drops the repeater input is programmed with select code 052. The time is in .1 second steps. The tail beep time is programmable from .2 to 25.5 seconds. To program .7 seconds tailbeep time enter:

4052 07 tail beep time of .7 seconds

15.4.3 Repeater Time-out Programming

The repeater time-out is programmable in 10 second intervals from 20 seconds to 2550 seconds (42.5 minutes). To program a time-out the select code is 4054.

15.5 CW ID Programming

*The CW ID is programmable with up to 31 characters. However, the programming is different from that of the other codes in that once the CW ID programming has been turned on the CW characters are entered using DTMF 1 for dit, 2 for dah, * for end of character and # for programming complete.*

Before programming the CW ID the control code for turning on programming must be performed. This is done in the same manner the other control codes are programmed except using select code 4121 (from Table 15.1). To make the code D49 enter:

4121 49 making CW ID programming code D49

Also, before the CW ID can be changed or programmed the programming must be enabled using the two programming enable codes of D7B and D7C. After this the CW ID programming code must be entered placing the controller in the CW ID entry mode.

15.5.1 CW ID Programming Example

As an example say we wish to program the CW ID to read (space) W8ABC (space) (space). First enter the CW ID programming code using the example above of D49. Follow this with DTMF *, 122* (W), 22211* (8), 12* (A), 2111* (B), 2121* (C), *, *. #.

The first * placed a space as the first character. Any time a space is desired the single entry of * will produce this. The 4122 programmed a dit dah dah (W) with the * forcing advancement to the next character. This process continued until the finish of programming at which time the # ended programming.

The CW ID capacity is 31 characters. If it is attempted to exceed this limit the controller will automatically place the end of CW ID character (#) in the ID table and abort programming.

15.5.2 CW ID Time Interval

The time between CW IDs is programmable in 10 second intervals from 20 seconds to 2550 seconds (42.5 minutes). The select code of 4055 is used for programming and using the same procedure as that for programming control codes.

15.5.3 CW ID Tone Programming.

The CW ID tone is programmable using select code 4056. The tone can range from a few Hertz to 1 kHz max. A programming of 01 will produce a tone of 1 kHz, 02 a tone of 500 Hz; the larger the number the lower the tone. To program a tone of 500 Hz enter:

4056 02 CW ID tone of 500 Hz.

15.5.4 CW ID Speed Programming

The CW ID speed is programmable from about 50 wpm to 5 wpm. When programming the speed the larger the number programmed the slower the speed. A programmed value of 07 is about 15 wpm. It is advised a speed parameter of from 5 to 9 be used.

THIS COMPLETES THE DESCRIPTION OF PROGRAMMING. AFTER PROGRAMMING IS COMPLETE ONE SHOULD ALWAYS DISABLE PROGRAMMING WITH THE PROGRAMMING DISABLE PROGRAMMING CONTROL CODE (D7A). THIS WILL PREVENT UNWANTED ALTERING OF THE PROGRAMMED DATA.

Table 15.1 Control and User Codes

Control Codes:

Repeater Enable	4100	A	6	9	
Repeater Disable	4101	A	5	9	
Freq programming Enable	4102	A			
Freq programming Disable	4103	A			
Master Enable	4104	A			
Master Disable	4105	A			
Remote Base Enable	4106	A			
Remote Base Disable	4107	A			
Controler Reset	4110	A	0	0	
DTMF access en/dis.	4111	A			
AUX 1-of-8 output	4113	A			
AUX HEX (aux 9-12)	4114	A			
Send CW ID Continous	4120	D	2	2	
CW ID Programming ON	4121	D	4	9	@
Tape Select code	4122	D			@
Remote Base Select	4123	D			@
DTMF muting en/dis	4126	D	I	I	
Master 1st digit en/dis	4127	D			
Master 1st digit program	4130	D	0		
Crossband enable/disable	4132	D			@
AUX momentary (12-15)	4134	D			X
CW ID enable/disable	4135	D	1	1	
Autopatch select	4136	D			
Autopatch enable/disable	4137	D			
External ID en/disable	4140	D	1	2	
Exteranl ID Record start	4141	D	4	3	
Control code en/disable	4170	D			
Programming Disable	4172	D	A	A	
Programming Enable 1	4173	D	A	B	
Programming Enable 2	4174	D	A	C	

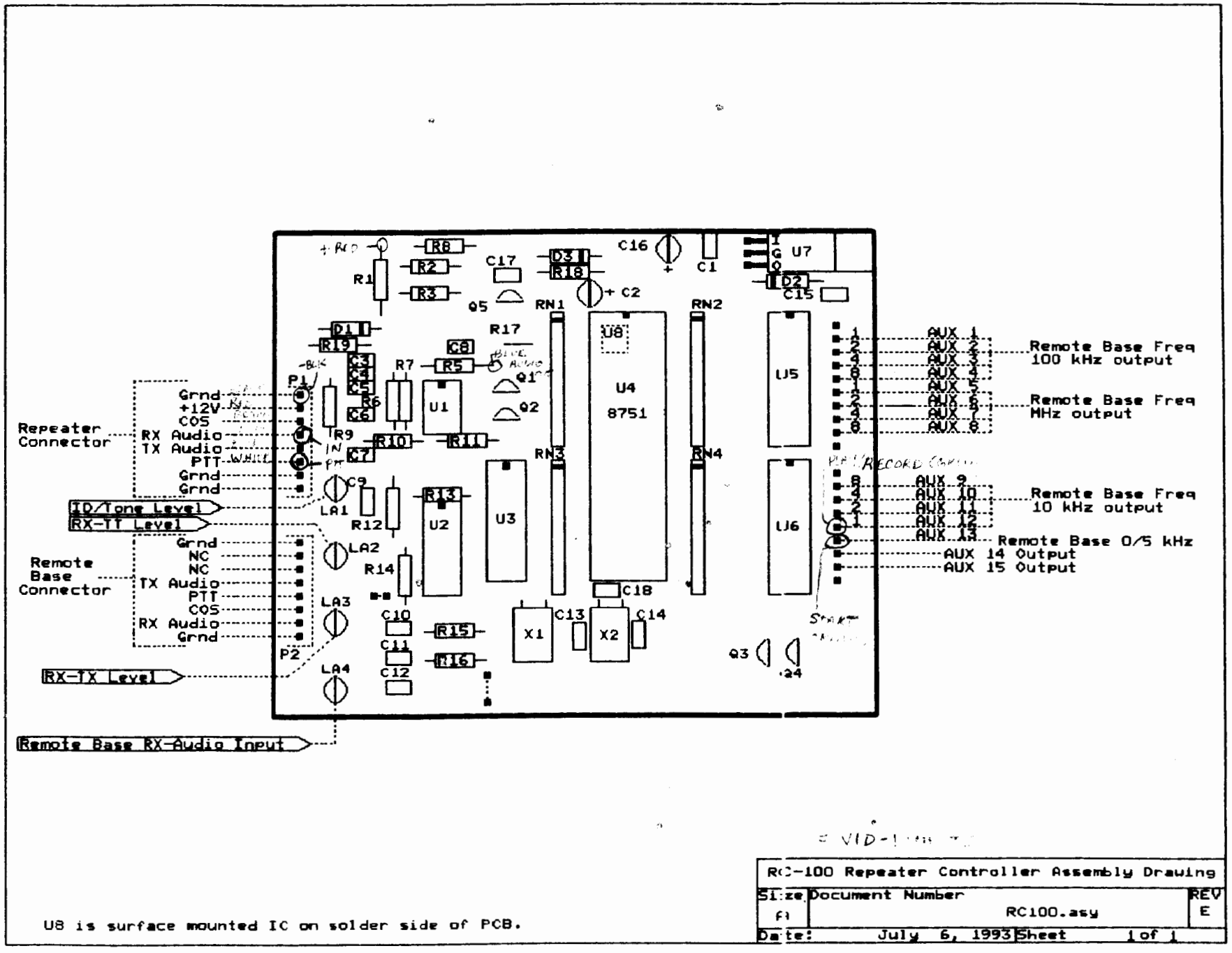
Controller Parameters:

@	Tail beep programming	4050	0	0	0	0	
@	Tail beep time (.1 sec)	4052					
@	Tail Time (.1 sec)	4053	2	0			
@	Timout Timer (10 sec)	4054					
@	CW ID timer (10 sec)	4055	3	0			
@	CW ID tone (01=1 kHz)	4056	0	3			
@	CW ID speed (07=15 wpm)	4057	0	5			
@	Anti-krchunk access time	4160	0	1			

User codes:

Remote Base ON	4070 *		OFF	4060 #	
Patch ON	4076 *		OFF/clear all	4063 #	
A equivlant	4061 #		D equvlant	4062 #	
Anti-kerchunker ON/OFF		4071 *	0	6	

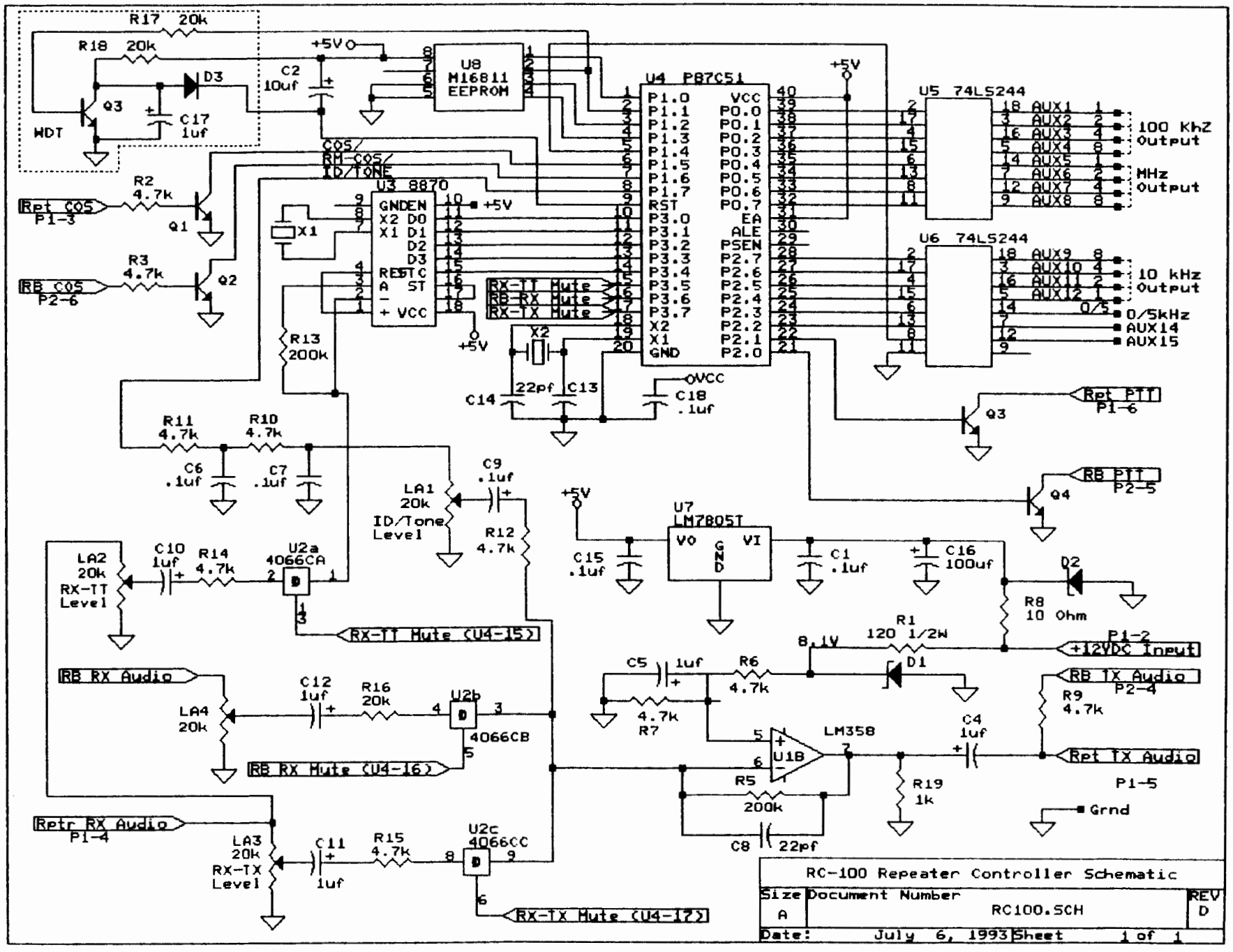
NOTE: Codes with @ require programming ON.

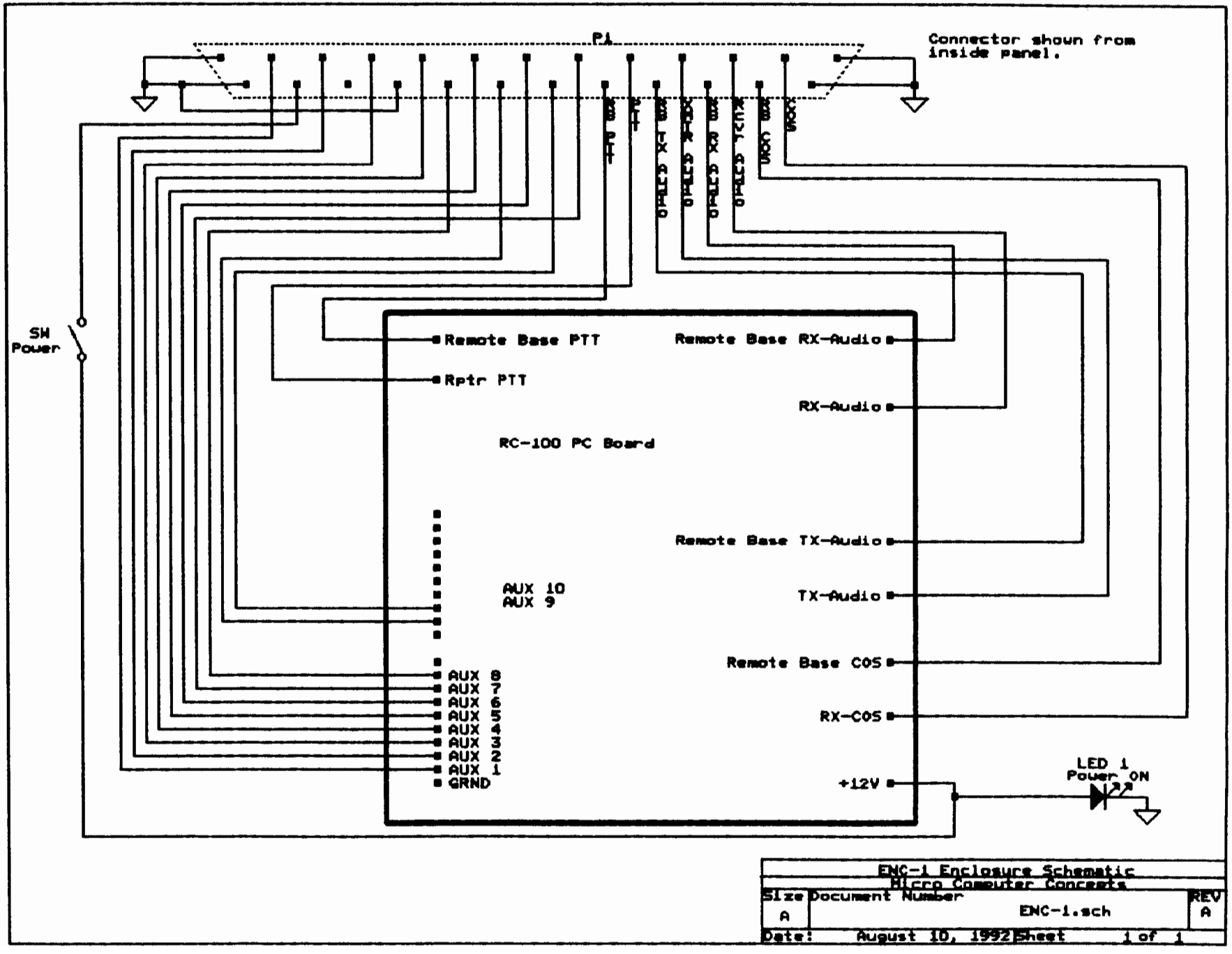


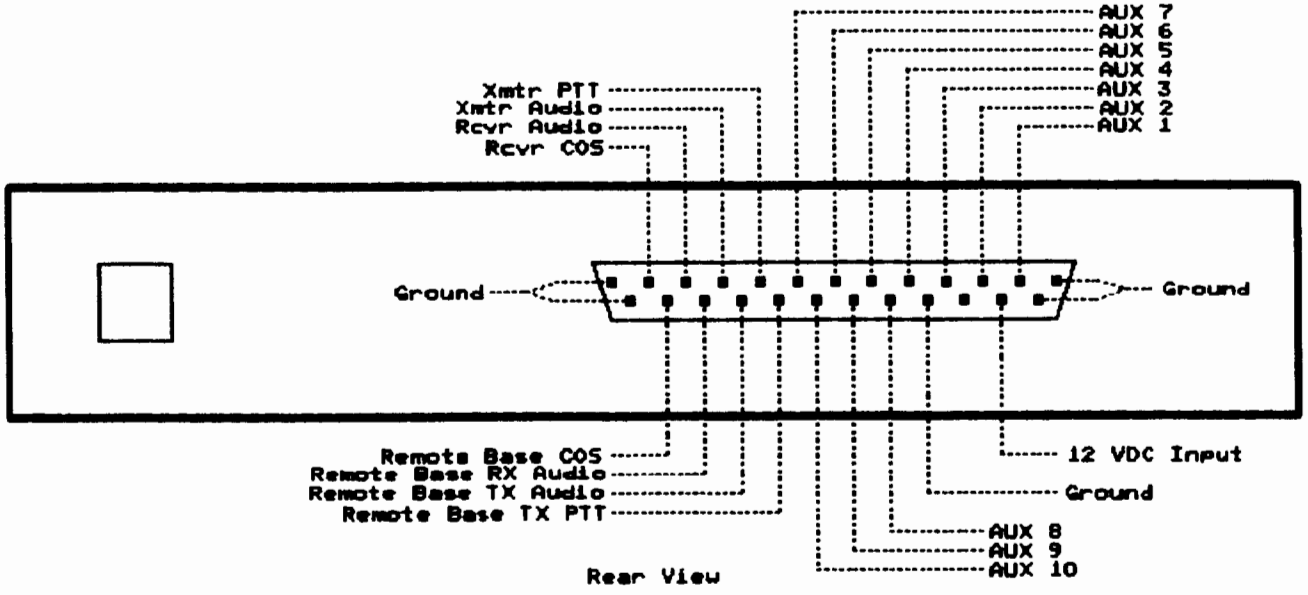
U8 is surface mounted IC on solder side of PCB.

RC-100 Repeater Controller Assembly Drawing

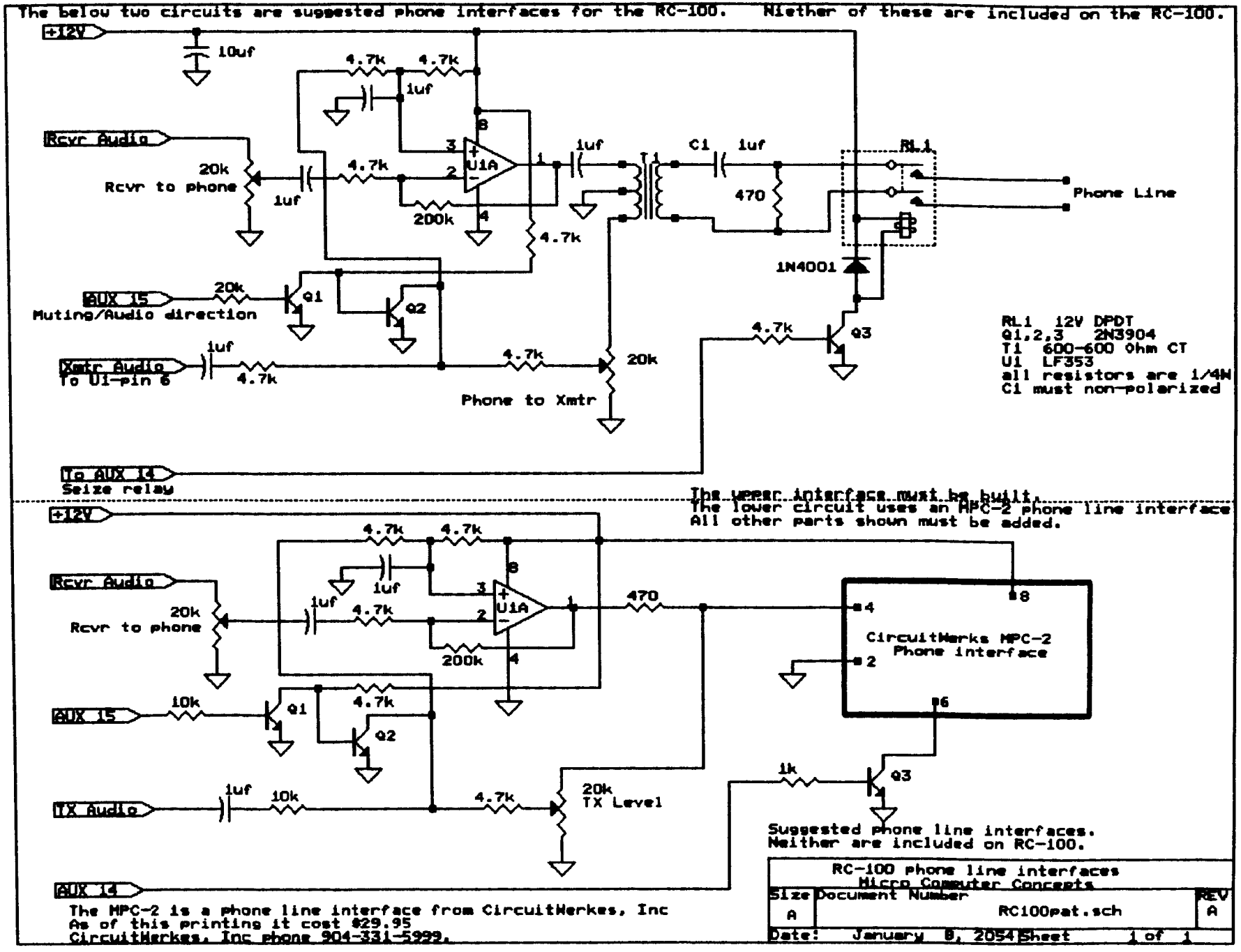
Size	Document Number	REV
A	RC100.asy	E
Date: July 6, 1993	Sheet 1 of 1	


R17 20k
R18 20k
D3
Q3
WDT
C17 1uf
+5VO
C2 10uf
U8 M16811 EEPROM
U4 P87C51
P1.0 VCC
P1.1 P0.0
P1.2 P0.1
P1.3 P0.2
P1.4 P0.3
P1.5 P0.4
P1.6 P0.5
P1.7 P0.6
RST P0.7
P3.0 EA
P3.1 ALE
P3.2 PSEN
P3.3 P2.7
P3.4 P2.6
P3.5 P2.5
P3.6 P2.4
P3.7 P2.3
X2 P2.2
X1 P2.1
GND P2.0
+5V
U5 74LS244
U6 74LS244
AUX1
AUX2
AUX3
AUX4
AUX5
AUX6
AUX7
AUX8
100 KhZ Output
MHz Output
AUX9
AUX10
AUX11
AUX12
10 kHz Output
0/5kHz
AUX14
AUX15
COS/
RM COS/
ID/TONE
U3 8870
GNDEN
X2 DO
X1 D1
D2
D3
RESTC
A ST
VCC
X1
X2
22pf
C13
C14
C18 .1uf
VCC
Rpt COS P1-3
RB COS P2-6
R2 4.7k
R3 4.7k
Q1
Q2
R13 200k
RX-TT Mute
RB-RX Mute
RX-TX Mute
R11 4.7k
R10 4.7k
C6 .1uf
C7 .1uf
C9 .1uf
LA1 20k ID/Tone Level
R12 4.7k
Rpt PTT P1-6
RB PTT P2-5
Q3
Q4
U7 LM7805T
VO GND VI
C15 .1uf
C1 .1uf
C16 100uf
D2
R8 10 Ohm
R1 120 1/2W
8.1V
P1-2
+12VDC Input
LA2 20k RX-TT Level
C10 1uf
R14 4.7k
U2a 4066CA
RX-TT Mute (U4-15)
RB RX Audio
C12 1uf
R16 20k
U2b
4066CB
LA4 20k
RB RX Mute (U4-16)
C5 1uf
R6 4.7k
4.7k R7
D1
RB TX Audio P2-4
R9 4.7k
LM358
U1B
C4 1uf
R5 200k
R19 1k
Rpt TX Audio
P1-5
Grnd
C8 22pf
Retr RX Audio P1-4
LA3 20k RX-TX Level
C11 1uf
R15 4.7k
U2c 4066CC
RX-TX Mute (U4-17)
RC-100 Repeater Controller Schematic
Size A
Document Number RC100.SCH
REV D
Date: July 6, 1993
Sheet 1 of 1


P1
Connector shown from inside panel.
SW Power
Remote Base PTT
Rptr PTT
Remote Base RX-Audio
RX-Audio
RC-100 PC Board
Remote Base TX-Audio
TX-Audio
AUX 10
AUX 9
Remote Base COS
RX-COS
AUX 8
AUX 7
AUX 6
AUX 5
AUX 4
AUX 3
AUX 2
AUX 1
GRND
+12V
LED 1
Power ON
ENC-1 Enclosure Schematic
Micro Computer Concepts
Size A
Document Number ENC-1.sch
REV A
Date: August 10, 1992
Sheet 1 of 1



ENC-1 Enclosure for RC-100		
Micro Computer Concepts		
Size: A	Document Number: ENC-1B.dwg	REV: A
Date: August 10, 1992	Sheet 1 of 1	


The below two circuits are suggested phone interfaces for the RC-100. Niether of these are included on the RC-100.
+12V
10uf
4.7k
4.7k
1uf
Rcvr Audio
20k
Rcvr to phone
1uf
4.7k
U1A
200k
4.7k
1uf
C1
1uf
RL1
470
Phone Line
1N4001
AUX 15
Muting/Audio direction
20k
Q1
Q2
Xmtr Audio
To U1-pin 6
1uf
4.7k
4.7k
20k
Phone to Xmtr
4.7k
Q3
To AUX 14
Seize relay
RL1 12V DPDT
Q1,2,3 2N3904
T1 600-600 Ohm CT
U1 LF353
all resistors are 1/4W
C1 must non-polarized
The upper interface must be built.
The lower circuit uses an MPC-2 phone line interface
All other parts shown must be added.
+12V
4.7k
4.7k
1uf
Rcvr Audio
20k
Rcvr to phone
1uf
4.7k
U1A
200k
470
CircuitWerks MPC-2
Phone interface
AUX 15
10k
Q1
4.7k
Q2
TX Audio
1uf
10k
4.7k
20k
TX Level
1k
Q3
AUX 14
Suggested phone line interfaces.
Neither are included on RC-100.
The MPC-2 is a phone line interface from CircuitWerkes, Inc
As of this printing it cost $29.95
CircuitWerkes, Inc phone 904-331-5999.
RC-100 phone line interfaces
Micro Computer Concepts
Size A
Document Number RC100pat.sch
REV A
Date: January 8, 2054 Sheet 1 of 1

RC-100 List of Components

05-07-1993

part number	description	qty	ref design
P4525	cap, .1uf 50V	6	C1,6,7,9,15,18
P833	cap, 100uf	1	C16
P2038	Cap, 10uf 16V	1	C2
P2105	Cap, 1uf 16V	5	C5,10-12
P4841	Cap, 22pf	3	C8,13,14
1N4746A	diode, 18V zen	1	D2
1N4001	diode, 50V	1	D3
1N4738	diode,8.2Vzener	1	D1
7805T	IC, 5V reg	1	U7
SCN87C51	IC, CPU	1	U4
G8870P	IC, DTMF dec	1	U3
LF353N	IC, dual Op-amp	1	U1
74LS244	IC, octal buf	2	U5,U6
CD4066	IC, quad swit	1	U2
RC100PCB	PCB	1	
P120W1	res, 120 Ohm 1W	1	R1
200KQ	res, 200k 1/4W	1	R5
20KQ	res, 20k 1/4W	2	R17,18
4.7KQ	res, 4.7k 1/4W	11	R2-4,8-12,14-16
Q9472	res, 9x4.7k	4	RN1-4
A9314	socket, 14 pin	1	
A9318	socket, 18 pin	1	
A9320	socket, 20 pin	2	
A9340	socket, 40pin	1	
A9308	socket, 8pin	1	
2N3904	transistor, NPN	5	Q1,2,3,4,5
X049	XTAL, 3.58 MHz	1	X2
X082	xtal, 4.096 MHz	1	X1

TOTAL

Printed 28 of the 28 records.

VID-1
Voice ID Module

Micro Computer Concepts

8849 Gum Tree Ave
New Port Richey, Fla 34653
(phone: 813-376-6575)

by: Ron Wright, N9EE

REV 1.2

1.0 INTRODUCTION

The VID-1 Voice ID board is a voice recorder with playback meant for identifying a repeater. The board is based around an Information Storage Devices ISD-1020A voice recorder IC.

The IDs-1020A is a single IC containing the necessary hardware to sequence store incoming analog signals with playback for up to 20 seconds. The information is stored in EEPROM with data retention of 10 years. Unlike many voice recorders which store the information in a digital form with analog-to-digital and digital-to-analog converters the ISD-1020A stores the information as discrete analog voltages in cells within the EEPROM. Each cell is like a capacitor storing a voltage. When the record mode is selected the internal circuitry steps through the cells one by one at 2.7 kHz rate sampling the analog input storing the incoming voltage on a cell then moving to the next cell storing the next sampled voltage. When in playback the cells are stepped through, but instead of storing a voltage the stored voltage is coupled to the output. This approach requires less memory. If each sample were to be stored digitally using say an 8 bit conversion then 8 times the number of cells (8 times the memory) would be required. The VID-1 also contains the necessary circuitry to control the record and playback.

Their are five interface lines which must be addressed when using the VID-1. These are; 1. power (8 to 15 VDC), 2. audio input, 3. audio output, 4. playback/record and 5. start. The audio input and output have pots for level adjustments (R1 & R2). The record/playback command is TTL (0 to 5 V) low for record and high for playback. The start command is high going low transition.

To record information one first forces the record/playback input low, forces the start input high to low and input the voice to be recorded. The VID-1 will then record the input information.

To playback the stored information one forces the record/playback high and forces the start input high to low. The VID-1 will then playback the stored information.

Two other inputs are provided to determine the length of time for record and playback. These are JP1 and JP2. The insertion or removal of these two jumpers in four combinations as shown on the VID-1.dwg drawing determine the time. The VID-1 can be setup for 5, 10, 15, or 20 seconds of record and playback.

The VID-1 can be used in any application where voice record and playback are needed. It is designed to as an accessory to the Micro Computer Concepts RC-100 and RC-1000 repeater controllers, but is not limited to these.

2.0 USING THE VID-1 WITH THE RC-1000

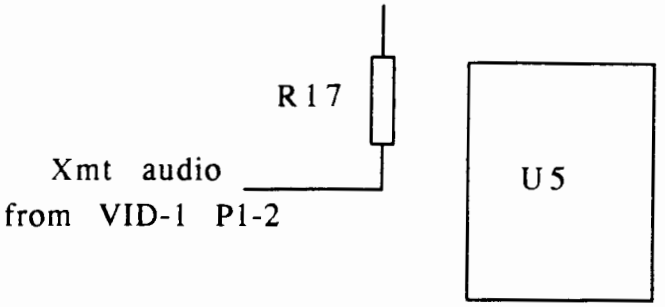
The VID-1 is meant to be used with the RC-1000 "EXTERNAL ID" strobe for starting the ID record and playback. Although the VID-1 can be used with any repeater for identification its use with the RC-1000 allows for remote recording of the stored message. This feature is useful for changing the message without the need to go to the repeater site.

Their are two methods given for remote recording. The RC-1000 software REV 3.1 contains special software for remote recording where previous REVs must use a slightly different procedure.

2.1 VID-1 INSTALLATION WITH RC-1000.

The installation to all RC-1000 is the same.The VID-1 installation with the RC-1000 requires the following:

1. *connect VID-1 "POWER" input to 8 to 15 VDC source.*
2. *connect VID-1 "START" input to RC-1000 "EXTERNAL ID" (P2-pin 4).*
3. *REV 3.1 to 3.22 connect VID-1 "PTT" to the RC-1000 PTT (P1-pin 2).*
   REV 3.3 and later connect VID-1 "PTT" (P1-pin 6) to VID-1 "START" (P1-pin 5).
4. *enable the RC-1000 "EXTERNAL ID".*
5. *install VID-1 JP1 & JP2 for desired play/record time. (see VID-1.dwg drawing for details)*
6. *connect VID-1 "AUDIO OUTPUT" to RC-1000 R17.*



Connecting VID-1 Xmt audio to RC-1000

If remote recording is desired connect the VID-1 Audio Input to the repeater receiver audio.

1. ***connect VID-1 "AUDIO INPUT" to receiver audio.***
2. ***connect VID-1 "PLAY/RECORD" input to RC-1000 AUX 3.***

2.2 RC-1000 Recording with REV 3.0 and Previous Software

Software REVs 3.0 and earlier do not contain software to specifically address remote recording of the VID-1 message. This can be accomplished, however, by the following procedure.

RECORDING MESSAGE:

The steps 1 thru 4 must be followed together so read carefully. When recording adjustment R1 controls the audio input level and R2 controls the output level. These levels may need adjustment to achieve desired levels and quality.

1. ***Force RC-1000 AUX 3 low with AUX control code.***
2. ***Enter touch tone code ## (force external ID).***
3. ***Via repeater rcvr enter the message to be stored.***
4. ***after repeater drops force AUX 3 high (VID-1 to playback mode).***

Enter touch tone ## and the VID-1 will playback stored message.

WARNING: AUX 3 CONTROLS THE RECORD/PLAYBACK MODE. ON POWER UP THE RC-1000 PLACES AUX 3 HIGH (PLAYBACK), BUT THROUGH THE AUX CONTROL CODES AUX 3 CAN BE FORCED TO THE LOW STATE. TAKE CARE TO INSURE AUX 3 IS IN PROPER STATE SO THE STORED MESSAGE WILL NOT BE INADVERTENTLY ERASED.

2.3 VID-1 RECORDING WITH RC-1000 REV 3.1 AND LATER.

The playback/record procedure for REV 3.1 and later software is controlled automatically by the RC-1000. There is a D __ __ "RECORD" code which must be programmed to start record. This "RECORD" code is programmed at select code 4164. Once programmed and after one enters this code the RC-1000 will automatically control AUX 3 for record.

RECORDING MESSAGE:

Steps 1 thru 4 must be followed together so read carefully. When recording adjustment R1 controls the audio input level and R2 controls the output level. These levels may need adjustment to achieve desired levels and quality.

1. Enter the programmed "RECORD" code.
2. drop input to repeater.
3. when you hear repeater tail beep re-key and start message recording. Recording start on tail beep.
4. When message complete drop input and let repeater unkey. This will stop record mode.

Enter touch tone ## and the VID-1 will playback stored message.

3.0 RC-100 OPERATION

The RC-100 software REVs 2.3 and later contain the necessary software to control the VID-1 through the external ID. REVs 2.2 and earlier do not have the external ID and will not control the VID-1.

Two control codes must be programmed for the external ID. These are the D __ __ "EXTERNAL ID" enable/disable (toggle) code at select code 4140 for enabling the external ID feature. Also, the D __ __ "RECORD" code at select code 4141 for controlling recording.

Perform the following to install the VID-1 with the RC-100.

INSTALLATION:

1. connect VID-1 power input to 8 to 15 VDC.
2. connect VID-1 audio output to RC-100 right end of R5.
3. connect VID-1 "START" input to RC-100 AUX 13 (ext ID).
4. connect VID-1 "PTT" to RC-1000 PTT.
5. Program & Enable "EXTERNAL ID" (select code 4140).

For remote recording:

1. *connect VID-1 "PLAYBACK/RECORD" to RC-100 AUX 12.*
2. *Program "RECORD" control code into RC-100 (4141).*
3. *connect VID-1 audio input to repeater receiver audio*

RECORDING MESSAGE:

The steps 1 thru 4 must be followed together so read carefully. When recording adjustment R1 controls the audio input level and R2 controls the output level. These levels may need adjustment to achieve desired levels and quality.

1. *Enter the programmed "RECORD" code.*
2. *drop input to repeater.*
3. *when you hear repeater tail beep re-key and start message recording. Recording starts on tail beep.*
4. *When message complete drop input and let repeater unkey. This will stop record mode.*

The RC-100 has no force external ID command. However, one can disable the CW ID and then #9 will force the external ID.

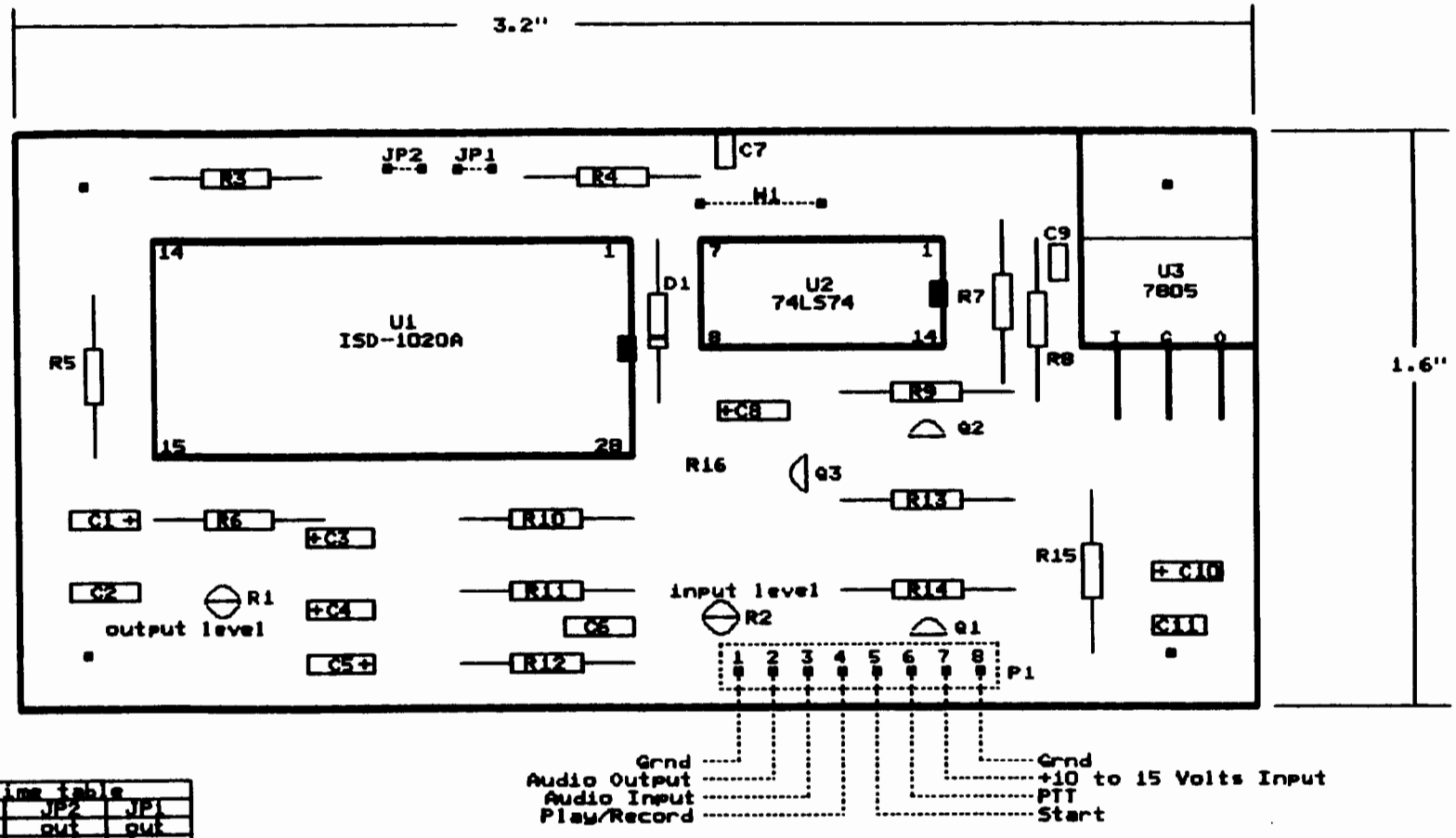
4.0 OPERATION WITH OTHER CONTROLLERS

The protocol for operating the VID-1 is to first record a message into its memory. This is done as follows.

1. *force VID-1 "PLAYBACK/RECORD" input low.*
2. *force VID-1 "START" low (recording will now begin).*
3. *enter through VID-1 "AUDIO INPUT" audio to be recorded.*
4. *return "PLAYBACK/RECORD" high to play mode.*

The protocol for playback is same as above except in step 1 force "PLAYBACK/RECORD" input high.

The record mode may require adjustment of R1 pot (input level adjustment). Playback level is controlled with R2.



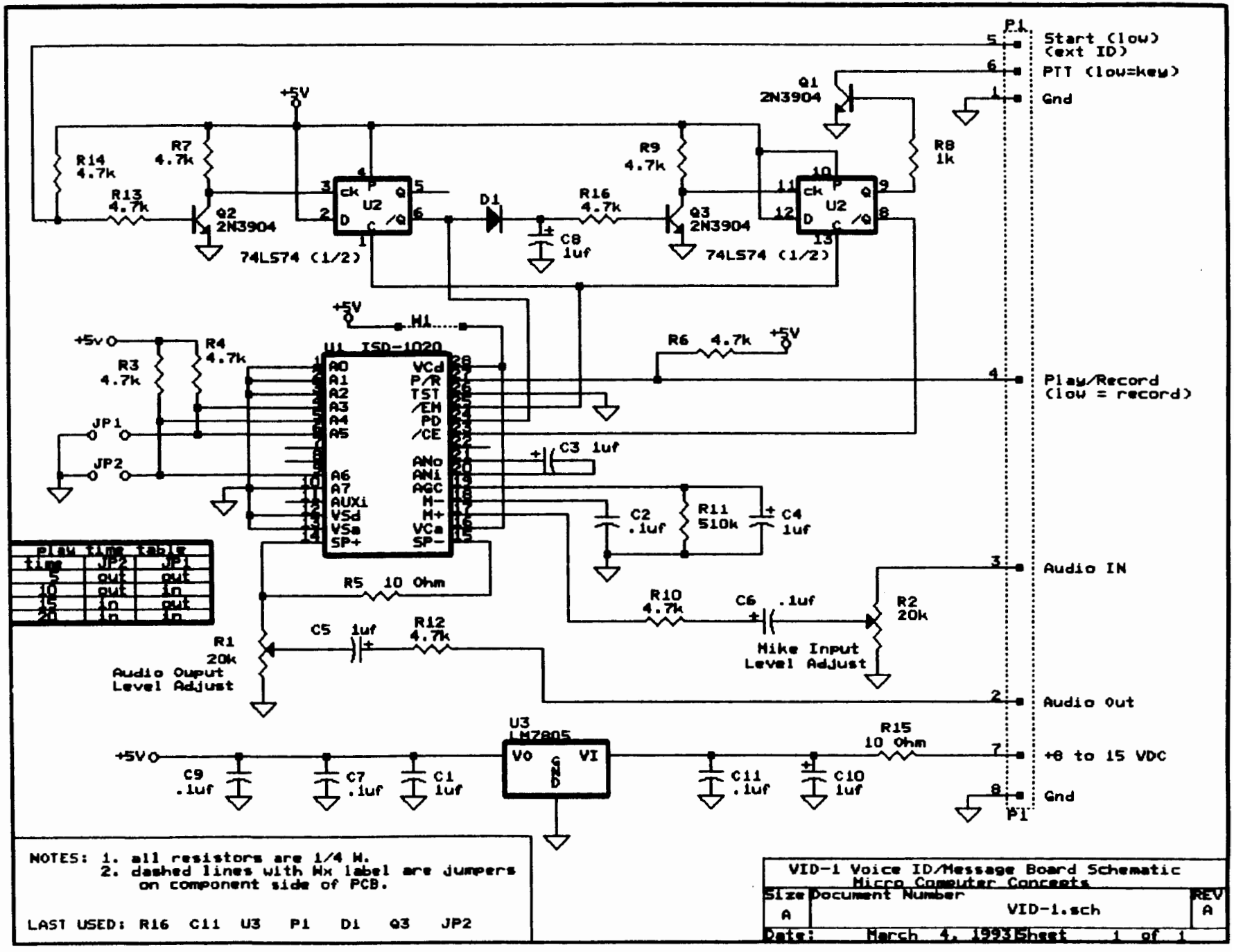
play time table		
time	JP2	JP1
5 sec	out	out
10 sec	out	in
15 sec	in	out
20 sec	in	in

NOTES:
1. All resistors are 1/4 Watt.
2. Dashes lines marked with Hx are jumpers on components side of PCB.

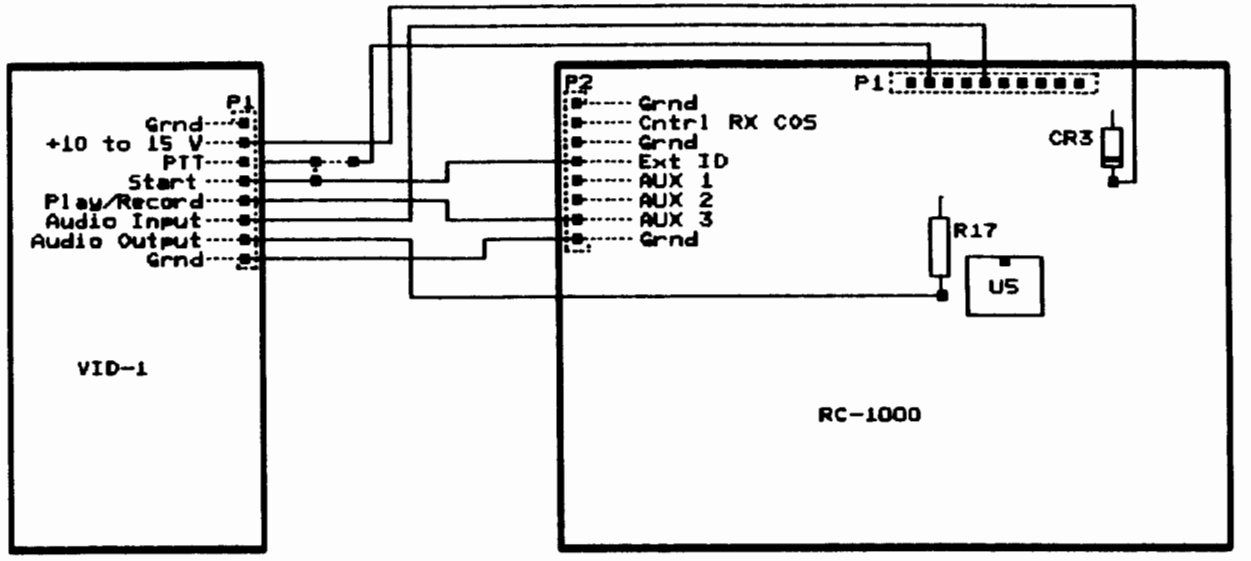
VID-1 Voice ID Board Assembly Drawing
Micro Computer Concepts

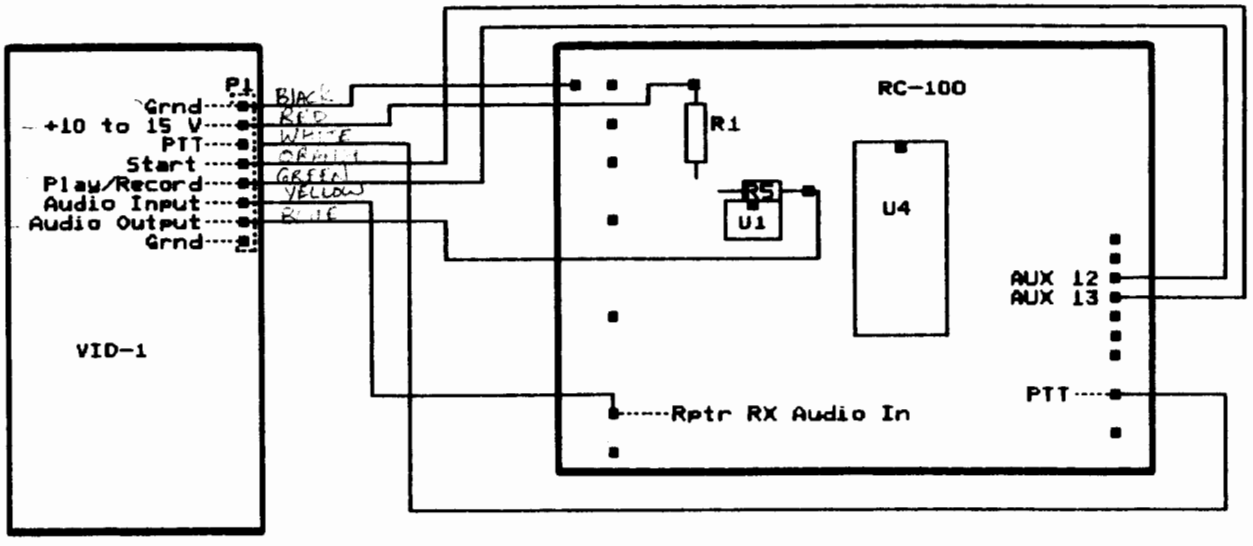
Size	Document Number	REV
A	VID-1.dwg	A

Date: March 4, 1995 Sheet 1 of 1


P1
Start (low) (ext ID)
PTT (low=key)
Gnd
Play/Record (low = record)
Audio IN
Audio Out
+8 to 15 VDC
Gnd
+5V
Q1 2N3904
Q2 2N3904
Q3 2N3904
R14 4.7k
R7 4.7k
R13 4.7k
R9 4.7k
R16 4.7k
R8 1k
U2 74LS74 (1/2)
D1
C8 1uf
U1 ISD-1020
R4 4.7k
R3 4.7k
JP1
JP2
R6 4.7k
C3 1uf
C2 .1uf
R11 510k
C4 1uf
R5 10 Ohm
R10 4.7k
C6 .1uf
R2 20k
Mike Input Level Adjust
R1 20k
Audio Ouput Level Adjust
C5 1uf
R12 4.7k
U3 LM7805
R15 10 Ohm
C9 .1uf
C7 .1uf
C1 1uf
C11 .1uf
C10 1uf
Play time table
time JP2 JP1
5 out out
10 out in
15 in out
20 in in
NOTES: 1. all resistors are 1/4 W.
2. dashed lines with Wx label are jumpers on component side of PCB.
LAST USED: R16 C11 U3 P1 D1 Q3 JP2
VID-1 Voice ID/Message Board Schematic
Micro Computer Concepts
Size A
Document Number VID-1.sch
REV A
Date: March 4, 1993 Sheet 1 of 1

Note: With RC-1000 REV 3.1 and earilier connect VID-1 PTT to RC-1000 PTT.
With RC-1000 REV 3.2 and later connect VID-1 PTT to VID-1 Start or RC-1000 EXT ID.





VID-1 to RC-100 & RC-1000 Connections Micro Computer Concepts		
Size A	Document Number VIDINSTL.sch	REV A
Date: June 22, 1993	Sheet 1 of 1	

VID-1 Voice ID Board List of Components

03-04-1993

Part Numbe	Discription	QTY	ref design	comments
	cap, .1uf	5	C2,6,7,9,11	
	cap, 1uf	5	C1,3,4,5,8	
WM2002	connector, 4 pin	1	JP1 & 2	
WM2006	connector, 8 pin	1	P1	
7805T	IC, 5 V regulator	1	U3	
74LS74	IC, dual D-type FF	1	U2	
ISD-1020A	IC, voice	1	U1	
VID-PCB	PCB,	1		custom by MCC
00G203	pot, 20k	2	R1,2	
10Q	resistor, 10 Ohm 1/4	2	R5,15	
1KQ	resistor, 1k, 1/4W	1	R8	
4.7KQ	resistor, 4.7k,1/4W	9	R3,4,7,9,10,12,14,17	digi-key
510KQ	resistor, 510k 1/4W	1	R11	
	screw, 4-40 .25 inch	4		
J170	spacer, .375 4-40	4		
2N3904	transistor, NPN	3	Q1,2,3	

TOTAL

Printed 16 of the 16 records.