RC-1000
Repeater Controller
Manual of Operations
(text version)

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RC-1000 WARRANTY

The RC-1000 is warranted for a period of 180 days (6 months) from the date of purchase to be free of defects in design, material, and workmanship. If the RC-1000 fails due to any of these defects Micro Computer Concepts will either replace or repair the RC-1000 if returned to MCC.

Items not covered under warranty: 1. damage due to lightning. 2. damage due to misuse or handling. 3. damage due to over voltage or power surges.

Micro Computer Concepts strives to insure your RC-1000 is designed and manufactured to the highest level possible. If you have questions regarding installing and connecting the RC-1000 to any piece of equipment, please feel free to call us. Also, we understand many of our customers have real day jobs and work with the RC-1000 in off hours. For this reason we are glad to accept calls 10 AM to 10 PM ET 7 days a week for your questions or moments.

********** Notice of Changes **********

Micro Computer Concepts reserves the right to make changes to the RC-1000 operation and/or specifications without notice. Although MCC tries to maintain it products to the highest standards it sometimes becomes necessary to alter operation of the control. This may result in changes which are not fully documented and described.

1.0 Introduction, RC-1000

This manual is written for the RC-1000 repeater controller. As with most technical manuals the information may be somewhat confusing. We at Micro Computer Concepts understand for anyone first encountering a control with the power of the RC-1000 they could be overcome. Thus, we invite calls of questions or comments. This is to say we want you to be satisfied with the control and are more than willing to help. If you encounter difficulty please give us a call at the phone number on the front of this manual 10 AM to 10 PM ET 7 days a week including holidays.

The RC-1000 is a controller for a receiver/transmitter operated in a repeater mode. The controller is all that is needed to control the repeater including a CW ID, control functions and the direct phone line connect autopatch. The RC-1000 contains the complete repeater and phone line interface requiring only the receiver audio and COS, the transmitter audio and PTT, and the phone line. If sub-audible tone access is desired for access a logic input for a externally supplied sub-audible tone decoder is provided.

1.1 Definitions

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

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

Autopatch...the interconnect of a repeater system to a phone line for enabling mobile units to access the phone system and make phone calls.

PL...private line or sub-audible tone residing on a transmission.

Control code...DTMF code for enabling and disabling various controller functions. These codes are usually reserved for control operators.

User code...DTMF code for accessing various user function such as autopatch calls.

DTMF...eight audible tones in the range of 697 to 1633 Hz two at a time for remote signaling. DTMF is used to remotely control and program the control.

DTMF pad...16 digit device for generating DTMF. Telephones have a 12 digit version.

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

CW...international Morse code employing short and long tones for sending alphanumeric characters. CW is used to identify the repeater with the FCC issued callsign.

COS..carrier operated squelch used by the controller for sensing when the repeater receiver has an input. This is a logic input going high or low when the receiver squelch is open.

PTT...push to talk used to key the transmitter. Pulls low to key transmitter.

1.2 Controller Details

The RC-1000'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 a 87C52 microcomputer (U1) 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 is a Mitel MT8880 (U4) for decoding and encoding DTMF signaling tones. The other various components act as buffers, amplifiers, audio switches and drivers for controlling and interfacing to the repeater and

phone line.

Also contained on the board are voltage regulators powering the various components.

The controller parameters such as CW ID, control and user codes, timer limits, etc. are programmable with DTMF and stored in an EEPROM (U8). The EEPROM is a device which allows data to be written, but does not loose the data when power is removed. The data retention life is specified for at least 10 years. See section 15 for programming.

A remote base interface allows for adding a transceiver to the repeater for linking to another repeater. All audio control, COS and PTT interface is provided. See section 7.

If a component fails the only part not easily obtainable is the 87C52 due to the program inside the IC was developed by Micro Computer Concepts. Thus to replace the 87C52 one must obtain it preprogrammed from MCC. This can be done for $35.00 which would includes any updated software.

Interface of the RC-1000 requires the receiver audio, receiver COS, transmitter audio, transmitter PTT, 10 to 15 volts at 100 ma max and the phone line. All audio is buffered and level adjusted with 6 pots. The COSs and PTTs are transistor buffered. This interface allows connection directly to most repeaters without the need for additional buffering. See section 12 for installation and adjustment information.

2.0 Power Up Conditions

When power is applied to the controller it initializes itself placing the repeater into a known state. This state is controlled by the controller software and the data stored in the EEPROM. Upon power up the controller fetches the initial state of the controller from the EEPROM. When a feature is enabled or disabled it will be in that state on power up. This includes timer time-outs, tail beeps and repeater access modes (carrier, PL, features enabled/disabled, etc).

As received from MCC the following is state is stored in the EEPROM:

1. Repeater Enabled with time-out 3 minutes. 2. Autopatch enabled, time-out 3 min., ON code *41, OFF #1. Dialing mode is DTMF. 3. Reverse patch enabled and in answer mode. 4. CW ID is "INIT ID/R" at 18 WPM with tone at 500 Hz. 5. All codes except autopatch and programming erased.

When any of the above conditions are changed the change will be stored in the EEPROM and on power up the new state will be the state the controller was

placed in.

3.0 Repeater Operation

The RC-1000/RC-1000V 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 transistor buffered COS receive indicator inputs. The outputs include buffered and amplified transmitter audio and a transistor open collector driver PTT. The receiver audio is adjustable providing separate level controls to the transmitter.

The repeater mode of operation is the controller sampling the COS input and when active and the repeat mode is enabled the transmitter will be keyed. The transmitter will remained keyed until either the COS becomes inactive or the repeater time-out. The COS active state is the condition when the receiver has an input or the squelch is opened. Its active state is determined by jumper JP1 which when not installed the COS is expected to go high, 2 to 30 volts with the squelch open or with a receiver input.

3.1 Access Modes

There are three control operator controlled access modes for repeater access; 1. carrier, 2. PL (sub-audible tone) and 3. DTMF access.

In the carrier access mode any input to the controller COS will bring up the repeater.

In PL access mode a PL decoder is required with its output connected to the controller PL input, P3-pin 7. In the PL access mode the PL decoder input acts as the COS with the repeater repeating only when the COS and PL decoder both are active. Thus, while in PL both the COS and PL input must be active to bring up the repeater.

In the DTMF access mode a DTMF code must be entered to access the repeater. See below for more details on this mode.

3.2 Repeater Time-out

The repeater time-out timer is used to limit the users transmission time. The time-out is programmable in 10 seconds steps up to 40 minutes. If the repeater has an input for the programmed time the repeater will send a serious of beeps indicating time-out is about to occur and then unkey the repeater. When the user timing out the repeater releases the input the controller will

rekey the repeater indicating the time-out timer has been reset.

The time-out timer is reset with the repeater tail beep or by DTMF digit one. 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. The time-out timer limit is programmed with the "Repeater Time-out" parameter. See Section 15 for programming.

3.3 Tail Timing

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. The repeater tail timer is programmable in 0.1 second steps with the "Repeater Tail Time" parameter. See section 15 for programming.

3.4 Anti-Kerchunker

The controller has a built-in anti-kerchunker which, when on, requires 1 second of receiver input to bring up the repeater. This may be useful to prevent distant stations from chattering the repeater in the event of a band opening where the distant users only chop in and out of the repeater.

When the anti-kerchunker is ON the one second input is required to access the repeater. After this one second input has occurred the repeater will function normally until 20 seconds of NO input exist. After this 20 seconds of no use period another 1 second of input must occur for repeater access.

The anti-kerchunker is turned ON and OFF with a * XX code (see section 15 for code programming). The code will toggle the state meaning if ON the code will turn it OFF and if OFF the code will turn it ON. When turned ON a tone/high tone response will be sent and when turned OFF a tone/low tone will be sent.

3.5 DTMF Access Mode

DTMF access requires the users to enter a three digit *XX DTMF code to bring up the repeater. Once this code has been entered any user can then use the repeater until the repeater has no input for 20 seconds at which time the repeater will go to "sleep" and the *XX DTMF code must be re-entered for access.

3.6 PL Override

The repeater PL access mode can be overridden with a single *XX user DTMF code

placing the repeater into temporary carrier access mode. When the repeater is in the PL mode and this code is entered the controller will operate in carrier mode until either the "PL ENABLE" control code is entered or no repeater activity occurs for 20 seconds or more or if the override code is re-entered the control will go back to requiring PL. At that time the override will be aborted and the PL mode will resume.

If the override is not desired simply do not program the *XX code or program the code to be *##. See Table 15.1 for programming this code.

4.0 AUTOPATCH

The RC-1000/RC-1000V contains interface and software for providing an autopatch. interfacing to and from the repeater transmitter and receiver with level adjustments on the RC-1000 control board.

The autopatch interface is a half-duplex type patch allowing one way communication at a time; from receiver to phone or from phone to transmitter.

The direction of audio is determined by the receiver input permitting phone to transmitter audio when NO input exits and receiver to phone audio only when the proper input is present. The proper input is determined by the access mode of the patch.

4.1 Autopatch Access Modes

The autopatch can be enabled or disabled using control codes. When disabled all autopatch access is ignored. The calling in via the phone line for control operator functions will not be affected by the autopatch being disabled, but no reverse patch will be permitted due to access to the patch is forbidden. The autopatch can be disabled independent of the repeater mode.

The autopatch can be placed into either carrier or PL access modes using DTMF control codes. Also the access mode can be placed into PL independent of the repeater access mode. This allows opening the repeater up for general carrier access while restricting the autopatch to users with PL. When the patch is accessed the proper input from the user must be present (carrier or PL) or the access attempt will be ignored.

4.2 Autopatch Access Codes

Two access codes will access the patch; 1. a three digit *xx up/two digit #x down codes or 2. * up/# down. Which code group is used is determined by the * up/# down feature being enabled or disabled. When disabled only the 3 digit up/2 digit down codes will access the patch. When enabled both set of codes

will function.

Access to the manual dial autopatch can be done two ways.

First is the "store & forward" mode where a user enters the 3 digit *XX access code followed by the desired phone number. The controller will then connect the phone line, dial tone will be heard and then the entered phone number will be autodialed by the controller. The user will hear masking dialing tones while the controller is dialing, not the actual DTMF dialing tones.

The second access is the re-encode mode where the user enters the three digit *XX access or single * (if * up/# down is enabled) and drops the repeater input. The controller will then connect the phone line and the dial tone will be heard. The user is to rekey and dial the desired phone number. As the user is entering the phone digits the controller will decode these digits and regenerate them for dialing the phone number. Muting of the users actual audio to the phone line prevents the users tone interfering with the controller DTMF generation.

The "store & forward" or re-encode while dialing modes are automatically controlled by the control. The dialing mode is determined solely by the method used to access the patch.

In both access modes the dialing is actually performed by the controller. This insures clean and level correct tones being fed to the phone line.

A third patch access mode is via the autodial where preprogram phone numbers are stored. With short access codes the controller will access the phone line and automatically autodial the phone number selected. See section 4.6 for details.

4.2.1 Long Distant Dialing

After accessing the patch if the first digit of the phone number is either a 1 or 0 or if more than 8 digits are dialed the patch will be terminated. This can be overridden with the use of the long distant patch access code or if the area code being dialed is one of eight programmed in the area code table. Either patch on code can be used with the only difference being the 1 and 0 first digit and 8 digit limit being denied or allowed. See section 4.4.6 Area Code Override Dialing for description of area code long distant dialing.

The "Autopatch With Long Distance" access code can be enabled/disabled with the control code. Also, if the access code is not programmed long distant cannot be accessed.

4.2.2 Patch with User Muting

The patch can be placed into a user mute mode which mutes the users audio during a patch. This means the only audio transmitted is the party on the phone. The user mute feature is enabled/disabled with the "Patch User Mute" DTMF control code.

4.3 Autopatch Time-out

Three autopatch time-out modes exit; 1. no time-out, 2. programmed time-out in 10 second steps up to 40 minutes and 3. programmed time-out with timer reset on repeater input.

In the no time-out mode the autopatch will never time-out.

In the programmed time-out the autopatch will terminate automatically when the programmed time-out point is reached. In this mode the time-out is flagged to the user with warning beeps 10 seconds prior to time-out. The time-out can be reset by entering DTMF digit 4. This will reset the patch time-out timer.

When the programmed time-out with reset on repeater input mode is selected the time-out timer is reset whenever a receiver COS input is seen by the controller. If no input occurs for the normal time-out programmed the controller will signal time-out is about to occur 10 seconds before timing out and if no input still occurs from the user the patch will be terminated.

In any of the time-out modes ten seconds prior to time-out a series of beeps will be generated indicating time-out is about to occur. In the reset time-out on input mode simply providing an input to the repeater will clear time-out. In the programmed time-out mode DTMF digit 4 will clear time-out.

4.4 Patch Dialing

Their are three dialing modes. These are DTMF re-encode, DTMF store & forward and pulse dialing. As received from MCC the controller is in the DTMF dialing mode.

4.4.1 DTMF Dialing

Their are two DTMF dialing modes of "store & forward" and " re- encode while dialing". The controller has a DTMF encoder/decoder IC, U4, which generates the DTMF digits for dialing phone numbers.

In the re-encode dialing mode the user is to enter the patch on code and drop the input and listen for a dial tone at which time the controller will connect the phone line. The user is to re- key and enter the desired phone number. As the user is entering the phone number digits the controller is decoding the digits and regenerating the same digits for dialing.

Which DTMF dialing mode is used is determined by how the patch is accessed. If the user enters the patch on code and without dropping the repeater input enters the phone number the store and forward mode is used. If, however, the user enters the patch on code and then drops the input the controller connects the phone line giving a dial tone and the re-encode mode is used. This operation is automatic.

The DTMF dialing mode is selected with the "Patch DTMF dial" control code.

4.4.2 Pulse Dialing

The pulse dialing mode functions the same as the DTMF store & forward dialing except the dialing is performed by pulse. After the patch on code is entered the users phone number digits must be entered which are stored in the control.

After at least 2 digits have been entered and the user drops the receiver input for 2 seconds the controller will connect the phone line and pulse dial the entered phone number. After pulse dialing the phone number the patch will operate in the normal mode.

Pulse dial is selected by the "Patch Pulse Dial" control code.

4.4.3 Dial of Leading Digit with Dialing

The autopatch can be forced to dial a single digit at the beginning of an autopatch. The leading digit feature is often needed for repeaters located in a location with an internal PBX terminal requiring say a 9 for accessing an outside phone line.

This mode is enabled/disabled with the "Patch Digit en/dis" control code. The leading digit is programmed with the "Patch Leading Digit" entry of 0 followed by the desired digit.

When the leading digit is enabled the controller will automatically insert the programmed DTMF leading digit at the beginning of all dialing. When in store & forward and for autodial dialing the leading digit will be inserted just prior to autodialing the stored phone number. When using DTMF re-encode dialing the leading digit will be inserted after phone line connect with the user having to wait for a dial tone.

There is no leading digit mode for pulse dialing.

4.4.4 Dial of 911 Lockout

The dialing of 911 can be locked out of the autopatch with the "DIAL 911 enable/disable" control code. When disabled dialing of 911 will terminate the patch.

4.4.5 Area Code Override Dialing

Using the normal autopatch access code will not allow for the first digit being a 1 or 0 or the phone number to have more than 8 digits. However, if a phone number with greater than 8 digits is entered and the number dialed contains an area code which matches a preprogrammed area code in the Area Code Table the dialing will be allowed. This allows for the repeater owners to preprogram up to 8 area codes which can be dialed using the normal patch on code and lock out other long distant dialing.

The entered phone number can be either a 11 digit number with the first digit being a 1 followed by the area code or the number can be 10 digits with the first 3 digits being the area code. The deciding factor is if the first digit is a 1. This feature allows for phone systems which require all dialing to have an area code, but in the case of 10 digit dialing the call is a local call.

4.4.5.1 Programming the Area Code Table

The procedure for programming the area codes is similar to programming autodial numbers. The procedure is to first turn on programming (D7B & D7C as the control is received), then enter 7 followed by slot number, 81 thru 88, followed by the 3 digit area code. As an example if the area code 727 is to be allowed using slot 82 one would enter the following:

7 82 727

If accepted the controller will respond in CW with "AD". The only difference between programming an autodial and an area code is the autodial requires 11 digits and an area code requires 3 digits.

In this example after entering the normal "Patch ON" code and dialing of any phone number with the first digit being a 1 and an area code of 727 followed by 7 digits will go thru.

4.5 Reverse Patch Operation

The reverse patch allows anyone from any telephone to call the repeater phone and signal repeater users monitoring that a party is being called. There are three reverse patch modes; 1. phone answer with automatic user signaling, 2. phone answer, but requiring caller to enter access code to signal users and

3. no answer with user signaling each time the phone rings.

4.5.1 Reverse Patch Answer Mode

When the answer mode is enabled and after ringing the preset number of ring pulses in any one minute period the controller answers the phone by closing relay RL1. This action does not access the autopatch and the phone line audio does NOT pass to the transmitter. Users monitoring the repeater will not know the call in has taken place for the repeater will function normally.

Two modes for reverse patch signaling are provided. These modes are controlled by the "REVERSE PATCH SIGNAL" enable/disable control code. When this mode is disabled and after answering the phone the controller waits for 8 seconds. After the 8 seconds and if the caller does nothing the repeater transmitter will key and a warble ring tone will be generated at a 1 second on 3 seconds off rate. This ring tone is the signal to the repeater users a call in is in process. A repeater user is then to answer the call in with the normal patch ON code.

During the 8 seconds after the phone has been answered the caller can put the controller into the control op mode using the "Call In ON" #x code. See section 5.4 Call in Operation.

If the "REVERSE PATCH SIGNAL" mode is enabled the calling party must enter a #x code to start the ring tone generation. If this # code is not entered the controller will terminate call in after the normal 1 minute time-out. This mode can aid in preventing wrong numbers or other unwanted calls from disturbing the repeater.

When the ring tone is sent to the transmitter a ring tone is also generated for the phone line to indicate to the caller of the ringing.

4.5.2 Reverse Patch NO Answer Mode

If the answer mode is disabled the controller will key the repeater transmitter and generate a ring tone on each ring of the phone. This is the signal for the user to answer the phone. In the no answer mode the phone line will not allow controlling the repeater via the phone line due to the control never answering the phone.

4.6 AUTODIAL

The autopatch has an autodial which allows for storing of up to 60 eleven digit phone numbers . The autodial codes all start with a programmable #X autodial prefix code followed by two digits of 01 thru 60.

A special autodial slot number 61 is reserved for a special 911 patch access. When a DTMF autodial code of 911 is entered the phone number in slot 61 will be accessed and autodialed. Thus, simply entering 911 from a users DTMF pad will autodial the phone number in slot 61.

A programmable prefix code of #X is provided to give some degree of autodial security. The #X code precedes all autodials except the special 911 emergency access. After an autodial slot has been programmed to access that slot enter the #X autodial prefix code followed by the slot number of 01-60.

The autodial functions in the same manner as the normal autopatch with the controller dialing the phone number (DTMF, pulse, dial 9, etc).

4.6.1 Autodial Programming

All autodial phone numbers are programmable and stored in the EEPROM memory (U8). To program a phone number the programming must be enabled (default D7B & D7C). After programming is on each autodial slot can be programmed at random in any order.

To program a autodial phone number enter 7 followed by the autodial slot number, 01 thru 60, followed by the 11 digits to be programmed. As an example if slot 16 is to be programmed with the phone number 1-727-555-1212 one would enter 7 16 1 727 555 1212. All autodial slots are programmed in this same manner.

When programming a number all 11 digits must be entered. However, if less than 11 digits are required the remaining unused digits must be entered as stars (*). Thus if 555-1212 were to be programmed in autodial slot 03 one would enter 7 03 555 1212 ****. The controller will not dial the star digits.

After programming an autodial a confirmation of CW "AD" (dit dah space dah dit dit) will be sent. If this confirmation is not heard the controller did not accept the entered number. Any attempt to program a slot higher than 61 will be ignored.

4.6.2 Autodial Erasing

To erase an autodial number simply enter 7 followed by the slot number and wait at least 4 seconds. The controller will erase the selected slot. Whenever an autodial slot which is erased is accessed the autodial access is ignore and the phone line will not connect.

4.7 Autopatch Busy Feature, RC-1000

When the phone line for RC-1000 is in use by another phone on the same phone line a special feature, when enabled, will deny accessing the autopatch. This feature requires replacing C16 with a zener diode of 18 volts, 1N4747, with the cathode to the center of the board at U6-pin 3 and enabling the busy feature with the NO PATCH ACCESS IF BUSY Axx control code.

WARNING: In some phone systems this feature will not allow call in for the reverse patch.

The reason for this in some phone systems each time a phone is called the central office equipment checks the called phone line requiring there be NO DC leakage on the phone line. If there is DC leakage the phone system assumes a defective line giving the caller a busy signal. With C16 in place there is NO DC path, but with a zener diode is place of C16 a DC path is present. This will affect only incoming calls and not calling out. In most phone systems the busy feature will function with no problem.

The code for enabling/disabling the "NO PATCH ACCESS IF BUSY" feature is programmed with:

select code 4123 A __ __

As received this feature is disabled. When enabled and a patch access is attempted and the phone is off hook the controller will give the user a low tone response.

The enable/disable control code toggles the enable state giving a tone/high tone response when enabled and tone/low tone when disabled.

NOTE: The phone line polarity must be connected so the phone line positive input , red wire, is connected to the RC-1000 phone line input farthest from the relay, RL1, and the negative side, green wire, to the point closest to RL1. Any simple voltmeter can be used to check the phone line polarity.

How it works: If the 18 volt zener is in place of C16 and the phone is on hook U6 pin 5 will be low due to the 48V on the phone line. When the patch is accessed the controller samples U6 and if low patch is allowed. If, however, the phone is off hook the line voltage will be less than 15 V causing the zener diode to be open and U6 pin 5 to be high and if patch access attempted, manual or autodial, access will be denied. When enabled and a patch access is attempted and the phone is off hook the controller will give the user a low tone response.

5.0 Control and User Codes

The RC-1000 contains a DTMF decoder, interface to the repeater receiver and control software for receiving DTMF commands for 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 U4 and interface directly to U1, the microcomputer.

The control and user codes are stored in the EEPROM and are programmable with DTMF. To program the codes see section 15.

5.1 Control Operator Codes

The control operator codes are used to enable and disable various repeater functions such as the autopatch and access modes. They also allow selection of various operational parameters such as timeout timers.

5.1.1 Control Code Enable/Disable

Due to the large number of AXX and DXX control codes an unwanted user could enter a code which might do something even if this user does not know what is done.

Access to the AXX and DXX control codes can be enabled or disabled with two control codes; Control Code enable and Control Code disable. When disabled the only control code to function is the Control Code Enable. These codes do NOT affect access to the * and # user codes.

5.1.2 Sub-audible Tone Control Access

The controller can be placed into a mode which requires sub-audible tone to access any AXX and DXX control code. The tone decoder logic input is used for sub-audible tone detection. See section 11 for Sub-audible tone details.

The "PL Control" enable/disable code places the controller into this mode. When entering this mode the decoder must be decoding (PL logic input in low state) or this mode will not be entered. This will prevent going into this mode accidentally.

This mode will allow for a higher degree of control code access security. This mode does not affect call-in from the phone line or control receiver input for control. The * and # codes also are not affected.

5.1.3 Control Codes Description

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

Master Enable see below Master Disable disable all repeater operation

Master Enable and Disable do not enable or disable any function, but rather unkeys the transmitter, turns OFF autopatch and remote base. When re-enabled the various repeater functions will be in that state when the master was disabled. The callin control operator function remains operational, but without reverse patch.

Repeater Enable	enables repeater function
Repeater Disable	disables repeater function
Repeater PL Enable	places repeater into PL access (does not affect patch access)
Repeater Carrier	places repeater into carrier access
DTMFAccess en/dis	toggles repeater DTMF access mode
Timeout enable/disable	toggles repeater timeout enable/disable (disable, no time-out)
Autopatch Enable	enables autopatch/autodial
Autopatch Disable	disables autopatch/autodial
Autopatch PL Enable	requires PL to access the autopatch/autodial
Autopatch Carrier	autopatch in carrier access
Dial 911 en/dis	allows patch dialing of 911 Dial 9 en/dis inserts programmed first digit in autopatch dialing
Reverse patch enable	enables reverse patch
Reverse patch disable	disables reverse patch
Reverse patch signal	toggles requiring signaling on reverse patch
Answer Enable	allow controller to answer phone
Answer Disable	controller never answers the phone Nr rings to answer number of ring pulses to answer the phone
Long Distance Enable	enables long distant autopatch
Long Distance Disable	disables long distant autopatch
*up/& down patch en/dis	toggles * for patch & # for patch termination
Patch Timeout en/disable	toggles autopatch timeout enable/disable
Patch normal timeout	selects the programmed patch timeout
Patch timer reset on input	selects patch timeout reset on user input
Patch User mute en/dis	toggles muting the mobile during autopatch

Autopatch enable/disable and access mode does NOT affect the repeater access mode. Reverse patch enable/disable does not affect autopatch access and does NOT affect phone line answering for control operator functions.

Remote base enable	enables remote base, but does not turn it on

Remote base disable	disables remote base
Remote Base w/rptr	remote base functions if repeater disabled
Voice/External ID en/dis	toggles voice/external ID enable/disable
CW ID enable/disable	toggles enables/disables CW ID
CW ID continuous	ID sent regardless of repeater use
CW ID	programming when in programming turns on programming of CW ID
AUX Output	master code for controlling AUX outputs
A equivalent	#X code replacing A in AXX codes
D equivalent	#X code replacing D in DXX codes

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

Programming Code 1	first programming enable codes
Programming Code 2	second programming enable codes
Program Disable	disables programming of EEPROM
Control Code enable	enables AXX & DXX control code access
Control Code disable	disables AXX & DXX control code access
Muting en/dis	toggle DTMF muting on/off

5.2 User Codes Description

The user codes are as follows:

Autopatch ON	*XX code - Connects line for manual patch
Autopatch OFF	#X code - terminates autopatch
Autopatch ON w/long dis	*XX code - Allows first digit of 1 or 0
Autopatch timer reset	4 - resets autopatch timer
Autopatch reset	#X code - provides new dial tone
Autodial prefix	#X plus autodial slot number (2 digits) for accessing autodials
Reverse Patch Signal	#X reverse patch DTMF signal code
Remote base ON	*XX code - Turns ON remote base
Remote base OFF	#X code - Turns OFF remote base
Remote base XMT ON	#X code - toggles remote base PTT ON/OFF
Callin control ON	places controller into control op mode muting repeater receiver to DTMF decoder
Pad tester ON	#0 Turns ON DTMF pad tester
Pad tester OFF	same as autopatch OFF code
Force CW ID	#X code - Forces CW ID
Force External ID	#X code - Forces external/voice ID to run
Anti-Kerchunker en/dis	*XX code - toggles ON/OFF kerchunker filter
DTMF Access code	*XX code for repeater access in DTMF mode
PL override code	*XX code for temporary placing repeater into carrier access

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 long high or low pitched tone indicating a function was acknowledged. If a function was enabled or turned ON the long beep will be high pitch. If the entered control code disabled or turned OFF a function the long tone will be low pitch. This signals the control operator of the acceptance of the entered code.

If control codes are entered via the phone line callin acknowledge tones will not be sent preventing interfering with normal repeater operation.

5.4 Code Programming

The control and user codes can be programmed by the user using DTMF with the codes being stored in EEPROM, U8. To enter the codes the programming must be enabled using the two separate "Programming Enable 1" and "Programming Enable 2" codes entered in their exact order.

See Section 15 for programming codes.

5.5 Callin Control Mode

The control can be controlled via the phone line. DTMF audio is normally routed to the DTMF decoder, U4, from the repeater receiver. However, if the repeater phone is called and the control answers and prior to generating ring tones for the reverse patch a special #X code can be entered forcing the muting of the receiver to decoder audio giving control to the calling party on the phone.

The controller will remain in the callin control mode until the calling party terminates the callin with the autopatch OFF code or the controller will automatically terminate the callin if no DTMF is entered for 1 complete minute.

Entering any DTMF digit resets this timeout timer. Upon callin termination of the receiver muting is released giving DTMF decoder access back to the repeater receiver.

5.6 Control Receiver Input

Separate DTMF decoder audio and control receiver COS inputs are provided for a control receiver. This receiver is meant only for control purposes with its audio never being repeated.

When the control receiver COS is driven active by the control receiver the controller will mute the repeater receiver to DTMF decoder. The audio from the control receiver will be decoded by the DTMF decoder in the same manner as any other DTMF entered.

5.7 Automatic Invalid DTMF Code Disable

The RC-1000 counts any invalid DTMF code entry and after this count exceeds a programmable limit the DTMF decoding is disabled until the repeater has no input for 20 seconds.

This feature tries to prevent an undesirable user from simply trying DTMF code at random until something happens. The number of attempts before the decoding is disabled is programmable with the "Invalid DTMF Limit" parameter. See Table 15.1 for use of this parameter programming. As received from MCC this parameter is set to 255 effectively disabling this feature.

If the control receiver COS becomes active or a callin from the phone line occurs the DTMF decoding is enabled regardless of the invalid attempts. These two control methods do not affect DTMF decoding of the repeater receiver.

The counter is cleared after NO repeater input for 20 seconds. While PROGRAMMING is on and during an AUTOPATCH the access counter is not operational preventing the disabling of DTMF decoding during these times.

7.0 Remote Base, RC-1000

Two inputs and two outputs on connector P3 are provided for controlling a transceiver for linking to another repeater or frequency. The inputs are remote base receiver audio and receiver high going COS for indicating a remote base receiver input. The outputs are remote base transmitter audio and PTT (low for key).

7.1 Remote Base Receiver Connection

The remote base receiver audio connects to the control on P3-pin 2 and is routed through U9D audio switch. This audio path is off whenever the remote base is off or when repeater receiver input is present giving priority to the repeater user or when there is no remote base receiver COS input.

The remote base COS must go high (2 to 30 volts) to indicate a receiver input. The COS is on P3-pin 4.

7.2 Remote Base Transmit Audio

The remote base transmitter audio is coupled through U9C audio switch from the repeater receiver. This switch is directly controlled by the CPU logic signal that also keys the remote base PTT. This audio path is muted when the remote base is off or when the remote base is not transmitting.

The remote base transmitter audio must be jumpered from J1, hole just below connector P2, to the desired audio source. It can be taken from the repeater receiver or the controller transmitter audio output both of which are on connector P1.

This jumper must be in place for the remote base transmit to function.

When connected to the repeater receiver all audio will pass to the remote base including DTMF. This may be desirable if DTMF control of the remote repeater is desired. However, all DTMF codes will be heard by the distant repeater. If muting of the DTMF is desired the audio should be taken from the transmitter audio output.

The remote base PTT is an open collector output pulling low for keying the transmitter.

It should be noted, however, if the remote base transmitter has relays in its PTT circuit, insure a diode is across the relay coil connected in a similar manner as that shown on the RC-1000 phone line relay schematic.

7.3 Remote Base Operation

The operation of the remote base is turned ON using the Remote Base On code. If the remote base transmit is on and when any input is seen on the repeater receiver input the remote base transmitter will key.

When no repeater input exist the remote base receiver will be monitored through the remote base COS input. With no remote base receiver input the remote base receiver audio will be muted. When an input does occur with the COS going high the repeater transmitter will be keyed and the remote base receiver audio will be unmuted repeating the remote base received signal.

Although it may not be necessary the controller mutes the transmitter audio when the remote base PTT is unkeyed. This is useful when the interface is connected to another on site repeater using simple wiring instead of a transceiver.

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

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 same state it was when the repeater was disabled.

7.4 Remote Base ON Tail Beep

When the remote base is ON a special tail beep at the end of a repeater users transmission can be generated. This beep will occur just after the normal tail beep. The tail beep will not occur at the end of a remote base transmission allowing a user to determine if the end of transmission is from the remote base or repeater.

The tail beep can be turned on and off with the "Remote Base Beep" control code. When off no remote base tail beep will occur.

The tail beep has two tone settings of 500 and 1000 Hz. The state of the remote base transmit being OFF, receive mode, will force a 500 Hz tone. When remote base transmit is ON the beep will be 1000 Hz. (see section 7.3 below for transmit control).

7.5 Remote Base Transmit Control

The remote base transmit can be controlled using the "Remote Base XMT on/off" DTMF code. When the remote base is ON entering the "Remote Base XMT ON/OFF" DTMF code will toggle the transmit state. When transmit is OFF the remote base beep, if enabled, will be 500 Hz and when transmit is ON it will be 1000 Hz.

When transmit is OFF the remote base will be in the receive only mode allowing the monitoring of the remote base via the repeater, but the remote base will not transmit.

7.6 Remote Base Operation with Repeater Disabled

The remote base can be used as a second repeater input and also as a means of remotely monitoring the repeater receiver input. Normally when the repeater is disabled the remote base does not function. However, with the "REMOTE BASE OP W/RPTR DIS" control code the remote base can be forced to function with the repeater disabled. When this feature is enabled the remote base will function even with the repeater enabled or disabled.

With this feature enabled and the remote base turned on a repeater input will force the remote base to transmit, if transmit is on, and with a remote base receiver input the repeater will transmit.

8.0 DTMF Pad Tester

The DTMF pad tester is provided to allow testing of the DTMF decoding. The tester is turned ON with #0. When ON the user is to enter a single digit and if decoded the controller will send the decoded digit in CW at the end of the

users transmission. The user can enter all of the 16 DTMF digits listening for the CW after each digit. The 0-9 and A-D will be sent in CW 0-9 and A-D and the * will send a S and the # will send a P.

The pad tester will automatically turn itself OFF if no repeater input occurs for 15 seconds. It can also be turned off with the autopatch OFF code. The pad tester is also turned off whenever an autopatch is in process.

9.0 Repeater Identification, RC-1000

The controller has a CW ID control program for identifying the repeater system. The ID takes place at the programmed time and speed. The ID is forced on power up and only when the repeater is in use.

The CW ID is sent at the proper time when the repeater is in use. This time is set by the ID Timer Interval. When it is time to ID the controller waits for the end of a users transmission preventing competing with the user. This is known as a smart or polite ID.

The only exception to this is the controller will not go for more than 10 minutes without identifying. If at the 10 minute point the repeater has not identified and a user is transmitting on the repeater input the controller will send the CW ID.

Timing of the ID is controlled by the programmed ID Timer Interval. This timer is in 10 second steps and the value programmed is in hexadecimal. The timer can be set from 20 seconds to 42 minutes.

The ID tone is user programmable in 1000 Hz/n where n is the programmed "CW ID Tone" value.

Section 15 describes the programming of the CW ID and its parameters.

The CW ID can be enabled and disabled using the CW ID Enable/Disable control code. When disabled no CW ID will be sent.

9.1 Continuous CW ID

The controller normally identifies only when the repeater is in use with a final ID after repeater usage. However, their are times when one wishes for the repeater to ID at the normal ID time interval even with no repeater activity. This mode can be forced with the Continuous CW ID control code. This code is a single control code which will toggle the continuous state of the continuous ID mode. When enabled the controller will ID at every normal ID time interval with or without activity. When disabled the control will ID only

with repeater activity at the normal ID interval.

9.2 External ID

An external ID output strobe is provided for allowing the user to provide an external ID such as a tape or voice system.

The operation of the external ID is that when the controller determines it is time to ID the input activity to the repeater is examined to determine if no repeater input has occurred in the previous 10 seconds. If an input did occur the internal CW ID is used to identify the repeater. However, if no input occurred the controller checks for the external ID to be enabled. If not enabled again the internal CW ID is used. If the external ID is enabled the external ID strobe is forced low then high.

There are two outputs for the external ID, External ID output and External ID play/record output.

The external ID can be force with the "Force External ID" code. The output is TTL (low is less than .6 volts and high is greater than 2.4 volts) and can drive 4.7 kOhms.

The external ID can be enabled and disabled with the use of a control code. If the CW ID is disabled the ID will be from the external ID only if enabled. If the external ID is disabled only the CW ID will be used. If both are disabled no ID will be sent.

9.3 CW ID Tone Control

The CW ID tone can be programmed by the user of 1000/n Hz where n is the parameter value programmed. The tone value is stored in EEPROM.

9.4 Repeater Access Telemetry

When programming the CW ID a special control character can be placed within the CW ID table to force repeater mode indication. When programming the ID if the sequence of "222222" (six 2s or dahs) is entered will force the mode of the repeater to be sent at that point within the ID. If the repeater is disabled the CW character "D" will be sent at this point. If the access mode is sub-audible or sub-audible tone the CW character "P" is sent. If enabled and in carrier access no character is sent.

9.5 Battery Operation Indicator

The RC-1000 has two power inputs of 12 VDC and BATTERY. Both of these are identical inputs isolated with diodes and each can power the controller.

However, it may be desirable to know if the controller is being powered from a battery to allow monitoring of the battery usage.

AUX 2 can be forced to operate as an input to indicate if the AC power is off and operating on battery. Battery operation is indicated by a special character being inserted in the CW ID programming which will force the controller to sample AUX 2 and if high give a "B" in CW within the CW ID.

To use this feature the repeater owner must connect the coil of a 115 VAC relay across the AC power. The relay contacts of the relay should be connected to AUX 2 and ground. When the AC power is on the relay will energize grounding AUX 2. When the AC power is off the relay will open letting AUX go high and when the CW ID is sent and the special character is found the controller will automatically send the character "B".

The special character to be programmed is "222221 (five 2s & one 1).

NOTE: If the special character is programmed AUX 2 cannot be used as an AUX output. If the special character is not programmed AUX 2 can be used in the normal AUX output mode.

10.0 Tail Beep Control

The controller provides a tail beep at the end of a users transmission to signal other users of end of transmission. The tail beep is made up of 4 segments with each segment being either 1000 Hz/N where N is the segment digit programmed or 0 for no tone .

The tail beep is programmed with select code 4055 followed by the four digits to determine what the tail beep will be. As an example if the tail beep segments desired were to be 1000 Hz, no tone, 500 Hz and 330 Hz one would enter:

4055 1023

The time the tail beep occurs within the tail can also be programmed. This parameter is known as the "TAIL BEEP TIME" and is in 0.1 second steps.

To program the tail beep see Section 15.

The tail beep is sent to signal other users a user has stopped transmitting. One other thing the tail beep signals. When the tail beep is sent the repeater time-out timer is reset.

Often it is desirable for the users to leave some time between their transmissions to allow other users to break into the repeater. By setting the "TAIL BEEP TIME" long, say 2 seconds, then the users will become accustom to leaving some time between transmissions as long as the users know the time-out timer is reset only on the tail beep.

11.0 Sub-audible Tone Decoders, RC-1000

If sub-audible operation is desired for the repeater and/or autopatch operation an optional external sub-audible decoder must be installed. The operation in the sub-audible mode is controlled within the controller determining if a feature must have sub-audible tone to function. This allows the selective use of sub-audible tone for some features and not required for others such as having the repeater in carrier and the patch in sub-audible tone mode.

The decoder need only be connected to the receiver and to the controller. The receiver must supply the sub-audible tone to drive the decoder for decoding and the logic output of the decoder is connected to the controller at the "PL Input" logic input, P3-pin 7. When the decoder is decoding its output must go low and is limited to 0 to 5 volts. The controller will see this low signal as a valid decoder input and the controller will take the required action. No additional connections other than power for the decoder are required.

11.1 Tone Decoders

Most commercial repeater manufactures either use their own tone unit designs or employ third party tone units. Probably the most widely used decoders are from Communications Specialist, Inc's (phone 800-854-0547). They manufacture two decoders which are described below.

11.1.1 TS-32P Tone Decode/Encode Unit

The TS-32P is a dip switch tone frequency selectable decoder and encoder. Communications Specialist no longer manufactures this unit and has replaced it with the TS-64 (see below for TS-64 information). However, many of these units are in the field and is described here.

To use the TS-32P decoder with the RC-1000:

1. Connect the TS-32P's OUT-1 to the RC-1000's "PL DEC Input", P3-pin 7.

2. Connect the TS-32's "TONE INPUT" to the receiver audio. This receiver audio must have low frequency response and is usually connected to the receiver

discriminator output.

3. Connect the TS-32's +V input to +6.0 to +30.0 volts, its ground to power ground and its "HANG UP" must be grounded.

4. Set the TS-32's dip switches to the proper positions for the tone frequency desired. See TS-32 data sheet for these settings.

5. Remove JU1 on the TS-32P.

After the TS-32 has been connected the RC-1000 must be placed into sub-audible tone mode with the programmed control codes. As state earlier there are a number of features which can require the sub-audible tone. For these features to require sub-audible their modes must be enabled.

11.1.2 TS-64DS Tone Decoder/Encoder Unit

The TS-64DS is a dip switch tone selectable decoder/encoder for sub-audible tone operation. It should be noted the TS-64 comes without the dip switch unless the TS-64DS is specified. Without the dip switch solder pads are provided for selecting the tone frequency.

The TS-64DS is supplied with a connector and color coded wires for identifying the various inputs and outputs. The following is a table describing these wires and how they are used with the RC-1000.

TS-64 wire	WIRE LABEL	FUNCTION	CONNECTION
VIOLET	HANG UP	decode disable	ground
ORANGE	PTT INPUT	turns on encoder	ground for encode
BLUE	HIGH PASS OUT	HP filter output	no connection
YELLOW	TONE OUTPUT	encode tone out	no connection
WHITE	RCVR MUTE	decode logic out	PL DEC Input, P3-pin 7
GREEN	DISC INPUT	decode audio in	rcvr discriminator
BLACK	GROUND	power ground	power ground
GRAY	PTT OUTPUT		no connection
RED	POWER	power input	6 to 20 volts

Also JP7 on the TS-64DS must be jumpered. This forces the mute output low when the tone is being decoded.

Set the TS-64DS's dip switches to the proper positions for the tone frequency desired. See TS-64DS data sheet for these settings.

The TS-64DS's RCVR MUTE (white wire) is the decode logic output. It is this logic output for connection to the RC-1000'S "PL DEC Input", P3-pin 7. It is to go low with decode.

11.2 Tone Decode Trouble Shooting

If sub-audible operation does not function properly the following are trouble shooting steps. Both the TS-32P and TS-64DS are addressed.

1. When decoding the TS-32s OUT-1 or TS-64's RCVR MUTE WHITE wire, connected to PL DEC Input, is to go low and when not decoding it must be high. The HANG UP must be grounded or the output will remain low in the decode state.

2. If the TS-32s OUT-1 or TS-64's RCVR MUTE WHITE wire remains low disconnect from the RC-1000 PL Decoder Input. This input should now be about 5 volts. If not the RC-1000 has a problem on this input. If high then reconnect TS-32s OUT-1 or TS-64's RCVR MUTE WHITE wire to RC-1000 PL DEC Input. If remaining low either HANG UP not grounded or decoder board has a problem.

3. If TS-32s OUT-1 or TS-64's RCVR MUTE WHITE wire remains high during decode dip switches might not be set for proper tone frequency or the "disc" input is not connected to proper point on receiver or the decoder has a problem.

11.3 Sub-audible Tone Encoding

The above does not use the TS-32's or TS-64DS's high pass filter or tone encoding. The high pass filter is used between the repeater receiver and RC-1000 to remove the received sub-audible tone so it will not be re-transmitted.

The encode feature can be used by simply connecting the TS-32's ENCODER OUTPUT or the TS-64DS's YELLOW wire to the transmitter designated tone input. The normal transmitter audio input usually will not pass this low frequency audio so a special input is provided on most FM transmitters for the tone encoder. There is a pot on the TS-32 and TS-64 for adjusting the encode level.

12.0 Controller Installation, RC-1000

Installation of the controller requires little effort and can be done in less than two hours. It is recommended the Getting Started section in the front of this manual be initially used for preliminary install.

Installation requires the connection to connector P1 of 10 to 15 volts DC power, receiver COS, receiver audio, transmitter audio, transmitter PTT and the phone line. Also the controller ground must be connected to the receiver ground, transmitter ground and power supply ground. Separate connections are recommended for these grounds.

The following is a description of each of these connections.

12.1 Controller Power

The controller provides a 12 volt battery input and 10 to 15 volt power supply input. Due to the low power of 100 ma max the controller can often be powered from the repeater power supply. The diode CR3 acts as an isolation diode for coupling an external battery to the controller when AC power is lost. However, this battery is needed only if the controller is needed to operate during AC power loss. The battery is not needed to keep the controller memory intact.

Two on board regulators include a 7805, +5 volt regulator (U7) for the logic circuits, and an 8.2 volt zener diode (CR1) for regulation of the audio circuit voltage.

See assembly drawing for the connection of the DC power input connections to P1-pin 8..

12.2 Repeater Connections to the Control

The following connections must be made to the repeater. Refer to the assembly drawing in the rear of this manual for the locations of the needed connections.

12.2.1 Repeater Receiver COS Connections

Two inputs are provided for connection to the receiver; COS and audio. The COS is a DC signal going high (2 to 30 volts) or low (0 to 0.5 volts) with a valid repeater receiver input. It is usually obtained from the squelch switch and is the same type of signal for driving a receive indicator lamp often found on modern receivers. The active state of the COS input can be high or low and is controlled by jumper JP1 (COS Level). With no jumper in JP1 the COS inputs requires 2 to 30 volt (high) signal to indicate a valid repeater receiver input and 0 to 0.5 volts (low) for no input. With JP1 in place the COS requires 0 to 0.5 volts for a valid receiver input and 2 to 30 volt for no input.

12.2.2 Repeater Receiver Audio Connections

The receiver audio input drives the controller DTMF decoder, autopatch phone line amp and the transmitter audio buffer. The audio should pass through the controller and should not go directly to the transmitter. The audio can be obtained from the speaker output or if available directly from the discriminator. The controller will squelch the audio when no input exist for allowing unsquelched audio from the receiver.

Connection of the COS and receiver audio should be made at the designated points on connector P1 shown on the assembly drawing in the rear of this

manual.

12.2.3 Repeater Transmitter Connections

Two transmitter outputs are provided on the controller: PTT and transmitter audio.

12.2.4 Transmitter PTT Connection

The PTT is an open collector transistor, Q5, and can handle 75 ma. during keying and 30 volts unkeyed. The PTT output pulls 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 across the transmitter relay coil with the cathode (banded end) to the relay supply side and the anode to the PTT side of the relay. For an example the RC-1000 phone relay RL1 and CR2 have this same arrangement.

12.2.5 Transmitter Audio Connection

The transmitter audio output is an op-amp buffer amplifier capable of driving 1000 ohms. It is recommended that the transmitter audio be coupled to the transmitter audio circuits a couple of stages after the mike input. The mike input usually requires very low level voltages and almost any stray signal such as noise and hum picked up by the connecting cables will be transmitted. Later stages require higher signal level for which the controller can supply. If the mike input is used and it is found the controller has too much audio a resistor divider should be inserted between the RC-1000 TX Audio Output and the repeater transmitter mike input. This resistor divider consist of a resistor between the control and transmitter audio input and another resistor from the transmitter audio input and ground. As a starting point the series resistor can be 15 kOhm with a 2 kOhm to ground. Increasing the 15 k or decreasing the 2 k will reduce the audio drive.

12.2.6 Phone Line Connection

The two wire phone line may be directly connected to the controller without the need for a coupler. Simply connect the two phone wires to the designate point as shown on the assembly drawing. Normally the polarity of the phone line connections is not a problem. However, it is recommended the RED wire be connected to hole closest to the corner of the RC-1000 PC board and the GREEN wire closest to the relay, RL1.

12.3 Audio Adjustments

There are level adjustments pots on the controller. Three adjust receiver audio, three adjust phone levels and one adjust ID/tone levels. The following is the procedure for adjusting each.

The procedure should be followed in order given, but is not required in that each level is independent from the others.

12.3.1 CW ID Level Adjustment, R1

The CW ID and tone generator levels are adjusted with R1. This adjustment should be adjusted with the CW ID running or using the tail beep if selected.

The ID is sent whenever the controller is powered up and with DTMF "Force CW ID" code. The tail beep occurs at the end of a users transmission. The recommended level is 1 to 2 kHz deviation.

NOTE: The proper setting of the CW ID and tail beep level is about 1/3 from minimum. If one finds the desired setting is very low this indicates the controller has much more transmitter audio than necessary. It is recommended the 15k/2k resistor divider described in section 12.2.5 above be installed between the controller and transmitter.

12.3.2 Receiver to Transmitter Level, R3

The receiver to transmitter audio level is controlled by R3 and should be adjusted for the same level coming into the repeater receiver as going out the repeater.

Using an oscilloscope across a monitor receiver speaker terminals is a good indicator. In this setup one should sample a transmission directly from a users input. Then tune the receiver to the repeater output and with the same user transmitting adjust R3 for the same repeater output level. In this procedure a single continuous tone should be used. This is often easy to obtain by using a tone pad using digit 5. Other digits may cause muting of the transmitter audio due to the controller muting action.

12.3.3 Receiver to DTMF Decoder Level, R4

The receiver DTMF decoder level is adjusted by R4. When the decoder detects DTMF pin 18 of U4 goes high until the tone is removed. Using a voltmeter or oscilloscope monitor U4-pin 18 and provide a repeater receiver input with DTMF digit 8.

From the fully CCW position slowly adjust R4 in the CW direction until pin 18 goes high (4 to 5 volts). Note this setting of R4.

Continue to adjust R4 CW until pin 18 returns low (near 0 volts) and note this setting. If R4 is adjusted all the way CW and pin 18 remains high use this fully CW point for the high limit setting.

Now adjust R4 to the point half way between the two noted setting. This should provide for a wide range of levels for the DTMF decoder to operate over. Normally the decoder will accept a 10 dB range providing more than is typically necessary for accepting many different users.

The audio the decoder actually sees can be observed with an oscilloscope at U4-pin 3. This is the output of the decoder op-amp. This will provide a better picture of the DTMF audio level. The recommended setting is when entering digit 8 the level at pin 3 should be 1 to 2 volts peak-to-peak adjusted by R4.

Various DTMF pads can be tested with the pad tester using #0 to turn on the tester. Then by entering one digit at a time and listing for the controller to return the digit in CW each digit can be tested. All 16 digits should be tested.

We find almost all decoder problems are with level adjusted by R4.

Very seldom does one find a rig to have a DTMF problem. If one can monitor a rig's DTMF on another and it sounds clean then the rig is most likely to be functioning properly.

12.3.4 Phone to Transmitter Level Adjustment, R6

To make the adjustment of R6 one must make an autopatch. As shipped from MCC the RC-1000 has autopatch ON code of *41 and OFF code of #1.

To adjust R6 first enter the autopatch ON code, *41, and drop the repeater input and listen for a dial tone. When the phone line connects adjust R6 until a pleasant and loud enough dial tone is heard on a monitor receiver tuned to the repeater output.

Now enter a phone number for a party who can assist in adjusting the phone level. When dialing masked dialing tones will be heard on the repeater output.

After the party has answered ask them to give normal audio into their phone and adjust R6 for the desired level.

12.3.5 Receiver to Phone Level, R2

This adjustment requires a distant party to be called on the phone. If pulse dialing is required it must be selected.

Call a party who can aid in providing phone voice audio level advice. Access the patch with *41, listen for a dial tone and when heard dial the desired phone number.

After the called party answers talk normally into the HT and adjust R2 for the desired level as advised by the called party.

12.3.6 Phone to DTMF Decoder Level, R5

As with the receiver to decoder level adjustment U4 pin 18 is to be used for this adjustment. Call a party who has a DTMF phone and who can assist in making this adjustment. After the called party answers instruct him/her to press a long digit 8 on the phone DTMF pad (note: due to the phone system DTMF pads generating very high level tones this adjustment should use a distant phone and not a pad placed over the phone mike. Also do not use a phone on the same line as the repeater line).

Adjust R5 CW for a high (4 to 5 volts) on U4-pin 18 and note this setting. Continue adjusting R5 CW until pin 18 returns low and note this setting. Adjust R5 half way between these settings.

Now insure the autopatch can be shut down with a users rig. If not adjust R5 slightly CCW until the user can shut down the patch.

This completes audio adjustment of the controller.

13.0 AUX Output

Pins 5, 6 & 7 of connector P2 are AUX outputs for use by the owner in selectively turning ON or OFF external devices such as repeater amplifier, tight or loose squelch, coffee pot so it will be ready on arriving at the repeater at 2 AM or whatever the owner requires. The outputs are controlled with control operator DTMF codes. An AUX output is high (2.4 to 5 volts) when ON and low (below .6 volts) when OFF.

Each output can be forced to a latched ON or OFF state. One control code is used to select the state of all three AUX outputs. This is known as the "AUX Output" code.

The following table describes the codes use.

AUX 1 ON	AUX output code followed by 1
AUX 1 OFF	AUX output code followed by 4
AUX 2 ON	AUX output code followed by 2
AUX 2 OFF	AUX output code followed by 5
AUX 3 ON	AUX output code followed by 3
AUX 3 OFF	AUX output code followed by 6

Using the above each AUX output can be latched ON or OFF using the two codes in the list. Each output can be selected to the desired state and one output does not affect another. The digits for controlling each output is arranged on the DTMF pad so as to make it easy to remember which AUX output is controlled by which digits. If one looks at a pad one will note the left most column will control AUX 1. The next column will control AUX 2 and the third will control AUX 3. In all cases the top digit turns ON the AUX and the digit in the row below turns it OFF.

14.0 IN CASE OF DIFFICULTY

After installation of the RC-1000/RC-1000V and problems are encountered the following items may give a solution. These items have been the most often encountered in the experience of MCC. If the below does not offer a solution please feel free to call MCC any time day or night.

AUDIO LEVEL PROBLEMS High transmitter level...the best gage for determining the proper level to the transmitter is the CW ID pot R1 setting. Pot R1 adjust this level and R1 should be set between 1/3 to 2/3s the total pot swing. If R1 is set below 1/3rd then controller has to much audio for the transmitter.

If level too high with R1 near bottom insert a resistor divider network between the controller audio output and transmitter audio input. A good start would be inserting a 15k resistor in series with the transmitter audio and a 2k to ground on the transmitter side. By increasing the 15k will reduce the level.

_____ Receiver to transmitter level too high...R3 adjust this level. If R3 at lower part of pot this usually is caused by receiver audio level being to high.

The level can be reduced by inserting a resistor between the receiver and RC-1000/RC-1000V receiver audio input. A 20 kOhm resistor is a good start.

DTMF DECODER PROBLEMS DTMF decoder does not respond...R4 adjust receiver to DTMF decoder level. We find almost all of our decoder problems are with level.

Very seldom do we find rigs having encoder problems.

The voltage on U4-pins 1, 2, 3 and 4 should be close to 2.5 volts. If not then either U4 defective or some outside on board problem is causing a problem.

When any DTMF digit except 5 is decoded the control mutes (turns off) the repeated audio. Using a receiver to listen to the repeater output, entering a digit other than 5 and very slowly adjusting R4 until the repeated audio is muted.

Also, the decoder U4-pin 18 will go high (3 to 5 volts) when a digit is decoded.

Also the audio the decoder is seeing can be checked at U4-pin 3 using an oscilloscope. At U4-pin 3 the DTMF audio level should be 1 to 2 volts peak-to-peak. NOTE: many of the U4 pins are used to interface to the CPU. These pins are continually going high/low at a rapid pace. If a volt meter is used to measure these lines 1 to 2 volts will be seen, but the measurements will mean nothing. A scope must be used, even then proper operation cannot be determined.

No audio through controller...insure COS level proper as stated above. Jumper JP1 sets the level for going high or low.

Insure DTMF decoder (U4) pin 18 low (0 to .7 volts). If high then decoder is defective or X2 crystal bad.

Can test U3 audio switch by shorting pins 3 & 4 (short will NOT damage device). U3-pin 5 should be high with open squelch.

TRANSMITTER AND COS PROBLEMS

NOTE: Often we get RC-1000s returned for repair with the problem being the unit is dead. Being dead often means the repeater transmitter will not key. The first thing we do is the following:

1. power down the control.
2. ground pin 10 of the CPU.
3. with pin 10 grounded power up the control.
4. if the transmitter now keys and you hear the tail beep remove the pin 10 ground and enter the Repeater Enable code, the first code in the code list.

If the above works it means the controller had been put into a shut down state. The codes, ID, etc you had programmed are still stored in U8. However, the

tail beep, timer values and the desired controller state (PL, functions disabled, etc.) will need to be set.

If the repeater still does not key then follow the below suggestions.

Repeater remains keyed and no CW ID on power up...this is usually due to the COS level being opposite to what control expects. As received from MCC the COS setup with no receiver input (squelch closed) a 0 to .5 volts should be seen at COS input and with a receiver the COS should be between 2 to 30 volts. To check open the squelch and see if ID is sent. If so level is opposite and "COS LEVEL" jumper JP1 must be inserted. This will invert the expected COS level required by the controller.

See controller drawing for the JP1 location. To verify COS proper for control with open squelch pins 5 and 6 of U3 should go high (3 to 5 volts). If high with squelch closed and low when squelched the COS is inverted and must install COS LEVEL jumper JP1.

When powered up transmitter remains keyed...has dial tone from phone line and no codes are recognized...CPU is not running. This can be caused by many problems. CPU defective, X1 crystal defective (can check with oscilloscope), Q2 defective, shorted C1 or defective 7805 (U7) 5 volt regulator. Measure voltage on CPU (U1) pin 9...should be low. If high ground with jumper and if operation proper CPU OK, but defective reset circuit (Q2, C1, etc). Check C1 (10 uf cap) for short or leaky or defective Q2. If X1 has no signal defective X1 or CPU.

U7, the 7805 regulator should have at least 7 volts at its input and 5 volts should be 4.75 to 5.25 volts. CPU may affect 5 volts...remove CPU and measure 5 volts. If now 5 volts CPU bad. If not remove other ICs and check 5 volts.

_____

CPU hot and/or with brown burn spot in top...CPU bad.

_____

R38 brown or charred...controller drawing way too much current. Most probable cause bade CPU and/or EEPROM, U8.

_____

When powered up continuous recycling of patch relay...capacitor C22 defective or open.

_____

If on power up and CW ID sent and has tail beep, but transmitter remains keyed...check pin 39 of CPU (U1). When CPU wishes to unkey repeater pin 39 goes low (0-0.5V) and when keyed pin 39 goes to .7 V. If pin 39 goes low and

transmitter remains keyed defective Q5.

Q5 can be damaged if the repeater transmitter has relays in its keying circuit and no diodes are across relay coils. See patch relay schematic for proper connection of diodes across a relay coil. Also, PTT may require more current than Q5 can handle (100 ma).

Repeater will not key on power up...controller is in master disable or defective PTT transistor, Q5. Enable with MASTER ENABLE control code. To check Q5 base will be .7 V for transmit and 0-0.5 V when unkeyed. If base goes high on power up, but no transmitter key defective Q5 or PTT not connected correctly.

If the CPU is removed and with power applied to the controller the transmitter should key. If the transmitter does not key then defective Q5 or PTT not connected correctly.

To check for the PTT correctly connected to the transmitter short to ground Q5 collector and transmitter should key. If not PTT wiring to transmitter is incorrect.

Repeater will key when powered up and ID, but will not key on receiver input...repeater disabled or in PL access mode or anti- kerchunker on. If disabled or in PL correct with control codes. Anti-kerchunker will require 1 second of input. Check for proper signals on U3 pin 6 as described in COS level section.

NOTE: On power up controller should key and send CW ID.

PROGRAMMING PROBLEMS

Cannot turn on programming...the DTMF decoder must be decoding properly for programming. Turn ON pad tester with #0 and insure all digits decode. When turning on programming insure at least seconds between code 1 and code 2. After entering code 2 a tone/high tone will be heard if programming was turned on.

Code programmed does not work...might have entered A, D, # or * when programmed code. When programming codes the first digit need not be entered. As example if code desired was A12 try AA1 as code. If proper response must reprogram code without entering A. Also, the # codes are # and a single digit.

However, when programming the # codes two digits must be programmed with the first digit always being a 0. If code is to be #7 then when programming must

enter 07. CW ID PROBLEMS Cannot program CW ID...programming must be on for CW ID programming. When programming CW ID the CW ID PROGRAM code must first be programmed using 4143 followed by two digits to be programmed as code. After programming code entered next enter the desired CW ID using 1s & 2s and *. The # will terminate programming and the CW ID entered will automatically be sent. If after programming the ID is not changed either programming or CW ID programming were not on. If no CW ID exist after programming usually this means the * does not function. Test with pad tester.

CW ID is nothing but clicks...tone set to low. Set tone with select code 4057 (02 = 500 Hz).

CW ID sends long tones or clicks...speed set too low. Set speed with programming select code 4053 (07 = 15 WPM).

AUTOPATCH PROBLEMS Patch does not dial proper number or no dialing...Pot R2, the receiver to DTMF decoder level, is improperly set.

When accessing patch and relay energizes, but no dial tone heard... phone not connected, R6 (phone to transmitter level) set to low or defective phone to transmitter audio. With patch relay energized test U3 audio switch by shorting pins 1 & 2. Pin 13 should be high with receiver squelched (no input).

Cannot terminate patch after patch on...R5 (phone to DTMF decoder level) set to high.

Cannot access patch...code either not programmed or patch in store and forward mode. After accessing patch no tail beep will be heard if access accepted. This indicates controller is waiting for user to enter phone number.

On call in phone answers quickly...number of pulses to answer programmed to low. The number programmed is number of ring pulses and not rings. Phone rings at 20 Hz pulse rate so a 1 second ring will generate 20 ring pulses. Make number high with highest number being set by programming #0 as number.

Reverse patch never answers phone...reverse either in no answer mode or defective U6. Phone busy when controller reverse patch called by distant party...capacitor C16 defective or phone relay energized. If relay energized check Q6 base. It will be .7V if CPU wishes to connect phone. If high either CPU wishes to connect line or CPU defective. If low and energized either

defective Q6 or short on relay. When relay energized Q6 collector should be low and when relay off should be same voltage as controller power input (12 VDC).

15.0 Programming the RC-1000/RC-1000V

Contained on the RC-1000/RC-1000V controller is an Electrically Erasable Programmable Read Only Memory (EEPROM). Unlike the 87C52 EPROM the EEPROM data can be altered and unlike RAM the memory is retained when power is lost. Special software has been incorporated within the 87C52 to control reading, writing and controlling the EEPROM. Also the EEPROM has build in features for protecting its data. When power falls below 4.5 volts it places itself into a no write mode. To enable EEPROM write the 87C52 must send a string of bits in the correct order to the EEPROM. This insures data will not be altered even during undefined and unknown conditions.

When power is applied to the RC-1000/RC-1000V the controller initialization data is fetched form the EEPROM. Certain items are forced OFF (DTMF pad tester, EEPROM programming, etc.), but the state of the repeater functions such as autopatch PL/carrier access state are retained from the last time they were set. The CW ID is also stored in the EEPROM and is fetched when time to send. Also the DTMF codes are stored in the EEPROM.

The EEPROM data can be altered with the proper DTMF codes and sequence. We refer to this as programming. The software has the features for forcibly turning off programming preventing tampering of the data by undesirable sources.

This section will describe how to turn on programming, how to enter the desired data and how to turn off or disable programming.

The following data is stored in the EEPROM:

1. Power up conditions and parameters.
2. All control & user codes.
3. Repeater, autopatch and tail time-outs.
4. CW ID with tone frequency and speed
5. Tail beep and tail beep timing.
6. Autodial phone numbers.

As received the controller has only the Programming Enable codes and all other codes are erased. The CW ID is set to INIT ID/R.

15.1 Programming Introduction

This section describes the programming of the RC-1000/RC-1000V in detail. However, due to the user being new to the programming this part of the programming section is made to provide examples enabling one to ease into the programming.

15.1.1 Getting Started

Prior to performing any programming of the control the programming must be enabled.

To enable programming perform the following:

1. Enter the default Programming Enable Code 1 D7B.
2. Wait at least 3 seconds.
3. Enter the default Programming Enable Code 2 D7C.
4. If accepted a tone/high tone response will be heard.

The above procedure is used any time programming is to be enabled and must be performed if the control either loses power or programming is DISABLED with the default Programming Disable code D7A.

Programming enable 1 and 2 codes can be changed and it is advised this be done because all controls shipped from MCC have these default programming enable codes.

Another way to enable programming is to Ground U1-pin 7 and enter ##. No response will be heard, but programming will be enabled.

15.2 Programming EEPROM Data

As mentioned previously various data is stored within the EEPROM. Using DTMF the user can alter the data to his liking. The following describe the various data and how they are entered by the user.

NOTE: For all programming the "PROGRAMMING ENABLE CODES 1 & 2" must be entered to turn on programming. Any attempt to change the EEPROM data without first enabling programming will result in the commands being ignored. However, once the programming has been enabled it will remain enabled until disabled or power is lost.

15.2.1 Forcing EEPROM Default Data

If the RC-1000/RC-1000V has been received from the factory initialization of

the EEPROM has been performed with the initial data and parameters as shown below. Thus, initialization need not be performed.

The initialization erases all codes, then sets the default PROGRAMMING ENABLE 1 & 2 code to D7B & D7C, the PROGRAMMING DISABLE code to D7A, the CW ID to INIT ID/R and then sets the operational state of the control (repeater enabled, time-out 3 minutes, etc).

Whenever the EEPROM was first installed into the RC-1000/RC-1000V or if it is required to be replaced the EEPROM has to be initialized so as to setup the control so the default programming enable 1 and 2 are stored. Then with these codes in place programming can be accessed allowing of programming the other features in the control.

15.2.2 Initialization Procedure

To initialize the EEPROM the user is to do the following:

1. Ground the "INIT" input U1-pin 7 on the RC-1000/RC-1000V CPU.
2. With the init pin grounded enter the DTMF code "AAA".

If the initialization was accepted the controller will give a tone/high tone response and at completion of initialization the CW ID of "INIT ID/R" will be heard. This takes about 3 to 4 seconds to complete.

Upon initialization the following parameters will exits.

1. CW ID will read "INIT ID/R".
2. PROGRAMMING ENABLE 1 code will be D7B.
3. PROGRAMMING ENABLE 2 code will be D7C.
4. PROGRAMMING DISABLE code will be D7A.
5. Repeater is enabled, Autopatch enabled, but off. Time-out 3 minutes, tail timer 3 seconds.
6. EEPROM placed in read only mode.
7. The PATCH ON code is *41 and PATCH OFF code is #1.
8. All other codes are erased.

After initialization the repeater parameters and codes must be programmed. The following is a list of the items programmable.

1. Control & user codes.
2. CW ID, ID tone and speed.
3. CW Tail Beep with programming of character.
4. Repeater and Patch time-out programming.
5. Repeater tail timer.
6. Tail beep and timing.

15.2.3 Restoring Programming Enable Codes

As received from MCC and at any time the above initialization is performed the Programming Enable 1 & 2 codes are set to D7B and D7C and the disable code is set to D7A. Also during initialization all other codes and the CW are erased.

However, it is sometimes desirable to restore the programming codes to their default values without disturbing the other programmed data.

The procedure for this is as follows:

1. Ground the INIT pin, U1 (CPU) pin 7.
2. enter the DTMF code ABB.

This will only restore the programming enable 1 & 2 codes to D7B and D7C and the disable code to D7A. No other data will be affected.

15.3 Control Code Programming

All control codes begin with either DTMF digit A or D followed by two digits. When programming a certain control code the only digits to be programmed are the second and third digits.

If a control code is not desired programming the second and third digits to "##" will force the controller to ignore the code. Thus, codes programmed to be "A##" and "D##" will do nothing and are erased.

NOTE: Two control codes cannot be the same. If any two codes are the same then only the first code encountered by the controller will function. However, one can a an A code with the same second and third digit as a D code. Thus one could have A34 as a code and D34 as a code and *34 as a code.

15.3.1 Control Code Programming Example

In the following steps refer to the Table 15.1 Programming Select Code at the end of this section. Also programming must be enabled to program any code.

In this example the REPEATER ENABLE code will be programmed to be A12. All codes can be programmed using this same method.

The first item is to get the select code for the REPEATER ENABLE code from Table 15.1. This select code is 4100. Now to make the code A12 do the following:

Enter 4100 followed by 12.

If programming was accepted the controller will respond with CW characters RR (dit dah dit dit dah dit). If RR is not heard then programming is not on or all six digits were not decoded by the DTMF decoder or too much time was left between the digits.

This entry will make the Repeater Enable code A12. Note the A part of the code was not entered, only the second and third digits of the code. This is because the A is fixed and cannot be changed.

The 4100 select code, as with all 4000 series codes, are for programming various codes and parameters. The 4000 series select codes do not enable, disable, turn on or off anything. They simply are used to program items.

Now to enable the repeater one would enter A12.

When programming the code all 6 digits must be entered with no more than 1 second between each digit.

Briefly this is what was done to program the REPEATER ENABLE control code.

1. The 4100 from Table 15.1 selected the code to be programmed.
   (the REPEATER ENABLE select code is 4100)
2. The 12 forced the code to A12. Note the A was not entered.
   The A part of the code is fixed.

As another example say we wish to make the "Patch Long Dist Enable" code a D59.

We first look to Table 15.1 and find the "Patch Long Dist Enable" select code is 4150. Now we enter 4150 followed by 59. The CW RR will be heard if accepted and the code will now be D59 and the code will be stored in the EEPROM.

This procedure is to be followed when programming all codes. All A and D codes use this procedure with the select code from table 15.1 and the two digits desired.

15.4 User Code Programming

User codes are used to turn features ON and OFF such as Autopatch ON to make a call, Remote Base ON, etc. User codes begin with either * or #. All * codes are three digits and # codes are two digits.

When programming a * code the second and third digit must be entered. When programming a # code two digits must be entered with the first digit always being zero (0).

To program a user code first enter the four digit select code from Table 15.1 followed by the two digits to be programmed.

When programming any # code the second digit can be any digit except 0. #0 is reserved for DTMF pad tester on code.

15.4.1 User Code Programming Example

As an example of a user code programming if the "AUTOPATCH ON" code desired is to *12 we first get its select code from Table 15.1. The select code is 4070. Now to program the code to *12 enter 4070 12 . The 4070 is the select code for Autopatch ON from Table 15.1 and the 12 forces the code to *12.

The # user codes use this same procedure with one slight change. The # codes are not three digits, but are two digits with the first digit being a # and the second being a single digit.

When programming a # code one still must enter two digits, but the first digit is to be a 0.

In the case of the "AUTOPATCH OFF" code if the desired code were to be #3 the code will be programmed by entering 4066 03 . Note the use of the leading 0 in programming the # code. Again when programming a #X code two digits are entered with the first digit always being a 0.

15.5 Star Codes Replace Pound Codes.

All #X codes can be made to be *XX codes. As in the above Patch Off code example if one enters #1 the patch will be terminated. Also if *01 is entered the patch will also be terminated.

When programming the # codes normally a 0 followed by the desired digit is entered. However, if one were to enter something other than the 0 then this # code would not work as a # code, but would work as a three digit * code.

As an example take again the PATCH OFF code. If we wanted to make this code *47 we again find the patch off select code of 4066 and then enter 4066 47. Now the patch off code would be *47 and their would be no # code to terminate the patch.

Any and all # codes can be converted to three digit * codes. The main thing done here is when programming instead of entering the 0 we entered some other digit.

15.6 CW ID Programming

Note: To program the CW ID programming must be enabled.

Programming of the CW ID uses a different programming sequence than control or user code programming. The ID programming is performed by first programming the "CW ID PROGRAMMING" control code. This code places the controller into the CW ID programming mode and while in this mode no control or user codes can be entered.

To program the CW ID perform the following:

1. program the CW ID Programming code.
2. now enter this DXX code.
3. using 1s for dits, 2s for dahs, * for next character and # for end ID programming.

Upon entering # the controller will abort CW ID programming and send the entered ID.

The CW ID Programming code is programmed by first getting the select code of 4143 from Table 15.1. Then enter 4143 followed by the two digits desired for the code. Now by entering the code the CW ID programming will be turned ON.

As an example if we wanted the code to be D12 we would enter 4143 12. If accepted the controller will respond with CW RR.

NOTE: The 4143 12 does not turn ON CW ID programming, but rather programs the code for turning ON CW ID programming.

Now to program a CW ID one would enter D12 followed by 1s for a dits, 2s for dahs, * for end of character and # to terminate programming.

This procedure permits the programming of the ID without any use of a look up table, however, one must know the morse code.

15.6.1 CW ID Programming Example

As an example of programming the CW ID of "(space) W4ABC/R (space)" the following sequence is entered. The CW ID Programming code of D12 from the above example will be used.

To program a CW ID of W4ABC/R do the following:

1. Enable programming.
2. Enter the CW ID programming code, D12 in this example.
3. Now enter

*	space
122*	W
11112*	4

12*	A
2111*	B
2121*	C
21121*	/
121*	R
*	space
#	end programming

If accepted the controller will now send the CW ID "W4ABC/R". If the ID is not sent then the controller did not accept the ID. This could be caused by either programming not on or the CW ID Programming code not programmed correctly.

Also entering the user code "Force CW ID" code will force the ID to be sent.

The * at the end of each character is the end of character entry and advances to the next character. The * entered alone simply places a CW space. Usually it is desirable to have a space or two at the beginning and end of the ID. This allows the repeater transmitter to come to full power and also not drop too quickly preventing cutting off some of the ID.

The # at the end enters the end of CW ID command and aborts the ID programming.

Up to 31 characters can be entered in the CW ID. A character is a full letter or number. An A, B, 7, etc. are single characters. If the programming of more than 31 characters is attempted the controller will automatically enter the end of ID command, #, and abort programming on entry of the 31st character..

15.6.2 Battery Operation Signal

When programming the CW ID entering the character string of 222221 (five 2s and a 1) the controller will use AUX 2 as an input for indicating battery mode. This character can be entered at any location in the ID table. See Section 9 for details.

15.6.3 Repeater Status Signal

Also when programming the CW ID entering the character string 222222 (six 2s) will give the repeater access status with a D for disabled, P for PL or sub-audible or nothing if enabled and in carrier access. This character can be entered at any location in the ID table.

15.6.4 CW ID Speed Programming

The CW ID speed can be set by using the "CW ID SPEED" programming code in the same manner as programming a control or user code. Once the programming has been enabled the CW speed parameter can be entered as a two digit number.

There is no direct correlation between the entered speed parameter and the speed. If the parameter is set to 07 then the CW ID will run at about 18 wpm. Increasing the parameter will decrease the speed and decreasing the parameter will increase the speed.

15.6.5 CW ID Tone Programming

The CW ID tone is set with the "ID TONE" select code 4057 followed by a two digit parameter entry. The ID tone is set to 1000 Hz/NN where NN is the programmed entry. If the parameter is set to 01 the CW ID tone will be 1000/01 or 1000 Hz; a parameter of 02 is 500 Hz, 03 is 330 Hz, etc. Higher the parameter the lower the frequency.

15.6.6 CW ID Time Interval Programming

The ID time is can be set from 20 seconds to 42 minutes and is set in 10 second increments. This is done using select code 4076 followed by the time interval in 10 second intervals. As with all timer values the parameter is in Hexadecimal. One must use the Decimal to Hex conversation table for the proper entry.

As an example if the time were to be set to 9 minutes:

1. convert to seconds which is 9 X 60 = 540 seconds
2. Since in 10 second intervals divide by 10 or 540/10 =54.
3. Look up 54 Hex to Decimal Conversion Table. To the right is the value of 36.
4. Now to set the ID interval to 9 minute = 540 seconds enter 4076 36.

15.7 Tail Beep Programming

The tail beep programmable parameters are the tail beep tones and time the tail beep is sent after COS dropping.

15.7.1 Tail Beep Tone Programming

The tail beep is made up of four continuous segments each 0.1 second long. Each segment can be programmed with a tone of 1000 Hz/N or with no tone.

To program the four tones enter the "TAIL BEEP PROG" select code 4055 followed by the four tone digits, one digit for each segment of the tail beep. Entry of a 0 for a segment results in no tone sent for that segment.

As an example if the tail beep of 1000 Hz, no tone, 330 Hz and 500 Hz were desired one would enter the DTMF sequence of 4055 1032.

The 4055 is the select code for the tail beep from Table 15.1.

The 1032 part of the entry gives a 1000/1 (1000 Hz) tone for the 1st segment, 0 giving no tone for the 2nd segment, 1000/3 (330 Hz) for the 3rd, and 1000/2 (500 Hz) for the 4th.

The tail beep can be programmed out by entering 4055 0000. This will give no tone for all four segments.

15.7.2 Tail Beep Time

The time the tail beep starts after the COS input drops can be programmed with the Tail Beep Time parameter.

To program this parameter enter the "TAIL BEEP TIME" select code 4054 and the desired time in 0.1 seconds. As an example for a desired time of .5 second one would enter 4054 05.

As with all timer values the entry is in Hexadecimal.

15.7.3 CW Character Tail Beep

The tail beep can be forced to be a single CW character. This might be desirable for signaling users of event situations such as a "W" for weather net.

The CW character is programmed in the same manner as the CW ID entry, but is limited to one character and when performing the character programming only one character will be accepted. Also programming must be enabled to program the character.

Once programmed the normal tone tail beep and CW tail beep character can be toggled between using the "CW Tail/Normal Beep" control code.

The CW tail beep character is programmed by first programming the "CW Tail Beep Prog" control code. Then enter this code and using 1s for dits, 2s for dahs and * # for end of programming. When the # for end of character is entered the programming is aborted.

As an example if the "CW Tail Beep Prog" control code were D39 and the character desired were to be a W then entering D39 122*# will program a W. Again programming must be enabled to program the character.

Table 15.1 RC-1000 Control & User Code List

A Codes

Function	sel	code	Function	sel	code
Repeater enable	4100	A_ _	Reverse Patch enable	4110	A_ _
Repeater disable	4101	A_ _	Reverse Patch disable	4111	A_ _
Repeater PL Access	4102	A_ _	Master enable	4112	A_ _
Repeater Carrier (PL off)	4103	A_ _	Master disable	4113	A_ _
Autopatch enable	4104	A_ _	Remote Base enable	4114	A_ _
Autopatch disable	4105	A_ _	Remote Base disable	4115	A_ _
Patch PL Access	4106	A_ _	Control Code disable	4116	A_ _
Patch Carrier (PL off)	4107	A_ _	Control Code enable	4117	A_ _
Answer Phone en	4120	A_ _	Dialing 911 en/dis	4122	A_ _
Answer Phone dis	4121	A_ _	DTMF Access en/dis	4133	A_ _
Remote Base w/prt dis	4124	A_ _	Patch outside line digit	4130	0_

D Codes

Function	sel	code	Function	sel	code
External ID en/dis	4140	D_ _	Patch Long Dist enable	4150	D_ _
Remote Base Beep	4141	D_ _	Patch Long Dist disable	4151	D_ _
Dial 9 en/dis	4142	D_ _	Patch Timeout en/dis	4152	D_ _
CW ID Program	4143	D_ _@	Patch User Mute en/dis	4153	D_ _
DTMF Muting en/dis	4144	D_ _	Patch Normal Timeout	4154	D_ _
(not used)	4145	D_ _	Patch timer reset on input	4155	D_ _
Patch Pulse Dial	4146	D_ _@	* up/# dwn Patch en/dis	4156	D_ _@
Patch DTMF Dial	4147	D_ _@	Reverse Patch Sig en/dis	4157	D_ _
CW ID Continuous	4160	D_ _	Patch Duplex en/dis	4170	D_ _
AUX Output	4162	D_ _	Timeout en/disable	4171	D_ _
CW ID en/dis	4163	D_ _	Programming disable	4172	D_ _ (D7A)
Ext ID Record	4164	D_ _	Programming enable 1	4173	D_ _ (D7B)
CW Tail Beep Prog	4165	D_ _	Programming enable 2	4174	D_ _ (D7C)
CW Tail/Normal Beep	4166	D_ _	PL Control en/dis	4167	D_ _

NOTE: CODES WITH @ REQUIRE PROGRAMMING ENABLED TO FUNCTION.

User Codes

Function	sel	code	Function	sel	code
Remote Base ON	4071	*_ _	Patch ON	4070	*_ _
Remote Base OFF	4061	#_	Long Dist Patch ON	4072	*_ _
A Equivalent	4062	#_	Anti-kerchunker ON/OFF	4073	*_ _
D Equivalent	4063	#_	Patch OFF	4066	#_
Call In ON	4064	#_	PL Override code	4131	*_ _
Patch Reset	4065	#_	DTMF Access code	4132	*_ _
Reverse patch signal	4067	#_	Autodial Prefix	4134	#_
Force CW ID	4126	#_	Remote Base xmt ON/OFF	4125	#_
Force External ID	4127	#_	DTMF Pad tester ON		#0 (fixed)

Repeater Parameter

note: all timer values are in hex. See dec to hex conversion table.

Function	sel	value	default value
Repeater Timeout	4050	_ _ @	12 = 3 minutes
Patch Timeout	4051	_ _ @	12 = 3 minutes
Repeater Tail Time	4052	_ _ @	1* = 3 seconds
CW ID Speed	4053	_ _ @	07 = 15 wpm
CW ID Tone	4057	_ _ @	02 = 500 Hz
CW ID timer interval	4076	_ _ @	3C = 8 minutes
Tail Beep Time	4054	_ _ @	07 = 0.7 seconds
Tail Beep Program	4055	_ _ _ _ @	1234 = 1000 500 330 250 Hz
Nr ring pulse to answ	4077	_ _ @	10 = about one ring
Invalid DTMF limit	4137	_ _ @	255

NOTE: CODES WITH @ REQUIRE PROGRAMMING ENABLED TO FUNCTION.