

RLC-DSP404
Repeater, Link and Remote Base Controller

Software Version 3.00
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Introduction:

The RLC-DSP404 is a powerful tool for controlling radio systems. It features include:

- 12 radio ports, each of which can be interfaced to a repeater, link or remote base
- Commands can be entered from any receiver, the reverse autopatch, or a computer.
- Separate DTMF decoders for each receiver input and the autopatch.
- Voice synthesizer with 680+ word library speaks ID and alarm messages and provides feedback while configuring the controller.
- Nearly all command codes, timer values, and messages are programmable.
- Each message can contain combinations of Morse code characters, synthesized speech words, sound effects, DVR tracks, etc.
- Hundreds of macros allow for the creation of custom commands.
- Real time clock/calendar chip allows the controller to speak the time or date and to execute macros at scheduled times.
- Autopatch with 501 programmable autodial numbers, cover tone, semi-private mode and a variety of voice response options (kerchunk to dial, etc).
- Reverse autopatch with over-the-air ringing, directed callout, or full control of the system.
- Support for frequency control of a variety of HF and VHF/UHF radios for remote bases.
- Extensive security system prevents unauthorized changes.
- 16 analog voltage inputs
- 16 logic inputs
- 16 open collector output drivers.
- I/O alarms can send alarm messages or trigger other actions when conditions change.
- Beaconsing system can repeat alarm messages over the air or call phone numbers until an alarm is acknowledged.

Chapter 1 of this manual contains the information you will need to interface it with your radios. The RLC-DSP404 default settings will allow you to get on the air quickly; setting your ID message may be all you need to do. Almost every feature can be customized if you wish; Chapters 2 through 20 are organized by feature so you can quickly find the information you need. There are several appendices with information you will probably refer to often. Near the beginning of this manual you will find a "Table Of Contents" organized by topic and a "Command List By Number" that lists all of the setup commands in numeric order, along with the pages on which more information can be found.

Nearly every feature of the controller can be configured using a radio with a DTMF pad (a 16-key pad, with 'A', 'B', 'C' and 'D', is helpful for some commands) or with a computer or serial terminal. Using a computer can save you a lot of time in the long run, as you can save a file with all of the commands used to set up the DSP4 and make future changes by modifying that file, then uploading the settings to the controller again. For more information about using a computer with the DSP4, see Appendix F.

If you have questions the manual doesn't answer, there are a variety of ways to get help:

Through the Internet:

- FAQs (Frequently Asked Questions): FAQs and their answers can be found at <http://www.link-comm.com/faqs.html>.
- User's Groups. You can ask questions and exchange information with other users (and us) by email by joining one of these groups.
- Email Us: You can get support for any of our products by emailing support@link-comm.com.
- Support Web Page: Links to the above support options and more can be found at

<http://www.link-comm.com/support.html>.

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Limited Warranty

COVERAGE:

Link Communications, Inc. warrants that its products will be free from defects in materials and workmanship for a period of one year from the date of shipment. During this time, Link Communications, Inc. will cover parts, labor and return shipping. If failure is caused by instances other than manufacturing defects, Link Communications, Inc. will repair the product and bill the customer for parts and labor. Contact Link Communications, Inc. for more information.

What Link Communications, Inc. will not cover:

1. Too much voltage to the controller. The RLC-DSP404 operates at +11V to +15V, negative ground.
2. Damage to the controller by lightning, accident, or incorrect power hook-up.
3. Incorrect unit installation.
4. Damage caused by shipment (damage claims are handled by the carrier).
6. Repairs by other than Link Communications, Inc.

THIS WARRANTY HOLDS ONLY TO THE ORIGINAL PURCHASER

HOW TO GET SERVICE

Please contact Link Communications, Inc. for servicing information and authorization.

SOFTWARE

Link Communications, Inc. holds the copyright on the RLC-DSP404's software and hardware. Changes to the software, copying of the software, and use of the voice code is prohibited without the written consent of Link Communications, Inc.

SOFTWARE UPDATES

Link Communications, Inc. will provide FREE Software updates for 6 months from the date of purchase. Software updates costs will be determined at the release of the update. Manual inserts and shipping are additional.

Return Policy

These policies supersede policies appearing on all other Link Communications, Inc. literature and are in effect for purchases made after March 1, 1989.

- **Please keep all packing material and documentation in the event that your equipment has to be serviced or returned.**
- Before returning any product, you must obtain a Return Authorization (RMA) number. You can obtain this by calling (406) 245-5002.
- **No returns, of any type, will be accepted without an RMA number. Please have the following information on hand when calling for an RMA number:** customer name, invoice number, serial number, and the nature of the problem. All can be found on your invoice.
- All product to be returned must **be returned within 30 days** from the invoice date, 100% complete, and must include manuals, parts bags, and other accessories provided by the manufacturer.
- All defective products will be accepted directly by Link Communications, Inc. for credit, exchange, replacement, or repair at Link Communications, Inc.'s discretion. **After 30 days from invoice date, the manufacturer's warranty applies.**
- All non-defective returns for credit, exchange, or refund are subject to a restocking fee on the schedule listed below. No returns will be accepted beyond the 30 day period. Shipping costs are not refundable.
 - 0 to 10 days 5% restocking
 - 11 to 20 days 10% restocking
 - 21 to 30 days 15% restocking
- **Link Communications, Inc. reserves the right to authorize product returns beyond 30 days from date of invoice. If the product is accepted after 30 days, credit will be issued toward FUTURE PURCHASE ONLY.**

If you have any questions — JUST ASK.

All of us have tried to make sure that this order has been shipped correctly. If we have made an error - we want to make it right. If you have a question or problem with this order, just write or call, and our staff will personally handle your situation.

Link Communications, Inc. is a Montana Corporation

FEIN 81-0490597

User Survey (Optional)

A knowledge of the user base will allow us to better serve you in the future by helping us develop more specialized software and hardware. Please take a few minutes and fill out this questionnaire.

RLC-DSP404 Serial Number _____

(The serial number should be noted on your invoice and handwritten on the DSP4 circuit board)

RLC-DSP404 Purchase Date _____

Application: (Circle All That Apply)

Ownership:

- 1 - Privately Owned Repeater
- 2 - Club Owned Repeater
- 3 - Group Owned Repeater
- 4 - Commercial Business Repeater
- 5 - Other _____

Installation:

- 1 - Wide Coverage Repeater with Chain Links
 - Port to Port Linking
- 2 - Full Duplex Links
- 3 - Half Duplex Links
- 4 - VHF Repeater: Power _____ Make _____
- 5 - UHF Repeater: Power _____ Make _____
- 6 - Link Ports Used as Repeater Ports: Yes No
- 7 - Serial Data Used to Control Repeater: Yes No
- 8 - Other Amateur Repeaters At the Site: Yes No
- 9 - Other Link Communication Inc. Products Used: Yes No

Misc:

- 1 - User Base: Technical Rag Chew Personal
- 2 - Autopatch used on the System: Yes No
- 3 - Frequency Adjustable Remotes: Yes No
- 4 - Linking to Other Repeaters: Yes No
- 5 - Linking Closed Access: Yes No
- 6 - PL Required on Main Repeater: Yes No Varies
- 7 - PL Required on Linking System: Yes No Varies

Please Return to:

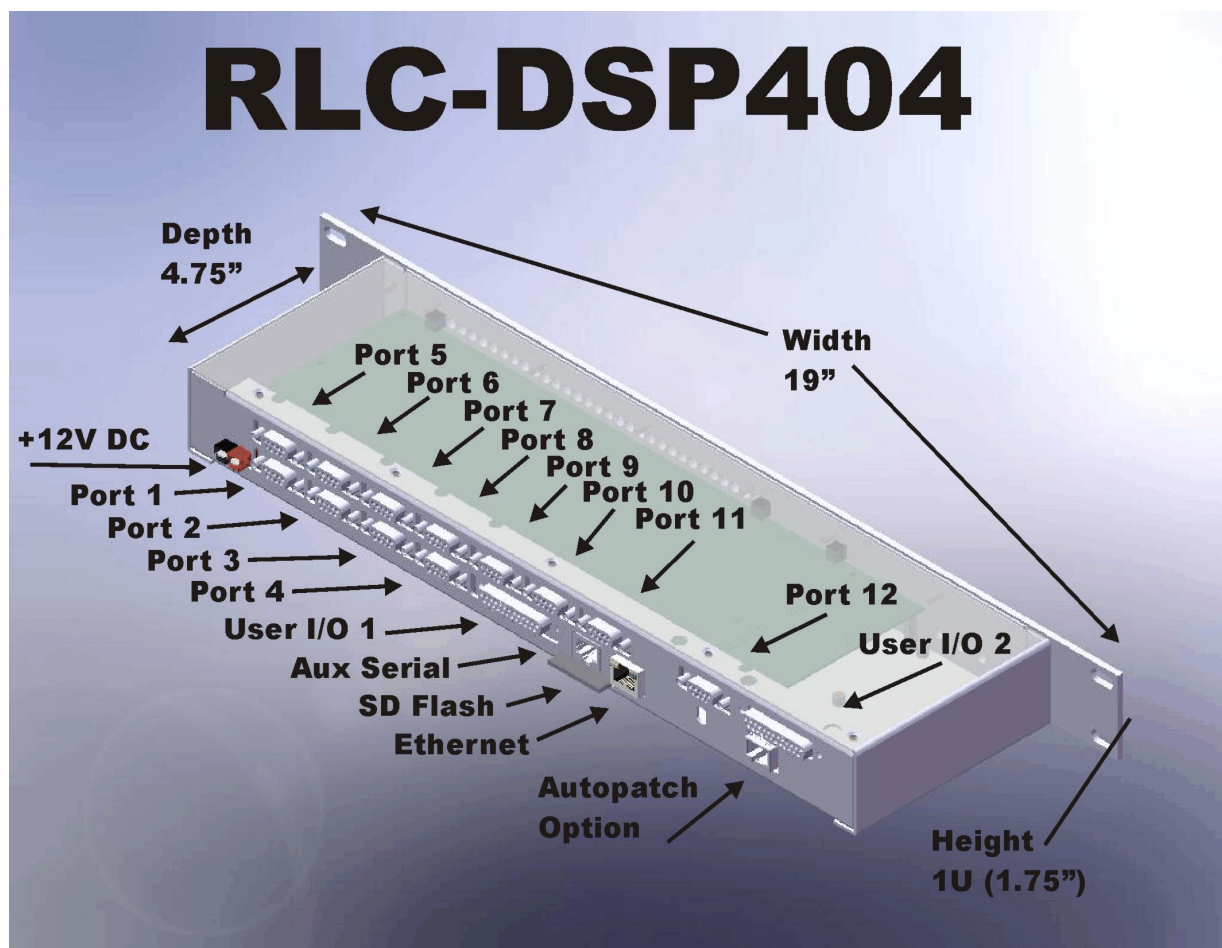
Link Communications, Inc.
1035 Cerise Rd
Billings, MT 59101-7378

Comments:

Chapter 1: Getting Started

Welcome to the powerful RLC-DSP404 advanced DSP based communications controller. The DSP404 supports up to 12 full-duplex radio ports, 16 inputs, 16 analogs and 16 output channels in a small 1U (1.750") enclosure.

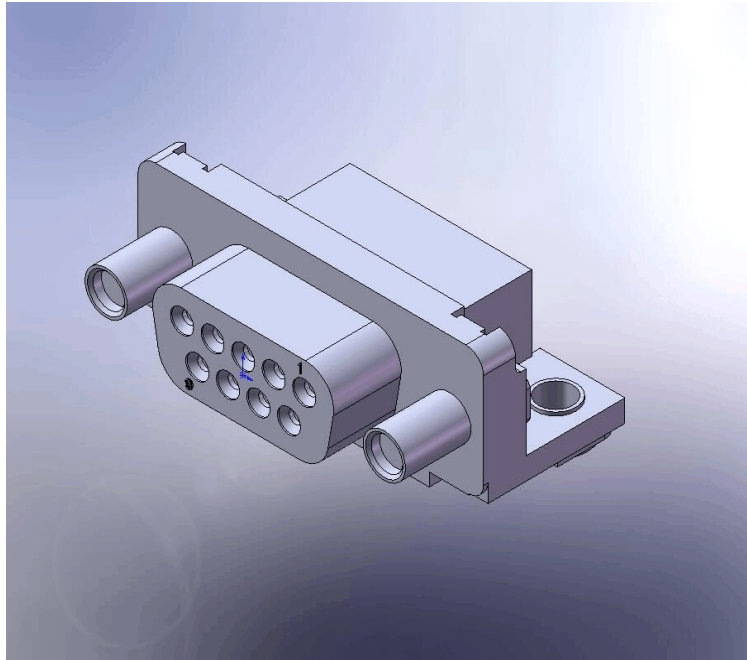
This section will cover the basic mechanical and port locations, radio port DB-9 connector pinouts and the DB-25 I/O connector pinouts. Initial port configuration switches will be explained and detailed. Following the hardware mechanical descriptions a complete discussion on the programming and operation of the included Windows^(TM) Remote Control Interface (RCI) software. Once section 1 has been read, the DSP-404 can be setup and operated. In most cases, the rest of the manual is used for reference only and not necessary for day to day operations of the system.



RLC-DSP404 Port Locations

RLC-DSP404 Radio Port

The DB-9 used on the DSP404 will accept any Link Communications controller based cable, but for extended operations you may need to make a few changes. The DSP404's input and output characteristics are different (in a good way), expanding the flexibility of the types of signals the controller can accept without external changes.



Front View of the DB-9 on the DSP-404

Pin	Default Function	Alternate Function	Default Switch Setting
1	Ground	RS-232 Transmit Data	6 position Switch 1 - Off, Switch 2 - On
2	CTCSS Detect	CTCSS/DCS Output	10 position Switch 8 - Off, Switch 9 - On
3	PTT Out	.....	.....
4	Audio Out	.....	.....
5	Audio In	.....	.....
6	Ground	RS-232 Receive Data	6 position Switch 3 - Off, Switch 4 - On
7	COR Detect	.....	.....
8	Ground	+5 Volt Output	6 position Switch 5 - Off, Switch 6 - On
9	Ground	.....	.....

You will notice that several pins have different functions depending on the switch settings. This enables a 9 pin connector to be used in varying applications without requiring a larger connector. In most instances you will leave the switch settings in their default position. A complete list of switch setting variables is provided below. It is a good idea to decide ahead of time what setting positions you need because you will need to open the case to access them. When the 12 port expansion card is installed you will need to remove that piece to access the lower boards switch settings.

There are two switches per port. The six position switch is for RS-232 serial and power selection. The ten position switch configures receiver and transmit setup functions

Switch	Default	Function
1	Off	DB-9 Pin 1 Function: RS-232 Transmit Data Output
2	On	DB-9 Pin 1 Function: Ground
3	Off	DB-9 Pin 6 Function: RS-232 Receive Data Input
4	On	DB-9 Pin 6 Function: Ground
5	Off	DB-9 Pin 8 Function: +5V Power Available (For smart cables)
6	On	DB-9 Pin 8 Function: Ground

Six Position Switch Functions

Switch	Default	Function
1	On	COR Input Pull-Up (47.5K ohm) to +3.3V
2	Off	COR Pull-Down (47.5K ohm) to Ground
3	On	CTCSS Input Pull-Up (47.5K ohm) to +3.3V
4	Off	CTCSS Pull-Down (47.5K ohm) to Ground
5	Off	Receiver Audio Input De-Emphasis filter, -6dB/octave
6	On	Transmit Audio Output Pre-Emphasis filter bypass, +6dB/octave
7	Off	Transmit Audio Output Gain Range (x3.33) <i>Higher gain when Off</i>
8	Off	DB-9 Pin 2 is a Tone Output from DAC 2
9	On	DB-9 Pin 2 is the CTCSS detect input
10	On	Receive Input Range Select ($\div 2.333$) <i>Higher gain when Off</i>

Ten Position Switch Functions

RLC-DSP404 I/O Port Pinout

The DB-25 used on the DSP404 will accept any Link Communications RLC-3 based cable. The I/O portion of the DSP404 will now accept without any switch changes, analog inputs from 0 to 15 volts. Any input voltages above +15V must be externally resistively divided to keep from over voltage on the analog system. The digital inputs can handle a maximum of 60V inputs. The output lines can handle a maximum of 100mA sinking current.

When attaching an externally powered temperature sensor, like the National Semiconductor LM335Z, a switch is provided that powers the sensor. This switch is an 8 position where each switch number corresponds to an analog input line.



Front View of the DB-25 on the DSP-404

The connector is divided into three distinct areas; Analog, Inputs and Outputs. There are 25 pins and 24 signals with one ground reference. The ground reference is at the same potential as the DSP404's (-) power terminal.

When attaching an analog input that is greater than +15V an external series resistor is necessary to act as a voltage divider. The input resistance of the analog input is 120K ohms. A series 100K resistor is part of the input circuit and a 20K resistor provides the necessary voltage divider to bring 15V maximum down to +2.5V which is the rail of the 12 bit Analog to Digital Converter (ADC).

$V_o = V_i (R_g / (R_i + R_g))$: $V_o = 2.5V$, $R_g = 100K$, $R_i = 20K$ and $V_i = 15V$ so...select R_i based on your V_i to keep from exceeding +2.5V at V_o . So 25Vi, R_i would be 180K (100K already there), so add a series 80K to handle a 25V input.

To test the 80K plug it back into the above formula.

$V_o = 25V(20K/180K+20K) \dots V_o = 2.5V$ which works.

If an 80K resistor is not available, choose the next larger value and then refer to Chapter 12 concerning your calibration and offset options that can be programmed to each analog input to address the analog input differences.

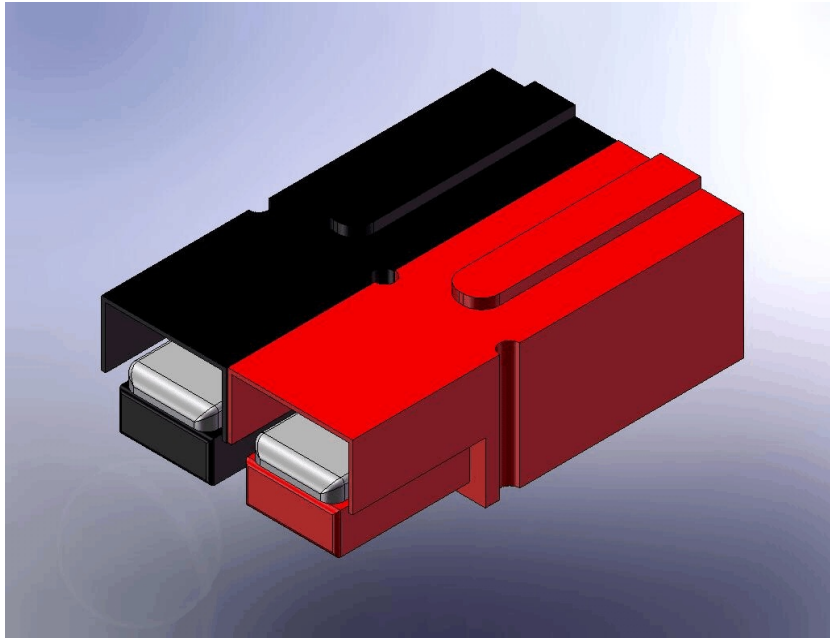
Pin	Functions		Pin	Functions
1	Ground Reference		14	Ground on I/O Board #1 : Analog 8 on I/ Board #2
2	Analog 7		15	Analog 6
3	Analog 5		16	Analog 4
4	Analog 3		17	Analog 2
5	Analog 1		18	Input 8
6	Input 7		19	Input 6
7	Input 5		20	Input 4
8	Input 3		21	Input 2
9	Input 1		22	Output 8
10	Output 7		23	Output 6
11	Output 5		24	Output 4
12	Output 3		25	Output 2
13	Output 1			

Switch	Function	Switch	Function
1	Analog #1 Power	5	Analog #5 Power
2	Analog #2 Power	6	Analog #6 Power
3	Analog #3 Power	7	Analog #7 Power
4	Analog #4 Power	8	Analog #8 Power (No function on I/O Board #1)

DB-25 pinout and Analog Power Switches

RLC-DSP404 Power Input

The RLC-DSP404 utilizes an Anderson Power Pole_(TM) power connector as the primary power system. All other Link controllers utilize a 2.5mm power connector but the style was changed to a latching power connector to address concerns with unplugging that could occur with the 2.5mm connector. There is, however, a 2.5mm power connector pattern on the PC board. A connector can be purchased to fill this pattern if desired.



Power Pole Polarities: Red is (+)...

Connecting a computer to the DSP404

Even if you plan to connect to the DSP404 using an Ethernet network (such as a LAN or Internet connection), you should first connect using a serial port.

Connecting RCI Using the Serial Port

First you will need to install RCI, the Remote Control Interface software for the DSP404, on a computer running Windows 2000, XP or Vista. If you don't have a copy or you want to download an updated copy, you can get it from the web site http://www.link-comm.com/ftp/dsp4/dsp4_rci/newest/ - look for the file DSP4RCI_Installer.exe. Connect a serial cable between a COM port on your computer and the serial port on the front of the DSP404 (next to the USB connector).

Start RCI and click on the "Settings" button. Select a "serial" connection and specify your computer's COM port. If you have everything set correctly, it should connect, at which time the "Connection Status" window will disappear. You can also try pressing the "Reconnect" button to make it try again.

If you have trouble getting it to connect, try another COM port (if you have one), or continue to the next step - it may help in determining the problem.

Using the serial port to set the network access password

If you plan on connecting the DSP404 to an Ethernet network, you will need to set a network access password (it defaults disabled). This can currently be done only through a serial port connection, as described below. This same process can be helpful for troubleshooting if you are having trouble getting RCI to connect through the serial port.

Make sure that you have a serial cable connected between your computer and the DSP404 as described above. Then you will need a serial communications program like HyperTerminal or Putty.

- HyperTerminal comes with Windows 95 and later, but may not be installed by default. If it is installed, you may be able to find it by clicking on Start > Programs > Accessories > Communications > Hyperterminal.
- Putty is a communications program that can be downloaded for free from <http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html>. Look for the file putty-0.60-installer.exe, or whatever the latest release version is.

Whichever program you choose, set it up for 115200 baud with no handshaking and the COM port used by your computer. Turn on power to the DSP404. You should see several screens of messages scroll by. Pressing Enter will provide you with a root:~> prompt. Type "passwd" in lower case to set the password.

passwd

... and enter a password as prompted. This password will be required to access the DSP404 over the network. It can only be changed through the serial port by repeating the above process if you ever forget it. When starting RCI, under Connection Settings you can enter this password for network access.

The password **IS NOT ECHOED** back to you when entering it. This is for your security. If you do not

see the information you typed, that is correct. The password will also need to be verified by retyping it. Once the DSP404 accepts the password you can now access the unit from the computer via the network.

When accessing the DSP404 from the serial port, not password is required.

*If you don't see any serial output, check the above, or look for more hints on the web page
http://link-comm.com/wiki/index.php?title=Serial_Port_Troubleshooting.*

Type "client" from the root:~> prompt to access the "DSP4>" prompt

Setting the DSP404's Network Addresses Automatically

If the DSP404 is plugged into an existing Ethernet network that has a router, it will by default try to obtain an IP address and other network settings from the router (using the DHCP protocol). You can view the settings by connecting to the serial port with HyperTerminal or Putty as described above, then entering the following command (shown in bold):

```
root:~> ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:18:8D:00:00:37
          inet addr:192.168.25.81  Bcast:192.168.25.255  Mask:255.255.255.0
          UP BROADCAST NOTRAILERS RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:275 errors:0 dropped:0 overruns:0 frame:0
          TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
```

The most important piece of information displayed is the IP address, shown above in *italics*. If the DSP404 was unable to obtain an IP address automatically, you will see something like the following instead:

```
root:~> ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:00:00:00:24:00
          UP BROADCAST NOTRAILERS RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
```

If your network has a router, it is generally much better to try to let it set the address automatically. If it does not have a router (such as if you are using a crossover cable or simple hub/switch between your computer and the DSP404), you will need to set the IP address manually.

Setting the DSP404's Network Addresses Manually

If you are running HyperTerminal or Putty, exit it and start RCI again. Wait until it connects (using the serial connection, as described above), then go to the TCB Settings menu and select "Network Settings". Make sure "Enable Network" is selected, and deselect "Use DHCP" (so you can enter the settings manually).

It can be complicated to figure out what network settings to use, but typically you can use one of the computers that is already on the network as an example. From a Windows computer, click Start > Run > and type "cmd" then press ENTER. You should get a command prompt. Type "ipconfig" at that prompt, as shown below:

```

C:\Documents and Settings\steve.strobel>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : 
    IP Address. . . . . : 192.168.0.21
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.0.1

```

If you get more information than shown above, look for the section with the title “Local Area Connection”. You can often choose an IP address for the DSP404 that is one greater than the IP address of your computer, which would be 192.168.0.22 in this case. Just to be sure, try to “ping” that address from your computer:

```

C:\Documents and Settings\steve.strobel>ping 192.168.0.22

Pinging 192.168.0.22 with 32 bytes of data:

Reply from 192.168.0.22: bytes=32 time<1ms TTL=128

```

If you get a reply as shown above, ***do not*** use that address; it is already in use by another device. Instead, you want to find an unused address, which will make ping respond like this:

```

C:\Documents and Settings\steve.strobel>ping 192.168.0.22

Pinging 192.168.0.22 with 32 bytes of data:

Request timed out.

```

You can use RCI to enter that IP address for the DSP404 to use. Use the *same* subnet mask and default gateway as your PC. After entering those settings, use RCI’s File > Reset Controller option to make the DSP404 save those settings and restart (so it can use the new network settings).

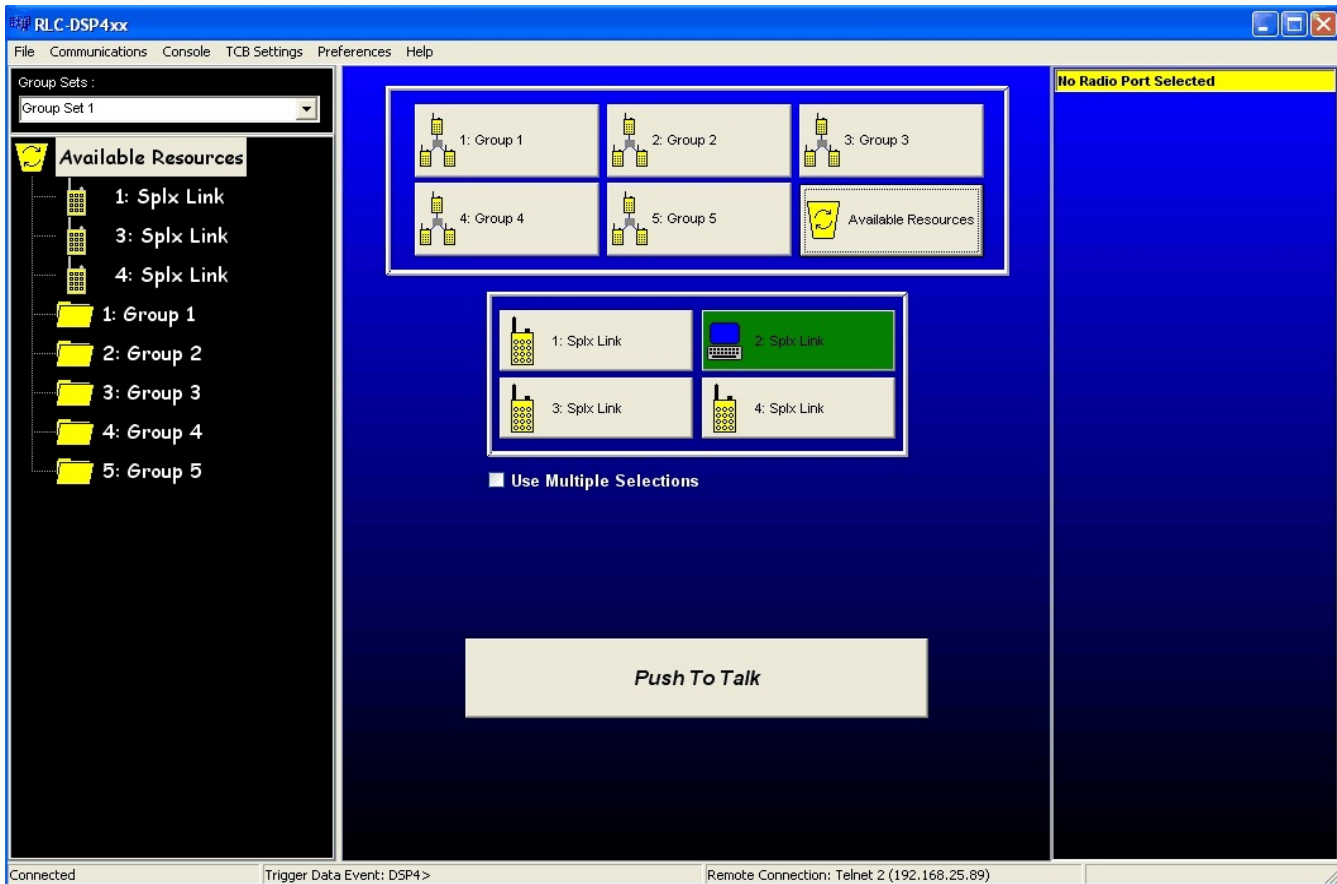
Testing the network settings

After the DSP404 restarts and loads the new network settings, you can try to “ping” it from your computer using the IP address you set for the DSP404. It should reply, as shown above. If it does, you can try making RCI connect to it via the network rather than serial connection. To do that go to the “Communications” menu and select “Communications Settings”. Select a connection type of “Telnet”, enter the IP address of the DSP404, and the password you set up previously. Click on “Reconnect” and it should connect within a few seconds. If it does not, try clicking on the “Reconnect” button again. If that doesn’t work, try “pinging” it again, and check your settings.

Windows(TM) Remote Control Interface (RCI)

The RLC-DSP404 comes with a very flexible GUI interface that enables most aspects of the DSP404 to be setup either using an RS-232 serial port or utilizing an Ethernet port. Only the Ethernet port enables the Voice Over Internet Protocol (VoIP) features, but either method works well for programming and operation. Ethernet programming has the added feature which enables up to four computers accessing at the same time, all with VoIP.

RCI cannot operate at this time without a controller hooked up to or connected to. All variables are stored on the controller and none on the computer. This feature keeps computer issues from affecting the controller's settings if a computer crashes or is not available. If this occurs then download a new version of RCI on any computer and connect to the controller and all of your settings are still there.



Windows(TM) Remote Control Interface (RCI)

The operational console for RCI. If you get to this screen your computer is communicating with the controller unit, and will indicate a good connection by the Remote Connection message. In this case, Telnet 2 (out of four possible connections). If you were connected using the RS-232 serial port, the connection dialog on the bottom of the screen would identify Serial as the connection type.

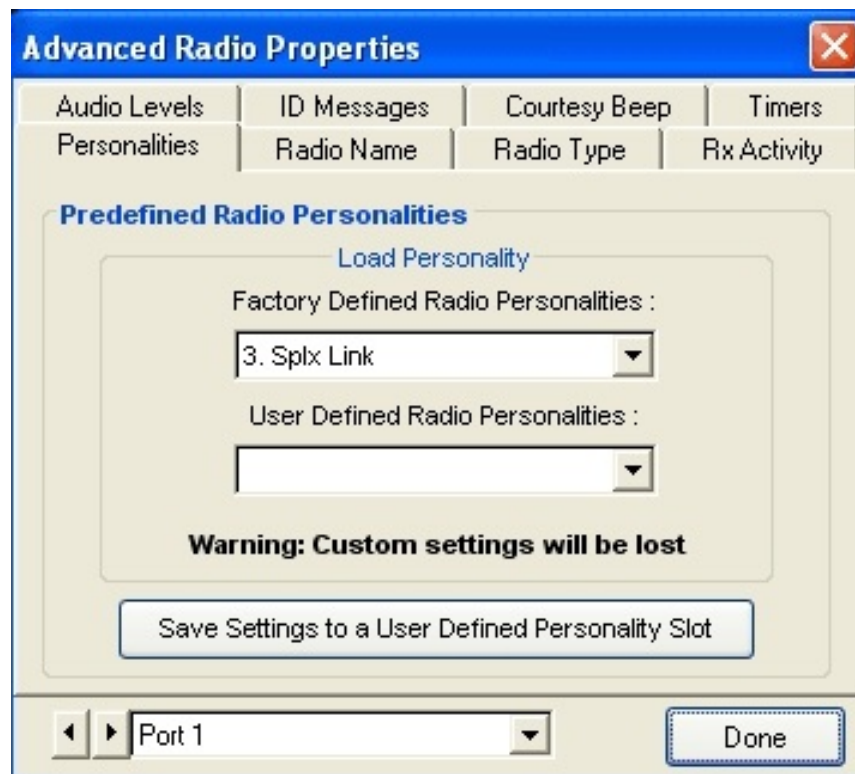
Port Setup from RCI

The easiest way to get to know your DSP404 is with the RCI GUI interface software. For the setup discussion I will exclusively be using RCI and not the DTMF commands. The DTMF commands are covered later in the manual and can be referenced if need-be.



Accessing setup is accomplished by clicking your Right mouse button when the pointer is over the Port or Group you wish to configure.

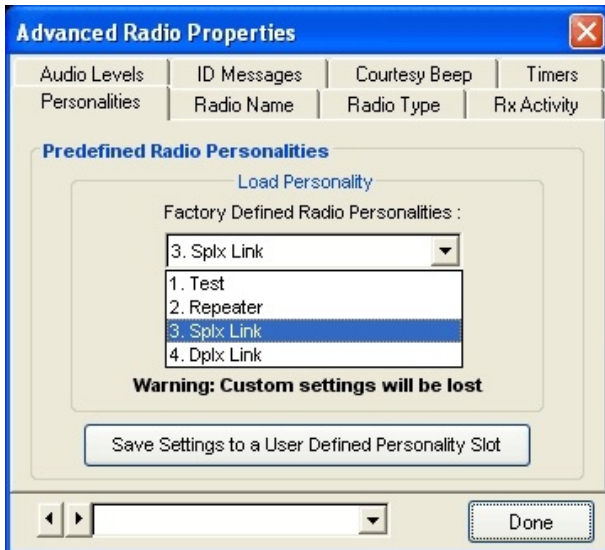
Right Click over the requested Port



Port Setup Screen

After right clicking the mouse over a port the Port Setup Screen will appear. This screen enables access to features and variable for the selected port. In an effort to minimize the amount of clicking required, a port selection box is located to the left of the “Done” button. This enables an easy method of selecting different ports without the need to exit setup and select a different port.

The initial setup screen enables the user to select a Radio Personality. Personalities contain only stuff that is specific to the make and model of the radio, not how it is used. A ports ID's and Courtesy Beeps are not stored because they are not radio specific.

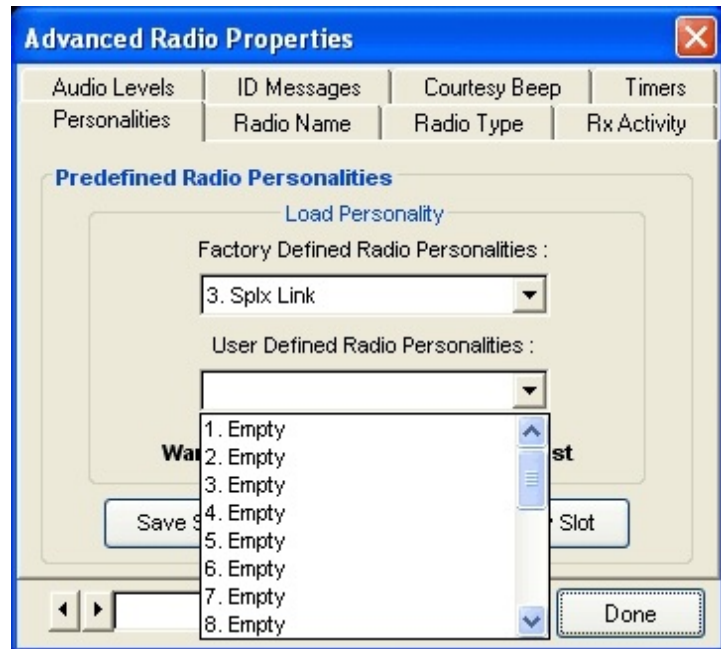


Some default radio personalities are included for a Repeater, Simplex Link and Duplex Link. To select a personality, select the required personality and press Done. Now all the settings stored in the personality will be recalled.

If a personality does not contain all the exact settings you wish, you can recall a setting and make your own changes.

If you want to use those changed setting on more than one port, you can save them to a User Defined Personality, then select that personality on the other ports.

Because every radio is unique, unique settings are necessary to have the radio setup correctly. A user slot is handy because it is a good place to start when connecting a radio to the system.



The next setup tab allows the port's displayed Radio Name to be shown on the Port button. The name is limited to 9 characters and shows up on the selected port button.

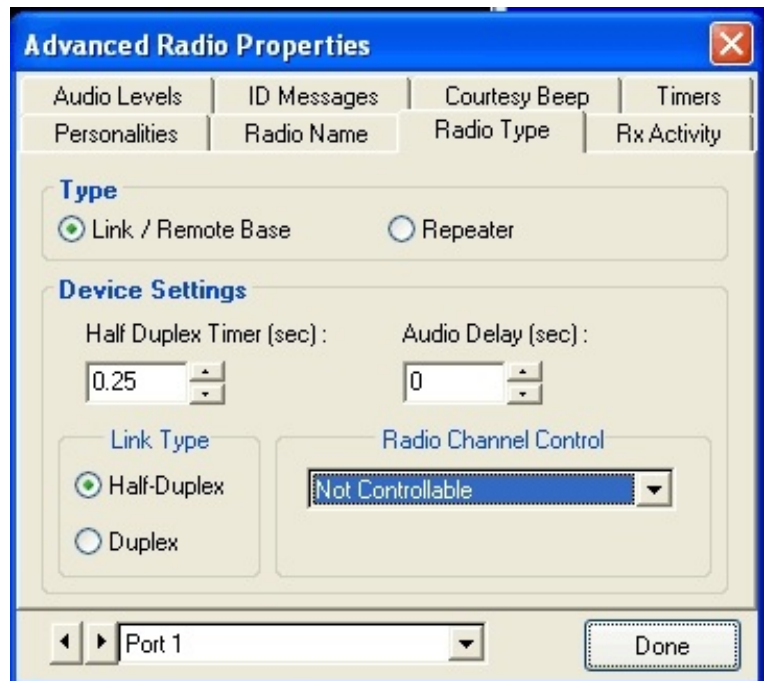
The Radio Description section is used for a description only and is not displayed. It is currently limited to 100 characters and could be used as a basic log for a port's additions, changes and maintenance.

The next tab is the Radio Type tab that controls the radio type connected to a port.

Link / Remote Base: This identifies that the radio attached to the port is not functioning as a repeater but as either a half-duplex (simplex) radio or a full-duplex base radio.

Repeater: This identifies that the radio connected to the port is operating as a repeater with its COR looped to the PTT on the same port.

Half Duplex Timer: This timer is only active when a radio is in Half Duplex mode, and is triggered when the PTT for the port goes from active to inactive. Some radios COR will bounce when coming out of PTT, and will cause an unnecessary courtesy beep or other PTT's on connected ports. If your radio has this problem, set the Half Duplex timer to a value that will suppress the COR hiccup.



Audio Delay: This timer provides delayed receiver audio from 0 seconds up to 5 seconds per port. The timer defaults to 0 seconds and is programmable in 1 millisecond steps.

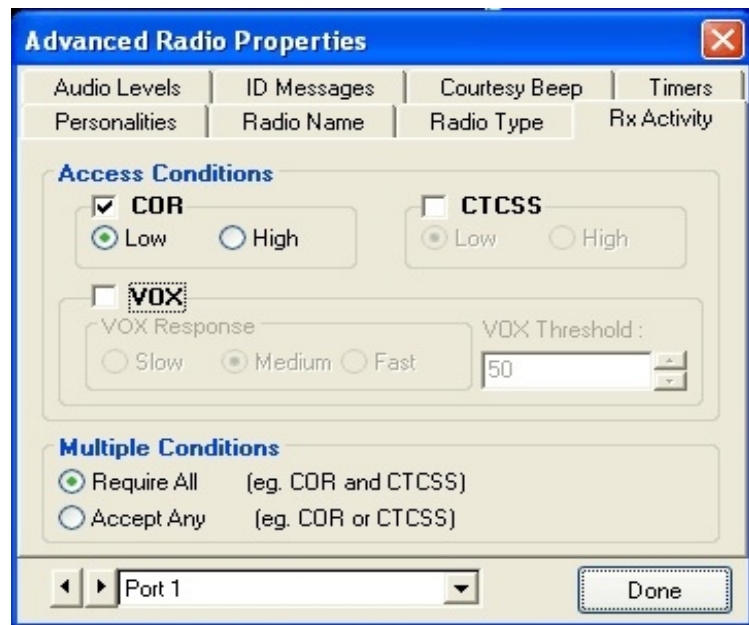
Link Type: This defines if the connected radio is either a Half Duplex (single antenna port with combined receiver and transmitter inside one package) or Full Duplex (two antenna ports with separate receiver and separate transmitters in one or two packages).

Radio Channel Control: This setting identifies the function of the connected radio. A Not Controllable radio is a typical radio without the controllers ability to frequency steer the radio. If steerable radios are connected, such as the Tait 8115, 9115 series radios, then select the Tait radio in the options box. When a steerable radio is selected for a port, the right hand 1/3 of the main screen changes to indicate a controllable radio is available. Otherwise this selection keeps that part of the screen unavailable. The default setting is Not Controllable.

The next tab to examine is the RX Activity Tab. This tab control the receiver access conditions for the port.

COR: Carrier Operated Receiver (Relay for the old timers...) Indicates that activity on DB-9 pin 7 must go either high or low to identify an active receiver. The default condition is active low.

CTCSS: Continuous Tone Coded Squelch System access is connected to pin 2 of the DB-9 connector. It receives activity from an external analog or digital tone decoder, or other source, as an alternate access method other than COR.



VOX: Voice Operated Transmitter is a method of accessing the controller with only the presence of voice. If a connected radio does not have a COR or CTCSS output and you wish to use it (sell it and get a radio with a COR or CTCSS line...), VOX must be used. In a repeater environment, it is best to use a radio with a hardware line and not VOX, but otherwise select VOX. When the voice is detected the controller will indicate an active receiver condition. Because VOX operated on voice, you will need to select a response time (typically Medium) to delay going from active to inactive between someone's words. If the average person using your system talks...really...slow... then you will need to set the VOX response to slow. The response is a voice activated hang timer, therefore when the person stops speaking, the controller will wait a period of time to make sure they are really no longer speaking.

VOX Threshold: This setting is the VOX trigger point where the controller treats incoming audio as either active or inactive. The lower the number the quieter the input audio to be detected. A setting of 50 works well with most audio sources.

When a line is set to be Low going indicates that the receiver must pull the line to ground for it to be recognized. Depending on the switch settings, the line can be released to an open (if the pull-up switch is on), be at a voltage and release the line when active (if the pull-down switch is on), or provide a voltage to the line and a ground when active (if both pull-up and pull-down switches are off).

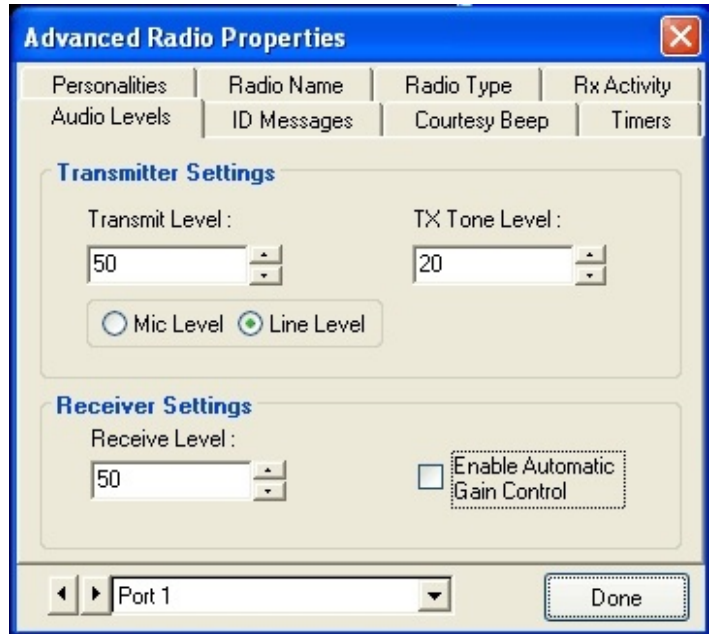
When a line is set to be High going, it operates opposite from the Low going line. So a receiver provides a voltage when active. Every receiver is different so between the switch settings and the Low/High selections, most receivers can be interfaced without issue. The COR and CTCSS lines are connected to an insulated gate FET which provides an extremely high input impedance to the connected receiver when the switches are both off. The switches provide either a pull-up or pull-down with a load of 47.5K ohms each. Refer to the switch settings at the beginning of this chapter for proper settings for pull-ups and downs on the COR or CTCSS lines.

The next tab controls the Audio Levels for the receiver, transmitter and tone system.

Transmit Level has 255 discrete adjustment steps (in 3/8dB/step) and is displayed as a 0 to 255 steps. Future software releases will add a fine level adjustment to span digitally the 1 step, steps. Mic and Line level selections are only available for the Tactical Communication Bridge (TCB) units.

TX Tone Level adjustment sets the level of the transmitted tones and is mixed with all other receivers audio. The tone level is a 0 to 100% adjustment.

Receiver Level adjustment adjusts the level of the incoming receiver audio that is presented to the 24 bit CODEC.



Enable Automatic Gain Control sets tells the controller to automatically adjust the units receiver audio level to a point where the controller's CODEC performs the best. This feature is useful when a variety of people use a system, with different levels of spoken audio. AGC is currently available on the TCB line of units and is planned for the DSP-404.

The next tab allows programming of a ports Identification Requirements like the CW Call Sign and the Voice ID used. All ID slots are programmed with the Voice ID entered from this form.

When a user sets up the ID's, currently only two ID's are setup directly with the GUI, the CW and a Voice ID for the selected port.

Access to other ports ID slots is accomplished by pressing the Advanced button. A list of the other ports available ID's will be listed and using the Macro Editor can easily add or modify the ID's.



The next tab enables the recalling and programming of a ports Courtesy Beep information. The user can recall default beeps (that are used on the RLC-Club and RLC-3 controllers), or program a Custom beep sequence when the Custom selection is made.

Advanced Radio Properties

Personalities | Radio Name | Radio Type | Rx Activity
Audio Levels | ID Messages | Courtesy Beep | Timers

☒ **Preset**

Default For Port [v] [Advanced]

☐ **Custom**

Tone 1 (Hz) Tone 2 (Hz) Length (0.01s) Pause (0.01s)

0500 0000 020 001

[v] Port 1 [Done]

Advanced Radio Properties

Personalities | Radio Name | Radio Type | Rx Activity
Audio Levels | ID Messages | Courtesy Beep | Timers

☐ **Preset**

Stardust [Advanced]

☒ **Custom**

Tone 1 (Hz) Tone 2 (Hz) Length (0.01s) Pause (0.01s)

0750 0000 012 000
0880 0000 008 000
1200 0880 008 000

[v] Port 1 [Done]

Macro Editor

Command : Data :

040 01200007500000
040 00800008800000
040 00800012000880

[Add Line] [Delete Line]

Macro Number : 392 [Done]

When a preset beep is requested, custom changes can be made to the recalled beeps by pressing the Advanced button which pulls up the macro editor with the contents of the Courtesy Beep macro.

If a preset beep is not desired, and the user wishes to have a Custom Beep, select Custom. Up to three custom tone combinations can be programmed here to provide unique beep sounds. If you need more than three tone sequences, use the Preset option and press the Advanced button. This will allow more than three tones to be programmed into the Courtesy Beep macro.

Advanced Radio Properties

Personalities | Radio Name | Radio Type | Rx Activity
Audio Levels | ID Messages | Courtesy Beep | Timers

☐ **Preset**

Stardust [Advanced]

☒ **Custom**

Tone 1 (Hz) Tone 2 (Hz) Length (0.01s) Pause (0.01s)

0750 0000 012 000
0880 0000 008 000
1200 0880 008 000

[v] Port 1 [Done]

The last tab under a ports setup is are the Port Specific Timers. There are only six timers that can be set under this screen, and these timer are only the timers that directly affect the ports operation.

The format to change and set timers is either with a point and click up or down selection or to directly enter the time with by clicking on the calculator icon.

Up and down clicking increment in 10mS steps, and are displayed in seconds format.

The image shows the 'Advanced Radio Properties' dialog box with the 'Timers' tab selected. The dialog has a blue title bar and a close button. It contains several tabs: Personalities, Radio Name, Radio Type, Rx Activity, Audio Levels, ID Messages, Courtesy Beep, and Timers. The 'Timers (sec)' section contains six settings, each with a numeric input field, up/down arrows, and a calculator icon:

- Mini Hang-Time: 0.50
- Hang-Time: 2.00
- Initial Delay: 0
- Time-out: 60
- TX Audio Delay: 0
- Half Duplex: 0.25

At the bottom, there is a dropdown menu set to 'Port 1' and a 'Done' button.

The image shows the 'TimerEntryForm' dialog box. It has a blue title bar and a close button. The text 'Current Time: 0.50 sec' is displayed at the top. Below it is a numeric input field showing '0.50' and a unit selector set to 'sec'. A numeric keypad is provided with buttons for digits 0-9, a decimal point, and unit selectors for 'min', 'sec', and 'msec'. There are also buttons for 'Bksp', 'Clear', and 'Enter'.

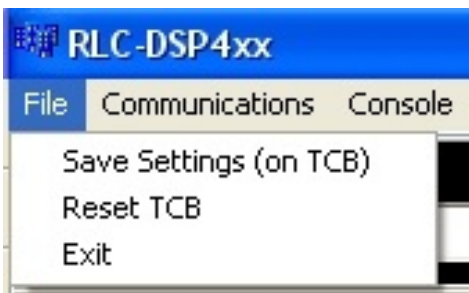
When using the calculator pad, different timer values are available when entering a time. Msec, Sec and Min are available.

Once the timer amount has been calculated press the Enter Bar to accept and continue.

System Features

Once a port has been setup access to some system features might be necessary in order for the GUI and unit to perform as desired.

Starting with the File drop-down menu there are three available options.



Save Settings (on TCB or RLC) will take the user changes and store them into non-volatile Flash memory. Until the settings are saved, they can be lost with a controller power-down event.

Reset the TCB (or RLC) will cause a power-on reset command to be issued to the controller. This is the same as pressing the Reset button or removing and reapplying power to the unit

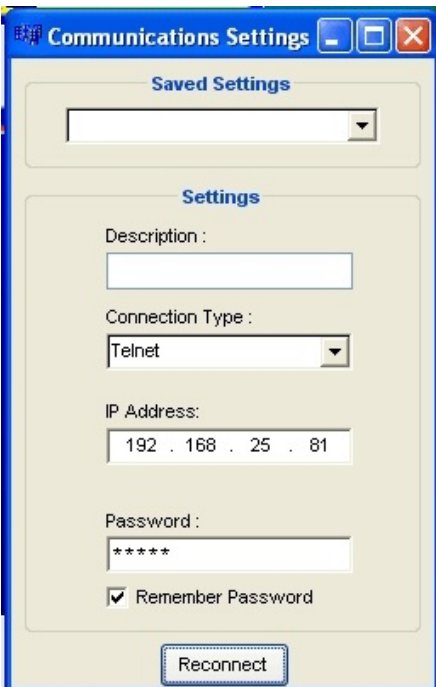
Exit will exit RCI

The Communications drop-down allows communications parameters to be accessed and changed.



There are three options that are available for the communications system. Controlling how the unit communicates with RCI, using serial or Telnet, watching the control signals status and accessing a terminal to make custom changes to the unit are supported.

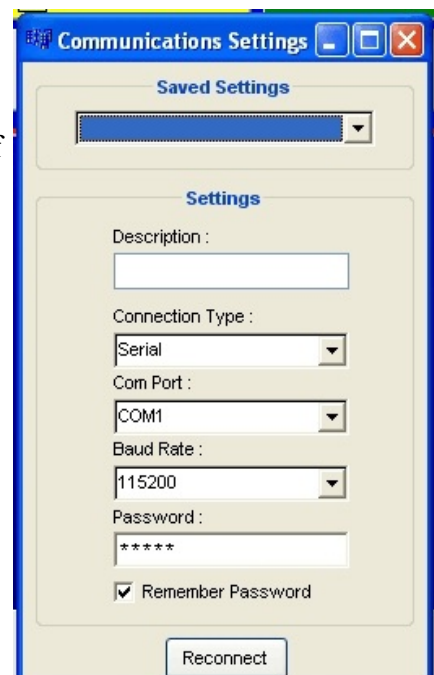
Communications Settings:

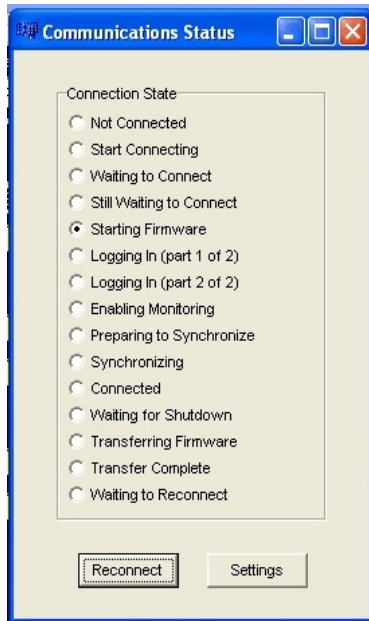


There are two options to connect to the unit. If using Telnet then an IP address and password is required. If using Serial, then a COM port, Baud Rate (115,200 Baud by default and password is necessary.

Note:

On the RS-232 serial port, there is no password out of initializations. One must be entered if desired. On the Network port a password **MUST** be entered before the network port will function.





When RCI first starts, the **Communications Status** screen will display. This screen shows 15 discrete steps that effect the connection, updating and saving on the controller. If the controller is connected, the Connected line will be highlighted.

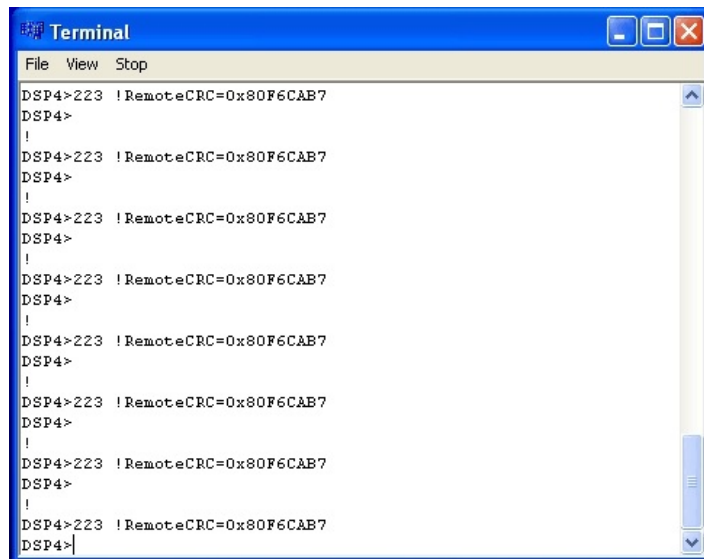
The communications settings will keep the system from connecting and when this occurs, the communications status screen will display. If your system is having connection problems, check the Communications Setup screen or press the Settings button.

Make a change then press the Reconnect button. If all else fails when working with a network, try the serial port.



If contacting technical support, note the point from the Status screen where the communications failed.

The **Terminal Screen** enables the user to watch and enter commands



To use the Terminal as a standard terminal ensure the “Verbose” selection is not checked under the view menu.

To watch RCI's communications to from RCI to the controller check the "Verbose" selection. This will unhide the background communications that is happening. All other features are self explanatory and can be played with without effecting the controllers operation.

Console drop-down menu accesses settings that affect RCI's console screen. The Console screen is the displayed screen on computers running RCI. The VoIP from the controller must go somewhere for the operator of RCI to access.

This screen requires a radio port to utilize and operate from. The port can be assigned from the Console drop-down menu but the port defaults to Port2.

To reassign the console port click the 'On Port' selection and assign a port. Only installed ports can be assigned as an RCI port therefore selection is limited to the non-greyed out ports.



VoIP Settings Form

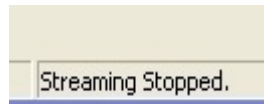
VoIP Settings can also accessed under the Console menu. VoIP is only available on computers that are operating over a network port but supports up to four connections at one time. The four connections share the same console port and get audio from the controller but are limited to one incoming audio stream at a time. The incoming stream is controlled by the Push To Talk (PTT) button on the screen (or spacebar). When in console controlled PTT, audio from the computers microphone is routed to the port assigned as Console on the controller. This port can be individually assigned to any of the units ports or part of a talk group to communicate with multiple ports.

When VoIP is enabled the user must select the method the data is accessed. Two methods are available; connection over a LAN or Connection through a Firewall. When connecting locally without exiting your LAN, no special configurations are necessary. The VoIP traverses using Port 23000 which will need to be opened is a firewall is used.

When going through a firewall, RCI can tell you the address it see's by pressing the "Get Public Address" button. RCI will show you the address that needs to be entered into the firewall address. You will still need to open port 23000 for the VoIP data to find the controller, but once connected the systems should talk.

Diagnosing VoIP's Operation: Because of the complex nature of VoIP, a method of easily diagnosing the operation of the system is necessary. There are several indications that diagnose the operation of the digital audio.

The screenshot shows two panels. The left panel, titled 'Latency Adjustments', contains two spinners: 'VoIP Out Latency' and 'VoIP In Latency', both set to the value 7. The right panel, titled 'Connection Statistics', is divided into three sections. The 'Counters' section shows 'Underflow 0', 'Over Flow 0', and 'Encroach 0'. The 'Lock' section shows 'Lock 0', 'Fragment 0', and 'Address 0'. The 'Cursors' section shows 'Current 0', 'Last 0', and 'Fill 0'. There are 'Clear' and 'Update' buttons at the bottom of the right panel.



The initial method of seeing if a problem exists with the VoIP is with the streaming message. If the message "Streaming Stopped" is on the screen (bottom of the VoIP Screen), data is broken between RCI and the unit. None of the Connection Statistics will fix this problem. This usually occurs when the IP addresses are incorrect or a firewall is blocking the VoIP from arriving at RCI. There are no tools built into RCI that can help in verifying the stream is working. A freeware program is available called wireShark that is a valuable tool when troubleshooting network connection problems. The software is available at www.wireshark.org/download.html.

Once the stream is working the connection statistics can help determine if your network bandwidth is good enough for VoIP operation. The controllers RCI socket operates at 128kbps stream (16 bit PCM at 8KHz) = 128 kbps rate. The broadband nature of the connection is to minimize any audio issues that can occur on the VoIP console channel. A lower bandwidth stream is in the development that drops the bandwidth down to 64kbps G.711 uLaw. Other CODEC's are in the development to drop the bandwidth even more and will be available in the future.

Once operational, the VoIP audio will follow the clicking on Ports or Groups from RCI. PTT routes the computer audio from the microphone to the receiver on the assigned port for VoIP on the controller and received audio will be routed to the speakers on the computer. The VoIP stream is a full-duplex link port.

Remember, if you have problems check your network connections.

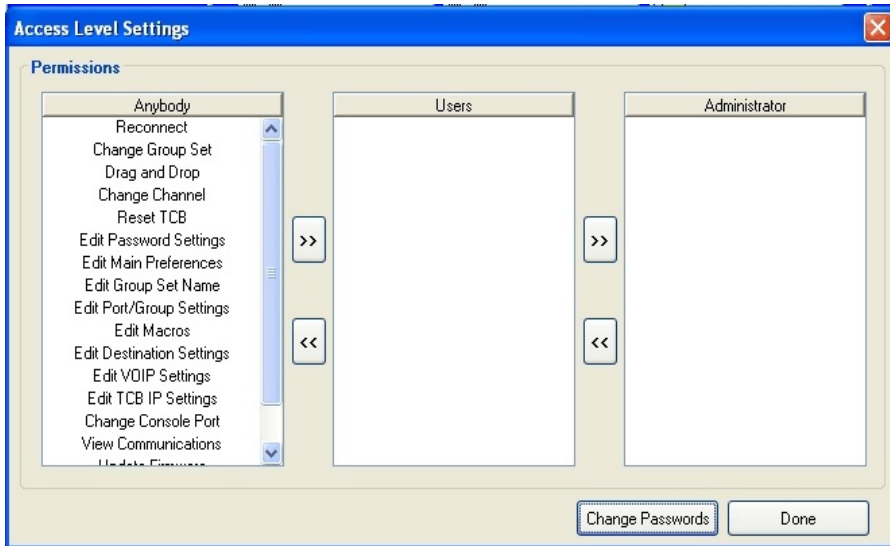
The screenshot shows the 'TCB Network Settings' dialog box. It has a 'Network Setup' section with two checked options: 'Enable Network' and 'Use DHCP'. Below these are three input fields for 'IP Address', 'IP Netmask', and 'IP Gateway', all showing '0 . 0 . 0 . 0'. To the right of these fields is a text box explaining that these settings control the network settings of the TCB itself, not the computer, and that after changing them, the TCB must be reset. A 'Done' button is at the bottom right.

Up to this point all settings have been RCI based, and not on the controller. The next drop-down is the TCB Settings menu.

The setting of the controllers IP information is accessed from the Network Settings tab. The controller supports both Static IP addresses and DHCP assigned. If you want to use the network check the Enable Network box and select the addressing mode you desire.

(A Telnet Password will be assigned here in order to enable the network. No yet documented...)

If not utilizing the DHCP server you will need to enter the Address, Netmask and Gateway information. Once completed, press the “Done” button to accept the changes. The controller will need to reboot for the changes to take place, and all settings will be saved. Once the controller has rebooted the network will be available.



The next settings tab controls the access level from RCI to the controller. User and Administrator permissions are assigned for most of the features that RCI can perform. The Administrator permissions can execute the User permissions, but the User permissions can not execute the Administrator permissions.

To change the passwords click on the Change Passwords button.

No passwords are assigned out of initialization, so it is good to assign them here. The RCI assigned password system ONLY effects the computer these are assigned. The password system was designed for dispatch operation where controlled access to the RCI system was necessary. The DSP404 still maintains a 1000 user password system as well as the Telnet/SSH password support. In a future release of software will move these passwords to the controller.



The next controller based menu is the Macro Editor. This feature enables the user to access the macros on the controller and to create, edit and delete them.

The example to the right has two commands, 032 and 030. Command 032 sends a serial message out the serial port when executed and Command 030 sends out a voice ID message. The contents are stored in macros 320. To add a command simply click the “Add Line” button and to delete a line in the macro click the “Delete Line” button. You can cycle to other macros without clicking the Done button.

When finished editing, click the “Done” button to exit.

Command	Data
032	Set ID for TX 1
030	40181340293301

Buttons: Add Line, Delete Line

Macro Number: 320 Done

Command Options

Name : 000

Allow execution from Receiver(s): 1-12

Security Level : 4

Command Number : 0 Done

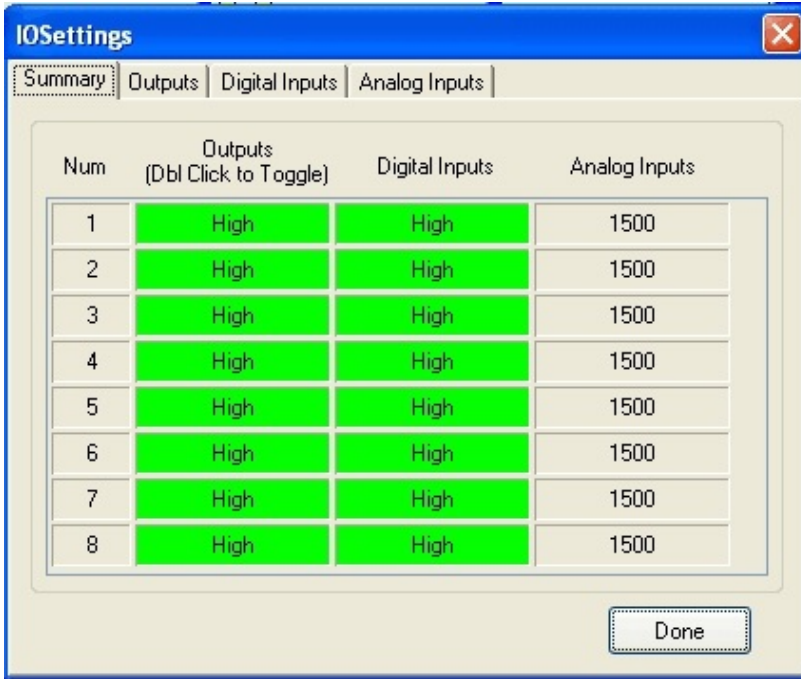
The next drop-down menu is the Command Editor. This feature allows Command Names to be changed, execution permissions to be assigned and security levels to be assigned. The command names can be addressed by DTMF Name or Number.

You can cycle to names without clicking the Done button.

When finished editing, click the “Done” button to exit.

Input and Output Line Control

The DSP404 has support for 16 input lines, 16 output lines and 15 analog 12 bit channels. Access to the telemetry signals is located under the TCB Settings drop-down menu and located under the IO settings tab.



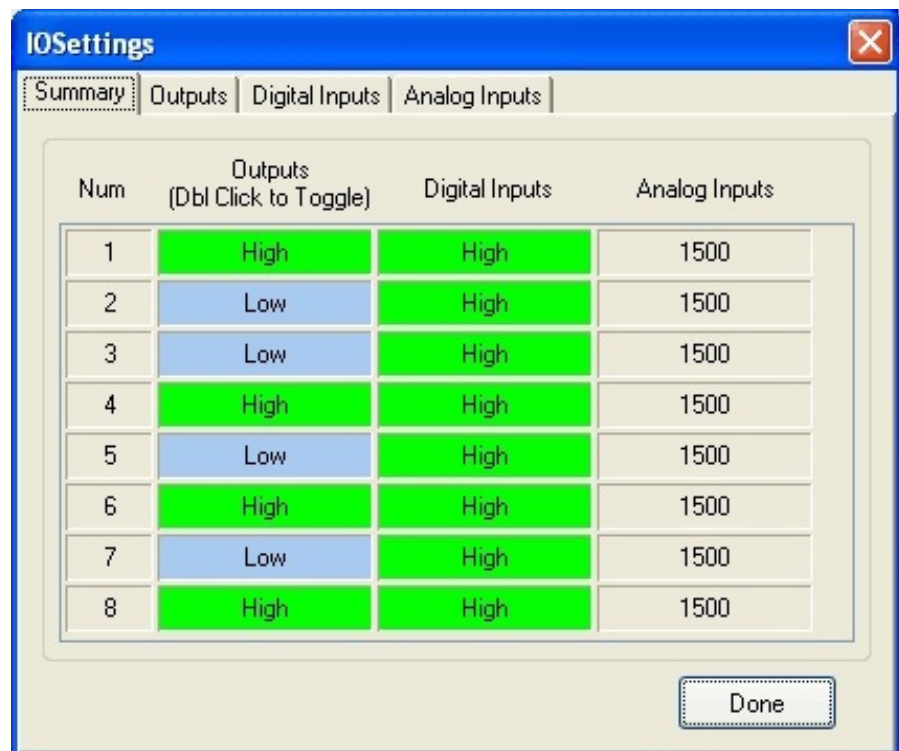
The summary screen shows all lines and the analog lines converted results. Currently the results are text based but a graphical faceplate template is being developed.

Only the output lines can be user functioned (because it is the only output feature) and is changed by double clicking the desired line.

The total system supports 16 of each of the signals, but only 8 of each are installed currently, therefore only 8 of each show.

After double clicking on output lines 2,3,5 and 7 they change state to Low from High (or open).

Calibrating and assigning unique settings to the input lines and analog signals will be documented at a later date (in the near future).



Other Misc. Menus and Operations



To manually check for an update for RCI and/or the DSP404 the user simply clicks the Help and the About sub-menu.

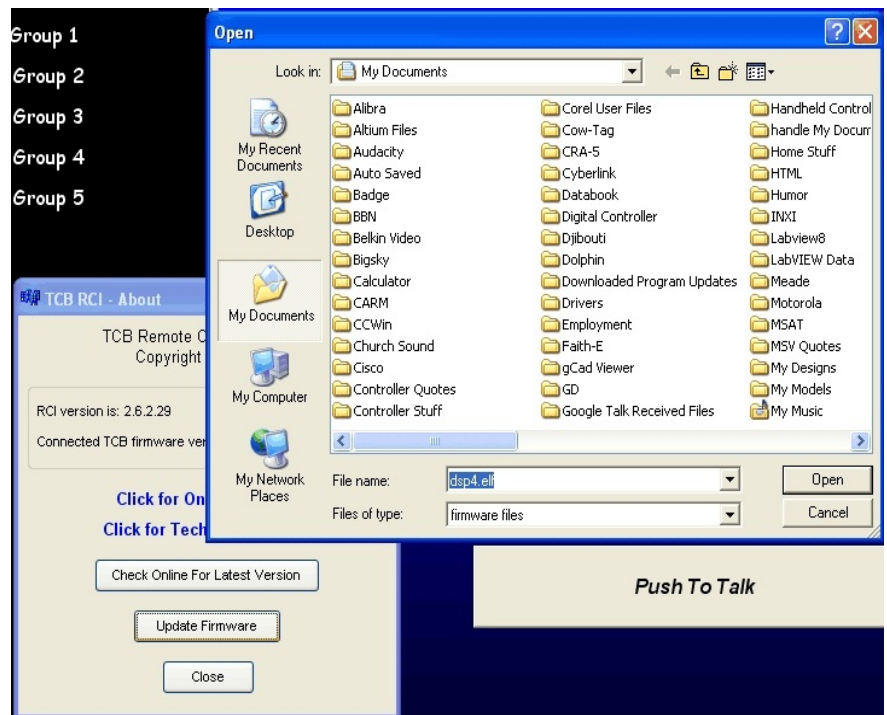
The following screen appears which accesses the Link Communications web site where the updates are located.

Once an update available and downloaded, the user can either update immediately (automatically done), or save the update for a later installation time.

When manually updating the firmware the user clicks the Update Firmware button which opens My Documents to load the file.

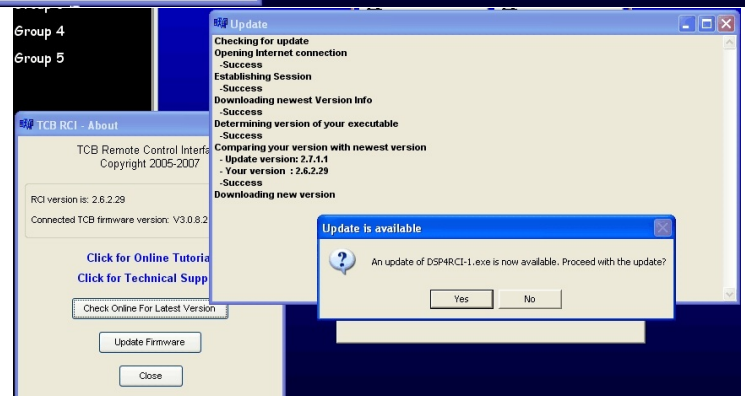
All RLC and TCB updates end in the “.elf” designation. This designation is the Linux and RTMS file that handles the executable.

Make sure you load the latest version of firmware as all firmware versions have the same name. It is recommended to make a copy of the downloaded firmware before transferring it to the controller. Rename the firmware to a unique name so you always have a copy and know what the latest version is.



Clicking “Yes” will download the new update and ready the system for the new version.

Clicking “No” will cancel updating the new version.



Chapter 2: Port Connection Commands

This chapter deals with the commands used in connection and control of the radio ports. The areas dealt with in this chapter are:

- Radio port connections
- Receiver access control
- COR and PL polarity control
- Transmitter PTT control

Connected Ports

In this chapter you will often see references to ports being "connected". When two ports are connected, they hear each other (the COR from each port will activate the PTT on the other, and the audio from each will be transmitted out the other). All of the radio ports on the controller can work independently, or they can be connected together in any combination. A typical configuration would be to have a repeater port "connected" to a remote base port. If all of the ports are connected to each other, the whole controller works as one unit, with audio received on any of the receivers going out all of the transmitters.

Port Groups

The RLC-DSP4 uses "port groups" (or just "groups") to control which ports are "connected" to each other. Ports that are in the same group are automatically connected to each other. Multiple groups can be used to connect different sets of ports together. This is similar in concept to people standing in various rooms. People in the same room can talk and be heard by others in the same room, but not by those in different rooms. A port that is not in a group will not be connected to any other ports.

Typically, each port will be a member of only one group at a time. When RCI is used to place a port in a group, it automatically removes it from any other groups. That is similar to a person walking out of one room and into another.

Advanced topic: It is possible for a port to be a member of more than one group at a time (command 017 can be used to set that up). In that case, any signals received by that port will be transmitted to members of both groups, and it will transmit any signals received by ports in either of the other groups. This is similar to a person standing in the doorway between two rooms; he can hear anything spoken in either room and when he speaks, he will be heard by everyone in both rooms. This often causes confusion. Consider the case where the "person in the doorway" (the port that is in more than one group) has a conversation with someone in one of the rooms (groups). The people in the other room can hear the person in the doorway; but not the responses of the person in the other room; they hear only one side of the conversation. To avoid this, it is often best to either "step into one of the rooms" (join one group or the other but not both) or put everyone in the same room (put all of the ports into the same group).

Group Sets

It is often useful to change which ports are members of each group, such as to turn a link on or off, or to set up for a net. This can be done directly each time using command 017, or it can be automated using

"group sets". A group set records which ports are in each group, and allows that set of groups to be restored at a later time.

To configure a group set, use RCI or command 017 to add some ports to one or more groups. Those changes will automatically be made to the currently-selected group set. Then select a different group set (using command 239 or the selection in the top-left corner of RCI) and configure it differently. To return to the original configuration, just select the original group set.

Repeater Ports

When a port on the DSP404 is set up to control a repeater rather than a link or remote base, the receiver on that port is effectively "connected to" the transmitter on that same port. In other words, anything received on that port will be transmitted on that port; it "repeats".

To set up a port as a repeater, use RCI to select "repeater" mode in the "Radio Type" tab or use the shortcut macro `"*16 pp"` where "pp" is the port number (example: 02 for port 2). To change a port configured as a repeater back to a link/remote base port, use `"*15 pp"`.

Turning a Repeater Off

There is more than one way to turn a repeater off, each of which has advantages and disadvantages. For this example, we will assume that you have a repeater connected to port 1.

One option is to disable the repeater transmitter. This will keep the transmitter from coming up for any reason. It will not repeat audio, it will not ID, it will not send any messages that may be caused by the scheduler (like speaking the time on the hour) or any alarm messages, and if a remote is connected, it will not send the audio from that remote. The receiver will still work normally. You can still use the receiver to turn the repeater back on or enter any other commands, and if you have a remote base port connected to the repeater port, your receiver's audio will still go out the remote. The repeater transmitter can be disabled by entering `"155 010"`.

Another option is to disable the repeater's receiver. In this case, the receiver will not cause any transmitters to key up and no audio that is received by that receiver will be transmitted out the repeater or any remotes. The repeater transmitter will continue to work normally. It will still ID (when it needs to), send scheduled and alarm messages, and if a remote is connected, it will still send the audio from that remote. You can disable port 01's receiver by entering `"005 010"`.

You can also choose whether or not to allow commands to be entered when the receiver is disabled with command 005. Entering `"005 0100"` will make the controller ignore any commands that are entered on that receiver. This may be useful for keeping someone who is trying to break into your controller from getting in. It will also keep you from doing anything from that receiver - even turning it back on. If you set command 005 this way and disable the receiver, you will have to turn the receiver back on from another receiver on the controller, from the reverse patch, or from the serial port. If you enter `"005 0101"` instead, the disabled receiver will still not cause any transmitters to key, but you will be able to enter commands on that receiver. If you enter `"005 0110"`, the repeater will continue to work but it won't accept any commands, including the command to turn it back on.

The final method for disabling a repeater is to disconnect the repeater port from itself by entering `"*15`

pp" as described in the "Repeater Ports" section above. This does not disable either the repeater receiver (it can still receive commands) or the transmitter (it can still send IDs and scheduled messages), but it turns off the repeat function so signals received by the repeater receiver will not be transmitted on the repeater transmitter. This is the best method for most systems.

017: Manage Port Membership In Groups

<017> 00 0GG	Recall which ports are in group "GG"
<017> A R 0GG PP	Change membership of port PP in group GG
<017> A R 0GG PP..QQ	Change membership of ports PP..QQ in group GG

Parameters:

- A is one of the following (from port_group_action_enum):
 - 0 - add port(s) to group
 - 1 - make port(s) monitor group
 - 2 - remove port(s) from group
 - 3 - toggle port(s) membership in group (if monitoring, leave group)
 - 4 - remove port(s) from all groups
- R is one of the following (from resolve_one_way_enum):
 - 0 - if specified port(s) are part of another group, remove them from that group and join the specified one (to avoid one-way conversations)
 - 1 - if specified port(s) are part of another group, do not remove them from that group and abort this command (to avoid setting up one-way conversations, won't "fix" existing ones)
 - 2 - join the specified group regardless of whether the specified port(s) are part of another group (may cause one-way conversations).

210: Recall if Group Contains Port

<210> ggg pp	Check to see if port 'pp' is in group 'ggg'
--------------	---

Parameters:

- 'pp' is the port to search for within the specified group.
- 'ggg' is the port group number to search.

Examples:

- 210 105 02 - Check to see if group 17 contains port 02.
- 210 110 01 - Check to see if group 22 contains port 01.

239: Manage Group Sets

<239>	recall all group sets' descriptions.
<239> 0	recall active group set and description
<239> 0 group_set	set active group set to group 'group_set'
<239> 1	recall active group set and description
<239> 1 group_set	set active group set to group 'group_set'

Examples:

- 239 - recall all group sets' descriptions.
- 239 0 - recall first (active) group set and description.
- 239 0 1 - set active group to the first item in the group sets drop-down menu.
- 239 1 - recall second group set and description.
- 239 1 1 - set active group to the second item in the group sets drop-down menu.

003: Recall Which Transmitters A Receiver Is Connected To

This command allows you to find out which transmitters will send the audio received on the specified receiver.

<003> pp	Recall Receiver Connections
----------	-----------------------------

Parameters:

- 003 is the default command name. This command finds what transmitters are connected to receiver 'pp'.
- pp is the receiver to recall the connections (to use '0*' for the current port, see Appendix L)

Default:

- Port 1 defaults as a repeater
- Ports 2..12 default to links

Example:

Receiver 1 is connected to transmitters 2 and 3

<003> 01 D or unkey or <Enter>

Response: Voice Response "1 Connect 2 3"

004: Recall Which Receivers Are Connected to a Transmitter

This command allows you to find out which receivers will cause the specified transmitter to key and send the received audio.

<004> pp	Recall Transmitter Connections
----------	--------------------------------

Parameters:

- 004 is the default command name. This command finds what receivers are connected to transmitter 'pp'.
- pp is the transmitter to recall the connections to (use '0*' for the current port, see Appendix L)

Default:

- Port 1 defaults as a repeater
- Ports 2..12 default to links

Example:

Receivers 1 and 2 are connected to transmitter 3

<004> 03 D or unkey or <Enter>

Response: Voice response "3 Connect 1 2"

009: Recall Controller's Entire Audio Crosspoint

This command allows you to check the audio crosspoint conditions on all radio ports on the controller. This command will check the connected conditions and both show the crosspoint map on the RS-232 serial port, and will speak the conditions out the port that DTMF requested the conditions.

<009>

Parameters:

- 009 is the default command name.

Voice Response:

The voice response will only speak if a receiver is connected on the selected port. If a receiver is connected to a port's transmitter, the controller will speak "rr connect tt" where rr and tt are the port numbers of the receiver and transmitter, respectively.

Voice Format:

```

1 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
2 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
3 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
4 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
5 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
6 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
7 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
8 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
9 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
10 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
11 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>
12 Connect <TX1> <TX2> <TX3> <TX4> <TX5> <TX6> <TX7> <TX8> <TX9> <TX10> <TX11> <TX12>

```

Serial Response:

		TX											
		1	2	3	4	5	6	7	8	9	10	11	12
RX	1	.	.	.	.	.	.	.	.	.	.	.	.
	2	.	.	.	.	.	.	.	.	.	.	.	.
	3	.	.	.	.	.	.	.	.	.	.	.	.
	4	.	.	.	.	.	.	.	.	.	.	.	.
	5	.	.	.	.	.	.	.	.	.	.	.	.
	6	.	.	.	.	.	.	.	.	.	.	.	.
	7	.	.	.	.	.	.	.	.	.	.	.	.
	8	.	.	.	.	.	.	.	.	.	.	.	.
	9	.	.	.	.	.	.	.	.	.	.	.	.
	10	.	.	.	.	.	.	.	.	.	.	.	.
	11	.	.	.	.	.	.	.	.	.	.	.	.
	12	.	.	.	.	.	.	.	.	.	.	.	.

005: Set Receiver and DTMF Decoder Conditions

This command lets you specify whether a user must have PL (CTCSS) to key up your repeater or whether it can be keyed with just carrier, among many other options. By selecting a “mode” from the table below, you can tell the controller what conditions must be met for a receiver to be considered active, that is to make it key connected transmitters. Each mode is described in detail on the following page.

This command also lets you specify the conditions the controller requires to be met for DTMF tones to be processed. Normally they are the same as the conditions for activating the receiver, but you can set them to be different. You can, for example, allow access to your repeater with just carrier, but require PL to enter any commands (enter “005 pp13”). Or you can require PL to access the repeater but provide a PL override command that can be entered with only carrier (enter “005 pp31). The controller will mute DTMF digits (if you have that option enabled, see command 007) regardless of the conditions you have set to execute commands.

<005> pp	Recall settings
<005> pp y	Set receiver's access mode
<005> pp y z	Set receiver's and DTMF decoder's access modes

Parameters:

- 005 is the default command name.
- ‘pp’ is the port number (01..12)
- ‘y’ is the receiver's access mode
- ‘z’ is the DTMF decoder's access mode. If not specified and the receiver's access mode is not zero, it will automatically be set the same as the receiver's access mode. To set 'z' to zero, all three digits of "pp y z" must be entered.

Defaults:

- Receiver defaults to mode 1 on all ports.
- The DTMF decoders default to mode 1 on all ports except port 1, where it is "always active". That should be changed once the COR polarity for port 1 is set up by entering "005 0111".
- If a port is connected to an RLC-ICM, use Mode 1.

Mode Definitions:

Mode	Definition
0	No Access
1	COR Access
2	PL Access
3	COR and PL Access
4	COR or PL Access
5	Always Active

Description of Modes:

- Mode 0: The receiver is effectively disabled; even if the carrier and/or PL is received, the controller will ignore that receiver and will not key connected transmitters. If you are going to do this, you need to have another way to enter commands to re-enable DTMF access (reverse patch, serial port, another radio port, scheduler...).
- Mode 1: The controller will respond to the COR signal, allowing access with carrier. The PL signal is ignored.
- Mode 2: The controller will respond to the PL signal. The COR signal is totally ignored. This mode may cause very long squelch tails since PL decoders are generally slow to recognize when the PL tone goes away (see mode 3).
- Mode 3: Both COR and PL must be active at the same time for the controller to respond to the receiver. Repeaters that require PL usually use this mode because it eliminates the long squelch tails often heard when using mode 2. Typically, when someone keys a repeater with PL, the receiver's COR signal will go active first. The controller will ignore it for the moment. Perhaps 100 milliseconds later (the actual time varies) the PL decoder will recognize the sub-audible tone and will activate the PL signal going to the controller. At that point the controller will see that the COR and PL are both active and will key up any connected transmitters (subject to the keyup delay filter and other factors). As long as both the COR and PL signals are active, the controller will consider that receiver to be active. When that person unkeys, the receiver's squelch circuit will recognize the loss of carrier very quickly (some squelch circuits are faster than others - ask about the RLC-MOT) and deactivate the COR signal. The controller will see the change in the COR signal and mute the audio right away, so you get a short squelch tail. The PL decoder will eventually figure out that the sub-audible tone went away and deactivate the PL signal, perhaps 200 milliseconds later. The delay in sensing the loss of PL won't matter because the audio is already muted (unlike mode 2).
- Mode 4: Either COR or PL will cause the controller to respond to the receiver. This mode is useful if you want to allow access to a repeater without PL, but you have to set the squelch relatively tight to keep noise from keying the repeater. As long as your signal to the repeater is relatively strong, you can transmit without PL and you will get short squelch tails just like in mode 1. If you are too far away and can't get a strong enough signal to the repeater to open the squelch, you can transmit a PL tone. If your signal is strong enough for the PL decoder at the repeater to work, you will be able to talk on the repeater, even if you can't open the squelch (similar to mode 2). Note that for this mode to work, the receiver must not mute the audio going to the controller when the squelch is closed (you must use unsquelched audio). When using this mode, you should transmit PL to the repeater only when necessary, as whenever you use PL, you will get long squelch tails.
- Mode 5: The controller considers the receiver to be active all of the time, regardless of the COR and PL signals. This mode is useful for working with HF radios, with or without all-mode squelch. If

the HF radio doesn't have squelch, or if it does but it is set too tight and the signal keeps dropping out, you can select this mode to tell the controller to treat it like it is always active while you are using it. You may want to change the access mode to mode 0 when you are not using it, to keep it from timing out.

Example:

You want to change the receiver and DTMF mode to COR and PL (mode 3) on port 2. Note that you don't need to specify the DTMF mode if it is the same as the receiver mode:

```
<005> 02 3 <unkey> or <005> 02 3 3
```

Voice Response: "Two CAP CAP" (CAP is for COR and PL)

Example:

You want to allow carrier access to a repeater on port 1, but you want to require PL to enter DTMF commands.

```
<005> 01 1 3
```

Response: Voice Response "One CAP COR"

203: Set Vox Response

<203> pp	recall vox response for port 'pp'
<203> pp l	set vox response level 'l'(0..2)
<203> pp l tth	set vox response level (0..2) and threshold 'tth'

Parameters:

- pp is the port number to recall or set
- 'l' is the vox response level (0 for slow, 1 for medium, 2 for fast)
- 'tth' is the vox threshold (0..100)

Examples:

- 203 01 0 - set vox response for port 01 to Slow
- 203 01 1 - set vox response for port 01 to Slow
- 203 01 2 - set vox response for port 01 to Slow

006: Set or Recall Receiver Priorities (monitor mute)

This command allows audio from a receiver to be automatically muted whenever audio from another receiver is heard. This can be used to mute a weather radio, for example, when someone keys the repeater. The weather radio will remain muted as long as the repeater receiver is active and for a few seconds afterward (this time can be changed). This is sometimes known as “monitor mute” because it is often used when monitoring another repeater system, weather radio, space shuttle audio, etc.

For each transmitter, you can specify the “priority” of each receiver. If two receivers of the same priority are active (keyed up) at the same time, their audio will be mixed (the way the controller always worked in firmware versions V1.80 and earlier). If they have different priority settings, the audio from the lower priority receiver will be muted.

<006> tt p	Recall settings for TX "tt"
<006> tt rr p	Set priority for one RX
<006> tt rr ss p	Set priority for two RX
<006> tt rr ss ...qq p	Set priority for multiple RX

Parameters:

- 006 is the default command name.
- 'tt' is the TX number (01..12)
- 'rr' is the RX number (01..12)
- 'p' is the priority (default priority for all receivers is 4, allowed values are 0..9)

Examples:

You have a repeater on port 1 and a weather radio on port 2. You want to mute the weather radio if any other receiver can be heard on transmitter 1. If all of the other receivers are still set to their default priority level (4), we just need to set the priority for RX 2 to something less than 4. We will set it to zero in this example.

```
<006> 01 02 0 D or unkey or <Enter>
```

Notes:

Timers (51..56) control how long lower priority receivers stay muted after higher priority receivers become inactive.

013: Set COR and PL Active Levels

This command allows you to select whether the COR and PL inputs are active low or active high. The default is active low; when the controller sees a COR line go to ground, it thinks that the receiver is getting a signal. If you have a radio or PL detector that goes high when active, you can use this command to tell the RLC-DSP404 to consider high to be the active level.

<013> pp c o	Set Active Level
<013> pp 0 0	Reset to Defaults

Notes:

- This command does not affect the input circuits at all; it does not disable the built-in pullup resistors on the RLC-DSP404's COR and PL inputs.
- If you are not able to enter commands using DTMF, you may need to temporarily fool the RLC-DSP404 into thinking that your receiver's active level is different than it is. For example, if your receiver outputs an active high COR signal to the RLC-DSP404, the DSP4 will not accept DTMF commands from that receiver until its COR polarity is changed with this command. You could solve this problem by temporarily disconnecting the COR line from the receiver and manually attaching it to ground. This will cause the RLC-DSP404 to think that the receiver is active (COR line is active low by default). You will have to disconnect that line from ground or press the 'D' key to simulate unkeying after entering each command.

Parameters:

- 013 is the default command name.
- pp is the port to select the active levels for.
- C is the COR polarity, 0 for active low, 1 for active high.
- o is the PL polarity, 0 for active low, 1 for active high.

Default:

- All COR and PL inputs default to active low.

Example:

Change Port 2's COR input to active high:

```
<013> pp 1 0 D or unkey or <Enter>
```

Voice Response: "2 1 0"

155: Enable or Disable PTT for a Port

This command allows you to turn a PTT off regardless of what else the controller is doing. It doesn't matter whether it is a repeater or a link, what receivers are active, or anything else, if this command gets executed with F=0, the PTT goes off and stays off. This command is not the best way to regularly shut off a repeater or link, but will get the job done in an emergency. The only way to make the PTT work normally is to execute this command with F=1 or to reinitialize the controller.

```
<155> tt f
```

Parameters:

- 155 is the default command name.
- P is which transmitter to turn off
- F is 1 to enable the PTT (the default) or 0 to disable it

Notes:

This command does not disable the receiver, so you can normally turn the repeater back on by executing this command and enabling the PTT. However, if you have the controller set up to require a challenge password and this command is password protected, you will not be able to hear the challenge with the PTT disabled so you won't be able to log on and enable the PTT again. In that case you will have to access the controller another way, such as from another radio port, from the reverse autopatch, or from the serial port.

156: Recall Which PTT are Enabled

This command allows you to recall which PTT are enabled and which have been turned off with Command 155.

```
<156>
```

Parameters:

- 156 is the default command name.

Voice Response:

Ports that are set to operate normally are listed. Any ports not listed have their PTT disabled. Normal response: "010203040506070809101112".

Chapter 3: Audio and DTMF Configurations

This chapter deals with how the controller handles DTMF digits that are received from a radio or the reverse autopatch. You can control both what is heard on the repeater while digits are being entered and what the controller does with those digits - whether it uses them to execute commands or ignores them.

Background:

The controller has a DTMF decoder that is constantly listening to each receiver. A DTMF decoder works by watching for 8 tone frequencies, 4 that represent the row and 4 that represent the column of a 16 key DTMF keypad. If a row frequency and a column frequency are detected at the same time, the decoder registers it as a valid digit and tells the microprocessor. This takes about 40 or 50 milliseconds from the time the DTMF digit starts.

DTMF Mute:

If you have the controller set to mute DTMF digits on a transmitter (see command 007), it will turn off the audio from the receiver that is receiving DTMF digits to that transmitter as soon as the digit is detected. Normally you will hear the first few milliseconds of the DTMF digit before it is detected and muted, although you can avoid hearing it at all with an audio delay module (available from Link Communications).

The audio stays muted for a few seconds (see command 020, DTMF mute timers) after each digit is released. If you press another digit during those few seconds (while the audio is still muted), you won't hear any part of the following digits. So when you key up to enter a command, those listening to the repeater will hear a short beep when you hit the first digit and then your digits will be muted (unless you wait too long between digits and the timer expires).

DTMF Cover Tone:

If you want to, you can turn on a "cover tone" that is sent while the DTMF digits are muted (see command 007). This constant beeping while digits are being entered lets people know that someone is programming, so they don't just key up and talk over the silence of the DTMF mute. You can change what the cover tone sounds like by editing macro 339.

Drop Transmitters When DTMF Muted Option:

In some cases (usually for link transmitters), it is desirable to let a transmitter unkey when DTMF is muted rather than transmitting a dead carrier or cover tone while DTMF is muted. Command 007 has an option to enable this. Note that after the DTMF mute starts, the transmitter's hang timer (and mini-hang timer) will run before the PTT will be turned off (the hang time is often very short on link transmitters, so this may not be noticeable). Also note that if there is another reason for the transmitter to stay keyed up (another connected active receiver, synthesized voice message, etc.), the transmitter remain keyed and the receiver that is entering DTMF will simply be muted. Finally, if the DTMF mute bypass is used, the transmitter will remain keyed so the DTMF digits can be heard.

DTMF Mute Options are Set for Each Transmitter:

The DTMF mute options are set for each transmitter (not receiver). This means, for example, that if you turn on the DTMF mute for your repeater transmitter, that DTMF tones will be muted on the repeater whether they are received from the repeater receiver, a link receiver, the autopatch, etc. In most systems, the DTMF mute (and often cover tone) are turned on for repeater transmitters.

DTMF Mute Bypass:

The DTMF mute bypass, if enabled, allows the mute to be temporarily bypassed so DTMF digits can be heard on transmitters where they are normally muted. The mute bypass is activated when the force-execution digit (usually 'D', see command 078 to change) is the first digit detected after a receiver becomes active (when the user keys up). The bypass feature can be used to send DTMF paging codes over a repeater that mutes DTMF digits or for passing commands out a link transmitter that normally mutes DTMF tones. When the DTMF mute is bypassed in this way, the controller ignores the DTMF digits that are entered; they will not cause the controller to execute commands or send error messages. The bypass feature is de-activated when the receiver becomes inactive (when the user unkeys).

A typical example involves a repeater and link port. Both transmitters have their DTMF mute functions enabled (possibly with cover tone or the drop-transmitter option), so when DTMF commands are sent to the controller, it will mute the digits. If the DTMF mute bypass feature is turned on for the link transmitter but not for the repeater transmitter, a user can key up, press 'D' to activate the bypass, then enter the DTMF digits. Those digits will be passed out the link transmitters but will still be muted on the repeater transmitter.

The 'D' (force-execution digit) itself will be muted as soon as it is detected. If you do not have an audio delay module, the first part of that 'D' will be heard and might mess up whatever you are passing tones to. There are a variety of ways to deal with this:

- Some devices (such as IRLP interfaces) automatically ignore 'D', so even if they do decode the part of the 'D' that is not muted, it won't have any effect.
- Install an audio delay module on the receiver the tones are being entered from. That will allow the 'D' to be completely muted, so the listening device won't hear it at all.
- If the tones are going to another controller that supports the same command 007 features:
 - Turn off the DTMF bypass on the other controller so the 'D' won't cause it to ignore the digits
 - Or see the "Advanced DTMF Mute Bypass Option" described at the end of command 007. It lets you disable the DTMF mute bypass for selected receivers.
- If the listening device has a force-execution digit or something similar that will cause it to ignore any digits already received, that digit could be sent after the 'D' and before the other digits.
- If the listening device resets when the signal goes away, use command 007 DTMF mute option 2 to drop the transmitter while digits are being muted and set the transmitters hang timer (and mini-hang timer) to zero. When the force-execution digit is detected and muted, the transmitter will drop until that digit is released. Then it will come back up allowing the other digits to be passed through.
- Turn DTMF mute off and enter the digits without using a 'D' first.

In firmware versions V1.80 and earlier, the DTMF mute bypass could be enabled or disabled for each *receiver*. If the bypass feature was used, the DTMF mute was disabled on *all* transmitters. In all

firmware versions since then, the DTMF bypass is enabled or disabled individually for each *transmitter*. It doesn't matter which receiver the DTMF digits are entered from (but see the "Advanced DTMF Mute Bypass Option" at the end of command 007); if the force execution digit is the first digit entered, any transmitters connected to that receiver will have their DTMF mute functions temporarily disabled (until that receiver unkeys). This change makes it possible to normally mute DTMF on both repeater and link outputs and to use the mute bypass to allow DTMF digits to be sent down links without those digits being heard on the repeater output.

Passing DTMF Digits Down Links:

Link transmitters can be handled in a variety of ways.

- If the DTMF mute is left off for link transmitters, all DTMF tones entered on the repeater receiver will be passed down the link (assuming that the repeater and link ports are connected, see command 000). If the controller at the other end of the link has similar command names to the local controller, it may try to execute commands that are not intended for it. If it has completely different command names (command 061 can help with this), uses preaccess (see Chapter 9), or has some other way of figuring out which commands it should try to process, this can work fine.
- If the DTMF mute is turned on for link transmitters and you need to send DTMF tones down the links to the repeater controller on the other end of the link, you have two options: bypass the DTMF mute or make the controller generate DTMF digits.
 - Command 007 allows the DTMF mute bypass feature to be enabled for link transmitters. Once it is enabled, digits can be passed from the repeater receiver out the link transmitters by keying up, pressing 'D' to activate the mute bypass, then entering the DTMF digits that need to go down the link.
 - User macros (see Chapter 8) can be executed in response to user-entered DTMF commands. Those macros can be named almost anything from 1 to 6 DTMF digits long using command 010. They can be programmed to send any string of DTMF digits out any transmitter. For example:

```

010 600 ABC123 ;           name macro 600 "ABC123"
055 600 ;                 make sure macro 600 is empty
056 600 037 2 ;           send audio out transmitter 2
056 600 031 01 02 03 04 ; send DTMF "1234"

```

Note that the DTMF digits sent by the macro ("1234") may be completely different than the digits the user entered to cause the macro to be executed ("ABC123").

Voice Falsing:

As mentioned earlier, a DTMF decoder works by watching for 8 tone frequencies, 4 that represent the row and 4 that represent the column of a 16 key DTMF keypad. If a row frequency and a column frequency are detected at the same time, the decoder registers it as a valid digit. Sometimes peoples' voices have those frequencies in them and cause the DTMF decoder to think that a digit is present when it is not. If you have the DTMF mute turned on, this will cause it to be activated and your voice will "drop out" for a couple of seconds as the controller thinks it is muting a DTMF digit. If you have the cover tone turned on, you will hear it as well. The voice falsing of the DTMF decoder is not the decoder's fault - it is just watching for those tones.

Occasional falsing can be made less noticeable by reducing the duration of the DTMF mute timers. If

you have an audio delay module installed, that timer can be set to one half second or so with no negative consequences. The disadvantage of short DTMF mute timer setting on inputs without audio delay modules is that if you pause between digits, the first digit entered after the pause may be heard on the repeater output. A mute time of one or two seconds usually works well.

There are a couple of things you can do to reduce falsing at its source. The first thing is to check all of your audio levels. If you have the receive audio turned up too high at any point before it gets to the decoder, it may be distorted, which adds harmonics and makes falsing more likely. If your audio levels are OK, you have older versions of the hardware, and you still have falsing problems, you may be able to change some components to minimize the problem. The resistor value change (described below) has been standard in later revisions of the controller hardware, so if your controller is new, you can skip the rest of this section.

There is a resistor that controls how long a DTMF digit must be present before the DTMF decoder will consider it to be valid. Increasing the value of this resistor will increase the required time and decrease the chances of falsing, but may keep fast autodialers from working. Some early controllers may have used a 300K resistor, while later controllers use 470K. Even larger values (up to about 700K, where the decoder stops working at all) can be used in extreme cases.

It is possible to add an additional circuit paralleled across the resistor described above. That circuit consists of a resistor and a diode in series. It does not change the amount of time it takes a digit to decode (the diode prevents that), but they help reduce falsing by "resetting" the decoder faster when a digit goes away. This resistor is normally 220K; smaller values would "reset" the decoder even faster. This should not be necessary except perhaps in extreme cases. *This circuit is already integrated in the DSP404's decoders, so no modification is necessary.*

205: Load Personality

<205> l ii pp	Load personality from list.
---------------	--------------------------------

Parameters:

- 'l' is the list type (0 = factory, 1 = user).
- 'ii' is the index number of the personality in the list.
- pp is the port to load personality 'ii' into.

Examples:

- 205 0 05 07 - load settings from factory personalities #5 into port 7.
- 205 1 03 05 - load settings from user personalities #3 into port 5.

206: Save Personality

<206> pp 'ii'	Save port settings from port 'pp' into personality index 'ii'
---------------	--

Parameters:

- pp is the port to save personality from.
- 'ii' is the index identifier to save settings into.

Examples:

- 206 07 05 - save settings from port 7 into personality index 05.
- 206 05 03 - save settings from port 5 into personality index 03.

200: Set Audio Level and Vox Threshold

<200> pp w	recall audio level of 'w' for port pp
<200> pp w m l..l	set rx/tx/tone/vox- threshold level to mode 'm' and level 'l..l'

Parameters:

- pp = port number to recall
- 'w' is the receiver, transmitter, or tone level to recall.
 - '0' for recall of RX level
 - '1' for recall of TX level
 - '2' for recall of tone level
- 'm' sets threshold of 'w' to level 'l..l' (0..100)
 - the '*' and '#' symbols allow change of current levels by a given value.
 - '*10' means increment by 10 (won't exceed 100)
 - '#5' means decrement by 5 (won't go below 0)

Notes:

- 200 pp 0 m l..l - set receiver audio level.
 - pp = port number
 - 'm' is 0 to enable AGC, 1 to disable it.
 - 'l..l' is the level to set it to (just the starting level if using AGC)

202: Set Transmitter Audio Delay

<202> pp	recall tx audio delay for port 'pp'
<202> pp l..l	set tx audio delay to level l..l

Parameters:

- pp is the port number to recall or set
- 'l..l' is the level (0..400 in 10 msec increments)
 - the '*' and '#' symbols allow change of delay levels by a given value.
 - '*10' means increment by 10 (won't exceed 400)
 - '#5' means decrement by 5 (won't go below 0)

Examples:

- 202 01 50 - set tx audio delay for port '01' to 500 msec.
- 202 01 *5 - increase audio delay by 5.
- 202 01 #5 - increase audio delay by 5.
- 202 01 * - increase audio delay by 1.
- 202 01 * - increase audio delay by 1.

007: Configure DTMF Mute/Cover Tone/Bypass

This command allows you to configure a what is heard on the specified transmitter when a user enters DTMF digits. By default they are passed through the controller just as any other audio would be. In some cases (such as when you are configuring the controller), it may be preferable to keep the digits from being heard. This command lets you simply mute the digits, mute them and send a cover tone (constant beeping), or drop the transmitter completely while the digits are being entered. A "bypass" function can also be enabled to allow DTMF digits to be passed through (rather than muted) if the force-execution digit (usually "D") is the first DTMF digit pressed after keyup. See the beginning of this chapter for more detailed explanations.

<007> pp	Recall settings
<007> pp m	Configure DTMF mute
<007> pp m b	Configure DTMF mute and bypass
<007> pp 0 1	Restore defaults

Parameters:

- 007 is the default command name.
- pp is the port to set up or recall
- M turns the DTMF mute on or off
 - 0 - Disables DTMF mute on the selected transmitter (default)
 - 1 - Enable DTMF mute on the selected transmitter
 - 2 - Enable DTMF mute with cover tone on the selected transmitter
 - 3 - Drop the transmitter when DTMF tones are being received
- B (optional) turns the DTMF mute bypass on or off
 - 0 - Disable the DTMF bypass for the selected transmitter
 - 1 - Enable the DTMF bypass for the selected transmitter (default)

Voice Response:

<port number "pp">
 <mute on/off>
 <cover tone on/off>
 <drop TX on/off>
 <bypass enabled for TX "P">
 <bypass enabled for RX "P">

Notes:

- A DTMF digit will be muted, cause cover tone, let the transmitter drop, etc. as long as it is held. It will continue to have an effect after it is release for the duration of the DTMF interdigit timer (see Chapter 4) controls how long after a digit is released it will continue to cause muting / cover tone / transmitter drop.

Example: For port 1,turn on DTMF mute with cover tone and turn off the mute bypass:

<007> pp 2 0 unkey, 'D' or <Enter>

Voice Response "1 2 OFF"

Notes about the Autopatch:

When using the autopatch, if the other end is hung up before the autopatch is, you may get a "second dial tone" which allows you to make another call without hanging up. Since the controller doesn't know that the other end hung up, it doesn't know that you are placing another call and will not prevent you from making a long distance call, even if long distance numbers are normally blocked. To prevent this, you can turn on the DTMF mute for the autopatch port, although there are some drawbacks to that. If you turn on DTMF mute for the autopatch port, command 111 will no longer let you dial, you will not be able to enter digits to control answering machines, leave pages, etc., or do anything else that requires passing DTMF digits entered from the radio down the phone line. In most cases, the DTMF mute can be left off with minimal risk of abuse.

Advanced DTMF Mute Bypass Option:

An optional digit can be appended to command 007 as described above, using the format "<007> pp m b rr" where "rr" is the additional digit. If "rr" is 1 (the default) and "D" is the first digit entered from receiver "pp", the DTMF bypass will work normally. If "r" is 0, the DTMF bypass feature will not work from receiver "pp". In that case, if "D" (the force-execution digit) is the first digit detected from receiver "p", it will just be ignored and following digits will be processed and muted as if the 'D' was never heard (those DTMF digits can cause commands to be executed, may cause error messages, etc.).

It might be useful to disable the DTMF bypass for link receivers. Then if a link receiver hears part of the DTMF "D" coming down the link from another site that is using the DTMF bypass feature to pass DTMF tones out its link transmitter, that 'D' won't cause that link receiver to ignore the following digits.

Chapter 4: Timers

This chapter deals with the controllers timers and time related issues. The areas dealt with in this chapter are:

- Programming, starting, restarting and recalling timers
- Setting and recalling the time-of-day clock

020: Set or Recall a Timer's Duration

This command allows you to set the duration of a timer.

<020> xxx	Recall timer's duration
<020> xxx t..t	Set timer's duration

Parameters:

- 020 is the default command name.
 - 'xxx' is the timer to be programmed (three digits)
 - 't..t' is the value to be programmed into the timer, 0 to 9999, one to four digits.
- The first group of timers are set in 10mS increments (100 counts per second).
The rest of the timers are set in 1 second increments (60 counts per minute, 3600 per hour).

Note:

When a timer is set, a count variable associated with that timer is set equal to duration of the timer (t..t from command 020). Once the timer is set, the count variable starts counting down from the *timer_duration* → 0 and then stops after expiring. If command 020 is used to set a timer's duration while the timer is running, the count associated with that timer will be adjusted accordingly. If the timer's duration is set to a value less than the current count, the timer will expire immediately. Conversely, if the timer is set to a value greater than the count, the appropriate time will be added to the count to lengthen the timer accordingly.

Pseudo Code:

```

IF( count != 0 ) THEN                                     // Timer already running
  IF( input_duration > current_duration ) THEN
    count += input_duration - current_duration           // Add appropriate time to count
    current_duration = input_duration                     // Set new timer's duration
  ELSE
    count = 0                                             // Stop timer, it has already run longer than input_duration
    current_duration = input_duration                     // Set new timer's duration
  END IF
ELSE                                                       // Timer not running
  current_duration = input_duration                       // Set new timer's duration
END IF

```

List of Timers

Message Start Delay Timer:

This timer controls how long the controller will wait before sending any tones or voice messages in two situations. The first is when you enter a command and unkey; it controls how long it will be before the response to that command will be sent. If the delay is set too short, you might miss the first word or two while your HT finishes switching from transmitting to receiving. The second situation in which this timer might delay tones or voice messages is when they need to be sent out of a transmitter that is not keyed up at the time. The transmitter will be keyed for at least the duration of this timer before the tone or voice is started. If this timer is too short, the transmitter might not have time to come up to full power and the beginning of the tone or voice message might be missed. If the tone or voice message is being sent down a link system with multiple hops, more time might be needed so all of the link transmitters will have time to come up.

- This timer is programmed in 10mS increments from 0..9999.
- If a timer value of 000 is entered, the timer is disabled.

Timer Number	Defaults
000 .. Message Start Delay Timer, Transmitter 1	500mS (050)
001 .. Message Start Delay Timer, Transmitter 2	500mS (050)
002 .. Message Start Delay Timer, Transmitter 3	500mS (050)
003 .. Message Start Delay Timer, Transmitter 4	500mS (050)
004 .. Message Start Delay Timer, Transmitter 5	500mS (050)
005 .. Message Start Delay Timer, Transmitter 6	500mS (050)
006 .. Message Start Delay Timer, Transmitter 7	500mS (050)
007 .. Message Start Delay Timer, Transmitter 8	500mS (050)
008 .. Message Start Delay Timer, Transmitter 9	500mS (050)
009 .. Message Start Delay Timer, Transmitter 10	500mS (050)
010 .. Message Start Delay Timer, Transmitter 11	500mS (050)
011 .. Message Start Delay Timer, Transmitter 12	500mS (050)

Courtesy Beep Delay Timer:

This timer specifies the minimum time between when a receiver unkeys and when its courtesy beep will be sent out connected repeater ports. The courtesy beep can also be delayed by other tones in the tone queues and the synthesized voice.

- This timer is programmed in 10mS increments from 001-9999
- If a timer value of 000 is entered, the transmitter will hang on the air forever.

Timer Number	Defaults
012 .. Courtesy Beep Delay Timer, Receiver 1	1 sec (100)
013 .. Courtesy Beep Delay Timer, Receiver 2	1 sec (100)
014 .. Courtesy Beep Delay Timer, Receiver 3	1 sec (100)
015 .. Courtesy Beep Delay Timer, Receiver 4	1 sec (100)
016 .. Courtesy Beep Delay Timer, Receiver 5	1 sec (100)
017 .. Courtesy Beep Delay Timer, Receiver 6	1 sec (100)
018 .. Courtesy Beep Delay Timer, Receiver 7	1 sec (100)
019 .. Courtesy Beep Delay Timer, Receiver 8	1 sec (100)
020 .. Courtesy Beep Delay Timer, Receiver 9	1 sec (100)
021 .. Courtesy Beep Delay Timer, Receiver 10	1 sec (100)
022 .. Courtesy Beep Delay Timer, Receiver 11	1 sec (100)
023 .. Courtesy Beep Delay Timer, Receiver 12	1 sec (100)

Transmitter Hang Timer:

This timer holds the transmitter PTT active after a connected receiver goes inactive. If a courtesy beep is sent, this is the minimum time after the courtesy beep before the PTT drops. This timer only has an effect when a connected receiver has been active since the PTT went active; otherwise this timer is ignored and the mini-hang timer (timer 036..042) is the only thing that will cause a delay. You must set the mini-hang timer shorter than this timer or this timer won't have any effect, as the actual delay is the longer of the two timers.

- This timer is programmed in 10mS increments from 000-9999 (000 is OK).

Timer Number	Defaults
024 .. Hang Timer for Transmitter 1	2 sec (200)
025 .. Hang Timer for Transmitter 2	2 sec (200)
026 .. Hang Timer for Transmitter 3	2 sec (200)
027 .. Hang Timer for Transmitter 4	2 sec (200)
028 .. Hang Timer for Transmitter 5	2 sec (200)
029 .. Hang Timer for Transmitter 6	2 sec (200)
030 .. Hang Timer for Transmitter 7	2 sec (200)
031 .. Hang Timer for Transmitter 8	2 sec (200)
032 .. Hang Timer for Transmitter 9	2 sec (200)
033 .. Hang Timer for Transmitter 10	2 sec (200)
034 .. Hang Timer for Transmitter 11	2 sec (200)
035 .. Hang Timer for Transmitter 12	2 sec (200)

DTMF Mute Timer:

This timer controls the amount of time a receiver entering DTMF stays muted after a DTMF digit is released (assuming the DTMF mute is enabled with command 007). If following digits are entered within the duration of this timer after the previous digit is released, they will be completely muted. If this timer is set shorter than the time between digits, the beginning of the following digits will be heard. In other words, setting this timer longer allows DTMF digits to be entered more slowly without hearing the beginning of the second and following digits. The disadvantage of increasing the duration of this timer is that if the DTMF decoder voice falses (see the beginning of Chapter 3 for more information about voice falsing), it will mute the voice longer.

- If an audio delay module is installed for a receiver, this timer can be set quite short (to the length of the delay, usually about 100mS) or slightly longer. The audio delay module will keep the beginning of any digits from being heard and the short delay will minimize the problems with voice falsing. If it is set too short, the *end* of each digit may be heard (if the controller quits muting before the audio gets through the audio delay module).
- This timer is programmed in 10mS Increments from 001-9999
- If a timer value of 000 is entered, your audio will be muted forever, so if you want it to be as short as possible, enter 001

Timer Number	Defaults
036 .. DTMF Mute Timer, Receiver 1	1 sec (100)
037 .. DTMF Mute Timer, Receiver 2	1 sec (100)
038 .. DTMF Mute Timer, Receiver 3	1 sec (100)
039 .. DTMF Mute Timer, Receiver 4	1 sec (100)
040 .. DTMF Mute Timer, Receiver 5	1 sec (100)
041 .. DTMF Mute Timer, Receiver 6	1 sec (100)
042 .. DTMF Mute Timer, Receiver 7	1 sec (100)
043 .. DTMF Mute Timer, Receiver 8	1 sec (100)
044 .. DTMF Mute Timer, Receiver 9	1 sec (100)
045 .. DTMF Mute Timer, Receiver 10	1 sec (100)
046 .. DTMF Mute Timer, Receiver 11	1 sec (100)
047 .. DTMF Mute Timer, Receiver 12	1 sec (100)

I/O Polling Timer:

This timer determines how often the controller checks to see if any of the analog/digital input lines have changed from high to low or low to high or if any analog alarm conditions have changed. If you want quicker response to changes, shorten this timer. If you don't want to hear about changes that happen more often than every minute or so, lengthen it to a minute. The default is one second.

Timer Number	Defaults
048 .. I/O Polling Timer	1 sec (100)

Courtesy Beep After Voice or Tones Timer:

This timer keeps a courtesy beep from being sent immediately after a voice message. It sets the minimum amount of time the controller will wait after the voice and tone generators stop before a courtesy beep will be sent. The courtesy beep delay timers (timers 007..023) control how long after *unkeying* the controller will wait, but if they have already expired and the courtesy beep is just waiting for the voice to finish, this timer will have an effect. An example of this is when you kerchunk a repeater after a long period of inactivity and then wait for the initial ID then the courtesy beep.

- This timer is programmed in 10mS Increments from 001-9999

Timer Number	Defaults
049 .. Courtesy Beep After Voice Timer, Transmitter 1	1 sec (100)
050 .. Courtesy Beep After Voice Timer, Transmitter 2	1 sec (100)
051 .. Courtesy Beep After Voice Timer, Transmitter 3	1 sec (100)
052 .. Courtesy Beep After Voice Timer, Transmitter 4	1 sec (100)
053 .. Courtesy Beep After Voice Timer, Transmitter 5	1 sec (100)
054 .. Courtesy Beep After Voice Timer, Transmitter 6	1 sec (100)
055 .. Courtesy Beep After Voice Timer, Transmitter 7	1 sec (100)
056 .. Courtesy Beep After Voice Timer, Transmitter 8	1 sec (100)
057 .. Courtesy Beep After Voice Timer, Transmitter 9	1 sec (100)
058 .. Courtesy Beep After Voice Timer, Transmitter 10	1 sec (100)
059 .. Courtesy Beep After Voice Timer, Transmitter 11	1 sec (100)
060 .. Courtesy Beep After Voice Timer, Transmitter 12	1 sec (100)

Doug Hall RBI-1 or RLC-ICM Delayed Send Timer:

Buffers inside the RBI-1 or the RLC-ICM overflow if it is sent too many changes too quickly. The RLC-DSP404 avoids this potential problem by collecting all of the changes that occur quickly (such as within a macro) and sends the combined result of all of them only when no changes have been made for the duration of this timer. This timer also affects the RLC-ICM.

- This timer is programmed in 10mS Increments from 001-9999

Timer Number	Defaults
061 .. RBI-1 or RLC-ICM Delayed Send Timer	500 mS (050)

HF Radio Scan Delay Timer:

This timer determines how quickly the HF radio will scan by controlling how long it waits before sending the next frequency step. Smaller timer values make it scan more quickly. It affects all three scan step sizes (slow, medium and fast) equally. It also has an effect on how quickly other changes are sent to the radio, although reasonable changes in that time won't be very noticeable. There is a limit to how quickly the controller can send command to the radio, so if setting this timer to a smaller value doesn't increase the scan speed past a certain point, you have probably reached that limit.

Some radios such as the Yaesu FT-767 require an acknowledgment to be sent after every command. This causes them to scan only half as fast as other radios given the same scan timer setting (since the controller has to send the frequency command and the acknowledgment for each step). When using those radios, you may wish to set the scan timer to about ½ the duration you would for other radios.

- This timer is programmed in 10mS Increments from 001-9999

Timer Number	Defaults
062 .. HF Scan Delay Timer	500 mS (050)

Transmitter Mini-Hang Timer:

This timer holds the transmitter PTT active for a minimum time after any keying source (connected receiver, synthesized voice, tone, CW, DVR message, etc) goes inactive. It can be used to keep the transmitter from dropping out immediately after a message. To control the hang time after a connected receiver unkeys, you can also use the normal hang timers (024..035); the actual hang time will be the longer of the two.

- This timer is programmed in 10mS increments from 000-9999

Timer Number	Defaults
063 .. Mini-Hang Timer, Transmitter 1	500 mS (050)
064 .. Mini-Hang Timer, Transmitter 2	500 mS (050)
065 .. Mini-Hang Timer, Transmitter 3	500 mS (050)
066 .. Mini-Hang Timer, Transmitter 4	500 mS (050)
067 .. Mini-Hang Timer, Transmitter 5	500 mS (050)
068 .. Mini-Hang Timer, Transmitter 6	500 mS (050)
069 .. Mini-Hang Timer, Transmitter 7	500 mS (050)
070 .. Mini-Hang Timer, Transmitter 8	500 mS (050)
071 .. Mini-Hang Timer, Transmitter 9	500 mS (050)
072 .. Mini-Hang Timer, Transmitter 10	500 mS (050)
073 .. Mini-Hang Timer, Transmitter 11	500 mS (050)
074 .. Mini-Hang Timer, Transmitter 12	500 mS (050)

Keyup Delay Timer:

The keyup delay timer is used to keep short noise bursts that open the receiver's squelch from keying up the repeater. It can also keep people from kerchunking the repeater. When enabled, it makes the controller totally ignore keyups shorter than the duration of this timer (the rest of this explanation will assume ½ second). If the receiver is keyed for longer than ½ second, the first ½ second will be ignored, then it will respond normally, bringing up the transmitter, triggering the ID system, etc. To keep every keyup from being delayed, the keyup delay is automatically disabled while the repeater is being used. It is only re-enabled when the repeater is not used for a default of 60 seconds (see timers 279..290). If this timer is set to zero (the default), the keyup delay is disabled. A typical setting would be 50, which is ½ second.

Timer Number	Defaults
075 .. Keyup Delay Timer, Receiver 1	0 (Disabled)
076 .. Keyup Delay Timer, Receiver 2	0 (Disabled)
077 .. Keyup Delay Timer, Receiver 3	0 (Disabled)
078 .. Keyup Delay Timer, Receiver 4	0 (Disabled)
079 .. Keyup Delay Timer, Receiver 5	0 (Disabled)
080 .. Keyup Delay Timer, Receiver 6	0 (Disabled)
081 .. Keyup Delay Timer, Receiver 7	0 (Disabled)
082 .. Keyup Delay Timer, Receiver 8	0 (Disabled)
083 .. Keyup Delay Timer, Receiver 9	0 (Disabled)
084 .. Keyup Delay Timer, Receiver 10	0 (Disabled)
085 .. Keyup Delay Timer, Receiver 11	0 (Disabled)
086 .. Keyup Delay Timer, Receiver 12	0 (Disabled)

Wind Speed Timer:

This timer is used to help determine the wind speed indicated by an anemometer. The number of pulses counted during the duration of this timer becomes the pseudo-analog value. For more information, see command 109.

Timer Number	Defaults
087 .. Wind Speed Timer	2.26 sec (226)

Word Too Long Timer:

There is no need to change this timer! It is used to ensure that even if the voice synthesizer messes up, that it will not cause the controller to leave a transmitter keyed. If a word takes longer than this timer, it will be truncated and the controller will go on to the next word.

Timer Number	Defaults
088 .. Word Too Long Timer	1.5 sec (150)

Receiver Priority Mute Timer:

This timer keeps lower priority receivers (as set with command 006) muted for the specified time after a higher priority receiver becomes inactive.

- This timer is programmed in 10mS increments from 000-9999

Timer Number	Defaults
089 .. Receiver Priority Mute Timer, Receiver 1	150 mS (015)
090 .. Receiver Priority Mute Timer, Receiver 2	150 mS (015)
091 .. Receiver Priority Mute Timer, Receiver 3	150 mS (015)
092 .. Receiver Priority Mute Timer, Receiver 4	150 mS (015)
093 .. Receiver Priority Mute Timer, Receiver 5	150 mS (015)
094 .. Receiver Priority Mute Timer, Receiver 6	150 mS (015)
095 .. Receiver Priority Mute Timer, Receiver 7	150 mS (015)
096 .. Receiver Priority Mute Timer, Receiver 8	150 mS (015)
097 .. Receiver Priority Mute Timer, Receiver 9	150 mS (015)
098 .. Receiver Priority Mute Timer, Receiver 10	150 mS (015)
099 .. Receiver Priority Mute Timer, Receiver 11	150 mS (015)
100 .. Receiver Priority Mute Timer, Receiver 12	150 mS (015)

Receiver Force Half Duplex Timer:

- This timer is programmed in 10mS increments from 000-9999

Timer Number	Defaults
101 .. Receiver Force Half Duplex Timer, Receiver 1	0 (disabled)
102 .. Receiver Force Half Duplex Timer, Receiver 2	0 (disabled)
103 .. Receiver Force Half Duplex Timer, Receiver 3	0 (disabled)
104 .. Receiver Force Half Duplex Timer, Receiver 4	0 (disabled)
105 .. Receiver Force Half Duplex Timer, Receiver 5	0 (disabled)
106 .. Receiver Force Half Duplex Timer, Receiver 6	0 (disabled)
107 .. Receiver Force Half Duplex Timer, Receiver 7	0 (disabled)
108 .. Receiver Force Half Duplex Timer, Receiver 8	0 (disabled)
109 .. Receiver Force Half Duplex Timer, Receiver 9	0 (disabled)
110 .. Receiver Force Half Duplex Timer, Receiver 10	0 (disabled)
111 .. Receiver Force Half Duplex Timer, Receiver 11	0 (disabled)
112 .. Receiver Force Half Duplex Timer, Receiver 12	0 (disabled)

Recently Active Receiver Timer:

- This timer is programmed in 10mS increments from 000-9999

Timer Number	Defaults
113 .. Recently Active RX/TX Timer, Port 1	1 mS (default)
114 .. Recently Active RX/TX Timer, Port 2	1 mS (default)

115	.. Recently Active RX/TX Timer, Port 3	..... 1 mS (default)
116	.. Recently Active RX/TX Timer, Port 4	..... 1 mS (default)
117	.. Recently Active RX/TX Timer, Port 5	..... 1 mS (default)
118	.. Recently Active RX/TX Timer, Port 6	..... 1 mS (default)
119	.. Recently Active RX/TX Timer, Port 7	..... 1 mS (default)
120	.. Recently Active RX/TX Timer, Port 8	..... 1 mS (default)
121	.. Recently Active RX/TX Timer, Port 9	..... 1 mS (default)
122	.. Recently Active RX/TX Timer, Port 10	..... 1 mS (default)
123	.. Recently Active RX/TX Timer, Port 11	..... 1 mS (default)
124	.. Recently Active RX/TX Timer, Port 12	..... 1 mS (default)

Patch Link Wait Before Idle Timer:

- This timer is programmed in 10mS increments from 000-9999

Timer Number	Defaults
125	.. Patch Link Wait Before Idle Timer, Port 1 200 mS (default)
126	.. Patch Link Wait Before Idle Timer, Port 2 200 mS (default)
127	.. Patch Link Wait Before Idle Timer, Port 3 200 mS (default)
128	.. Patch Link Wait Before Idle Timer, Port 4 200 mS (default)
129	.. Patch Link Wait Before Idle Timer, Port 5 200 mS (default)
130	.. Patch Link Wait Before Idle Timer, Port 6 200 mS (default)
131	.. Patch Link Wait Before Idle Timer, Port 7 200 mS (default)
132	.. Patch Link Wait Before Idle Timer, Port 8 200 mS (default)
133	.. Patch Link Wait Before Idle Timer, Port 9 200 mS (default)
134	.. Patch Link Wait Before Idle Timer, Port 10 200 mS (default)
135	.. Patch Link Wait Before Idle Timer, Port 11 200 mS (default)
136	.. Patch Link Wait Before Idle Timer, Port 12 200 mS (default)

Console PTT Force Inactive Timer:

- This timer is programmed in 10mS increments from 000-9999

Timer Number	Defaults
137	.. Console PTT Force Inactive Timer, Port 1 100 mS (default)
138	.. Console PTT Force Inactive Timer, Port 2 100 mS (default)
139	.. Console PTT Force Inactive Timer, Port 3 100 mS (default)
140	.. Console PTT Force Inactive Timer, Port 4 100 mS (default)
141	.. Console PTT Force Inactive Timer, Port 5 100 mS (default)
142	.. Console PTT Force Inactive Timer, Port 6 100 mS (default)
143	.. Console PTT Force Inactive Timer, Port 7 100 mS (default)
144	.. Console PTT Force Inactive Timer, Port 8 100 mS (default)
145	.. Console PTT Force Inactive Timer, Port 9 100 mS (default)

146 .. Console PTT Force Inactive Timer, Port 10 100 mS (default)
 147 .. Console PTT Force Inactive Timer, Port 11 100 mS (default)
 148 .. Console PTT Force Inactive Timer, Port 12 100 mS (default)

Impolite ID Timer:

This timer waits until either the timer expires or activity goes away before sending an ID.

- This timer is programmed in 1Sec increments from 001-9999

- If a timer value of 000 is entered, the controller will not interrupt a conversation to send an ID.

Timer Number	Defaults
160 .. Impolite ID Timer, Transmitter 1	20 sec (020)
161 .. Impolite ID Timer, Transmitter 2	20 sec (020)
162 .. Impolite ID Timer, Transmitter 3	20 sec (020)
163 .. Impolite ID Timer, Transmitter 4	20 sec (020)
164 .. Impolite ID Timer, Transmitter 5	20 sec (020)
165 .. Impolite ID Timer, Transmitter 6	20 sec (020)
166 .. Impolite ID Timer, Transmitter 7	20 sec (020)
167 .. Impolite ID Timer, Transmitter 8	20 sec (020)
168 .. Impolite ID Timer, Transmitter 9	20 sec (020)
169 .. Impolite ID Timer, Transmitter 10	20 sec (020)
170 .. Impolite ID Timer, Transmitter 11	20 sec (020)
171 .. Impolite ID Timer, Transmitter 12	20 sec (020)

Initial ID Timer:

This timer times the amount of inactivity before an initial ID is sent.

- This timer is programmed in 1Sec increments from 001-9999
- If a timer value of 000 is entered, the controller will never send an initial ID.

Timer Number	Defaults
172 .. Initial ID Timer, Transmitter 1	10 min (600)
173 .. Initial ID Timer, Transmitter 2	10 min (600)
174 .. Initial ID Timer, Transmitter 3	10 min (600)
175 .. Initial ID Timer, Transmitter 4	10 min (600)
176 .. Initial ID Timer, Transmitter 5	10 min (600)
177 .. Initial ID Timer, Transmitter 6	10 min (600)
178 .. Initial ID Timer, Transmitter 7	10 min (600)
179 .. Initial ID Timer, Transmitter 8	10 min (600)
180 .. Initial ID Timer, Transmitter 9	10 min (600)
181 .. Initial ID Timer, Transmitter 10	10 min (600)
182 .. Initial ID Timer, Transmitter 11	10 min (600)
183 .. Initial ID Timer, Transmitter 12	10 min (600)

Pending ID Timer:

This timer times inner activity ID timer so a proper Pending ID can be send during activity.

- This timer is programmed in 1Sec increments from 001-9999
 - If a timer value of 000 is entered, the controller will never send a rotating ID.
 - This timer should normally be set shorter than the initial ID timer (one minute shorter works well).
- You may need to make sure that the duration of this timer plus the duration of the impolite ID timer is less than 10 minutes to meet requirements for ID timing.

Timer Number	Defaults
184 .. Pending ID Timer, Transmitter 1	9 min (540)
185 .. Pending ID Timer, Transmitter 2	9 min (540)
186 .. Pending ID Timer, Transmitter 3	9 min (540)
187 .. Pending ID Timer, Transmitter 4	9 min (540)
188 .. Pending ID Timer, Transmitter 5	9 min (540)
189 .. Pending ID Timer, Transmitter 6	9 min (540)
190 .. Pending ID Timer, Transmitter 7	9 min (540)
191 .. Pending ID Timer, Transmitter 8	9 min (540)
192 .. Pending ID Timer, Transmitter 9	9 min (540)
193 .. Pending ID Timer, Transmitter 10	9 min (540)
194 .. Pending ID Timer, Transmitter 11	9 min (540)
195 .. Pending ID Timer, Transmitter 12	9 min (540)

Timeout Timers:

This timer times how long each receiver has been active. If the receiver is active longer than the duration of this timer, it is disabled until it goes inactive, and its time out message (see Chapter 8 for list of macros) is sent out all transmitters that are connected to it. It is reset and the time out clear message is sent when a timed out receiver goes inactive.

- This timer is programmed in 1 second increments from 001-9999
- If a timer value of 000 is entered, the controller will never time-out.
- By default the time out timer is reset as soon as a receiver unkeys. To make it wait until the courtesy beep to reset (which may help discourage “tailgating”), see command 041.

Timer Number	Defaults
196 .. Time Out Timer, Receiver 1	..... 3 min (180)
197 .. Time Out Timer, Receiver 2	..... 3 min (180)
198 .. Time Out Timer, Receiver 3	..... 3 min (180)
199 .. Time Out Timer, Receiver 4	..... 3 min (180)
200 .. Time Out Timer, Receiver 5	..... 3 min (180)
201 .. Time Out Timer, Receiver 6	..... 3 min (180)
202 .. Time Out Timer, Receiver 7	..... 3 min (180)
203 .. Time Out Timer, Receiver 8	..... 3 min (180)
204 .. Time Out Timer, Receiver 9	..... 3 min (180)
205 .. Time Out Timer, Receiver 10	..... 3 min (180)
206 .. Time Out Timer, Receiver 11	..... 3 min (180)
207 .. Time Out Timer, Receiver 12	..... 3 min (180)

Dial Tone Timers:

These timers are used to limit how long the dial tone will run. The dial tone can also be stopped by other things, such as a DTMF character being entered on the port the dial tone is being set out of or the preaccess timer expiring (since indicating that a link has been preaccessed is what dial tone is used for most). If you want to generate dial tone that can't be stopped by any of these things, use Command 040 and generate a two tone chord with frequencies of 350 and 440 Hz.

- This timer is programmed in 1Sec increments from 001-9999
- If a timer value of 000 is entered, this timer will never stop the dial tone.

Timer Number	Defaults
208 .. Dial Tone Timer, Transmitter 1	8 sec (008)
209 .. Dial Tone Timer, Transmitter 2	8 sec (008)
210 .. Dial Tone Timer, Transmitter 3	8 sec (008)
211 .. Dial Tone Timer, Transmitter 4	8 sec (008)
212 .. Dial Tone Timer, Transmitter 5	8 sec (008)
213 .. Dial Tone Timer, Transmitter 6	8 sec (008)
214 .. Dial Tone Timer, Transmitter 7	8 sec (008)
215 .. Dial Tone Timer, Transmitter 8	8 sec (008)
216 .. Dial Tone Timer, Transmitter 9	8 sec (008)
217 .. Dial Tone Timer, Transmitter 10	8 sec (008)
218 .. Dial Tone Timer, Transmitter 11	8 sec (008)
219 .. Dial Tone Timer, Transmitter 12	8 sec (008)

Preaccess Timers:

These timers control how long the "window" of access is between when you enter the preaccess code and when you have to enter a DTMF digit or be locked out. It starts running again as soon as each DTMF digit is released, and will lock you out if it expires. When it expires, it throws away whatever DTMF digits have been entered so far and won't accept any more commands until the controller is accessed again. It also stops the dial tone when it expires.

- This timer is programmed in 1Sec increments from 001-9999
- If a timer value of 000 is entered, this timer will never expire.

Timer Number	Defaults
220 .. Preaccess Timer, Port 1	8 sec (008)
221 .. Preaccess Timer, Port 2	8 sec (008)
222 .. Preaccess Timer, Port 3	8 sec (008)
223 .. Preaccess Timer, Port 4	8 sec (008)
224 .. Preaccess Timer, Port 5	8 sec (008)
225 .. Preaccess Timer, Port 6	8 sec (008)
226 .. Preaccess Timer, Port 7	8 sec (008)
227 .. Preaccess Timer, Port 8	8 sec (008)
228 .. Preaccess Timer, Port 9	8 sec (008)
229 .. Preaccess Timer, Port 10	8 sec (008)
230 .. Preaccess Timer, Port 11	8 sec (008)
231 .. Preaccess Timer, Port 12	8 sec (008)

User Timers:

These timers are not normally used by the controller. They are provided for your use. You can start them running by executing Command 022 and stop them with 023 (or they will stop automatically when they expire). Also, when one of these timers expires, the corresponding special macro (see Chapter 8) is automatically executed. This allows you to start these timers when certain things in the controller happen, and do something when the timer expires. These timers are programmed in one second increments.

Timer Number	Defaults
232 .. User Timer 00	0 sec (000)
233 .. User Timer 01	0 sec (000)
234 .. User Timer 02	0 sec (000)
235 .. User Timer 03	0 sec (000)
236 .. User Timer 04	0 sec (000)
237 .. User Timer 05	0 sec (000)
238 .. User Timer 06	0 sec (000)
239 .. User Timer 07	0 sec (000)
240 .. User Timer 08	0 sec (000)
241 .. User Timer 09	0 sec (000)
242 .. User Timer 10	0 sec (000)
243 .. User Timer 11	0 sec (000)
244 .. User Timer 12	0 sec (000)
245 .. User Timer 13	0 sec (000)
246 .. User Timer 14	0 sec (000)
247 .. User Timer 15	0 sec (000)

DTMF Interdigit Timers or Auto-execution timers (See Command 078):

These timers are used to get rid of stray DTMF digits after several seconds without entering any more digits. For example, if you key and press a DTMF digit, then start talking, this timer will throw that digit away after a default of 5 seconds. That way if, after you talk a while, you try to enter a command, the digit you entered 30 seconds ago won't mess it up. Of course if you unkeyed during that time, all of the digits would be either executed or discarded anyway. This also reduces problems caused by voice falsing the DTMF decoder, by discarding the incorrectly received digits if no more digits are received during the duration of this timer. This timer starts running when the DTMF digit is released, so you can hold a DTMF digit as long as you like without it being discarded.

Timer Number	Defaults
248 .. DTMF Interdigit Timer, Receiver 1	5 sec (005)
249 .. DTMF Interdigit Timer, Receiver 2	5 sec (005)
250 .. DTMF Interdigit Timer, Receiver 3	5 sec (005)
251 .. DTMF Interdigit Timer, Receiver 4	5 sec (005)
252 .. DTMF Interdigit Timer, Receiver 5	5 sec (005)
253 .. DTMF Interdigit Timer, Receiver 6	5 sec (005)
254 .. DTMF Interdigit Timer, Receiver 7	5 sec (005)
255 .. DTMF Interdigit Timer, Receiver 8	5 sec (005)
256 .. DTMF Interdigit Timer, Receiver 9	5 sec (005)
257 .. DTMF Interdigit Timer, Receiver 10	5 sec (005)
258 .. DTMF Interdigit Timer, Receiver 11	5 sec (005)
259 .. DTMF Interdigit Timer, Receiver 12	5 sec (005)

Reverse Patch Ring Timer:

This timer sets the maximum time between rings allowed for the reverse patch to work. If this timer expires between rings, the ring count starts over. This would keep the reverse patch from ever answering the phone.

- This timer is programmed in 1 second increments from 001-9999

Timer Number	Defaults
260 .. Reverse Patch Ring Timer	10 sec (010)

User Log-off Timer:

This timer specifies the amount of time between correctly executed command entries that a user has before the controller logs the user off the system.

Timer Number	Defaults
261 .. Log-off timer for Port 1	300 sec (300)
262 .. Log-off timer for Port 2	300 sec (300)
263 .. Log-off timer for Port 3	300 sec (300)
264 .. Log-off timer for Port 4	300 sec (300)
265 .. Log-off timer for Port 5	300 sec (300)
266 .. Log-off timer for Port 6	300 sec (300)
267 .. Log-off timer for Port 7	300 sec (300)
268 .. Log-off timer for Port 8	300 sec (300)
269 .. Log-off timer for Port 9	300 sec (300)
270 .. Log-off timer for Port 10	300 sec (300)
271 .. Log-off timer for Port 11	300 sec (300)
272 .. Log-off timer for Port 12	300 sec (300)
273 .. Log-off timer for the Serial Port ...	300 sec (300)
274 .. Log-off timer for the Webserver ...	300 sec (300)
275 .. Log-off timer for Telnet Server 1 ...	300 sec (300)
276 .. Log-off timer for Telnet Server 2 ...	300 sec (300)
277 .. Log-off timer for Telnet Server 3 ...	300 sec (300)
278 .. Log-off timer for Telnet Server 4 ...	300 sec (300)

Re-Enable Keyup Delay Timers:

These timers determine how long a receiver must be inactive after being keyed up before the keyup delay will be re-enabled. See the description for timers 075..086 for more information.

Timer Number	Defaults
279 .. Re-Enable Keyup Delay Timer, RX 1	60 sec (060)
280 .. Re-Enable Keyup Delay Timer, RX 2	60 sec (060)
281 .. Re-Enable Keyup Delay Timer, RX 3	60 sec (060)
282 .. Re-Enable Keyup Delay Timer, RX 4	60 sec (060)
283 .. Re-Enable Keyup Delay Timer, RX 5	60 sec (060)
284 .. Re-Enable Keyup Delay Timer, RX 6	60 sec (060)
285 .. Re-Enable Keyup Delay Timer, RX 7	60 sec (060)
286 .. Re-Enable Keyup Delay Timer, RX 8	60 sec (060)
287 .. Re-Enable Keyup Delay Timer, RX 9	60 sec (060)
288 .. Re-Enable Keyup Delay Timer, RX 10	60 sec (060)
289 .. Re-Enable Keyup Delay Timer, RX 11	60 sec (060)
290 .. Re-Enable Keyup Delay Timer, RX 12	60 sec (060)

021: Restart a Timer (if already running)

The controller automatically starts and stops most timers, but you can override the controller's normal way of doing things with this command. You can also use this command with the user timers (timers 232-247).

This command allows you to restart a timer if it is currently running. This means that the count associated with the timer has not yet expired (count = 0). When recall the timer, get a message like this, "Timer TTT LL count CC" where TTT is the timer number, LL is the duration it is set to, and CC is the current count, the amount of time left before it expires if it is currently running. Also see command 022.

<021> xxx

Parameters:

- 021 is the default command name.
- XXX is the timer to restart (three digits, see command 020 for list of timers)

Pseudo Code:

```

IF( count != 0 ) THEN           // Timer already running
    count = timer_duration      // Start timer over at beginning
END IF
  
```

022: Start/Restart a Timer

The controller automatically starts and stops most timers, but you can override the controller's normal way of doing things with this command. You can also use this command to make the user timers (timers 232-247) start running.

This command sets the count variable associated with a specific timer equal to the duration of the timer set with command 020 or to a value specified in this command. Once the count variable is set, the countdown to expiration begins. If the timer is already running, this command will make it start over.

<022> xxx	Start timer 'xxx' for the duration set with command 020
<022> xxx t..t	Start timer 'xxx' for duration 't..t'

Parameters:

- 022 is the default command name.
- 'xxx' is the timer to start (three digits, see command 020 for list of timers)
- 't..t' is the duration the timer should run for *this time only*. This does not permanently change the duration of the timer; that is what command 020 is for.

Notes:

- Some timers (such as the ID timers) are reset to their normal duration periodically by the firmware, so command 022 may be ineffective on those timers.
- If a timer's normal duration has been set to 0 with command 020, it will not run even if you specify a value for t..t with command 022. A duration of zero set with command 020 totally disables the timer.

Pseudo Code:

```

IF( Setting new temp_time ) THEN
    count = input_duration           // Start timer for temporary duration
ELSE
    count = timer_duration           // Start timer for duration set by command 020
END IF

```


026: Recall the Time of Day Clock in Male Speech

This command allows you to read the Time of Day Clock. The readback is Male time reading. Refer to Command 025 for setting the clocks time.



<026>

Parameters:

- 026 is the default command name.

Voice Response:

"Male voice: <Hour> <Minute> <AM/PM>"

027: Recall the Time of Day Clock in Female Speech

This command allows you to read the Time of Day Clock. The readback is Female time reading. Refer to Command 025 for setting the clocks time.



<027>

Parameters:

- 027 is the default command name.

Voice Response:

"Female voice: <Hour> <Minute> <AM/PM>"

028: Sets the Date

This command allows you to set the date on the RLC-DSP404 Clock.

```
<028> mm dd yy w
```

Parameters:

- 028 is the default command name.
- MM is the month with leading zeros
- DD is the day of the month with leading zeros
- YY is the last two digits of the year

W is the day of the week

Number	Day
1	Sunday
2	Monday
3	Tuesday
4	Wednesday
5	Thursday
6	Friday
7	Saturday

Example:

Want to set the date to January 2, 1996

```
<028> 01 02 96 3
```

029: Recall the Date

This command allows you to read the date stamp of the controller. The readback is Male date reading. Refer to Command 028 for setting the date.



<029>

Note: if you want to recall the date as part of a message, you may want to try the variable words (Appendix B, words 800 and above). Speaking those words with command 036 will let you format the date readback any way you like it.

Parameters:

- 029 is the default command name.

Voice Response:

"This is <Day of Week> <Month> <Day> <pause> <Year>"

Chapter 5: Command Names

This chapter deals with command names and controlling when those command names will be accepted and executed by the controller.

- Command name programming, checking and recalling
- Blocking and allowing command execution

How Command Names and Command Numbers are Used:

The RLC-DSP404 controller has 1000 commands. The first 300 are commands that do a specific task and are described in this manual. The rest of the commands are macros that automatically execute a sequence of other commands. The controller automatically uses some of the macros to send IDs, courtesy beeps, and other things. These macros that are called automatically are described in Chapter 8. The remainder of the macros can be used for anything you want, such as turning on a link and sending a message for example.

Command Names:

Any of the 1000 commands can be executed by entering DTMF digits from a radio, from the reverse autopatch, or with a computer or serial terminal that is connected to the controller's RS-232 serial port. To execute the commands, you enter the command's name and unkey or press enter. To execute some of the first 300 commands, you have to enter more digits after the command name, to give the controller more information.

The command names default to 000, 001, 002..999. So to recall the time (command 026), you would just enter 026 and unkey. To set the time (command 025), you would enter "025" followed by the current time (two digits for the hour, two digits for the minute, and one digit to specify AM or PM). All of the other commands are similar.

You can change the name of any or all of the commands using command 010. The name can be changed to any combination of DTMF digits up to six digits long. Normally you should avoid using the 'D' as part of the command names to avoid conflicting with the force-execution digit. If you are doing your programming from a computer or serial terminal, you can use characters that aren't DTMF digits in your command names, but then you won't be able to execute them from a radio.

Command Numbers:

The controller keeps track of both what the command was originally named (what it is in the manual) and what you may have renamed it to (they start out the same, 000, 001...). The original name is sometimes called the command number and it never changes. The command number is used for several things. One of them is renaming commands. To rename command 009 to ABC, you would enter "010 009 ABC", where 010 is the rename command, 009 is the command number, and ABC is the new name. If you then change your mind and want it to be called CBA, you would enter "010 009 CBA". Note that you still use 009, not ABC, when renaming it to CBA. You always rename the command number to the new name, not the old name to the new name. This eliminates any confusion if you forget a command's name or if you have more than one command with the same name.

Command numbers are also used when programming macros (see commands 053 and 056), setting DTMF execution masks (commands 130 and 131) and several other things. Remember that you use the command name to execute the commands; you sometimes use the command number as part of the information you enter after a command name.

When you execute a command from the serial port, you can enter the command name just as you would from a radio or the reverse patch, hitting enter instead of unkeying when you are finished. That is why the prompt you get when you press enter is "DTMF>"; you can enter digits just like they were DTMF digits. There is also a way to execute commands from the serial port using the command number. This is handy because the command number never changes. To execute a command using its number, just put an N at the beginning of the line, followed by the command number and any other digits that command might need (see command 080 for information about how this works internally). We could rename command 009 to ABC from the serial port just as we did from the radio, by entering "010 009 ABC" and pressing enter (spaces are always accepted but never required). But if the name of command 10 was changed, that would no longer work. If we enter "N010 009 ABC", it will work even if command 10 has been renamed because the N makes the controller use the command number for command 010 rather than its name. This is especially useful if you store a list of commands in a file on a computer (so you can upload the whole file to the controller and set it up all at once), as you don't have to worry about whether any of the commands you use in that file have been renamed. The N cannot be used from a radio, since there is no DTMF digit N. You wouldn't want it to be possible from a radio anyway, or it would be a major security problem.

Converting Command Name <--> Command Number:

Command Number ---> Command name is accomplished with Command C011

If you have forgotten the name of command number 009, you can find out what it is by entering "011 009" and unkeying or pressing enter, or you can just change it to the name you want it to have with 010.

Command Name ---> Command number is accomplished with Command 012

If you know that entering a command name of "ABC123" causes a command to execute but you don't know what command number it is executing, you can use command 012 to find out by entering "012 ABC123" and unkeying or pressing enter.

Advanced Command Naming Topics:

You probably don't need to read this section, but it is here just in case. If it doesn't make sense to you, just skip it.

The controller has a table which it uses to keep track of the information for each command. This information is used when the controller tries to find out what command you have entered the name for. If more than one command have the same name, it can also be used to intelligently figure out which one you wanted. Some of the entries are:

- Command name (including the length of the name).

- Data length: that is how many digits, if any, are needed after the command name.
- If the data length is not zero, whether the amount must be exact or whether more digits can be entered.
- DTMF execution mask (see command 130)
- User level required to execute (see Chapter 18)

For example, Command 009 would have a data length of zero, command 000 would have a data length of 2 which must be exact, and command 036 would have a minimum data length of 3, but could be longer. Other checking such as making sure that the data for 036 is a multiple of three digits and limiting the maximum length is done by the commands themselves. Where the checking is done is important. The checks that can be done with the information in the table can be used to help figure out which command you want to execute when the names are ambiguous, while the checks that are done within the commands themselves are too late.

When you enter a command and unkey or press enter, the controller scans the whole table of commands looking for a match. It ignores any commands that would be blocked by the DTMF execution mask or that require that you log on using a password to execute. It also ignores any that it knows have the wrong number of data digits after the command name (using the information in the table as discussed above), although there are some cases where it can't tell until the command is chosen and causes an error. From the remaining commands, it chooses the one with the longest name that matches what was entered. In case of a tie, it chooses the one with the lowest command number.

For example, if you have commands named "1", "12", "123", "1234" and "12345" and you enter "12399", assuming that all of them pass the initial execution mask and password and data length checks, the controller will select the command named "123" and will execute it with the data digits "99". That is it will find the longest match, then use the rest of the digits as data. Keep this in mind when you change command names to be less than three digits. If you change the "Retrieve Public Mail" command (177) to have the name "12", then enter "123" to get the mail from mailbox 3, you may instead execute command "123" because it also matches and has a longer name. If command 123 needs additional digits after the command name, the controller will figure out what you mean, but sometimes it just can't tell. So when you rename commands, keep in mind that any name that is the same as the beginning of another name might be ambiguous.

This ability of the controller to find the longest matching name can be used in several practical ways. For example, command 000 connects two ports together. It normally sends "X connect Y" as the voice response. If you have a repeater on port 1 and a link to another site on port 2, you might want the message to be "Link up" instead. You could make a macro named "00012" or "00021" that would connect the two ports and send that message. Then entering "00012" or "00021" would cause your custom message to be sent, while "00013" or any other command starting with "000" would access the normal command 000 and cause the normal "X connect Y" message. Another example: your autopatch up code is "*" and your autodial slot is number 43. Pressing "*43" normally causes the response, "Autodial 43". You want to make it say "KC7HXB home" instead. To do this, make a macro called "*43" and make it speak that voice response, then make the call. "*" followed by any other number will still make it say "Autodial", but "*43" will find the macro and cause your custom message. This technique can also be used to turn off the time out timer for emergency numbers.

It is possible, although not recommended, to give several commands the same name. For example, 000, 009 and 036 could all be named "ABC" and the controller would always be able to figure out which one

you wanted because of the information stored in the command table. Command 000 always takes exactly two data digits, 009 never takes any, and command 036 requires three or more. So "ABC" would select command 009, "ABC12" would select command 000 and connect ports 1 and 2, and "ABC001002003" would make command 036 speak "one two three". This feature is most often used when trying to clone the command codes used on a previous controller, using more than one command on this controller.

In summary, the controller lets you name commands just about any way you want to, even if it is confusing for you and it. It does its best to figure out what you mean, using the data length, DTMF execution masks and passwords to eliminate some possibilities, but sometimes it is impossible. If you can't get it to work the way you want it to, check the command names with commands 011 and 012, then start naming them back to their original names with 010 until the confusion goes away. The most common confusion is having one command that is named the same as the beginning of another command, so the longer one gets executed when you expected the shorter one. When all of the commands have their original names, there is no confusion because every command has its own unique three digit name, the command number.

010: Re-Program Command Names

This command allows you to re-name the command names on the controller. The names can be from 1 to 6 digits in length.

```
<010> xxx yyyyyy
```

Shortcut:

If you want to change the first few digits of a whole range of command names, check out command 062.

Notes:

You should avoid renaming command 080, or the 'N' method of entering commands from the serial port will quit working. See Appendix F for more information about using 'N'.

Parameters:

- 010 is the default command name.
- XXX is the command's number. It is the same as the last three digits of the command name as listed in the manual. Examples: the command number for this command (010) is 010. For command 123, the command number is 123. The command number is always three digits. Renaming the command does not change the command number - you still use the command number as listed in the manual.
- YYYYYY is the new command name.
 - You only enter as many digits for the command name as the length you want the new name to be. You do not need to enter any leading digits for the command name.

Acceptable entries:

XXX Y	- New command name is 1 digit in length
XXX YY	- New command name is 2 digits in length
XXX YYY	- New command name is 3 digits in length
XXX YYYY	- New command name is 4 digits in length
XXX YYYYY	- New command name is 5 digits in length
XXX YYYYYY	- New command name is 6 digits in length

Default:

- Command names begin with 000 and end with 999

Voice Response:

"Change <command number>"

The new name is not read back for security. To check that the command was renamed correctly, use "011 <command number>".

Example #1:

Want to re-name command 013 to ABC12

- 1) Command Number is 013
- 2) New command name is ABC12
- 3) 010 013 ABC12 D or unkey or <Enter>
- 4) Voice response: "Change thirteen"

Example #2:

You changed your mind. Now you want command number 013 (which we just renamed to ABC12) to ABC123 instead.

- 1) Command Number is 013
- 2) New command name is ABC123
- 3) 010 013 ABC123 D or unkey or <Enter>
- 4) Voice response: "Change thirteen"

Note that the current command name does not matter at all, only the command number (the last three digits of the command name in the manual) and the new name.

062: Change the Beginning of Command Names

This command allows you to change the first one, two or three digits of the names of a range of commands. If you specify one digit, all of the command names in the range you specified will become four digits long. If you specify 2, they will be 5 long (and 3, 6). The last three digits of a command's name can not be changed with this command (see command 010). This is to avoid accidentally assigning the same name to multiple commands.

<062> bbb eee d	Change the first digit of the name in a range
<062> bbb eee dd	Change the first and second digits of the name in a range
<062> bbb eee ddd	Change the first, second and third digits of the name in a range
<062> bbb eee	Strip off enough leading digits to make each command name three digits or less. This will "undo" most of the changes made with the above formats.

Parameters:

- 062 is the default command name.
- BBB is the number of the first command in the range that you want to change
- EEE is the number of the last command in the range that you want to change
- D or DD or DDD are the new first digits of the command names

Notes:

- You should avoid renaming command 080, or the 'N' method of entering commands from the serial port will quit working. See Appendix F for more information about using 'N'.
- Any commands in the range that have names shorter than three digits long will have zeros added before their names to make them three digits long before this command changes the other digits. For example, 062 010 050 A changes C010 to A010, 123 to A123, A1 to A0A1, and # to A00#.

Example 1:

You want to change the names of all of the commands in the controller to start with '#' so that they can be executed from a 12-key touch tone pad:

```
<062> 000 999 # D or unkey or <Enter>
```

Example 2:

You want to make the names of commands 010 through 050 more difficult to guess by making them 6 digits long, starting with the digits 96C:

```
<062> 010 050 96C D or unkey or <Enter>
```

011: Recall Command Name

This command allows you to recall the name of a command. It also tells you whether it requires more digits to be entered after the command name, if so how many, and whether more digits than that will be accepted. You specify the command number (the name of the command in this manual) and the controller will look up its name.

<011> xxx

Parameters:

- 011 is the default command name.
- XXX is the command number ranging from 000-999

Voice Response:

- The voice response is XXX YYYYYY 'ED' (Number of Digits of Extra Data)
- "ED" signifies that the following number is the amount of additional data needed for that command.
- If the word "Variable" is spoken, the controller will accept more than the specified number of digits. If not, exactly that many digits must be entered. See the discussion about command names and numbers at the beginning of this chapter for more information.

Parameters:

- 011 is the default command name.
- This command recalls the command number for the associated command name
- YYYYYY is the command name with default command name of 000-999

Voice Response:

The voice response is "Command Number (000-999)" is YYYYYY

012: Find Commands Named ...

This command tells the controller to find all of the commands that have the name you specify. Normally it will only find one command, but if you have several commands with the same name, it will list them all.

<012> y..y

Parameters:

- 012 is the default command name.
- Y..Y is the command name with default command name of 000-999

Voice Response: The voice response is "y..y is <cmd number>, <cmd number>..." or "y..y is not used" if there are no commands that have that name.

Blocking Execution from Certain Ports

Purpose of these commands:

The following two commands allow you to mark (or unmark) certain commands so that they can not be executed from certain ports. You might want to use them to make it so your autopatch can not be accessed from the link ports. If you are using one of the ports as a control port, you could make all of the commands in the controller so they could only be executed from that control port. You could call these commands from the scheduler to disable some or all of the commands at night. This adds a lot of security to your controller.

Caution:

Because these commands can keep you from executing commands, they can lock you out of your own controller. If you have a terminal or computer hooked up to the serial port, these commands can not lock you out, so you don't have to worry about it. Also, you can always re-initialize the controller (see Appendix D), but that erases all of your programming and you have to be at the site to do it. In other words, be careful what commands you block and what ports you block their execution from. If you don't want to use these functions and you want to erase their names so that they can not be entered accidentally, enter the following commands:

Command 010 130 D or unkey or <Enter>

Command 010 131 D or unkey or <Enter>

These commands erase the names of command numbers 130 and 131 so that they can not be executed without renaming them to a valid name.

If you think you have locked yourself out, execute the following command from every port you can get touch tones to, or from the serial port. If they are executed they will allow access to every command from every port and the reverse autopatch.

Command 131 x 000 999 D or unkey or <Enter>

--- x is the port number you are trying to restore access to

130: Block Command Execution From Port

This command allows you to block execution of a command or a range of commands by a port. Before using it, please read the cautions on the previous page.

<130> ccc	Recall which ports are blocked from executing this command
<130> pp ccc	Block execution for a single command
<130> pp ccc ddd	Block execution for a range of commands

Parameters:

- 130 is the default command name.
- pp is the port to block access by (use '0*' for the current port, see Appendix L)
- CCC is the first command number to block
- DDD is the last command number in the range of commands to block

131: Allow Command Execution From Port

This command allows you to reverse the effects of Command 130 and allow the specified port to execute a command or range of commands again. This command is not dangerous - it can not lock you out of your own controller.

<131> ccc	Recall which ports are blocked from executing this command
<131> pp ccc	Allow execution for a single command
<131> pp ccc ddd	Allow execution for a range of commands

Parameters:

- 131 is the default command name.
- P is the port to allow access by (use '0*' for the current port, see Appendix L)
- CCC is the first command number to allow
- DDD is the last command number in the range of commands to allow

Chapter 6: CW, DTMF, Voice and DVR Messages

This chapter deals with all of the different types of messages that can be sent from the controller: CW, DTMF, synthesized voice and real voice from the digital voice recorder.

- Sending of CW Messages
 - CW speed and tone control
- DTMF regeneration
 - Regeneration parameters
- Send a Voice message
- Play, Record and Erase a Digital Voice Recorder message
- Generate one and two tone sequences
- DTMF Keypad test

The controller normally figures out which transmitters each message should go to. Responses to commands go to the port that executed the command, IDs go to the port that needs them, and courtesy beeps go to all of the repeaters that could hear the audio from the receiver that caused the ID. Almost all of these defaults can be overridden by the user, if you so desire. For more information about how the messages are routed and how you can change the default routing, see Chapter 16 and Appendix A.

030: Send a CW Message

This command allows you to send a CW message. It will be sent to the ports that are in the audio routing variable at the time this command is executed (for more info, see Appendix A). The message will be sent at the speed and frequency that has been set up for the specific port with 042 and 043.

```
<030> cc..cc
```

Parameters:

- 030 is the default command name.

CC is the CW data, two digits per character

CW	XX	.	CW	XX	.	C W	XX	.	CW	XX	.	CW	XX
0	00	.	A	10	.	K	20	.	U	30	.	SPACE	40
1	01	.	B	11	.	L	21	.	V	31	.	PAUSE	41
2	02	.	C	12	.	M	22	.	W	32	.		
3	03	.	D	13	.	N	23	.	X	33	.		
4	04	.	E	14	.	O	24	.	Y	34	.		
5	05	.	F	15	.	P	25	.	Z	35	.		
6	06	.	G	16	.	Q	26	.	/	36	.		
7	07	.	H	17	.	R	27	.	0	37	.		
8	08	.	I	18	.	S	28	.	?	38	.		
9	09	.	J	19	.	T	29	.	AR	39	.		

Notes:

- This table is duplicated in Appendix C for ease of reference.

118: Send a Morse Code Message

This command allows you to send a morse code message.

Example:

118 KC7HXB/R - Sends the string "KC7HXB/R" via morse code.

031: Send a DTMF Sequence

This command allows you to send DTMF tones. For each DTMF digit sent, two digits must be entered (that allows special characters like pause and the force-execution digit (see command 078) to be sent). They will be sent to the ports that are in the audio routing variable at the time this command is executed (for more info, see Appendix A). See Command 044 to set up the duration of the tones and pauses between tones. See command 069 (below) for an alternate way to send DTMF tones.

```
<031> DD..DD
```

Parameters:

- 031 is the default command name.
- DD is the DTMF data (See Below)

Number	DTMF Digit
00	0
01	1
02	2
03	3
04	4
05	5
06	6
07	7
08	8

09	9
10	A
11	B
12	C
13	D
14	*
15	#
16	<Pause>

Example:

Want to send the DTMF data '0 0 0 1 1 D'

```
<031> 00 00 00 01 01 13 D or unkey or <Enter>
```

069: Send a DTMF To Specified Transmitter

This command allows you to send DTMF tones to a specified transmitter. The digits are sent as entered, with one DTMF digit sent for each DTMF digit entered (because of that, the force-execution digit (see command 078) cannot be sent with this command - use command 031 if that is necessary). See

Command 044 to set up the duration of the tones and pauses between tones.

```
<069> tt D..D
```

Parameters:

- 069 is the default command name.
- tt is the transmitter number the DTMF digits should be sent to (use '0*' for the current port, see Appendix L)
- D..D are the DTMF digits to be sent.

Example:

Send DTMF "026" out transmitter 2:

```
<069> tt 026 D or unkey or <Enter>
```

Example #2:

Make a macro to send user-entered DTMF digits out transmitter 2:

- 010 600 ABC ; name macro "ABC"
- 067 600 01 1 ; allow macro to take data (see command 067)
- 055 600 ; make sure macro is empty
- 056 600 069 2 ; user-entered data will be appended here

Now entering "ABC 026" will cause DTMF "026" to be generated out transmitter 2.

Example #3:

Same as Example #2, but send a 'D' after the user-entered digits (if 'D' is the force-execution digit for whatever is listening to that transmitter, it will make the command execute right away).

Add the following onto the macro started in Example #2:

- 056 600 037 2 ; send the following data out TX 2
- 056 600 031 13 ; send DTMF 'D'

Notes:

- Remember that this command cannot be used to send the force execution digit (usually 'D') of the port that is entering the command because as soon as that digit is pressed, the command will be executed. Example #3 above shows one way to deal with this. See command 078 for more information about the force-execution digit.
- If this command is entered from the serial port, any invalid DTMF digit (anything but 0..9, A..D, * and #) will be sent as a pause (and "Debug code 38" will be output on the serial port). Spaces will not have any effect, as they are always stripped out of commands entered from the serial port before the controller executes them.

036: Send a Voice Message

This command allows you to send a voice message out of the radio ports on the controller. This is handy for building voice messages for macro sequences, sending voice IDs, etc. Which ports will send the message is determined by the current audio routing variable at the time the command is executed (see Appendix A).

```
<036> vvv..vvv
```

Parameters:

- 036 is the default command name.
- VVV is the Voice word to be spoken
 - See Appendix B for voice word numbers

Note: if you want the voice message to stop if someone keys up in the middle of the message (a polite voice message), see commands 063 and 064. These commands are often used for IDs.

066: Send a Voice Message Using English Words

This command allows you to send a voice message out of the radio ports on the controller, just like command 036 does. The difference is that you have to look up word numbers to use command 036, while this command lets you just type in the words in English, with underscores between the words. If you enter a word that isn't in the controller's voice library, it will spell it. Since DTMF keypads only have the letters A..D (if that), this command is only useful when working from the serial port. There is no polite version of this command (see commands 063 and 064).

```
<066> w..w [polite][:mac]
```

Parameters:

- 066 is the default command name.
- w..w are the words to be spoken, in English, with underscores between words
- "polite" is an option to send the message politely. this field is optional, and if omitted, the message is sent impolitely by default.
- ":mac" is a second optional macro number. Allows for substitution of polite macro with another.

Example:

```
066 this_is_a_test_message - sends message this_is_a_test_message impolitely.
066 this_is_a_test_message [polite: 360]- sends message this_is_a_test_message politely, via macro 360.
```

Sending DVR-1 Messages:

If you have the optional DVR-1 (Digital Voice Recorder), you can include DVR tracks in the messages you generate with this command. Simply put "DVRxxx" where 'xxx' is a track number wherever you want the DVR track to go in the message. For example: "066 this_is_a_test_pause DVR123_repeater DVR32" will make the synthesized voice speak "This is a test", then the DVR will play track 123, then the synthesized voice will speak "Repeater", and finally the DVR will play track 32.

040: Send One or Two Tone Sequence

This command causes a tone "sequence" to be sent out the ports specified by the routing variable (see Appendix A for information about the routing variable). A "sequence" is composed of one or two tones which are generated simultaneously for a specified duration and followed by a specified pause. Most courtesy beeps use only one tone at a time, although many have several tones in sequence. This type of courtesy beep would be generated by calling this command several times from a macro, sending a one-tone chord each time (see examples on the following pages). DTMF digits and dial tone are familiar two-tone combinations, and can be easily generated using this command.

Sequence	Command Type
Single Tone	<040> ttt ppp ffff
Single Tone	<040> tttt pppp ffff
Dual Tone	<040> ttt ppp ffff gggg
Dual Tone	<040> tttt pppp ffff gggg

Parameters:

- TTT or TTTT is a number representing the duration of the tone in 10mS increments. If you use four digits for the duration of the tone, you must also use four digits for the duration of the pause. The tone duration is limited to 60 seconds (6000).
- PPP or PPPP is a number representing the duration of the pause to follow the tone in 10mS increments. If you use four digits for the duration of the tone, you must also use four digits for the duration of the pause. The pause duration is limited to 60 seconds (6000).
- FFFF is the frequency of the primary tone in hertz. All four digits must be entered.
- GGGG is the frequency of the secondary tone in hertz. All four digits must be entered. It is only used when you want both tones active at the same time, like a DTMF tone. If you want a beep at one frequency then a beep at another frequency, call this command twice from a macro and only specify one frequency each time.

Note about Courtesy Beeps

The RLC-DSP404 courtesy beeps are not simply a programmable beep. When it is time to send a courtesy beep, the RLC-DSP404 decides which ports should receive the courtesy beep, sets the audio routing variable to those ports (see Appendix A), and calls that port's courtesy beep automatic macro (see Chapter 8). This makes it possible for you to make your courtesy beep do a lot more than just beep. If you call command 040 (send One, Two or Three Tone Chord), it will beep. If you call 040 more than once in the courtesy beep macro, it will beep more than once (examples below). If you call 036 (speak voice message), you will get a voice message for your courtesy beep. If you call 030, it will send CW. If you call 031, it will send DTMF. If you really want to, you can do several of the above.

Since most people want a sequence of beeps for their courtesy beep, we will provide some examples. Note that to get a single-beep courtesy beep, you just call 040 once from the courtesy beep macro. To get a three tone sequence, you call 040 three times within that macro. Each time command 040 is called, it can send one or two simultaneous tone frequencies. Below are some widely used courtesy beep sequences.

Examples:

All tone frequencies are in hertz. All times are in milliseconds.

Sequence Name	Tone 1	Tone 2	Duration	Pause	Command to Program Beep Replace "mmm" with macro num
1 - Bumble Bee	0330	N/A	100mS	0mS	053 mmm 040 010 000 0330
....	0500	N/A	100mS	0mS	056 mmm 040 010 000 0500
....	0660	N/A	100mS	0mS	056 mmm 040 010 000 0660
2 - Yellow Jacket	0330	N/A	50mS	0mS	053 mmm 040 005 000 0330
....	0500	N/A	50mS	0mS	056 mmm 040 005 000 0500
....	0660	N/A	50mS	0mS	056 mmm 040 005 000 0660
3 - Shooting Star	0800	N/A	100mS	0mS	053 mmm 040 010 000 0800
....	0800	N/A	100mS	0mS	056 mmm 040 010 000 0800
....	0540	N/A	100mS	0mS	056 mmm 040 010 000 0540
4 - Comet	0500	N/A	100mS	0mS	053 mmm 040 010 000 0500
....	0500	N/A	100mS	0mS	056 mmm 040 010 000 0500
....	0750	N/A	100mS	0mS	056 mmm 040 010 000 0750
5 - Stardust	0750	N/A	120mS	0mS	053 mmm 040 012 000 0750
....	0880	N/A	80mS	0mS	056 mmm 040 008 000 0880
....	1200	0880	80mS	0mS	056 mmm 040 008 000 1200 0880
6 - Duncicap	0440	0500	200mS	0mS	053 mmm 040 020 000 0440 0500
....	0440	0350	200mS	0mS	056 mmm 040 020 000 0440 0350
7 - Dial Tone	0440	0350	100mS	100mS	053 mmm 040 010 010 0440 0350
8 - Low-High Beep	0500	N/A	100mS	0mS	053 mmm 040 010 000 0500
....	0665	N/A	100mS	0mS	056 mmm 040 010 000 0665
9 - High-Low Beep	0665	N/A	100mS	0mS	053 mmm 040 010 000 0665
....	0500	N/A	100mS	0mS	056 mmm 040 010 000 0500
10 - Cover Tone	0440	N/A	200mS	300mS	053 mmm 040 020 030 0440
11 - Audible Ring Tone	0440	0480	400mS	400mS	053 mmm 040 040 040 0440 0480

Example:

I want port 1's courtesy beep to be number 5 as listed above.

- 1) Locate the courtesy beep macro for port 1 in Chapter 8.
 - 256 is Port 1's courtesy beep macro
- 2) Command 055 erases the old contents of a macro
 - 055 256 D or unkey or <Enter>
- 3) Command 056 appends a command onto the end of a macro - we will do the first tone
 - 056 256 040 012 000 0750 D or unkey or <Enter>
 - 012 is the duration of the beep in 10 millisecond increments
 - 000 is the duration of the pause in 10 millisecond increments
 - 0750 is the frequency of the tone in hertz
- 4) Command 056 appends a command onto the end of a macro - the second tone
 - 056 256 040 008 000 1200 D or unkey or <Enter>
 - 008 is the duration of the beep in 10 millisecond increments
 - 000 is the duration of the pause in 10 millisecond increments
 - 1200 is the frequency of the tone in hertz
- 5) Command 056 appends a command onto the end of a macro - the third beep
 - It is a dual tone beep
 - 056 256 040 008 000 1200 0880 D or unkey or <Enter>
 - 008 is the duration of the beep in 10 millisecond increments
 - 000 is the duration of the pause in 10 millisecond increments
 - 1200 is the frequency of one tone in hertz
 - 0880 is the frequency of the other tone in hertz
- 6) Now when port 1's courtesy beep needs to be sent, the courtesy beep macro will call Command 040 three times to generate the three beeps.

041: Set/Recall Courtesy Beep Settings

This command allows you control several options for courtesy beeps. In most cases the default values will work fine, so you may not need to use this command at all.

One thing this command allows you to do is to turn courtesy beeps on or off for a selected transmitter. Normally courtesy beeps are sent out of repeater transmitters and not out of link transmitters, so if that is what you want, you won't have to change anything. If you want a courtesy beep out of a link transmitter or you want to turn courtesy beeps off for a repeater transmitter, then you should use this command.

If you want a particular receiver to quit generating courtesy beeps (to be sent out any transmitter), erase the courtesy beep macro for that receiver (see Chapter 8 for more details about the courtesy beep macros).

Normally courtesy beeps are not sent when using the autopatch or HF remote base. This command allows you to change that.

Normally the time out timers are reset each time a receiver unkeys. This command lets you change that, so they aren't reset until the courtesy beep for that receiver is sent. This setting may help discourage "tailgating."

<041> pp e	Enable/disable courtesy beeps
<041> pp e a	Enable/disable, autopatch
<041> pp e a h	Enable/disable, autopatch, HF
<041> pp e a h t	Enable/disable, autopatch, HF, TOT

Parameters:

- 041 is the default command name.
- pp is the selected port (01..12)

- E sets the conditions under which courtesy beeps are enabled

E	Description
0	Disable courtesy beeps for this transmitter
1	Enable courtesy beeps for this transmitter only if it is a repeater (the default)
2	Enable courtesy beeps for this transmitter, even if it is a link

- A - 0 to disable courtesy beeps during autopatch calls (the default), 1 to enable them for this transmitter.
- H - 0 to disable courtesy beeps while using HF remote base (the default), 1 to enable them for this transmitter.
- T - 0 to reset the time out timer for this receiver when the receiver drops (the default), 1 to wait until the courtesy beep. Setting it to wait for the courtesy beep will encourage users to not to reply until the courtesy beep has been sent to avoid being cut off by the time out timer. Once a receiver has timed out, even a momentary unkey will clear the timed-out condition (since no courtesy beep is sent at that time, no delay is necessary).

042: Set CW Speed for a Selected Port

This command allows you to set up the CW systems speed in words per minute. The maximum CW speed the FCC allows for identification is 20 WPM, but the controller will handle 05..50 words per minute.

<042> pp ss

Parameters:

- 042 is the default command name.
- pp is the selected port (01..12)
- SS is the words per minute send value

Default:

All ports default to 20 words per minute

043: Set CW 2-Tone Frequencies for a Selected Port

This command allows you to set up the CW tone frequencies used by the CW system.

<043> pp aaaa	Set CW to a single tone
<043> pp aaaa bbbb	Set CW to dual tones

Parameters:

- 043 is the default command name.
- pp is the selected port (01..12)
- AAAA is the first tone frequency (0000..9999) Hz
- BBBB is the second tone frequency (0000..9999) Hz

Default:

Tone 1 is set to 1064 Hz.

Tone 2 is set to 0000 Hz.

Notes:

- You should not set "aaaa" and "bbbb" to the same value or they will cause the output of the two tone generators to be superimposed. Depending on the phase shift between them, the amplitude may be louder or softer than a single tone, and may change at seemingly random times.

044: Set Up DTMF Regenerate Parameters

This command allows you to set up the DTMF regenerate parameters for each attached port. You may need to use this command to slow your DTMF tones down if a scanning DTMF decoder is on any of the attached systems that you want the RLC-DSP404 to control.

<044> pp aaaa bbbb

Parameters:

- 044 is the default command name.
- pp is the selected port (01..12)
- AAAA is the duration of the DTMF sequence in 10mS steps (0000..9999)
- BBBB is the pause between DTMF digits in 10mS steps (0000..9999)

Default:

Both duration and pause set to 100mS

051: Start Dial-Tone

This command allows you to generate a dial tone down for a given time down the port that requested this command. This command is used to give you an indication that access to the controller has been accomplished. This is not pre-access, simply dial tone generation. The dial tone is routed to the port that DTMF requested the command. This command is used in conjunction with the pre-access macros.



<051>

Parameters:

- 051 is the default command name.

.

Notes:

How to cancel the dial tone once it is running:

- 1) You can cancel the dial tone with a DTMF digit on the port dial tone is present.
- 2) When the dial tone timer expires (See Command 020)

063: Send a Polite Voice Message

This command is identical to 036 except that audio from receivers is given priority over the voice message. If a receiver that is on the same port as, or is connected to, any transmitter that is sending the voice message keys up, the voice message will be discarded so you can hear the receiver instead. In other words, if someone is talking, the controller won't interrupt (it is "polite"). If someone interrupts the controller (keys up while it is speaking), it will finish the word it is currently speaking and then throw the rest of the message away. This is commonly used for speaking scheduled messages, such as reading the time at the top of every hour. It could also be used for IDs, but if you want a CW ID to be sent when the voice ID is interrupted, use command 064 instead.

```
<063> vvv..vvv
```

Parameters:

- 063 is the default command name.
- VVV..VVV is a list of synthesized voice words to be spoken
(See Appendix B for word numbers)

Example:

- Speak the time only if it won't play over someone talking: "063 810". Note that word 810 is a special word that speaks the current time. To put that command into macro 600, enter: "053 600 063 810". You can then call macro 600 from a macro, the scheduler, a tail message, etc. to speak the time politely.

Notes:

- The autopatch will not interrupt polite voice messages. In other words, a polite voice message that is spoken to the autopatch port will not be interrupted by the autopatch "receiver," even though it is always active during a call.

064: Send a Polite Voice Msg, If Interrupted Execute Cmd

This command is identical to Command 063 except that if a receiver is active and causes the voice message to be thrown away, it will cause another command to be executed. This is used to make a voice ID that gets interrupted cause a CW ID to be sent instead (see the example below).

```
<064> ccc vvv..vvv
```

Parameters:

- 064 is the default command name.
- CCC is the command number to execute if the message is interrupted
- VVV is the Voice word to be spoken
 - See Appendix B for voice word numbers

Example:

You want to program a polite voice pending ID message for port 1 that will send a CW ID if it is interrupted. Since the first pending ID for port 1 is sent by macro 326, we will program that macro to execute command 064. We will tell command 064 to either speak the voice ID, or if it is interrupted, to execute the impolite ID (command number 350) instead. We will make the voice ID say the words "I D" with are word numbers 039 and 034 (you would want to change this - see Appendix B for other word numbers):

```
053 226 064 250 039 034 unkey, D or <Enter>
```

The above string uses command 053 to program macro 326 to execute command number 064. When command 064 executes, it checks for receiver activity. If the receiver is active, it executes command 350 (the impolite ID). Otherwise it speaks the voice message "ID". See Chapter 11 for more information about programming IDs.

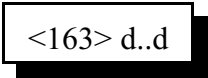
Notes:

- The autopatch will not interrupt polite voice messages. In other words, a polite voice message that is spoken to the autopatch port will not be interrupted by the autopatch "receiver," even though it is always active during a call.

163: Keypad Test

This command will read back whatever digits are entered. This allows you to check your DTMF keypad and make sure that the controller is accepting all of the digits.

The '*' character will be spoken as "Star" and '#' will be "Pound".



<163> d..d

Parameters:

- 163 is the default command name
- D..D are the digits to be read back

The DVR Digital Voice Recorder

What the DVR is:

The DVR is an optional device that allows you to record sounds, store them in memory and play them at any time. It can be used to personalize your controller by recording any message or sounds that you want and playing them back for ID messages or in place of most other synthesized voice messages. Some of these messages are played in response to commands that you or the users enter; others are played at certain times, such as for an ID. Both types of messages will be described below.

DVR Tracks:

All DVR recordings are stored in numbered "tracks." Certain tracks have special purposes and are played automatically at certain times. Others are available for you to use in any way you wish. The length of each track is limited only by available memory. Each track uses only as much storage space as is actually needed.

The first 250 tracks (numbered 000..249) have no predetermined use - you may use them for ID messages, command responses (by calling Command 173 from a macro), or anything else you can think of. Tracks 250..260 or so are used for prompting. They are discussed further in the section below titled "Recording the Prompting Tracks". The remaining tracks are not directly accessible by number. They are used to support the mailbox features and are automatically accessed by the mailbox commands.

Public Mailboxes:

The DVR uses special internal tracks to provide two types of mailboxes: public and private. Both types allow you to leave messages for other repeater users. You can leave a message in a public mailbox by simply entering the "Leave Public Mail" command (after setting up the prompting tracks as described below). The DVR will then ask you who the mail is for. You key up and say their name or call sign. The DVR will then ask you to record your message. When you are through, it will tell you that your message has been stored. You can check if there is mail for you by simply entering the "Check Public Mail" command. It will list the names or call signs of the people that there is mail for, or will tell you that there is no mail. If there is mail for you, you can listen to your message by entering the "Retrieve Public Mail" command. Up to nine public mailboxes can be in use at a time.

Private Mailboxes:

Private mailboxes allow you to leave voice mail in someone's private mailbox. To do this you have to know the number of their mailbox. There are 500 private mailboxes, so everyone in your club can have their own. Each private mailbox can hold up to five messages at a time. You can retrieve or delete the mail in your own mailbox without affecting anyone else's mailbox.

Audio Quality/Recording Time:

The audio quality of tracks played with the DVR is nearly identical to the original. You will probably not be able to distinguish between a recording and someone talking "live." Technically, the DVR samples and plays audio at 8KHz with 8 bit resolution (256 voltage levels). This uses 64000 bits per second, which is 8000 bytes per second. At this rate, each megabyte of memory will hold 131 seconds of recorded audio. A small portion of the memory is used for other purposes, so the actual amount of storage will be slightly less than 131 seconds per megabyte. In a future software version, it may be possible to record with lower quality to extend the recording time.

The Audio Check Command:

Before executing any DVR commands on the RLC-DSP404 you should enter Command 182 1 D or unkey to tell the RLC-DSP404 that the DVR is installed. The controller will respond by saying "one". If you do not do this, some of the commands will work, but others will not.

The easiest way to test the DVR is to execute the "Audio Check" command. To use it, simply key your radio and enter "Command 170", then unkey. Key up again and say something. When you unkey, the DVR will play whatever you said back to you, then erase it. If this command works, you have the DVR connected and working. You can execute this command as many times as you want to without harm and without wearing anything out. It can also be used to help you know if your signal is noisy into the repeater; just use this command to record a test message and you can listen to your own audio. Yet another use for this command is to find out how much record time (memory) is still available. To do this, start recording and count off the minutes and seconds you have been recording. When the DVR's memory is full, it will stop recording. When you unkey and the message is played back, you will hear yourself count as long as the DVR was able to record before it ran out of memory (this could take a long time if the memory is not almost full - if it takes too long, the max record length timer could stop it before the memory is full).

Recording DVR Tracks:

Before recording a track, you should make sure it is empty. If a track has already been recorded, you will not be able to record it again until you erase it. All tracks are empty when the DVR is powered up. To record a track using COR to start and stop the recording, you should enter the record command followed by the track number, "171 TTT" (where TTT is the track number), then unkey (to tell the controller to execute that command and get ready to record). Then key up and start speaking your message. When you are finished, simply unkey. The DVR will automatically delete a fraction of a second of the beginning and end of your message to get rid of any noise caused by keying or unkeying.

If you wish to record a track without using COR, such as from the reverse autopatch in programming mode, you can use a DTMF digit to start and stop the recording. For example, to record track 0, you could enter "Command 171 000 D". As soon as you release the 'D', the DVR will begin recording. When you are finished speaking your message, press any DTMF digit to stop the recording. The DVR will automatically delete a fraction of a second at the end of your message to make sure that the sound of the DTMF digit is completely erased. Note that some phones (especially ones that can be used as speaker phones) mute about the first ½ second of each phrase you say; this makes recording nice DVR messages with them very difficult.

After you have recorded the prompting tracks (described later), you can use a more friendly version of the record command. Command 172 performs the same function as Command 171, but plays a DVR track that says something like "Please record your message now" after you enter the command and unkey (or press 'D').

When recording using either the prompted or non-prompted command, you must start recording within 10 seconds of entering the record command and unkeying or you will have to enter the command again. This is so a record command can't be entered and end up recording someone that keys up an hour later not knowing that the record command was the last thing entered. The default 10 second window can be changed with Command 020; it is the "DVR Start Recording Timer".

The only limit on the length of message that can be recorded is the amount of memory that is still available. To keep people from leaving long mailbox messages, the DVR record length limit timer (timer 164) can be set to limit the length of message that can be left. It defaults to 30 seconds, but can be lengthened or shortened as desired using Command 020. You may also need to lengthen your time out timer to record very long messages. Note that because some of the audio switching circuits are shared between the voice synthesizer and DVR, that only one may be playing at a time. If you play an exceptionally long DVR message, it may postpone the sending of synthesized voice IDs and other messages. For this reason, you should keep your DVR messages relatively short.

Playing Messages:

There are many things that can cause a DVR message to be played. For example, Command 170 records a message, then plays it back automatically. Command 172 plays a message to tell you to start recording a new message, then lets you record it. To simply play a message that has already been recorded, you can use Command 173. It works a lot like Command 036 does with the synthesized voice, playing the messages you request. Command 173 can be called from any macro to provide DVR IDs, courtesy beeps, autopatch off messages, etc.

Erasing Tracks:

There are several reasons to erase tracks. Tracks that have been recorded before must be erased before they can be recorded again. Tracks that are no longer being used should be erased to make more storage space available for new messages. Once a track has been erased, there is no way to recover it, so be careful when deleting tracks, especially when deleting a whole range at once. Deleting tracks can take several seconds, so don't be surprised if it takes a while before you hear the message erased message. If you are erasing a single message, the controller will continue to run normally while it waits for the DVR to finish deleting the message and send "message erased". If you delete a range of DVR messages with one command, the controller will stop everything else it is doing while it tells the DVR to delete each of the tracks. When it is finished, the DVR will speak "message erased" to let you know it is finished.

Recording the Prompting Tracks:

There are several special messages that are played automatically at certain times. They should be recorded before attempting to use the prompted record command or the mailboxes. The messages shown below are only suggestions; you can record them to say anything you want them to. To record them, enter the commands and speak the messages shown below. For more information about recording tracks, see the "Recording Tracks" section above.

Command 171 250 D or unkey	"Please record your message now"
Command 171 251 D or unkey	"Your message is stored"
Command 171 252 D or unkey (track 253 is not used)	"Message erased"
Command 171 254 D or unkey	"Who is your message for?"
Command 171 255 D or unkey	"There are no messages."
Command 171 256 D or unkey	"There is mail for..."

If you want to see how your messages sound, you can play most of them by entering Command 173 250 <unkey> (for track 250). Message 256 can not be checked this way, so record it and don't worry about checking it until you try out Command 175..178. If you want to erase one of these tracks so you can record it again, enter Command 174 250 <unkey> (to erase track 250). After recording these messages, the DVR is ready for use. Flip through the manual and try all of the commands until you are comfortable with them. If you want to erase all of your messages and start over, you can erase them with Command 174 or you can unplug the DVR and controller for several seconds, then power them back up (and wait for the DVR to finish its memory test).

Making DVR Messages Polite:

Currently, DVR command 173 is similar to the synthesized voice command 036 in that they are both impolite (see commands 063 and 064 for more information about "polite" messages). There are no DVR commands similar to the synthesized voice commands 063 (speak politely) or 064 (speak politely and do something if interrupted) in this firmware version (they are planned for a future version), but they can be simulated on the DVR-1 (the big DVR, not the small one) by programming macros similar to those shown below. To make polite DVR messages, the DVR-1 must be running V1.50 or later firmware; older versions of DVR firmware will continue to work but will not be polite and may cause the following (harmless) message to be printed to the controller's serial port: "DVR is not responding (1), Error sending command to DVR".

- Speak polite DVR message (like command 063):

055 600	; erase macro 600
056 600 036 801	; start polite mode
056 600 173 <dvr tracks>	; play dvr tracks
056 600 036 802	; stop polite mode
- Speak polite DVR message and do macro 250 if interrupted (like command 064):

055 601	; erase macro
056 601 036 801	; start polite mode
056 601 173 <dvr tracks>	; play dvr tracks
056 601 036 803 250	; stop polite mode, do 250 if interrupted

170: Record and Play Audio Test

This command makes the DVR start recording. When you unkey or press a DTMF digit to stop recording, it automatically plays it back. This is useful for testing the DVR and for checking how your signal sounds into the repeater. To use this command enter 170 and unkey, then key up and talk or enter "170 D" and start speaking immediately. When through speaking, unkey and your recording will be played back immediately. The track is automatically erased after it is played back.

<170>

Parameters:

- 170 is the default command name

171: Record DVR Track (non-prompted)

This command makes the DVR start recording a track. To use this command enter Command 171 TTT D or unkey. Either way, your message will be recorded and stored in track TTT.

<171> t	Record track 0..9
<171> tt	Record track 00..99
<171> ttt	Record track 000..260

Please note that a DVR track that has been recorded before must be erased before it can be recorded again. This is to avoid accidentally recording over an existing message.

Parameters:

- 171 is the default command name
- T, TT, TTT is the DVR track number (1..3 digits, track 0..260)

172: Record DVR Track (prompted)

This command has the same result as Command 171: it records a DVR track. The difference is that after entering the Command 172 TTT and unkeying, this command plays a special DVR track to tell you it is ready to start recording. This is useful because it lets you know that the command has been executed and the DVR is ready. After the prompting message is finished, you can key up and start recording. The disadvantage of this command compared with Command 171 is that you have to wait until the prompting message is finished before you can start recording. If you are recording a lot of tracks, it is faster to use Command 171.

<172> t	Record prompted track t
<172> tt	Record prompted track tt
<172> ttt	Record prompted track ttt

Please note that a DVR track that has been recorded before must be erased before it can be recorded again. This is to avoid accidentally recording over an existing message.

Parameters:

- 172 is the default command name
- T, TT, TTT is the DVR track number (1..3 digits, track 0..260)

173: Play DVR Tracks

This command makes the DVR start playing the specified track or tracks. They will be heard on the ports that are in the current audio routing variable (see Appendix A), just like the other commands that send tones or synthesized voice are. This is the command that you would use in an ID macro to send a DVR ID.

<173> ttt	Play single track
<173> t..t	Play multiple in-a-row tracks
<173> ttt ttt..ttt	Play multiple separate tracks

Parameters:

- 173 is the default command name
- TTT is a DVR track number. If only one track specified, can enter 1..3 digits. If more than one track is specified, must enter groups of three digits.

174: Erase DVR Tracks

This command makes the DVR erase the specified track or range of tracks. There are several reasons to erase tracks. Tracks that have been recorded before must be erased before they can be recorded again. Tracks that are no longer being used should be erased to make more storage space available for new messages. Once a track has been erased, there is no way to recover it, so use this command with caution, especially when erasing a range of tracks.

<174> ttt	Erase single track
<174> t..t	Erase multiple in-a-row tracks
<174> ttt ttt..fff	Erase multiple separate tracks

Parameters:

- 174 is the default command name
- TTT is a DVR track number to be erased. If only specify one track can use 1..3 digits.
- FFF (optional). If specified, DVR tracks TTT through FFF will be erased. FFF must be larger than TTT.

Note: If the DVR track for "message erased" is not heard, make sure you have entered Command 182 1 D or unkey to set up the DVR and that the "message erased" track has been recorded. You may have to wait for several seconds after entering the command for the DVR to finish deleting the message and send "message erased".

175: Record Public Mail

This command allows the user to record a message and who it is for and stores it in a public mailbox. It uses some of the special tracks to prompt the user to record the name or call sign and the message, and to tell him that the message has been stored. For more information, see the "Public Mailboxes" section at the beginning of the DVR section.

<175>

Parameters:

- 175 is the default command name

176: Check Public Mailboxes

This command recalls who has mail in the public mailboxes. The DVR will either play the special track that says, "There is mail for", then the name or call sign for each of the messages that are stored in the public mailboxes or it will play the special track, "There is no public mail". The names or call signs will be spoken in the order that the messages were recorded. If you want to check the public mail without the DVR saying anything if there is no mail, enter "173 256 257".

<176>

Parameters:

- 176 is the default command name

177: Retrieve Public Mail

This command allows a user that has mail in a public mailbox to retrieve it. This command is usually used after checking the public mailboxes with Command 176. When you check the public mailboxes with Command 176, you should keep track of where your name or call sign are in the list of people that have mail. For example, if Command 176 says, "There is mail for Joe, Mary, Bob, Jim", and you are Bob, your mail will be stored in public mailbox #3, because your name is third in the list. To retrieve your mail, you would enter "Command 177 3 D or unkey".

<177> s

Parameters:

- 177 is the default command name
- s is which mailbox your mail is in (1..9)

178: Erase Public Mail

This command throws away the contents of a public mailbox, the last one that was retrieved. It must be used only after retrieving a public mailbox message with Command 177. It erases only the last public mailbox message that was retrieved; all of the others remain unchanged (although they may be moved up to a lower numbered mailbox to avoid leaving gaps).

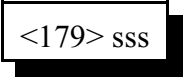
<178>

Parameters:

- 178 is the default command name

179: Record Private Mail

This command allows the user to record a message and store it in a private mailbox. You must know the mailbox number you wish to leave a message in to use this command. Since each user has his own mailbox, there is no need for you to record his name or call sign as with the public mailboxes.



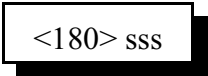
```
<179> sss
```

Parameters:

- 179 is the default command name
- SSS is the number of the mailbox to leave the message in

180: Retrieve Private Mail

This command allows a user to retrieve the mail that has been left in his private mailbox. If he has no mail, the special DVR track "You have no mail" will be spoken. If there is more than one message in his mailbox, all of them will be spoken consecutively.



```
<180> sss
```

Parameters:

- 180 is the default command name
- SSS is the number of the mailbox get the mail from

181: Erase Private Mail

This command throws away the contents of a private mailbox, the last one that was retrieved. It must be used only after retrieving a private mailbox message with Command 180. It erases all of the messages in that mailbox, but does not affect any of the other private mailboxes.



```
<181>
```

Parameters:

- 181 is the default command name

Chapter 7: Serial Port Commands

This chapter deals with the following topics:

- Information about serial transfers
- RS-232 baud rates
- Other serial port options
- Sending serial messages out of the main serial port
- Sending SPI serial data with the output lines

Where the Serial Ports Are:

The RLC-DSP404 has a serial port on the motherboard (which is the DB-9 located on the front panel) that is used for entering commands on the controller. This is called the main serial port. Each radio card also has a serial port controlling remote base radios (the top DB-9 connector on revision A radio cards, combined onto the single DB-9 on revision B and C cards).

Controlling what Serial Messages are Sent:

This section only refers to the main serial port, since it is the one you use for entering commands and that the controller uses to tell you when there is an error. When the controller is reset (such as when the power is turned on), it sends a serial message that tells you the controller type, software version, etc. Of course you will only see this message if you have a computer or serial terminal connected to the main serial port. If you then type a command on the computer or serial terminal and press enter, the controller will process the command and print on the screen either what it did (except for a few commands that don't print anything) or an error message telling you what went wrong.

If you enter a command from a radio using DTMF, the controller normally will not print anything on the serial screen. It "suppresses" that serial so if you are programming from the serial port at the same time someone is entering DTMF commands, the responses to their commands won't confuse you. You can keep the responses to commands entered by DTMF from being suppressed by turning serial suppression off with command 060. This can be handy for figuring out what is going wrong when entering DTMF commands.

Commands 162 and 169 bypass the check to see if serial is suppressed so they always print. Since you will normally want serial suppression to be turned on, these commands are useful for sending messages that you always want to be printed, even if the command to send them is entered from a radio port or executed by the scheduler or some other internal device.

The RS-232 Serial Protocol:

Most serial devices (computers, mice, external modems, serial terminals, etc.) use the RS-232 serial protocol. The main serial port on the RLC-DSP404 is RS-232 compatible. All you need to connect it to a computer, terminal or modem is the proper cable. The serial ports on the radio cards can be made to be RS-232 compatible by installing a Dallas DS275 chip into the socket labeled U8 (underneath the tone level pot). Make sure that there are no jumper blocks on header J5 (right next to U8) when you plug in the DS275, or you could destroy the chip.

TTL versus RS-232 Signal Levels:

Some devices, like HF remote base radios, require an adapter to convert their serial ports to the signal levels used for RS-232 (-12 and +12 volts). Without that adapter, they use TTL signal levels (0 and 5 volts). You should never connect a serial port that uses TTL level signals to one that uses RS-232. It is possible to make the serial ports on the radio cards use TTL level signals by installing jumper blocks on header J5, rather than installing a DS275 in socket U8. The jumper blocks should short pins 1 and 2 together and 3 and 4 together.

024: Set Up RS-232 Serial Baud Rate

This command allows you to set up the baud rate for the RLC-DSP404's main serial port. The baud rate for the main serial port should be set to match the computer, serial terminal, or modem that you have connected to it to program the controller with (it defaults to 9600 baud).

```
<024> x..x
```

Parameters:

- 024 is the default command name.
- x..x is the baud rate. Any baud rate from 300-19200 including non-standard rates can be specified. The baud rate you enter will be rounded slightly to the nearest available rate, but should always be compatible with the actual rate selected. The standard baud rates supported are 300, 600, 1200, 2400, 4800, 9600 and 19200 baud.

Example:

To set the baud rate to 2400 baud

```
<024> 2400 unkey, 'D' or <Enter>
```

060: Set Up Serial Port Options

This command allows you to turn several options on or off for the main serial port. Each of these options is discussed below.

The first is whether or not the serial port converts all characters that you type to upper case or not. The default is to convert them, because all of the default command names are in upper case (they must be to be executed by DTMF). Converting all of the characters makes it impossible to do a few things however, such as programming serial messages that contain lower case letters.

The second allows you to choose whether the controller will send a carriage return and line feed at the end of each line (the default) or just a carriage return. The latter might be useful in situations where the line feed messes up a modem or packet radio. Most communications programs can automatically add the line feeds back in when they receive a carriage return so that the screen will scroll, rather than printing each line over top of the last one. If you are trying to make a modem dial you, you will have to turn line feed sending off or when you send "ATDT<phone number>" the controller will follow it with a CR/LF (carriage return and line feed). The CR will tell the modem to start dialing. The LF will make it stop dialing - if a modem receives any characters from the controller while it is dialing, it will abort.

The third determines whether serial messages that are generated by commands that are executed by DTMF are suppressed or printed. If they are suppressed (the default), the only serial messages that will be printed are: the reset/copyright message, serial responses to commands executed from the serial port (not DTMF), and serial messages sent with Command 162.

The fourth is whether the serial is queued (buffered) or not. Normally it is buffered so that the controller can continue to run while the serial is sent in the background. Occasionally, usually for debugging purposes, you may want the serial to be sent before execution continues. In this case, you can turn queuing off. It automatically gets turned on whenever the controller is reset.

<060> x y	Set case sensitivity and line feeds.
<060> x y z	Set case sensitivity, line feeds and suppression.
<060> x y z q	Set case sensitivity, line feeds, suppression and queuing.
<060> 0 1 1 1	Set all settings to default values.

Parameters:

- 060 is the default command name.
- X is 1 to make the serial port case sensitive (no automatic conversion to upper case)
0 to make the serial port convert all characters entered to upper case
- Y is 1 to send line feeds (the default) or 0 to suppress them
- Z (optional) is 1 to suppress serial (the default) or 0 to send serial caused by commands entered from DTMF
- Q (optional) is 1 for queued serial (the default) or 0 to send it before continuing

032: Send Serial Message

This command allows you to send a custom message out the controller's serial port. If the message is entered with DTMF the serial message will only contain DTMF digits. If the message is entered using the RS-232 port, then the message will contain whatever characters you enter. This command is used to display serial error messages (they are sent from macros 200..219 using this command), among other things. The message will only be sent if you cause this command to be executed from the serial port or if you turn suppressed serial off with command 060, to minimize the amount of stuff being sent out of the serial port. If you want a message to be sent no matter what, use command 162.

<032> s..s

Parameters:

- 032 is the default command name.
- s..s is the data to be sent over the RS-232 port
 - The message length is limited to the maximum command length (about 200 characters) or if used in a macro, by the space left in a macro (less than 100 characters). If you need a longer message, split it up between several macros and use one macro to call the next macro in the sequence.

Voice response:

There is no voice response for this command

Notes:

- To change the baud rate, see command 024.
- Serial output is normally queued (buffered) so that controller operation does not wait for the message to be sent before continuing. Queueing can be controlled with command 060.
- Spaces are automatically stripped when the controller processes commands, including commands that send serial messages. This allows upload files to contain spaces without affecting the format of the input data. If a user wishes to have a 'space like character' sent the '_' (underscore) data can be used.

162: Always Send Serial Message out the Main Serial Port

This command is identical to Command 032 except that it always sends its message, regardless of whether command 060 is set to suppress serial sending or not.

169: Always Send Serial out Main Serial Port by ASCII Code

This command does the same thing as Command 162, but lets you enter characters by their ASCII codes. For each character you want to send, you have to enter a three digit number - that character's ASCII code (in decimal, not hex). This allows you to send characters that are not on the keyboard, or to send characters that are not on a DTMF pad when programming by DTMF. For a table of the ASCII codes, see Appendix G.

```
<169> ccc ccc ... ccc
```

Parameters:

- 169 is the default command name
- CCC is the ASCII code for one serial character.

Notes:

- To send a space with this command, use the ASCII code 032 (hex 0x20).
- This command does not automatically send carriage returns (ASCII 013) or line feeds (ASCII 010). If you do send a carriage return, the controller may automatically send a line feed afterward (see command 060).

138: Direct SPI Send using Open Collector Output Lines

This command is provided only for advanced use controlling SPI devices. Unless you need to control a serial shift register, ignore this command (it could be used to send data to the Doug Hall RBI-1 or the RLC-ICM, but using the specialized commands is much easier). This command accepts data in hex (two digits per byte) and sends that data in an SPI format (with data and clock line) using the open collector output lines on the Deluxe/Deluxe II board.

<138> xx	Send individual byte
<138> xx..xx	Send multiple bytes

Parameters:

- 138 is the default command name.
- XX is the hex number (00..FF) representing a byte of data to send. To send codes with 'E' or 'F', you will have to enter this command from the serial port. You may have to change your force execution digit (see command 078) to be able to enter some hex codes. You must enter an even number of XX digits since it takes two hex digits to make one byte of data.

Notes:

- External shift registers like the 74HC164 will decode the shifted data and return it to 1's and 0's for external BCD radio control.
- Each hex digit entered corresponds with four binary digits. If you are sending only digits 0..9, they can be used as BCD data.

Key Entered	Data Sent	.	Key Entered	Data Sent
0	0000	.	8	1000
1	0001	.	9	1001
2	0010	.	A	1010
3	0011	.	B	1011
4	0100	.	C	1100
5	0101	.	D	1101
6	0110	.	E	1110
7	0111	.	F	1111

- The data is output on the pins of the outputs connector shown below:

Data Output - Output #7 (Pin 6)
 Clock - Output #8 (Pin 2)
 Ground - Pin 1

Chapter 8: Macros

How Macros Get Executed:

Macros can be executed just like any other commands: you can enter the name of the macro from a radio and unkey (or press the force execution digit), you can enter the macro name from the serial port, you enter an 'N' followed by the macro number from the serial port, etc. In addition, the controller will automatically execute macros at certain times, such as to send an ID or a courtesy beep. The macros that the controller calls in this way are called "automatic macros" because they are called automatically. The automatic macros are listed in this chapter along with descriptions of when they get executed. When the controller is reinitialized (at the factory or if you do it), many of these macros are programmed with examples of what you might want to do: the ID macros speak sample IDs, the courtesy beep macros send beeps and the I/O macros send messages that tell you what changed. You can change what is in any or all of the automatic macros to make them do what you want.

Macros numbered 600 and higher are not listed with descriptions, because the controller doesn't have a specific purpose for them; they are called "user macros". They are extras that can be used for anything else you might want to do. You will probably want to keep a list of what you use each one for so you can remember it later. After you program them, you may want to change their names and execute them from your radio with DTMF, program the automatic macros to execute them, or tell the controller to execute them at certain times using the event triggers (see Chapter 20).

What a macro is:

There are at least two common understandings of what a macro is. The RLC-DSP404 currently supports the more flexible of the two types; eventually it may support both. The kind the RLC-DSP404 supports could be called a "multiple command macro" because it provides a way to execute a sequence of internal commands in response to one command from the user. In other words, this kind of macro contains a list of commands that are executed in order when the macro is executed. If you commonly want to connect your repeater port to a link port and turn DTMF muting on and change your courtesy beep, you could program a macro to execute the appropriate commands. This type of macro is very similar to the macros that many word processors and other computer programs allow you to make to automate things that you do often.

The other commonly used kind of macro (that the RLC-DSP404 does not currently support) could be called a "snapshot macro". It allows you to set up the controller the way you like it, take a snapshot of it, and restore the controller to that configuration at any time by recalling the snapshot. While this may be convenient, it is also limiting. Consider an example: you have two stand alone repeaters running off of one RLC-DSP404 controller. You are setting up one repeater today and plan to set up the other tomorrow. You set up the repeater with a certain courtesy beep and take a snapshot. You then set it up with a different courtesy beep and take another snapshot. Now you can easily switch back and forth between the two courtesy beeps just by recalling the appropriate snapshot. The next day you set up the other repeater port in a similar way, with two different courtesy beeps. Now you start having problems. Whenever you change the courtesy beep on one repeater, it messes up the courtesy beep on the other repeater as well, since everything gets stored in one big snapshot macro. You can't make a snapshot macro that does just what you want; it always restores a whole configuration at once.

The solution to the dilemma illustrated above is to use multiple command macros that do exactly what you want them to and nothing else. If you want a macro to connect you to Link A and not to Link B, make a multiple command macro to disconnect your repeater from Link B and connect it to Link A. Executing this macro will not interfere with anything else that is going on in the controller like a snapshot would.

Advanced Macro Topics:

Limits on Macros:

Since one macro can call another macro, you may wonder if macro 600 could call 601, which could call 602, which could call 603, etc. until you had called 100 macros or so. The answer is not quite. There are two limits. One is that if the total time it takes the processor to decode and execute the whole chained macro sequence is more than 1/2 second or so, the controller may reset itself. It is unlikely that you will ever reach this limit (it would probably take more than 20 macros all hooked together to even come close to this limit). The other limit restricts how deeply the macros can be *nested* (called from another macro). This is not a limit on how many commands can be called inside of a macro. It is not a limit on how many macros can be executed from one macro. It is a limit on one macro calling another macro that calls another macro that calls another macro. You can think of it as a limit on how deep an outline can go. For example, you execute macro 600. It calls Command 038, macro 601, and Command 000. This can be shown as the level with Roman numerals:

- I Call Command 038
- II Call macro 601
- III Call Command 000 and connect port 1 and 3

Macro 601 could contain Command 007 and call macro 602. Since macro 601 is called from macro 600, it is *nested* one level deeper, to level 2. This could be shown as capital letters in the outline:

- I Call Command 038
- II Call macro 601
 - A Call Command 007
 - B Call macro 602
- III Call Command 000 and connect port 1 and 3

Macro 602 could call macros 603, 604 and 605. Macro 602 is nested one level deeper than 601, so it is at level 3.

- I Call Command 038
- II Call macro 601
 - A Call Command 007
 - B Call macro 602
 - 1 Call macro 603
 - 2 Call macro 604
 - 3 Call macro 605
- III Call Command 000 and connect port 1 and 3

Macros 603 , 604 and 605 are at level 4. Note that they are all at the same level. Any commands that are called from these macros will be at level 5. This is about as deep as the RLC-DSP404 will let you nest macros, 5 or 6 levels. If you ever exceed this limit, error macro 209 will be executed. This is the nested macro depth limit.

Macros that Accept Data at Runtime:

Normally macros must be programmed with all of the data they will need to execute. For example, a macro that dials a phone number could be programmed as follows:

```
055 600 ;           erase macro 600
056 600 112 123 4567 ;   call 123-4567
```

Such a macro will always call the same phone number. It can be executed by entering "600". There is a way to make macros that accept more information at the time they are executed, and pass that data into the commands that are executed by the macro. For example:

```
055 600 ;           erase macro 600
056 600 112 ;       phone number will be supplied at runtime
```

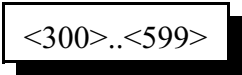
contains everything it needs to know to make the call, except for what phone number it is supposed to use. You can tell the controller to get the rest of the information needed to execute the macro at the time you tell it to execute the macro with command 067. For the above example, you could enter:

```
067 600 07 0 ;      make macro 600 accept exactly seven digits
```

Command 067 tells the controller that a macro will need more information at runtime. In this case, we specified that the user would enter exactly seven digits. It would also be possible to let the user enter seven or more digits ("067 600 07 1"), or any number of digits ("067 00 1"). See command 067 for more information.

300..599: Execute an Automatic Macro

These commands allow you to manually recall program macro sequences. These sequences are executed automatically by the controller to send IDs, courtesy beeps, alarm analog lines, recall input conditions, etc. These macros are programmed the same way as user macros, but are automatically called by the controller when certain events occur. You can also execute them manually by entering the command name (300 through 599). This is useful for testing the macros to make sure that they are programmed the way you want them to be. They are described in the “Automatic Macro Explanations” section at the end of this chapter.



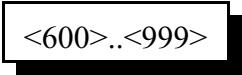
<300>..<599>

Parameters:

- 300..599 is the default command name.

600..999: Execute a User Macro

These commands allow you to execute user macro sequences. These macros are not used by the controller for any specific purpose, so you can use them for any purpose.



<600>..<999>

Parameters:

- 600..999 is the default command name.

055: Erase Macro

This command erases a macro. If it is executed after it has been erased, nothing will happen. There is no way to "unerase" a macro that has been erased.

```
<055> mmm
```

Parameters:

- 055 is the default command name.
- MMM is the command number of the macro to erase.

056: Add Command to a Macro

This command allows you to add a command to a macro. If the macro was empty (contained no commands), it becomes the first command in the macro.

```
<056> mmm ccc d..d
```

Parameters:

- 056 is the default command name.
- MMM is the macro number for this sequence to be stored in
- CCC is the command number within a macro
- D..D is the additional data associated with command CCC

Example:

Want to execute command 031 using macro 600

031 with 20 additional digits: 00 01 02 03 04 05 06 07 08 09 (sends 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 in CW)

```
<056> 600 031 00 01 02 03 04 05 06 07 08 09 D or unkey or <Enter>
```

053: Erase Then Add Command To Macro

This command is just a shortcut for entering command 055 then 056 (to erase then add a command to a macro).

```
<053> mmm ccc d..d
```

The following examples are equivalent:

; Example #1

055 600 ; erase macro (make sure it is empty)

056 600 066 TEST ; make macro speak "test"

; Example #2

053 600 066 TEST ; erase macro then make it speak "test"

Parameters:

- 053 is the default command name.
- MMM is the macro number for this sequence to be stored in
- CCC is the command number to be executed by the macro
- D..D is the additional data associated with command MMM

Example:

Want to execute command 031 using macro 600

031 with 20 additional digits: 00 01 02 03 04 05 06 07 08 09 (sends 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 in CW)

```
<053> 600 031 00 01 02 03 04 05 06 07 08 09 D or unkey or <Enter>
```

054: Recall Macro Contents

This command recalls the contents of a macro so that you can find out what the macro is programmed to do. It does not execute the commands in the macro, only recalls them to the serial screen or speaks them with the voice synthesizer. The format of the response is explained below.

<054> mmm

Parameters:

- 054 is the default command name.
- MMM is the macro number to recall

Format of the Voice Response:

"M" [macro number]
 "N" [number of commands in the macro]
 "C" [which command in the macro] [command number]
 "D" [number of digits of data] [the digits of data]
 repeat last two lines until all commands in macro have been recalled
 ? "percent" how many percent full the macro is

Example:

Recall Default Contents of Macro 300 (Command length not matched error handling macro):

You enter the command "054 300 D or unkey or <Enter>"

The serial response is:

Macro 300 contains 2 commands:
 #1 Command #032 with 31 digits of data: Command name length not matched
 #2 Command #036 with 09 digits of data: 133002028

The voice response is:

"M 300" macro number 300
 "N2" number of commands in the macro is 2
 "C1 32" the first command in the macro is command number 032 (send serial message)
 "D31" this command has 31 digits of data which are: "Command name length not matched"
 (speaks each letter, with pauses for spaces)
 "C2 36" the second command in the macro is command number 9
 "D9" this command has 9 digits of data which are:
 "133002028" the words "Error Two-Hundred"

057: Copy a Macro

This command allows you to copy a macro. It erases whatever used to be in the destination macro and replaces it with a copy of whatever is in the source macro.

```
<057> mmm ddd
```

Parameters:

- 057 is the default command name.
- MMM is the number of the source macro
- DDD is the number of the destination macro

058: Erase a Command in a Macro

This command allows you to erase a command in a macro without erasing the whole macro. The commands inside of the macro are numbered 00, 01, 02... so the first command is numbered 00. It may be helpful to execute command 054 to recall the contents of the macro so that you know which command to erase.

```
<058> mmm nn
```

Parameters:

- 058 is the default command name.
- MMM is the number of the macro
- NN is the number of command inside of the macro to erase (00, 01, 02...)

Voice Response:

"M <macro number> <pause> <number of command erased>

059: Insert a Command in a Macro

This command allows you to insert a command in a macro without erasing the following commands. This is useful for adding a command to the beginning or middle of a macro. The commands inside of the macro are numbered 00, 01, 02... so the first command is numbered 00. It may be helpful to execute command 054 to recall the contents of the macro so that you know where you want to insert the new command.

<059> mmm nn ccc d..d

Parameters:

- 059 is the default command name.
- MMM is the number of the macro
- NN is the where inside of the macro to insert the new command (00, 01, 02...)
 If NN is larger than the number of commands in the macro, the new command will be appended to the macro.
- CCC is the command number of the command to insert
- D..D is the data for the above command

Voice Response:

"M <macro number> <pause> <number of command inserted>

067: Set Macro Data Length

This is an advanced command that lets you specify that a macro should gather some extra information (more digits entered after the name of the macro) when it is executed and pass that information on to the commands inside of the macro. See the examples below for some of the possible uses of this command.

<067> mmm	recall data length for macro 'mmm'
<067> mmm xx y	'mmm' is the macro number 'xx' is number of digits of data 'y' is '0' if the amount of data must be exact or '1' if more data is OK.

Notes:

- When the macro executes, any commands in the macro that require a fixed amount of data will first take the data that was specified when the macro was programmed, then will take as many of the digits specified at runtime as needed.
- Commands in the macro that will accept a variable amount of data get all of the remaining digits specified at run-time.
- Any extra digits will be discarded.

Default:

- <067> mmm 00 0

Examples:

- Extra autopatch up code:
067 600 01 1 ; allow macro 600 to take 1 or more digits
053 600 112 ; make macro 600 call patch up command
; the phone number will be specified at runtime
010 600 n..n ; rename new patch up code to "n..n"
Usage: "n..n <phone number>"
- Connect port 3 to the port that user specifies:
067 601 01 0 ; allow macro 600 to take 1 digit
053 601 000 3 ; connect port 3 to port specified at runtime
Usage: "601 x" will connect port 3 to port x

Automatic Macros

The following is a list of the macros that are automatically executed by the controller at certain times. Because they are executed automatically when something happens (like a timer expiring) rather than because a user specifically told it to execute by entering the macros name, they are called "automatic" macros. The only difference between automatic and user macros is who (or what) decides that they should be executed. They are named according to the function that they usually perform. If you want to change how something works, you can change what commands the macro executes to suit your own desires. An example of this would be changing an impolite ID macro to send your repeater's ID rather than the example ID that is programmed in at the factory.

You can execute any of these macros by entering its name which corresponds to its macro number followed by a 'D' or unkey or <Enter> (example 300 would execute macro 300). This is useful for finding out what is already in the macros. You find out even more about what is in a macro by recalling its contents with Command 054 D or unkey or <Enter> then the macro's number. If you do this from a serial terminal, it will be relatively easy to understand. If you do it from a DTMF pad, the voice message may seem long and complicated. This is because the synthesized voice must spell out the messages that are programmed in the macros. You can learn a lot about how the controller works by looking at what is inside of the macros with Command 054. Command 054 also tells you how many percent full a macro is. Each macro can store 100 bytes of information, about 100 keystrokes.

Automatic Macro Explanations

Macros 300..319 are where your error messages come from. Whenever an error occurs in the controller, it will cause one of these macros to be executed. To find out what caused the error, remember what the error number is and look at the description of the corresponding macro number below. You can change the error messages to say anything you want them to, or nothing at all, by changing these macros. Please note, however, that if you remove the error messages completely, that you may not be able to tell when an error occurs. See the section about error messages in Chapter 1 for more detailed descriptions.

Macro	Definition	.	Macro	Definition
300	No matching Command Name	.	310	Invalid data value
301	Too few data digits	.	311	Command does not exist
302	Too many data digits	.	312	Bad Autopatch number
303	Invalid number of data digits	.	313	Autopatch error
304	Execution blocked from port	.	314	Invalid User
305	User level too low	.	315	DVR is busy
306	Reserved	.	316	Macro is full
307	Command executed OK	.	317	HF Error
308	Internal problem	.	318	Not Defined
309	Macro depth problem	.	319	Not Defined

Macros 320..391 These macros are automatically called when it is time to send an ID. You will want to erase (with Command 055) what is in these macros when you get the controller and put your own ID messages in these macros. It would be worth your time to study the way these IDs are programmed at the factory (see Command 054) so that you can make yours work the same way. Note that Command 064 is used to speak the voice IDs so that they will be polite and will automatically call the impolite ID macro (which is usually CW) if they are interrupted. Shortcut: if you want all four of the pending IDs for a port to send the same message, program that message in the first of the four pending ID macros, then program the other three to execute the first one. To change the ID timers, see Command 020.

Macro	Definition	Macro	Definition
320	.. Initial ID, Port 1	356	.. Pending ID #3, Port 1
321	.. Initial ID, Port 2	357	.. Pending ID #3, Port 2
322	.. Initial ID, Port 3	358	.. Pending ID #3, Port 3
323	.. Initial ID, Port 4	359	.. Pending ID #3, Port 4
324	.. Initial ID, Port 5	360	.. Pending ID #3, Port 5
325	.. Initial ID, Port 6	361	.. Pending ID #3, Port 6
326	.. Initial ID, Port 7	362	.. Pending ID #3, Port 7
327	.. Initial ID, Port 8	363	.. Pending ID #3, Port 8
328	.. Initial ID, Port 9	364	.. Pending ID #3, Port 9
329	.. Initial ID, Port 10	365	.. Pending ID #3, Port 10
330	.. Initial ID, Port 11	366	.. Pending ID #3, Port 11
331	.. Initial ID, Port 12	367	.. Pending ID #3, Port 12
332	.. Pending ID #1, Port 1	368	.. Pending ID #4, Port 1
333	.. Pending ID #1, Port 2	369	.. Pending ID #4, Port 2
334	.. Pending ID #1, Port 3	370	.. Pending ID #4, Port 3
335	.. Pending ID #1, Port 4	371	.. Pending ID #4, Port 4
336	.. Pending ID #1, Port 5	372	.. Pending ID #4, Port 5
337	.. Pending ID #1, Port 6	373	.. Pending ID #4, Port 6
338	.. Pending ID #1, Port 7	374	.. Pending ID #4, Port 7
339	.. Pending ID #1, Port 8	375	.. Pending ID #4, Port 8
340	.. Pending ID #1, Port 9	376	.. Pending ID #4, Port 9
341	.. Pending ID #1, Port 10	377	.. Pending ID #4, Port 10
342	.. Pending ID #1, Port 11	378	.. Pending ID #4, Port 11
343	.. Pending ID #1, Port 12	379	.. Pending ID #4, Port 12
344	.. Pending ID #2, Port 1	380	.. Impolite ID, Port 1
345	.. Pending ID #2, Port 2	381	.. Impolite ID, Port 2
346	.. Pending ID #2, Port 3	382	.. Impolite ID, Port 3
347	.. Pending ID #2, Port 4	383	.. Impolite ID, Port 4
348	.. Pending ID #2, Port 5	384	.. Impolite ID, Port 5
349	.. Pending ID #2, Port 6	385	.. Impolite ID, Port 6
350	.. Pending ID #2, Port 7	386	.. Impolite ID, Port 7
351	.. Pending ID #2, Port 8	387	.. Impolite ID, Port 8
352	.. Pending ID #2, Port 9	388	.. Impolite ID, Port 9
353	.. Pending ID #2, Port 10	389	.. Impolite ID, Port 10
354	.. Pending ID #2, Port 11	390	.. Impolite ID, Port 11
355	.. Pending ID #2, Port 12	391	.. Impolite ID, Port 12

Macros 392..403 are executed when it is time to send a courtesy beep. You would normally call Command 040 from this macro to generate the tones of your courtesy beep. If you want your courtesy beep to contain several beeps in sequence, you can call Command 040 multiple times within one macro, once for each beep.

Note: Before this macro is automatically called after you unkey, the audio routing variable is set to make the tones go to the proper ports, so you do not have to worry about that at all. Just call the commands you want to be executed when it is time for a courtesy beep (you could send beeps, DTMF digits, voice messages...) and the audio will automatically be sent to the correct ports. To change the courtesy beep timers, see Command 020.

Macro	Definition
392	.. Courtesy Beep Slot, Port 1
393	.. Courtesy Beep Slot, Port 2
394	.. Courtesy Beep Slot, Port 3
395	.. Courtesy Beep Slot, Port 4
396	.. Courtesy Beep Slot, Port 5
397	.. Courtesy Beep Slot, Port 6
398	.. Courtesy Beep Slot, Port 7
399	.. Courtesy Beep Slot, Port 8
400	.. Courtesy Beep Slot, Port 9
401	.. Courtesy Beep Slot, Port 10
402	.. Courtesy Beep Slot, Port 11
403	.. Courtesy Beep Slot, Port 12

Macros 404..419 are called when the analog input lines go into a High alarm. You may want to use these macros to speak an voice message indicating the alarm, start a beaconing alarm (see Chapter 19) and/or take some other action such as turning off an open collector output line. To change how often the RLC-DSP404 checks to see if an alarm has occurred, see the I/O polling timer in Chapter 4. The default is once per second.

Macro	Definition
404	.. High Alarm, Analog Line 1
405	.. High Alarm, Analog Line 2
406	.. High Alarm, Analog Line 3
407	.. High Alarm, Analog Line 4
408	.. High Alarm, Analog Line 5
409	.. High Alarm, Analog Line 6
410	.. High Alarm, Analog Line 7
411	.. High Alarm, Analog Line 8
412	.. High Alarm, Analog Line 9
413	.. High Alarm, Analog Line 10
414	.. High Alarm, Analog Line 11
415	.. High Alarm, Analog Line 12
416	.. High Alarm, Analog Line 13
417	.. High Alarm, Analog Line 14
418	.. High Alarm, Analog Line 15
419	.. High Alarm, Analog Line 16

Macros 420..435 are called when the analog input lines go into a Low alarm. You may want to use these macros to indicate an alarm condition.

Macro	Definition
420	.. Low Alarm, Analog Line 1
421	.. Low Alarm, Analog Line 2
422	.. Low Alarm, Analog Line 3
423	.. Low Alarm, Analog Line 4
424	.. Low Alarm, Analog Line 5
425	.. Low Alarm, Analog Line 6
426	.. Low Alarm, Analog Line 7
427	.. Low Alarm, Analog Line 8
428	.. Low Alarm, Analog Line 9
429	.. Low Alarm, Analog Line 10
430	.. Low Alarm, Analog Line 11
431	.. Low Alarm, Analog Line 12
432	.. Low Alarm, Analog Line 13
433	.. Low Alarm, Analog Line 14
434	.. Low Alarm, Analog Line 15
435	.. Low Alarm, Analog Line 16

Macros 436..451 are called when the analog input lines go out of either High or Low alarm into a Normal condition. You may want to use these macros to indicate that the analog reading is no longer causing an alarm.

Macro	Definition
-------	------------

436	.. Alarm to Normal, Analog Line 1
437	.. Alarm to Normal, Analog Line 2
438	.. Alarm to Normal, Analog Line 3
439	.. Alarm to Normal, Analog Line 4
440	.. Alarm to Normal, Analog Line 5
441	.. Alarm to Normal, Analog Line 6
442	.. Alarm to Normal, Analog Line 7
443	.. Alarm to Normal, Analog Line 8
444	.. Alarm to Normal, Analog Line 9
445	.. Alarm to Normal, Analog Line 10
446	.. Alarm to Normal, Analog Line 11
447	.. Alarm to Normal, Analog Line 12
448	.. Alarm to Normal, Analog Line 13
449	.. Alarm to Normal, Analog Line 14
450	.. Alarm to Normal, Analog Line 15
451	.. Alarm to Normal, Analog Line 16

Macros 452..467 are called when the digital inputs lines go from Low to High. You may want to use these macros to indicate an alarm condition. These macros are only called if the input alarms are enabled with command 092 (see Chapter 12).

Macro	Definition
-------	------------

452	.. Low to High, Input Line 1
453	.. Low to High, Input Line 2
454	.. Low to High, Input Line 3
455	.. Low to High, Input Line 4
456	.. Low to High, Input Line 5
457	.. Low to High, Input Line 6
458	.. Low to High, Input Line 7
459	.. Low to High, Input Line 8
460	.. Low to High, Input Line 9
461	.. Low to High, Input Line 10
462	.. Low to High, Input Line 11
463	.. Low to High, Input Line 12
464	.. Low to High, Input Line 13
465	.. Low to High, Input Line 14
466	.. Low to High, Input Line 15
467	.. Low to High, Input Line 16

Macros 468..483 are called when the digital input lines go from High to Low. You may want to use these macros to indicate an alarm condition. These macros are only called if the input alarms are enabled with command 092 (see Chapter 12).

Macro	Definition
468	.. High to Low, Input Line 1
469	.. High to Low, Input Line 2
470	.. High to Low, Input Line 3
471	.. High to Low, Input Line 4
472	.. High to Low, Input Line 5
473	.. High to Low, Input Line 6
474	.. High to Low, Input Line 7
475	.. High to Low, Input Line 8
476	.. High to Low, Input Line 9
477	.. High to Low, Input Line 10
478	.. High to Low, Input Line 11
479	.. High to Low, Input Line 12
480	.. High to Low, Input Line 13
481	.. High to Low, Input Line 14
482	.. High to Low, Input Line 15
483	.. High to Low, Input Line 16

Macros 484..495 are called when the Time-Out Timer expires. You may want to program these messages to indicate when a time-out condition occurred. They default to speaking "One Time Out" (or whatever receiver it is that just timed out). To adjust the time out timers, see Command 020.

Macro	Definition
484	.. Time-out Timer Message, Port 1
485	.. Time-out Timer Message, Port 2
486	.. Time-out Timer Message, Port 3
487	.. Time-out Timer Message, Port 4
488	.. Time-out Timer Message, Port 5
489	.. Time-out Timer Message, Port 6
490	.. Time-out Timer Message, Port 7
491	.. Time-out Timer Message, Port 8
492	.. Time-out Timer Message, Port 9
493	.. Time-out Timer Message, Port 10
494	.. Time-out Timer Message, Port 11
495	.. Time-out Timer Message, Port 12

Macros 496..507 are called when the Time-Out Timer comes out of a time-out condition. You may want to program these messages to indicate that a time-out condition has just been cleared.

Macro	Definition
-------	------------

496	.. Time-out Condition Clear Message, Port 1
497	.. Time-out Condition Clear Message, Port 2
498	.. Time-out Condition Clear Message, Port 3
499	.. Time-out Condition Clear Message, Port 4
500	.. Time-out Condition Clear Message, Port 5
501	.. Time-out Condition Clear Message, Port 6
502	.. Time-out Condition Clear Message, Port 7
503	.. Time-out Condition Clear Message, Port 8
504	.. Time-out Condition Clear Message, Port 9
505	.. Time-out Condition Clear Message, Port 10
506	.. Time-out Condition Clear Message, Port 11
507	.. Time-out Condition Clear Message, Port 12

Macros 508..519 If you don't use preaccess, you can totally ignore these macros. Even if you do use preaccess, you don't have to worry about them. They are automatically renamed and programmed when you configure a port for preaccess with Command 070 or 071. If you are curious, however, read on. When a port is set to require preaccess (either with Command 070 or 071), these macros are automatically programmed and renamed. The access code ("*" for a repeater, "#??" for a link) is actually the new name of these macros. Also, the command decoder is told to ignore every command that is entered from that port except for these macros. When you enter the access code, one of these macros is executed. The commands that are automatically programmed into these macros may do a lot of things (such as start dial tone for a link), but they always do this one thing, they execute Command 074. Command 074 tells the command decoder to let that port access all of the commands in the controller again, but only until the preaccess timer (see Command 020) runs out.

You should never have to change the contents of these macros by hand (since Command 070 and 071 do the work for you), but you might want to change their names. When you use Command 070 to configure a port as a preaccess repeater, it assumes that you want the local-mode access code to be "*". If that is not true, you can simply rename the first preaccess macro for that port to something else. Similarly, the link access code that is usually "#" plus two digits, can be changed to any valid command name up to six digits long.

Macro Definition

508 .. Pre-Access Storage, Port 1
 509 .. Pre-Access Storage, Port 2
 510 .. Pre-Access Storage, Port 3
 511 .. Pre-Access Storage, Port 4
 512 .. Pre-Access Storage, Port 5
 513 .. Pre-Access Storage, Port 6
 514 .. Pre-Access Storage, Port 7
 515 .. Pre-Access Storage, Port 8
 516 .. Pre-Access Storage, Port 9
 517 .. Pre-Access Storage, Port 10
 518 .. Pre-Access Storage, Port 11
 519 .. Pre-Access Storage, Port 12

Macro 520 is called whenever the controller is reset, whether it is reset because the power was just turned on, because you pressed the reset button, or because you executed the remote reset command. You can use it to execute any commands that you want to be executed on reset. If you run out of space in this, or any other macro, because you are trying to do too much, just call another macro, or several of them, from this macro and split up the work.

Macro Definition

520 .. Macro Called on Reset

Macro 521 is a temporary macro that is used when appending macros etc. It is of no use to you because it will be overwritten often.

Macro Definition

521 .. System Temporary Macro

Macros 522..537 are called when the corresponding user timer (see Command 020) expires. These timers can be started with Command 022 and stopped with Command 023. They are not normally used, but are provided for users that have a special purpose for them.

Macro	Definition	Macro	Definition
522	.. User Timer # 00	530	.. User Timer # 08
523	.. User Timer # 01	531	.. User Timer # 09
524	.. User Timer # 02	532	.. User Timer # 10
525	.. User Timer # 03	533	.. User Timer # 11
526	.. User Timer # 04	534	.. User Timer # 12
527	.. User Timer # 05	535	.. User Timer # 13
528	.. User Timer # 06	536	.. User Timer # 14
529	.. User Timer # 07	537	.. User Timer # 15

Macro 538 is automatically executed immediately before the autopatch is taken off hook when a call is made. It can be used to disconnect link ports before the call begins.

Macro	Definition
538	.. Called before Autopatch is taken Off Hook

Macro 539 is automatically executed immediately after the autopatch is hung up. It can be used to reconnect the links that were disconnected in macro .

Macro	Definition
539	.. Called after Autopatch is placed On Hook

Macro 540 is used to speak "Autopatch Busy" when you try to use the patch when it is already in use. It is automatically programmed when the controller is reinitialized. You can erase it and program your own autopatch busy message if you wish.

Macro	Definition
540	.. Called when the Autopatch is Busy

Macro 541 is used to speak "Autopatch" before the phone number is read back and dialed. It is automatically programmed when you set up the autopatch with Command 110. You can erase it and program your own message if you wish, but be sure that you recall the pre-programmed message first and understand what it does (it may do some other things depending on the number readback mode). You can also change the number of pauses that are spoken after the word "Autopatch" to change the delay before the number readback begins. See also macro 542.

Macro	Definition
541	.. Called before Autopatch number is read-back

Macro 542 is used to speak pauses after the number is read back. It is automatically programmed when you set up the autopatch with Command 110. You can change it if you wish, but be sure that you recall the pre-programmed macro first and understand what it does. You can change the number of pauses that are spoken to change the time that you can wait after the number is read back and still be able to kerchunk to make it dial/not dial (depending on the number readback mode).

Macro Definition

542 .. Called after Autopatch number is read-back

Macro 543 is an autopatch macro that is used for number readback mode 2.

Macro Definition

543 .. Internal Autopatch Macro

Macro 544 is used to speak "Call complete at <time>" when you hang up the patch. It is automatically programmed when the controller is reinitialized. You can erase it and program your own autopatch off message if you wish.

Macro Definition

544 .. Called when the Autopatch is hung-up.

Macro 545 is called when the DTMF cover tone is requested. It normally sends a 440 Hz tone using command 040. It can be set back to the default beep by entering: "053 545 040 020 030 0440". Any other tone, CW character, or voice message could also be used, although you will want to keep the duration fairly short.

Macro Definition

545 .. DTMF cover tone macro

Macro 546 is called when a user logs on using his password. First his callsign is spoken, then this macro is called. It is normally programmed to speak "control up". It can be programmed to speak other messages if you wish.

Macro Definition

546 .. User Logon Message

Macro 547 is called when a user tries to log on but gets the password wrong. It normally says "fail".

Macro Definition

547 .. User Logon Fail Message

Macro 548 is called when a user logs off. First his callsign is spoken, then this macro is called. It is normally programmed to speak "control down".

Macro Definition

548 .. User Logoff Message

Macros 549..550 are automatically programmed by command 048 when it sets up a beacon. If you are setting up beacons without using command 048, you can use any macros you wish.

Macro Definition

549 .. Beaconsing Message Macro

550 .. Beaconsing Message Macro

Macro 551 is used to speak "Autodial" before an autodial call is made. It corresponds to macro 551 which is used for non-autodial calls.

Macro Definition

551 .. Called before autodial number is read-back

Macro 552 can be used to make a two-stage autopatch call (command 111 style) with long distance checking and DTMF regeneration. It makes the controller generate up to 8 seconds of dial-tone (which can be controlled by the dial tone timers for each port) and seed the command buffer (see command 079) with command 112, so any digits entered when the dial tone is heard will be passed as data to command 112. Both this macro and command 112 can be given the same name, often '*' (using command 010). Then if the user enters '*' and a phone number before unkeying, the controller will execute command 112 and make the call in one step. If the user just enters '*' and unkeys, the controller will know that it doesn't have enough information to call command 112, so it will do this macro instead. The macro will make the controller send dial tone, after which the user can key up again to enter the phone number.

Macro Definition

552 .. Make two-stage autopatch call

Macros 553..599 are reserved for future applications

Macros 600..999 are user macros. They can be used for anything you want.

Chapter 9: Pre-Access Commands

What preaccess is:

Preaccess is a system used by several large linking systems to specify which controller in the network a DTMF command is intended to go to. A common configuration would be to enter the "*" key before commanding the local repeater, "#99" before commanding a distant controller via a link, and "#98" before commanding a different controller on the linking system. The advantage of requiring the user to "preaccess" a controller before commanding it is that you can use the same command names on each controller without confusion as to which one you are talking to. This is a very simplified description, but it should give you the idea.

What you need to know:

Because the preaccess system works quite differently from the way the RLC-DSP404 normally works, there is a lot involved with changing back and forth. Commands 070 and 071 have been provided to make the conversion to preaccess easy and painless. If you have converted a port to preaccess and want to change it back, use command 072.

You always configure one port at a time for preaccess, so you can set up one port for preaccess and leave another port alone. This allows you to have a mixed system. This might be useful if you want to try out preaccess on one port without forcing all of the users of a repeater on a different port to change the way they do things. It also allows you to use the RLC-DSP404 to interface between linking systems that do things differently.

049: Set Link Access Tone Frequencies

This command allows the user to set the tone frequencies that will be heard when the preaccess code is entered on a link. The default is to send dial tone (350 and 440Hz).

```
<049> pp xxxx yyyy
```

Parameters:

049 is the default command name

pp is the port number to set the tone frequencies for

1 - Port 01

2 - Port 02

3 - Port 03

4 - Port 04

5 - Port 05

6 - Port 06

7 - Port 07

8 - Port 08

9 - Port 09

10 - Port 10

11 - Port 11

12 - Port 12

XXXX is the first tone of the 2-tone combination

YYYY is the second tone of the 2-tone combination

Default:

XXXX is 0440 hertz

YYYY is 0350 hertz

Description	Tone 1	Tone 2
Dial Tone	0440 Hertz	0350 Hertz
Warble	0440 Hertz	0480 Hertz

070: Configure a Repeater for Preaccess

This command sets up a port to be a preaccess repeater. To execute commands from the repeater, key up, press the '*' key and enter the command. The command will be executed immediately, without waiting for you to unkey. This allows you to execute multiple commands in sequence without unkeying after each one. Also, when you pressed the star key, you were removed from any other repeaters or links you may have been connected to. In other words, the '*' puts you into a local control mode. This mode will expire if you unkey for 8 seconds (see command 076).

If you key this repeater and do not press the '*' key, you will not be in the local control mode and will be connected to other ports normally.

```
<070> pp
```

Parameters:

- 070 is the default command name.
- P is the port to make a preaccess repeater

071: Configure a Link for Preaccess

This command sets up a link to use the preaccess system. Links that are configured for preaccess will ignore any DTMF tones that are not preceded by Z..Z where Z..Z is the site access code you specify below. This allows commands to be sent down a linking system without every controller along the way trying to execute them, sending error messages, etc. To execute a command from such a link port, key up, enter Z..Z and the command. It will be executed when you unkey or press 'D'

```
<071> pp y z..z
```

Parameters:

- 071 is the default command name.
- pp is the port to set up as a preaccess link
- Y is 0 for no dial tone when accessed, 1 for dial tone
- Z..Z is the site access code. Typical site access codes are "#11", "#75", "#99", etc., that is a '#' followed by two decimal digits. The controller will allow any preaccess code from 1 to 6 digits long with any of the 16 DTMF digits in it, although you may have to change your force-execution digit temporarily (see command 078) while you execute this command to use the force-execution digit as part of the access code.

072: Disable Preaccess Requirement for a Port

This command allows you to turn off preaccess as set with Commands 070 or 071. It sets the specified port back to factory defaults:

- Force-execution digit is 'D'
- Autoexecution is off
- Preaccess is off

It also restores the preaccess macro for that port back to factory defaults:

- Empty (contents are erased)
- DTMF execution mask cleared

<072> pp

Parameters:

- 072 is the default command name.
- P is the port for which to turn the preaccess requirement off (01..12)

073: Recall Ports with Preaccess Requirement

This command allows you to determine which ports require preaccess.

<073>

Parameters:

- 073 is the default command name.

074: Allow Access To a Port that Requires Preaccess

This command allows commands to be executed on the port the command is executed from until the preaccess timer which it starts (see command 020 for more info on timers) runs out. It is usually called from the preaccess macro (see Chapter 8) for that port so that when that preaccess macro is executed, it temporarily allows access to the rest of the commands in the controller.

<074>

Parameters:

- 074 is the default command name.

075: Set Stop Access Conditions

When a port is configured for preaccess, it will not be allowed to execute commands until the access code has been received. Typically this access code is "*" for a repeater port or "#" plus two digits for a link. When the access code is received, the controller executes command 074 (among other things) which sets a flag indicating that it is OK to execute commands entered from that port. The controller will continue to accept and execute commands until that flag is cleared, at which point it will require the access code to be entered again. This command controls which conditions will clear that access flag.

<075> pp	Recall Current Settings
<075> pp x y z I f	Set Stop Access Conditions

Parameters:

- 075 is the default command name.
- pp is the port for which to set or recall the stop access conditions (01..12)
- X is 1 to enable / 0 to disable stopping access when a command is executed
- Y is 1 to enable / 0 to disable stopping access when an invalid command is entered
- Z is 1 to enable / 0 to disable stopping access when the receiver drops after a DTMF tone has been entered
- I is 1 to enable / 0 to disable stopping access when the DTMF interdigit timer expires.
- F is 1 to enable / 0 to disable stopping access when the force-execution digit is pressed

Notes:

- All digits following parameter pp are optional.
- The preaccess timer (see Chapter 4) will always clear the access flag when it expires. It cannot be disabled with this command. It starts running when you enter the access code and is re-started whenever you release a DTMF digit. It will never expire while you are holding down a DTMF digit. When no digits have been entered for the duration of the timer, it clears the access flag. These conditions provide additional ways to clear the flag.
- Parameter X: A command is executed or tries to execute and causes an error. If X is 1, you will not be able to execute the access code once, then multiple commands. You will be able to enter the access code, one command, access code, one command...
- Parameter Y: An error occurs because the digits entered are not a valid command name. If you make a mistake and this condition is enabled, you will have to enter the access code before you can try again.
- Parameter Z: DTMF digits have been entered since the access code was entered and you unkey. This condition doesn't care how many commands you enter or whether they were valid or not; if you enter anything and unkey, you will be forced to enter the access code again.
- Parameter I: The DTMF interdigit timer expired. This may occur if you enter a few digits then pause for a while without unkeying or if your voice falses the DTMF decoder.
- Parameter F: The force-execution digit (usually 'D') was entered. If the force-execution digit is part of the access code, it will not trigger this condition, otherwise it will.

076: Recall Stop Access Conditions

This command allows you to recall the conditions that will stop access on a port. See Command 075 for descriptions of the conditions.

```
<076> pp
```

Parameters:

- 076 is the default command name.
- pp is the port for which to recall the stop access conditions (01..12)

077: Isolate a Port from the Rest of the System

This command breaks the audio and PTT links between the specified port and all other ports in the system until the preaccess timer (which it starts) runs out. It temporarily overrides but does not change the crosspoint connections you may have set. It is useful for isolating a port while you enter local control commands without the tones going down any connected links. It is usually called from the preaccess macro of a port configured as a repeater. This macro is usually named '*', the local control key.

```
<077> pp
```

Parameters:

- 077 is the default command name.
- pp is the port for which to allow access (01..12)

Chapter 10: Scheduler

How the Scheduler Works:

The scheduler provides you with the ability to have up to 100 events occur automatically at hourly, daily, weekly, monthly or yearly intervals. The information used to store when event is supposed to occur and what it is supposed to do is stored in a "scheduler slot". The information about each event you want to set up must be stored in a different scheduler slot. You can change the contents of a scheduler slot by simply programming something different into that slot. Each event can call one command or user macro. If you call a macro, you can execute as many commands as you want in response to that scheduler event. You can use command 084 to keep a scheduled event from happening (disabling it) and to re-enable it later. Programming is explained in the command descriptions.

082: Set Up a Scheduler Event

This command sets up when a scheduler event will occur and what will happen at that time.

<082> ss ccc mm	Hourly Event	"at 15 minutes after each hour..."
<082> ss ccc hh mm p	Daily Event	"every day at 3:30 PM..."
<082> ss ccc d hh mm p	Weekly Event	"every Tuesday at 3:30 PM..."
<082> ss ccc dd hh mm p	Day-of-Month Event	"on the 3rd of every month at..."
<082> ss ccc ww d hh mm p	Week-of-Month Event	"on the 2nd Tuesday of every month..."
<082> ss ccc nn dd hh mm p	Yearly Event	"on January 6th of every year..."

Parameters:

- 082 is the default command name.
- SS is the number of the scheduler slot to set up [00..99]
- CCC is the number of the command to be executed by the scheduler

Note: The command that the scheduler executes must not require any data (like is normally entered after the "*" key), because there is no way to supply that data. If you want the scheduler to execute a command that requires data, you must make the scheduler call a user macro, then program that macro to call the command with the appropriate data.
- MM is how many minutes after the hour the event will occur
- HH is the hour that the event will occur (12 hour time)
- P is 0 to indicate A.M. or 1 to indicate P.M.
- D is the day of the week (one digit)

Number	Day
1	Sunday
2	Monday
3	Tuesday
4	Wednesday
5	Thursday
6	Friday
7	Saturday

- DD is the day of the month (two digits, 00..31)
- WW is the week of the month (01..05, must be two digits)
- NN is the month of the year

Note about audio responses:

The default audio routing variable for commands executed by the scheduler is set by command 050. If you want to change where the audio goes, either change the default with command 050 or change it inside of a macro with command 037.

Example #1 (hourly):

You want to have the controller speak the time (command 026) at the top of every hour. We will program an hourly event in scheduler slot 00 to execute command number 026 when the minutes are 00:

082 00 026 00 D or unkey or <Enter>

Example #2 (daily):

Next you decide that you don't want it to recall the time at night, just from 8 A.M. through 10 P.M. This is really two events, one to enable it in the morning, another to disable it at night. The command to enable or disable scheduler slots is 084. Because 084 requires data after the command name, we will have to call it from a macro. First we will write the macros to enable and disable reading the time, then we will make the scheduler call those macros.

053 600 084 00 1 D or unkey
 053 601 084 00 0 D or unkey
 082 01 600 07 30 0 D or unkey
 082 02 601 10 30 1 D or unkey

Make macro 600 enable scheduler slot 00
 Make macro 601 disable scheduler slot 00
 Program scheduler slot 01 to execute command 600 at
 7:30 A.M. every day
 Program scheduler slot 02 to execute command 601 at
 10:30 P.M. every day

Example #3 (weekly):

Friday (day 6 to the scheduler) at 5:00 P.M. you want the message "TGIF" (word numbers 050, 037, 039, 036) spoken out all radio ports on the controller. Again, we need to use a macro (number 602 for this example) to set the audio routing mask to all ports and speak the message:

053 602 037 010203040506070809101112 D or unkey

Program macro to set audio routing variable to all radio ports

056 602 036 050 037 039 036 D or unkey

Append macro to speak voice message "TGIF"

Now we will program weekly scheduler event 03 to execute macro 602:

082 03 602 6 05 00 1 D or unkey

Example #4 (day-of-month):

One minute after midnight on the first day of each month, you want the controller to speak "this is" then the name of the month out ports 1 and 2. The word numbers for "this is" are 353 and 205. We will use the variable word number 816 to speak the current month (see Appendix B for word numbers). To program macro number 603, we enter:

053 603 037 12 D or unkey

Program macro to set audio routing variable to ports 1 and 2

056 603 036 353 205 816 D or unkey

Append macro to speak "this is" and the name of the month

Now we will make scheduler slot 04 call macro 603 monthly on the first day of the month at 12:01 A.M.

082 04 603 03 12 01 0 D or unkey

Example #5 (week-of-month):

On the second Tuesday of every month at 5:45 PM you want the message "Club meeting at 6:30" spoken out all radio ports on the controller. Again, we need to use a macro (number 604 for this example) to set the audio routing mask to all ports and speak the message:

053 604 037 010203040506070809101112 D or unkey

Program macro to set audio routing variable to all radio ports

056 604 036 131 311 086 006 021 D or unkey

Append macro to speak voice message "Club meeting at 6:30"

Now we will program weekly scheduler event 05 to execute macro 604:

082 05 604 02 3 05 45 1 D or unkey

Example #6 (yearly):

You want to turn DTMF mute off on the repeater on port 1 at 10 minutes after noon on April fools day. First we program macro 605 to call command 007:

053 605 007 1 0 D or unkey

Macro will call command 007

Then we program scheduler slot 06:

082 06 605 04 01 12 10 1 D or unkey

083: Recall a Scheduler Event

This command recalls when a scheduler event will occur and what will happen at that time.

<083> ss

Parameters:

- 083 is the default command name.
- SS is the number of the scheduler slot to recall [00..99]

Explanation of the voice response:

"S ?? On/Off" Recalling Scheduler slot ?? and stating whether it is enabled (see command 084).

"C ???" When the scheduler event occurs, it will execute command number ???.

"Frequency ?" How often the event happens (these changed in version 2.11)

- 5 - hourly
- 4 - daily
- 3 - weekly
- 2 - day-of-month
- 1 - week-of-month
- 0 - yearly

From this point on, the response depends on the frequency.

Hourly:

"?" How many minutes after the hour the event happens.

Daily:

"Time ???? " What time of day the event happens.

Weekly:

"???? " The day of the week.

"Time ???? " What time of day the event happens.

Day of Month:

"D ?" What day of the month the event happens.

"Time ???? " What time of day the event happens.

Week of Month:

"W ?" What week of the month the event happens.

"???? " The day of the week.

"Time ???? " What time of day the event happens.

Yearly:

"???? " The month of the year that the event happens.

"D ?" What day of the month the event happens.

"Time ???? " What time of day the event happens.

084: Enable/Disable a Scheduler Event

This command allows you to temporarily disable a scheduler slot, then re-enable it later without having to reprogram it from scratch.

<084> ss c	Enable or Disable One Event
<084> ss tt c	Enable or Disable Range Of Events

Parameters:

- 084 is the default command name.
- SS is the (first) number of the scheduler slot to enable or disable [00..99]
- TT is the last number of the scheduler slot to enable or disable [00..99]
- C is 1 to enable the event, 0 to disable it

Chapter 11: The ID System

How the IDs Work:

Whenever an ID needs to be sent, a macro is called automatically by the controller. Those macros can be programmed to do anything, but typically they send a voice or CW message. There are six different ID macros for each port, one initial ID macro, four pending ID macros, and one impolite ID macro. Only the initial ID macro and impolite ID macros need to be programmed, as all four of the pending ID macros default to doing the same thing as the initial ID macro.

Even though the default is for all of the pending IDs to do the same thing as the initial ID macro, it adds variety to make them different. The initial ID macro is called the first time the repeater is kerchunked after not being used for a while. It is usually programmed to send a relatively long descriptive voice message. Each of the pending ID macros gets called occasionally during a conversation. They are usually programmed to send a shorter voice ID. The controller can either rotate through them or do them in random order (see command 087). The controller tries to wait until you unkey to send an initial or pending ID, but if it is time to send an ID and you don't unkey, it has to ID while you are still keyed to stay legal. When this happens, the controller calls the impolite ID macro, which is usually programmed to send a CW message.

Polite Voice IDs:

When the controller is sending a voice initial or pending ID, you might want to be able to key up during that ID and have the controller switch to CW. This is known as a polite ID, and is set up by programming the ID macro to send a polite voice message (see command 064 for details).

Example:

We want to program the IDs for the repeater on port 1. The initial ID and all of the pending IDs will be, "Welcome to the KC7HXB repeater in Sidney, the time is <time>". The impolite ID will be, "KC7HXB/R" in CW.

To make a file on a computer to enter this ID (strongly recommended, see Appendix F for more information), you could enter it like this:

```
; Initial ID: Welcome to the KC7HXB repeater in Sidney, the time is <time>
N053 320 064 380 526 487 476 041 033 007 038 054 032 411 257 661 476 484 270 810
; Impolite ID: KC7HXB/R
N053 380 030 20 12 07 17 33 11 36 27
```

To enter it from a radio using the DTMF pad, key up and enter a whole line, then unkey (note that the 'N' at the beginning of each line and the comments - everything following a ';' - are omitted):

```
053 320 064 380 526 487 476 041 033 007 038 054 032 411 257 661 476 484 270 810
053 380 030 20 12 07 17 33 11 36 27
```

Since the pending IDs default to doing the same thing as the initial ID, they don't have to be programmed separately unless you want them to send a different message. If you did, you could program them as follows:

```
; Pending IDs: This-is the KC7HXB repeater
N053 332 064 380 480 476 041 033 007 038 054 032 411
N053 344 064 380 480 476 041 033 007 038 054 032 411
N053 356 064 380 480 476 041 033 007 038 054 032 411
N053 368 064 380 480 476 041 033 007 038 054 032 411
```

To Program Your Own IDs:

The following instructions and the above example should be enough to get your IDs programmed for port 1. More details about how everything works internally will follow, but aren't needed just to get started.

```
N053 320 064 380 <word numbers from Appendix B> ; initial ID
N053 380 030 <CW characters from Appendix C> ; impolite ID
```

If you want to program your pending IDs to be different from the initial ID:

```
N053 332 064 380 <word numbers from Appendix B> ; pending ID 1
N053 344 064 380 <word numbers from Appendix B> ; pending ID 2
N053 356 064 380 <word numbers from Appendix B> ; pending ID 3
N053 368 064 380 <word numbers from Appendix B> ; pending ID 4
```

To program the IDs for port 2, use the following:

```
N053 321 064 381 <word numbers from Appendix B> ; initial ID
N053 381 030 <CW characters from Appendix C> ; impolite ID
```

If you want to program your pending IDs to be different from the initial ID:

```
N053 333 064 381 <word numbers from Appendix B> ; pending ID 1
N053 345 064 381 <word numbers from Appendix B> ; pending ID 2
N053 357 064 381 <word numbers from Appendix B> ; pending ID 3
N053 369 064 381 <word numbers from Appendix B> ; pending ID 4
```

As long as you want your initial IDs to be voice and polite and your impolite ID to be CW, you don't need to worry about how the above commands program macros that execute commands and supply information to those commands. If you want to do something different, read the following section.

More about Programming IDs:

The above instructions for programming IDs are typical of how all of the macros in the controller can be programmed. It may look complicated at first, but it all follows a pattern. The 053 at the beginning of each line tells the controller to erase anything that might already be in the macro because you want to start over and put the following stuff in instead. The next three digits are the number of the macro. A list of all of the macros can be found in Chapter 8. Then comes the stuff that gets put into the macro. 064 and 030 are command numbers - you can look them up elsewhere in this manual - that speak polite voice messages and send CW messages. The rest of the line is information that is used by command 064 or 030 when the macro is executed. 064 needs to know two things: what message to speak, and what to do if you key up during the message. The first three digits after the 064 is the number of the impolite ID macro, which is usually CW; that is what 064 does if you key up during the message. The rest of the

digits are the word numbers that tell it what to say. 030 doesn't need to know what to do if you key up while it is sending CW, so it just needs to know what CW characters you want to send. Chapter 8 has more information about programming macros and commands 064 and 030 have more information about the information they need.

Some variations on these macros would be:

- Make all of the IDs CW. To do this, use 030 and CW character numbers rather than 064, just like the impolite ID macro in the example.
- Make the voice IDs do something besides the impolite ID CW message. To do this, put a different command number after the 064 when you program the macro. That command will be executed if you interrupt the ID (but not if you are keyed when it is time for the ID to be sent - the impolite ID macro will be called in that case).
- Make the voice IDs just quit if you key up while they are being sent. To do this, just replace command 064 with 063 and remove the following three digits (063 doesn't need to know what to do if it is interrupted).
- Make the voice IDs impolite, that is make them keep talking even if you key up. To do this, just replace command 064 with 036 and remove the following three digits (036, like 063, doesn't need to know what to do if it is interrupted).
- Make the initial and pending IDs use the optional digital voice recorder. To do this, instead of using command 064, use 173 for the DVR followed by the DVR track numbers you want to play. There is no way at this time to make DVR IDs polite except on the DVR (see the section titled "Making DVR Messages Polite" in Chapter 6).

ID Timing:

You may have wondered how the controller knows when to send an ID. It uses three timers, the initial ID timer, the pending ID timer and the impolite ID timer (see command 020 for more timer information). The default values are 10 minutes, 9 minutes and 20 seconds, respectively. If it has been more than 10 minutes since the repeater was last used, the next time it is keyed up, the controller will try to send the initial ID. It will attempt to wait until you unkey so it can send the (typically) voice ID without it talking over you or switching to CW (if it is polite). It will wait up to the duration of the impolite ID timer for you to unkey. If you do not unkey within this time, it will cancel the initial ID and send the impolite one instead. If you do unkey so it starts to speak the initial ID and that ID is programmed to be polite, keying up will make it switch to CW.

The pending ID timer is started whenever any ID is sent. When the pending ID timer expires, it checks to see if anyone has keyed the repeater since the last ID. If they have not, there is no need to ID - the last transmission was already identified. If someone has keyed since the last ID, the controller starts trying to send a pending ID. Like with the initial ID, it will wait a while for you to unkey to avoid sending a voice ID while you are keyed up. If you unkey, it checks to see if you have chosen to have the pending IDs rotate through their cycle, or whether you want them selected randomly, and sends that ID. If you don't unkey before the impolite ID timer runs out, it calls the impolite ID instead.

To summarize, with the default timer settings, the controller will ID every 9 minutes during a conversation and one more time after the last time the repeater is keyed. If it can, it will send a voice ID; otherwise it will send a impolite CW ID. It will not ID at all if no one is using the repeater. You can change the ID timers if you want to, but make sure you set the pending ID timer to be shorter than the

initial ID timer (at least a second) and that the duration of the pending ID timer plus the impolite ID timer is less than 10 minutes (or whatever the legal maximum time between IDs is). The initial ID timer can be as long as you like. Since the only thing that causes IDs to be sent is someone keying up, you should also include your ID in messages that may be sent spontaneously such as scheduled messages (time on the hour for example) or analog alarms.

085: Enable/Disable IDing a Port

This command allows you to enable or disable the IDing functions for a port. Normally all ports are identified, including link ports. Often this is not desired. This command allows you to turn off the IDing functions.

This command also lets you specify whether the controller should use the pending ID messages or the impolite CW message during conversations. If you choose the latter, the controller won't even try to send voice IDs during conversations (after the initial ID); it will always use the impolite CW ID message. If you choose voice IDs, it will try to sneak in a voice ID when you unkey. If you key up during the voice ID and it is programmed to be polite, it will switch to CW at that point.

<085> pp I	Enable or disable ID
<085> pp I 0	Enable or disable ID. Use pending IDs during conversations
<085> pp I 1	Enable or disable ID. Use impolite CW ID during conversations.

Parameters:

- 085 is the default command name.
- pp is the port for which to enable or disable the IDs (01..12)
- 'I' is 1 to enable IDs, 0 to disable them

Defaults:

IDs are enabled only on port 1.
The controller tries to use voice IDs during conversations.

Notes:

If you only want to disable some of the IDs for a port, keeping the pending IDs but not the initial ID, for example, just erase the ID macro that you don't want to do anything (see Chapter 8 for macro definitions).

086: Recall Which Ports have IDs Enabled

This command lists the ports that have IDing enabled. If all ports do, it speaks "010203040506070809101112".

<086>

Parameters:

- 086 is the default command name.

087: Set Random or Rotating Pending IDs

This command allows you to select whether the four pending IDs for a port will be sent in random order or whether they will just be rotated through (1, 2, 3, 4, 1, ...).

```
<087> pp c
```

Parameters:

- 087 is the default command name.
- pp is the port for the IDs (01..12)
- C is the ID control, 1 for random, 0 for rotating (default is rotating)

088: Recall Random or Rotating Pending ID Selection

This command allows you to recall which ports rotate through the pending IDs (1, 2, 3, 4, 1, 2, 3, 4, 1, 2, ...) and which ones select them in random order. Voice response will list the ones that rotate, the others are random.

```
<088>
```

Parameters:

- 088 is the default command name.

Chapter 12: I/O System

About the I/O System

Note that you can control how often the RLC-DSP404 checks the analog/digital input lines and analog alarms by using Command 020 to change the duration of timer 48. The default is to check the alarms once per second.

Open Collector Output Lines

When turned on, an open collector output gets connected to ground; when turned off it is an open circuit. The open collector output lines never output any voltage. The way they are commonly used is to connect one lead of the coil of a relay (or whatever else you want to control) to 12 volts and the other lead to an open collector output line. When the open collector output is turned on and applies a ground, the coil of the relay will be energized and will turn the relay on. The open collector output line can "sink" (apply a ground of) about 150 milliamps. Connecting an open collector output line directly to a power supply and turning it on will destroy the output driver. Make sure that whatever you are turning on and off draws less than 150mA.

The open collector output lines can be turned on and off with Commands 093 and 094. You can recall whether a line is currently on or off with Command 095. If you want to speak a custom message when you turn an open collector output on or off, program one of the user macros to speak the message you want, execute Command 038 (to suppress the rest of the voice responses), and then turn the open collector output line on or off.

Digital Input Lines

Digital inputs lines can only distinguish between two levels, high and low. If the voltage on the input is below 0.5V, it will consistently read low. If it is above 2.0V, it will consistently read high. If it is between 0.5 and 2.0V, it may read inconsistently. If the connected device does not keep the voltage high enough or low enough to read consistently, you may need to buffer it with a relay or transistor. Do not apply negative voltage to an input line.

If the digital input line has a pullup resistor, it can be directly interfaced with an open collector output or a switch with one lead connected to ground. When open collector output or switch does not pull the line low, the pullup resistor will make sure it reads high.

Digital input lines can be used in three ways.

- Command 090 can read an input line and tell you whether it is high or low.
- A custom voice message can be assigned to each state of an input line, such as "door open" and "door shut" (instead of high and low). To do this, program the voice messages you want to be spoken for the high and low states into the input line macros (see automatic macros in Chapter 8). You can then cause the appropriate message to be spoken by executing Command 091.

- If you want a message to be spoken whenever an input line changes from high to low or low to high, you can cause the macros you programmed in the step above to automatically be executed at those times by enabling an "input line alarm" with Command 092. You could use this feature along with a door switch to tell you when someone opens or closes a door.

Analog Input Lines

When an input line is used as an analog line, the way the voltage is interpreted can be customized, so rather than telling you the voltage directly, the controller can convert the voltage to a temperature, percentage, wind speed, etc. The information needed to set up a variety of common conversions is provided in a chart (see command 102). If you have an unusual application, it is possible to set up a custom conversion scale.

If you need to set up a custom conversion scale, you will need to deal with the following issues:

"Resolution" refers to how many digits after the decimal place you want to know about. Temperature is usually read to the nearest degree, zero digits after the decimal. When reading a battery or power supply's voltage, you probably want to hear more than "thirteen volts" or "fourteen volts", something like "thirteen point six volts". To obtain this kind of reading, you would specify one digit after the decimal point.

The **"conversion ratio"** specifies how the controller interprets the voltage it detects. It could also be called the "scale" or "meter faceplate". If you are measuring wind speed, you may want a reading that varies from zero to 100 MPH. If wind direction, zero to 360 degrees. If pH, zero to 14. If temperature, way below zero to a hundred degrees or more. No matter what scale you want the reading to use, the voltage going into the analog line must be between 0 volts and 5 volts. If you have a sensor to measure something in the physical world that can provide a voltage that varies between 0 volts and 5 volts, you can set up the conversion ratio to handle it. The point of this discussion is to make it clear that the controller does not care what the real-world quantity is, it just needs a variable voltage and the proper conversion ratio. You tell the RLC-DSP404 what the conversion ratio is by specifying two points:

The first is what real world quantity would cause the sensor to output 0 volts. In many cases this is zero. For example, if you are using a small motor with a propeller to detect wind speed and the wind is not blowing, you will get 0 volts. But what about temperature? If our sensor outputs 0 volts for zero degrees, how would we get negative temperature readings? The analog lines can only accept positive voltages. The answer is that we use a temperature sensor that outputs about 2.5 volts at zero degrees, less than that when below zero and more than that when above zero. So our first conversion point for temperature says that it would have to be 460 degrees below zero to get 0 volts out of the sensor.

The second point we set specifies what real world quantity would cause the sensor to output 5 volts. If your wind speed detector outputs 5 volts when the wind is blowing 150 MPH, this point would be 150. For the temperature sensor we use (the LM335), it would have to be 440 degrees out to get 5 volts out of the sensor.

"Calibration" refers to correcting for small errors in a reading. If the controller tells you it is 85 degrees when it is 88, you can calibrate it to correct for the small error. If it is way off, you probably have the conversion set wrong.

You can also set "analog alarms". These will cause a macro to be executed whenever the value read on one of the analog lines goes above or below a preset value. See Commands 104..107 for more information.

090: Read Whether Digital Input Line is High or Low

This command allows you to read the digital input lines. The controller will speak a message that indicates whether the line is high or low.

<090> ll	Read single digital input line
<090> ll..ll	Read multiple digital input lines

Parameters:

- 090 is the default command name.
- ll is the digital input line number (01..16)

Notes:

To provide customized messages for the digital input lines, see Command 091.

091: Execute Digital Input Line High or Low Macro

This command is similar to Command 090. The difference is that instead of speaking the word "high" or "low", the high or low internal macro for that digital input line will be executed. This allows you to program custom messages such as "door open" and "door shut". See Chapter 8 to find the macro numbers for each digital input line.

<091> l	Execute macro for one digital input line
<091> ll..ll	Execute macros for multiple digital input lines

Parameters:

- 091 is the default command name.
- ll is the digital input line number (01..16)

Notes:

Multiple digital input lines can be read with one call to this command by entering more than one port number here.

092: Enable/Disable Digital Input Line Alarm

This command allows you to turn on digital input line alarms that will occur whenever an digital input line goes high or low. When the alarm occurs, it will execute the digital input line high or low macro. Note that these are the same macros that get executed by Command 091 whenever the digital input line is read. The high and low alarms can be enabled or disabled separately.

<092> ll a c

Parameters:

- 092 is the default command name.
- ll is the digital input line number (01..16)
- A is 1 for the high alarm, 0 for the low alarm
- C is 1 to enable the alarm, 0 to disable it

Note:

There is currently no command to recall whether the digital input line alarm is turned on or off.

093: Turn Open Collector Output Line On

This command allows you to turn an open collector output line on. The outputs are active low open collector drivers, so on means that they apply a ground to that open collector output. Off means that the open collector output is open, or not hooked to anything.

<093> 1	Turn a single open collector output line on
<093> ll..ll	Turn multiple open collector output lines on

Parameters:

- 093 is the default command name.
- ll is the open collector output line number (01..16)

Notes:

To provide customized messages when turning open collector output lines on or off, use a macro that both executes this command and the speak voice message command (036).

094: Turn Open Collector Output Line Off

This command allows you to turn an open collector output line off. The outputs are active low open collector drivers, so on means that they apply a ground to that open collector output. Off means that the open collector output is open, or not hooked to anything.

<094> 1	Turn a single open collector output line off
<094> ll..ll	Turn multiple open collector output lines off

Parameters:

- 094 is the default command name.
- ll is the open collector output line number (01..16)

Notes:

To provide customized messages when turning open collector output lines on or off, use a macro that both executes this command and the speak voice message command (036).

095: Recall Whether Open Collector Output Line is On or Off

This command allows you to recall whether the open collector output lines are turned on or off.

<095> 1	Check a single open collector output line
<095> 11..11	Check multiple open collector output lines

Parameters:

- 095 is the default command name.
- 11 is the open collector output line number (01..16)

Notes:

To provide a customized message when an open collector output line is turned on or off, call Commands 093 or 094 from a macro that also speaks a voice message. There is no easy way to get a customized message to recall whether a line is on or off at the current time without turning it on or off again. If you really need custom recall messages and you are very familiar with macro programming, read the following, otherwise don't bother. The idea is to use a macro to call the open collector output line on and off commands. Also in that on/off macro, call the program-single-command-macro command and program another macro (we will call it the recall macro) to speak the appropriate recall message. That recall macro could then be executed to find out whether the open collector output line was turned on or off last. In other words, we would use the on and off macros to program the recall macro. Whichever on/off macro was executed last would have programmed the recall macro last, making it contain the appropriate message. If you didn't understand all of this, don't worry about it, use this command, and wait for a later software version that will make all of this easier.

100: Read Analog Input Line

This command allows you to read the analog input lines on the RLC-DSP404. The number that is read back will depend on three other things: the precision used (set with Command 101), the conversion scale (set with Command 102), and the calibration (set with Command 103). When you want to read the analog lines as part of a custom message such as "The temperature is ??? degrees Fahrenheit" you should use the read-analog-input special words (see words numbered 800 and higher in Appendix B). They will allow you to read the analog input without all of the extra " Line ?" words that you won't want in your messages.

<100> 1	Read a single analog line
<100> 11..11	Read multiple analog lines

Parameters:

- 100 is the default command name.
- 11 is the analog input line number (01..16)

Notes:

Multiple analog input lines can be read with one call to this command by entering more than one port number here.

Example:

Command 100 works fine, but I want a nicer message when reading wind speed. 053 erases then starts programming a macro. 600 is the macro number. 036 is the command to speak a voice message. The following numbers come from Appendix B and specify the words for the message. Word 838 is a special word number that the controller automatically replaces with the current reading for analog line 3.

```
; Speak "The wind speed is (analog 3) miles per hour"
053 600 036 476 531 452 270 838 003 317 375 249
```

101: Set Resolution For Analog Input

This command allows you to specify how many digits after the decimal point will be used when reading each analog input line. If you want to read voltage to 1/10 of a volt, you specify one digit after the decimal point. This decimal point is assumed in the other analog commands since there is no good way to enter a decimal point on a DTMF pad. If you specify one decimal place with this command, the other analog commands will assume that the numbers you enter have an assumed decimal point one digit from the end. In other words, if you want to specify a value of 12 volts and you are using one digit after the decimal point, you must enter 120. The descriptions of those commands will explain this in more detail.

```
<101> ll r
```

Parameters:

- 101 is the default command name.
- ll is the analog input line number (01..16)
- R is the number of digits after the decimal point (0..3)

Explanation:

This command may allow you to read an analog input with more decimal places than the controller can accurately measure. That doesn't hurt anything, but may be misleading (such as indicating that the temperature is 75.251 degrees when you really only know it is within about one degree of 75). The analog to digital converter (ADC) in the controller accepts a voltage between 0 and 15 volts (higher voltages may be reduced to that range with an external series resistor on the out of range analog input.) and can differentiate 4096 (or 12-bit resolution) levels within that range, about 3.66mV per level. LM335 temperature sensors output a voltage of 10mV per degree Kelvin (Celsius - 273). This corresponds to about 5mV (10mV * 5/9) per degree Fahrenheit, about one-half degree resolution. There is no reason to try to read temperature with two decimal places when conversion itself doesn't have that much resolution. Even one digit after the decimal point is pushing it - it would sound like you were getting 1/10 degree resolution even though you would really only be getting about ½ degree resolution. We recommend reading temperature to the nearest degree (0 digits after the decimal point).

Another example: reading battery voltage. Since the controller requires 12 or so volts to run, the processor's analog to digital converter reads the power supply voltage directly. So analog input line #4 is connected to the controller's power input. To make the controller read the power supply voltage, we need to set it to convert the value read on a scale of 0..15V. This can be done by entering

102 08 0 0000 0 0015;	read analog input 8 on 0 to 15 volt scale
101 08 0 ;	read analog input 8 with no decimal places

102: Set Conversion Ratio For Analog Input

This command allows you to select what scale the analog inputs are read on. This allows you to use the analog inputs to read temperature on a scale from hundreds of degrees below zero to hundreds above, battery voltage on a scale from 0 to 25 volts or wind direction from 0 to 360 degrees. Anything that can generate an analog voltage can be read on a scale appropriate to the measurement. Unfortunately, this flexibility brings with it a little complexity. To make it easy, we provide a chart of the common conversions you might use. If you want to use a conversion that is not listed, read the explanations after the chart and study the examples on the chart. Once you see the pattern, the calculations are not difficult.

Command Parameters	Description	Resolution
<102> xx n wwww m zzzz	General conversion form	....
<102> xx 0 0000 0 1023	Default Setting	1 analog to digital converter count
<102> 08 0 0000 0 0250	Internal Battery Voltage	0.1 volts, enter "101 08 1"
<102> xx 1 0460 0 0440	Fahrenheit temperature	1 degree, enter "101 x 0"
<102> xx 1 0273 0 0227	Celsius temperature	1 degree, enter "101 x 0"
<102> xx 0 0000 0 0005	0..5 volts	1 volt, enter "101 x 0"
<102> xx 0 0000 0 0050	0..5 volts	0.1 volt, enter "101 x 1"
<102> xx 0 0000 0 0500	0..5 volts	0.01 volt, enter "101 x 2"
<102> xx 0 0000 0 0025	0..25 volts	1 volt, enter "101 x 0"
<102> xx 0 0000 0 0250	0..25 volts	0.1 volt, enter "101 x 1"
<102> xx 0 0000 0 2500	0..25 volts	0.01 volt, enter "101 x 2"
<102> xx 0 0000 0 0100	0 to 100%	1 percent, enter "101 x 0"
<102> xx 0 0000 0 0360	0 to 360 degrees	1 degree, enter "101 x 0"

Notes:

- Please note that regardless of the conversion used, the voltage entering the analog inputs must be between 0 and 5 volts.
- For more information about hooking up a LM335Z temperature sensor, see Appendix H.

Parameters:

- 102 is the default command name.
- xx is the analog input line number (01..16)
- n is 1 for negative, 0 for positive for the following number
- wwww is the reading with a 0 volt input with leading 0s if necessary
- m is 1 for negative, 0 for positive for the following number
- zzzz is the reading with a 5 volt input to the processor with leading 0s if necessary.

Custom Analog Conversion Ratios:

If the conversions provided in the chart are what you need, don't bother reading this section. It describes how to come up with your own conversions.

The conversion is simply a linear ratio. You provide a reading that corresponds with 0 volts at the processor and another number that corresponds with 5 volts at the processor, and the controller just does a linear interpolation.

First we will describe some of the conversions in the table, then illustrate how to come up with your own:

0 to 15 volt, 1 volt resolution:

This is about as straightforward as it can get. When it reads 0, it converts it to zero. When the processor reads 15 volts, it converts it to 15 volts.

0 to 15 volt, 1/10 volt resolution:

When it reads 0, it converts it to zero. To get 1/10 volt resolution, we need to use one digit after the decimal point. Because of this we have to assume one decimal point when we enter the conversion points. When the processor reads 15 volts, we need to convert to 150, which with one assumed decimal place, is 15.0 volts.

0 to 15 volt, 1/100 volt resolution:

When it reads 0, it converts it to zero. To get 1/100 volt resolution, we need to use two digits after the decimal point. When the processor reads 15 volts, we tell it to convert it to 1500, which with one assumed decimal place, is 15.00 volts.

Temperature in Celsius, 1 degree resolution:

The key to figuring this one out is knowing how the LM335 temperature sensor works. It provides an output voltage of 10mV per degree Kelvin. It should therefore output zero volts at zero degrees Kelvin. Zero degrees Kelvin is minus 273 degrees Celsius, so that is our first conversion point, -273. The 15 volt conversion point would be reached at $15V/10mV \text{ per degree} = 1500 \text{ degrees Kelvin}$, or 1227 degrees Celsius (above zero). This is our other conversion point.

Temperature in Fahrenheit, 1 degree resolution:

This conversion is very similar to the one for Celsius temperature. 0 degrees Kelvin is -460 degrees Fahrenheit. 500 degrees Kelvin is 440 degrees Fahrenheit.

One more example will illustrate how to develop a conversion that is not listed in the chart. Let us assume that we want to read the wind speed at our site and that we have an anemometer (wind speed detector) that reads 10 volts at 100 MPH. Since the maximum voltage is below 15 volts no external divider is necessary. We will assume that 0 volts are produced when the wind is not blowing and that it increases linearly from there. That sets our zero point to be zero. We must calculate our full scale reading as if it will occur at 15 volts, even though the sensor will never put out that much voltage. What we need to know is how fast the wind would have to blow to give us a 15 volt signal. A simple ratio will give us the answer:

$$\frac{100 \text{ MPH}}{10 \text{ volts}} = \frac{X \text{ MPH}}{15 \text{ volts}}$$

Cross Multiplying: $100 * 15 = 10 * X$, $1500 = 10 * X$, $X = 150 \text{ MPH}$

We now know that the low point is 0, the high point is 150, and that we need to use the voltage divider.

103: Calibrate an Analog Input

This command allows you to correct for small amounts of error in reading analog sources. It should not be used until the resolution and conversion ratios are set (with Commands 101 and 102). It is not intended to fix readings that are way off (more than 20 percent or so). If you are getting a reading that is a long way off, go back to Command 102 and correct the conversion ratio. This command accepts as input the correct value for an analog input line and adds or subtracts the right amount from the reading it is receiving to make it equal what you say it is. To get rid of this correction factor, execute the reset calibration form of this command shown in the table below.

<103> ll n www	Calibrate an analog input
<103> ll 2	Reset calibration

Parameters:

- 103 is the default command name.
- ll is the analog input line number (01..16)
- N is 1 for negative, 0 for positive for the following number
- WWW is the actual value that should be read by the sensor.

Notes:

The value you enter will have as many assumed decimal places as you set with Command 101.

104: Set an Analog Alarm

This command allows you to set an alarm that will occur when an analog reading goes below a low alarm point or above a high alarm point. When the alarm occurs, it will execute an internal macro (see Chapter 8 for internal macro definitions). You can program this internal macro to do anything, turn open collector output lines on or off, speak a voice message, change your courtesy beep, etc. The alarm point will be checked at intervals determined by the duration of the input alarm timer (see Command 020). When the analog reading comes out of alarm by the "Hysteresis" amount (set with Command 105), the analog alarm clear macro will be executed. You might want to program this macro to change an open collector output line and/or speak an alarm clear message.

<104> ll a n www	Set an Analog Alarm
------------------	---------------------

Parameters:

- 104 is the default command name.
- ll is the analog input line number (01..16)
- A is 0 for a low alarm, 1 for a high alarm
- N is 1 for negative, 0 for positive for the following number
- WWW is the alarm point with leading 0s if necessary

Notes:

The value you enter will have as many assumed decimal places as you set with Command 101.

105: Set Analog Alarm Hysteresis

Hysteresis is a concept not everyone is familiar with, so let me illustrate it before I try to explain how to use it. Let us suppose that you are using one of the analog lines to read the temperature inside of your radio shack. In the winter, you want the controller to automatically turn the heater on and off to keep the temperature above 40 degrees. To do this you decide to control the heater with a relay that you can switch with one of the open collector output lines. Next you set a low alarm at 40 degrees and program the low alarm macro for that analog line to turn the heater on and speak the message "low alarm". Now you need a way to turn the heater back off. To do this you use the analog alarm to normal macro to turn the heater off and speak the message "low alarm clear". This is where Hysteresis comes in. Do you want the heater to turn off at 41 degrees? This would probably make the heater turn on and off really often. It might be better if it warmed up to 45 degrees before the heater turned off, so it would turn on and off less often. The amount that it has to warm up past where the low alarm point was is the amount of Hysteresis, in this case 5 degrees. In the case of a high alarm (such as would be used to run an air conditioner, the amount of Hysteresis is how much the temperature would have to drop below the high alarm point before the alarm to normal macro would be executed. The amount of Hysteresis is the same for the high and low alarms (if this is not acceptable for your application, let us know). This command lets you set how much Hysteresis each analog line uses when determining whether the alarm is clear yet.

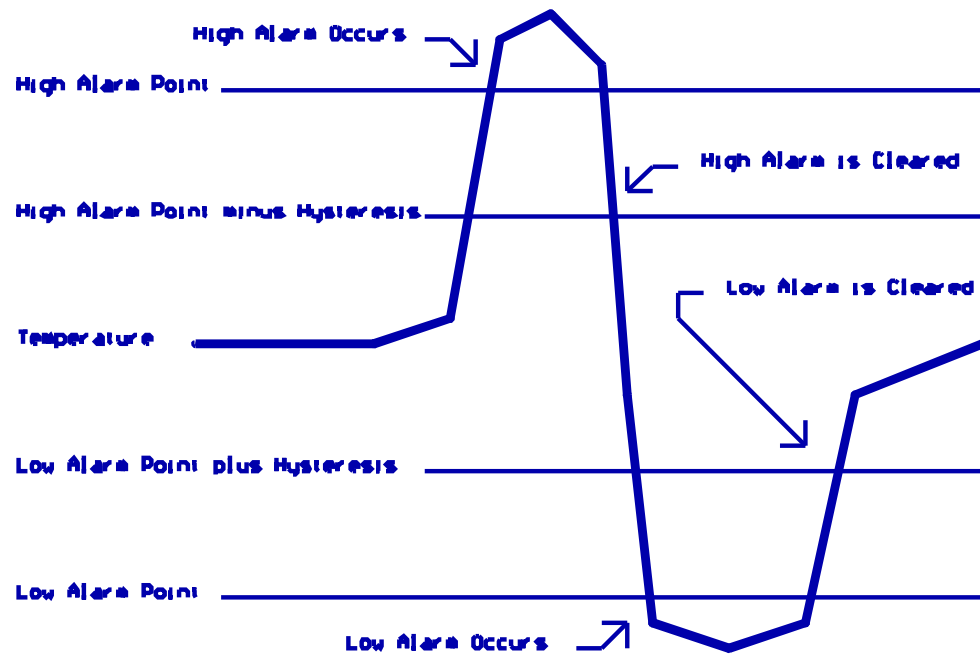
```
<105> ll wwwww
```

Parameters:

- 105 is the default command name.
- ll is the analog input line number (01..16)
- WWWW is the alarm point with leading 0s if necessary

Notes:

The value you enter must be a positive number and will have as many assumed decimal places as you set with Command 101.



106: Enable/Disable an Analog Alarm

This command allows you to control whether or not the analog alarms will occur without having to mess with the alarm points. This might be used to turn off a low temperature alarm while you are working at a site and have the door open or to disable turning a heater on when you are running on battery power. If an alarm is disabled, Command 107 will still tell you whether or not the line is in alarm, but the alarm macro will never execute.

<106> ll a n

Parameters:

- 106 is the default command name.
- ll is the analog input line number (01..16)
- A is 0 for a low alarm, 1 for a high alarm
- N is 1 to enable the alarm, 0 to disable it

107: Recall Analog Lines in Alarm

This command lists all of the ports in high alarm, then all of the ports in low alarm. It is helpful when trying to find out whether you have set the alarm points correctly.

<107>

Parameters:

- 107 is the default command name.

108: Recall Analog Line Configuration

This command recalls all kinds of information about an analog line's conversion, resolution, calibration, alarm points, Hysteresis, alarm enabled/disabled status, etc. It is intended to aid in setting up the analog subsystem, not as a user command.

<108> ll

Parameters:

- 108 is the default command name.
- ll is the analog input line number (01..16)

Description of the voice response:

- "analog ?" - which analog input on the I/O board we are referring to (1..5)
- "0 volts is ?" - the lower calibration point
- "5 volts is ?" - the upper calibration point
- "calibrate ?" - how many units the calibration changes the reading
- "low alarm ?" - the low alarm point
- "high alarm ?" - the high alarm point
- "h ?" - the amount of Hysteresis
- "low alarm ?" - whether alarm is on or off
- "high alarm ?" - whether alarm is on or off

160: Clear Analog High/Lows

This command allows you to reset the analog high/low values. They are reset to whatever the current value is. The readings can be read by speaking the appropriate word numbers (see Appendix B).

<160> a ll..ll

Parameters:

- 160 is the default command name
- A is 0 for the low value, 1 for the high value, 2 to clear both the low and high values
- ll..ll are the analog input lines (01..16)

161: Set Analog Smoothing Factor

This command allows you to smooth the analog readings to "average out" noise and sudden changes.

```
<161> ll ss
```

Parameters:

- 161 is the default command name.
- ll is the analog input line (01..16)
- SS is the smoothing factor

Smooth Factor	Average Smooth Time
50	about 9 seconds
60	about 13 seconds
70	about 18 seconds
80	about 30 seconds
90	about 50 seconds
95	about 120 seconds
97	about 220 seconds
98	about 325 seconds
99	about 11 minutes

109: Configure Wind Speed Reading

This command can be used to tell the controller to count the pulses coming from an anemometer (those whirly things with three cups that spin in the wind) to determine the wind speed. It counts the number of pulses in a default of 2.26 seconds and treats that number like a voltage that could be read by an analog line. All of the normal analog commands will work with the resulting number: command 102 will control the scaling, command 100 will provide the current reading, the analog alarms can be used to notify you if the wind exceeds a certain speed, etc.

<109> 0	Don't calculate wind speed
<109> xx	Use input line 'xx' for wind speed

Parameters:

xx - the contact closure input line to use for wind speed.

Note:

The "conversion ratio" (see command 102) for the analog line corresponding to the input number used for wind speed needs to be set up for the default ratio (0 to 1023, enter "102 xx 0 0000 0 1023" where xx is the input line number).

Details:

To read wind speed, hook up the anemometer so that the reed switch that closes as it rotates connects the input line on the controller to ground. Using a voltmeter or logic probe, make sure that the line pulses every time the anemometer goes around. The line can be connected directly to inputs 1..3, or to input 5 (on pin 4) if you use a 10K pullup resistor to 5 volts. Then use command 109 to tell the controller which input line it is connected to. From that point on, reading the analog line of that number will give you a number related to the wind speed.

To make the controller read the wind speed in miles per hour, you will need to find out how fast your anemometer pulses relative to the wind speed. One common anemometer (Davis) is rated at 26.6 pulses per minute per mile per hour. $60/26.6 = 2.2556$ seconds to get one pulse per mile per hour. The wind speed timer is set to count the pulses in 2.26 seconds. If the analog conversion ratio is left at the default 1:1 (it can be changed with command 102), the analog line will read the speed in miles per hour. The wind speed measurement can be adjusted by changing the timer or by changing the conversion ratio with command 102. Using the calibrate command for wind speed is not recommended, as any calibration offset will keep it from reading zero when it is calm. You can use command 100 or the analog special words to make the controller speak the wind speed.

096: Control or Recall Extended Output Lines

“Extended” output lines provide a way to control more external devices or signals than the number of open collector output lines built into the controller (or option boards). By connecting external shift registers such as are used on many BCD boards to three of the controller's open collector output lines, you can control up to 64 “extended” output lines. Whenever command 096 is executed to set or recall the state of an extended output line, the controller shifts out 64 bits of information representing the state of each of the outputs. Extended output line 64 is shifted out first, line 1 last. The data is also shifted out when the controller is reset and the extended outputs are enabled (you should not enable the extended output lines if you are not using them, or output lines 5, 6 and 7 will get messed up every time the controller resets).

<096> 0	Disable the extended output lines (the default)
<096> 1	Enable the extended output lines
<096> xx	Recall the state of extended output line “xx”
<096> xx 1	Turn extended output line “xx” on
<096> xx 0	Turn extended output line “xx” off

Parameters:

XX - the extended output line number (two digits, 01..64)

Details:

Most standard shift registers should be compatible with this command. Up to eight 8-bit shift registers can be chained together, each one providing eight more extended outputs. If the shift registers have separate output registers (like the 74HC595 or 4094), the latch line can be used to keep the outputs from rippling each time new data is shifted in.

Open Collector Output Line Number	Description
5	Latch - Optional, but will prevent the lines from “rippling” as data is shifted if used
6	Clock - pulses 64 times to shift data out
7	Data - goes high or low for each clock pulse. If using the RBI-1 or RLC-ICM, this line will be shared. Both should work normally.

Chapter 13: Autopatch Routines

Configuring the Autopatch:

Command 110 is used to enable and configure the autopatch. The autopatch uses port 4 when installed. It allows you to specify whether or not you want the autopatch to speak the number it is about to dial using the synthesized voice. If you select to have the number read back, you can choose whether it should read it back "politely" (so it can be interrupted by kerchunking) or "impolitely" (so it always reads back the whole number). See command 044 in Ch 6 for DTMF regenerate parameters.

Autopatch Up Commands:

There are three different commands that can be used to access the autopatch. All of them connect the port that the command was entered from (and any ports connected to it) to the autopatch. These commands should not normally be executed from the serial port or by the scheduler (how do you connect an autopatch to a scheduler?). They are:

- **Manual Off Hook:** Command 111. This command connects the radio port to the phone line without dialing any numbers. You can dial phone numbers without DTMF regeneration by executing this command, waiting for dial tone, and entering the number on your DTMF pad. Since the tones are not captured and regenerated but go out directly onto the phone line, there is no long distance checking, etc.
- **Normal Forward Dial:** Command 112. This command is the one you would usually make available to users. Three digit numbers will access autodial slots, 4 through 11 digit numbers will be checked against the dialing tables (explained later), then regenerated over the phone line. If you have specified pre-dial digits (such as a '9' to get out of a local PBX) with Command 116, they will be dialed first.
- **Special Forward Dial:** Command 113. This command is similar to the normal forward dial but it bypasses the dialing table checks. It is the most convenient way to bypass all of the long distance checking. It will dial any predial digits that you have programmed with Command 116.
- **Two-Stage Patch:** Macro 552. The user can execute this macro, unkey and hear dial tone, then key up again to enter a phone number. The phone number will be processed by command 112, which will check it against the long-distance dialing tables and regenerate the DTMF digits. For users that aren't used to entering the patch up code (often '*') and phone number all at once before unkeying, this macro may reduce confusion.

Using '*' for the Autopatch Up Command:

You can use the '*' digit to execute any of the above autopatch commands. Simply rename your autopatch command to a '*' using Command 010 ("010 112 *" for example). This will allow you to use the patch by simply keying up, pressing '*', then the phone number you wish to dial.

Macro 552 and command 112 can both be named the same thing (such as '*') without causing problems. The controller knows that command 112 requires more digits to be entered at the same time as the DTMF command name and that macro 552 does not, so it will execute the appropriate command automatically.

Hanging Up:

No matter which command was used to bring up the autopatch, Command 114 will hang it up. If you want to have more than one hang up command, just make several different macros call Command 114. You can rename command 114 to '#' by entering "010 114 #" unkey, 'D' or <Enter>.

Command 115 can also be used to hang up the patch. It differs from command 114 in that it will not hang up the patch from a radio port that is not part of a call in progress. For example: port 1 and port 2 are running independent repeaters (they aren't connected), and port 1 makes an autopatch call. Port 2 continues to operate normally, unaware that the autopatch is in use. Then someone on port 2 decides to make a call on the patch and gets the autopatch busy message. Rather than waiting for the user on port 1 to finish their call, the person trying to make a call on port 2 decides to hang up the patch so he can make his own call. If he uses command 115, the controller will not hang up the patch because port 2 is not connected to the autopatch. If he uses command 114, it will. Either command will work to hang up the patch if they are entered from port 1, the port that made the call. Often command 115 is used as the primary hang up command and command 114 is reserved as a control operator command, to be used only when an emergency mandates hanging up someone else's call. Resetting the controller with command 035 also hangs up the patch and can be executed from any radio port.

Connected Ports:

Any ports that are connected to the port you make the autopatch call from will also be included in the autopatch call. Any ports being monitored by the port you make the autopatch call from will be monitored by the patch. For example, if you have connected repeaters and someone wants to make a call from one of them, you can bring the patch up for them from the other one. (This is done internally by disconnecting all ports from the patch, then "smart connecting" it to the port that is placing the call in the same way that command 008 works).

Predial Digits:

Autopatches that are on a PBX often have to dial a '9' or some other combination of digits to reach the outside world. The RLC-DSP404 has the ability to dial these digits for you. You can tell it what digits to dial and how long of delays to use before and after these "predial digits" with Command 116. These digits will be dialed before every number that is dialed with the forward dial commands. You can choose whether or not they should be dialed before each autodial number. This allows you to dial numbers that do not require the predial digits by putting them in an autodial slot.

The Autodialer:

There are 501 autodial slots that can each hold up to an eighteen digit phone number. They are numbered 0 through 500. They can be accessed by executing either of the forward dial commands with

the number of the autodial slot you want to dial. They can be programmed with Command 124. You can find out what number is in an autodial slot with Command 125. You can select whether or not the predial digits (set with Command 116) get sent before the autodial number with Command 126. This is useful for those using a PBX because it allows them to have some autodial slots go to internal numbers and some to dial the predial digits to get to the outside world. Command 127 allows you to enable or disable the use of an autodial slot. This allows you to keep an autodial number from being dialed without erasing the slot and having to re-program it later.

Limiting Call Duration:

The time out timer for the autopatch port limits the total duration of the call. If the timer expires, it will execute the autopatch port's time out macro (see Chapter 8) and hang the autopatch up. If you would like a message to be spoken when this happens, put the commands to speak that message in the time out macro. If you do not want the autopatch to time out, set the timer's duration to 9999 with Command 020. You will probably want to erase the contents of the time out clear macro for the autopatch port with Command 055.

You will be warned before the patch times out. Thirty seconds before timeout, three beeps will be sent out of the radio port and down the phone line (so both sides of the conversation know it). Two beeps are sent twenty seconds before, and one ten seconds before. The CW characters 'S', 'T', and 'E' are used for these warning beeps by default, but you can change them (or eliminate them altogether) using the event triggers (see Chapter 20).

To reset the patch time out timer during a call, use Command 022 to reset timer 124 (see Chapter 4 for more information about timers) by entering "022 124" and unkeying. You could make macro 600 extend the patch timer using the code `**3` as follows:

053 600 030 18 D or unkey	; send CW 'T' as a beep-beep response
056 600 038 D or unkey	; be silent for rest of macro
056 600 022 124 D or unkey	; reset patch time out timer
010 600 <code>**3</code> D or unkey	; rename macro 600 to <code>'**3'</code>

How the Dialing Tables Work:

The dialing tables are used to control which long distance numbers can be dialed with Command 112 and which cannot. They do not affect autodial numbers or numbers dialed with Command 113. If you attempt to dial a number with Command 112 that is not allowed you will get an error 212 (you can disable or change this error message by editing macro 212 - see Chapter 8). By default all but 7 digit numbers are blocked (see command 119). Before a number is dialed using Command 112, it must pass the following tests:

- All digits in the phone number must be decimal digits. A, B, C, and D are not allowed; if you need to dial these digits, put them in as predial digits, use an autodial slot or use Command 113.
- If the number is one, two or three digits and is 500 or less, it will be treated as an autodial number. The autodial number will be looked up, and if it has been programmed, it will be

accepted without checking to see if it is long distance or not. It is assumed that whoever programs the autodial slots will decide whether to allow long distance numbers in autodial slots or not.

- If the number matches any entry in the allowed number table, it may be allowed (see the rule below); otherwise it is blocked. In other words, if you don't specifically allow that type of number, command 112 won't allow it to be dialed. By default, allowed number slot 000 is programmed to allow all seven digit numbers (it is programmed to "####", which means, "allow any three digits followed by any four digits" - see command 119 for more information).
- If a number matches an entry in the allowed number table as described above, it is checked against the nuisance number table. If it matches one of the entries in the nuisance number table, it is blocked (even though the rule above allowed it). For example, the nuisance number table can be used to keep some seven digits numbers from being dialed even though all other seven digit numbers are allowed.

If the number passes all of the above tests and is accepted, it will be read back (if you turn number readback on with Command 110) and then dialed.

Both the allowed numbers table and the nuisance number table store each type of number in a separate "slot". Each slot affects only one length of number, so allowing all seven digit numbers will not affect six or eight digit numbers. You should keep track of what you put in each slot as you program them, so that you can easily change them later.

The allowed numbers table has 500 slots, numbered 000..499. Each slot can hold one type of number that you want to allow. For example, you might want to program slot 0 to allow seven digit numbers that begin with the prefix 245, such as 245-5002 and slot 1 to allow eleven digit numbers that begin with 1800. To do this, you could enter Command 119 000 245 D or unkey (where Command 119 is the name of the command that programs the allowed numbers table, 0 is the slot to store this type of number in, and 245 is the number we want to allow, ignoring the last four digits). If you instead wanted to allow all seven digit numbers, not just 245 numbers, we could enter Command 119 000 #### D or unkey instead. The # symbol is a wildcard digit that represents any decimal digit. To allow 1800 numbers (using slot 1 so we don't mess up the seven digit numbers we allowed in slot 0), we would enter Command 119 001 1800#### D or unkey.

The nuisance number table allows you to block numbers that would otherwise be allowed. It has 100 slots, numbered 000..099. You may not need to use the nuisance number table. It is usually used to block prank calls. For example, we allowed all seven digit numbers in the allow table example above. If someone was calling our fax number (245-4889) with the autopatch as a prank, we could block that number by entering Command 121 000 2454889 D or unkey. Note that the nuisance number table is independent from the allowed number table; slot 000 in one table does not interfere with slot 000 in the other table. The nuisance number table requires that you enter all of the digits of the phone number; it does not ignore the last four digits like the allowed number table does. The nuisance number table accepts wildcards. Even if we had allowed all seven digit numbers in the allow table as in the examples above, we could block seven digit numbers beginning with 554 by entering Command 121 001 554##### D or unkey.

You can check the operation of the dialing tables at any time by either trying to dial a number with the forward dial command, or just *pretending* to dial it with Command 123. This command will tell you whether a number would be blocked by the dialing table or would be dialed, without actually using the autopatch. Command 123 will work even if you don't have an autopatch.

Other Commands that Affect the Autopatch:

Command 007 (see Chapter 3) allows you to turn the DTMF mute on or off for the autopatch port. While this does not affect the DTMF digits that are actually generated when the autopatch is dialing, it does have several other effects. See the note on command 007 for more information. During an autopatch call it is possible to connect and disconnect radio ports from the autopatch port, including or excluding them from the remainder of the call. Note that any ports that are included or excluded from the call should also be connected or disconnected from the ports that were already a part of the call, so they can hear both sides of the conversation.

110: Configure the Autopatch

This command allows you to enable or disable the autopatch and allows you to choose whether and how the number is read back before it is dialed.

<110> p s

Parameters:

- 110 is the default command name.
- p is the autopatch enable/disable control. 0 - Disable the autopatch. 1 - Enable the autopatch.
- s is the readback style, described below. Modes 2 and 3 watch to see if you force the command to be executed by pressing the force-execution digit (defaults to 'D', see command 078) or kerchunk before, during, or shortly after the number is read back; if you do they will immediately quit reading the number back and either dial the number (mode 2) or abort dialing (mode 3). Also see the notes for more options.

S - Readback Style	Reads Number Back	If Kerchunked or Force Execution
0	Never	No Effect
1	Always	No Effect
2	Politely	Makes it Dial
3	Politely	Makes it Abort Dialing
4	Politely	No Effect (dials either way)

Default: The autopatch system is enabled. Readback style is type '1' (read back before dialing).

Notes:

- You can adjust messages and the duration of the delays before and after the phone number is read back by editing macros 540..544 and 551, after you execute this command to set them up.
- If this command is executed while the patch is in use, it will hang the patch up.
- This command automatically turns on timed execution and makes '#' be the force-execution digit for the autopatch port, to make entering commands from the reverse patch easier (see command 133). These changes can be reversed/modified with command 078.

111: Manual Off Hook

This command connects the port from which the command is executed to the autopatch without dialing any numbers. Touch tones from your radio can be used to dial numbers without DTMF regeneration. This is usually used only for testing, because it doesn't regenerate your DTMF digits, it doesn't allow you to block long distance numbers, and it usually causes an error message when you dial a number. The error message may be generated because the controller can't tell whether you are entering a command (such as to hang up the patch) or dialing a number, so it treats the number as a (usually invalid) command; you can just ignore the error message. Command 114 can be used to hang up the patch.

<111>

Parameters:

- 111 is the default command name.

112: Normal Forward Dial

This is the normal autopatch up command you would make available to your users if you want an open autopatch. If the number you enter is 3 digits or less, it dials that autodial number. If it is longer, it checks it against the dialing tables described at the beginning of this autopatch section and if it passes, dials that number.. Command 114 can be used to hang up the patch.

<112> sss	Autopatch using an autodial memory slot
<112> d..d	Autopatch using user entered number

Parameters:

- 112 is the default command name.
- SSS is the autodial slot number (1..3 digits)
- D..D is the phone number you want to dial

Notes:

- The longest number that can be dialed with the command is eleven digits, because that is the longest number that can be specified in the allowed number table. If you need to dial longer numbers, use Command 113.

113: Forward Dial with no Long Distance Checking

This is the autopatch up command you would use if you wanted to dial a number without worrying about whether or not it is allowed by the dialing tables. You would not normally make this command available to the average user, because it would allow them to dial any number, including long distance numbers.

<113> sss	Autopatch using an autodial memory slot
<113> d..d	Autopatch using user entered number

Parameters:

- 113 is the default command name.
- SSS is the autodial slot number (1..3 digits)
- D..D is the phone number you want to dial

Notes:

- You can call this from a macro to dial numbers too long to fit in an autodial slot.

Example:

Have macro 600 dial the number 012345678901234567890

```
<053> 600 113 012345678901234567890 D or unkey or <Enter>
```

The user will program macro 600 to bring up the patch and dial the number 012345678901234567890.

137: Autodial Only

This is the same as the other dialing commands except it will only let you dial autodial numbers.

```
<137> sss
```

Parameters:

- 137 is the default command name.
- SSS is the autodial slot number 0..500 (1..3 digits)

129: Repeat Dial (or recall last number dialed)

This command allows you to easily redial the last number you called or to find out the last number someone else called. You can make it “forget” the last number dialed.

<129>	Redial the last number dialed
<129> pp	Recall (speak, do not dial) the last number dialed from port 'pp'
<129> pp 0	Forget the last number dialed from port 'pp'

Notes:

- The controller keeps track of the last number dialed separately for each port that can use the autopatch, so if you make a call from port 1 and get a busy signal, then someone on port 2 makes a call (which you might not even know about), then you attempt a redial from port 1, it will redial the number you called, not the number that was called from port 2.
- This command works for numbers that are dialed directly or using an autodial slot, but it does not remember numbers that are dialed while using command 111 (manual off hook).
- If you try to use the redial feature after the number has been "forgotten", the controller will speak "Repeat Dial Clear" (it does that by calling an event trigger, see Chapter 20 if you wish to change that message).
- If you want to allow users to dial the last number dialed but not to use the recall or forget features, make a macro that calls this command and only give users access to that macro. For example:

```
010 600 ABC ;           name macro "ABC"
053 600 129 ;          program macro to execute command 129
```

114: Hang up the Autopatch

This is the command to use to hang up the autopatch, no matter which of the three autopatch up commands you used to take it off-hook.

<114>

Parameters:

- 114 is the default command name.

Note:

- The autopatch is also hung up whenever the controller is reset.

Example:

I want my autopatch hang-up code to be '#'

<010> 114 # D or unkey or <Enter>

Now the users will enter '#' to hang-up the autopatch.

115: Possibly Hang up the Autopatch

This command normally works exactly like command 114, but it won't allow you to hang up the patch if someone else on another radio port is using it and you aren't. Command 114 will hang up the patch if it is in use by any port; that is you can hang it up even if someone else on another port of the controller that is using it. It is important to be able to do that if there is an emergency and you need to cut them off. On the other hand, if someone tries to use the patch and gets the "autopatch busy" message, they may not realize (or care) that someone else is using the patch even though they can't hear it, and they may hang it up. Giving the users access to command 115 rather than 114 will solve that problem, as only the port(s) that can hear the autopatch call will be allowed to hang it up.

<115>

116: Set / Recall the Predial Digits and Timing

When either of the forward dial commands are used, several things must take place before the number is actually dialed:

- If number readback is turned on, speak the number.
- Take the phone line off-hook. This is the same as you picking up your phone at home.
- Since the controller can not listen to see if it gets dial tone from the phone line, it just delays for a little bit and assumes that dial tone is there. We will call this delay the "initial delay".
- If you must dial '9' or some other digits to get out of a local switchboard or PBX, those digits should be dialed here. We will call those "predial digits". You can also use these predial digits to dial special codes to turn on or off call waiting, caller ID, and other special features that your phone company may offer. They can be omitted if you are not on a PBX.
- After dialing the predial digits, you may need to delay again while the PBX hooks you up to an outside telephone line. We will call this delay the "after-predial delay". This delay can be set to zero if you are not using predial digits.
- Now we can dial the actual number.

This command lets you set the initial delay, predial digits (if any), and after-predial delay.

Recall Settings	<116> 0
Change Settings	<116> iii aaa d..d

Parameters:

- 116 is the default command name.
- III is the duration of the initial delay in 10mS increments (001..250). Default is 100. Do not set to 0.
- AAA the duration of the after-predial delay in 10mS increments (001..250). Default is 100. Do not set to 0.
- D..D are the predial digits. They can be omitted. The maximum number of predial digits is 10. Any of the 16 DTMF digits can be used, although you might have to temporarily change your force-execution digit to use it (see command 078).

Defaults:

Initial delay = 100 (1 second)
 After-predial delay = 100 (1 second)
 Predial digits = none

Note:

Do not use a delay time of 0, or will lock the TX on the air sending the dialing cover tone until the controller is reset.

119: Set Allowed Numbers Table Slot

This command allows you to set one of the slots in the allowed numbers table. For a description of this table and how to use it, see the explanation of the dialing tables before Command 110.

<119> sss	Clear slot sss
<119> sss d..d	Program slot sss

Parameters:

- 119 is the default command name.
- SSS is the slot number (000..499)
- D..D is the area code/prefix (do not include the last four digits of the phone number). The '#' digit is a wildcard that matches any digit.

Defaults:

- Slot 000 is programmed to “###”, which allows all seven digit numbers.

Example:

```
<119> 001 1800 ### D or unkey or <Enter>
```

- This will allow all 1-800 numbers

120: Recall Allowed Numbers Table Slot

This command allows you to recall the contents of one of the slots in the allowed numbers table. For a description of this table and how to use it, see the explanation of the dialing tables before Command 110.

```
<120> sss
```

Parameters:

- 120 is the default command name.
- SSS is the slot number (000..499)

121: Set Nuisance Numbers Table Slot

This command allows you to set one of the slots in the nuisance number table. For a description of this table and how to use it, see the explanation of the dialing tables before Command 110.

<121> sss	Clear slot sss
<121> sss d..d	Program Slot sss

Parameters:

- 121 is the default command name.
- SSS is the slot number (000..099)
- D..D is the whole number to be blocked (do include the last four digits of the phone number). The '#' digit is a wildcard that matches any digit.

Defaults:

- No slots are programmed, so any numbers allowed by command 119 can be dialed with command 112.

Example:

- "121 000 245 5002" will program slot 000 to block 245-5002 even though it is allowed by default (along with all other seven digit numbers) by command 119.

122: Recall Nuisance Numbers Table Slot

This command allows you to recall the contents of one of the slots in the nuisance number table. For a description of this table and how to use it, see the explanation of the dialing tables before Command 110.

<122> sss

Parameters:

- 122 is the default command name.
- SSS is the slot number (000..099)
- D..D is the whole number to be blocked (do include the last four digits of the phone number). The '#' digit is a wildcard that matches any digit.

123: Test Dialing Tables

This command allows you to test the dialing tables. It takes the telephone number you enter and tests it in the exact same way the normal forward dial Command 112 does, but instead of dialing the number, it just tells you whether or not the number is rejected by the dialing tables. This comes in very handy when setting up the dialing tables, because you don't have to actually dial and hang up numbers to see if they are blocked or not. This command also works from the serial port, allowing you to check the dialing table from a terminal or computer. You do not have to have an autopatch installed to use this command.

```
<123> d..d
```

Parameters:

- 123 is the default command name.
- D..D is the number you wish to test with the dialing tables

124: Set Autodial Slot

This command allows you to set one of the autodial slots. For a description of the autodial slots and how to use them, see the autopatch section before Command 110.

```
<124> sss d..d
```

Parameters:

- 124 is the default command name.
- SSS is the slot number (0..500)
- D..D is the whole number to be dialed (up to 18 digits), not including any predial digits (they must be set with Command 116 - you can keep them from being sent for an autodial slot with Command 126).

Notes:

- You can clear the data out of a slot by entering Command 124 SSS D or unkey
- You can disable a slot without erasing it with Command 127.
- After you program an autodial memory, the predial information for that slot is enabled
- Autodial numbers are not checked by the long distance dialing tables

125: Recall Autodial Slot

This command allows you to recall the contents of one of the autodial slots.

<125> sss

Parameters:

- 125 is the default command name.
- SSS is the slot number (0..500)

126: Send Predial Digits / Callsign for Autodial Slot?

This command allows you to control whether or not the predial digits will be sent before an autodial number. The default is to send them. By telling the controller not to send them, you can dial extensions on the PBX you are on (numbers that don't need the predial digits) with an autodial slot. The initial delay and after-predial delay (see Command 116) are sent in either case.

It also allows you to control whether or not any call signs you may have programmed for your users will be spoken when dialing their autodial slot. You may also want to assign autodial slots for emergency numbers and program their "callsign" to be something like "police". See command 191 for information about programming call signs.

Set Predial Sending	<126> sss p
Set Callsign Sending	<126> sss p c

Parameters:

- 126 is the default command name.
- SSS is the slot number (0..500)
- 'p' is 1 to send the predial digits (the default), 0 to not send them.
- 'c' (optional, no change if omitted) is 1 to send the callsign for that autodial slot if it is programmed (the default), 0 is to just use the number of the autodial slot. The default call signs are the number of the slot, spoken as separate digits like "two three zero". If you set 'c' to 0, it will speak the number of the slot as a number, like "two hundred thirty".

Notes:

This command must be executed after you program an autodial position. The default setting for this command is predial enabled. If you have a predial number programmed, and you do not want the controller to add a predial your autodial slot number, then you must execute this command and disable the predial setting for that specific autodial number.

127: Enable/Disable an Autodial Slot

This command allows you to disable an autodial slot without erasing its contents so you can enable it later without having to re-enter the number.



```
<127> sss c
```

Parameters:

- 127 is the default command name.
- SSS is the slot number (0..500)
- C is 1 to enable the slot (also done automatically when you program it), 0 to disable it

128: Set/Recall Patch Audio Options for a TX

Talking to someone using the autopatch is different in several ways from talking to someone on a repeater. One difference is that when you are talking on a repeater, everyone has to wait until you unkey before they can talk (unless they have a stronger signal than you do and can capture the repeater receiver); a person talking on a phone during an autopatch call can talk at the same time that you are talking on the radio. If you are using a typical transceiver (HT or mobile) that is half-duplex (cannot transmit and receive at the same time), you can't talk and listen at the same time. If the autopatch is set up to work full-duplex and the person on the phone talks at the same time you do, you will not be able to hear what they are saying, but anyone else listening to the repeater will be able to hear both you and them. To avoid this problem, the autopatch can be set to work in half-duplex mode. Half-duplex mode causes the audio from the phone to be muted whenever you are talking; if someone starts to say something that shouldn't be transmitted, all you have to do is key up and they will get muted. This is the default mode. In some situations, such as when you have two radios (one to talk on and the other to listen with) or a radio that can transmit and receive at the same time (possibly on different bands), you may want to change the autopatch to work in duplex mode. You can change the mode in the middle of a call, and can select the mode for each transmitter separately.

Another difference between talking to someone on a repeater versus an autopatch is that the person using the phone through the autopatch doesn't care if your audio gets transmitted out the repeater or not; he is listening to the phone. If you don't want everyone else that is monitoring the repeater to hear the things you say while you are talking on the autopatch, you can tell the controller to mute your audio at those times. That is known as "semi-private" mode. Anyone that is listening to the repeater while you use the autopatch in semi-private mode will only hear one side of the conversation, what the person on the phone says. You can turn on a cover tone to be sent while the person on the radio is talking, or just let it be silent.

<128> pp	Recall half-duplex and semi-private settings for a port
<128> pp h	Set autopatch half-duplex mode for a port
<128> pp h s	Set autopatch half-duplex and semi-private modes for a port
<128> pp 0 0	Full duplex mode, not semi-private
<128> pp 1 0	Half duplex, not semi-private
<128> pp 1 1	Half duplex, semi-private with no cover tone
<128> pp 1 2	Half duplex, semi-private with cover tone

Parameters:

- 128 is the default command name.
- pp is the port (01..12) that the autopatch call is made or answered from, not the autopatch port (3).
- H is the Half-Duplex on/off setting, 1 for half duplex (the default), 0 for full duplex

Notes:

- The half/full duplex mode and semi-private mode settings are independent, but the semi-private feature doesn't work well in duplex mode because the autopatch hybrid is not (and can not be) perfect. For this reason, only the combinations shown in the chart above are useful in most situations.

- This command allows you to control whether the audio from the autopatch gets muted when one of the receivers that can send audio to the patch is active. When the controller receives a command to bring up the patch, it connects that port and any ports that are monitoring or connected to that port to the patch, so they can all take part in the call. Each of those ports' transmitters will stay up for the duration of the call. Each transmitter that is set for full-duplex mode with this command will transmit the audio from the autopatch for the entire duration of the call; if it also transmits the audio from a receiver, it will mix it with the autopatch audio. Each transmitter that is set up for half-duplex mode (the default) with this command will mute the audio from the autopatch whenever someone keys up their radio to talk to the person on the phone. This allows the control op to mute anything that the person on the phone may say by simply keying up, rather than having to hang up the patch.

133: Set up Reverse Patch

This command allows you to set up the reverse autopatch. You must set up the forward patch functions with Command 110 before you use this command. If you want to change how the reverse patch works, just execute this command again with the new information.

<133>	Recall reverse patch settings
<133> 0	Disable reverse autopatch
<133> 1 xx y..y	Configure for over-air ringing
<133> 2 xx	Configure for control mode with no password
<133> 2 xx n..n	Configure for control mode with password n..n

Parameters:

- 133 is the default command name.
- There are three reverse patch "modes".
 - Mode 0** disables the reverse patch. Forward patch will still work normally.

Mode 1 is the ring over air mode

XX - Number of rings the controller waits before ringing over the air.

Y..Y - What ports the ringing will be routed to

Mode 2 is the control mode

XX - Number of rings the controller waits before answering the phone.

N..N - Access code required when in mode 2 access

Note about Ring Detection:

This command automatically enables the keyup delay filter (see the description for the keyup delay timers in Chapter 4 for more information) for the autopatch port (port 4). This helps prevent transients on the phone line from fooling the controller into thinking the phone is ringing when it is not. If the phone line going to the controller rings in very short bursts, you may have to disable or shorten the keyup delay timer after executing this command to get the controller to answer.

Note on Mode 2:

After XX rings, the controller will answer the phone and give you about 29 seconds to enter the access code N..N, or it will hang up on you. If you enter the code N..N correctly the controller will speak "Control" and let you enter commands by DTMF just as you would from a radio port. Since you can't unkey to tell the controller to execute the commands, you will have to either use timed execution or change your force-execution digit for the autopatch from 'D' to '#' (both of those things are done automatically by command 110, see command 078 for more details). Note that you will have to have to rename any commands you wish to execute from the telephone to not contain the digits 'A', 'B', 'C' or 'D', as those digits can't be entered from most telephones.

After entering the access code, you can go out over radio ports or just monitor them by executing Commands 000 and 001. For example, if your autopatch is on port 12 and you wish to monitor the repeater on port 1, execute Command 001 121 D or wait if in timed execution mode. This will make the autopatch (port 12) monitor the repeater (port 1).

134: Access Reverse Patch Control Mode

You do not need to know about this command - it is for the controller's internal use when using reverse patch mode 2 (control mode), so you can quit reading now if you want. When the controller answers the phone in mode 2, the only commands you can execute are the pre-access macros for the autopatch port, because the controller turns preaccess on when you set up the patch. When you specify the reverse patch access code with Command 133, it renames one of the pre-access macros for that port to the access code and programs that macro to call this command when executed. This command allows you to access all of the commands until the patch is hung up, resets the patch time out timer, and stops the pre-access timer, among other things. If you are accessing the reverse patch in mode 2 and the time out timer is about to expire, you can execute this command to keep the patch from timing out.

<134>

Parameters:

- 134 is the default command name.

135: Answer Reverse Patch

This command is used to answer a reverse patch call that is ringing out over the air (Autopatch needs to be configured as mode 1 with command 133 or mode 2 if command 132 is also used). It will only work when the reverse patch is ringing - it is not a substitute for the manual off-hook command. The patch is hung up the same way as for forward patch, with Command 114.

<135>

Parameters:

- 135 is the default command name.

Notes:

- The controller will speak "Connect" out both the radio and the autopatch when this command is executed successfully.
- If you try to execute this command and the reverse autopatch has not been ringing, you will get an autopatch error (See System wide errors at the front of the manual)

132: Start Reverse Patch Call-Out

There are several different ways to use the reverse autopatch. Command 133 allows you to select what the controller should do when it detects that the phone line is ringing (when someone is calling the controller). It can ignore the ringing (mode 0), generate a ring tone over the air without answering the phone (mode 1), or answer the phone after a few rings (mode 2). This command is only useful when command 133 is set for mode 2.

After the controller answers the phone, it may require you to enter a password (see command 133 for details). After the password has been entered, it will say “control”, unless you have changed that message to something else. At that point, the controller will wait for you to enter a command. You could enter any command, such as 026 to recall the time or 187 to log on so you can do password-protected commands. By using this command, you can make the controller do a general call-out or directed call-out.

<132>	Start general call-out
<132> x <132> xx <132> xxx	Start directed call-out to user xxx

If you start a general call-out, the controller will generate a ring-tone over the air. Anyone listening can answer the call-out by entering the reverse patch answer command (135, or whatever you have renamed it to). If no one answers the call-out, the controller will generate the ring tone a certain number of times, then give up and say “No answer” to the person on the phone. The number of times it will ring before giving up can be changed with command 136; it defaults to 5 rings for a general call-out. The ring tone will normally be transmitted on port 1, but that can be changed with command 192.

If you start a directed call-out and someone is talking on one of the ports that the call-out is going to, the controller will generate a ring tone until they unkey. Then it will speak their callsign, “Call for” and their callsign again, send the ring tone three times, and speak “<callsign> call for <callsign>” again. Finally, it will ring a few more times, then give up and tell the person on the phone “No answer”. The call-out can be answered at any time with command 135 or stopped with the hang up command (114 or 115). The callsign for each user can be set with command 191. Normally the call-out will be done on the transmitter connected to port 1, but that can be changed (or directed call-out can be disabled) for each user with command 192. Command 192 can also be used to change how many times the controller will generate the ring tone before giving up (the default is three). The person listening to the phone will hear a DTMF ‘1’ rather than a standard telephone ring tone.

If you wish to stop either a general or directed call-out before anyone answers it, enter the hang up code (the name of command 114 or 115). This will stop the call-out but will not cause the controller to hang up. You can then execute command 132 to try again, or any other command. If you wish to hang up, enter the hang up code again.

136: Set up Reverse Autopatch Ring

This command allows the user to set up the over the air ringing tone and duration.

<136>	Recall ring duration and frequencies
<136> gg dd	Set number of rings before give up when using command 132
<136> xxx yyyy zzzz	Set ring duration and frequencies

Parameters:

- 136 is the default command name.
- GG is the maximum number of times the controller will generate a ring tone when command 132 is used to do a general call-out. Default is 5 rings.
- DD is the maximum number of times the controller will generate a ring tone at the end of the directed reverse patch call-out sequence. See command 132 for more details. The default is 3 rings.
- XXX is the duration of the ring tone
- YYYY is the Frequency of the first ring tone
- ZZZZ (optional) is the Frequency of the second ring tone

Defaults:

Ring tone duration defaults to 2 Second
 Ring tone frequencies default to 0440 Hz and 0480 Hz.

Example:

To set the ring back to the default: 136 200 0440 0480

Notes:

- You should not make the duration of the ring tone too long. The controller will stack up tone requests and could still be ringing over the air after the phone has answered if the duration of the tone is longer than the delay between rings from your phone company.
- When using command 132 for either a general or directed call-out, the person on the phone will hear a DTMF '1' rather than the tone frequencies specified with this command (that the person listening to the radio will hear). That is because the RLC-DSP404 does not have the hardware needed to send a normal ring tone to the autopatch.

192: Set/Recall Call-Out Options

The command allows you to set and recall several options that affect how the reverse patch call-out command (132) works. The default is to allow the general call-out and directed call-out for all users. If you disable the directed call-out for a user and someone attempts to do a directed call-out to them using command 132, they will hear the message “No P A G E R”. Each user’s callsign can be set with command 191 (in Chapter 18).

<192> 0 000	Recall general call-out settings
<192> 0 000 0	Disable general call-out
<192> 0 000 1 xx..xx	Enable general call-out to transmitters xx..xx

<192> 0 uuu	Recall directed call-out settings for user uuu
<192> 0 uuu 0	Disable directed call-out to user uuu
<192> 0 uuu 1 xx..xx	Enable directed call-out to user uuu on transmitters xx..xx

<192> 1 uuu vvv	Recall settings for range of users from uuu to vvv
<192> 1 uuu vvv 0	Disable directed call-out for users uuu..vvv
<192> 1 uuu vvv 1 xx..xx	Enable directed call-out for users uuu..vvv on transmitters xx..xx

Parameters:

- uuu is the user number
- vvv is the last user number in a range from user uuu to user vvv
- xx..xx is a list of the ports that the call-out will be transmitted on. The default for everything is transmitter 1.

Chapter 14: Doug Hall RBI-1 and RLC-ICM Routines

What the RBI-1 is:

Doug Hall Electronics' Remote Base Interface (RBI-1) allows the RLC-DSP404 to control the Kenwood series TM-X21 and TM-X31 mobile radios. The RBI-1 converts the data output by the RLC-DSP404 into a format that the radios can use. Up to four bands can be supported by one RBI-1 interface, with one band active at a time. PL (CTCSS) encode and decode is handled by the radios. The RBI-1 plugs into one of the RLC-DSP404's radio ports and uses three of the open collector output lines. The audio, COR and PTT interface is made through the RLC-DSP404's radio port and the signals that control the RBI-1 and ultimately the radio come from the open collector output lines. More information about the RBI-1, including the address and phone number for Doug Hall Electronics, is included on the following pages. Link Communications does not sell the RBI-1 interface.

What the RLC-ICM is:

The RLC-ICM is a remote base interface for IC-900 and IC-901 band modules. The RLC-ICM uses the same data stream from the repeater controller as the RBI-1, except for the special setup codes sent with command 139. Up to four bands can be supported by one RLC-ICM interface. Unlike the RBI-1, more than one band can be active at the same time; up to all four bands can transmit or receive at the same time. The RLC-ICM also supports a Communications Specialists' TS-64 PL board for each band module. Each band that has a TS-64 can encode and decode PL. Different bands can use different PL frequencies. The RLC-ICM plugs into one of the RLC-DSP404's radio ports and uses two of the open collector output lines on the Club Deluxe module. The audio, COR and PTT interface is made through the RLC-DSP404's radio port and the signals that control the RLC-ICM and ultimately the radio come from the open collector output lines. More information about the RLC-ICM can be found at <http://www.link-comm.com/rlcicm.html>.

Interfacing and Setup:

It is very easy to interface the RBI-1 or RLC-ICM to the RLC-DSP404. Directions for building the needed cable is provided on one of the following pages. You can build it yourself or order one from Link Communications, Inc.. The RBI-1 is connected to the radio's microphone connectors with cables supplied with the RBI-1. The RLC-ICM includes cables and small interface boards to connect to the IC-900/901 band modules. The only other connections are power, ground and antenna to the radios. The RBI-1 gets its power from the radio; the RLC-ICM has its own power plug.

If you are using the RLC-ICM, you will need to set it up with command 139. After that, all of the commands to set frequency, bands, etc should work.

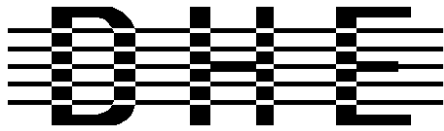
Using the RBI-1 or the RLC-ICM:

Using the RBI-1 or the RLC-ICM (after it is set up) is very straightforward. There are separate commands to do each of the following tasks:

- 139: Setup RLC-ICM Interface
- 141: Control/Recall RBI-1 Output Lines

- 142: Set Frequency and Optional Offset for RBI-1 or RLC-ICM
- 143: Set Offset for RBI-1 or RLC-ICM
- 144: Set Offset Format for RBI-1 or RLC-ICM
- 145: Set Power Level for RBI-1
- 146: Set PL Frequency for RBI-1 or RLC-ICM
- 147: Turn PL Encode Off/On for RBI-1 or RLC-ICM
- 148: Turn PL Decode Off/On for RBI-1 or RLC-ICM
- 149: Recall Band, Frequency and Offset for RBI-1 or RLC-ICM
- 150: Recall All RBI-1 or RLC-ICM Settings
- 151: Turn Radio Power On or Off for RBI-1
- 152: Goto Radio Memory for RBI-1

If there are combinations of settings that you use often, you can program them into the memories on the Kenwood radios (if you are using the RBI-1) or you can program user macros to select those settings, making the controller's macro work like a memory.



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INTRODUCTION

The DHE Remote Base Interface (RBI-1) Adapts the Kenwood series TM-X21 and TM-X31 mobile radios to several brands of Repeater Controllers. The RBI model 1 converts the serial data stream from the Controller and Directly controls the Kenwood Mobile radio. All connections to the Kenwood radio are made thru the microphone jack. In the maximum configuration using a Kenwood TM-701 Dual Band Mobile you can control Frequency, CTCSS encode On/Off, RF power level, Offset, Power On/Off, and Band. This is all accomplished thru the microphone jack.

The controller can modify the following functions (on at least some radios, see below):

- Full frequency control, 4 ports/radios, and 4 bands.
- Transmitter power HI/MED/LOW
- CTCSS Frequency select, Encode on/off, Decode on/off.
-20 and -12 MHz offsets on 1200.

The Supported Kenwood Mobile Radios are as follows:

140	220	440	1200	Dual Band	
TM-221	TM-321	TM-421	TM-521	TM-621 +	TM-721 +
TM-231	TM-331	TM-431	TM-531	TM-631 +	TM-731 +
TM-241		TM-441	TM-541		TM-701 +
+ Dual Banders					

SUPPORT CROSS REFERENCE

FUNCTION	CTCSS ENCODE	CTCSS SELECT	CTCSS DECODE	MULTI BAND	RF PWR POWER
GENERIC	Y	Y	Y	Y	Y
TM-X21	Y	N	N		N
TM-X31	Y	Y	Y		Y
TM-X41	Y	Y	Y		Y
TM-621/721	Y	N	N	Y	N
TM-631/731	Y	N	N	Y	N
TM-701	Y	Y	Y	Y	Y

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SPECIFICATIONS

Microprocessor: INTEL 87C51 Series 12MHz

Connections:

Power: RCA Phono + center pin.
 Controller: 9 Pin female "D" Connector
 Expansion: 9 Pin male "D" connector.
 Radios: 4 8 Pin Modular Compatible with Kenwood PG-4H cable.
 1 PG-4H provided. Additional cables available from Kenwood or DHE.

Adjustments: "T" (VR1) Radio transmit audio level adjust.
 "R" (VR2) Radio receive audio level adjust.

Audio: Radio Transmit 0.050V to 2.5V Input. (response controlled by capacitor removal)
 Impedance 15K.
 Radio Receive 0.020V to 2.5V Output. (response controlled by capacitor removal)
 Impedance 5K.

"S" Meter output: 0 to +5V 0V = no signal, 5V = > "S" 9.
 Output impedance approx 5K.

Expansion output: 8 outputs, ground active, Sink 500mA each, 1A maximum total.

Power Requirements: + 10 to + 14 Vdc @ 23mA.

Size: 1.5" X 5.1" X 5.5"

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Installation

Place or mount the RBI-1 in close proximity to the Kenwood mobile radio to be used. Connect the RBI-1 with the provided PG-4H Cable from the 8 pin modular jack marked "RADIO" to the Kenwood Microphone jack. Only Port 1 (140/DUAL) will support a Dual Band radio. Port 1 is the only Port the 140 MHz radio can be connected to.

The RBI will support all 4 bands (140/220/440/1200) as follows:
If Port one (on the RBI-1, not the controller) is filled, Port 2 is for 220 only, Port 3 is for 440 only, Port 4 is for 1200 only. Basically, if the selected band is unavailable on Port 1 it will go to the port assigned to that band.

Installation instructions are included with the RLC-ICM for connecting it to the IC-900/901 modules.

Building the RBI-1/RLC-ICM Cable

It is important to keep your interface cable as short as possible. The cable should never be more than 6 feet in length; shorter is better.

RBI-1 Connector J2	RLC-DSP404 Connections
Pin# - Line Name	Pin# - Line Name
<hr/>	
.....	<u>I / O DB-25</u>
1 - RBI-1 RESET	Pin 24 (output 4)
3 - Data	Pin 10 (output 7)
4 - Clock/Strobe	Pin 22 (output 8)
9 - Ground	Ground, Pin 1
	- This pin is required for noise suppression
2 - "S" Meter output	Analog Input on DSP4 (optional)
	- Pin 2,3,4,5,14,15,16 or 17.
.....	<u>Connections to the radio port</u>
5 - Kenwood TX Audio (T Pot)	4 - RLC-DSP404 audio out
6 - Kenwood RX Audio ® Pot)	5 - RLC-DSP404 audio in
7 - COS from Kenwood RX	7 - RLC-DSP404 COR input (Active high)
8 - PTT to Kenwood TX	3 - RLC-DSP404 PTT output
9 - Ground	1 - RLC-DSP404 ground connection
2 - RLC-ICM (not RBI-1) PL	
Detect Out	2 - RLC-DSP404 PL detect input (optional)

In case it wasn't clear, there is only one connector on the RBI-1 that goes to the RLC-DSP404. It is connected to two different connectors on the RLC-DSP404. The audio connector goes to one of the radio ports, the RLC-Club RLC-DSP412's open collector output lines provide the serial control signals

Setup and Adjustment

The RBI-1 COR signal is active high. The RLC-ICM COR signal is active low. Set the COR polarity to active high with command 013.

Audio receive level from the Kenwood to the Controller is controlled by VR2 ®). The audio level from the Controller to the Kenwood is adjusted by VR1 (T). Refer to the manual for additional adjustments in the controller.

Capacitor C5 (10uF) Inside the RBI-1 Interface must be removed and replaced with a 1uF/25V Tantalum Capacitor for the Audio to sound correct. Remove capacitors C16 and C17 to keep the audio from sounding too 'Bassy'.

Kenwood Radio Setup

The Kenwood radios need certain parameters set up before they can be controlled from the RBI-1, such as STEP. To make sure everything is set properly for use with the RBI-1, you should reset the radio to make sure all of the settings are set to the factory defaults. Instructions about how to do this can be found in your Kenwood operating guide or in the list below. This will erase the memories you have stored in the radio - you can enter them in again afterward.

TM-701	Hold the MR key down during power on to reset.
TM-X21	Hold the VFO/M and M.IN keys down during power on to reset.
TM-621/721	Hold the F key down during power on to reset.
TM-631/731	Hold the MR key down during power on to reset.
TM-X31	Hold the MR key down during power on to reset.
TM-X41	Hold the VFO key down during power on to reset.

Set the step size to 5KHz. (25KHz on 1200 MHz units)

Set dual band radio to single band.

Set power to desired setting. Remember, remote base transmitters can have a high duty cycle because it will be transmitting during all activity on the Repeater side. The mobile radios used in a remote base configuration should be set to low power in most cases.

Set VFO/MEM to VFO for external frequency input.

Set CTCSS for desired frequencies. When using TM-X31/X41 series it will be set by the controller and will override your initial setting.

Set CTCSS Decode to off.

Set ABC and AL to off on models that support it.

Turn off Repeat functions.

Once these have been set, connect the Mike jack to the RBI. Reset the RBI to initialize the radio to the controller and get them in sync.

Any time there are manual changes from the radio front panel, the RBI and the Radio can get out of sync. This will require a RBI reset to correct. We recommend hooking the reset line from the RBI to an open collector output from the controller. To reset the RBI-1, turn the open collector output line on and back off. If you do not turn the line back off, the reset line will be held low, disabling the RBI-1. A macro can be used to let you toggle the open collector output line with a single command.

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139: Set Up the RLC-ICM Interface

The RLC-ICM interface allows the RLC-DSP404 to control IC-900/901 band modules using the same commands as are used for the Doug Hall RBI-1. This command tells the controller which interface you are using (default is the RBI-1) and allows you to set up the RLC-ICM interface. This setup procedure is not necessary for the RBI-1, since it will only support one band module being on at a time.

Once you have set up the RLC-ICM with this command, you can use most of the RBI-1 commands (Commands 141..150) as described.

You may want to check the test points/LEDs (see page following command 139) to make sure that these commands are being correctly received by the RLC-ICM. If they are not, you will have to enter them again, as they are not stored by the controller.

<139> 000	Set the controller for RBI-1 (the default)
<139> c ss	Set the controller for RLC-ICM

Parameters:

- 139 is the default command name.
- C is the connector number on the RLC-ICM that the module you are setting up is plugged into (1..4).
- SS is the setup code described below

Procedure:

- First tell the RLC-ICM which band module is plugged into each of its connectors. The setup codes are listed in the chart below. You will need to execute command C139 once for each setup code you wish to enter.

SS (the setup code)	Description
00	28 MHz Module
05	50 MHz Module
10	140..160 MHz Module
15	220 MHz Module
20	430..440 MHz Module
25	1200 MHz Module (not currently active)

The default setup for the RLC-ICM is to have connector 1 plugged into the 140..160 MHz module, connector 2 plugged into the 220 MHz module and connector 3 plugged into the 430..440 MHz module. As an example, the following commands will enter those settings again:

Command 139 110 D or unkey or <Enter>

Command 139 215 D or unkey or <Enter>

Command 139 320 D or unkey or <Enter>

- Second, you must tell each band module what size of offset to use when you select a plus or minus offset with Commands 142 or 143. The setup codes follow:

SS (the setup code)	Description
30	100 KHz Offset
35	500 KHz Offset
40	600 KHz Offset
45	1 MHz Offset
50	1.6 MHz Offset
55	1.7 MHz Offset
60	5 MHz Offset
65	12 MHz Offset
70	20 MHz Offset

Example:

To select a 100 KHz offset for the 140..160 MHz module that is plugged into connector 1, enter Command 139 130 D or unkey.

- Setup codes 75 and 80 are reserved for special offset memories, which are not yet supported.

- You should normally use Commands 000, 001 and 002 to control turning the remote base on and off and monitoring it. Those commands treat the whole RLC-ICM interface as one unit, connecting to and disconnecting from it the same way they would a link port. In addition to these commands, you can tell the RLC-ICM interface to enable transceive, enable receive only, or disable individual modules using the following codes:

SS (the setup code)	Description
85	Enable Transceive
90	Enable Receive Only (Transmit Disabled)
95	Disable Module Completely

If you have properly entered the above commands, the RLC-ICM is set up and ready to use. To enter frequencies, turn PL on and off, etc., use the RBI-1 commands in this section of the manual (commands 142..150).

RLC-ICM Firmware Versions:

V1.23 and later versions of the RLC-ICM (not RLC-DSP404) firmware work slightly differently than earlier versions. The changes include:

- When you switch from one frequency band to another by entering a new frequency with command 142, version 1.23 and later automatically disable the other frequency bands (as if you entered setup code 95). You can re-enable the other bands using setup code 85 or 95. Earlier versions left the other bands enabled until you specifically disabled them.
- When you change frequency with command 142 (or use some of the other commands), version 1.23 and later do not automatically switch to receive only mode (as if you did setup code 90) like earlier versions did.

Because of these differences, the example below has a separate version for each version of RLC-ICM firmware.

Example:

If you wanted to monitor the 140..160 MHz module and the 220 module, but only transmit on 140, you could enter Command 139 2 90 D or unkey to disable transmitting on the 220 module on connector 2 and Command 139 1 85 D or unkey to enable transceive on 140..160 MHz (connector 1). If you then used Command 000 to connect the repeater port you were using to the port that the RLC-ICM is on, you would be able to transmit on and receive from the 140..160 MHz module but only receive from the 220 MHz module.

If you are using RLC-ICM firmware version 1.22 or earlier, you may want to write macros to enable transceive after changing frequencies. The following commands will program macro 600 to enable transceive on the 140..160 MHz module on connector 1 and name that macro to 12:

```

Command 053 600 038 D or unkey      ; be silent for the rest of the macro
Command 056 600 139 185 D or unkey   ; enable transceive
Command 010 600 12 D or unkey        ; rename macro 600 to 12

```

RLC-ICM Internal Operation Test Points

The RLC-ICM controller for Icom IC900\901 modules supports on-board function test points (LEDs in later versions). These test points are supported in the software release V1.14 and later. The test points are located towards the center of the interface. Test points are located on connector J10 which is a 5 pin male header connector (or just LEDs).

The following signals are present on J10.

Pin 1	-	Transfer complete (Data received without errors)
Pin 2	-	Configuration data received (Set-up data received without errors)
Pin 3	-	Error detected in transfer (Errors were encountered on the RLC-ICM)
Pin 4	-	1 second pulse output (Indicates program is running)
Pin 5	-	Ground reference

When any data is sent to the RLC-ICM one of the above pins will change state. The active state is +5v (high) or the LED being lit. More than one state may be present at a time and the states will be active for 10 seconds (Except the 1 second pulse output).

Controller interfacing:

The most common use for these signals is to read them with a voltmeter when troubleshooting the RLC-ICM. They could also be connected to digital input lines on the controller to provide remote feedback that commands were or were not transferred correctly, although this should not be necessary once the RLC-ICM has been interfaced and tested.

When a frequency is selected on the interface, and the data was received without errors, pin #1 will go from the low (0v) state to the high (5V) state. When connected to an digital input line the controller can respond (Remote Base OK) for example. If an error is received during transfer pin #3 will go from the low (0v) state to the high (5V) state. When connected to an digital input line the controller can respond (Remote Base Error) for example. These lines simply tell the user that the data was received.

These lines can not directly interface to LED's, relays or any current "hungry" device. They are only designed for correct\error detection.

142: Set Frequency (and Offset) for RBI-1 or RLC-ICM

This command allows you to change the frequency of the radios connected to the Doug Hall RBI-1 or the RLC-ICM. After entering the command name (default is 142), you can just enter the frequency the way you would say it (ignoring the decimal point). To go to 147.38MHz, you could just enter "142 14738" and unkey. You do not need to enter 0's at the end unless you want to change the offset, in which case you have to enter three digits after the assumed decimal point before the digit that specifies the offset. For example, "142 1473801" would select a positive offset (using format 0, see command 144). The controller will determine what band the frequency is in and send the information to the remote base interface. The remote base interface figures out which radio handles that band's information and sends the frequency to that radio.

<142> 29xxf o	10 meter
<142> 5xxf o	50 MHz
<142> 14xxxf o	144 MHz
<142> 22xxxf o	220 MHz
<142> 43xxxf o	430 MHz
<142> 44xxxf o	440 MHz
<142> 124xxxf o	1240 MHz
<142> 125xxxf o	1250 MHz
<142> 126xxxf o	1260 MHz
<142> 127xxxf o	1270 MHz
<142> 128xxxf o	1280 MHz
<142> 129xxxf o	1290 MHz

Parameters:

- 142 is the default command name.
- XXX is the new frequency (MHz, 100KHz, 10KHz)
- F (optional) is the 5 KHz entry
- O (optional) is the new offset (see Command 143 for the format)

Notes:

- If you do not want to change the current offset, you can leave off the last few digits of the command as shown in the chart above.
- You can keep the controller from speaking the frequency by either entering or not entering a '*' as a "megahertz point", like "142 147*38". See command 144 for more information.

143: Set Offset for RBI-1 or RLC-ICM

This command allows you to change the offset on the radio connected to the Doug Hall RBI-1 or the RLC-ICM. The offset is always specified as one digit, 0 to 3. There are two different common definitions of what digit corresponds with what offset. They are shown in the table below. The RLC-DSP404 supports both. You can select which format you want to use with Command 144.

<143> o

Parameters:

- 143 is the default command name.
- O is the new offset

Offset	Format 1	Format 2
0	Minus	Minus 20 (1200 only)
1	Plus	Minus
2	Simplex	Simplex
3	Minus 20 (1200 only)	Plus

Note:

You can recall the current band unit, frequency, and offset with Command 149.

144: Set Offset and Frequency Readback Styles

This command allows you to change the way you enter the offset with Commands 142 and 143. The offset is always specified as one digit, 0 to 3. There are two different common definitions of what digit corresponds with what offset. They are shown in the table below. As an example, if you enter "142 147380 1" you will get a positive offset if you are using format 0 and a minus offset if you are using format 1.

This command also allows you to control under what conditions the controller will speak the frequency when you use commands 142 and 146 (PL frequency). By default, if the frequency is entered without a '*' ("142 14738" for example), the controller will speak the frequency ("one hundred forty seven point three eight") to confirm that it made the change. In some cases, such as when someone is jamming the remote base, you might not want the frequency to be spoken. In those cases, you can insert a '*' for a "megahertz point" while entering the frequency, like "142 147*38", and the controller will just say the word "Frequency" rather than telling you what the frequency is. If you want to reverse this logic, so the controller normally speaks the word "Frequency" and you have to enter a '*' to make the controller speak what the frequency is, use the last format in the table below.

<144> x	Select offset format x, don't change '*' readback setting
<144> x 0	Select offset format x, '*' disables frequency readback
<144> x 1	Select offset format x, '*' enables frequency readback

Parameters:

- 144 is the default command name.
- X is the new offset format. Used in conjunction with Command 143

Offset	X = 0	X = 1
0	Minus	Minus 20 (1200 only)
1	Plus	Minus
2	Simplex	Simplex
3	Minus 20 (1200 only)	Plus

Defaults:

- the default format is X = 0 and '*' makes it say the word "Frequency".

Note:

There is no command to recall which format you are using. If you are unsure, execute Command 143 1 D or unkey. If it says "plus", you are using format 0. If it says "minus", you are using format 1.

145: Set Power Level for RBI-1

This command allows you to change the power of the radio connected to the Doug Hall RBI-1. The power level for the RLC-ICM is set with a jumper on the RLC-ICM and cannot be changed remotely without special wiring (connecting the control line to a open collector output on the controller).

<145> 0	Low Power
<145> 1	Medium Power
<145> 2	High Power

Parameters:

- 145 is the default command name.

Default:

- the default is low power

146: Set PL Frequency for RBI-1 or RLC-ICM

This command allows you to change the PL (CTCSS) frequency of the radio connected to the Doug Hall RBI-1 or the RLC-ICM. The frequency you set will apply to both received and transmitted PL. See Commands 147 and 148 to turn the PL encoder and decoder on and off.

<146> x..x

Parameters:

- 146 is the default command name.
- X..X is the PL frequency in Hz. Valid frequencies are listed below. Default is 67.0 Hz.

Notes:

- The RLC-DSP404 makes selecting PL frequencies easy by allowing you to enter approximate values for the PL frequencies. For example, you can select a PL of 71.9 Hz by entering any of the following values for X..X in the command above: 71, 72, 710, 719, 7100, and 7190. The RLC-DSP404 takes the number that you enter and finds the closest match among the valid PL frequencies. When the synthesized voice responds to this command, it tells you the actual frequency selected, even if the value you entered was approximate.
- A '*' is never required as a decimal point, but can be used ("146 127*3") to tell the controller whether to speak the new PL frequency or whether to just say "PL". See command 144 for more information.

Valid RBI-1 PL Frequencies (see next page for RLC-ICM PL frequencies)

67.0 Hz	85.4 Hz	103.5 Hz	127.3 Hz	156.7 Hz	192.8 Hz	241.8 Hz
71.9 Hz	88.5 Hz	107.2 Hz	131.8 Hz	162.2 Hz	203.5 Hz	250.3 Hz
74.4 Hz	91.5 Hz	110.9 Hz	136.5 Hz	167.9 Hz	210.7 Hz	
77.0 Hz	94.8 Hz	114.8 Hz	141.3 Hz	173.8 Hz	218.1 Hz	
79.7 Hz	97.4 Hz	118.8 Hz	146.2 Hz	179.9 Hz	225.7 Hz	
82.5 Hz	100.0 Hz	123.0 Hz	151.4 Hz	186.2 Hz	233.6 Hz	

Valid RLC-ICM PL Frequencies

33.0 Hz	54.9 Hz	82.5 Hz	114.8 Hz	159.8 Hz	189.9 Hz	233.6 Hz
35.4 Hz	56.8 Hz	85.4 Hz	118.8 Hz	162.2 Hz	192.8 Hz	241.8 Hz
36.6 Hz	58.8 Hz	88.5 Hz	123.0 Hz	165.5 Hz	196.6 Hz	250.3 Hz
37.9 Hz	63.0 Hz	91.5 Hz	127.3 Hz	167.9 Hz	199.5 Hz	254.1 Hz
39.6 Hz	67.0 Hz	94.8 Hz	131.8 Hz	171.3 Hz	203.5 Hz	
44.4 Hz	69.4 Hz	97.4 Hz	136.5 Hz	173.8 Hz	206.5 Hz	
47.5 Hz	71.9 Hz	100.0 Hz	141.3 Hz	177.3 Hz	210.7 Hz	
49.2 Hz	74.4 Hz	103.5 Hz	146.2 Hz	179.9 Hz	218.1 Hz	
51.2 Hz	77.0 Hz	107.2 Hz	151.4 Hz	183.5 Hz	225.7 Hz	
53.0 Hz	79.7 Hz	110.9 Hz	156.7 Hz	186.2 Hz	229.1 Hz	

147: Turn PL Encode Off/On for RBI-1 or RLC-ICM

This command allows you to turn the PL (CTCSS) encoder of the radio connected to the Doug Hall RBI-1 or the RLC-ICM off or on.

<147> 0	PL Encode Off
<147> 1	PL Encode On

Parameters:

- 147 is the default command name.

Default:

- the default PL encode off

148: Turn PL Decode Off/On for RBI-1 or RLC-ICM

This command allows you to turn the PL (CTCSS) decoder of the radio connected to the Doug Hall RBI-1 or the RLC-ICM off or on.

<148> 0	PL Decode Off
<148> 1	PL Decode On

Parameters:

- 148 is the default command name.

Default:

- the default PL decode off

149: Recall Frequency and Offset for RBI-1 or RLC-ICM

This command allows you to recall the current band, frequency and offset settings of the radio connected to the Doug Hall RBI-1 or the RLC-ICM. The format of the voice response is given below. If you want information about power, PL, etc., see the next command: Command 150.

<149>

Parameters:

- 149 is the default command name.

Voice Response:

XXX.YYY	The frequency in MHz.
O	The offset as indicated below:
"minus"	minus offset
"s"	simplex
"plus"	plus offset
"minus 20"	minus 20 MHz offset (1200 radios only)

150: Recall All RBI-1 or RLC-ICM Settings

This command allows you to recall all of the current settings for the RBI-1 or the RLC-ICM. The format of the voice response is given below. When this command is used with the RLC-ICM, it recalls the settings of the last band for which a command is issued (the other band's information cannot be recalled).

<150>

Parameters:

- 150 is the default command name.

Voice Response:

XXX.YYY	The frequency in MHz.
O	The offset as indicated below:
"minus"	minus offset
"s"	simplex
"plus"	plus offset
"minus 20"	minus 20 MHz offset (1200 radios only)
"power XXXX"	power setting is low/moderate/high
"PL XX.X Hertz"	PL (CTCSS) frequency is XX.X hertz
"PL TX On/Off"	PL encoder is on/off, "PL RX On/Off", PL decoder is on/off

151: Turn Radio Power On or Off for RBI-1

This command allows you to use the Doug Hall RBI-1 to turn the radio's power off, if the radio supports it. This feature is not supported by the RLC-ICM.

<151> 0	Radio Power Off
<151> 1	Radio Power On

Parameters:

- 151 is the default command name.

Example:

I want to turn off the power on my 2 meter radio

<151> 0

Voice Response:

"Radio Power <ON/OFF>"

152: Goto Radio Memory Channel for the RBI-1

This command allows you to go to one of the memory channels that is stored on the radio. It is not supported by the RLC-ICM. These memories must be set up ahead of time, since there is no way to program them using the RBI-1. The controller doesn't know what frequency (or any of the other settings) the memory has in it - that is determined totally by the radio. Only some radios support this feature. The most common use for memories is to go to frequencies that you can't get to otherwise, such as NOAA weather frequency. If you have more than one radio connected to the RBI-1, the memory recall command always goes to the last radio you sent a frequency to. So if you are on two meters and you want to recall a memory on the 220 radio, you need to enter a 220 frequency first to select that radio, then use this command to go to the memory. The number of memories available is determined by the radio. This command does not work on the RLC-ICM, as those band modules do not have internal memories. It is possible to program macros on the controller that go to a specific frequency, offset, etc and use them like memories.

<152> x..x

Parameters:

- 152 is the default command name.
- x..x is the memory to go to (1..20, or as supported by the radio)

Notes:

When you recall a memory and follow that with a 'Recall all RBI-1 or RLC-ICM settings (Command 150)' only the radio power and memory information will be recalled. Because the memory contents are not known by the controller, the frequency readback can not be used. It is a good idea to have the frequencies noted for future use.

Example:

I want to recall the NOAA weather channel which is in memory channel 15.

<152> 15

Voice Response:

"Look Up <x..x>"

141: Control/Recall RBI-1 Output Lines

The Doug Hall RBI-1 has eight open collector output lines that can be used to control other hardware, such as antenna switches. This feature is not supported by the RLC-ICM. Those output lines can be controlled with this command. See the RBI-1 manual for more information about their current sink limits and other specifications.

<141> X	Recall State of Output 'X'
<141> X 1	Turn Output 'X' On
<141> X 0	Turn Output 'X' Off

Note:

- When an output line is turned on or off using this command, there will be a slight delay (about a second) before the change will actually take place. Because of the delay, this command cannot be used to quickly pulse an output line. See commands 093 and 094 which use the output lines on the Deluxe board if you need pulses.

Chapter 16: Special Audio Routing Commands

See Appendix A for more information about audio routing.

037: Set Audio Routing Variable for Commands In a Macro

This command allows you to override the default message routing variable within a macro. It only remains in effect until the end of the macro or until 037 or 038 are executed, whichever comes first. Appendix A has more information about controlling where messages are sent. The most common use of this command is to send the audio generated by commands in a macro to a different combination of ports than it is normally sent to. An example of this is provided below.

```
<037> pp..qq
```

Parameters:

- 037 is the default command name.
- pp..qq is the list of ports the message is to be routed to (use '0*' for the current port, see Appendix L)

Note:

The changes made to the audio routing variable by this command affect all commands (including other macros) executed until the end of the macro containing this command, or until command 037 or 038 are executed again, whichever occurs first.

Example:

You have repeaters on ports 1 and 2. You want to make a recall time command that will speak the time out both repeaters whenever it is executed. Since command responses normally only go out of the port that entered the DTMF command (but see command 050), we need to use a macro and manually change the audio routing variable (with 037). We will use the command to recall the time in the male voice (026) for this example. You could use any of the user macros (600..999), but we will use 600 for this example.

- First we will recall macro 600 to make sure that there is nothing stored in it that we want to keep: 054 600 D or unkey or <Enter>
- If it has something in it, we can erase it with 055 600 D or unkey, or choose a different macro.
- Now we can append the commands we want to the macro. The first command we want the macro to execute will set the audio routing variable to ports 1 and 2. This command is 037 124 D or unkey. To append it onto the end of the macro we enter 056 600 037 01 02 D or unkey.
- We then want the macro to recall the time (command 026). To append this onto the end of the macro we enter 056 600 026 D or unkey.
- Now we can cause the time to be recalled out ports 01 and 02 by executing the macro 600.
- If you want to rename this macro to "567", for example, do the following: 010 600 567 D or unkey. Now entering 567 and unkeying will execute the macro and cause the time to be spoken out ports 01 and 02.

038: Execute the Rest Of This Macro Silently

This command kills all voice/CW responses beyond this point. This command is designed for use within a macro. When multiple commands are executed inside a macro, the commands that are executed contain their own message responses. To keep from hearing all of the responses when the macro is executed, simply execute command 038 first, then all messages following that command are canceled. If you want a message response to occur from within a macro, speak the response before you execute 038.

<038>

Parameters:

- 038 is the default command name.

Notes:

The changes made to the audio routing variable by this command affect all commands (including other macros) executed until the end of the macro containing this command, or until command 037 or 038 are executed again, whichever occurs first.

Example:

Want to change the access mode of port 1 and speak a message indicating what you did.

1) Use a multiple command macro for this purpose

Macro 600 will be used to execute this sequence.

2) 005 is the Access mode change command

Want to change the mode to COR and PL Access

005 01 3 "Port 1 COR and PL"

3) 036 is the Voice message speak command

Want to speak "Repeater on PL"

4) Macro programming:

055 600;

erase the macro

056 600 036 411 358 046 042 ;

speak "Repeater on PL"

056 600 038 ;

be quiet for rest of macro

056 600 005 01 3 ;

set to COR and PL access mode

5) The macro will speak the message "Repeater On P L" and not the mode change message "1 CAP"

065: Restore Audio Routing Variable (Undo 037 and 038)

This command allows you to restore the audio routing within a macro to whatever it was at the beginning of the macro. In other words, if commands 037 or 038 have been executed earlier in the macro, their effects will be negated. It has no effect if used outside of a macro.

<065>

Example:

I want to make a macro to connect ports 1 and 2 and speak "Link Up" to whichever port entered the command (which is the default, see command 050). This can be done without using command 065 as follows:

055 600 ;	erase whatever is in macro 600
056 600 036 292 507 ;	speak "link up"
056 600 038 ;	be quiet for the rest of this macro
056 600 000 0102 ;	connect ports 01 and 02

The above method may seem backwards, as the command to send the "link up" response comes before the ports are actually connected. When the controller executes the macro, it puts the words "link up" in a buffer to be spoken when the voice synthesizer has time and immediately goes ahead and finishes the macro, connecting the ports. Assuming that the voice synthesizer is not busy speaking something else, it will speak "link up" soon afterward.

The following macro does the exact same thing, and will sound exactly the same to the person that enters it:

055 600 ;	erase whatever is in macro 600
056 600 038 ;	be quiet for the rest of this macro, unless
	command 037 or 065 are executed
056 600 000 0102 ;	connect ports 1 and 2
056 600 065 ;	set the audio routing back to what it was at the
	beginning of this macro
056 600 036 292 507 ;	speak "link up"

Note that the ports are connected first, then the audio routing is restored and the message is sent. It takes one more command in the macro (065) to put things in this order, but if it makes more sense to you do program your macros this way, there is no harm in doing it. Note that in both macros, command 038 is needed to keep the default response of command 000 from being spoken: "one connect two".

039: Recall the Ports in the Current Audio Routing Variable

This command allows you to determine what ports audio is being sent out of without having a radio tuned to each of the transmitters. It speaks a list of numbers which represent the ports that are included in the audio routing variable at the time it is executed (see Appendix A for more information about audio routing variables).

```
<039>
```

Example:

You want to know what transmitters are hearing the courtesy beep that is generated when port 2's receiver unkeys. Solution: append this command to the end of the courtesy beep macro (257) for port 2 so it will speak the number of the ports that just heard the courtesy beep:

```
<056> 257 039 D or unkey or <Enter>
```

Note:

To erase command 039 from the courtesy beep macro when you are tired of hearing it, use command 058 and you will not have to erase the whole macro and program it again.

050: Set Up or Recall Default Audio Routing Variables

This command allows you to configure which transmitters send different voice messages and tones. Each time a command is executed that generates a message to tell you what it did or an event occurs that triggers a message, the controller figures out what transmitters should send that message and stores it in an "audio routing variable" until it is actually sent. Normally if you enter a command using DTMF on a repeater, the response message will be sent out that repeater so you can hear it. The same goes for a link. But in some cases, you might want the response messages to commands entered from a link to be sent out both the link and a repeater, so you can keep track of what is going on. This command allows you to do that. It allows you to control where response messages will be sent for commands that are entered from each receiver or the serial port. It also allows you to control where messages that are generated by the scheduler, I/O alarms and event triggers will be sent.

Please note that when a macro is executed, it may override these default settings by using commands 037 and 038 (they only work inside of a macro). This command sets the *default* routing; commands 037 and 038 override it and change it to something else. If it has been changed using commands 037 or 038 in a macro, command 065 will restore it to the default setting for the remainder of the macro.

Recall Default	<050> SS
Set Default to pp..qq	<050> SS pp..qq
Clear Default	<050> SS 0

Parameters:

- 050 is the default command name.
- SS specifies which default audio routing variable to change
 - 01 - commands entered from receiver 1
 - 02 - commands entered from receiver 2
 - 03 - commands entered from receiver 3
 - 04 - commands entered from receiver 4
 - 05 - commands entered from receiver 5
 - 06 - commands entered from receiver 6
 - 07 - commands entered from receiver 7
 - 08 - commands entered from receiver 8
 - 09 - commands entered from receiver 9
 - 10 - commands entered from receiver 10
 - 11 - commands entered from receiver 11
 - 12 - commands entered from receiver 12
 - 13 - commands entered from the serial port
 - 14 - commands executed from Telnet server 1
 - 15 - commands executed from Telnet server 2
 - 16 - commands executed from Telnet server 3
 - 17 - commands executed from Telnet server 4
 - 18 - commands executed from Web server

- pp..qq is a list of the ports that the audio will be sent out of. Enter a '0' if you do not want the audio to be sent anywhere.

Default:

Commands entered from a receiver are sent to whichever port entered the command. All others default to sending messages out transmitter 1.

Notes:

- When you enter a command on the serial port to change the audio routing variable for commands entered from the serial port, the routing is changed before the response to this command is generated. For example, if you turn the responses off by entering "050 09 0", you won't get a voice response. If you enter "050 09 01" to turn them back on for port 01 (the default), you will get a voice response out port 01.
- Command 114 (the autopatch hangup command) can not be controlled with this command, as it sets its own audio routing to speak the hang up message to all of the ports that are listening to the patch, not just to the one that hung it up.
- See Appendix A for more information about audio routing variables in general, commands 037, 038 and 065 for information about routing audio within a macro.

Chapter 17: Special Control Commands

035: Remotely Reset the Controller

This command allows you to remotely reset the RLC-DSP404 controller. This does exactly the same thing as turning the power off and back on or pressing the reset switch on the board. It will not cause you to lose any of your programming - that is only possible by being at the site of the controller and following one of the initialization procedures described in Appendix D.

<035>

Parameters:

- 035 is the default command name.

207: Persist

The RLC-DSP404 does not save most settings as soon as you change them (as earlier RLC controllers did). It works more like a computer that loads a file into memory, works on it, then saves it again. If you lose power without saving, the changes will be lost. To save the changes, you can either reset the controller (with command 035), or enter "207 1" at any time. You can also save settings from RCI using the File > Save Settings (on controller) menu option.

<207> 1

Update persistent data.

078: Set Command Entry Options for a Port

This command allows you to specify several options concerning how the controller will process the characters you enter.

<078> pp	Recall Options
<078> pp c	Set Chaining
<078> pp c t	Set Chaining and Timed Execution
<078> pp c t e	Set All Options
<078> pp 0 0 D	Set for Normal Operation

Parameters:

- 078 is the default command name.
- pp is the port for which to change the options
 - 1..12 indicate the corresponding port
 - 13 indicates the serial port
- C is the chaining control. This variable allows your commands to be chained together. Must be entered but is ignored for the serial port.
 - 1 Enables command chaining
 - 0 Disables command chaining (the default)
- T is the timed execution. This variable allows timed execution of commands entered. Must be entered but is ignored for the serial port.
 - 1 Enables timed execution
 - 0 Disables timed execution (the default)
- E (optional) is the new force-execution digit (default is 'D' for radio ports, '!' for the serial port).

Defaults:

2. Chaining and timed execution should normally be turned off and the force execution digit set to 'D' for all radio ports. Port 1 defaults with timed execution enabled to make it easier to change the COR polarity if necessary when first setting up. After getting it set up correctly, timed execution should normally be turned off by entering "078 1 0 0".

Command Chaining:

Normally the controller considers everything you enter before unkeying or pressing 'D' or the enter key to be one command. If there are more characters that it knows what to do with, it generates an error message and discards the command. The chaining option lets you enter more than one command at a time, executing all of them at once when you unkey. This can cause problems when it is ambiguous where one command ends and the next begins, but may be useful in some cases. With the chaining option turned on, the controller will let you chain on another command without unkeying after any command that always takes the same number of digits. This includes all of the macros and a lot of the commands numbered 000 to 199 (those which never take any digits after the command name). Of the remaining commands numbered between 000 and 199, you can find out which commands can have another command come immediately after them by looking them up with command 011; if it does not say "variable", you can enter another command after it. If command 011 does say "variable", that command must be the only command entered or the last command in a chain of commands. It is recommended that you leave this option turned off unless you have a specific reason to turn it on. This option is not available (the setting is ignored) for commands entered from the serial port.

Timed Execution:

Normally when you enter a DTMF command, you unkey to tell the controller it is time to execute the command. If you enter a command and wait longer than a few seconds (see the DTMF interdigit timer - command 020) the controller assumes that you didn't want to do that command and it throws it away. This keeps a digit accidentally entered from messing up a command you might enter 30 seconds later (if you didn't unkey in the meantime). It also reduces the likelihood of DTMF voice falsing (see introduction to Chapter 3) causing a command to be executed accidentally; if your voice falses the decoder and you don't unkey for a few seconds, the controller will just discard that falsed digit. There are times, however, when it isn't possible to unkey and it would be handy to have another way to tell the controller to execute. If your repeater squelch gets stuck open or someone sits on their mike, the controller won't be able to tell if you unkey. In this situation, you can enter a command and then force it to execute with the force-execution digit (normally 'D', but can be changed with this command). If your radio doesn't have 'D' on the DTMF keypad, you won't be able to do this. Another situation is when you call in on the reverse autopatch; you can't unkey and most phones don't have the 'D' key. In either of those cases, you might want to turn on timed execution. When timed execution is turned on, instead of throwing a command away if you pause for a few seconds, the controller executes it. This is the preferred method of entering commands on the reverse autopatch. If you use it, you will probably want to shorten the DTMF interdigit timer (see command 020) to 2 or 3 seconds. This option is typically only used on radio ports if you are controlling from a radio that doesn't have 'D' on its DTMF keypad. This option is not available (the setting is ignored) for commands entered from the serial port.

The Force-Execution Digit:

As mentioned previously, the force-execution digit tells the controller to immediately execute any command that may have been entered, without waiting for you to unkey. It is recommended that you leave this digit set to 'D' in most cases, but if you need to change it, 'A', 'B', 'C' and '*' are other acceptable choices ('*' and '#' work pretty well from the reverse autopatch if you don't want to use timed execution). Please note that you will not be able to use any commands that have the force-execution digit in their names, so avoid that digit when setting up command names. If you use '*' as the force-execution digit for your repeater port, you will not be able to use '*' as your autopatch up code. If you

use the DTMF mute bypass feature (see introduction to Chapter 3), your choice of force-execution digit will affect that as well.

Advanced Note:

If you are trying to change the force-execution digit for one port (call it 'A') by entering this command on another port (call it 'B'), you will be unable to change A's force-execution digit to be the same as B's in the normal way. This is because when port B sees that digit, it can't tell whether you want it to execute immediately or whether that is what you are trying to change A's force-execution digit to. The easy solution is to enter this command from the port that you are trying to change. If you must enter it from another port, specify the new force execution-digit to be a '9' (or any other decimal digit). The controller will consider this to be a special case (since changing the force-execution digit to a '9' would normally be a very bad idea) and will instead change it to be the same as it is for the source that entered the command. If you didn't understand this paragraph, just ignore it.

079: Seed Command Buffer

This command allows you to seed the command buffer with a command and any necessary data digits. The next time digits are entered from the corresponding source, they will be appended to the seeded values.

<079> ss 0	Clear
<079> ss ccc d..d	Seed Command Buffer

Parameters:

- 079 is the default command name.
- ss is the source that commands will be executed from
 - 01..12 indicates a radio port
 - 0* indicates current port
- ccc is the command number
- d..d is the data digits for ccc, if necessary

Example:

-Can be used with a macro to make '*' up patch with dial tone and long distance checking:

```

110 11                ; enable the patch
010 600 *             ; name patch up macro '*'
056 600 051           ; start dial tone
056 600 038           ; mute following voice responses
056 600 022 125 3000  ; reset dial tone timer for 30 seconds
056 600 079 0* 112    ; on next keyup, feed data to command 112

```

080: Execute Command by Number

This command executes other commands without regard to what their names are. In other words, if you know the number of the command as shown in the manual, you can execute it without knowing its name by using this command. It is automatically named “N” rather than “080” as you would normally expect, which means it can only be executed from the serial port unless you rename it (since DTMF pads don’t have the letter “N”). The purpose of this command is explained in the notes below.

```
<080> XXX D..D
```

Parameters:

<080> is the name of this command, normally “N”. See notes below.

XXX is the *number* of the command you wish to execute

D..D is the data required by command XXX, if any

Notes:

Since this command makes it easy to execute commands without considering if their names have been changed, renaming commands does not provide much security from someone trying to mess up the programming from the serial port. If access to the serial port can not be controlled (if you have a modem connected to it, for example), you should use the password system to secure the controller. This command does not bypass the password system; if a password is necessary to execute a command directly, the password will still be required if you use this command.

The purpose of this command is to make it easier to program the controller from a computer. One of the best ways to program the controller is to use a text editor (“Notepad” works well in Microsoft Windows™) to create a file that contains all of the commands needed to set up the controller. Such a file can be “uploaded” to the controller using a communications program. A small example of such a file is shown below (note that everything following a ‘;’ (semicolon) until the end of the line is a comment):

```
; Setup file for repeater controller
007 011 ;          turn on DTMF mute for port 1
000 0101 ;        make port 1 a repeater
010 000 A12 ;      rename command 000 to “A12”
```

After uploading a file like the one above, you might notice an error in the file or decide to add something else to the file. After making the changes with the editor, you can upload the file again. During this

second upload, the line "000 011" will cause a "Command name not found" error because command 000 was renamed during the previous upload. To avoid this problem, you can either reinitialize the controller before each upload (see Appendix D) or you can modify the file as shown below:

```
; Setup file for repeater controller
N007 011 ;          turn on DTMF mute for port 1
N000 0101 ;         make port 1 a repeater
N010 000 A12 ;       rename command 000 to "A12"
```

By inserting an "N"(the name of this command, 080) at the beginning of each line, the controller will ignore any name changes and will allow you to upload the file multiple times without errors.

164: Recall Software Version

This command allows you to recall the software version that the controller is running, which might be useful when calling for technical support. Do not be concerned if the controller software version is later than your manual version, as many of the changes between software versions do not require manual changes.



<164>

Parameters:

- 164 is the default command name

165: Reset COP Watchdog Timer

This command allows you to reset the COP watchdog timer from within a macro. The only time this should be needed is if you are executing an extremely long macro sequence (many macros calling each other). If such a macro sequence takes too long to execute, it will cause the controller to reset, because the controller thinks that something is wrong. Executing this command in the middle of such a long macro sequence will tell the controller that everything is ok; it is just taking a long time.

<165>

Parameters:

- 165 is the default command name

Advanced Information:

The COP timer is actually a hardware timer (in the DS1232 chip) that automatically resets the controller if the controller gets stuck in a loop. To keep it from resetting the controller, the software must pulse a pin on the chip at least every second or so to tell the chip that the Computer is Operating Properly (hence the name COP timer). On our controllers, that pin is pulsed in the main loop, from which all of the procedures and functions are called. If there is a bug in any of those procedures or functions that makes it take longer than a second or so (a long time for a computer) to return to the main loop, the COP timer resets the controller. It is possible to write enough long macros that call other long macros so that when the controller executes them it takes longer than a second and thereby fools the COP timer into thinking that there is a problem and causes the controller to reset. If that happens, you can call command 165 in the middle of those long macros to manually tickle the COP and keep it from resetting the controller. That is the only use for this command.

167: Do Nothing

This command does nothing. After executing, it returns an OK error code like most other commands do. It is used as the default command to execute for commands like Command 157.

<167>

Parameters:

- 167 is the default command name

Chapter 18: 500 User Structure

The Password System

The RLC-DSP404 provides several features that allow you to protect it from unwanted access. They range from very simple to extremely secure. Of course the more secure methods are also more complicated. If you don't need a lot of security, don't worry about the advanced password features. This section discusses just the password structure. Other ways of adding security are changing command names (see commands 010, 011, 012 and 062) and blocking access to commands from certain ports (see commands 130 and 131). The password system is disabled when the controller is shipped and after you re-initialize it (which sets everything back to defaults), so you don't have to worry about entering passwords until you are ready for it.

The password system allows you to require that users "log in" to the controller before they will be able to execute some or all of the commands. You can even allow some users, such as control operators, more access than others. This is accomplished by assigning each user a "user level" which determines how much they are allowed to do. User levels can range from 0 to 7. Typically, the owner of the system would be level 7, control operators level 6..3 (more on that later), and other Club members level 2..1. Level 7 users always have access to every command in the controller. A good rule is to assign lower levels to commands that are less important. For example, lower level users can not access higher level commands, but higher level users can access lower level commands.

When the password system is enabled, the RLC-DSP404 requires a certain user level to execute each command. The commands default to suggested levels, but you can change them if you wish. When someone logs into the controller and tries to execute a command, their user level must be equal to or greater than the level required by that command, or the RLC-DSP404 will not let them execute the requested command. The command for setting up passwords is a level 4 command, so only users that are level 4,5,6 or 7 can set passwords. The command to change which ports are connected together is level 4, so user levels 4, 5, 6 and 7 can bring up links, set up crossband repeaters, etc. Commands that are assigned level 0 can always be executed by anyone, even if they do not log into the controller first. Recalling the time is an example of a level 0 command.

You will need to tell the controller what each user's level is, and assign them a password, callsign, autodial number and other information for each user. To keep track of this information, you will need to assign each user a number between 001 and 500. We will call this their "user number". It will also be their autodial slot number, their paging slot number, etc. They will have to tell the controller what their user number is, along with their password, to log in. For the purpose of examples in the manual, we will consider the owner to be user 001, the control operators to be 002 through 009, and the rest of the Club members 010 through 500, although it doesn't really matter whether you are user 003 or 300.

When someone tries to execute a command without logging onto the controller, the controller doesn't know who they are, so it considers them to be user 000. If they try to execute a command without

logging onto the controller, the controller will compare the user level required to execute that command with the user level for user 000. If user 000 is set to be level 7, they will be able to execute any command in the controller without logging on. This is how the password system is disabled when the controller is shipped or after you re-initialize. If user 000 is set to level 0, they will only be able to execute level 0 commands (like recalling the time) without logging on. If user 000 is set to level 2, they will be able to use the autopatch without logging on.

If you decide you want to enable the password system, you should first set up a password for yourself and assign yourself a user level (see command 186):

Example:

186 001 1 7 0 1234 ; user 001, enabled, level 7, fixed password 1234

Now you can try logging in. First check and see if anyone else is logged in by entering Command 188 and unkeying. Now log in by entering Command "187 001 1234", where 187 is the login command, 001 is your user number and 1234 is your password. The controller should respond and tell you that it accepted the command. Now enter Command 188 and note that you are logged in. Now logout by entering Command 189 and unkeying. Command 188 will confirm that you are no longer logged in. You will also be logged out automatically if you do not enter a valid command for 60 seconds (you can change the automatic logout timer with Command 020).

Example:

Set up user 002 as a control operator (or yourself for now). Assign them a different password.

186 002 1 6 0 4321 ; user 002, enabled, level 6, fixed password 4321

Try logging in as user 002. It is important to set up and test two different users before continuing to enable the password system, to prevent you from accidentally locking yourself out of the controller.

187 002 4321 ; log in as user 002

189 ; log out

Remember that when no one is logged in, the controller considers you to be user 000. Up to this point, user 000 has been a level 7 user and could execute any command. Now we will change user 000 to a level 0 user, so that only level 0 commands like reading the time can be executed without logging on. ***Make sure you have followed the example up to this point and can log on as a level 6 or 7 user, or this will lock you out of the controller.***

186 000 1 0 ; enable the password system

To disable the password system (you may have to log on first):

186 000 1 7 ; disable the password system

Note that there is no reason to program a password for user 000, since everyone is user 000 until they log in. Now enter Command 009 to try and recall the crosspoint settings. If you are not logged in, the controller won't let you (that is a level 4 command). Log in as user 001 or 002 as described above and try Command 009 again. You can check to see if you are logged in by entering Command 188.

If you want your Club members to be able to use the autopatch and remote base and do other common things without logging on, but you still want your control operators to have to log on to change how the controller is programmed, log on, enter the command sequence for Command 186 000 1 2. This sets user 000 to level 2. If you do this, everyone will be able to execute level 0, 1 and 2 commands without logging in.

If you want to turn the password system off, log on and enter the command sequence for Command 186 000 1 7. This sets user 000 to level 7. If you do this, the controller will allow all commands to be executed without logging on.

Before setting up the rest of the users, you should consider how secure you want your system to be and choose from the following methods of logging into the controller. ***Before experimenting with these methods, make sure that you are able to log on as at least TWO different users, both level 7. Otherwise if you mess up, you might not be able to log in. A secure system can lock you out too!***

Method #1 - No Passwords:

To log on with this method, you have to tell the controller your user number, but you don't have to enter a password. This is useful when you want to require people to log on to execute commands so you know who they are, but it doesn't provide much security. It is easy to log on as someone else, because you don't have to know their password. To set up user 001 with no password, enter Command 186 001 1 7. User 001 can log on with Command 187 001.

Method #2 - Fixed Passwords:

We have already used this method in the examples above. With fixed passwords, you log onto the controller by entering Command 187 followed by your user number and your password, for example "187 001 1234". You can make your password up to eight digits long. For example, using Command 186 001 1 7 0 12345678, user 001 is assigned a fixed password of 12345678. Longer passwords are obviously harder to guess, but if someone is decoding your DTMF tones, they will probably be able to figure out your password no matter how long it is. Even so, fixed passwords are probably secure enough for most Club members, and possibly secure enough for even the owner and control operators.

Method #3 - Challenge Passwords:

When a user with a challenge password logs in, it takes two steps. First you enter the logon command (Command 187) followed by their user number excluding the password information. The controller looks up the user number, finds out that the user is configured for a challenge password entry, and issues the challenge by requesting the user to enter certain randomly selected digits of his password. The user then re-executes Command 187 followed by those digits of the users password that the controller asked for. An example will probably make this a lot more clear. You will have to logon before trying this example, since command 186 is a level 6 command.

Example:

```

186 003 1 6 3 ABCABC      ; user 003, enabled, level 3, password ABCABC
187 003                    ; request to login
                            ; controller responds with "Please enter 2, 6, 3"
187 B C C                  ; enter 2nd, 6th, and 3rd digit of password
                            ; controller responds with logon message

```

Command 186 told the controller that user 003 wanted a 3 digit challenge password of ABCABC. "Command 187 003" told the controller that user 003 was trying to login. The controller knew (because of command 186) that user 003 needed a three digit challenge. It randomly chose to ask for the 2nd, 6th, and 3rd digit of the password. After the controller issues such a challenge, the next time command 187 is executed, it should be the answer to the challenge. In this case, user 003 entered the three digits that the challenge asked for, as you can see below:

Requested digits:	1	2	3	4	5	6
Password digits:	A	B	C	A	B	C

The 2nd, 6th and 3rd digit of the password are "B C C".

The challenge password method is more secure than the fixed password method, because if someone decodes your DTMF digits as you enter your password, they don't learn your entire password, but only those digits that you enter. If they try to logon using your password, the challenge will likely ask for digits they don't know.

The challenge will never ask for the same digit twice, so the challenge can't ask for more digits than the length of your password. For the most security, it is recommended that you use at least six and preferably eight digits (the maximum length) for your password and have the challenge ask for three or four digits.

Method #4 - Challenge Passwords with Decoy Digits:

While the method #3 is very secure, if someone decodes your DTMF digits as you log on many times, they will eventually learn all of the digits of your password. Using "decoy digits" makes it much more difficult to figure out a password by decoding the digits.

The controller doesn't require you to enter decoy digits, but it allows it if you have a challenge password. Consider the challenge password that was set up for user 003 in the example for method #3.

```
187 003                ; request to login
                        ; controller responds with "Please enter 2, 6, 3"
```

Now instead of entering: "187 B C C" like with method #3, enter "187 5 3 A B C C B". Note that "B C C" still appears in the digits entered. The other digits ("5 3 A" and the final "B") are not needed; they are just "decoy" digits and are ignored by the controller. But someone decoding your DTMF tones doesn't know which digits are the decoy digits and which ones are digits 2, 6 and 3 of your password. So even if they decode your DTMF digits as you log on dozens of times, they probably won't be able to figure out your password.

All you have to do to use method #4 is request to log in ("187 003" for example), figure out what digits the controller is asking for, then enter 187, some decoy digits, the digits the controller asked for, and some more decoy digits. You should randomly choose from all of the DTMF digits (except the force-execution digit which defaults to 'D') for your decoy digits. You can use from 0 up to 8 or so decoy digits before and again after the digits the controller asks for.

Remember that the whole purpose of the decoy digits is to keep someone that is listening and decoding your tones from figuring out which of the digits you enter are the decoy digits and which ones are the answer to the challenge. Use different decoy digits each time. Try to enter the decoy digits at the same rate that you do the other digits.

If all of this password stuff sounds too complicated, remember that using a challenge password with decoy digits is only needed to deal with extreme security problems. You will probably be just fine with no passwords and just changing a few of the important command names or with Method #1 fixed passwords.

186: Set up User Password

This command allows the system manager to set-up a user's password. Once the password is set, the user must then enter the correct sequence to access commands higher than level 0.

<186> uuu	Recall a user's password information
<186> uuu e	Enable/Disable a selected user
<186> uuu e l	Enable/Disable a selected user and set the user level
<186> uuu e ll t p..p	All of the above plus enter password information

Parameters:

UUU - user number (001..500)

E - 1 enable / 0 disable

L - user level

T - password type (0 = fixed. 1 or more is number of challenge digits)

P..P - your password (8 digits max)

Notes:

- Can enable or disable a user by only entering through E.
- If choose a password type of 0 but don't enter a password, you will be able to log in by just entering the name of command 187 followed by your user number (password method #1).

187: User Log-on

This command is the actual command the user uses when accessing high level commands. Because of the importance of this command it can never be assigned an access level higher than '0'. By correctly entering password information, the user can log-on to the controller and have access to all commands that are assigned a level equal or less than their level.

<187> uuu p..p	Fixed password where p..p is the length of 'uuu' password
----------------	---

or...

<187> uuu <unkey> <voice prompt speaks the users required entries> then <keyup> and p..p	Challenged password where p..p are the digits from 'uuu' password table.
--	--

Parameters:

- 187 is the default command name
- UUU is the user number (001..500)
- P..P is the password data

Notes:

If a password is challenged the user must unkey and allow the controller to prompt them with the digits to enter from their custom password table.

188: Recall Who Is Logged In

This command tells you who, if anyone, is logged in. If someone is causing problems, you can find out who they are (or at least who they are logged in as) with this command. If you have not been monitoring and you want to log on to the repeater, you should use this command first to find out if someone is already logged in.

If no one is logged in when you execute this command, it will speak "clear".



<188>

Parameters:

-188 is the default command name

189: User Log-off

Once a user has completed their needs on the system, they should log-off. Once off the system they must again log-on in order to execute any system commands assigned a level higher than '0'.



<189>

Parameters:

-189 is the default command name

Notes:

If the controller should lose power while you are logged on, it will automatically log you off when power is restored so no one else can control without logging on. Actually, everyone is automatically logged off whenever the controller is reset for any reason.

190: Assign a User Level to a Command

This command assigns a user level to a command name, or a range of command names. The commands default to reasonable levels, but you can change them to anything you wish.

<190> ccc	Recall level of a single command
<190> ccc l	Set the level for a single command
<190> ccc eee	Recall the level for a range of commands
<190> ccc eee l	Set the level for a range of commands

Parameters:

CCC is the command number from 000..999

L is the level assigned

- 0 is the lowest level with no log on required
- 7 is the highest level of log on

EEE is the ending command number for entries that require this data

Notes:

- The controller will not let you use a larger value for ll than your user level. This is to keep you from locking yourself out of the controller.
- If a command currently has a level higher than your user level, you will not be able to change it. This is too keep lower level users from gaining unauthorized access.
- You cannot change the level of the logon command; it is always 0. This is necessary to avoid locking yourself out of the controller.

191: Assign a Callsign to a User

This command assigns a callsign to a user number. User 14 might be KC7HXB for example. This callsign is used when the controller speaks messages about logging on and off and in several other places. It is possible to use a different name for a user instead of their callsign. The default "call signs" are just the user number; user 14 is "zero one four". The "callsign" can consist of any words listed in Appendix B. This includes all of the numbers and letters and the special words like the current time.

<191> uuu	Recall user callsign
<191> uuu www..www	Set the user callsign

Parameters:

- 191 is the default command name
- UUU is the user number (001..500)
- www..www is a list of word numbers from Appendix B. There is a limit of 8 words per user number.

Notes:

- When you program a callsign for a user, the controller will automatically begin using it for the voice readback of the autodial slot with the same number. You can keep the call signs from being used for the autodials with command 126.

Chapter 19: The Beaconsing System

The beaconsing system was designed to alert you when something at the site needs your attention. It can be set up to announce a message over the radio and/or call you using the autopatch. It can beacon a limited number of times, or indefinitely until you cancel the beacon.

Note:

If you have two beacons in a row set up to go to the autopatch, and the patch never hangs up between them, you may need to shorten the hang timer for the autopatch port to less than a second.

045: Setup Beacon Table

This command allows you to set up the beacon table. It is this table that controls what happens when a beacon is started. The different slots in the table can be used to alert you of different things, or they can be used together (when N is set to 01..50) to alert you in several different ways, such as by radio and by telephone.

<045> SS	Recall slot SS
<045> SS MMM XX TTTT NN T D..D	Set slot SS

Parameters:

045 is the default command name.

SS = beaconsing table slot number to set up/recall: 01..50. If this is the last parameter entered, will recall the current settings of the slot in the table.

MMM = macro/command number to do

XX = number of times to do it

TTTT = time to wait between in seconds between calls to MMM. If the message spoken in command/macro MMM uses the controller's synthesized voice or DVR and it takes longer than this timer is set for, the controller will wait until the message is done. This timer should be set fairly short (less than 5 seconds) when T=1 (autopatch), so when you answer the phone you won't have to wait a long time before you hear the message.

NN = next beaconsing table slot to do (01..50), or

00 = stop after done with this slot

T = type of beacon to do

0 = beacon out radio port(s)

D..D = list of radio ports, audio routing

1 = beacon out of autopatch

D..D = phone number to dial

046: Start Beacon

This command starts a beacon using the table you set up with command 045. You can start with any of the beacon table slots, so different conditions can start different messages.



```
<046> SS
```

Parameters:

046 is the default command name.

SS = beaconing table slot number to start with (01..50)

047: Cancel Beacon

This command allows you cancel a beacon after it has been started. Since only one beacon can be active at a time, you don't have to specify which one you want to cancel.



```
<047>
```

Parameters:

047 is the default command name.

048: Start Beacon Using English Words

This command allows you to start a beacon from the serial port that will speak the message you specify using English words. It automatically programs macro 343 (and possibly 344) to speak the message you specify (see command 066 for more details) and starts beaconing using the beacon table slot you specify (which should be set up ahead of time to call macro 343). This command is most useful for alerting you of errors that occur in another system that can output a serial error message and execute this command. Any word that is not in the controller's voice library (see Appendix B) will be spelled out.

```
<048> SS Error_message_in_English_words
```

Parameters:

048 is the default command name.

SS is the beacon slot number to use (often is 01)

Error_message_in_English_words is the message to be spoken, with the words separated by underscore digits.

Example:

```
048 01 This_is_a_test_error_message
```

Chapter 20: Event Triggers

The controller does a lot of things totally under the control of the built-in firmware which you as the user can't change, such as turning on a PTT when a receiver goes active and hanging up the phone when it times out. Other things are done by calling automatic macros (see Chapter 8), such as sending IDs and courtesy beeps. Although you can't control when the automatic macros get called, you can control what they do. Event triggers give you even more flexibility. They allow you to execute any of the built in commands or any of the macros whenever certain things happen. All you have to do is tell the controller what command you want to do when each event occurs with command 157. If you only want it to happen some of the time, you can just disable the event trigger with command 159. If you tell the event trigger to execute a macro, you may need to program the macro to do something (see Chapter 8). You should keep track of what command you assign each event trigger to execute, as you may need to know later.

If you want to execute more than one command from an event trigger, make the event trigger call a macro, then program the macro to execute each of the commands in turn. That way the event trigger calls only a single macro and the macro takes care of calling multiple other commands.

157: Set/Recall Event Trigger

This command allows the user to assign a macro or command call when an event occurs in order to get response or action to occur. These are useful for alarming, and interrogating events that occur.

<157> eee	Recall event trigger 'eee'
<157> eee ccc	Set event trigger 'eee' to execute command 'ccc'

Defaults:

- All events are enabled and most are set to call command 158 (the exceptions are noted in the event trigger listing later in this chapter)

Notes:

- When this command is used to set an event trigger, it automatically enables the event trigger.

158: Default Event Trigger Action

This command is very unusual. It should only be called from an event trigger, never directly or as part of a macro. In other words, the only use for this command is as the parameter ‘ccc’ in command 157. Whenever this command is executed, it looks to see which event trigger called it, and does something different for each one. The controller uses this method to reset timers, send messages and do a lot of other things that need to work “out of the box,” but which you might want to override and make do something different. To change what one of the event triggers does, use command 157 to make that event trigger call a macro rather than this command. Then program the macro to do something different than this command did for that event trigger. The things that this command will do when called from each event trigger may be noted in the event trigger listing later in this chapter.

<158>	Do the default action for the event trigger this was called from
-------	--

159: Enable/Disable Event Trigger

This command can be used to enable or disable one of the event triggers. If an event trigger is disabled, it will not do anything. When it is re-enabled, it will do whatever command it was previously set to do.

<159> eee 1	Enable event trigger ‘eee’
<159> eee 0	Disable event trigger ‘eee’

Event Table

000 - COR Active, Port 1	008 - COR Active, Port 9
001 - COR Active, Port 2	009 - COR Active, Port 10
002 - COR Active, Port 3	010 - COR Active, Port 11
003 - COR Active, Port 4	011 - COR Active, Port 12
004 - COR Active, Port 5	012 - COR Inactive, Port 1
005 - COR Active, Port 6	013 - COR Inactive, Port 2
006 - COR Active, Port 7	014 - COR Inactive, Port 3
007 - COR Active, Port 8	015 - COR Inactive, Port 4
	016 - COR Inactive, Port 5

017 - COR Inactive, Port 6	052 - Port Active, Port 5
018 - COR Inactive, Port 7	053 - Port Active, Port 6
019 - COR Inactive, Port 8	054 - Port Active, Port 7
020 - COR Inactive, Port 9	055 - Port Active, Port 8
021 - COR Inactive, Port 10	056 - Port Active, Port 9
022 - COR Inactive, Port 11	057 - Port Active, Port 10
023 - COR Inactive, Port 12	058 - Port Active, Port 11
024 - PL Active, Port 1	059 - Port Active, Port 12
025 - PL Active, Port 2	060 - Port Inactive, Port 1
026 - PL Active, Port 3	061 - Port Inactive, Port 2
027 - PL Active, Port 4	062 - Port Inactive, Port 3
028 - PL Active, Port 5	063 - Port Inactive, Port 4
029 - PL Active, Port 6	064 - Port Inactive, Port 5
030 - PL Active, Port 7	065 - Port Inactive, Port 6
031 - PL Active, Port 8	066 - Port Inactive, Port 7
032 - PL Active, Port 9	067 - Port Inactive, Port 8
033 - PL Active, Port 10	068 - Port Inactive, Port 9
034 - PL Active, Port 11	069 - Port Inactive, Port 10
035 - PL Active, Port 12	070 - Port Inactive, Port 11
036 - PL Inactive, Port 1	071 - Port Inactive, Port 12
037 - PL Inactive, Port 2	072 - Any Connected RX Active, Port 1
038 - PL Inactive, Port 3	073 - Any Connected RX Active, Port 2
039 - PL Inactive, Port 4	074 - Any Connected RX Active, Port 3
040 - PL Inactive, Port 5	075 - Any Connected RX Active, Port 4
041 - PL Inactive, Port 6	076 - Any Connected RX Active, Port 5
042 - PL Inactive, Port 7	077 - Any Connected RX Active, Port 6
043 - PL Inactive, Port 8	078 - Any Connected RX Active, Port 7
044 - PL Inactive, Port 9	079 - Any Connected RX Active, Port 8
045 - PL Inactive, Port 10	080 - Any Connected RX Active, Port 9
046 - PL Inactive, Port 11	081 - Any Connected RX Active, Port 10
047 - PL Inactive, Port 12	082 - Any Connected RX Active, Port 11
048 - Port Active, Port 1	083 - Any Connected RX Active, Port 12
049 - Port Active, Port 2	084 - All Connected RX Inactive, Port 1
050 - Port Active, Port 3	085 - All Connected RX Inactive, Port 2
051 - Port Active, Port 4	086 - All Connected RX Inactive, Port 3

087 - All Connected RX Inactive, Port 4	122 - Port 1 DTMF Active 2
088 - All Connected RX Inactive, Port 5	123 - Port 1 DTMF Active 3
089 - All Connected RX Inactive, Port 6	124 - Port 1 DTMF Active 4
090 - All Connected RX Inactive, Port 7	125 - Port 1 DTMF Active 5
091 - All Connected RX Inactive, Port 8	126 - Port 1 DTMF Active 6
092 - All Connected RX Inactive, Port 9	127 - Port 1 DTMF Active 7
093 - All Connected RX Inactive, Port 10	128 - Port 1 DTMF Active 8
094 - All Connected RX Inactive, Port 11	129 - Port 1 DTMF Active 9
095 - All Connected RX Inactive, Port 12	130 - Port 1 DTMF Active A
096 - Any DTMF Active, Port 1	131 - Port 1 DTMF Active B
097 - Any DTMF Active, Port 2	132 - Port 1 DTMF Active C
098 - Any DTMF Active, Port 3	133 - Port 1 DTMF Active D
099 - Any DTMF Active, Port 4	134 - Port 1 DTMF Active *
100 - Any DTMF Active, Port 5	135 - Port 1 DTMF Active #
101 - Any DTMF Active, Port 6	136 - Port 2 DTMF Active 0
102 - Any DTMF Active, Port 7	137 - Port 2 DTMF Active 1
103 - Any DTMF Active, Port 8	138 - Port 2 DTMF Active 2
104 - Any DTMF Active, Port 9	139 - Port 2 DTMF Active 3
105 - Any DTMF Active, Port 10	140 - Port 2 DTMF Active 4
106 - Any DTMF Active, Port 11	141 - Port 2 DTMF Active 5
107 - Any DTMF Active, Port 12	142 - Port 2 DTMF Active 6
108 - Any DTMF Inactive, Port 1	143 - Port 2 DTMF Active 7
109 - Any DTMF Inactive, Port 2	144 - Port 2 DTMF Active 8
110 - Any DTMF Inactive, Port 3	145 - Port 2 DTMF Active 9
111 - Any DTMF Inactive, Port 4	146 - Port 2 DTMF Active A
112 - Any DTMF Inactive, Port 5	147 - Port 2 DTMF Active B
113 - Any DTMF Inactive, Port 6	148 - Port 2 DTMF Active C
114 - Any DTMF Inactive, Port 7	149 - Port 2 DTMF Active D
115 - Any DTMF Inactive, Port 8	150 - Port 2 DTMF Active *
116 - Any DTMF Inactive, Port 9	151 - Port 2 DTMF Active #
117 - Any DTMF Inactive, Port 10	152 - Port 3 DTMF Active 0
118 - Any DTMF Inactive, Port 11	153 - Port 3 DTMF Active 1
119 - Any DTMF Inactive, Port 12	154 - Port 3 DTMF Active 2
120 - Port 1 DTMF Active 0	155 - Port 3 DTMF Active 3
121 - Port 1 DTMF Active 1	156 - Port 3 DTMF Active 4

157 - Port 3 DTMF Active 5	192 - Port 5 DTMF Active 8
158 - Port 3 DTMF Active 6	193 - Port 5 DTMF Active 9
159 - Port 3 DTMF Active 7	194 - Port 5 DTMF Active A
160 - Port 3 DTMF Active 8	195 - Port 5 DTMF Active B
161 - Port 3 DTMF Active 9	196 - Port 5 DTMF Active C
162 - Port 3 DTMF Active A	197 - Port 5 DTMF Active D
163 - Port 3 DTMF Active B	198 - Port 5 DTMF Active *
164 - Port 3 DTMF Active C	199 - Port 5 DTMF Active #
165 - Port 3 DTMF Active D	200 - Port 6 DTMF Active 0
166 - Port 3 DTMF Active *	201 - Port 6 DTMF Active 1
167 - Port 3 DTMF Active #	202 - Port 6 DTMF Active 2
168 - Port 4 DTMF Active 0	203 - Port 6 DTMF Active 3
169 - Port 4 DTMF Active 1	204 - Port 6 DTMF Active 4
170 - Port 4 DTMF Active 2	205 - Port 6 DTMF Active 5
171 - Port 4 DTMF Active 3	206 - Port 6 DTMF Active 6
172 - Port 4 DTMF Active 4	207 - Port 6 DTMF Active 7
173 - Port 4 DTMF Active 5	208 - Port 6 DTMF Active 8
174 - Port 4 DTMF Active 6	209 - Port 6 DTMF Active 9
175 - Port 4 DTMF Active 7	210 - Port 6 DTMF Active A
176 - Port 4 DTMF Active 8	211 - Port 6 DTMF Active B
177 - Port 4 DTMF Active 9	212 - Port 6 DTMF Active C
178 - Port 4 DTMF Active A	213 - Port 6 DTMF Active D
179 - Port 4 DTMF Active B	214 - Port 6 DTMF Active *
180 - Port 4 DTMF Active C	215 - Port 6 DTMF Active #
181 - Port 4 DTMF Active D	216 - Port 7 DTMF Active 0
182 - Port 4 DTMF Active *	217 - Port 7 DTMF Active 1
183 - Port 4 DTMF Active #	218 - Port 7 DTMF Active 2
184 - Port 5 DTMF Active 0	219 - Port 7 DTMF Active 3
185 - Port 5 DTMF Active 1	220 - Port 7 DTMF Active 4
186 - Port 5 DTMF Active 2	221 - Port 7 DTMF Active 5
187 - Port 5 DTMF Active 3	222 - Port 7 DTMF Active 6
188 - Port 5 DTMF Active 4	223 - Port 7 DTMF Active 7
189 - Port 5 DTMF Active 5	224 - Port 7 DTMF Active 8
190 - Port 5 DTMF Active 6	225 - Port 7 DTMF Active 9
191 - Port 5 DTMF Active 7	226 - Port 7 DTMF Active A

227 - Port 7 DTMF Active B	262 - Port 9 DTMF Active *
228 - Port 7 DTMF Active C	263 - Port 9 DTMF Active #
229 - Port 7 DTMF Active D	264 - Port 10 DTMF Active 0
230 - Port 7 DTMF Active *	265 - Port 10 DTMF Active 1
231 - Port 7 DTMF Active #	266 - Port 10 DTMF Active 2
232 - Port 8 DTMF Active 0	267 - Port 10 DTMF Active 3
233 - Port 8 DTMF Active 1	268 - Port 10 DTMF Active 4
234 - Port 8 DTMF Active 2	269 - Port 10 DTMF Active 5
235 - Port 8 DTMF Active 3	270 - Port 10 DTMF Active 6
236 - Port 8 DTMF Active 4	271 - Port 10 DTMF Active 7
237 - Port 8 DTMF Active 5	272 - Port 10 DTMF Active 8
238 - Port 8 DTMF Active 6	273 - Port 10 DTMF Active 9
239 - Port 8 DTMF Active 7	274 - Port 10 DTMF Active A
240 - Port 8 DTMF Active 8	275 - Port 10 DTMF Active B
241 - Port 8 DTMF Active 9	276 - Port 10 DTMF Active C
242 - Port 8 DTMF Active A	277 - Port 10 DTMF Active D
243 - Port 8 DTMF Active B	278 - Port 10 DTMF Active *
244 - Port 8 DTMF Active C	279 - Port 10 DTMF Active #
245 - Port 8 DTMF Active D	280 - Port 11 DTMF Active 0
246 - Port 8 DTMF Active *	281 - Port 11 DTMF Active 1
247 - Port 8 DTMF Active #	282 - Port 11 DTMF Active 2
248 - Port 9 DTMF Active 0	283 - Port 11 DTMF Active 3
249 - Port 9 DTMF Active 1	284 - Port 11 DTMF Active 4
250 - Port 9 DTMF Active 2	285 - Port 11 DTMF Active 5
251 - Port 9 DTMF Active 3	286 - Port 11 DTMF Active 6
252 - Port 9 DTMF Active 4	287 - Port 11 DTMF Active 7
253 - Port 9 DTMF Active 5	288 - Port 11 DTMF Active 8
254 - Port 9 DTMF Active 6	289 - Port 11 DTMF Active 9
255 - Port 9 DTMF Active 7	290 - Port 11 DTMF Active A
256 - Port 9 DTMF Active 8	291 - Port 11 DTMF Active B
257 - Port 9 DTMF Active 9	292 - Port 11 DTMF Active C
258 - Port 9 DTMF Active A	293 - Port 11 DTMF Active D
259 - Port 9 DTMF Active B	294 - Port 11 DTMF Active *
260 - Port 9 DTMF Active C	295 - Port 11 DTMF Active #
261 - Port 9 DTMF Active D	296 - Port 12 DTMF Active 0

- 297 - Port 12 DTMF Active 1
- 298 - Port 12 DTMF Active 2
- 299 - Port 12 DTMF Active 3
- 300 - Port 12 DTMF Active 4
- 301 - Port 12 DTMF Active 5
- 302 - Port 12 DTMF Active 6
- 303 - Port 12 DTMF Active 7
- 304 - Port 12 DTMF Active 8
- 305 - Port 12 DTMF Active 9
- 306 - Port 12 DTMF Active A
- 307 - Port 12 DTMF Active B
- 308 - Port 12 DTMF Active C
- 309 - Port 12 DTMF Active D
- 310 - Port 12 DTMF Active *
- 311 - Port 12 DTMF Active #
- 312 - Tried to hang up patch when was already hung up.
- 313 - Before turn HF mode on
- 314 - After turn HF mode off
- 315 - HF Band 160m
- 316 - HF Band 80m
- 317 - HF Band 40m
- 318 - HF Band 30m
- 319 - HF Band 20m
- 320 - HF Band 17m
- 321 - HF Band 15m
- 322 - HF Band 12m
- 323 - HF Band 10m below 29MHz
- 324 - HF Band 10m above 29MHz
- 325 - HF Band 6m
- 326 - HF Band 2m
- 327 - HF Band 125cm
- 328 - HF Band 70cm
- 329 - HF Band 33cm
- 330 - HF Band 23cm
- 331 - HF Band Other
- 332 - Pre Patch Off Hook
- 333 - Pre Patch On Hook.
- 334 - Reverse Patch Answered - default audio routing is to the autopatch port.
- 335- Reverse Patch Password OK - makes command 158 speak "Control"
- 336 - Command Entered from Reverse Patch - Makes command 158 reset patch time-out timer.
- 337 - 30 seconds until patch time-out - doesn't make command 158 do anything.
- 338 - 20 seconds until patch time-out - doesn't make command 158 do anything.
- 339 - 10 seconds until patch time-out - doesn't make command 158 do anything.
- 340 - Patch Dialing Cover Tone - makes command 158 send a cover tone while dialing a number.
- 341 - Mode 1 Connect - Someone answered reverse patch while ringing in mode 1.
- 342 - Mode 2 Connect - Someone answered directed reverse patch.
- 343 - Repeat Dial Message - happens when command 129 is used. Speaks "Repeat Dial".
- 344 - Nothing to Re-Dial Message - happens when command 129 is used.
- 345 - Call Aborted Message - Hang up patch before dial forward completed. Speaks "Cancel call." Must be programmed to execute command 158.
- 346 - Dial Timer Expired, Port 1
- 347 - Dial Timer Expired, Port 2
- 348 - Dial Timer Expired, Port 3
- 349 - Dial Timer Expired, Port 4
- 350 - Dial Timer Expired, Port 5
- 351 - Dial Timer Expired, Port 6
- 352 - Dial Timer Expired, Port 7
- 353 - Dial Timer Expired, Port 8
- 354 - Dial Timer Expired, Port 9

355 - Dial Timer Expired, Port 10
356 - Dial Timer Expired, Port 11
357 - Dial Timer Expired, Port 12
358 - PTT Active, Port 1
359 - PTT Active, Port 2
360 - PTT Active, Port 3
361 - PTT Active, Port 4
362 - PTT Active, Port 5
363 - PTT Active, Port 6
364 - PTT Active, Port 7
365 - PTT Active, Port 8
366 - PTT Active, Port 9
367 - PTT Active, Port 10
368 - PTT Active, Port 11

369 - PTT Active, Port 12
370 - PTT Inactive, Port 1
371 - PTT Inactive, Port 2
372 - PTT Inactive, Port 3
373 - PTT Inactive, Port 4
374 - PTT Inactive, Port 5
375 - PTT Inactive, Port 6
376 - PTT Inactive, Port 7
377 - PTT Inactive, Port 8
378 - PTT Inactive, Port 9
379 - PTT Inactive, Port 10
380 - PTT Inactive, Port 11
381 - PTT Inactive, Port 12

Notes about the Event Triggers:

Tail Messages: There are three tail messages assigned to each transmitter. They can be used to indicate that you are on battery power, that a link is up, to announce club meetings, etc. If you transmit PL from your repeater, you may want to consider turning the PL encoder off and sending a CW pause from a tail message to make your PL go away before the repeater actually drops (you could turn the PL encoder back on from the "any connected receiver active" event trigger). You can enable any one, two, or all three tail messages at the same time. The controller will send them in order after the courtesy beep (if on a repeater) and hang time are over. They will normally be the last thing sent before the transmitter drops (the mini-hang time is all that happens afterward). To keep them from getting too annoying, they will be sent no more often than the duration of the tail message timers (see Chapter 4), which defaults to 5 minutes. If you set the tail message timers to 0, they will be sent every time the transmitter drops. If you key up while a tail message is being sent, it will start the cycle over again; that is the tail message will be sent again after you unkey, and the courtesy beep and hang timer are done.

Chapter 21: Remote Base Control

224: Set Port Destination Info

<224> pp	Recall Settings for port 'pp'.
<224> pp ['c']['x..x']	Apply sub-command 'c' with parameters 'x..x' to port 'pp'.

Parameters:

- 'pp' is the port to set/recall.
- 'c' is the sub-command to perform. (see chart below)
- 'x..x' is additional data required by the sub-command.

Sub-command Chart	
Command Description	Function
<0> 'x'	Select resource type for port 'pp'. 0 = Not controllable 1 = Tait radio
<1> 'x..x'	Select destination for port 'pp'. 'x..x' = port destination. Can be 1..3 digits.

Examples:

- 224 01 - recall settings for port 01.
- 224 01 0 1 - enable channel selection for port 01.
- 224 01 1 24 - select channel 24 on port 01.

225: Set Destination Info

<225> 'ddd'	recall settings for destination 'ddd'.
<225> 'ddd' ['c' [x..x]]	apply command 'c' to destination 'ddd'.

Parameters:

- 'ddd' is the destination to set/recall.
- 'c' is the sub-command to execute. (see chart below)
- 'x..x' is any additional information required by the sub-command.

Sub-command Chart	
Command Description	Function
<0> 'x'	Set destination type to type 'x'. 0 = empty 1 = channel 2 = direct-freq-control
<1> 'x..x'	Set destination description to 'x..x'.
<2> 'set_of_ports'	Set of ports for which destination 'ddd' is enabled. Formatting for 'set_of_ports' is as follows: "a,b,c,d,e" (include quotations)
<3> 'DDD' 'set_of_ports'	Set of ports for which destinations 'ddd' <i>through</i> 'DDD' are enabled. Formatting for 'set_of_ports' is as follows: "a,b,c,d,e" (include quotations)

Examples:

- 225 005 - recall settings for destination 005.
- 225 005 0 1 - set destination 005 type to channel.
- 225 005 1 NOAA Weather - set destination 005 description to "NOAAWEATHER"
- 225 005 2 "1-5,8" - set the ports for which destination 005 is enabled to 1,2,3,4,5, and 8.
- 225 005 3 009 "1,2,3,5" - set the ports for which destinations 005 through 009 are enabled to 1,2,3, and 5.

226: Set Destination Radio Channel T Info

<code><226> 'ddd'</code> <code>0 'x..x'</code>	set the radio channel number 'x..x' for the destination 'ddd'.
---	---

Parameters:

- 'ddd' is the destination to set.
- 0 is sub-command that sets radio channel number 'x..x' for destination 'ddd'.
- 'x..x' is the radio channel number for destination 'ddd'. (defaults to 1)

227: *Set Destination Radio Freq T Info*

<227> 'ddd' ['c' [x..x]]	set destination frequency option 'c' for destination 'ddd'.
-----------------------------	--

Parameters:

- 'ddd' is the destination to set.
- 'c' is sub-command. (see chart below)
- 'x..x' is additional info required by the sub-command.

Sub-command Chart	
Command Description	Function
<0> 'xxx.yyyzzz'	Set RX frequency to MHz.KhzHzz Use '.' or '*' for decimal point. If no point entered, number is considered MHz.
<1> 'xxx.yyyzzz'	Set RX frequency to MHz.KhzHzz Use '.' or '*' for decimal point. If no point entered, number is considered MHz.
<3> 'x'	Set bandwidth 'x'. 0 = 12.5Khz (narrow, use with FRS) 1 = 20Khz (medium) 2 = 25Khz (wide - default)
<4> 'x'	Set power level 'x'. 0 = very low power 1 = low power 2 = medium power 3 = high power
<5> 'x'	Sub-audible signal settings. 0 = sub-audible signaling disabled. (no CTCSS, DCS, etc) 1 = enable CTCSS 2 = enable DCS
<6> 'x'	Sub-audible tx/rx settings to 'x'. 0 = use sub-audible signaling (if enabled) for RX only. 1 = use sub-audible signaling (if enabled) for TX only. 2 = use sub-audible signaling (if enabled) for RX and TX.
<7> 'x..x'	Set CTCSS frequency to 'x..x' Currently lets you set to any 1/10Hz frequency. Example Freq: "103.5"

<8> 'ccc'	Set DCS code 'ccc'. If code is less than 3 digits, leading zeros will be added.
-----------	---

229: Set Destination Info by Persist Format

<229>	set the radio channel number 'x..x' for the destination 'ddd'.
-------	--

Parameters:

- 'ddd' is the destination to set.
- 0 is sub-command that sets radio channel number 'x..x' for destination 'ddd'.
- 'x..x' is the radio channel number for destination 'ddd'. (defaults to 1)

235: Set Destination With Send Page Macro T Info

<235> 'ddd' ['c'['x..x]]	sets up page macro info for destination 'ddd'.
-----------------------------	--

Parameters:

- 'ddd' is the destination to modify.
- 'c' is the sub-command to execute. (see table below)
- 'x..x' is additional data required by the sub-command.

Sub-command Chart	
Command Description	Function
<0>	Erases the page macro.
<1> 'ccc' 'd..d'	Append command 'ccc' with arguments 'd..d' to the page macro.
<2> 'ffff' 'dddd' [pppp]	Append macro to send tone with frequency 'ffff', duration 'dddd' milliseconds, and then pause for 'pppp' milliseconds. Pause defaults to zero if not specified.
<7> [hhhh]	After sending each page, add a hangtime for 'hhhh' milliseconds to every place the page was send except the console.
<8> 'set_of_ports'	send the page hang to 'set_of_ports'. the destination number is ignored. see example of sub-command 9 for format.
<9> 'set_of_ports'	send the page to 'set_of_ports'. see example for format.

Examples:

- 235 003 - recall settings for destination 003.
- 235 003 0 - erase the page macro for destination 003.
- 235 003 1 030 00 01 02 - append command 030 with args '00 01 02' to page macro.
- 235 003 2 0850 0500 0000 - append the paging macro tone of 850Hz for 500ms followed by a 0ms pause.
- 235 003 9 1-3,5 - send the page to transmitters 1,2,3,5.

Chapter 22: Windows(TM) Remote Control Interface GUI Commands

201: Set Up Network

This command sets the IP Address, netmask and gateway.

<201> w	Enable/Disable Network, Select Action
<201> w aaa.aaa.aaa.aaa	Set IP/Netmask/Gateway

Parameters:

- 'w' is the action to perform.
 - '0' to disable network
 - '1' to enable network
 - '2' to set IP address (requires address)
 - '3' to set Netmask (requires address)
 - '4' to set Gateway (requires address)
 - '5' to disable DHCP
 - '6' to enable DHCP
- 'aaa.aaa.aaa.aaa' is the IP Address if required.

Examples:

- 201 0 - Disable Network
- 201 1 - Enable Network
- 201 2 192.168.0.182 - Set IP Address to "192.168.0.182"
- 201 3 255.255.255.0 - Set Netmask to "255.255.255.0"
- 201 4 192.168.0.1 - Set Gateway to "192.168.0.1"
- 201 5 - Disable DHCP
- 201 6 - Enable DHCP

204: Set Radio Name

<204>	recall the name of all ports.
<204> pp "..."	set name of port 'pp' to "..."

Parameters:

- pp is the port number to recall or set
- "..." is the name to tie to the port number.

Examples:

- 204 - Recall the name of all ports.
- 204 02 HT/MTXc - Set name for port 02 to "HT/MTXc"

208: Set Console PTT

<208> pp 'e'	Set PTT for port number 'pp' e
<208> pp 'e' 'ttt'	Set PTT for port number 'pp' e and start timer 'ttt'.

Parameters:

- pp is the port number to recall or set
- 'e' enables or disables ptt for port pp (0 = disable, 1 = enable)
- 'ttt' is the start time of the PTT timer.

Examples:

- 208 - Recall the name of all ports.
- 208 02 HT/MTXc - Set name for port 02 to "HT/MTXc"

214: Set Remote Logging

<214> 'r'	enable/disable remote logging.
-----------	--------------------------------

Parameters:

- 'r' enables/disables remote logging for the connection this command was received from.
 - 0 - Disable Remote Logging
 - 1 - Enable Remote Logging

Example:

- 214 0 - Disable Remote Logging.
- 214 1 - Enable Remote Logging.

215: Update Remote Data

<215>	update remote data
-------	--------------------

Example:

- 215 - updates remote data.

222: Streaming Audio Configuration

<222> pp [c [aaa]	Applies sub-command 'c' and address 'aaa' to port 'pp'.
----------------------	--

Parameters:

- 'pp' is the group to setup.
- 'c' is the sub-command to use.
 - 0 = disable streaming.
 - 1 = enable streaming.
 - 2 = set voip streaming address (requires variable 'aaa'; see below).
- 'aaa' is additional data needed for the sub-command, in this case, an address in format "aaa . aaa . aaa . aaa"

Example:

- | | |
|-----------------------|--|
| 222 02 0 | - Disable streaming for port 'pp'. |
| 222 02 1 | - Enable streaming for port 'pp'. |
| 222 02 2 192.168.0.33 | - Set streaming address for port 'pp' to 192.168.0.33. |

223: Request Remote CRC

<223>	request remote crc.
-------	---------------------

Example:

- 223 - request remote crc.

237: Set Radio Description

<237> pp "d..d"	Sets description of port 'pp' to "d..d"
--------------------	--

Parameters:

- 'pp' is the port to accept description.
- 'd..d' is the port description to be applied to port 'pp'.

Example:

- 237 01 FIRSTPORT - set description of port 01 to "FIRSTPORT".

238: Set Password Settings

<238>	Recall user permissions and passwords.
<238> 1	<new user password>
<238> 2	<new admin password>
<238> 3	<new user permission set>
<238> 4	<new admin permission set>

Examples:

- 238 - recall all permissions.
- 238 1 "user password" - set user password to "user password".
- 238 2 "admin password" - set admin password to "admin password"..
- 238 3 0x001E - new user permission set 0x001E.
- 238 4 0x7FE0 - new admin permission set 0x7FE0.

219: Set Group Name

<222>	recall the names of all groups.
<222> 'ggg' "..."	set name of group 'ggg' to "..."

Parameters:

- 'ggg' is the group to setup.
- "..." is the group name to use.

Example:

219 002 HT/MTXc - set the name of user group 2 to "HT/MTXc"

Appendix A: The Audio Routing Variable System

Explanation of the System

The key to controlling messages on the RLC-DSP404 is understanding what the audio routing variable needs to be in each different situation. Fortunately, the RLC-DSP404 does most of the work for you. When any command is executed by the user (either by DTMF or the serial port) or by the controller itself (to send an ID, courtesy beep, etc.), the audio routing variable is automatically set to send the audio to the logical place. You only need to concern yourself with this information if you wish to change the way the audio is routed. The value of the audio routing variable in several situations is listed below:

- When a command is executed by DTMF, the audio routing variable is set to send all of the responses to the port that the DTMF input came from.
- Before a time out, time out clear, or any ID macro is executed, the audio routing variable is set to send the message to the relevant port.
- Before a courtesy beep is sent, the audio routing variable is set to send the beeps to the right ports (repeater ports connected to the receiver that just unkeyed).

You probably noticed in the list above that the audio routing variable automatically sends the audio where you would normally want it to go. The only reason you need to know about it is because there are a few situations where the controller can not know correct audio routing.

Suppose, for example, that you want the scheduler to cause the time to be read at the top of every hour. How could the controller know that you want only ports 1 and 2 to hear the message? It can't. There are two ways for you to specify where messages from the scheduler go. First, choose where you want most of the messages caused by the scheduler to go. Tell the controller what ports those are with Command 050. Now all of the messages caused by the scheduler will go out those ports. What if you want one of the messages caused by the scheduler to go somewhere else? Simply make the scheduler call a user macro and program the first command in the macro to be Command 037 D or unkey and list the ports where you want the message to go to. This will change the audio routing variable for the rest of the commands in the macro. Command 037 can be used to change where the messages generated by any macro will go. All commands executed after Command 037 in a macro until the end of that macro will go to the ports specified with Command 037.

A similar situation exists for commands entered from the serial port. Since the controller sends serial responses to the commands that you execute, you don't have to worry about voice responses if you don't want to. There are times, however, when you want to hear the voice messages that are generated. You can use Command 050 to specify which ports get the audio that is caused by the serial port. The RLC-DSP404 defaults to sending these messages out of port one, but you can send them to any ports you

want to, or to no ports at all.

Suppressing Command Responses in Macros:

There is one other time when you will often want to change the audio routing variable. Suppose that you have programmed macro 600 to connect the main repeater on port 1 to port 2 (a link in this example). Your macro would probably contain command "000 12". The voice response from that command would be "1 connect 2 on". To replace that voice response with "link on" (word numbers 292 and 358), do the following:

Insert Command 038 (suppress audio) as the first command in the macro:

Command 059 600 00 038 D or unkey or <Enter>

If you executed the macro at this point, it would be silent.

Insert the new voice message even before that:

Command 059 600 00 036 292 358 D or unkey or <Enter>

Now the macro will do the following:

- Speak the voice message "link on" (command number 036)
- Suppress the audio (set the audio routing variable to no ports, command number 038)
- Connect ports 1 and 2 (throws the voice responses away)
- Connect ports 1 and 4 (throws the voice responses away)

So a template for making macros that have a customized voice response could be:

055 600 ;	make sure macro is empty
056 600 036 <word numbers> ;	send voice response
056 600 038 ;	be quiet for rest of this macro
056 600 <do other stuff here>	

The same process can be used to suppress or change the voice response from any macro. Any commands that are executed after Command 038 in a macro will be silent.

Appendix B: Voice Word Table

Romeo's words (words 000..543):

These words make up the main vocabulary of the controller. They are arranged with the numbers first, then the alphabet, then alphabetically.

Prefixes and Suffixes (words 544..552):

These are really parts of words. They can be used in combination with other words to make some new words. For example, you can use words 311 and 549 together to form the word "meetings".

Juliet's words (words 553..586):

These are used primarily for time and date. They are not intended to allow you to run the whole controller with the female voice.

Pause (word 587):

Word 587 is listed as "pause". It causes the voice to pause for a moment, such as between sentences. It does not speak the word "pause". It can be used in combination with any of the other words.

Sound Effects (words 588..598):

Try them!!!

Junior's words (599..685):

Romeo quit the recording business, so we had to get Junior to record some other words for us. Some words were recorded by both Romeo and Junior, so you might want to check both places in the word list. It usually sounds best if you don't mix words from the two lists in one message, but sometimes that is the only way to get the words you want.

Variable words (810..919):

Most of these words allow you to insert a message that is not always the same into a voice message, such

as the current time. If you want to include the time in one of your IDs, for example, you could just include word 810 in the ID message. "At <the time>, this-is the XXXXX repeater" would be word numbers 086, 810, 480, 475, 054, 054, 054, 054, 054, 411. These words make it easy to write custom messages that read the time, date, I/O lines, etc.

Word List:

Romeo's Words

000 ZERO	025 SEVENTY	052 V
001 ONE	026 EIGHTY	053 W
002 TWO	027 NINETY	054 X
003 THREE	028 HUNDRED	055 Y
004 FOUR	029 THOUSAND	056 Z
005 FIVE	030 MILLION	057 ABORT
006 SIX	031 A	058 ABOUT
007 SEVEN	032 B	059 ABOVE
008 EIGHT	033 C	060 ACKNOWLEDGE
009 NINE	034 D	061 ACTION
010 TEN	035 E	062 ADJUST
011 ELEVEN	036 F	063 ADVANCED
012 TWELVE	037 G	064 ADVISE
013 THIRTEEN	038 H	065 AERIAL
014 FOURTEEN	039 I	066 AFFIRMATIVE
015 FIFTEEN	040 J	067 AIR
016 SIXTEEN	041 K	068 AIRPORT
017 SEVENTEEN	042 L	069 AKRON
018 EIGHTEEN	043 M	070 ALERT
019 NINETEEN	044 N	071 ALL
020 TWENTY	045 O	072 ALOFT
021 THIRTY	046 P	073 ALPHA
022 FORTY	047 Q	074 ALTERNATE
023 FIFTY	048 R	075 ALTITUDE
024 SIXTY	049 S	076 AMATEUR
	050 T	077 AMPS
	051 U	078 AND

079 ANSWER	114 CALIBRATE	149 CURRENT
080 APPROACH	115 CALL	150 CUYAHOGA FALLS
081 APRIL	116 CALLING	151 CYCLE
082 AREA	117 CALM	152 DALLAS
083 ARRIVAL	118 CANCEL	153 DANGER
084 AS	119 CAUTION	154 DATE
085 ASSOCIATION	120 CEILING	155 DAY
086 AT	121 CELSIUS	156 DAYS
087 AUGUST	122 CENTER	157 DAYTON
088 AUTO	123 CHANGE	158 DECEMBER
089 AUTOMATIC	124 CHARLIE	159 DECREASE
090 AUTOPILOT	125 CHECK	160 DECREASING
091 AUXILIARY	126 CIRCUIT	161 DEGREES
092 AVON	127 CLEAR	162 DELTA
093 AVON MOUNTAIN	128 CLIMB	163 DEPARTURE
094 A.M.	129 CLOCK	164 DEVICE
095 BAND	130 CLOSED	165 DIAL
096 BANK	131 CLUB	166 DINNER
097 BASE	132 CODE	167 DIRECTION
098 BATTERY	133 COLUMBUS	168 DISPLAY
099 BELOW	134 COME	169 DIVIDED
100 BETWEEN	135 COMPLETE	170 DOOR
101 BLOWING	136 COMPUTER	171 DOWN
102 BLUE KNOB	137 CONDITION	172 DOWNWIND
103 BOARD	138 CONGRATULATIONS	173 DRIVE
104 BOOST	139 CONNECT	174 DRIZZLE
105 BOZO	140 CONNECTICUT	175 DUST
106 BRAKE	141 CONTACT	176 EAST
107 BRAVO	142 CONTROL	177 ECHO
108 BREAK	143 CONVERGING	178 ELECTRICIAN
109 BROKEN	144 COSHOCTON	179 ELEVATION
110 BUSY	145 COUNT	180 EMERGENCY
111 BUTTON	146 COURSE	181 ENGINE
112 BY	147 CRANE	182 ENTER
113 CABIN	148 CROSSWIND	183 EQUAL

184 EQUALS	219 GATE	254 IGNITE
185 ERROR	220 GAUGE	255 IGNITION
186 ESTIMATED	221 GEAR	256 IMMEDIATELY
187 EVACUATE	222 GET	257 IN
188 EVACUATION	223 GLIDE	258 INBOUND
189 EXIT	224 GO	259 INCH
190 EXPECT	225 GOLF	260 INCREASE
191 FAIL	226 GOODBYE	261 INCREASING
192 FAILURE	227 GREEN	262 INCREASINGTO
193 FARAD	228 GREENWICH	263 INDIA
194 FAHRENHEIT	229 GROUND	264 INDICATED
195 FARMINGTON	230 GURNEE	265 INFLIGHT
196 FAST	231 GUSTINGTO	266 INFORMATION
197 FEBRUARY	232 HAIL	267 INNER
198 FEET	233 HALF	268 INSPECTOR
199 FILED	234 HAM	269 INTRUDER
200 FINAL	235 HAMFEST	270 IS
201 FINDLAY	236 HAMVENTION	271 IT
202 FIRE	237 HAVE	272 JANUARY
203 FIRST	238 HAZARDOUS	273 JULIET
204 FLAPS	239 HAZE	274 JULY
205 FLIGHT	240 HEAVY	275 JUNE
206 FLOW	241 HELLO	276 KENTUCKY
207 FOG	242 HELP	277 KEY
208 FOR	243 HENRY	278 KILO
209 FOURTH	244 HERTZ	279 KNOTS
210 FOXTROT	245 HIGH	280 LAND
211 FREEDOM	246 HOLD	281 LANDING
212 FREEZING	247 HOME	282 LATE
213 FREQUENCY	248 HOTEL	283 LAUNCH
214 FRIDAY	249 HOUR	284 LEAN
215 FROM	250 HOURS	285 LEFT
216 FRONT	251 ICE	286 LEG
217 FULL	252 ICING	287 LESS THAN
218 GALLONS	253 IDENTIFY	288 LEVEL

289 LIGHT	324 MODERATE	359 OPEN
290 LIMA	325 MONDAY	360 OPERATION
291 LINE	326 MONTH	361 OPERATOR
292 LINK	327 MORETHAN	362 OSCAR
293 LIST	328 MOTOR	363 OTHER
294 LITTON	329 MOUNT HAMILTON	364 OUT
295 LOCK	330 MOUNT TAMALPAIS	365 OUTER
296 LONG	331 MOVE	366 OVER
297 LOOK	332 MOVING	367 OVERCAST
298 LOW	333 MUCH	368 PAPA
299 LOWER	334 NEAR	369 PARTIALLY
300 LUNCH	335 NEGATIVE	370 PASS
301 MACHINE	336 NET	371 PASSED
302 MAINTAIN	337 NEW	372 PATCH
303 MANUAL	338 NEWINGTON	373 PATH
304 MARCH	339 NEW HAVEN	374 PELLETS
305 MARKER	340 NEXT	375 PER
306 MAY	341 NIGHT	376 PERCENT
307 MAYDAY	342 NO	377 PHONE
308 ME	343 NORTH	378 PICO
309 MEAN	344 NORTHEAST	379 PLEASE
310 MEASURE	345 NORTHWEST	380 PLUS
311 MEETING	346 NOT	381 POINT
312 MEGA	347 NOVEMBER	382 POLICE
313 MESSAGES	348 NUMBER	383 POSITION
314 METER	349 OAKS	384 POWER
315 MICRO	350 OBSCURED	385 PRACTICE
316 MIKE	351 O'CLOCK	386 PRESS
317 MILES	352 OCTOBER	387 PRESSURE
318 MILL	353 OF	388 PRIVATE
319 MILLI	354 OFF	389 PROBE
320 MINUS	355 OHIO	390 PROGRAMMING
321 MINUTES	356 OHMS	391 PULL
322 MIST	357 OIL	392 PUSH
323 MOBILE	358 ON	393 P.M.

394 QUEBEC	428 SECOND	463 TANK
395 RADAR	429 SECONDS	464 TARGET
396 RADIO	430 SECURITY	465 TARPON SPRINGS
397 RAIN	431 SELECT	466 TAXI
398 RAISE	432 SEPTEMBER	467 TEEN
399 RANGE	433 SEQUENCE	468 TELEPHONE
400 RATE	434 SERVICE	469 TEMPERATURE
401 RATTLESNAKE	435 SET	470 TERMINAL
MOUNTAIN	436 SEVERE	471 TEST
402 READY	437 SEXY	472 THANK YOU
403 REAR	438 SHORT	473 THAT
404 RECEIVE	439 SHOWERS	474 THE (LONG E)
405 RED	440 SHUT	475 THE (SHORT E)
406 RELEASE	441 SIDE	476 THE
407 REMARK	442 SIERRA	477 THIN
408 REMOTE	443 SIGHT	478 THINLY
409 REPAIR	444 SLEET	479 THIRD
410 REPEAT	445 SLOPE	480 THIS IS
411 REPEATER	446 SLOW	481 THIS
412 RICH	447 SMOKE	482 THUNDERSTORMS
413 RICHMOND	448 SNOW	483 THURSDAY
414 RIG	449 SOUTH	484 TIME
415 RIGHT	450 SOUTHEAST	485 TIMER
416 ROAD	451 SOUTHWEST	486 TIMES
417 ROGER	452 SPEED	487 TO
418 ROMEO	453 SPRAY	488 TODAY
419 ROUTE	454 SQUAWK	489 TOMORROW
420 RUNWAY	455 STALL	490 TONIGHT
421 SAFE	456 START	491 TOOL
422 SAINT PETERSBURG	457 STOP	492 TORNADO
423 SAND	458 STORM	493 TORONTO
424 SANTA CLARA	459 SUNDAY	494 TOUCHDOWN
425 SAN LEANDRO	460 SWITCH	495 TOWER
426 SATURDAY	461 SYSTEM	496 TRAFFIC
427 SCATTERED	462 TANGO	497 TRANSMIT

498 TRIM
 499 TUESDAY
 500 TURBULANCE
 501 TURN
 502 UNDER
 503 UNIFORM
 504 UNIT
 505 UNLIMITED
 506 UNTIL
 507 UP
 508 USE (NOUN)
 509 USE (VERB)
 510 VALLEY
 511 VALVE
 512 VARIABLE
 513 VERIFY
 514 VICTOR
 515 VISIBILITY
 516 VOLTS
 517 WAIT
 518 WAKE
 519 WAKEUP
 520 WARNING
 521 WATCH
 522 WATTS
 523 WAY
 524 WEATHER
 525 WEDNESDAY
 526 WELCOME
 527 WEST
 528 WEST HARTFORD
 529 WHISKEY
 530 WILL
 531 WIND
 532 WISKEY

533 WITH
 534 WRONG
 535 X-RAY
 536 YANKEE
 537 YELLOW
 538 YESTERDAY
 539 YOU
 540 YOUR
 541 ZED
 542 ZONE
 543 ZULU

Prefixes and Suffixes

544 FIF-
 545 THIR-
 546 -ED
 547 -ER
 548 -ING
 549 -S
 550 -TEEN
 551 -TH
 552 -TY

Juliet's Words

553 OH
 554 ONE
 555 TWO
 556 THREE
 557 FOUR
 558 FIVE
 559 SIX
 560 SEVEN
 561 EIGHT

562 NINE
 563 TEN
 564 ELEVEN
 565 TWELVE
 566 THIRTEEN
 567 FOURTEEN
 568 FIFTEEN
 569 SIXTEEN
 570 SEVENTEEN
 571 EIGHTEEN
 572 NINETEEN
 573 TWENTY
 574 THIRTY
 575 FORTY
 576 FIFTY
 577 GOOD
 578 MORNING
 579 AFTERNOON
 580 EVENING
 581 THE
 582 TIME
 583 IS
 584 A.M.
 585 P.M.
 586 O'CLOCK

Pause

587 PAUSE

Sound Effects

588 LASER
 589 WHISTLE
 590 PHASER

591 TRAIN
 592 EXP
 593 CROWD
 594 TIC
 595 TOC
 596 HIGH-LOW TONE
 597 LOW-HIGH TONE
 598 HIGH TONE

Junior's Words

599 ALARM
 600 AMATEUR
 601 ANALOG
 602 ARIZONA
 603 AUTOPATCH
 604 BACHELOR
 605 BAD
 606 BASE
 607 BATTERY
 608 BAY
 609 BILLINGS
 610 BOZEMAN
 611 CANOE
 612 CAPROCK
 613 CENTRAL
 614 CHARGING
 615 CLOUDS
 616 CLUB
 617 COMMUNICATIONS
 618 CONTROLLER
 619 DIGITAL
 620 EMPIRE
 621 EVENT
 622 FIELD

623 FLASH
 624 FLOOD
 625 FRIENDLY
 626 GOLDEN
 627 GREYCLIFF
 628 HAM
 629 HAMFEST
 630 HARRISON
 631 HOLLEY
 632 HOME
 633 INFORMATION
 634 INLAND
 635 INPUT
 636 INSIDE
 637 KOOTENAI
 638 LINK
 639 LITTLEROCK
 640 MEDIUM
 641 MEETING
 642 MICA
 643 MONITOR
 644 MOUNTAIN
 645 NET
 646 OBED
 647 OREGON
 648 OUTSIDE
 649 PEAK
 650 POUND
 651 PUMP
 652 PYRAMID
 653 RACES
 654 RADIO
 655 RATTLESNAKE
 656 REMOTE
 657 REPEATER

658 RIDGE
 659 SANDRA
 660 SCAN
 661 SIDNEY
 662 SKYWARN
 663 SOCIETY
 664 SPOKANE
 665 STAR
 666 STATE
 667 SUNDANCE
 668 SYSTEM
 669 TACOMA
 670 THIS
 671 TIGER
 672 TODAY
 673 TOMORROW
 674 TONIGHT
 675 VALUE
 676 VOLTAGE
 677 WASHINGTON
 678 WATCH
 679 WATER
 680 WELCOME
 681 WITH
 682 YAKIMA
 683 YELLOWHEAD
 684 YELLOWKNIFE
 685 ZED

Internal Variable Words (don't use these)

800 UNUSED
 801 START POLITE
 802 END POLITE
 803 END POLITE DO CMD

804 DO DELAYED DIAL
805 START DVR TIMER

User Variable Words

810 TIME
811 HOUR (12 hr)
812 HOUR (24 hr)
813 MINUTE OF HOUR
814 AM/PM
815 DATE
816 MONTH OF YEAR
817 DAY OF MONTH
818 YEAR
819 DAY OF WEEK
830 TIME (FEMALE)
831 HOUR,F (12 hr)
832 HOUR,F (24 hr)
833 MINUTE,F
834 AM/PM (FEMALE)
835 MRN/AFT/EVE, F

Special Word Pairs:

Most of the following words need to be followed by another word number that specifies which one to do: which analog line to read, which command to execute, which time zone to use, etc. For example, to read analog 5 as an S-meter, you would want to speak word 861 followed by word 005.

840 xxx - read analog
001..016

841 xxx - analog 001..016
high value

842 xxx - analog 001..016
high time

843 xxx - analog 001..016
low value

844 xxx - analog 001..016
low time

848 xxx - read analog 1..16 as S-Meter. To obtain a current reading, must use an event trigger to clear the high value each time the COR goes active. For example "157 000 500" followed by "053 500 038" and "056 500 160 15" will reset the high value for analog line 1 whenever the COR for port 1 goes active.

849 xxx - read analog line as a Direction: N, NE, E, SE, S, etc.

850 xxx - execute command xxx (up to command 900 or so, may not go all the way to 999). Will not happen until this word is actually spoken.

851 xxx - speak 24 hour time in male voice adding xxx hours. Can use to speak the time for any time zone.

852 xxx - same as above in female voice

853 xxx - callsign of user xxx (as set with cmd 191)

854 xxx - callsign of user logged onto port xxx

855 ~~xxx~~ - callsign of user being paged with command 132

Appendix C: CW Code Table

CW	XX	.	CW	XX	.	CW	XX	.	CW	XX	.	CW	XX
0	00	.	A	10	.	K	20	.	U	30	.	SPACE	40
1	01	.	B	11	.	L	21	.	V	31	.	PAUSE	41
2	02	.	C	12	.	M	22	.	W	32	.		
3	03	.	D	13	.	N	23	.	X	33	.		43
4	04	.	E	14	.	O	24	.	Y	34	.		
5	05	.	F	15	.	P	25	.	Z	35	.		
6	06	.	G	16	.	Q	26	.	/	36	.		
7	07	.	H	17	.	R	27	.	0	37	.		
8	08	.	I	18	.	S	28	.	?	38	.		
9	09	.	J	19	.	T	29	.	AR	39	.		

Note: Sending the “CW” character 42, 43 or 44 actually plays one of the internal DVR messages.

Appendix D: Reset and Initialization

The terms "reset" and "initialization" refer to totally different things on the RLC-DSP404. The controller is "reset" when any of the following things happen:

- the power is turned off and back on
- the reset button on the motherboard is pressed and released
- Command 035 is executed

Resetting the controller does not cause you to lose any of your programming. It does restart all of the timers and a lot of other internal variables. If the controller is not doing what you think it should, try resetting it and see if things straighten out.

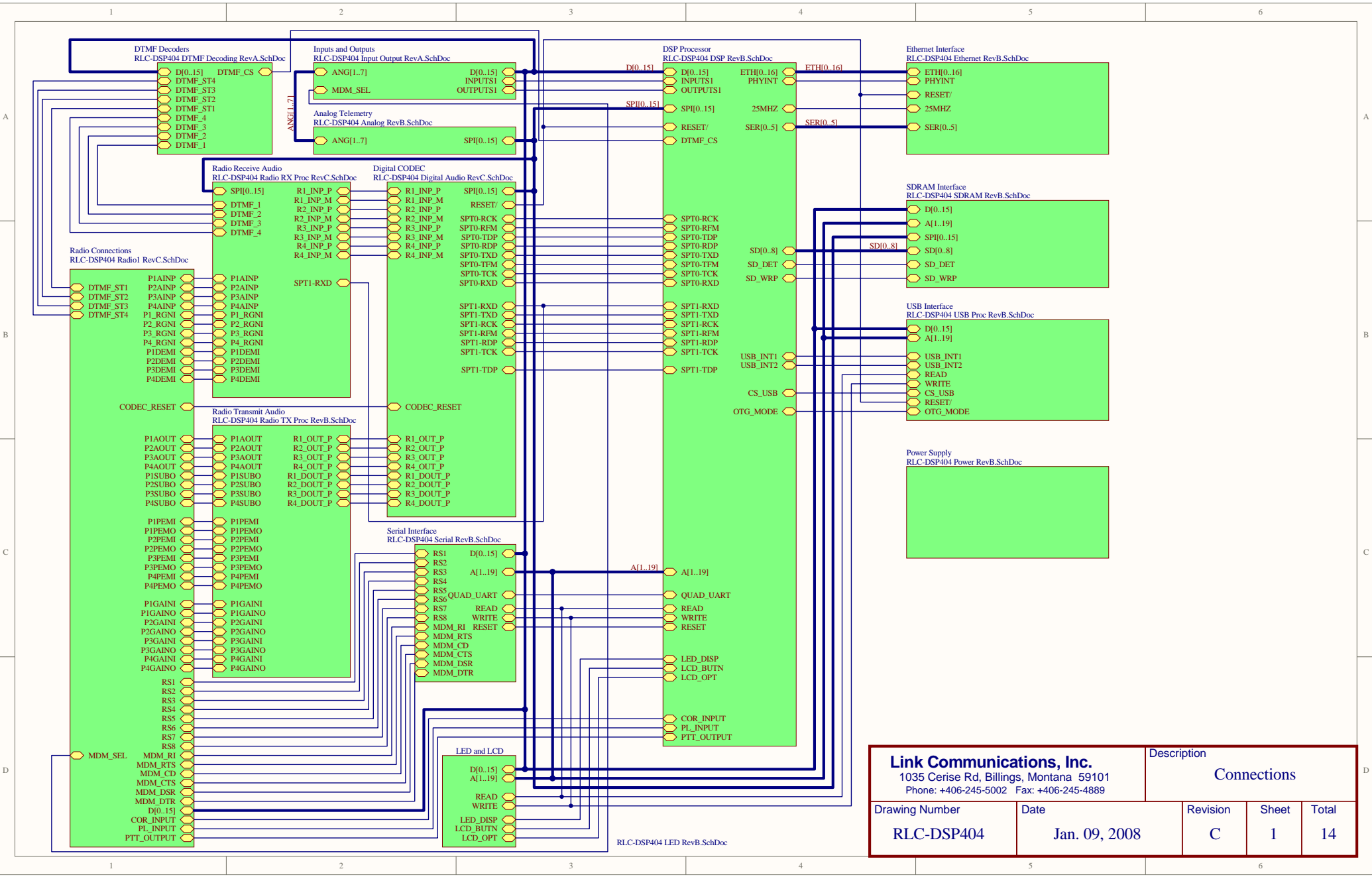
"Initialization" (sometimes called "re-initialization") resets all of the controller's internal settings back to the factory defaults. It does cause you to lose all of your programming. You will almost always have to initialize the controller when you install a new version of software, but rarely otherwise. If you are trying to learn to program the RLC-DSP404 and you mess things up, you can use this to put everything back the way it is supposed to be. Initialization does not hurt the RLC-DSP404 in any way - there is no EEPROM or anything to wear out. To reinitialize the RLC-DSP404, follow one of the two methods below:

Method #1: Press and hold the INIT button on the motherboard. Turn on the power. Wait for about 3 seconds (or longer). Release the INIT button.

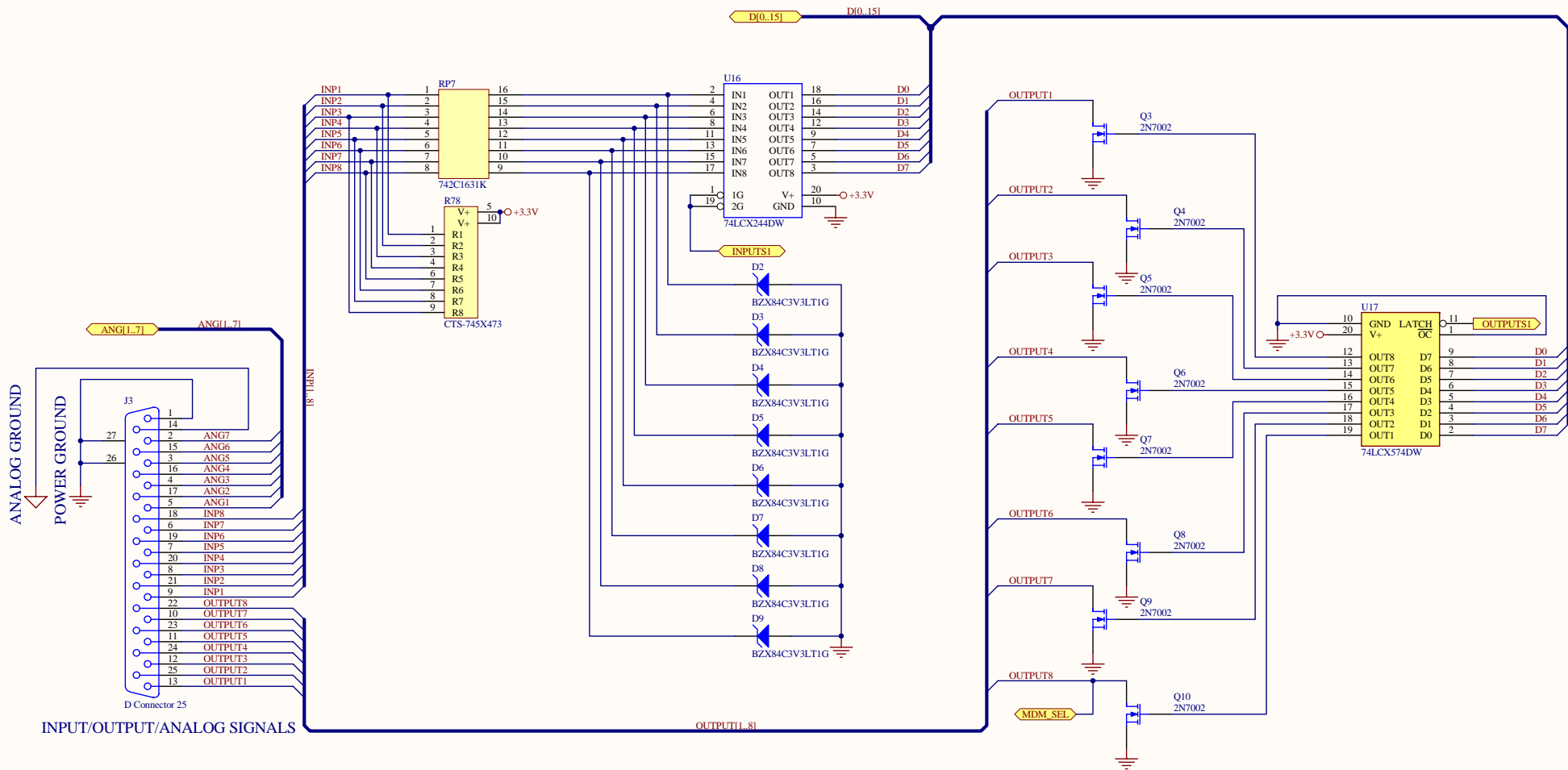
Method #2: Turn the power on. Press and hold the INIT button. Press and release the RESET button. Wait at least 3 seconds. Release the INIT button.

If you are successful you will hear the message "I-N-I-T" out of the transmitter that is hooked to port 1 and see the message "All settings have been reset to factory defaults" on the serial terminal.

E: Hardware Documentation



Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description Connections			
Drawing Number	Date	Revision	Sheet	Total	
RLC-DSP404	Jan. 09, 2008	C	1	14	



Link Communications, Inc.

1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

Description

I/O Section

Drawing Number

RLC-DSP404

Date

Jan. 09, 2008

Revision

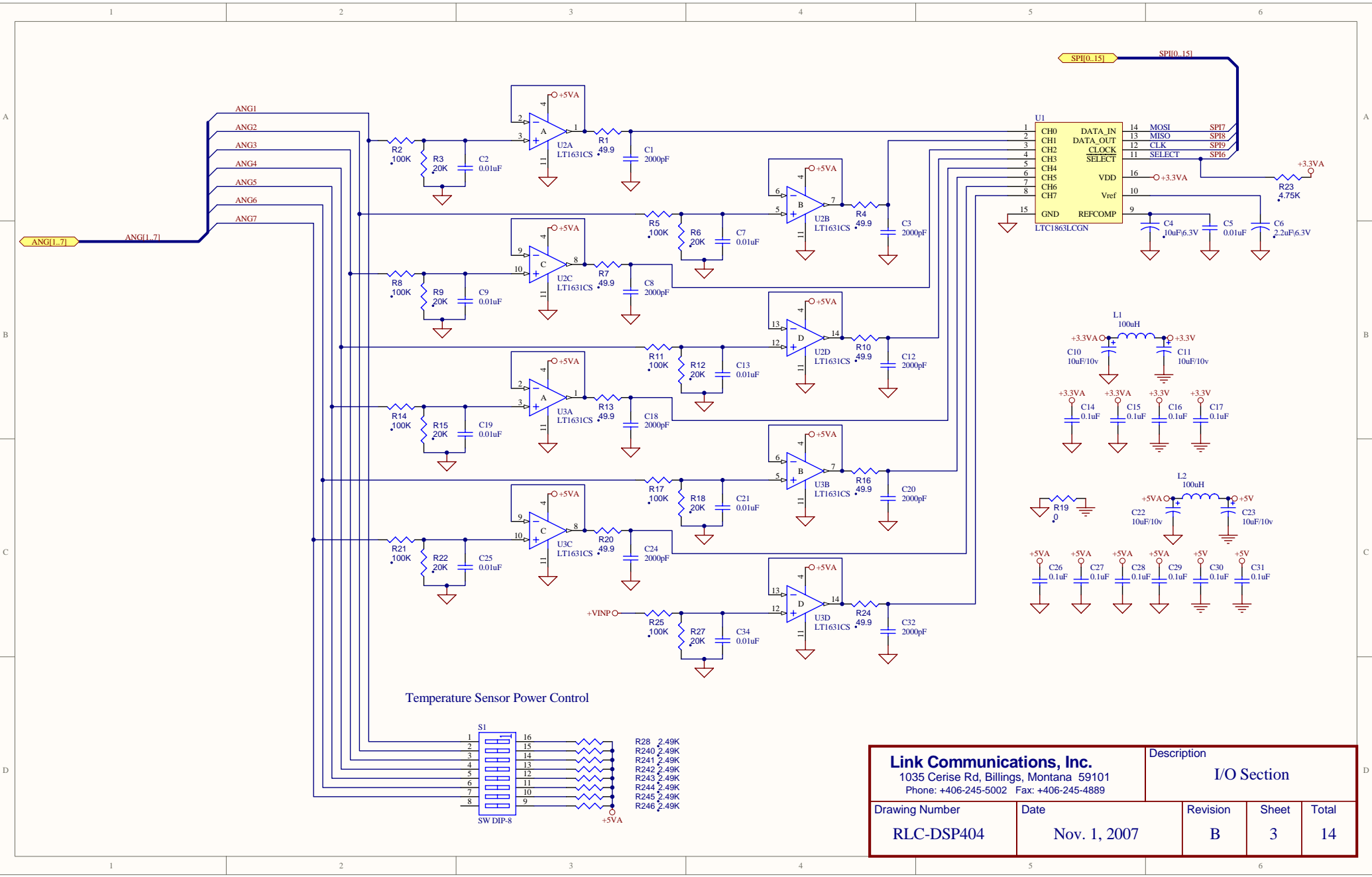
A

Sheet

2

Total

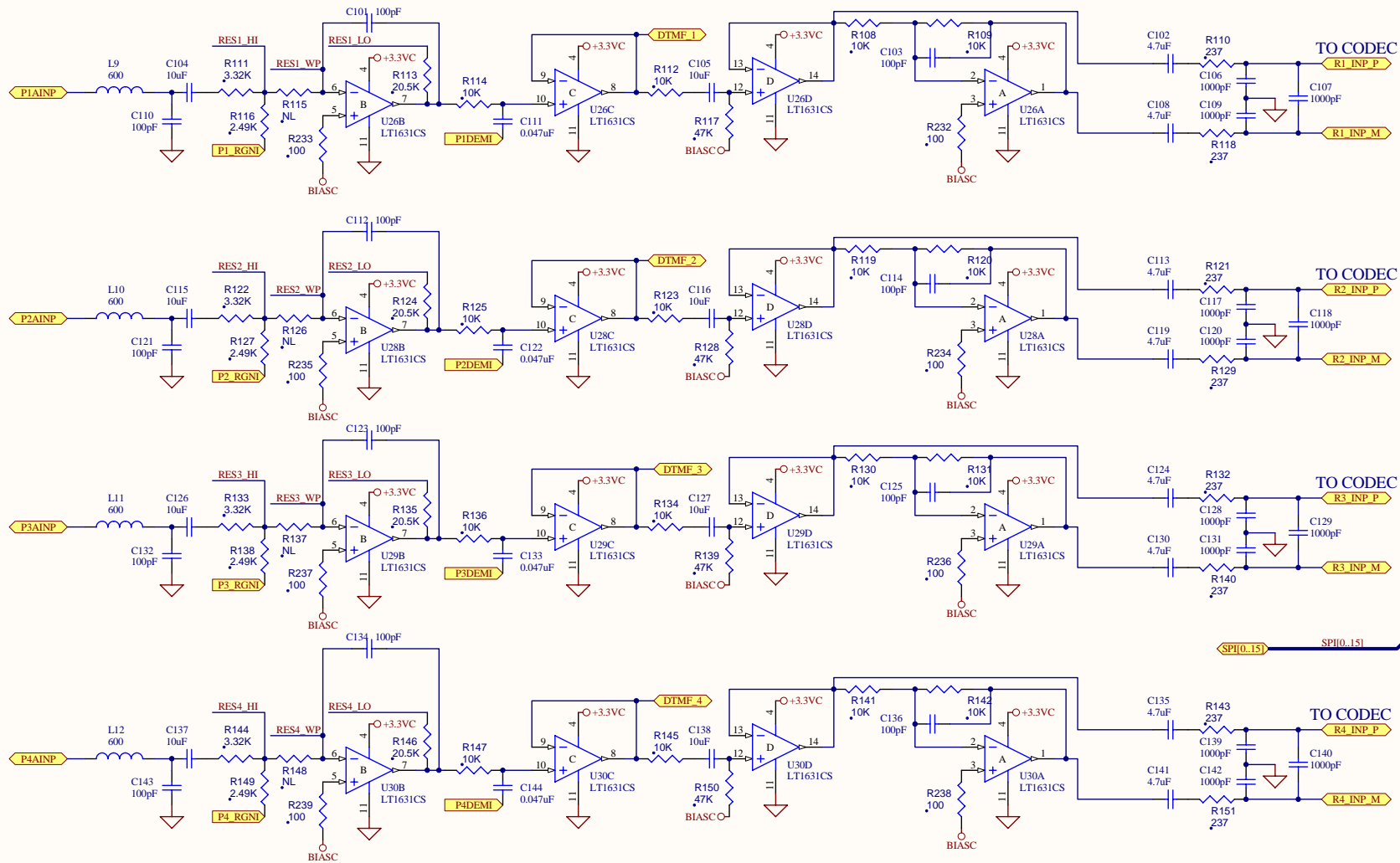
14



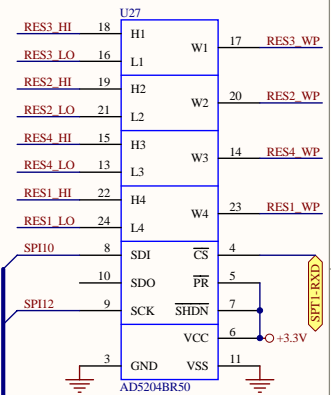
Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description I/O Section		
Drawing Number RLC-DSP404	Date Nov. 1, 2007	Revision B	Sheet 3	Total 14

SPI10: CODEC SPI Data Out
 SPI11: CODEC SPI Data In
 SPI12: CODEC SPI Clock
 SPI13: Ports 1-4 CODEC and Softpot
 SPI14: Ports 5-8 CODEC and Softpot
 SPI15: Ports 9-12 CODEC and Softpot
 CHANGED 10/02/07:





change spi13 to sport1 pins



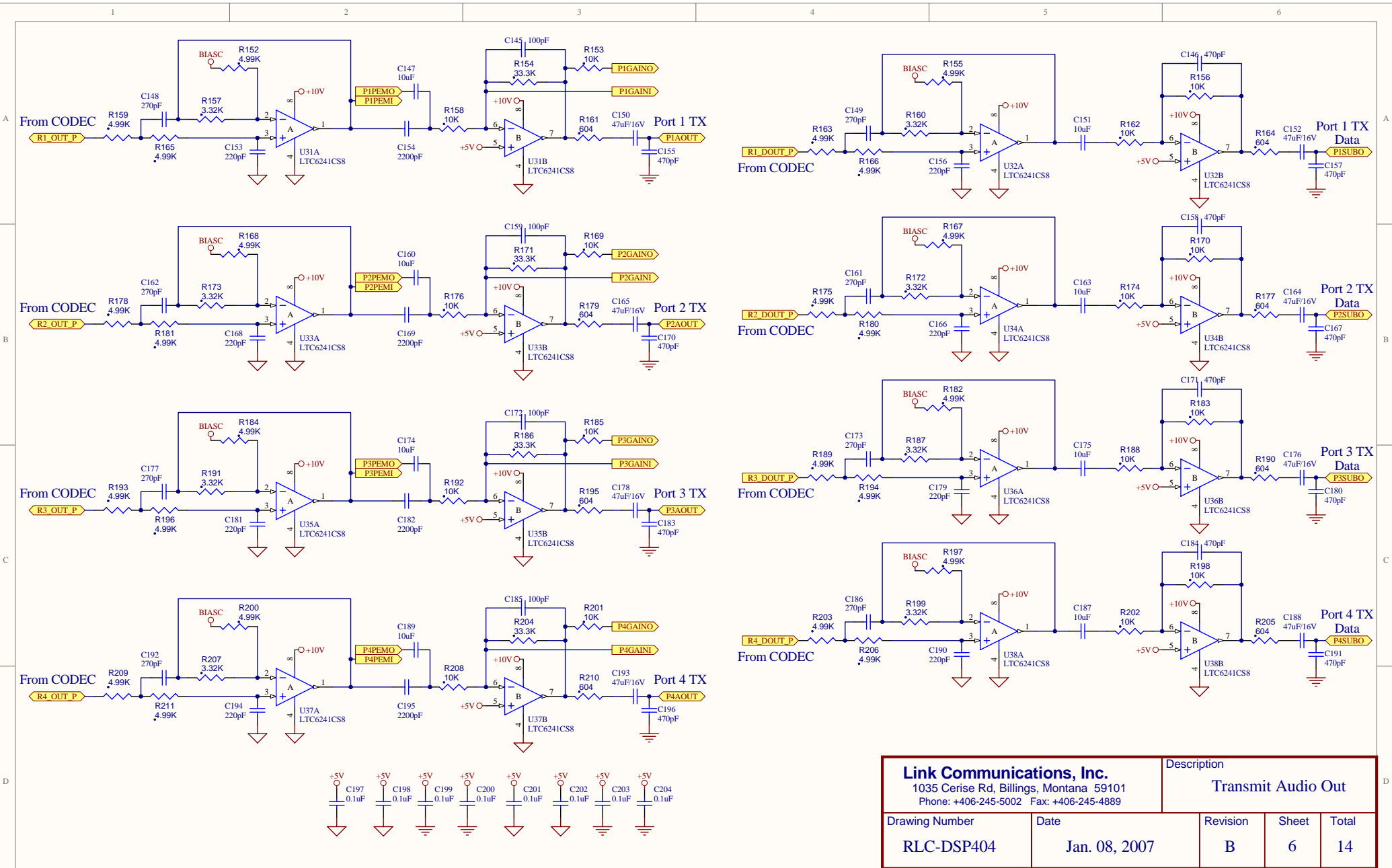
Link Communications, Inc.

1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

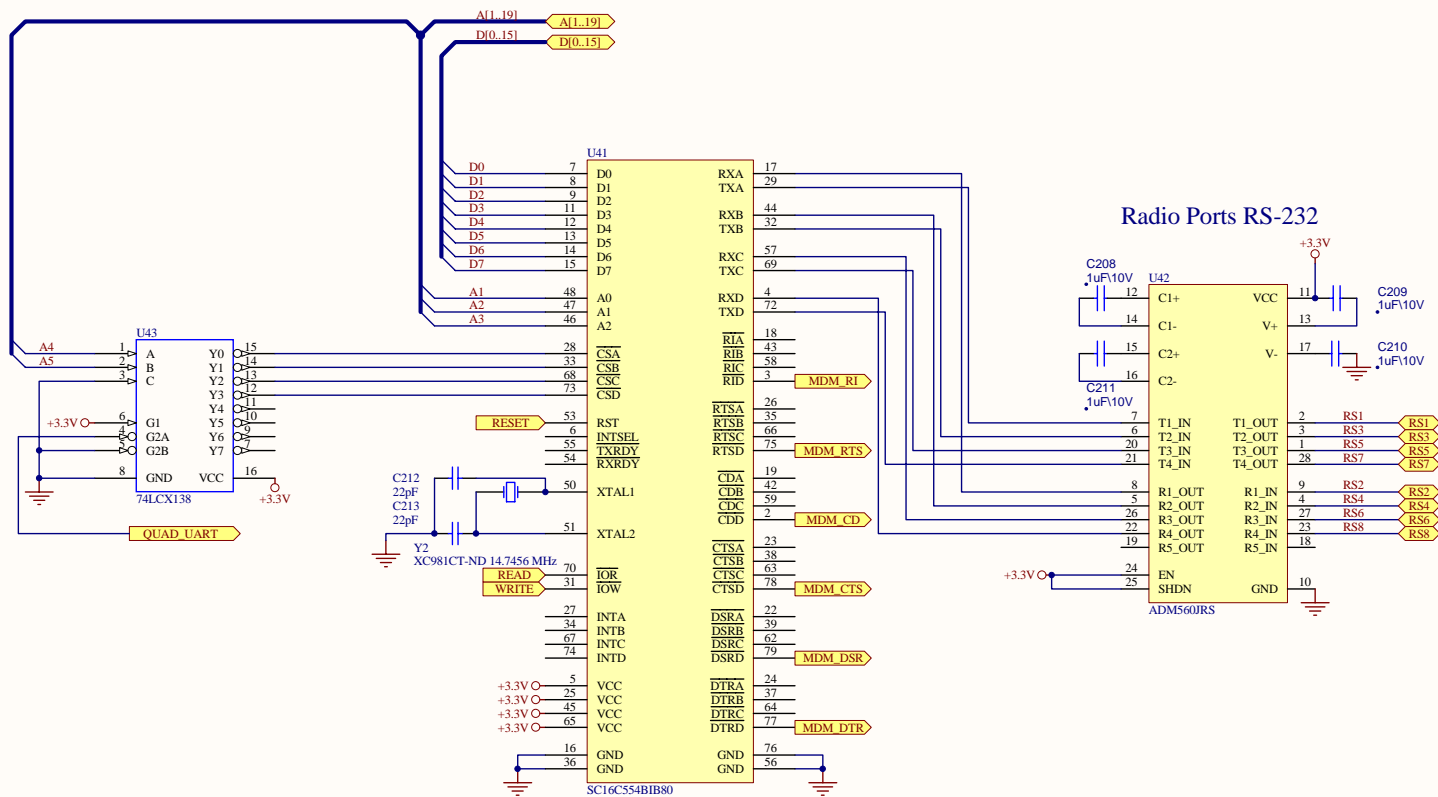
Description

Receive Audio In

Drawing Number	Date	Revision	Sheet	Total
RLC-DSP404	Jan. 07, 2008	C	5	14



Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description Transmit Audio Out		
Drawing Number RLC-DSP404	Date Jan. 08, 2007	Revision B	Sheet 6	Total 14



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1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

Description

RS-232 SERIAL PORTS

Drawing Number

RLC-DSP404

Date

Nov. 16, 2007

Revision

B

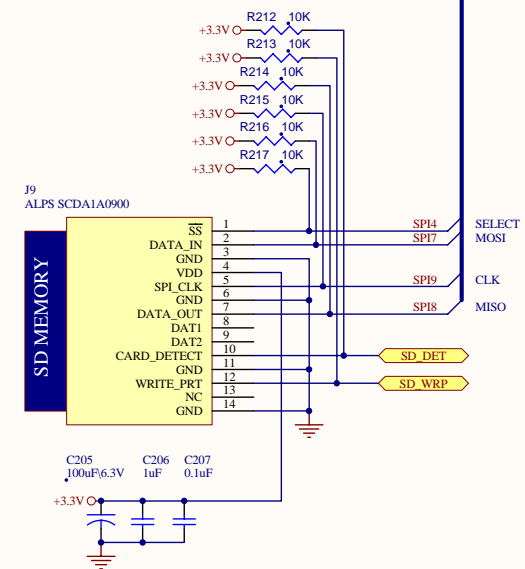
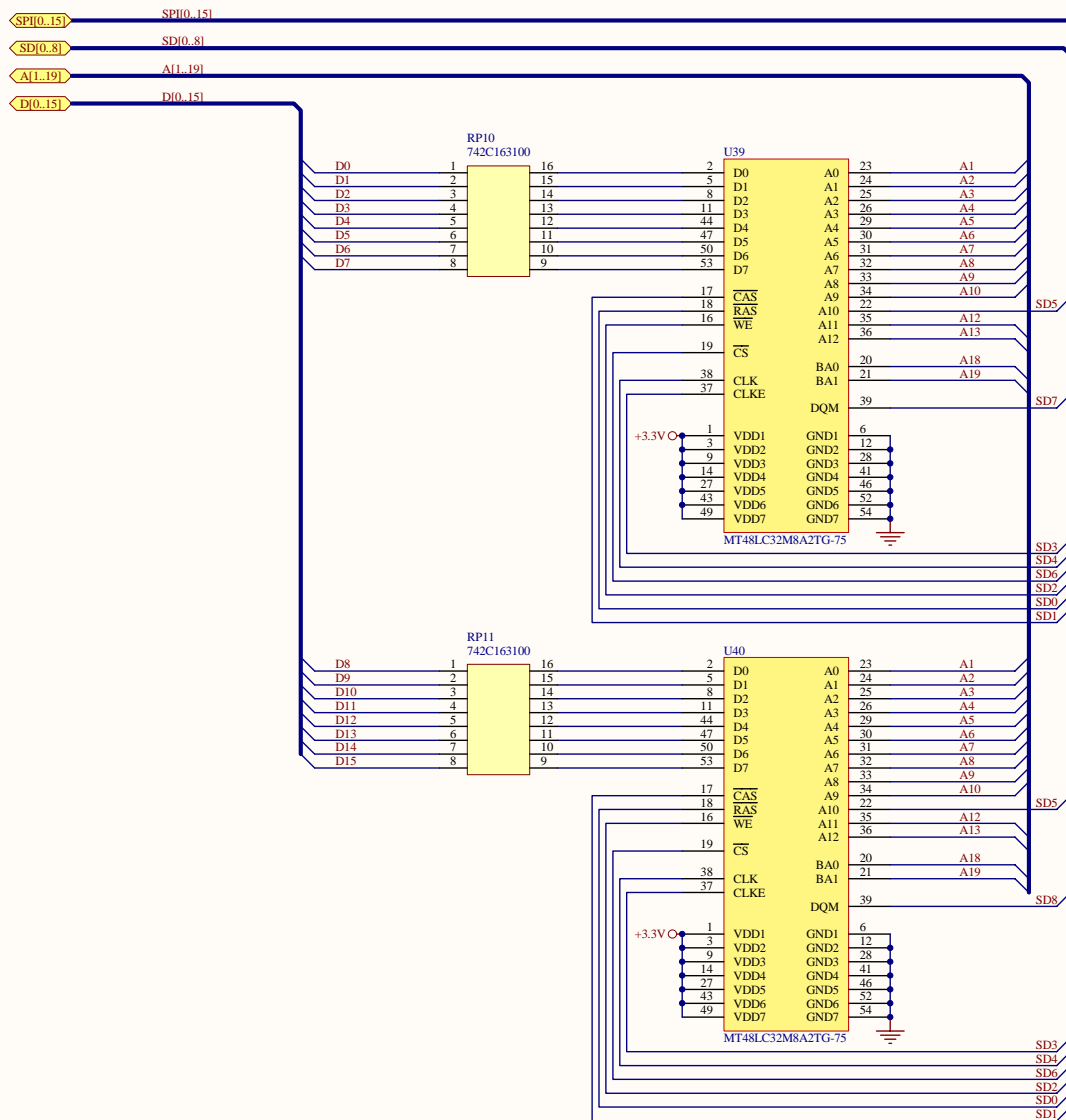
Sheet

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Total

14





Link Communications, Inc.

1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

Description

64MB SDRAM and SD Flash

Drawing Number

RLC-DSP404

Date

Oct. 29, 2007

Revision

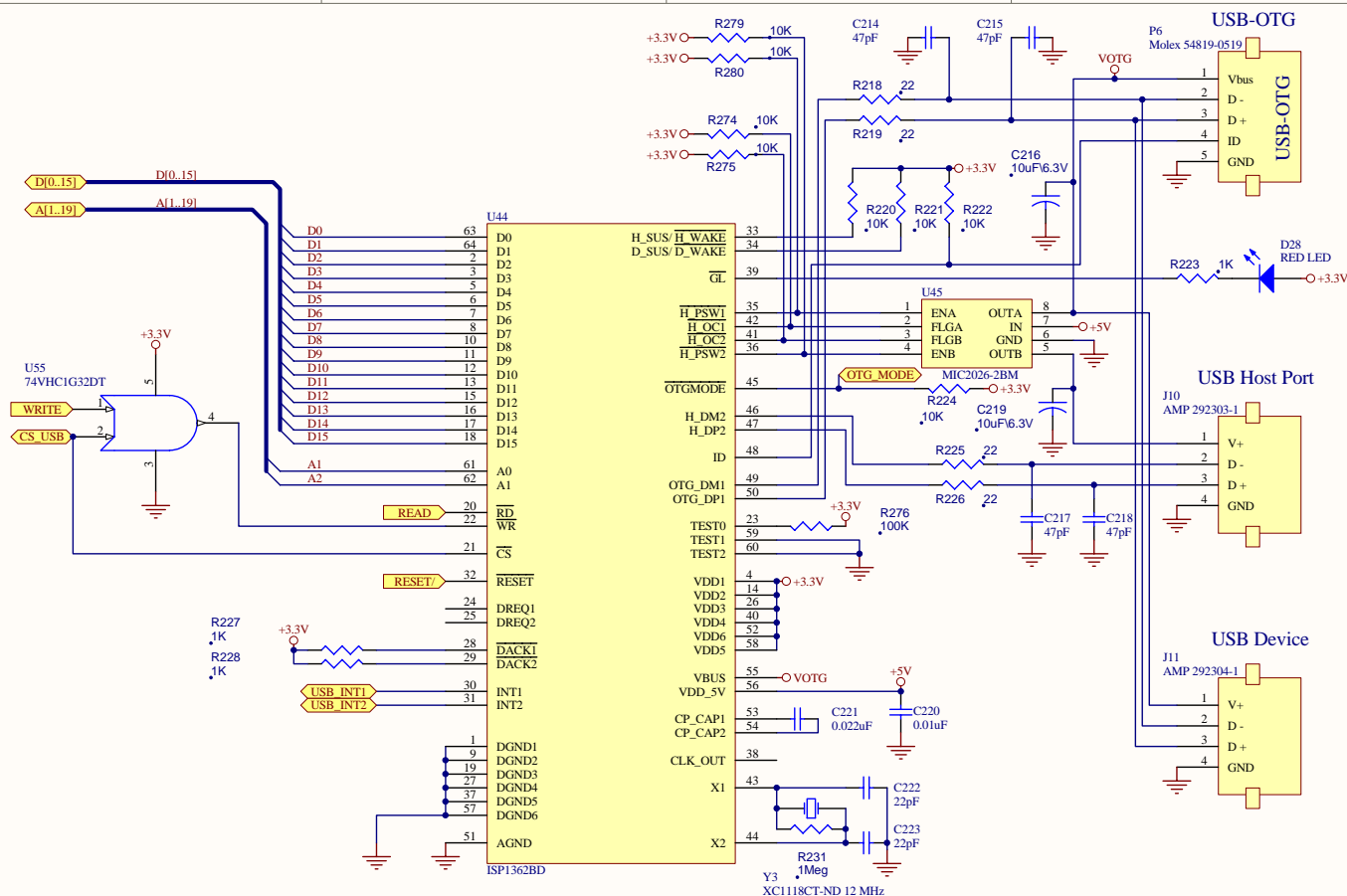
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Sheet

11

Total

14



Link Communications, Inc.

1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

Description

USB Interface

Drawing Number

RLC-DSP404

Date

Nov. 16, 2007

Revision

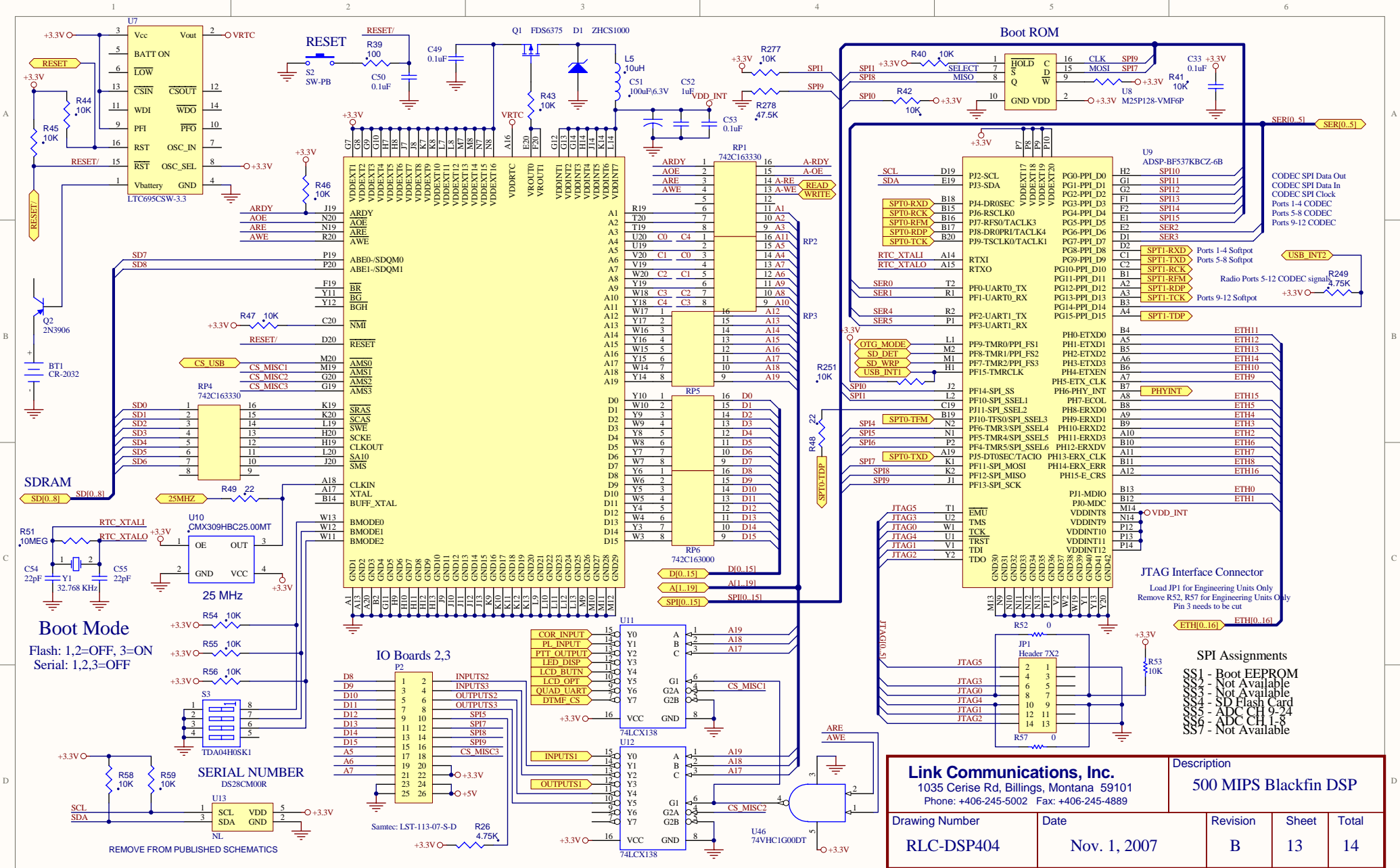
B

Sheet

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Total

14



SPI Assignments
SS1 - Boot EEPROM
SS2 - Not Available
SS3 - Not Available
SS4 - SD Flash Card
SS5 - ADC CH 0-24
SS6 - ADC CH 1-8
SS7 - Not Available

External DC In

P7
2.5mm POWER CONNECTOR
Option 1: 2.5mm

J4
AndPowerPole
Option 2: Anderson PP



R81
20V-MOV

F1

miniSMD075F/24

D27
DL4001

C90
1000pF

Power LED

R248
1K

D29
GREEN LED

C80
10uF25V

C78
0.1uF

C79
0.1uF

C81
10uF25V

U20
LM1117SX-ADJ

IN

TAB

OUT

ADJ

R80
1.64K

R79
234

C77
100uF16V

+10V

C82
0.1uF

C73
10uF20V

C74
10uF20V

C75
10uF20V

C76
10uF20V

C83
100uF35V

U21

+Vin

FEEDBACK

ON/OFF

C-BOOST

GND

LM2676S-3.3V

OUTPUT

+3.3V

C88
0.01uF

L8
33uH

C89
470uF16V

C84
10uF20V

C85
10uF20V

C86
10uF20V

C87
10uF20V

C96
0.1uF

C97
0.1uF

C98
10uF25V

U22
LM1117SX-5.0

IN

TAB

OUT

ADJ

C95
100uF16V

+5V

C99
0.1uF

F2

miniSMD075F/24

+5V1

C91
10uF20V

C92
10uF20V

C93
10uF20V

C94
10uF20V

+3.3V

C236
1000pF

+3.3V

C237
1000pF

+3.3V

C238
1000pF

+3.3V

C239
1000pF

+3.3V

C240
1000pF

+3.3V

C241
1000pF

+3.3V

C242
1000pF

+3.3V

C243
1000pF

+3.3V

C244
0.1uF

+3.3V

C245
0.1uF

+3.3V

C246
0.1uF

+3.3V

C247
0.1uF

+3.3V

C248
0.1uF

+3.3V

C249
0.1uF

+3.3V

C250
0.1uF

+3.3V

C251
0.1uF

+3.3V

C252
0.1uF

+3.3V

C253
0.1uF

+3.3V

C254
0.1uF

+3.3V

C255
0.1uF

+3.3V

C256
0.1uF

+3.3V

C257
0.1uF

+3.3V

C258
0.1uF

+3.3V

C259
0.1uF

+3.3V

C260
0.01uF

+3.3V

C261
0.01uF

+3.3V

C262
0.01uF

+3.3V

C263
0.01uF

+3.3V

C264
0.01uF

+3.3V

C265
0.01uF

+3.3V

C266
0.01uF

+3.3V

C267
0.01uF

Link Communications, Inc.

1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

Description

Power Interface

Drawing Number

RLC-DSP404

Date

Oct. 29, 2007

Revision

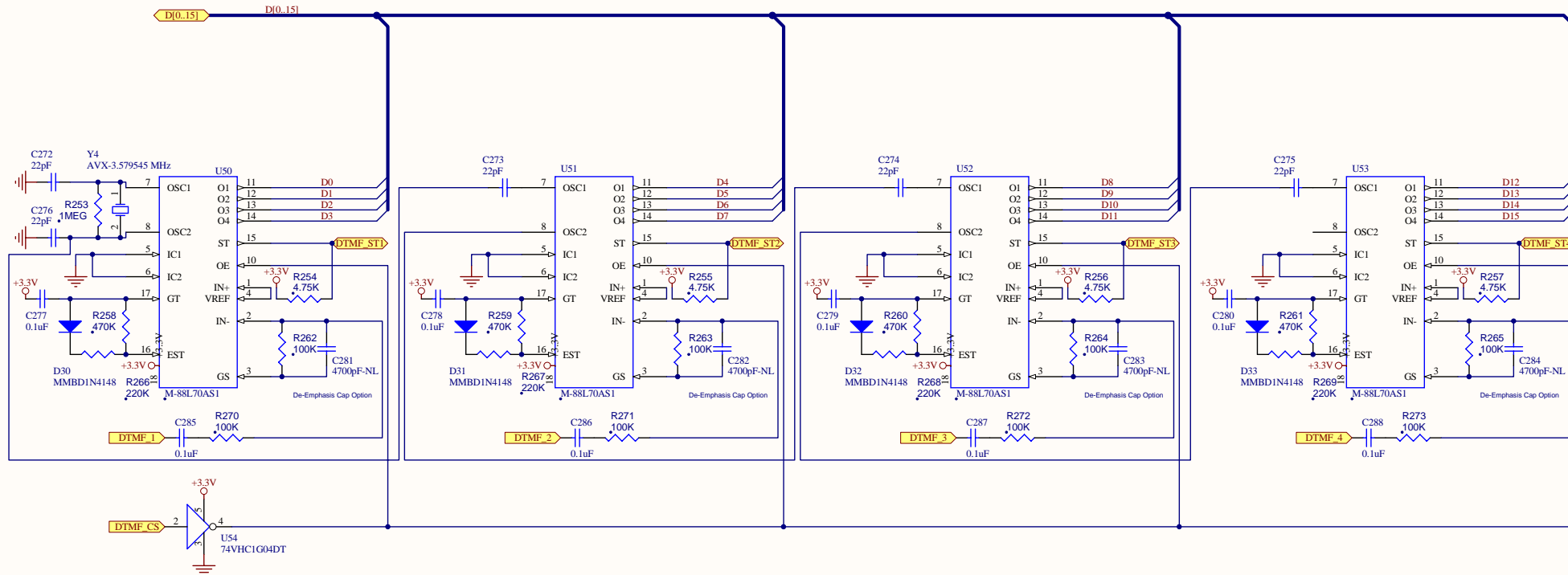
B

Sheet

14

Total

14



Link Communications, Inc.

1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

Description

DTMF Decoding

Drawing Number

RLC-DSP404

Date

Nov. 1, 2007

Revision

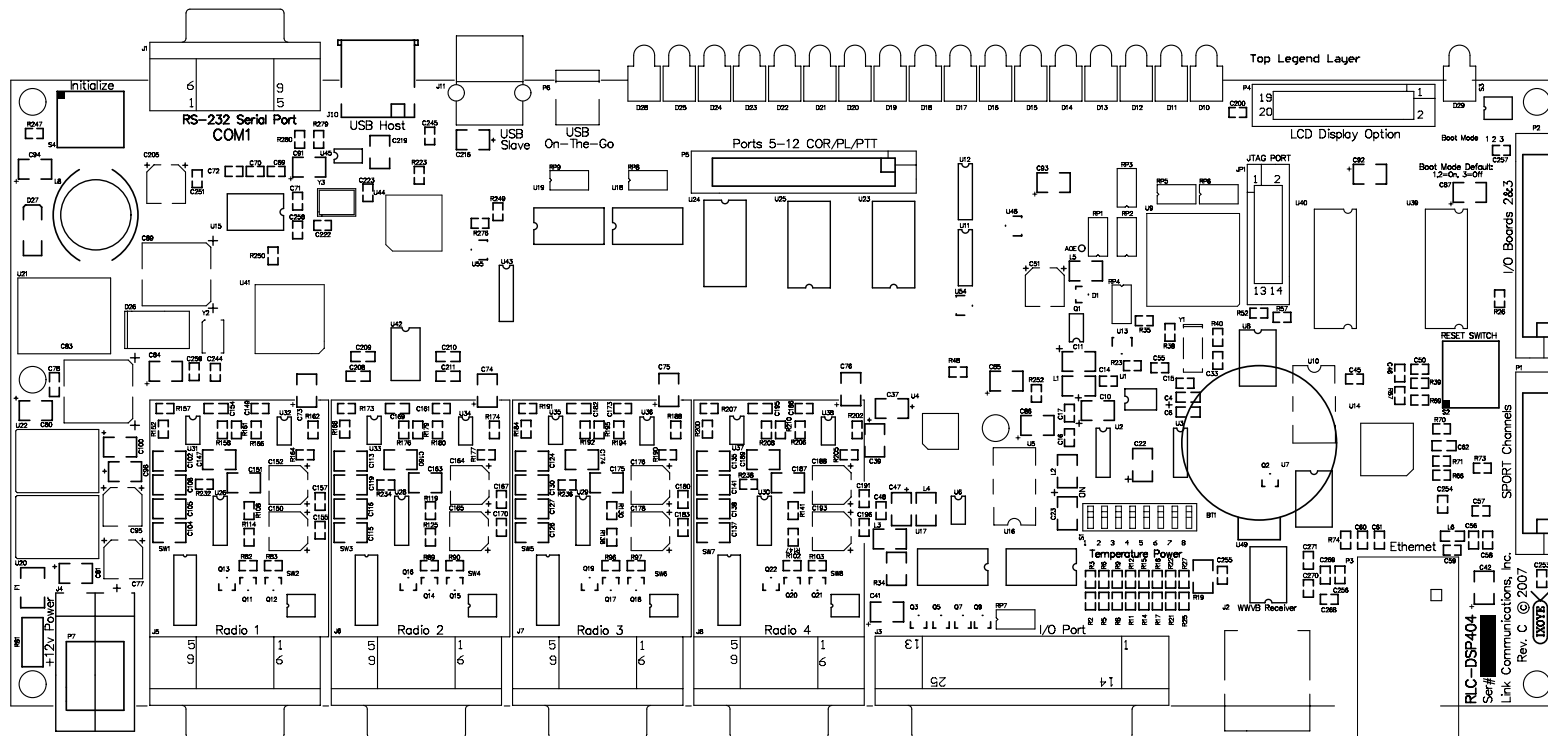
A

Sheet

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Total

15



This is a detailed architectural floor plan of a large, multi-story building complex. The plan is oriented with North (N) at the top. The drawing shows a complex network of rooms, corridors, and outdoor spaces. Key features include:

- Central Courtyard:** A large, open area in the center of the plan, surrounded by various buildings and walkways.
- Buildings:** Numerous rectangular buildings of varying sizes, some with multiple stories, are distributed throughout the plan. Some buildings are labeled with numbers (e.g., 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 8

Appendix F: Programming with the Serial Port

Entering commands from the serial port works almost exactly the same way as with DTMF tones from a radio. The characters you enter on the keyboard are treated the same way as the digits on your radio keypad. Of course you can enter digits on the keyboard that you can not enter from a keypad, which gives you a little additional flexibility. Some of the things you can do from the keyboard that you can not do from a DTMF pad are:

- Back up. If you type a digit you did not mean to type, simply press the backspace key and erase it.
- Press the Enter key. This tells the controller to try to execute whatever you have typed so far. This is exactly the same as unkeying your radio to force a command to execute. When you have entered a command you can either enter an '!' or press <Enter> to make it execute.
- Store a bunch of commands in a file on your computer that you can upload without typing them again. See the section on using a serial upload file later in this appendix.

Example: I want to execute Command 009 to see which ports are connected together:

Over the air:

<Key radio> 009 <Unkey or press "D">

From the serial port:

<ENTER>

You will see the serial port prompt "DTMF>". This indicates that the characters you enter are being treated just as if they were entered by DTMF from a radio port

009 <Enter or press "D">

Voice responses to commands entered serially:

Normally, when you enter commands from the serial port, the voice responses go out port one. Since you also get responses on your computer screen, they really aren't needed in most cases, and can get annoying if you are doing a lot of programming. You can control whether or not you get voice responses to the commands you enter serially with Command 050. Using that command you can tell the RLC-DSP404 to send the voice responses out any port (or more than one), or nowhere at all. To keep it from sending voice responses, enter "050 13 0" and press enter (you can also make that the first line of your upload files). To turn them back on, enter "050 13 1" and press enter (see command 050 for more information).

If you are uploading a large file and you have the voice enabled, the voice might not be able to keep up with the commands that are being uploaded. If this happens and the voice gets 300 words or so behind, it will just skip those words so it is caught up and again try to keep up. You either have to upload very slowly or turn the voice off during uploads to avoid this.

Using a serial upload file:

A very convenient way to set up your controller if you have a computer is to type all of the commands that you use to set up your controller in a file using a word processor. Save the file in ASCII (plain text) format. Load your communications program and make sure you are talking to the RLC-DSP404 by hitting return and checking for the "DTMF>" prompt. Now do an ASCII upload of the file that you saved all of your commands in (the controller won't know that you are doing an automatic upload, it will just think you are typing fast). Test the stuff you uploaded and if you want to make a change, go back to your editor and change it in the file. Now upload it again. By setting up your controller this way, you have a permanent record of everything you have done. If something ever gets messed up on the controller, all you have to do is initialize it (see Appendix D) and re-upload your file. Also, when you get a new version of software (which will almost always require you to reinitialize), you will probably only have to make minor changes to your file to make it work with the new software version. This will definitely save you time in the long run. **There is no quick and easy way to download all of the information in the controller to a file, so it is best to create the file as you go.** (QuickStart, available free from our web site, can download most of the settings, but it takes several hours. It works much better if you use it from the very beginning and keep a file of your settings on your computer so you don't need to download them from the controller later.) An example will illustrate the idea:

Using your favorite editor, enter the following (including the comments):

```
; this line is a comment - put a description of the file here
050 13 0          ;Turn off the voice responses to serial commands
007 01 1          ;Turn DTMF muting on for port 1
050 01 3 1        ;Turn on voice responses to port 1
036 01 35         ;Speak the word "Complete"
```

Save the file as "RLC-DSP404.txt" (without the quotes) or some other name of your choice.

Load your communications program.

Hit <Enter> and watch for the "DTMF>" prompt from the RLC-DSP404. If you do not get it, check your cable and setup in your communications software.

You may want to tell your communications program to open a log file at this point.

It will come in handy for checking if any of the commands caused errors.

Start an ASCII upload of your file.

Wait until it finishes.

Close the log file if you opened one.

Try out your new settings. 009 will check the crosspoint and 007 will check the DTMF muting. Go back to your editor, make the required changes, and repeat the cycle.

Note about spaces in serial commands:

The controller totally ignores spaces in commands you enter from the serial port. Spaces are shown in the manual to make it easier to see the separate groups of characters; you may want to do this in your upload files as well. Spaces are never required, but you can put them wherever you want in your serial commands to make them easier to read.

Note about comments in serial upload files:

You can put as many comments in your upload files as you want. Anything following a ';' will be considered a comment and will be totally ignored by the controller. If you want a whole line to be a comment, just start it with a semicolon like this:

```
; this line is a comment.
```

If you want to put a comment after a command (on the same line), do it like this:

```
N026;          this is a comment - this command recalls the time.
```

It is highly recommended that you comment your upload files thoroughly. You will thank yourself when you go back months later and try to figure out what you were trying to do.

Note about capital letters:

By default the RLC-DSP404 converts everything you type to a capital letter. This is because DTMF characters are always treated as capital letters and it avoids confusion. However, there may be a time when you would like to enter lower case letters, such as when you send serial messages with Command 032. At those times you can turn off the conversion to all capital letters with Command 060.

Note about upload speeds:

If you upload a file with more than a dozen commands or so in it, you may find that the responses from the RLC-DSP404 get way behind, or even get lost with the message "Serial Output Queue just overflowed - it now looks empty". This is caused by the RLC-DSP404 trying to send back all of the descriptive responses to the commands and not being able to send the responses as fast as it gets new commands. Eventually it runs out of buffer space and is forced to throw some of the responses away (it does not support software flow control yet). This does not affect the commands that are being sent to the RLC-DSP404 in any way - just the responses that you see on the screen. If you do not care about the responses, just let them get thrown away and forget it. There is no file size limit, just a limit on how fast you can send it to the controller. If you need to know what the responses are, you need to insert pauses while your communications program sends the commands to the RLC-DSP404. Slowing the baud rate down will not help significantly, as that will slow down the responses just as much as the commands you are sending. There are several ways to do this:

- Tell the comm program to wait until it sees a new "DTMF>" prompt before sending the next line. To do this with the Windows 3.1 terminal program, go to the "Settings" menu, select "Text Transfers", then select flow control of "Line at a Time" and set a "Wait for Prompt String" of "DTMF>". Other comm programs will only let you set a single pacing character. You can try '>' (the last character in the "DTMF>" prompt). Waiting for a new prompt, or at least the last character of it, is the best method because it makes the comm program wait exactly as long as needed for the controller to finish the previous command.
- Change the ASCII transfer settings on your communications software to insert a 1.5 second delay after each line (longer for slow baud rates, shorter for fast baud rates). This will give the RLC-DSP404 time to send the responses back without overflowing the queue. You may have to experiment to get enough delay to avoid overflowing without having to wait all day for the upload to finish.
- If you can't figure out how to do either of the above methods, you can try putting tilde characters at the end of each line in you upload file, like this:

N026; comment ~~~

The tilde tells most comm programs to pause for a bit, usually ½ to 1 second.

Serial responses to commands entered from a radio:

Normally the commands that are entered from a radio do not cause anything to be sent out of the serial port; that is they are "suppressed". This lets you program the controller from the serial port while people are entering DTMF commands without them causing confusing messages to show up on the serial screen. If you want to see the commands that are being entered from the radios, you can turn "suppressed" serial off with command 060.

Very Long Serial Commands:

This section only applies to very long serial commands. If a line fits on the screen (80 characters wide), it isn't long enough to worry about. But there may be times when you make a very long command, maybe programming a voice message:

```
; make macro 600 speak one two three four five six seven eight
053          600 036  001 002 003  004  005 006 007  008 ;    comment
```

There is an internal line length limit; you will get an error message if you exceed it. If you do exceed it, check the following things: make sure there is a ';' right after the command, even if the comment is way off to the right. It is ok if the comment exceeds the line length limit - that won't cause an error, it just won't let you backspace once you have exceeded the limit.

If you have checked to make sure the ';' comes right after the end of the command and you still get a message that the command is too long and overflows the buffer, remove some of the spaces in that command. If even that isn't enough to get it under the length limit, you will probably have to break it up into separate commands, possibly speaking the first half and last half of the message separately.

QuickStart Software For Windows™

The RLC-DSP404 can be configured with a program called RLC-QuickStart that runs under Microsoft Windows™. RLC-QuickStart allows a user to program some of the basic functionality of the controller through a graphical "point and click" interface. The software is meant to help with getting a new controller set up and running quickly as well as making some of the basic everyday changes a little easier to handle. Some of the more common uses of RLC-QuickStart include programming IDs, timers, macros, and port connections. Even if you don't use QuickStart, you can (and should if possible) use a computer to set up the controller. See Appendix F for more information.

Installation:

Installation of the RLC-QuickStart software requires a CD-ROM drive and a hard drive on your computer. RLC-QuickStart is available for download from <http://www.link-comm.com/quickstart.html> or on the CD included with your controller.

If you have downloaded RLC-QuickStart from the web site, skip steps 1 through 3.

- 1) Insert the CD into the CD-ROM drive.
- 2) Click <Start><Run>.
- 3) Click <Browse> and then navigate to the CD-ROM drive.
- 4) Double-click on "install_rlcqs.exe" and follow the rest of the instructions provided by the installer program.

Operation:

Click on the 'RLC-QuickStart' icon and the software will begin to run. Once the software is running you can select an existing file to work on, or click cancel to continue to the main program. If you have gotten to the main program screen by clicking cancel instead of selecting a file to edit, you must now select an option from the File menu. You may choose to create a New Blank file, open an Existing File, or Import your controller's current settings into a new file.

Once you have made your desired changes, save the file. You can either quit now or use the terminal window to upload the software to a controller via. modem software or a direct connection (with a serial cable connected between your computer and the controller).

Limitations:

Not all functions of the controller can be edited graphically with this software. If there are functions you wish to program that cannot be edited graphically, you may use the text editor in the Terminal window of RLC-QuickStart to enter the commands using a text file. For more help on this topic, refer to Appendix F.

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Appendix G: ASCII Chart

This chart may be helpful when programming serial messages with Command 034. Not all of the codes are included because not all of them are universally used and some don't print well.

032	062 >	092 \	122 z	153 Ö	183 ƞ	213 ₣
033 !	063 ?	093]	123 {	154 Ü	184 ƚ	214 Ʒ
034 "	064 @	094 ^	124 |	155 ø	185 Ɵ	215 ƹ
035 #	065 A	095 _	125 }	156 £	186 Ơ	216 ƺ
036 \$	066 B	096 `	126 ~	157 ¥	187 ơ	217 ƻ
037 %	067 C	097 a	128 Ç	158 ₣	188 Ƣ	218 Ƽ
038 &	068 D	098 b	129 ü	159 f	189 ƣ	219 █
039 '	069 E	099 c	130 é	160 á	190 Ƥ	220 █
040 (	070 F	100 d	131 â	161 í	191 ƥ	221 █
041)	071 G	101 e	132 ä	162 ó	192 Ʀ	222 █
042 *	072 H	102 f	133 à	163 ú	193 Ƨ	223 █
043 +	073 I	103 g	134 å	164 ñ	194 ƨ	224 α
044 ,	074 J	104 h	135 ç	165 Ñ	195 Ʃ	225 β
045 -	075 K	105 I	136 ê	166 ª	196 ƪ	226 Γ
046 .	076 L	106 j	137 ë	167 °	197 ƫ	227 π
047 /	077 M	107 k	138 è	168 ı	198 Ƭ	228 Σ
048 0	078 N	108 l	139 ï	169 ƿ	199 ƭ	229 σ
049 1	079 O	109 m	140 î	170 ƻ	200 Ƭ	230 μ
050 2	080 P	110 n	141 ì	171 ½	201 Ʈ	231 τ
051 3	081 Q	111 o	142 Ä	172 ¼	202 Ʊ	232 Φ
052 4	082 R	112 p	143 Å	173 ĵ	203 Ʋ	233 Θ
053 5	083 S	113 q	144 É	174 «	204 Ƴ	234 Ω
054 6	084 T	114 r	145 æ	175 »	205 =	235 δ
055 7	085 U	115 s	146 Æ	176 ☼	206 ƴ	236 ∞
056 8	086 V	116 t	147 ô	177 ☼	207 Ƶ	237 φ
057 9	087 W	117 u	148 ö	178 ☼	208 ƶ	238 €
058 :	088 X	118 v	149 ò	179 |	209 Ʒ	239 ∩
059 ;	089 Y	119 w	150 û	180 ƿ	210 Ƹ	240 ≡
060 <	090 Z	120 x	151 ù	181 ƿ	211 ƹ	241 ±
061 =	091 [	121 y	152 ÿ	182 ƿ	212 ƺ	242 ≥

243 \leq

244 \int

245 \int

246 \div

247 \approx

248 $^{\circ}$

249 \cdot

250 \cdot

251 $\sqrt{}$

252 n

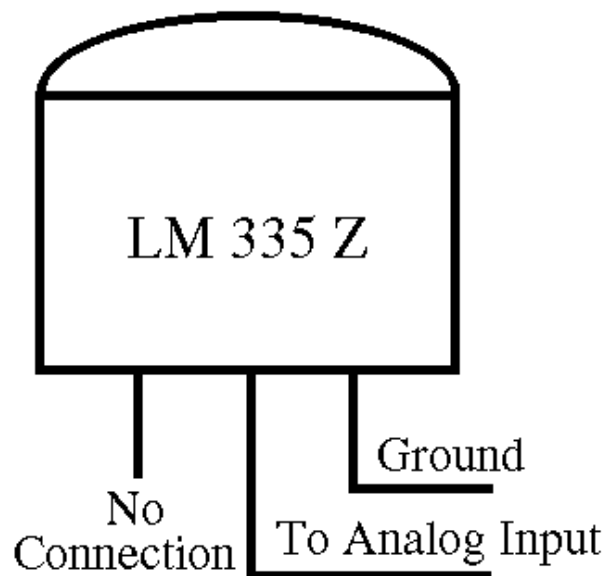
253 2

254 \blacksquare

255

Appendix H: Using the LM335 Temperature Sensor

The RLC-DSP404 supports the National Semiconductor LM335Z temperature sensor. The sensor converts temperature into voltage. This voltage is read by the controllers ADC (Analog-Digital Converter) which allows the controller to read a voltage. When using the LM335Z sensor, the sensor needs to be powered in order for the temperature to be read. The sensors will be powered when the powering dip switch for the appropriate input is switched to ON. Locate on the DSP404's main board (for analog inputs 1-8) or on the daughter board (for analog inputs 9-16) an 8 position DIP switch. This switch is the largest DIP switch on the board. Switch the switch position to ON to power the external LM335 temperature sensor.



LM335Z Temperature Probe Connections Diagram

Troubleshooting:

- The voltage across the sensor should be between 2.7 and 3.0 V in most cases (Temperature Celsius = (voltage*100)-273).
- If the voltage across the sensor measures about 0.6V, the temperature sensor may be hooked up backwards (OUT switched with GND).
- If the voltage across the sensor is near 0V, make sure that the sensor is powered (as described at the top of this page) and that the wires aren't shorted out.
- If the voltage across the sensor is near 5V, there is either a bad connection to the sensor, the wrong pins are being used, or the sensor is blown out (possibly by nearby lightning).

Appendix I: Software Problem and Request Form

Link Communications Inc. Numbers: 406 - 245 - 4889 (Fax) 406 - 245 - 5002 (Voice)

email: feedback@link-comm.com

Name _____

Serial # _____

Phone # _____ Fax # _____

Request: _____

[illegible]

Attention Allan or Steve

Number of Pages: _____

Software Problem and Request Form

Link Communications Inc. Numbers: 406 - 245 - 4889 (Fax) 406 - 245 - 5002 (Voice)

email: feedback@link-comm.com

Name _____

Serial # _____

Phone # _____ Fax # _____

Request: _____

[illegible]

Attention Allan or Steve

Number of Pages: _____

Appendix K: Internet Linking (VoIP)

The RLC-DSP404 can be easily interfaced with any of several Internet linking (VoIP) systems (IRLP, EchoLink, iLink, etc.). Linking through the Internet is very similar to using RF links, with the Internet link interfacing in the same way and serving the same purpose as RF link radios.

VoIP interfaces (often a computer with a sound card and possibly some specialized hardware) are usually connected in one of two ways:

- Method A: Connected to the link port of a repeater controller.
- Method B: Connected to a radio tuned to the frequency of a repeater (like a remote base).

Method A:

If using method A, the controller's link port should be configured as follows:

- Zero hang time (see the hang timers and mini-hang timers in Chapter 4)
- No courtesy beeps on link transmitter (that is the default, see command 041)
- No ID messages on link transmitter (that is the default, see command 085)

To get the controller to communicate with the VoIP interface, the controller needs to be configured so the port that the users are talking on and listening to (usually a repeater port) is "connected" (see chapter 2) to the link port that is wired to the VoIP interface. The controller will then pass audio back and forth from the Internet link to the repeater. The only audio passed from the controller to the Internet link will be the audio received on the repeater (no courtesy beeps or IDs), even when the controller sends a CW ID out the repeater while someone is talking.

Note that when wiring the controller's link port to the VoIP interface, the labels for the connections may be confusing. VoIP interfaces are generally designed for interfacing to a radio rather than to a controller. Because of that, its connections may be labeled to match the point in the radio to which they would normally be connected rather than according to their function on the VoIP interface. In other words, "audio in" may refer to the VoIP interface's audio *output*, which would normally be connected to the *radio's* audio input. Such an audio output from the VoIP interface would need to be connected to the controller's audio input (pin 5 on the DB-9). The COR (sometimes called CAS) and PTT connections may be similarly confusing. Just make sure that outputs from the controller are connected to inputs on the VoIP interface and vice versa, and you should be OK.

Method B:

If using method B, care should be taken to keep the repeater's courtesy beeps and ID from being sent down the Internet link, and to keep the repeater's hang time from holding up the Internet link. One way to accomplish this is to encode PL (CTCSS) on the repeater transmitter only when someone is actually

talking (not during the courtesy beep, hang time and IDs), then to set the radio connected to the Internet linking interface so it requires PL (tone squelch mode). That could be done for a simple repeater by switching the encoded PL based with the repeater receiver's COR signal. In a more complex system, where the audio going out the repeater transmitter could come from other sources (other repeater receivers running on the same controller, other links, remote bases, or an autopatch), one of the controller's open collector output lines should be used to switch the encoded PL. The controller can then be configured to turn that output line on and off at the appropriate times as follows:

; program macro 600 to turn output line on (encoded PL on)

```
055 600                ;make sure macro is empty
056 600 038            ;be quiet for rest of this macro
056 600 093 1          ;turn on output line 1
```

; program macro 601 to turn output line off (encoded PL off)

```
055 601                ;make sure macro is empty
056 601 038            ;be quiet for rest of this macro
056 601 094 1          ;turn off output line 1
```

```
; set event trigger to automatically execute macro 600 (so it will
; send PL) when a connected receiver is active
157 18 600
```

```
; set event trigger to automatically execute macro 601 (so it will
; stop sending PL) when all connected receivers are inactive
157 21 601
```

Controlling:

To control a Internet linking interface using DTMF digits (to connect it to other nodes, etc.), you will need to provide a way to either pass user-entered DTMF digits through the controller to the interface or to make the controller generate DTMF digits on command. There are a variety of ways to do this.

- Option #1: Pass all user-entered DTMF digits through to the Internet linking interface. If interface method B (described above) is used, this means turning off the DTMF mute feature (see command 007) for the repeater transmitter, which will allow anyone listening to the repeater to hear the digits entered. If using interface method A (also described above), the DTMF mute needs to be turned off only for the link transmitter; DTMF can still be muted on the repeater transmitter. In either case, the Internet linking interface will "hear" all digits entered by users.

With this method, the controller may send error messages in response to the DTMF strings that are entered, or worse yet, execute a command you did not intend for it to. To get rid of error messages, you can just delete the macro that generates them. For example, "Error 301" is generated by macro 301; you can delete it by entering "055 301". The following methods don't have this problem.

- Option #2: Pass user-entered DTMF digits only if they bypass the DTMF mute. To do this, use command 007 to turn on the DTMF mute bypass for the port that is connected to the Internet linking interface. To send DTMF digits to that interface, key up, press 'D' (the force execution digit, can be changed with command 078), then the digits you want to send. The controller will ignore those digits and will not send error messages in response to them.

If you do not have an audio delay module on the receiver that the DTMF digits are entered from, the first 40mS or so of the 'D' will be passed out the transmitter before the mute kicks in. If the DTMF decoder on the Internet linking interface is fast enough, it may decode that 'D' and get confused (that isn't a problem with IRLP, as it always ignores the DTMF digit 'D').

- Option #3: Use controller macros to generate DTMF digits. If the number of DTMF commands you want to send to the Internet linking interface is reasonably small, you can make a controller macro for each one. The macro can be renamed (see command 010), send a voice message to confirm what it is doing, and send DTMF. For example:

```
010 600 ABC                ;name macro ABC
055 600                    ;make sure macro is empty
056 600 036 139 003        ;speak "Connect three"
056 600 069 3 0003         ;send DTMF "0003" to TX 3
```

Alternately, the last two line of the above macro could be replaced with the following lines. This method allows DTMF pauses and the force-execution digit (normally 'D') to be sent (see command 069 for its limitations).

```
056 600 037 3              ;route following DTMF to TX 3
056 600 031 00 00 00 03   ;send DTMF "0003"
```

- Option #4: Make a command to regenerate whatever DTMF digits the users enter.

```
010 600 ABC                ;name macro "ABC"
067 600 01 1              ;allow macro to take data (see command 067)
```

055 600	;make sure macro is empty
056 600 069 3	;user-entered data will be appended here

Now entering "ABC 026" will cause DTMF "026" to be generated out transmitter 3. In other words, "ABC" means "send the following DTMF digits to transmitter 3".

Appendix L: Use '0*' For the Current Port

Commands 003, 004, 008, 037, 061, 068, 130 and 131 allow '0*' to be entered as a port number when the command is entered from one of the radio ports. The '0*' gets replaced with a number that corresponds with the port number that entered the DTMF digits. For example, if "008 0*2" is entered from port 01, the controller will execute it as if "008 012" had been entered. If a '0*' is used as a port number from the serial port or a macro that is executed by anything but a DTMF command (as part of an ID, event trigger, scheduler, etc), it will not be replaced with a port number and will usually cause an error.