

RLC-DSP402
Repeater, Link and Remote Base Controller

Software Version 5.18
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Introduction:

The RLC-DSP402 is a powerful tool for controlling radio systems. It features include:

- Two radio ports, each of which can be interfaced to a repeater, link or remote base radio.
- 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.
- Built-in DVR stores messages using 16MB internal flash memory.
- Extensive security system prevents unauthorized changes.
- 8 analog voltage inputs
- 8 logic inputs
- 8 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-DSP402 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.

By using the included RCI (Remote Control Interface) software, you may find that you don't need anything more than Chapter 1 of the manual, as it lets you set up the most commonly used controller features by pointing-and-clicking, without having to look up codes in the manual. If you find that you need some of the more advanced features, you can access them through the terminal window of RCI (entering commands directly or uploading text files full of commands), or of course you can enter the commands using a radio with a DTMF pad or using a computer running terminal software (serial or telnet). For more information about that, see Appendix F. More information about RCI can be found later in Chapter 1.

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://rlccontrollers.com/wiki/index.php?title=Repeater_Controller_FAQs or <http://tinyurl.com/3kjyhph>
- Email Us: You can get support for any of our products by emailing support@rlccontrollers.com.
- User's Groups. You can ask questions and exchange information with other users (and us) by email by joining one of these groups. You can find links to them on our support page (see the following)...
- Support Web Page: Links to the above support options and more can be found at <http://rlccontrollers.com/index.php/site/Support/> or <http://tinyurl.com/3v3jcek>

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Limited Warranty

COVERAGE:

Audio Test Solutions, 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, Audio Test Solutions, Inc. will cover parts, labor and return shipping. If failure is caused by instances other than manufacturing defects, Audio Test Solutions, Inc. will repair the product and bill the customer for parts and labor. Contact Audio Test Solutions, Inc. for more information.

What Audio Test Solutions, Inc. will not cover:

1. Too much voltage to the controller. The RLC-DSP402 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 Audio Test Solutions, Inc.

THIS WARRANTY HOLDS ONLY TO THE ORIGINAL PURCHASER

HOW TO GET SERVICE

Please contact Audio Test Solutions, Inc. for servicing information and authorization.

SOFTWARE

Audio Test Solutions, Inc. holds the copyright on the RLC-DSP402'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 Audio Test Solutions, Inc. Some (but not all) of the controller's software is licensed under the GPL (GNU Public License) and is available upon request.

SOFTWARE UPDATES

Audio Test Solutions, Inc. will provide FREE Software updates for 6 months from the date of purchase. The cost of further software updates will be determined at the release of the update. Updated manuals and shipping are additional.

Return Policy

These policies supersede policies appearing on all other Audio Test Solutions, 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) 294-5108.
- **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 Audio Test Solutions, Inc. for credit, exchange, replacement, or repair at Audio Test Solutions, 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
- **Audio Test Solutions, 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.

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-DSP402 Serial Number _____

(The serial number should be noted on your invoice and handwritten on the DSP402 circuit board)

RLC-DSP402 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:

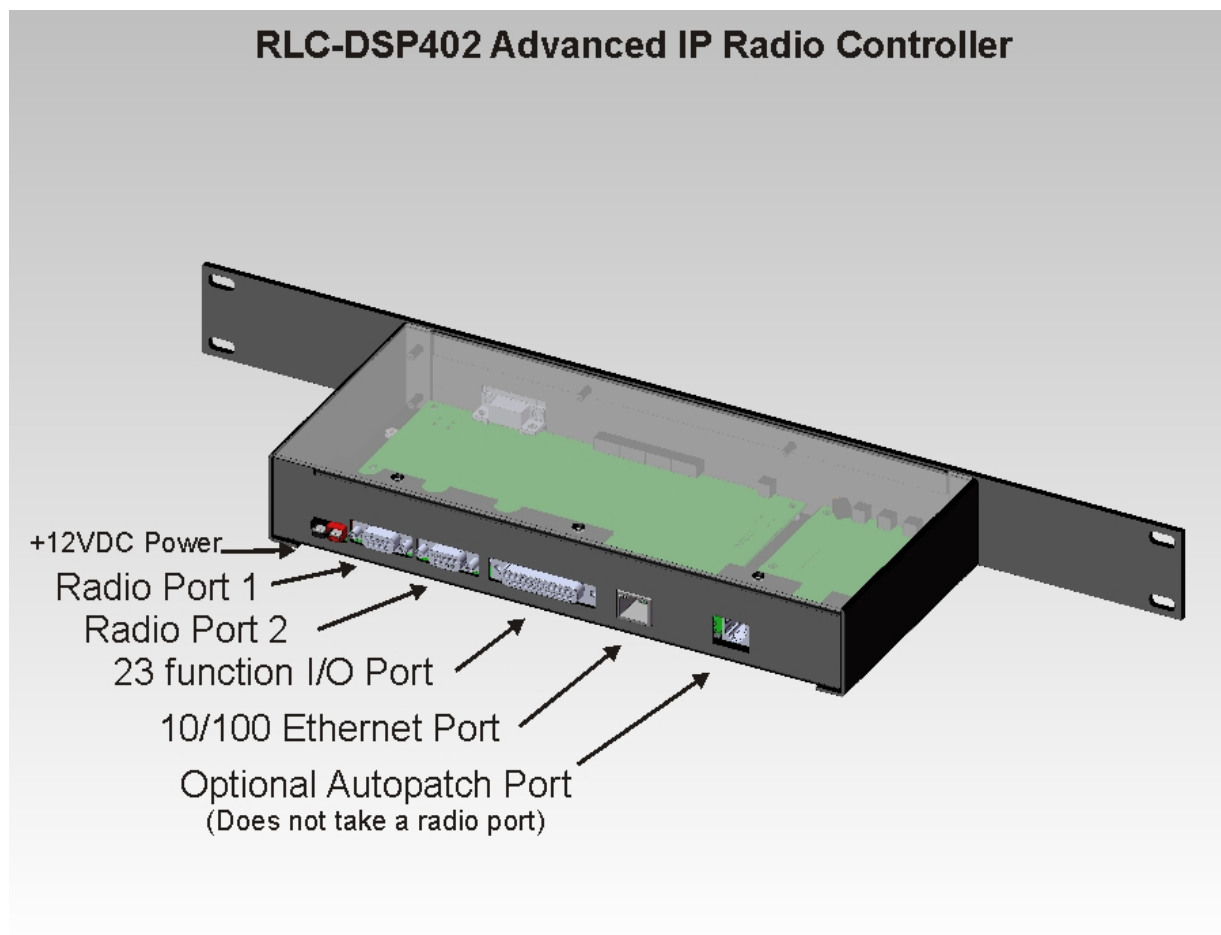
Audio Test Solutions, Inc.
4890 Vandaveer Rd
Billings, MT 59101

Comments:

Chapter 1: Getting Started

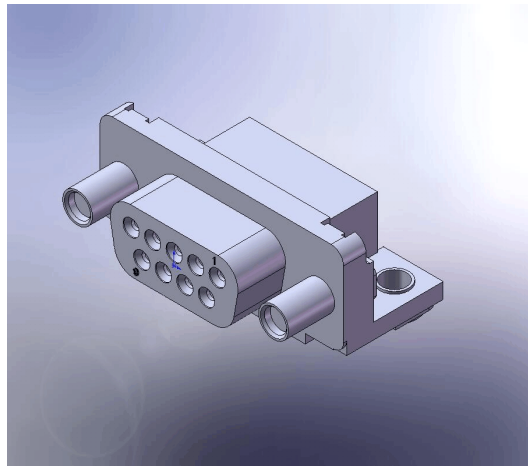
Welcome to the powerful RLC-DSP402 advanced DSP based communications controller. The DSP402 supports up to 12 full-duplex radio ports, 8 inputs, 8 analogs and 8 output channels in a small 1U (1.750") enclosure.

This section will cover the basic mechanical and port locations, radio port DB-9 connector pinouts and the DB-25 I/O connector pinout. 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 DSP402 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.



Radio Port Pinout

The DB-9 used on the DSP402 will accept any Audio Test Solutions controller based cable, but for extended operations you may need to make a few changes. The DSP402'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

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

I/O Port Pinout

The DB-25 used on the DSP402 will accept any Audio Test Solutions RLC-3 based cable. The I/O portion of the DSP402 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 I/O Connector

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 DSP402'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 $25V_i$, 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.

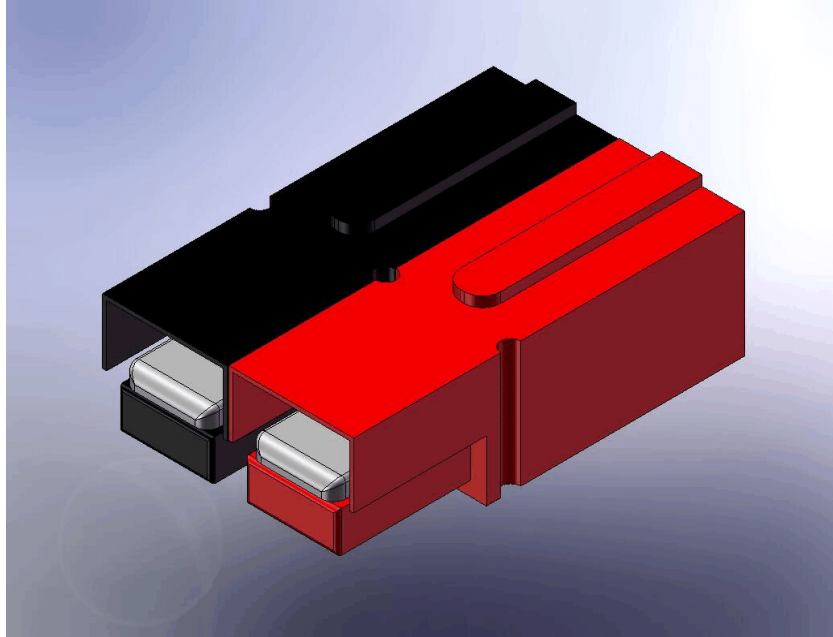
Pin	Functions		Pin	Functions
1	Ground Reference		14	Ground on I/O Board #1 : Analog 8 on I/ Board #2
2	Analog 7		15	Analog 6
3	Analog 5		16	Analog 4
4	Analog 3		17	Analog 2
5	Analog 1		18	Input 8
6	Input 7		19	Input 6
7	Input 5		20	Input 4
8	Input 3		21	Input 2
9	Input 1		22	Output 8
10	Output 7		23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

Power Input

The DSP402 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

Even if you plan to connect to the DSP402 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 DSP402, 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://rlccontrollers.com/wiki/index.php?title=RLC-DSP402 Firmware and Manuals](http://rlccontrollers.com/wiki/index.php?title=RLC-DSP402_Firmware_and_Manuals). Connect a serial cable between a COM port on your computer and the serial port on the front of the DSP402 (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 DSP402 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 DSP402 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 DSP402. 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 DSP402 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 DSP402 accepts the password you can now access the unit from the computer via the network.

When accessing the DSP402 from the serial port, no password is required.

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

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

Setting the Network Addresses Automatically

If the DSP402 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 DSP402 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 DSP402), you will need to set the IP address manually.

Setting the DSP402'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 DSP402 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 DSP402 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 DSP402 save those settings and restart (so it can use the new network settings).

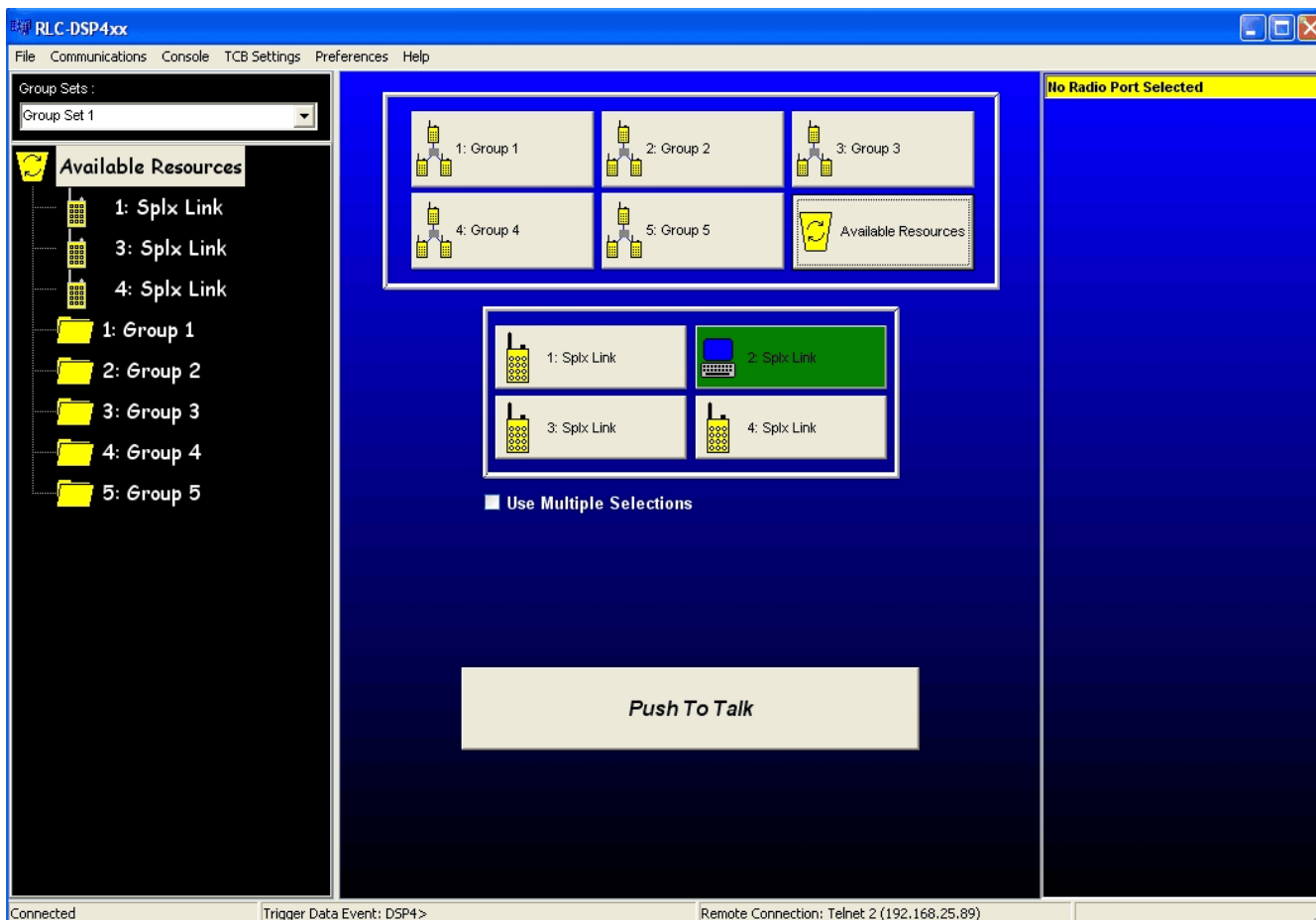
Testing the network settings

After the DSP402 restarts and loads the new network settings, you can try to “ping” it from your computer using the IP address you set for the DSP402. 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 DSP402, 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-DSP402 comes with a very flexible GUI interface that enables most aspects of the DSP402 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.



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.

Windows(TM) Remote Control Interface (RCI)

Port Setup from RCI

The easiest way to get to know your DSP402 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.



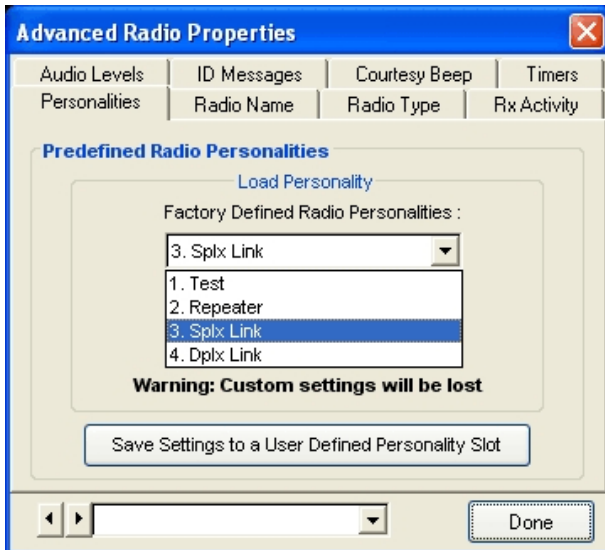
Accessing setup is accomplished by clicking your Right mouse button when the pointer is over the Port or Group you wish to configure.

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.

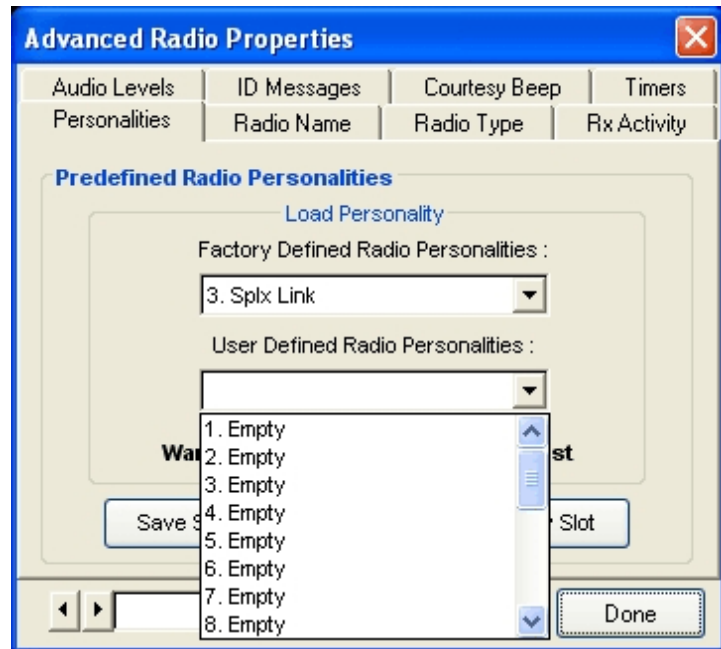


Some default radio personalities are included for a Repeater, Simplex Link and Duplex Link. To select a personality, select the required personality and press Done. Now all the settings stored in the personality will be recalled.

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.

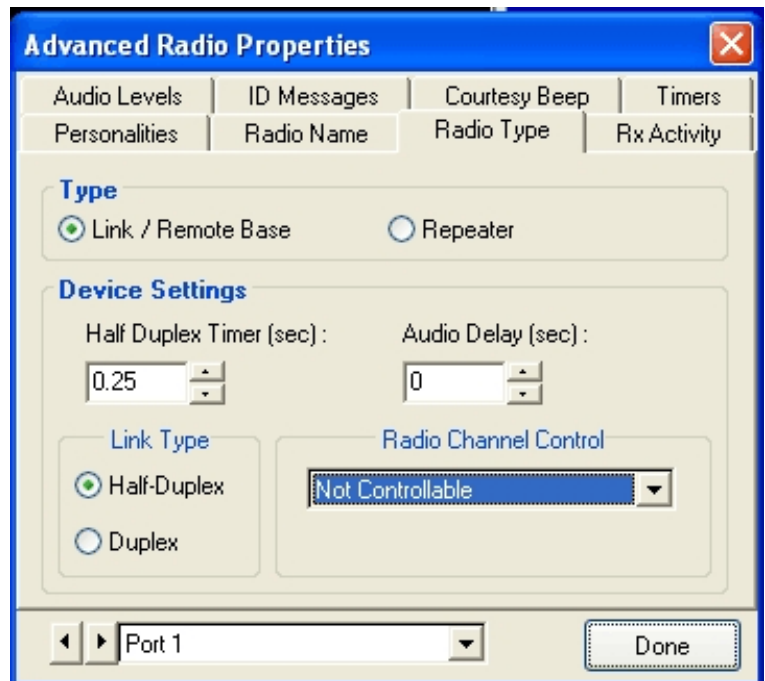
Repeater: This identifies that the radio connected to the port is operating as a repeater with its COR looped to the PTT on the same port.

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 hick-up.

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).

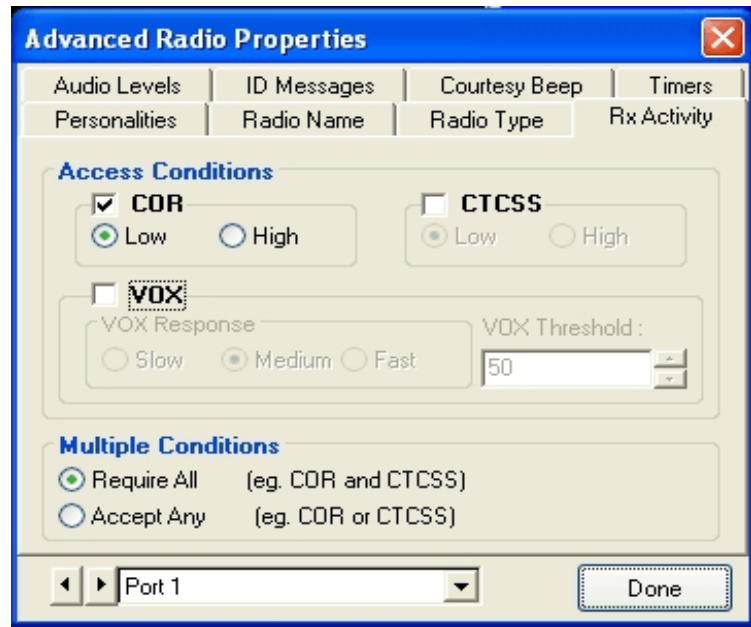
Radio Channel Control: This setting identifies the function of the connected radio. A Not Controllable radio is a typical radio without the controllers ability to frequency steer the radio. If steerable radios are connected, such as the Tait 8115, 9115 series radios, then select the Tait radio in the 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.

Advanced Radio Properties

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

Transmitter Settings

Transmit Level : 50 TX Tone Level : 20

☐ Mic Level ☒ Line Level

Receiver Settings

Receive Level : 50 ☐ Enable Automatic Gain Control

Port 1 Done

Enable Automatic Gain Control 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 DSP402.

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.

Advanced Radio Properties

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

IDs

☒ Enable IDs

Call Sign : KF7FW

Voice ID : Welcome to the KF7FW Repeater

Advanced

Port 1 Done

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

☒ **Custom**

Stardust [v] [Advanced]

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 [v] [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 title bar with a close button. Below the title bar are four tabs: 'Personalities', 'Radio Name', 'Radio Type', and 'Rx Activity'. The 'Timers' tab is active, showing a section titled 'Timers (sec)'. This section contains six timer 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 of the dialog, there is a dropdown menu set to 'Port 1' and a 'Done' button.

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

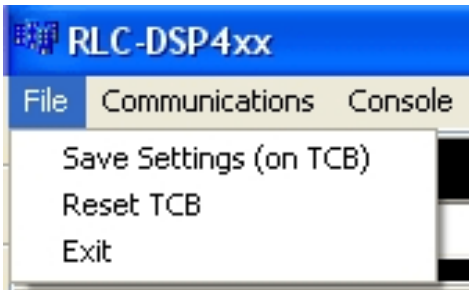
When using the calculator pad, different timer values are available when entering a time. Msec, Sec and Min are available.

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.

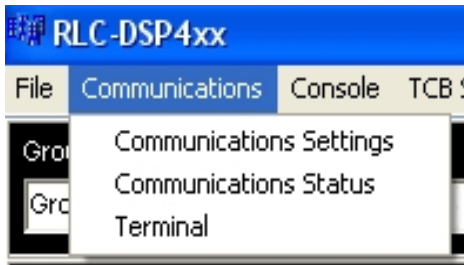


Save Settings (on TCB or RLC) will take the user changes and store them into non-volatile Flash memory. Until the settings are saved, they can be lost with a controller power-down event.

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

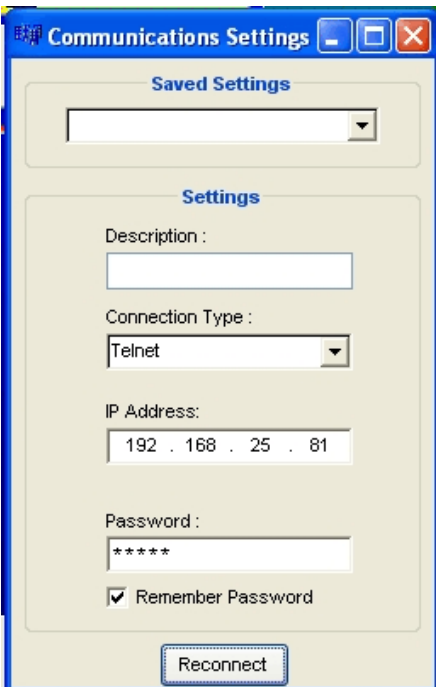
Exit will exit RCI

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.

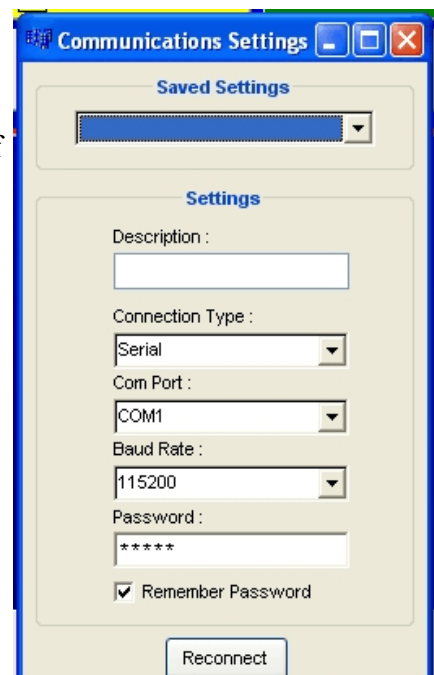
Communications Settings:

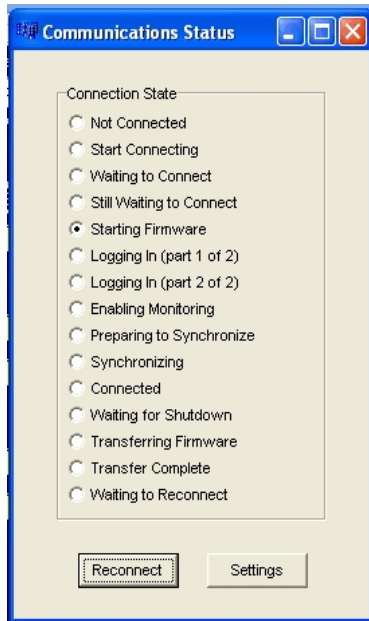


There are two options to connect to the unit. If using Telnet then an IP address and password is required. If using Serial, then a COM port, Baud Rate (115,200 Baud by default and password is necessary.

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.

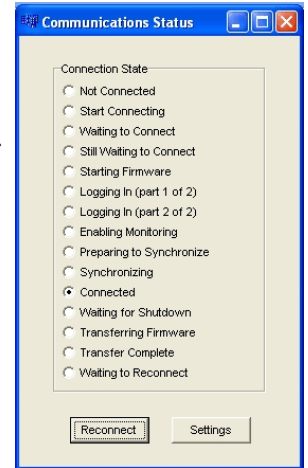




When RCI first starts, the **Communications Status** screen will display. This screen shows 15 discrete steps that effect the connection, updating and saving on the controller. If the controller is connected, the Connected line will be highlighted.

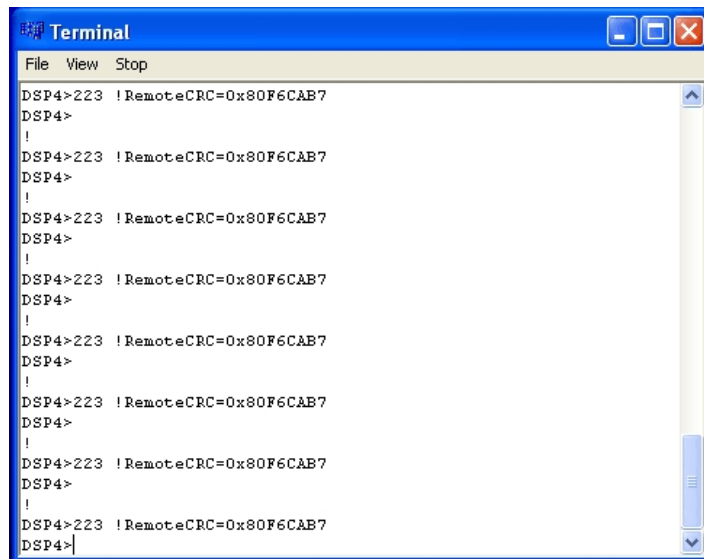
The communications settings will keep the system from connecting and when this occurs, the communications status screen will display. If your system is having connection problems, check the Communications Setup screen or press the Settings button.

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



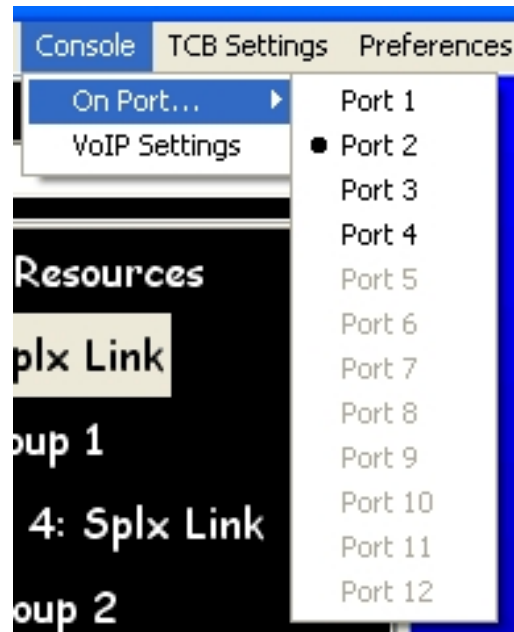
To use the Terminal as a standard terminal ensure the “Verbose” selection is not checked under the view menu.

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

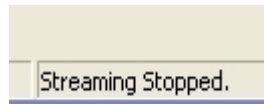
VoIP Settings can also accessed under the Console menu. VoIP is only available on computers that are operating over a network port but supports up to four connections at one time. The four connections share the same console port and get audio from the controller but are limited to one incoming audio 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.

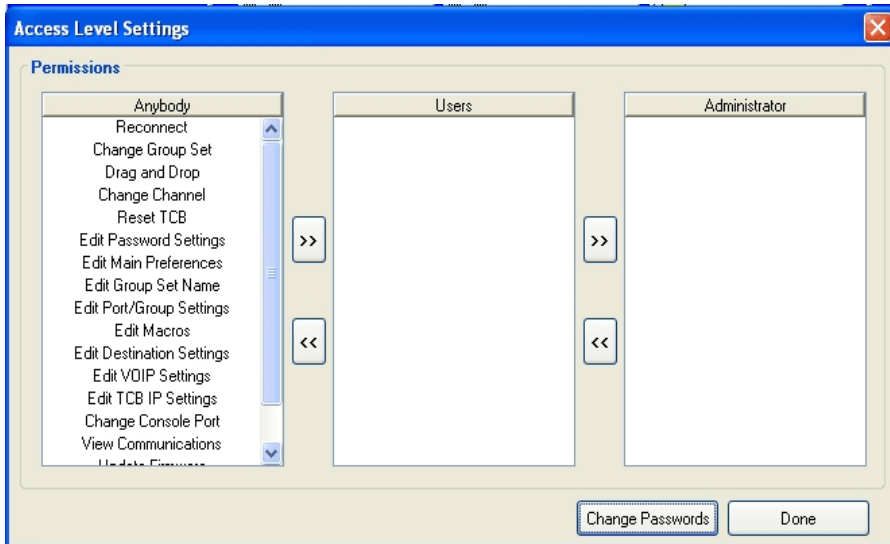
The screenshot shows the 'TCB Network Settings' dialog box. It has a 'Network Setup' section with two checked options: 'Enable Network' and 'Use DHCP'. Below these are three input fields for 'IP Address', 'IP Netmask', and 'IP Gateway', all showing '0 . 0 . 0 . 0'. To the right of these fields is a text 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 window controls RCI-level security. On this form are three columns (Anybody, Users and Administrator) and a list of actions that can be performed within RCI. An action that is in the "Anybody" column does not require a password, but when attempting to perform an action in the "Users" or "Administrator" column, you will be prompted to enter the respective user or administrator password. Administrator can perform the actions in the "Users" column, but users cannot perform the actions in the "Administrator" column. Actions can be moved between columns by selecting them with the mouse and clicking the appropriate arrow button.

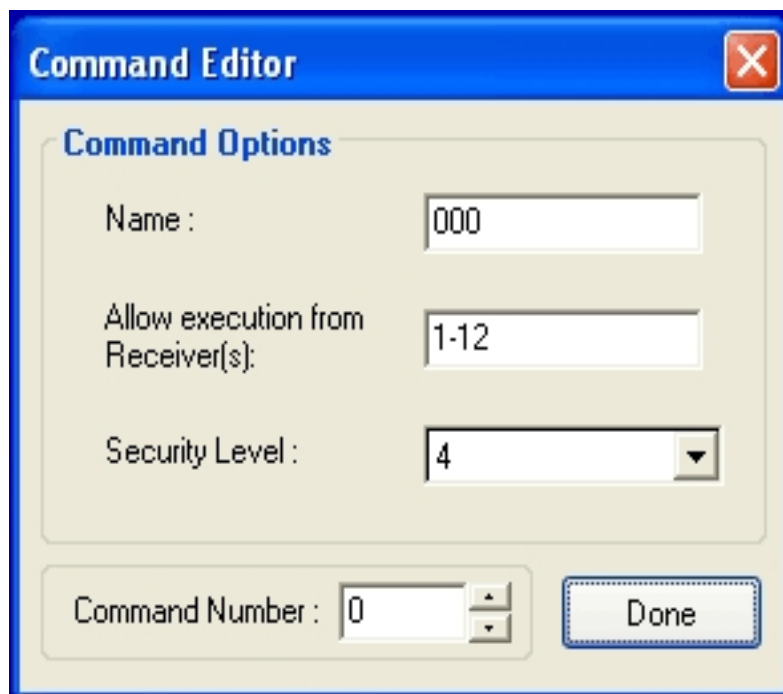
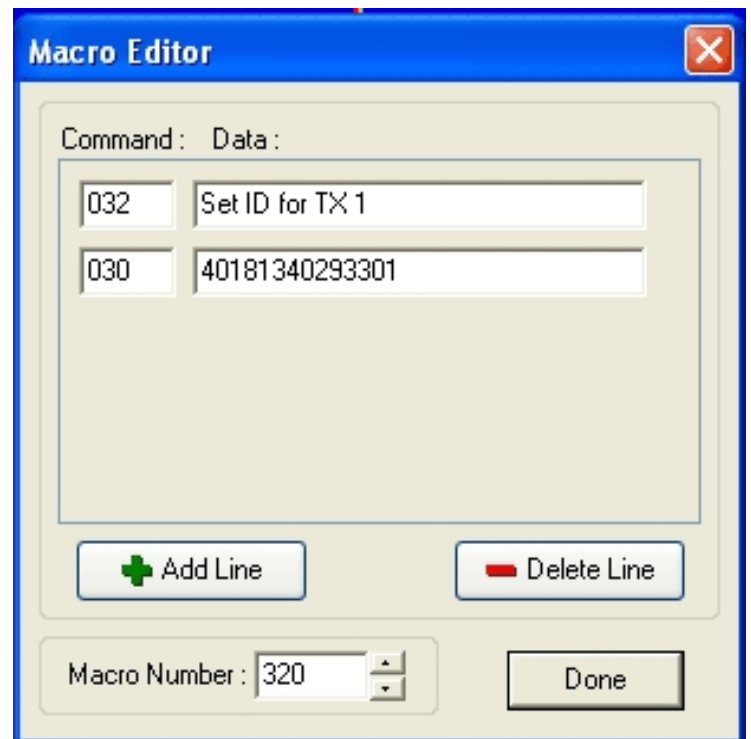
column, but users cannot perform the actions in the "Administrator" column. Actions can be moved between columns by selecting them with the mouse and clicking the appropriate arrow button.

The default user password is "user" and the default administrator password is "admin" but it is recommended that you change them when initially setting up your DSP402. To change the passwords click on the Change Passwords button. A form will appear where you can enter a new password for each level. If you forget either password, you can use command 238 at the terminal to reset it.

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.



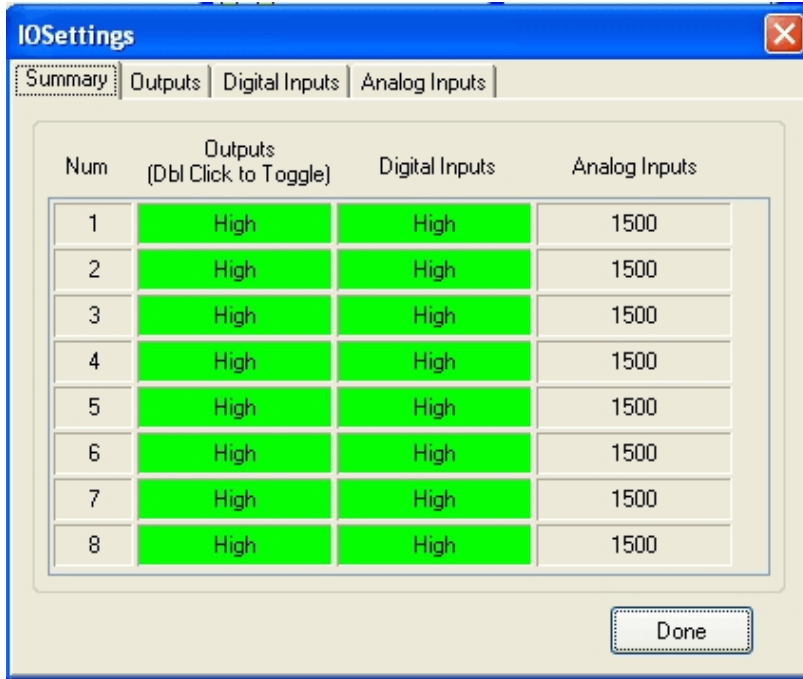
The next drop-down menu is the Command Editor. This feature allows Command Names to be changed, execution permissions to be assigned and security levels to be assigned. The command names can be addressed by DTMF Name or Number.

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 DSP402 has support for 8 input lines, 8 output lines and 8 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.

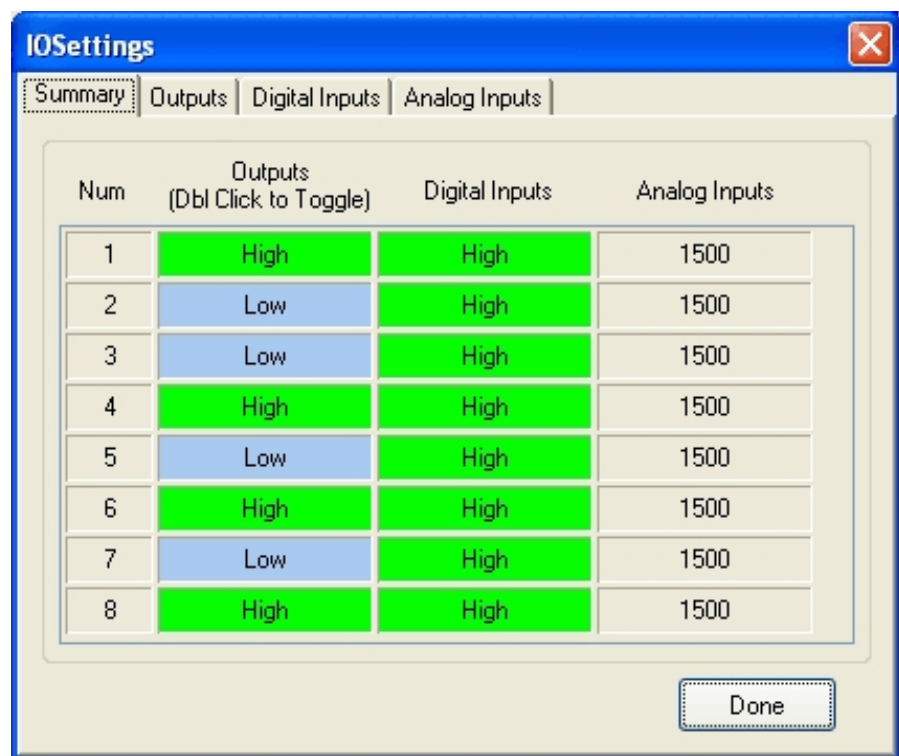


The summary screen shows all lines and the analog lines converted results. Currently the results are text based but a graphical faceplate template is being developed.

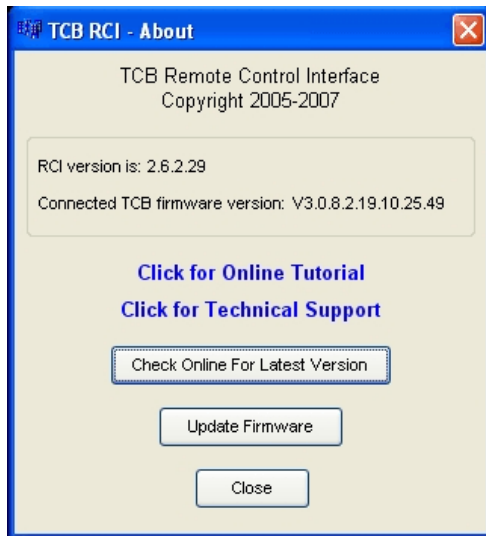
Only the output lines can be user functioned (because it is the only output feature) and is changed by double clicking the desired line.

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.



Other Misc. Menus and Operations



To manually check for an update for RCI and/or the DSP402 the user simply clicks the Help and the About sub-menu.

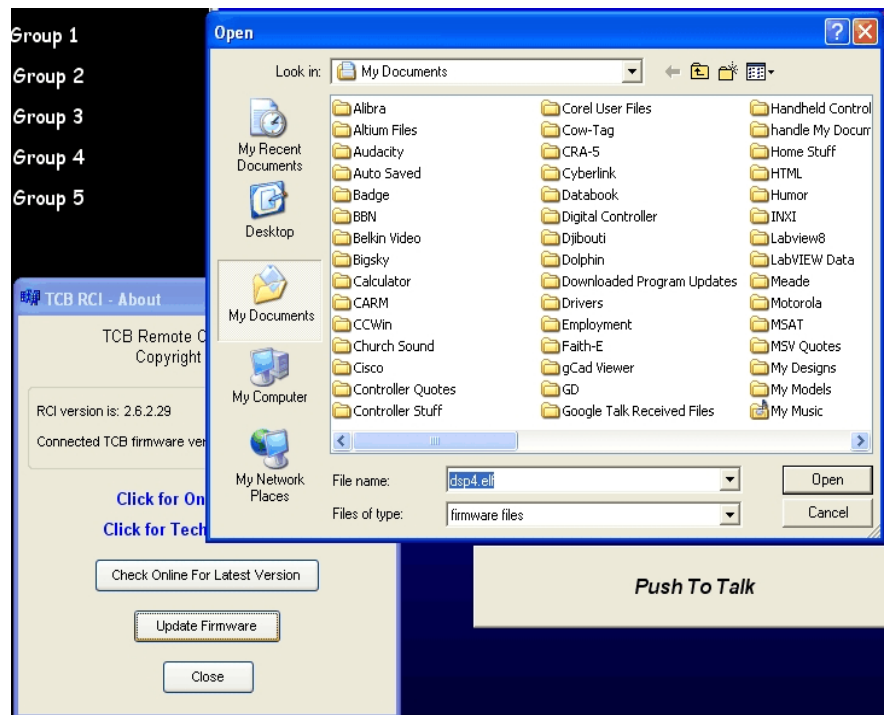
The following screen appears which accesses the Audio Test Solutions web site where the updates are located.

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.

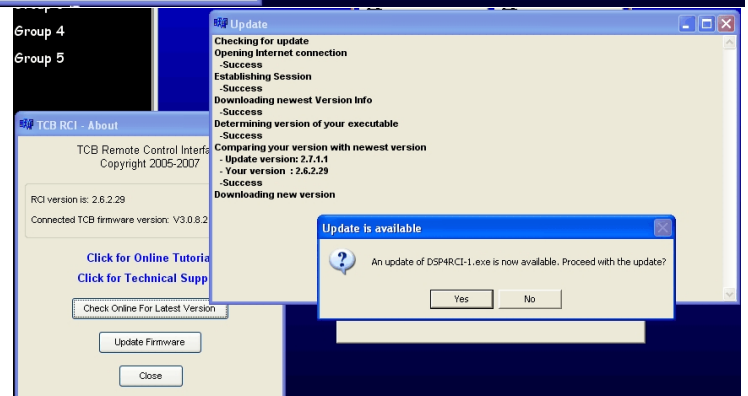
All RLC and TCB updates end in the “.elf” designation. This designation is the Linux and RTMS file that handles the executable.

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.



Complete Reference Manual

This is the last paragraph in many printed manuals. For many users, this information will be all that is needed to get the RLC-DSP402 interfaced to radios and programmed using the RCI software. For others who may wish to find more technical information about advanced capabilities of the controller, the complete reference manual may be available from the following sources:

- A CD-ROM, included with new controllers.
- The DSP402 firmware and manuals web page,
[http://rlccontrollers.com/wiki/index.php?title=RLC-DSP402 Firmware and Manuals](http://rlccontrollers.com/wiki/index.php?title=RLC-DSP402_Firmware_and_Manuals)
- In printed form from Audio Test Solutions.

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-DSP402 uses "port groups" (sometimes called 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 DSP402 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 "*15pp" 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.

Notes:

- In firmware versions through at least V4.10, "group_set" should be specified as one less than the intended groupset. For example, to select or recall the settings for groupset 1, use "0" when specifying the group_set when calling this command. For groupset 5, use "4".

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-DSP402 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-DSP402's COR and PL inputs.
- If you are not able to enter commands using DTMF, you may need to temporarily fool the RLC-DSP402 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-DSP402, the DSP402 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-DSP402 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 turn off a repeater or link (see the section "Turning a Repeater Off" at the beginning of Chapter 2 for more information), 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 Audio Test Solutions).

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. If not using an audio delay module, a mute time of one or two seconds usually works well.

The most important thing you can do to minimize falsing is to check your audio levels at each point in the signal chain. If the levels are high enough to cause distortion (even if it is not audible), it will introduce harmonics that can causing DTMF falsing. Chapter 1 includes instructions for setting the audio level received by the controller.

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.

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)
012. . . Message Start Delay Timer, Autopatch	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
013. . . Courtesy Beep Delay Timer, Receiver 1.	1 sec (100)
014. . . Courtesy Beep Delay Timer, Receiver 2.	1 sec (100)
015. . . Courtesy Beep Delay Timer, Receiver 3.	1 sec (100)
016. . . Courtesy Beep Delay Timer, Receiver 4.	1 sec (100)
017. . . Courtesy Beep Delay Timer, Receiver 5.	1 sec (100)
018. . . Courtesy Beep Delay Timer, Receiver 6.	1 sec (100)
019. . . Courtesy Beep Delay Timer, Receiver 7.	1 sec (100)
020. . . Courtesy Beep Delay Timer, Receiver 8.	1 sec (100)
021. . . Courtesy Beep Delay Timer, Receiver 9.	1 sec (100)
022. . . Courtesy Beep Delay Timer, Receiver 10.	1 sec (100)
023. . . Courtesy Beep Delay Timer, Receiver 11.	1 sec (100)
024. . . 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 063..074) 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
025. . . Hang Timer for Transmitter 1.	2 sec (200)
026. . . Hang Timer for Transmitter 2.	2 sec (200)
027. . . Hang Timer for Transmitter 3.	2 sec (200)
028. . . Hang Timer for Transmitter 4.	2 sec (200)
029. . . Hang Timer for Transmitter 5.	2 sec (200)
030. . . Hang Timer for Transmitter 6.	2 sec (200)
031. . . Hang Timer for Transmitter 7.	2 sec (200)
032. . . Hang Timer for Transmitter 8.	2 sec (200)
033. . . Hang Timer for Transmitter 9.	2 sec (200)
034. . . Hang Timer for Transmitter 10.	2 sec (200)
035. . . Hang Timer for Transmitter 11.	2 sec (200)
036. . . Hang Timer for Transmitter 12.	2 sec (200)
037. . . Hang Timer for Autopatch	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
038. . . DTMF Mute Timer, Receiver 1	1 sec (100)
039. . . DTMF Mute Timer, Receiver 2	1 sec (100)
040. . . DTMF Mute Timer, Receiver 3	1 sec (100)
041. . . DTMF Mute Timer, Receiver 4	1 sec (100)
042. . . DTMF Mute Timer, Receiver 5	1 sec (100)
043. . . DTMF Mute Timer, Receiver 6	1 sec (100)
044. . . DTMF Mute Timer, Receiver 7	1 sec (100)
045. . . DTMF Mute Timer, Receiver 8	1 sec (100)
046. . . DTMF Mute Timer, Receiver 9	1 sec (100)
047. . . DTMF Mute Timer, Receiver 10	1 sec (100)
048. . . DTMF Mute Timer, Receiver 11	1 sec (100)
049. . . DTMF Mute Timer, Receiver 12	1 sec (100)
050. . . DTMF Mute Timer, Autopatch	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
051. . . 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 012..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
052. . . Courtesy Beep After Voice Timer, Transmitter 1.	1 sec (100)
053. . . Courtesy Beep After Voice Timer, Transmitter 2.	1 sec (100)
054. . . Courtesy Beep After Voice Timer, Transmitter 3.	1 sec (100)
055. . . Courtesy Beep After Voice Timer, Transmitter 4.	1 sec (100)
056. . . Courtesy Beep After Voice Timer, Transmitter 5.	1 sec (100)
057. . . Courtesy Beep After Voice Timer, Transmitter 6.	1 sec (100)
058. . . Courtesy Beep After Voice Timer, Transmitter 7.	1 sec (100)
059. . . Courtesy Beep After Voice Timer, Transmitter 8.	1 sec (100)
060. . . Courtesy Beep After Voice Timer, Transmitter 9.	1 sec (100)
061. . . Courtesy Beep After Voice Timer, Transmitter 10.	1 sec (100)
062. . . Courtesy Beep After Voice Timer, Transmitter 11.	1 sec (100)
063. . . 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-DSP402 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
064. . . 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
065. . . 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
066. . . Mini-Hang Timer, Transmitter 1.	500 mS (050)
067. . . Mini-Hang Timer, Transmitter 2.	500 mS (050)
068. . . Mini-Hang Timer, Transmitter 3.	500 mS (050)
069. . . Mini-Hang Timer, Transmitter 4.	500 mS (050)
070. . . Mini-Hang Timer, Transmitter 5.	500 mS (050)
071. . . Mini-Hang Timer, Transmitter 6.	500 mS (050)
072. . . Mini-Hang Timer, Transmitter 7.	500 mS (050)
073. . . Mini-Hang Timer, Transmitter 8.	500 mS (050)
074. . . Mini-Hang Timer, Transmitter 9.	500 mS (050)
075. . . Mini-Hang Timer, Transmitter 10.	500 mS (050)
076. . . Mini-Hang Timer, Transmitter 11.	500 mS (050)
077. . . Mini-Hang Timer, Transmitter 12.	500 mS (050)
078. . . Mini-Hang Timer, Autopatch	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
079. . . Keyup Delay Timer, Receiver 1..	0 (Disabled)
080. . . Keyup Delay Timer, Receiver 2..	0 (Disabled)
081. . . Keyup Delay Timer, Receiver 3..	0 (Disabled)
082. . . Keyup Delay Timer, Receiver 4..	0 (Disabled)
083. . . Keyup Delay Timer, Receiver 5..	0 (Disabled)
084. . . Keyup Delay Timer, Receiver 6..	0 (Disabled)
085. . . Keyup Delay Timer, Receiver 7..	0 (Disabled)
086. . . Keyup Delay Timer, Receiver 8..	0 (Disabled)
087. . . Keyup Delay Timer, Receiver 9..	0 (Disabled)
088. . . Keyup Delay Timer, Receiver 10..	0 (Disabled)
089. . . Keyup Delay Timer, Receiver 11..	0 (Disabled)
090. . . 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
091. . . 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
092. . . 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
093. . . Receiver Priority Mute Timer, Receiver 1.	150 mS (015)
094. . . Receiver Priority Mute Timer, Receiver 2.	150 mS (015)
095. . . Receiver Priority Mute Timer, Receiver 3.	150 mS (015)
096. . . Receiver Priority Mute Timer, Receiver 4.	150 mS (015)
097. . . Receiver Priority Mute Timer, Receiver 5.	150 mS (015)
098. . . Receiver Priority Mute Timer, Receiver 6.	150 mS (015)
099. . . Receiver Priority Mute Timer, Receiver 7.	150 mS (015)
100. . . Receiver Priority Mute Timer, Receiver 8.	150 mS (015)
101. . . Receiver Priority Mute Timer, Receiver 9.	150 mS (015)
102. . . Receiver Priority Mute Timer, Receiver 10.	150 mS (015)
103. . . Receiver Priority Mute Timer, Receiver 11.	150 mS (015)
104. . . 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
105. . . Receiver Force Half Duplex Timer, Receiver 1.	0 (disabled)
106. . . Receiver Force Half Duplex Timer, Receiver 2.	0 (disabled)
107. . . Receiver Force Half Duplex Timer, Receiver 3.	0 (disabled)
108. . . Receiver Force Half Duplex Timer, Receiver 4.	0 (disabled)
109. . . Receiver Force Half Duplex Timer, Receiver 5.	0 (disabled)
110. . . Receiver Force Half Duplex Timer, Receiver 6.	0 (disabled)
111. . . Receiver Force Half Duplex Timer, Receiver 7.	0 (disabled)
112. . . Receiver Force Half Duplex Timer, Receiver 8.	0 (disabled)
113. . . Receiver Force Half Duplex Timer, Receiver 9.	0 (disabled)
114. . . Receiver Force Half Duplex Timer, Receiver 10.	0 (disabled)
115. . . Receiver Force Half Duplex Timer, Receiver 11.	0 (disabled)
116. . . 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
117. . . Recently Active RX/TX Timer, Port 1.	1 mS (default)
118. . . Recently Active RX/TX Timer, Port 2.	1 mS (default)

119. . . Recently Active RX/TX Timer, Port 3.	1 mS (default)
120. . . Recently Active RX/TX Timer, Port 4.	1 mS (default)
121. . . Recently Active RX/TX Timer, Port 5.	1 mS (default)
122. . . Recently Active RX/TX Timer, Port 6.	1 mS (default)
123. . . Recently Active RX/TX Timer, Port 7.	1 mS (default)
124. . . Recently Active RX/TX Timer, Port 8.	1 mS (default)
125. . . Recently Active RX/TX Timer, Port 9.	1 mS (default)
126. . . Recently Active RX/TX Timer, Port 10.	1 mS (default)
127. . . Recently Active RX/TX Timer, Port 11.	1 mS (default)
128. . . 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
129. . . Patch Link Wait Before Idle Timer, Port 1.	200 mS (default)
130. . . Patch Link Wait Before Idle Timer, Port 2.	200 mS (default)
131. . . Patch Link Wait Before Idle Timer, Port 3.	200 mS (default)
132. . . Patch Link Wait Before Idle Timer, Port 4.	200 mS (default)
133. . . Patch Link Wait Before Idle Timer, Port 5.	200 mS (default)
134. . . Patch Link Wait Before Idle Timer, Port 6.	200 mS (default)
135. . . Patch Link Wait Before Idle Timer, Port 7.	200 mS (default)
136. . . Patch Link Wait Before Idle Timer, Port 8.	200 mS (default)
137. . . Patch Link Wait Before Idle Timer, Port 9.	200 mS (default)
138. . . Patch Link Wait Before Idle Timer, Port 10.	200 mS (default)
139. . . Patch Link Wait Before Idle Timer, Port 11.	200 mS (default)
140. . . 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
141. . . Console PTT Force Inactive Timer, Port 1.	100 mS (default)
142. . . Console PTT Force Inactive Timer, Port 2.	100 mS (default)
143. . . Console PTT Force Inactive Timer, Port 3.	100 mS (default)
144. . . Console PTT Force Inactive Timer, Port 4.	100 mS (default)
145. . . Console PTT Force Inactive Timer, Port 5.	100 mS (default)
146. . . Console PTT Force Inactive Timer, Port 6.	100 mS (default)
147. . . Console PTT Force Inactive Timer, Port 7.	100 mS (default)
148. . . Console PTT Force Inactive Timer, Port 8.	100 mS (default)
149. . . Console PTT Force Inactive Timer, Port 9.	100 mS (default)

- 150. . . Console PTT Force Inactive Timer, Port 10. 100 mS (default)
- 151. . . Console PTT Force Inactive Timer, Port 11. 100 mS (default)
- 152. . . 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 (or when the courtesy beep is sent, if that option is enabled with command 041).

- 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)
208. . . Time Out Timer, Autopatch	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
209. . . Dial Tone Timer, Transmitter 1.....	8 sec (008)
210. . . Dial Tone Timer, Transmitter 2.....	8 sec (008)
211. . . Dial Tone Timer, Transmitter 3.....	8 sec (008)
212. . . Dial Tone Timer, Transmitter 4.....	8 sec (008)
213. . . Dial Tone Timer, Transmitter 5.....	8 sec (008)
214. . . Dial Tone Timer, Transmitter 6.....	8 sec (008)
215. . . Dial Tone Timer, Transmitter 7.....	8 sec (008)
216. . . Dial Tone Timer, Transmitter 8.....	8 sec (008)
217. . . Dial Tone Timer, Transmitter 9.....	8 sec (008)
218. . . Dial Tone Timer, Transmitter 10.....	8 sec (008)
219. . . Dial Tone Timer, Transmitter 11.....	8 sec (008)
220. . . Dial Tone Timer, Transmitter 12.....	8 sec (008)
221. . . Dial Tone Timer, Autopatch	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
222. . . Preaccess Timer, Port 1.	8 sec (008)
223. . . Preaccess Timer, Port 2.	8 sec (008)
224. . . Preaccess Timer, Port 3.	8 sec (008)
225. . . Preaccess Timer, Port 4.	8 sec (008)
226. . . Preaccess Timer, Port 5.	8 sec (008)
227. . . Preaccess Timer, Port 6.	8 sec (008)
228. . . Preaccess Timer, Port 7.	8 sec (008)
229. . . Preaccess Timer, Port 8.	8 sec (008)
230. . . Preaccess Timer, Port 9.	8 sec (008)
231. . . Preaccess Timer, Port 10.	8 sec (008)
232. . . Preaccess Timer, Port 11.	8 sec (008)
233. . . Preaccess Timer, Port 12.	8 sec (008)
234. . . Preaccess Timer, Autopatch	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
235... User Timer 00.	0 sec (000)
236... User Timer 01.	0 sec (000)
237... User Timer 02.	0 sec (000)
238... User Timer 03.	0 sec (000)
239... User Timer 04.	0 sec (000)
240... User Timer 05.	0 sec (000)
241... User Timer 06.	0 sec (000)
242... User Timer 07.	0 sec (000)
243... User Timer 08.	0 sec (000)
244... User Timer 09.	0 sec (000)
245... User Timer 10.	0 sec (000)
246... User Timer 11.	0 sec (000)
247... User Timer 12.	0 sec (000)
248... User Timer 13.	0 sec (000)
249... User Timer 14.	0 sec (000)
250... 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
251. . . DTMF Interdigit Timer, Receiver 1.	5 sec (005)
252. . . DTMF Interdigit Timer, Receiver 2.	5 sec (005)
253. . . DTMF Interdigit Timer, Receiver 3.	5 sec (005)
254. . . DTMF Interdigit Timer, Receiver 4.	5 sec (005)
255. . . DTMF Interdigit Timer, Receiver 5.	5 sec (005)
256. . . DTMF Interdigit Timer, Receiver 6.	5 sec (005)
257. . . DTMF Interdigit Timer, Receiver 7.	5 sec (005)
258. . . DTMF Interdigit Timer, Receiver 8.	5 sec (005)
259. . . DTMF Interdigit Timer, Receiver 9.	5 sec (005)
260. . . DTMF Interdigit Timer, Receiver 10.	5 sec (005)
261. . . DTMF Interdigit Timer, Receiver 11.	5 sec (005)
262. . . DTMF Interdigit Timer, Receiver 12.	5 sec (005)
263. . . DTMF Interdigit Timer, Autopatch	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
264. . . 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
265. . . Log-off timer for Port 1.	300 sec (300)
266. . . Log-off timer for Port 2.	300 sec (300)
267. . . Log-off timer for Port 3.	300 sec (300)
268. . . Log-off timer for Port 4.	300 sec (300)
269. . . Log-off timer for Port 5.	300 sec (300)
270. . . Log-off timer for Port 6.	300 sec (300)
271. . . Log-off timer for Port 7.	300 sec (300)
272. . . Log-off timer for Port 8.	300 sec (300)
273. . . Log-off timer for Port 9.	300 sec (300)
274. . . Log-off timer for Port 10.	300 sec (300)
275. . . Log-off timer for Port 11.	300 sec (300)
276. . . Log-off timer for Port 12.	300 sec (300)
277. . . Log-off timer for the Autopatch	300 sec (300)
278. . . Log-off timer for the Serial Port	300 sec (300)
279. . . Log-off timer for the Webserver	300 sec (300)
280. . . Log-off timer for Telnet Server 1.. . . .	300 sec (300)
281. . . Log-off timer for Telnet Server 2.. . . .	300 sec (300)
282. . . Log-off timer for Telnet Server 3.. . . .	300 sec (300)
283. . . Log-off timer for Telnet Server 4.. . . .	300 sec (300)

Beacon Timer:

This timer specifies the amount of time the controller will wait before trying to send the next beacon. See Chapter 19 for more information about the beaconing system.

Timer Number	Defaults
284. . . Beacon Timer	1 sec (001)

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
285. . . Re-Enable Keyup Delay Timer, RX 1.	60 sec (060)
286. . . Re-Enable Keyup Delay Timer, RX 2.	60 sec (060)
287. . . Re-Enable Keyup Delay Timer, RX 3.	60 sec (060)
288. . . Re-Enable Keyup Delay Timer, RX 4.	60 sec (060)
289. . . Re-Enable Keyup Delay Timer, RX 5.	60 sec (060)
290. . . Re-Enable Keyup Delay Timer, RX 6.	60 sec (060)
291. . . Re-Enable Keyup Delay Timer, RX 7.	60 sec (060)
292. . . Re-Enable Keyup Delay Timer, RX 8.	60 sec (060)
293. . . Re-Enable Keyup Delay Timer, RX 9.	60 sec (060)
294. . . Re-Enable Keyup Delay Timer, RX 10.	60 sec (060)
295. . . Re-Enable Keyup Delay Timer, RX 11.	60 sec (060)
296. . . 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:

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

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

```

023: Stop a Timer

This command allows you to stop a timer, so that it will not finish counting down and eventually expire. The controller automatically stops most timers as needed, so the only time you should need to use this command is when you want to change the way the controller normally works. Most timers automatically stop when they expire.

 $\langle 023 \rangle$ xxx

Parameters:

- 023 is the default command name.
- XXX is the timer number

Pseudo Code:

```
count = 0 // Stop timer
```

025: Sets the Time of Day Clock

This command allows you to set the time of day clock on the RLC-DSP402.

<025> hh mm a/p

Parameters:

- 025 is the default command name.
- HH is the actual hours with leading zeros
- MM is the actual minutes with leading zeros
- a/p is the AM/PM selection (1=PM, 0=AM)

Example:

Want to set the time to 3:25 PM

<025> 03 25 1 D or unkey or <Enter>

Voice Response: "<Hour> <Minute> <AM/PM>"

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-DSP402 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-DSP402 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.

066: Send a Voice Message Using English Words

This command is a more convenient alternative to commands 036, 063 and 064 when entering voice messages using a computer. It allows you to type voice messages in English rather than looking up word numbers (in Appendix C). It is not useful when programming using a radio with a DTMF pad, as you can't directly enter the whole alphabet using DTMF.

```
066 "door open"
066 "[polite] door open"
066 "[polite:CCC] door open"
```

To make the controller speak a message using command 066, just enter the command number, then the message surrounded in double-quotes (without the quotes, the controller will remove the spaces from the message). The controller will look for each word in its library (see Appendix C for a list of words), and speak it if it is found. If the word is not found, the controller will spell it (this works well for call signs). Note that if you forget the quotes, the controller will skip the spaces, run all of the words together into one long string, and will likely spell the whole message. This format corresponds with how command 036 generates voice messages.

If the special word "[polite]" (entered with the square brackets) is found in the message, the remainder of the message will be spoken "politely", that is the controller will stop speaking and discard the remainder of the message if someone keys up a connected receiver. This is useful for non-essential announcement messages, and corresponds with how command 063 works.

It is also possible to use this command to speak a polite message that if interrupted, will do something else. This is commonly used to speak ID messages which if interrupted will cause a CW ID to be sent. This corresponds with how command 064 works.

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

Notes:

- 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.
- Command 066 may be a more convenient alternative to this command if you are entering messages using a computer (rather than a DTMF pad).

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.
- Command 066 may be a more convenient alternative to this command if you are entering messages using a computer (rather than a DTMF pad).

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 332, 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 380) 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):

```
053 332 064 380 039 034 unkey, D or <Enter>
```

The above string uses command 053 to program macro 332 to execute command number 064. When command 064 executes, it checks for receiver activity. If the receiver is active, it executes command 380 (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.
- Command 066 may be a more convenient alternative to this command if you are entering messages using a computer (rather than a DTMF pad).

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-DSP402 courtesy beeps are not simply a programmable beep. When it is time to send a courtesy beep, the RLC-DSP402 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 to set the conditions under which courtesy beeps will be sent to the specified transmitter, or disable them completely. Note that this command deals with transmitters; if you want to disable the courtesy beep for a receiver, just erase the courtesy beep macro for that receiver (see Chapter 8) using command 055.

The default is to send courtesy beeps only to transmitters that are on ports configured as repeaters, not links or remote bases (see Chapter 2). By default, courtesy beeps are disabled during autopatch calls (see chapter 13) and when using the interactive HF remote base (see Chapter 15), although this command will allow you to override either or both of those settings.

The final option may help discourage "tailgating" (keying up before the courtesy beep). Normally the time out timers get reset immediately when a receiver unkeys. If, however, this option is set to 1 (rather than 0), the time out timers won't be reset until the courtesy beep is sent. This will increase the chance of a "tailgater" getting cut off by the time out timer expiring.

<041> pp 0	Disable all courtesy beeps for TX pp
<041> pp 1	Enable courtesy beeps for TX pp only if it is a repeater (default setting)
<041> pp 2	Enable courtesy beeps for TX pp regardless of whether it is a repeater or link (default setting)
<041> pp e a	As before, plus control whether courtesy beeps are sent during autopatch calls. Set 'a' to 0 to disable (default), 1 to enable.
<041> pp e a h	As before, plus control whether courtesy beeps are sent while using the interactive HF mode. Set 'h' to 0 to disable (default), 1 to enable.
<041> pp e a h t	As before, plus control when the time out timers get reset. Set 't' to 0 to reset them immediately when a receiver goes inactive (default) or to 1 to wait until the courtesy beep.

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-DSP402 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)

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

Digital Voice Recorder Functions

What the DVR is:

On most other repeater controllers, a digital voice recorder is an option, if available at all. The DSP402 has a built in DVR with many advanced features. Messages can be stored temporarily in RAM or permanently in flash memory using an optional SD memory card or USB flash drive, which provide virtually unlimited storage. The DVR 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 entered by DTMF, while others are played automatically, such as ID messages. Both types of messages are 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 900 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.

The Audio Check Command:

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.

- Enter "171 900", unkey, then key and say, "Record your message now"
- Enter "171 901", unkey, then key and say, "Message stored". After this and the following commands, the DVR should respond "message stored".
- Enter "171 902", unkey, then key and say, "Message erased"
- Enter "171 903", unkey, then key and say, "Who is your message for?"
- Enter "171 904", unkey, then key and say, "There are no messages"
- Enter "171 905", unkey, then key and say, "There is mail for..."

If you want to see how your messages sound, you can play them by Command 173 900 <unkey> (for track 900).

If you want to erase one of these tracks so you can record it again, enter Command 174 900<unkey> (to erase track 900). 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 . For an example of how each of the DVR commands can be used, see

http://rlccontrollers.com/wiki/index.php?title=DSP404_DVR_Example

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 (the big DVR, not the small one) by programming macros similar to those shown below. To make polite DVR messages, the DVR 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 380 if interrupted (like command 064):

055 601	; erase macro
056 601 036 801	; start polite mode
056 601 173 <dvr tracks>	; play dvr tracks
056 601 036 803 380	; stop polite mode, do 380 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).

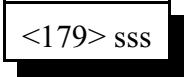
<178>

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.



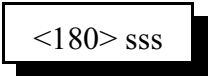
```
<179> sss
```

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.



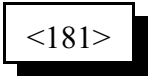
```
<180> sss
```

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-DSP402 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 port connector also has serial port connections for controlling remote base radios with RS-232 serial ports (see Chapter 1 for the DIP switches that enable them). There is also a type of serial data ("SPI") that can be sent with the open collector output lines on the I/O connectors that is usually used for controlling remote base interfaces (RLC-ICM, Doug Hall RBI-1, or BCD-controlled radios).

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-DSP402 is RS-232 compatible. All you need to connect it to a computer, terminal or modem is the proper cable.

Both radio ports on the DSP402 have DIP switches near the radio port DB-9 connector that can be used to enable a RS-232 serial port (see page 1-2 and following for more information). Note that the serial port should be enabled for only one of the radio ports, as they share some circuitry.

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.

The SPI Serial Format:

There is another type of serial protocol that is totally unrelated to RS-232. It is used for controlling some remote base interfaces, such as the Doug Hall RBI-1, RLC-ICM and BCD radio interfaces. Instead of using a data in and data out line like RS-232, it uses two lines for output: data out and clock out. There is no input to the controller; data is transferred only one way. Since there is a clock line, there is no need to specify a baud rate (although there are a few timing restrictions). The RLC-DSP402 uses the open collector output lines to send this type of serial. It is sent automatically by the RBI-1 / RLC-ICM commands and can be sent manually using command 138. Remember that the outputs are open collector and require pullup resistors (pullups are built into the RBI-1 and RLC-ICM).

024: Set Up RS-232 Serial Baud Rate

This command allows you to set up the baud rate for the RLC-DSP402'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). If you are using the serial port for controlling an HF remote base (see Chapter 15), the controller will set the baud rate automatically for the type of HF radio you are using.

`<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 300..319 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-DSP402 currently supports the more flexible of the two types; eventually it may support both. The kind the RLC-DSP402 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-DSP402 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-DSP402 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-DSP402 will let you nest macros, 5 or 6 levels. If you ever exceed this limit, error macro 309 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..411 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-DSP402 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

Macros 412..419 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
412. . .	Low Alarm, Analog Line 1
413. . .	Low Alarm, Analog Line 2
414. . .	Low Alarm, Analog Line 3
415. . .	Low Alarm, Analog Line 4
416. . .	Low Alarm, Analog Line 5
417. . .	Low Alarm, Analog Line 6
418. . .	Low Alarm, Analog Line 7
419. . .	Low Alarm, Analog Line 8

Macros 420..427 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
420. . .	Alarm to Normal, Analog Line 1
421. . .	Alarm to Normal, Analog Line 2
422. . .	Alarm to Normal, Analog Line 3
423. . .	Alarm to Normal, Analog Line 4
424. . .	Alarm to Normal, Analog Line 5
425. . .	Alarm to Normal, Analog Line 6
426. . .	Alarm to Normal, Analog Line 7
427. . .	Alarm to Normal, Analog Line 8

Macros 428..435 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
428. . .	Low to High, Input Line 1
429. . .	Low to High, Input Line 2
430. . .	Low to High, Input Line 3
431. . .	Low to High, Input Line 4
432. . .	Low to High, Input Line 5
433. . .	Low to High, Input Line 6
434. . .	Low to High, Input Line 7
435. . .	Low to High, Input Line 8

Macros 436..443 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
--------------	-------------------

436. . .	High to Low, Input Line 1
437. . .	High to Low, Input Line 2
438. . .	High to Low, Input Line 3
439. . .	High to Low, Input Line 4
440. . .	High to Low, Input Line 5
441. . .	High to Low, Input Line 6
442. . .	High to Low, Input Line 7
443. . .	High to Low, Input Line 8

Macros 444..455 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
--------------	-------------------

444. . .	Time-out Timer Message, Port 1
445. . .	Time-out Timer Message, Port 2
446. . .	Time-out Timer Message, Port 3
447. . .	Time-out Timer Message, Port 4
448. . .	Time-out Timer Message, Port 5
449. . .	Time-out Timer Message, Port 6
450. . .	Time-out Timer Message, Port 7
451. . .	Time-out Timer Message, Port 8
452. . .	Time-out Timer Message, Port 9
453. . .	Time-out Timer Message, Port 10
454. . .	Time-out Timer Message, Port 11
455. . .	Time-out Timer Message, Port 12
456. . .	Time-out Timer Message, Autopatch

Macros 456..467 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
457. . .	Time-out Condition Clear Message, Port 1
458. . .	Time-out Condition Clear Message, Port 2
459. . .	Time-out Condition Clear Message, Port 3
460. . .	Time-out Condition Clear Message, Port 4
461. . .	Time-out Condition Clear Message, Port 5
462. . .	Time-out Condition Clear Message, Port 6
463. . .	Time-out Condition Clear Message, Port 7
464. . .	Time-out Condition Clear Message, Port 8
465. . .	Time-out Condition Clear Message, Port 9
466. . .	Time-out Condition Clear Message, Port 10
467. . .	Time-out Condition Clear Message, Port 11
468. . .	Time-out Condition Clear Message, Port 12
469. . .	Time-out Condition Clear Message, Autopatch

Macros 468..479 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

470. . . Pre-Access Storage, Port 1
 471. . . Pre-Access Storage, Port 2
 472. . . Pre-Access Storage, Port 3
 473. . . Pre-Access Storage, Port 4
 474. . . Pre-Access Storage, Port 5
 475. . . Pre-Access Storage, Port 6
 476. . . Pre-Access Storage, Port 7
 477. . . Pre-Access Storage, Port 8
 478. . . Pre-Access Storage, Port 9
 479. . . Pre-Access Storage, Port 10
 480. . . Pre-Access Storage, Port 11
 481. . . Pre-Access Storage, Port 12
 482. . . Access Password, Autopatch

Macro 480 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

483. . . Macro Called on Reset

Macro 481 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

484. . . System Temporary Macro

Macros 482..497 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
485. . .	User Timer # 00	493. . .	User Timer # 08
486. . .	User Timer # 01	494. . .	User Timer # 09
487. . .	User Timer # 02	495. . .	User Timer # 10
488. . .	User Timer # 03	496. . .	User Timer # 11
489. . .	User Timer # 04	497. . .	User Timer # 12
490. . .	User Timer # 05	498. . .	User Timer # 13
491. . .	User Timer # 06	499. . .	User Timer # 14
492. . .	User Timer # 07	500. . .	User Timer # 15

Macro 498 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
501. . .	Called before Autopatch is taken Off Hook

Macro 499 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
502. . .	Called after Autopatch is placed On Hook

Macro 500 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
503. . .	Called when the Autopatch is Busy

Macro 501 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
504. . .	Called before Autopatch number is read-back

Macro 502 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

505. . . Called after Autopatch number is read-back

Macro 503 is an autopatch macro that is used for number readback mode 2.

Macro Definition

506. . . Internal Autopatch Macro

Macro 504 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

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

Macro 505 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: "053 505 040 020 030 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

508. . . DTMF cover tone macro

Macro 506 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

509. . . User Logon Message

Macro 507 is called when a user tries to log on but gets the password wrong. It normally says "fail".

Macro Definition

510. . . User Logon Fail Message

Macro 508 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

511. . . User Logoff Message

Macros 509..510 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

512. . . Beaconsing Message Macro

513. . . Beaconsing Message Macro

Macro 511 is used to speak "Autodial" before an autodial call is made. It corresponds to macro 501 which is used for non-autodial calls.

Macro Definition

514. . . Called before autodial number is read-back

Macro 512 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

515. . . Make two-stage autopatch call

Macros 513..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-DSP402 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-DSP402 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

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 (see Chapter 2).

```
<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:

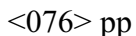
- 075 is the default command name.
- pp is the port for which to set or recall the stop access conditions (01..12)
- X is 1 to enable / 0 to disable stopping access when a command is executed
- Y is 1 to enable / 0 to disable stopping access when an invalid command is entered
- Z is 1 to enable / 0 to 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 (see Chapter 2). 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.
- P 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 (using a computer is 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".

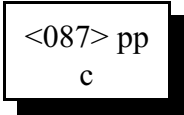
<086>

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-DSP402 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-DSP402 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. Each input has a pullup resistor; it will read high if not connected.

<090>1	Read single digital input line
<090> 1	Read multiple digital input lines

Parameters:

- 090 is the default command name.
- 1 is the digital input line number (1..8)

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 1	Execute macro for one digital input line
<091> 1..1	Execute macros for multiple digital input lines

Parameters:

- 091 is the default command name.
- 1 is the digital input line number (1..8)

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> l a c

Parameters:

- 092 is the default command name.
- l is the digital input line number (1..8)
- 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 l	Turn a single open collector output line on
<093 l..l	Turn multiple open collector output lines on

Parameters:

- 093 is the default command name.
- l is the open collector output line number (1..8)

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 1..1	Turn multiple open collector output lines off

Parameters:

- 094 is the default command name.
- 1 is the open collector output line number (1..8)

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> 1..1	Check multiple open collector output lines

Parameters:

- 095 is the default command name.
- 1 is the open collector output line number (1..8)

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-DSP402. 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> 1..1	Read multiple analog lines

Parameters:

- 100 is the default command name.
- 1 is the analog input line number (1..8)

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"
053 600 036 476 531 452 270 838 317 375 249
```


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> l r

Parameters:

- 101 is the default command name.
- l is the analog input line number (1..8)
- 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 serial resistor). The analog to digital converter can distinguish between 4096 (12-bit resolution) voltage levels within that range, providing a resolution of about 3.66mV.

LM335 temperature sensors output a voltage of 10mV per degree Kelvin (Celsius - 273). For each change in temperature of one degree Fahrenheit, the voltage will change about 5mV ($10\text{mV} * 5/9$), about the same as the resolution of the ADC. In other words, the controller can determine what the temperature is to the nearest degree. You could tell the controller to speak the temperature with one or two digits after the decimal point, but it wouldn't give you significantly more information. It generally works best to read the temperature to the nearest degree (0 digits after the decimal point).

Another example: reading battery voltage. Since your battery probably supplies between 12 and 14 volts, less than the 15 volt maximum of the analog inputs, it can be connected directly to an analog input line (a fuse would be a good idea). It can then be read a resolution of about 3.66mV; you can choose how many decimal points to make the controller report.

101 4 1 ;	read analog input 4 with 1 decimal place
102 4 0 0000 0 0150 ;	read analog input 4 on 0.0 to 15.0 volt scale

or

101 4 2 ;	read analog input 4 with 2 decimal places
102 4 0 0000 0 1500 ;	read analog input 4 on 0.00 to 15.00 volt scale

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 (see Appendix H), battery voltage on a scale from 0 to 15V 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.

The chart below shows some commonly used conversion ratios. If you have a different type of sensor and need a different conversion ratio, there is information after the chart about how to calculate the needed values.

Command Parameters	Description	Resolution
<102> 1 n wwww m zzzz	General conversion form	....
<102> 1 0 0000 0 1500	Voltage from 0.00 to 15.00 (default setting)	3.66 mV
<102> 1 1 0460 0 2240	Fahrenheit temperature	1 degree, enter "101 x 0"
<102> 1 1 0273 0 1227	Celsius temperature	1 degree, enter "101 x 0"
<102> 1 0 0000 0 0100	0 to 100% (of the 0..15V input range)	1 percent, enter "101 x 0"
<102> 1 0 0000 0 0360	0 to 360 degrees (0V = 0 degrees, 15V = 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 15V volts.
- For more information about hooking up a LM335Z temperature sensor, see Appendix H.

Parameters:

- 102 is the default command name.
- 1 is the analog input line number (1..8)
- 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 ADC

(analog-to-digital converter) and another number that corresponds with 5 volts at the ADC, 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, 1/100 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 two assumed decimal places, is 15.00 volts.

Temperature in Celsius, 1 degree resolution, no voltage dividers:

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 $5V/10mV \text{ per degree} = 1500 \text{ degrees Kelvin}$, or 1227 degrees Celsius (above zero). This is our other conversion point.

Temperature in Fahrenheit, 1 degree resolution, no voltage dividers:

This conversion is very similar to the one for Celsius temperature. 0 degrees Kelvin is -460 degrees Fahrenheit. 1500 degrees Kelvin is 2240 degrees Fahrenheit.

0 to 25 volt, 1 volt resolution, with the voltage divider. (analog input line 4):

The difference between this and the 5 volt conversion is the voltage divider. The divider cuts the received voltage to 1/5 before passing it on to the processor. In other words, the zero point does not change, but the full-scale reading is now 25 rather than 5 volts. Since we want it to read 25 volts when we give it 25 volts, the zero point is 0 and the full scale point is 25. Seems too easy, doesn't it?

The other resolutions of the 0 to 25 volt conversions are left to a comparison with the 5 volt conversions.

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 above 5 volts we will need to use a voltage divider. To avoid having to disconnect the pullup resistors on inputs 1..3 (which is necessary to use a voltage divider with them), we will use analog input #5 and make our own external voltage divider. The divider will have the input voltage coming through a 40.2K resistor in series with a 10K resistor. The other end of the 10K should be hooked to ground. Analog input #5 should be connected to the point where the two resistors are joined, where the voltage should be about 1/5 what it is at the input of the voltage divider. 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 15V volts, even though the sensor will never put out that much. What we need to know is how fast the wind would have to blow to give us a 15V volt signal. A simple ratio will give us the answer:

$$\frac{100 \text{ MPH}}{10 \text{ volts}} = \frac{X \text{ MPH}}{15V \text{ volts}}$$

Cross Multiplying:

$$100 * 15V = 10 * X$$

$$1500 = 10 * X$$

$$X = 150 \text{ MPH}$$

We now know that the low point is 0, the high point is 150, so we can set up the conversion with 102 0 0000 0 0150.

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 (zero out) this correction factor, execute the reset calibration form of this command shown in the table below.

<103> 1 n www	Calibrate an analog input
<103> 1 2	Reset calibration

Parameters:

- 103 is the default command name.
- 1 is the analog input line number (1..8)
- 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> l a n www	Set an Analog Alarm
-----------------	---------------------

Parameters:

- 104 is the default command name.
- l is the analog input line number (1..8)
- 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.

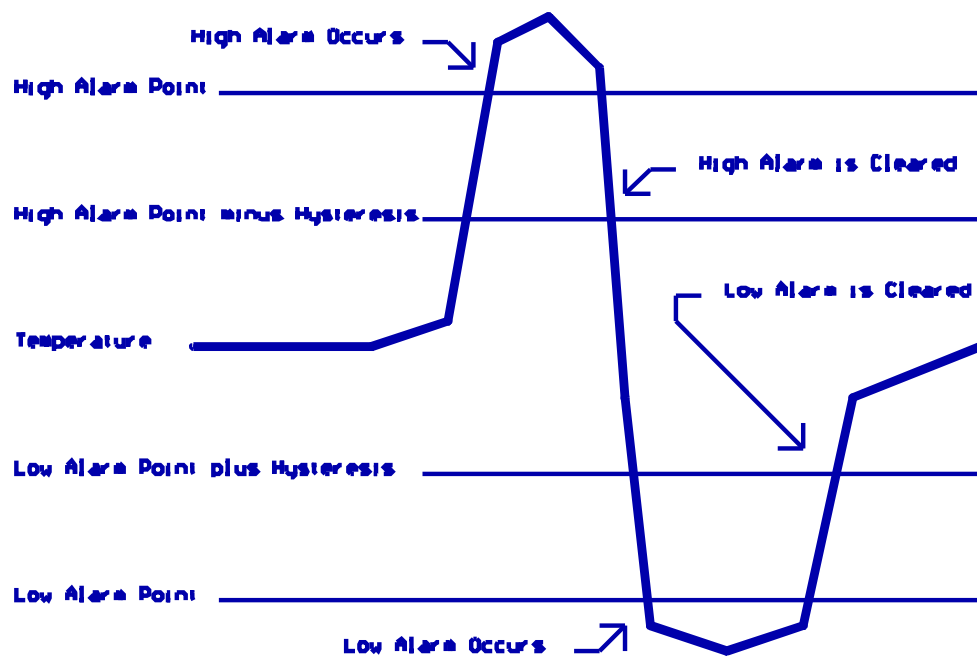
```
<105 1 wwwww
```

Parameters:

- 105 is the default command name.
- 1 is the analog input line number (1..8)
- WWW 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 l a n
```

Parameters:

- 106 is the default command name.
- l is the analog input line number (1..8)
- 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 1

Parameters:

- 108 is the default command name.
- 1 is the analog input line number (1..8)

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 1..1

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
- 1..1 are the analog input lines (1..8)

161: Set Analog Smoothing Factor

This command allows you to smooth the analog readings to "average out" noise and sudden changes.

```
<161 1 ss
```

Parameters:

- 161 is the default command name
- 1 is the analog input line (1..8)
- 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> 1	Use input line 'X' for wind speed

Parameters:

1 - 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 1 0 0000 0 1023" where 1 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. It allows you to specify which radio port the autopatch is plugged in to and 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 several different commands that can be used to place a call using 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 (because there is no way to connect the audio to them). 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 512. 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 '*' and the phone number you wish to dial, then unkeying.

Macro 512 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 512 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:

If an autopatch call is placed from a port that is in a group (connected to other ports), the autopatch will also be placed in that group for the duration of the call so that all of the connected ports will be able to hear the conversation. If an autopatch call is placed from a port that is *not* in a group, by default the controller will put both that port and the autopatch port into group 3 (to connect them together). You can change which group is used for that purpose by editing the before-patch-off-hook macro (see Chapter 8).

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-DSP402 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 199 (see Chapter 4 for more information about timers) by entering "022 199" 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
056 600 022 199 D or unkey	; reset patch time out timer
010 600 <code>**3</code> D or unkey	; rename macro 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 294-5108 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 (294-5109) 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.

Half-Duplex Links and the Autopatch:

In most cases autopatch calls are placed by users of a repeater. Once a call is connected, the repeater transmitter typically stays keyed continuously for the duration of the call. When no radios are keyed, the repeater transmits audio from the autopatch (whatever the person on the phone is saying). When a radio is keyed, the repeater "repeats" their audio (and typically mutes the audio from the phone, see command 128 for more info). When the call is terminated, the repeater returns to normal operation and transmits only when someone keys their radio or to send ID, courtesy beeps, hang time, etc.

If the repeater port on the controller is "connected to" (in a group with) *other* ports (repeater or link ports) when a call is placed, those other ports will normally also be connected to the autopatch port. That potentially allows everyone that could communicate using the connected repeaters and links before the call was placed to continue to talk with each other and with the person on the phone during the call. Note that the radios connected to those other ports on the controller (not the end-users' radios) will transmit continuously during the call, just as the repeater does, sending audio from the phone and other connected radios. This works fine for repeaters and full-duplex link radios, but causes problems for half-duplex link radios. Those half-duplex link radios will transmit all of the audio as described above, but because they are continuously transmitting during the call, anyone at the other end of that link will be unable to respond and be heard. This is not a fault of the autopatch, but a side effect caused by the patch receiving audio all of the time and the half-duplex link not being able to receive while transmitting.

The RLC-DSP402 deals with this potential problem by providing a way to automatically disconnect any half-duplex link ports before connecting an autopatch call. The same method could be used, if desired, to disconnect full-duplex links or cross-band repeaters if desired. Before connecting the autopatch port to the port that enters the command to complete the call, it calls the "Before patch off hook" event trigger (???); see Chapter 20 for a list of event triggers. You can use command "157 ??? mmm" to call a macro when that event trigger is fired. The macro can then be programmed to disconnect any ports that you do not want included in the call. This can be done by using command 017 to take them out of the talk group.

Port Connections During A Call:

This section addresses the same subject as the section "Connected Ports" earlier in this chapter but provides more details.

The "Half-Duplex Links and the Autopatch" section above mentions that the controller automatically connects ports to the autopatch. This section provides more details about how that is done by default and how you can customize it. As described in Chapter 2, ports are "connected" by putting them into the same "talk group". Naturally, to "connect" the autopatch port to another port, they should be put into the same group. The question is, "which group?"

If the port that enters the command to complete the autopatch call (typically the repeater port, and referred to as such hereafter) is already in a group, the autopatch port is simply added to that group. It then automatically becomes connected to all of the ports that were previously in that group (unless they are removed by a macro called from the "Before patch off hook" event trigger as described above).

If the repeater port is not already in a group but the autopatch port is in a group (typically by itself), the repeater port will be put into the same group as the autopatch. To ensure that the autopatch port is always in a group, command 110 automatically programs the "Before patch off hook" event to call a macro that puts the autopatch port into **group 3**. That macro can be changed to use a different group if desired; it should generally be a group that is not used for any other purpose (to avoid accidentally connecting ports to the patch during a call). If the macro is changed so it does not put the patch into a group (not recommended) and the repeater port is not in a group, the patch commands may fail and generate error message 313.

110: Configure the Autopatch

This command sets which port the autopatch interface is hooked to and allows you to choose whether and how the number is read back before it is dialed.

<110> pp s

Parameters:

- 110 is the default command name.
- pp is the radio port that the autopatch is hooked to (01..12). Enter 00 to specify that no ports are autopatches. The DSP402 autopatch is connected to the controller with a ribbon cable (inside the rack cabinet). It uses a special connection to the controller that is treated as port three, so the port number for this command must be entered as 03. No circuits are shared with the radio ports, so both radio ports can be used at the same time as 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 disabled.

Notes:

- If you change the autopatch port with this command, you will need to set up the reverse patch again with Command 133.
- 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.
- This command also sets up an event trigger to put the autopatch port into group 3 when a call is completed - See the section "Port Connections During a Call" above for more info about that.

- The DSP402's autopatch connects to the controller through a ribbon cable inside the cabinet. It is also possible to use a different autopatch board (such as the one designed for the RLC-3 and RLC-4) on any port using that port's DB-9 connector; this might be useful if you want to locate the autopatch board a distance from the controller, such as at the other end of a full-duplex radio link.

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. If they try to hang it up with this command while someone else is using it, you may want to speak a message that indicates that they aren't allowed to do that. Event trigger 332 "Hang Up Command 115 Blocked" (see Chapter 20) will let you do that.

<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	Prog ram 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:

- "121 000 294 5108" will program slot 000 to block 294-5108 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 pp.. qq	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.

pp..qq - 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-DSP402 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 pp..qq	Enable general call-out to transmitters x..x

<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 pp..qq	Enable directed call-out to user uuu on transmitters x..x

<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 pp..qq	Enable directed call-out for users uuu..vvv on transmitters x..x

Parameters:

- uuu is the user number
- vvv is the last user number in a range from user uuu to user vvv
- pp..qq 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-DSP402 to control the Kenwood series TM-X21 and TM-X31 mobile radios. The RBI-1 converts the data output by the RLC-DSP402 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-DSP402's radio ports and uses three of the open collector output lines. The audio, COR and PTT interface is made through the RLC-DSP402'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. Audio Test Solutions does not sell the RBI-1 interface.

What the RLC-ICM is:

The RLC-ICM is a (now discontinued) 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-DSP402'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-DSP402'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://rlccontrollers.com/ftp/rlc-icom/>

Interfacing and Setup:

It is very easy to interface the RBI-1 or RLC-ICM to the RLC-DSP402. Directions for building the needed cable is provided on one of the following pages. You can build it yourself or order one from Audio Test Solutions, 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.

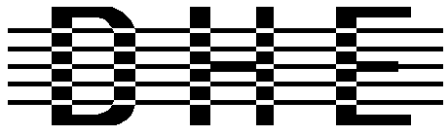
Using the RBI-1 or the RLC-ICM:

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 Pin# - Line Name	RLC-DSP402Connections Pin# - Line Name
	<u>Connections to 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 - Audio out
6 - Kenwood RX Audio ® Pot).	5 - Audio in
7 - COS from Kenwood RX	7 - COR input (Active high)
8 - PTT to Kenwood TX.	3 - PTT output
9 - Ground.	1 - Ground connection
2 - RLC-ICM (not RBI-1) PL Detect Out.....	2 - PL detect input (optional)

In case it wasn't clear, there is only one connector on the RBI-1 that goes to the DSP402. It is connected to two different connectors on the DSP402. The audio connector goes to one of the radio ports, the 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-DSP402 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-DSP402) 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-DSP402 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-DSP402 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-DSP402 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 15: Serial Controlled (HF) Radio Support

This section describes the controller's interface for serial controlled radios. Most such radios are for the HF bands, but some such as the FT-736 handle the VHF and UHF bands. The controller's software will handle frequencies through the 1.2GHz band for radios that support them. When "HF radios" are referred to in this chapter, other serial controlled radios are also included.

HF Radio Interfacing

The audio in, audio out and PTT connections to the serial controlled radio should be made just like for a repeater or any other radio, as described in Chapter 1. If the serial controlled radio has a COR output (from an all-mode squelch), it can be connected normally as well. If the radio does not have a COR output, set the COR polarity for that radio port to active high, so the internal pullup will make it always active (or leave it active low and tie the COR input to ground). This is necessary because the controller normally mutes incoming audio unless the COR line is active (see command 005 for more information). Note that having the COR line always active will make the HF receiver time out, so you might want to disable the time out timer for that radio port by setting it to zero (with command 020). If it does time out, you can reset the time out timer by resetting the controller with command 035 (you will have to exit HF mode to do that).

In addition to the audio in, audio out, COR and PTT signals, you will need to connect the controller to the radio's serial port, so you can control the frequency and other settings. Most serial controlled radios use TTL level signals, rather than the RS-232 signals that computers, mice, modems, and the controller's main serial port all use. RS-232 signals switch between +12 and -12 volts, while TTL signals change from 0 to 5 volts. A few radios use RS-232 level signals. **Do not connect an RS-232 serial port to a TTL serial port without an adapter!** Adapters to convert TTL signals to RS-232 signals can be purchased from the radio manufacturers or built from scratch. Some of these adapters may invert the data (the Kenwood TS-870 for example), just to make it more confusing. We have schematics for the level converters for some radios; check our web page or call us for more information. Once you have connected an adapter to the radio, you can simply connect the RS-232 serial port on the adapter to main serial port on the RLC-DSP402. This is the same serial port you can use to connect the RLC-DSP402 to a computer, so you can only use one at a time: either the HF radio or the computer for control.

If you are using a Kenwood level translator, you may have to connect pins 4 and 5 together on the DB-25 connector that plugs into the level translator. This connects the RTS and CTS handshaking lines.

If you want to use TTL level output, take a 16 pin socket and solder a jumper wire between pins 11 and 14 on the top of the socket. Remove the Max232 and plug in the socket instead (don't plug the Max232 into the socket). It will hook the processor's TTL output up to the data out line on the DB-9 without doing a level conversion like the Max232 does. Please note that hooking up the TTL output directly bypasses the protection of the Max232 and exposes the processor to the outside world. Shorting out the TTL output line or hitting it with static may damage the processor, requiring that it be sent back to Audio Test Solutions for repair (the processors are not easy to replace in the field, and if you damage the socket trying, there are 132 little pins to try to decoder to replace it). Use the TTL output at your own risk; getting a level translator from the radio manufacturer is much safer.

HF Radio Control:

There are several commands that are used to set up the HF radio interface. They tell the controller what radio is installed and a few other things. After the radio is set up and you are ready to change frequencies, scan, etc., you can go into a special "HF control mode". When you are in this mode, all of the normal commands are disabled and a separate set of HF control commands are used instead. This makes it possible to control the HF radio with short command codes without having to worry about what other commands might get executed accidentally. These commands are organized by mapping the DTMF keypad in a logical way that makes the various commands easy to remember. When you are done using the HF radio, there is a command code that takes you back to the normal mode where you can execute the normal commands. It is possible to execute HF commands from normal mode using command 199. This is usually used in a macro. There is also a way to execute normal commands while you are in HF mode (see keypad code 4). And finally, there are event triggers (see command 157) that are called when the different HF commands are entered that can be used to customize how the HF commands work (not finished yet). While in HF mode, the '#' key is used as the force-execution digit to make it easier to control the HF remote from the reverse autopatch.

Virtual Radio Features:

Although the RLC-DSP402's HF remote base interface is loaded with features, it uses only the most basic features on the HF radio itself: receive frequency, transmit frequency, vfo, split, and mode. The rest of the features are provided by the RLC-DSP402 itself. This allows the RLC-DSP402 to provide all of those features even on radios that don't have built-in support for them. Scanning is performed by sending a change of frequency several times a second, so the controller always knows what frequency the radio is on and so it can handle scan edges even if the radio doesn't support them directly. Memories are stored on the controller, so radios without built-in memories can support them with the RLC-DSP402. Even VFO A and VFO B are simulated by the controller; they work like you would expect but both use VFO A on the radio (the radio's VFO B is used to handle offsets with some radios). You could call all of these features that are handled by the controller "virtual" features, since they may or may not exist on the radio but the controller makes it work like they do. The only reason you need to know about which features are virtual and which ones actually use the features of the radio is so you can understand why the display on the radio doesn't always reflect the commands you enter. Watching the display on the radio may be more confusing than just using the frequency recall command (keypad command '8') while you are in HF mode.

Default Values:

The first time the HF remote is turned on (or after it has been reinitialized), it will go to 14.25 MHz, USB. All of the virtual memories also default to 14.25 MHz, USB. Of course you can change them to any other frequency you may choose.

Example:

I want to control a Kenwood TS-870S. I want my command prefix digit to be '1', so I enter "195 11". I then enter "196 02 2 0" to set the radio type and tell the controller that it will be connected to port two. The audio cable is built just like the one for my repeater was. Since the TS-870S already has a RS-232 serial port, I don't need a level converter, but I do need a null modem adapter in the serial cable between it and the controller to connect the data out line on each end to the data in line on the other. At least for now, I don't care about transmit or scan band edges, so I am going to skip command 197. Entering "198" from the repeater on port 1 turns on HF mode and sets the frequency to 14.25 MHz. "179" starts it scanning up fast. Kerchunking it stops the scan. "13" will turn of HF mode.

195: Configure HF Mode

This command configures the HF control mode and assigns the HF command prefix digit. It also tells the RLC-DSP402 that the serial port will be used for HF control rather than for programming the controller. You must disable HF control before the serial port will work for programming again.

<195> 0	Disable HF
<195> 1 p	Enable HF and set HF prefix digit to 'p'
<195> 2	Turn HF off without enabling or disabling
<195> 3	Recall HF mode settings

Parameters:

p = the HF command prefix digit. This is the digit that must be pressed before any command is entered in HF mode. It is commonly set to '1'. If you prefer not to use a prefix digit, just enter "195 1".

Notes:

- When you disable HF with "195 0", the HF remote will be turned off if it is in use and it will be disabled so it cannot be turned back on until it is enabled with this command.
- Normally the HF remote will be turned off from the port that is using it, by entering the HF command prefix digit followed by a '3' (the exit command - see the HF commands on the following pages). If you need to turn the HF remote off from another port (one that is not currently controlling the HF remote), you can enter "195 2".

Voice Response:

"HF on/off, key x" where "on/off" indicates whether HF is enabled or disabled (not whether HF mode is turned on or not) and "x" is the HF command prefix digit. "x" will be "clear" if no prefix digit is used.

Example:

I want the remote base turned on and I want my HF command prefix digit to be a '1'.

195 1 1

196: Configure HF Radio

This command tells the controller which radio port the HF radio is interfaced to and which type of radio it is. The controller uses this information to automatically set the baud rate (4800 for Kenwood or Yaesu, 1200 for Icom) and to send the proper command codes for your radio.

<196> 0	Recall HF Radio Configuration
---------	-------------------------------

<196> pp 2 0	Kenwood TS-450, TS-570, TS-690, TS-850, TS-870, TS-950 and other recent radios
<196> pp 2 1	Kenwood TS-50, TS-140S, TS-440, TS-440S, TS-680, TS-711, TS-790A, TS-811, TS-940, R-5000 and other early radios

<196> pp 3 0	Yaesu FT-736
<196> pp 3 1	Yaesu FT-757 (no control of modes), FT757GXII
<196> pp 3 2	Yaesu FT-767
<196> pp 3 3	Yaesu FT-747GX, FT-890, FT-900, FT-990, FT-1000
Not Supported	FT-727R, FRG-8800

<196> pp 1 xx	Icom. See table on next page or check your radio manual to find 'xx' (the address) for your radio
---------------	---

Parameters:

pp = the radio port that the HF radio is connected to.

xx = radio address (Icom only)

Normally if you are transmitting on the HF radio and you enter a command that causes serial data to be sent to the radio, such as changing a frequency, the controller will automatically drop the PTT to the HF radio while the serial data is sent. Some radios like the Yaesu FT-736 and the Kenwood TS-711 require this. Even radios that don't require it seem to have less problems with getting incorrect commands if they are not transmitting while they receive data, probably due to RF getting into the serial cable. If you want the controller to keep transmitting while it sends serial data, append a '1' to the end of the appropriate command above. For example: "196 02 2 1 1" would select port 02, Kenwood, type 1, leave PTT on when sending serial. "196 02 2 1" would make the PTT drop while sending serial.

Voice Response:

"HF on <port>, <I/K/Y><type> On/Off" where <port> is the radio port on the controller that the HF radio is connected to, <I/K/Y> signifies the brand of the radio (Icom, Kenwood or Yaesu, respectively), and <type> signifies the radio type. On/Off indicates whether the PTT will be left on

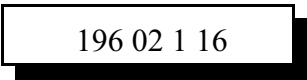
while serial data is being sent (default is off).

Icom Notes:

- Because the Icom radios can co-exist on a common serial bus (CI-V), a radio address is needed to select what radio gets the serial data. The list below shows the addresses of some Icom radios. If you don't find your radio listed, check your radio's owner's manual.
- Some Icom radios will let you change their addresses. This should not cause any problems as long as you don't change the address of an IC-735 to anything but 04 and you don't change the address of any other radio to 04. The IC-735 uses a slightly different format to set the frequency and the controller software uses this format whenever the radio address is set to 04.

Example 1:

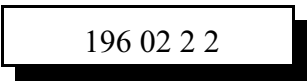
I want to tell the controller that there is an Icom IC-725 on radio port 02.



196 02 1 16

Example 2:

I have a Kenwood TS-440 radio on port 02.



196 02 2 2

Icom Radio Addresses

Controller Setting (Decimal)	Radio Setting (HEX)	Radio Type	Controller Setting (Decimal)	Radio Setting (HEX)	Radio Type
04	04	IC-735	36	24	IC-1271 A/E
08	08	IC-R7000	38	26	IC-781
16	10	IC-275 A/E/H	40	28	IC-725
18	12	IC-375 A	42	2A	IC-R9000
20	14	IC-475 A/E/H	44	2C	IC-765
22	16	IC-575 A/H	46	2E	IC-970 A/E/H
24	18	IC-1275 A/E	48	30	IC-726
26	1A	IC-R71 A/E/D	50	32	IC-R72
28	1C	IC-751 A	52	34	IC-R7100
30	1E	IC-761	72	48	IC-706
32	20	IC-271 A/E/H	78	4E	IC-706 MK2
34	22	IC-471 A/E/H	86	56	IC-746

197: Set/Recall Transmit/Scan Band Edges

This command allows you to set and recall the edges of the frequency ranges that you are allowed to transmit in and within which the scanning function will loop. These two features are completely separate: they are stored separately and they operate independently, although the frequency ranges for both are set with this command.

Transmit Edges: The controller will let you receive on any frequency, but only transmit within the transmit edges that you set up with this command. This protects you from accidentally transmitting on a frequency you shouldn't.

Scan Edges: The controller will let you start scanning from any frequency. Since you will often want to focus on a small frequency range, it will also allow you to set a more limited range to scan within. This is the purpose of the scan band edges. Even if you started scanning from a frequency that was not within any of the scan bands, if you are scanning up and reach the top edge of a scan band, it will automatically loop to the bottom edge and continue scanning. If it reaches the bottom edge of a scan band, it will automatically loop to the top edge. It will speak the current frequency immediately before and after looping.

197 e	Recall Edges for all Bands
197 e c	Set Edges for all Bands for a Class (novice..amateur extra)
197 e bb	Recall Edges for one Band
197 e bb c	Set Edges for one Band for a Class
197 e bb u f..f*f..f	Set Upper or Lower Edge for one Band to a Specific Frequency

Parameters:

e = 0 to set a transmit band edge(s), 1 for a scan band edge(s)

c = Class to set edge(s) to. You can find out what the edges are for each class by setting them then recalling them with this command.

0	Novice
1	Technician / Tech Plus
2	General
3	Advanced
4	Amateur Extra

bb = 0..15 which band. See the table below. You don't have to leave the bands as they default if you want to re-assign them some other way. If two bands overlap, the first one found that contains the current frequency will be used.

u = 0 for lower edge, 1 for upper edge. If you try to set the upper edge to a lower frequency than the lower edge, the lower edge will be set to match it. If you try to set the lower edge to a higher frequency than the upper edge, the upper edge will be set to match it.

f..f*f..f = the new frequency. The '*' should go between the 1MHz digit and the 100KHz digit of the frequency. Example "14*25" for 14.25MHz. Frequencies over 2GHz have not been tested.

Defaults:

The following table shows the defaults for both the transmit and scan edges (they can be set separately). These are the edges of the voice bands for the amateur extra class. Note that voice is not allowed on 30 meters. There is also a user defined band at the end that you can set for any other frequency range.

Band	bb	Lower Edge	Upper Edge
160 meters	00	1.8 MHz	2.0 MHz
80 meters	01	3.75 MHz	4.0 MHz
40 meters	02	7.15 MHz	7.3 MHz
30 meters	03	0.0 MHz	0.0 MHz
20 meters	04	14.15 MHz	14.35 MHz
17 meters	05	18.11 MHz	18.168 MHz
15 meters	06	21.2 MHz	21.45 MHz
12 meters	07	24.93 MHz	24.99 MHz
10 meters	08	28.3 MHz	28.999999 MHz
10 meters	09	29.0 MHz	29.7 MHz
6 meters	10	50.1 MHz	54.0 MHz
2 meters	11	144.1 MHz	148 MHz
1.25 meters	12	222.0 MHz	225.0 MHz
70 cm	13	420.0 MHz	450.0 MHz
33 cm	14	902.0 MHz	928.0 MHz
23 cm	15	1240.0 MHz	1300.0 MHz
user defined	16	0.0 MHz	0.0 MHz

198: HF Mode Enable

This command enables the HF remote base mode. This mode re-defines the DTMF keyboard into a quick HF remote access pad. When this mode is enabled, only HF commands can be entered (see the following pages). In order to execute any system wide commands the user must get out of the HF mode with keypad command '3' or use keypad command '4'.

<198>

Parameters:

There are no parameters for this command

Defaults:

HF mode is disabled

Response:

- "HF Remote On <frequency>" if successful.
- "HF is off" if need to enable HF control with command 195.
- "HF busy X" if another port is in HF control mode. X is the number of the port this is currently using the HF remote . If they just forgot to exit HF mode, you can turn them off with "195 2", then enter "198" again to enable control from the port you are using.
- "Error 217" if you are already in HF mode.

HF Prefix:

The HF prefix is a single digit that is configured with Command 195. This digit is always the first digit entered when executing a command while in HF mode. The reason for the prefix digit is to keep single digit entries from accidentally being entered.

Example: I am in HF mode and need to start the scan function for fast up scanning

Enter: 1 79 unkey or '#'

Response: "Scan up fast"

Example: I am in HF mode and need to enter a frequency

Enter: 1 29*600 unkey or '#'

Response: '2 9 point 6 0 0 0 0'

Example: I am in HF mode and need to recall memory 15

Enter: 1 515 unkey or '#'

Response: <frequency>

In all these examples the format for data entry was:

<HF Prefix> <Command> <Additional Data if Needed> <unkey or '#>

HF Remote Base Keypad Definition:

1: RX Only 1x: HF Mode... 1 - USB 2 - LSB 3 - AM 4 - FM 5 - CW	2: RX and TX 21: Toggle PL RX 22: Toggle PL TX 23: PL Off 28: Recall PL 2<Hz>: Set PL Freq	3: Exit HF Mode, Return to Normal Command Mode	A: Bump Up 20Hz
4: Bump Down 100Hz 4<name>: Execute Command by Name	5: Select VFO A 5xx: Recall Memory 0..99	6: Bump Up 100Hz	B: Bump Down 20Hz
7: Bump Down 500 Hz 7x: Start Scan... 1 - Down Slow 3 - Up Slow 4 - Down Med. 6 - Up Medium 7 - Down Fast 9 - Up Fast	8: Recall Current VFO Settings 80: Offset Off 81: Offset On 811: Minus Offset 810: Plus Offset 81xy: Set size of offset for this band	9: Bump Up 500Hz	C: Not Defined
* Use as Frequency <Point> Key	0: Select VFO B 0xx: Write Memory Channel 0..99	#: Force- Execution Digit, Like an Enter Key	D: Not Defined

Explanation of Keypad Commands:

Remember that before pressing the digit shown on the keypad map above, you must enter the HF prefix digit you set with command 195. The prefix digit is shown as a 'p' in the descriptions below; it defaults to '1'.

Digit 1:

- **"p 1":** Selects receive only mode. Keying the repeater will not cause the HF radio to transmit while in receive only mode. You can also go to any frequency the radio supports while in this mode, while the allowed frequency ranges may be restricted when transmit is enabled. Voice response: "HF Receive". This does the same thing as command 001 does when you are not in HF mode.

- **"p 1 x"**: Select radio mode. "x" is from the table below. If your radio supports wide and narrow versions of a mode, the wide version will be used.

"x"	Definition
1	Selects USB Mode
2	Selects LSB Mode
3	Selects AM Mode
4	Selects FM Mode
5	Selects CW Mode

Digit 2:

- **"p 2"**: Select transceive mode. Keying the repeater will cause the HF radio to transmit while in this mode. You can only go to frequencies that are within the transmit band edges while in this mode. If you try to go to a disallowed frequency, or if you try to enable this mode while on a disallowed frequency, the controller will generate the HF error (the default is for it to speak "error 217") and will not do it. If this command is successful, you should hear the voice response: "HF Transmit". This does the same thing as command 000 does when you are not in HF mode.
- **"p 2 1"**: Toggle PL receive requirement. Normally off. If turned on, receiver squelch will not open unless the correct PL frequency is detected. Not supported by all radios. On the Yaesu FT-736, PL receive only works when PL transmit is enabled.
- **"p 2 2"**: Toggle PL transmit setting. Normally off. If turned on, will transmit the current PL frequency. Not supported by all radios.
- **"p 2 3"**: Turn PL receive and transmit off.
- **"p 2 8"**: Recall PL receive and transmit settings and frequency.
- **"p 2 <Hz>"**: Set the current PL frequency to <Hz>. Do not use the '*' as a decimal point. You can enter the frequency to the nearest Hz, and the controller will look it up the nearest exact match for you.

Digit 3:

- **"p 3"**: Exit HF mode and return to normal command mode. Voice response is "HF Off".

Digit 4:

- **"p 4"**: Bump down 100 Hz. If you are in transceive mode, you may get an error if the new frequency would be disallowed by the transmit edges. Voice response is "Down 100".
- **"p 4 <command name>"**: Execute command <command name>. For example: "p 4 026" would recall the time from HF mode, just as "026" would from normal command mode.

Digit 5:

- **"p 5"**: Selects virtual VFO A. Has no effect if you are already using virtual VFO A. Restores the receive frequency, transmit frequency offset and mode to whatever they were when you last used virtual VFO A.
- **"p 5 x" or "p 5 xx"**: Recalls the contents of virtual memory "xx" into the current virtual VFO. This includes the receive frequency, transmit frequency offset and mode. Once a memory has been recalled, you can bump up or down, scan, or do anything else you would do with a

frequency you entered directly into the VFO. Since the memories are virtual, that is they are stored in the controller's memory rather than in the radio, all 100 memories will work regardless of whether your HF radio has built-in memories or not.

Digit 6:

- **"p 6"**: Bump up 100 Hz. If you are in transceive mode, you may get an error if the new frequency would be disallowed by the transmit edges. Voice response is "Up 100".

Digit 7:

- **"p 7"**: Bump down 500 Hz. If you are in transceive mode, you may get an error if the new frequency would be disallowed by the transmit edges. Voice response is "Down 500".
- **"p 7 x"**: Start scan type "x" (see table below). Scanning is normally stopped by keying up. If you are using command 199 to control the HF radio, you may find it useful to enter a value for "x" that is not in the table below to stop scanning.

"x"	Definition
1	Scan Down Slow
3	Scan Up Slow
4	Scan Down Medium
6	Scan Up Medium
7	Scan Down Fast
9	Scan Up Fast

Digit 8:

- **"p 8"**: Recalls the current frequency, offset (if not zero) and virtual VFO (if it is VFO B).
- **"p 8 0"**: Turn transmitter frequency offset off (set it to 0). Voice response is "Off".
- **"p 8 1"**: Turn transmitter frequency offset on (set it to whatever offset was last used on this band). Voice response is "<offset frequency> MHz". The controller will not bother to tell the radio to go into split mode unless you have transmit enabled (keypad command 2).
- **"p 8 1 x"**: Turn offset on and make it negative if "x" is 1, positive if x is 0 or 2.
- **"p 8 1 x y"**: Turn offset on and make it negative if "x" is 1, positive if x is 0 or 2. Set offset size "y" from the table below.

Offset Code	Offset size
0	0
1	100 KHz
2	500 KHz
3	600 KHz
4	1 MHz
5	1.6 MHz
6	1.7 MHz
7	5 MHz
8	12 MHz
9	20 MHz

Note: Only some Icom radios support controlling the split function from the serial port. Those that do include the IC-725, IC-726, IC-765, IC-781, and IC-970. The IC-R71, IC-R72, IC-271, IC-275, IC-375A, IC-475, IC-735, IC-471, IC-575, IC-751, IC-751A, IC-761, IC-1271, IC-1275, IC-R7000, IC-R7100, and IC-R9000 do not support turning split on and off from their CI-V interfaces. If you attempt to turn split mode on for a radio that doesn't support it, the controller will send the command and respond as if it worked, but the radio will not change. If you want to control split mode remotely, you can wire one of the controller's open collector output lines to the split button on the radio. Then you will be able to "push" the split button by turning the open collector output line on and off.

Digit 9:

- **"p 9"**: Bump up 500 Hz. If you are in transceive mode, you may get an error if the new frequency would be disallowed by the transmit edges. Voice response is "Up 500".

Digit 0:

- **"p 0"**: Selects virtual VFO B. Has no effect if you are already using virtual VFO B. Restores the receive frequency, transmit frequency offset and mode to whatever they were when you last used virtual VFO B. VFO B is called a "virtual VFO" because the controller keeps track of it separately from virtual VFO A so it will work as you would expect, but both will usually use VFO A on the radio. In other words, if you look at the radio, it will probably show VFO A even when you select virtual VFO B.
- **"p 0 x" or "p 0 xx"**: Writes the contents of the current virtual VFO into virtual memory "xx". This includes the receive frequency, transmit frequency offset and mode. Since the memories are virtual, that is they are stored in the controller's memory rather than in the radio, all 100 memories will work regardless of whether your HF radio has built-in memories or not. Voice response is "Write xx".

Digit A:

- **"p A"**: Bump up 20 Hz. If you are in transceive mode, you may get an error if the new before the 100 KHz digit. Voice response is "Up 20".

Digit B:

- **"p B":** Bump down 20 Hz. If you are in transceive mode, you may get an error if the new before the 100 KHz digit. Voice response is "Down 20".

Digit C and D: Not used.

Digit *: Used only when entering frequencies. See the instructions for "HF Frequency Entry:" below.

Digit #: Used to make a command execute right away, without waiting for you to unkey. Similar to the forced execution digit of 'D' that is used when not in HF mode. If you press '#' after entering a command, you may not be able to hear part of the voice response to that command. Simply unkeying will avoid this problem.

Scanning:

Although your HF radio may have a scan feature built in, it is not used when scanning with the controller (see the "Virtual Radio Features" section at the beginning of this chapter). Instead, the controller sends a new frequency to the radio several times a second. Each time a new frequency is sent, it is 20, 100 or 500Hz different than the previous frequency, depending on whether you have selected slow, medium or fast scanning. A new frequency is sent just as often when scanning slowly as when scanning fast, but because the frequency is changed by a different amount, the resulting scan rate is different. You can change how often a new frequency is sent to the radio by adjusting a timer. Changing that timer will affect all three scan rates. See command 020 in Chapter 4 for information about changing the HF scan timer value.

When the controller reaches the top or bottom of a scan band (see command 197), it will speak the current frequency, wrap around to the other edge of that band, speak the frequency again, and continue scanning. It will also speak the frequency every 10 KHz when scanning slow or medium or every 25 KHz when scanning fast.

HF Frequency Entry:

To enter a new frequency, press the HF prefix digit (default is '1') followed by the frequency. Put a '*' after the 1 MHz digit. For example, to go to 14.25 MHz, enter "1 14*25" and unkey or press '#'. Leading and trailing zeros are optional. The '*' must be entered, as that is the only thing the controller uses to tell whether you are entering a frequency or another command.

Automatic Mode Selection:

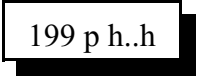
When frequencies below 10 MHz are entered, LSB mode is automatically selected. When frequencies between 10 MHz and 29 MHz are entered, USB mode is automatically selected. When frequencies above 29 MHz are entered, FM mode is automatically selected. Of course you can always override the default mode (using keypad command 1). When memories are recalled, they retain the mode they were stored with, rather than using the automatic mode selection feature.

Typical HF remote base session:

- HF Prefix is '1'
- | | | | |
|-----|-----------|------------|--|
| 1) | 198 | D or unkey | ; Enable HF remote mode |
| 2) | 1 29*68 # | or unkey | ; Move the HF remote to 29.680 MHz, VFO 'A' |
| 3) | 1 0 # | or unkey | ; Select VFO 'B' |
| 4) | 1 29*58 # | or unkey | ; Move the HF remote to 29.580 MHz, VFO 'B' |
| 5) | 1 5 # | or unkey | ; Select VFO 'A' |
| 6) | 1 8 1 # | or unkey | ; Select Split (Repeater Mode) |
| 7) | 1 2 # | or unkey | ; Go into transmit and receive mode |
| ... | | | |
| | 1 3 # | or unkey | ; Cancel HF mode after communications are complete |

199: Enter HF Command (w/o being in HF mode)

This command allows you to control an HF radio without switching into HF mode with command 198. This may be useful when you just want to change just one thing or if you want to write a macro that will do a lot of things at once. After entering the command name, you should enter your HF prefix digit (if you have one, see command 195, then any other digits you would enter if you were in HF mode (1 for receive, 14*25 to change frequency, etc).



199 p h..h

Parameters:

- p = your HF command prefix digit if you have one (see command 195)
- h..h is a command you would normally enter while in HF mode (they are described after command 198)

Notes:

- It is possible to write a macro that uses command 199 to do several things, then execute that macro from HF mode using the keypad digit 4.

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 autopatch
 - 14 - not used
 - 15 - commands executed from client (serial, telnet, SSH, etc) connection 1
 - 16 - commands executed from client (serial, telnet, SSH, etc) connection 2
 - 17 - commands executed from client (serial, telnet, SSH, etc) connection 3
 - 18 - commands executed from client (serial, telnet, SSH, etc) connection 4
 - 19 - commands executed through web interface
 - 20 - commands executed by an event trigger or automatic macro
 - 21 - commands executed by the scheduler

- 22 - commands executed by an I/O alarm
- 23 - commands executed by the internal firmware logic
- 24 - commands executed by interactive HF radio controls
- 25 - do not use
- 26 - commands executed using RCI's send page feature

- 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-DSP402 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: Save Settings to Flash or Undo Changes

The RLC-DSP402 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.

When the DSP402 starts up, it loads the last saved settings into memory. It is also possible to use this command to re-load those settings at a later time. This will effectively undo any changes you have made since you last saved.

<207> 1	Save settings to flash memory
<207> 2	Undo changes since last save (load settings from flash memory)

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 (12 is the autopatch)
 - 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:

- 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> s 0	Clear
<079> s ccc d..d	Seed Command Buffer

Parameters:

- 079 is the default command name.
- S is the source that commands will be executed from
 - 01..12 indicates a radio or autopatch port Note that at least through firmware version 4.10, this command uses only one digit for "s", so the serial port option below will not work. This command will eventually be changed so "s" is two digits.
 - 13 indicates the serial port
 - # 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
056 600 022 211 3000  ; reset dial tone timer for 30 seconds
056 600 079 # 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:

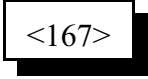
- 165 is the default command name

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-DSP402 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-DSP402 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-DSP402 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 l 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 **L** 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 to 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 Beacons System

The beacons 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 = beaconing 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 beaconing 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	018 - COR Inactive, Port 6
001 - COR Active, Port 2	019 - COR Inactive, Port 7
002 - COR Active, Port 3	020 - COR Inactive, Port 8
003 - COR Active, Port 4	021 - COR Inactive, Port 9
004 - COR Active, Port 5	022 - COR Inactive, Port 10
005 - COR Active, Port 6	023 - COR Inactive, Port 11
006 - COR Active, Port 7	024 - COR Inactive, Port 12
007 - COR Active, Port 8	025 - Reserved
008 - COR Active, Port 9	026 - PL Active, Port 1
009 - COR Active, Port 10	027 - PL Active, Port 2
010 - COR Active, Port 11	028 - PL Active, Port 3
011 - COR Active, Port 12	029 - PL Active, Port 4
012 - Reserved	030 - PL Active, Port 5
013 - COR Inactive, Port 1	031 - PL Active, Port 6
014 - COR Inactive, Port 2	032 - PL Active, Port 7
015 - COR Inactive, Port 3	033 - PL Active, Port 8
016 - COR Inactive, Port 4	034 - PL Active, Port 9
017 - COR Inactive, Port 5	035 - PL Active, Port 10

036 - PL Active, Port 11	084 - Any Connected RX Active, Port 7
037 - PL Active, Port 12	085 - Any Connected RX Active, Port 8
038 - Reserved	086 - Any Connected RX Active, Port 9
039 - PL Inactive, Port 1	087 - Any Connected RX Active, Port 10
040 - PL Inactive, Port 2	088 - Any Connected RX Active, Port 11
041 - PL Inactive, Port 3	089 - Any Connected RX Active, Port 12
042 - PL Inactive, Port 4	090 - Any Connected RX Active Patch
043 - PL Inactive, Port 5	091 - All Connected RX Inactive, Port 1
044 - PL Inactive, Port 6	092 - All Connected RX Inactive, Port 2
045 - PL Inactive, Port 7	093 - All Connected RX Inactive, Port 3
046 - PL Inactive, Port 8	094 - All Connected RX Inactive, Port 4
047 - PL Inactive, Port 9	095 - All Connected RX Inactive, Port 5
048 - PL Inactive, Port 10	096 - All Connected RX Inactive, Port 6
049 - PL Inactive, Port 11	097 - All Connected RX Inactive, Port 7
050 - PL Inactive, Port 12	098 - All Connected RX Inactive, Port 8
051 - Reserved	099 - All Connected RX Inactive, Port 9
052 - Port Active, Port 1	100 - All Connected RX Inactive, Port 10
053 - Port Active, Port 2	101 - All Connected RX Inactive, Port 11
054 - Port Active, Port 3	102 - All Connected RX Inactive, Port 12
055 - Port Active, Port 4	103 - All Connected RX Active Patch
056 - Port Active, Port 5	104 - Any DTMF Active, Port 1
057 - Port Active, Port 6	105 - Any DTMF Active, Port 2
058 - Port Active, Port 7	106 - Any DTMF Active, Port 3
059 - Port Active, Port 8	107 - Any DTMF Active, Port 4
060 - Port Active, Port 9	108 - Any DTMF Active, Port 5
061 - Port Active, Port 10	109 - Any DTMF Active, Port 6
062 - Port Active, Port 11	110 - Any DTMF Active, Port 7
063 - Port Active, Port 12	111 - Any DTMF Active, Port 8
064 - Autopatch Active	112 - Any DTMF Active, Port 9
065 - Port Inactive, Port 1	113 - Any DTMF Active, Port 10
066 - Port Inactive, Port 2	114 - Any DTMF Active, Port 11
067 - Port Inactive, Port 3	115 - Any DTMF Active, Port 12
068 - Port Inactive, Port 4	116 - Any DTMF Active Patch
069 - Port Inactive, Port 5	117 - Any DTMF Inactive, Port 1
070 - Port Inactive, Port 6	118 - Any DTMF Inactive, Port 2
071 - Port Inactive, Port 7	119 - Any DTMF Inactive, Port 3
072 - Port Inactive, Port 8	120 - Any DTMF Inactive, Port 4
073 - Port Inactive, Port 9	121 - Any DTMF Inactive, Port 5
074 - Port Inactive, Port 10	122 - Any DTMF Inactive, Port 6
075 - Port Inactive, Port 11	123 - Any DTMF Inactive, Port 7
076 - Port Inactive, Port 12	124 - Any DTMF Inactive, Port 8
077 - Autopatch Inactive	125 - Any DTMF Inactive, Port 9
078 - Any Connected RX Active, Port 1	126 - Any DTMF Inactive, Port 10
079 - Any Connected RX Active, Port 2	127 - Any DTMF Inactive, Port 11
080 - Any Connected RX Active, Port 3	128 - Any DTMF Inactive, Port 12
081 - Any Connected RX Active, Port 4	129 - Any DTMF Inactive Patch
082 - Any Connected RX Active, Port 5	130 - Port 1 DTMF Active 0
083 - Any Connected RX Active, Port 6	131 - Port 1 DTMF Active 1

132 - Port 1 DTMF Active 2	180 - Port 4 DTMF Active 2
133 - Port 1 DTMF Active 3	181 - Port 4 DTMF Active 3
134 - Port 1 DTMF Active 4	182 - Port 4 DTMF Active 4
135 - Port 1 DTMF Active 5	183 - Port 4 DTMF Active 5
136 - Port 1 DTMF Active 6	184 - Port 4 DTMF Active 6
137 - Port 1 DTMF Active 7	185 - Port 4 DTMF Active 7
138 - Port 1 DTMF Active 8	186 - Port 4 DTMF Active 8
139 - Port 1 DTMF Active 9	187 - Port 4 DTMF Active 9
140 - Port 1 DTMF Active A	188 - Port 4 DTMF Active A
141 - Port 1 DTMF Active B	189 - Port 4 DTMF Active B
142 - Port 1 DTMF Active C	190 - Port 4 DTMF Active C
143 - Port 1 DTMF Active D	191 - Port 4 DTMF Active D
144 - Port 1 DTMF Active *	192 - Port 4 DTMF Active *
145 - Port 1 DTMF Active #	193 - Port 4 DTMF Active #
146 - Port 2 DTMF Active 0	194 - Port 5 DTMF Active 0
147 - Port 2 DTMF Active 1	195 - Port 5 DTMF Active 1
148 - Port 2 DTMF Active 2	196 - Port 5 DTMF Active 2
149 - Port 2 DTMF Active 3	197 - Port 5 DTMF Active 3
150 - Port 2 DTMF Active 4	198 - Port 5 DTMF Active 4
151 - Port 2 DTMF Active 5	199 - Port 5 DTMF Active 5
152 - Port 2 DTMF Active 6	200 - Port 5 DTMF Active 6
153 - Port 2 DTMF Active 7	201 - Port 5 DTMF Active 7
154 - Port 2 DTMF Active 8	202 - Port 5 DTMF Active 8
155 - Port 2 DTMF Active 9	203 - Port 5 DTMF Active 9
156 - Port 2 DTMF Active A	204 - Port 5 DTMF Active A
157 - Port 2 DTMF Active B	205 - Port 5 DTMF Active B
158 - Port 2 DTMF Active C	206 - Port 5 DTMF Active C
159 - Port 2 DTMF Active D	207 - Port 5 DTMF Active D
160 - Port 2 DTMF Active *	208 - Port 5 DTMF Active *
161 - Port 2 DTMF Active #	209 - Port 5 DTMF Active #
162 - Port 3 DTMF Active 0	210 - Port 6 DTMF Active 0
163 - Port 3 DTMF Active 1	211 - Port 6 DTMF Active 1
164 - Port 3 DTMF Active 2	212 - Port 6 DTMF Active 2
165 - Port 3 DTMF Active 3	213 - Port 6 DTMF Active 3
166 - Port 3 DTMF Active 4	214 - Port 6 DTMF Active 4
167 - Port 3 DTMF Active 5	215 - Port 6 DTMF Active 5
168 - Port 3 DTMF Active 6	216 - Port 6 DTMF Active 6
169 - Port 3 DTMF Active 7	217 - Port 6 DTMF Active 7
170 - Port 3 DTMF Active 8	218 - Port 6 DTMF Active 8
171 - Port 3 DTMF Active 9	219 - Port 6 DTMF Active 9
172 - Port 3 DTMF Active A	220 - Port 6 DTMF Active A
173 - Port 3 DTMF Active B	221 - Port 6 DTMF Active B
174 - Port 3 DTMF Active C	222 - Port 6 DTMF Active C
175 - Port 3 DTMF Active D	223 - Port 6 DTMF Active D
176 - Port 3 DTMF Active *	224 - Port 6 DTMF Active *
177 - Port 3 DTMF Active #	225 - Port 6 DTMF Active #
178 - Port 4 DTMF Active 0	226 - Port 7 DTMF Active 0
179 - Port 4 DTMF Active 1	227 - Port 7 DTMF Active 1

228 - Port 7 DTMF Active 2
 229 - Port 7 DTMF Active 3
 230 - Port 7 DTMF Active 4
 231 - Port 7 DTMF Active 5
 232 - Port 7 DTMF Active 6
 233 - Port 7 DTMF Active 7
 234 - Port 7 DTMF Active 8
 235 - Port 7 DTMF Active 9
 236 - Port 7 DTMF Active A
 237 - Port 7 DTMF Active B
 238 - Port 7 DTMF Active C
 239 - Port 7 DTMF Active D
 240 - Port 7 DTMF Active *
 241 - Port 7 DTMF Active #
 242 - Port 8 DTMF Active 0
 243 - Port 8 DTMF Active 1
 244 - Port 8 DTMF Active 2
 245 - Port 8 DTMF Active 3
 246 - Port 8 DTMF Active 4
 247 - Port 8 DTMF Active 5
 248 - Port 8 DTMF Active 6
 249 - Port 8 DTMF Active 7
 250 - Port 8 DTMF Active 8
 251 - Port 8 DTMF Active 9
 252 - Port 8 DTMF Active A
 253 - Port 8 DTMF Active B
 254 - Port 8 DTMF Active C
 255 - Port 8 DTMF Active D
 256 - Port 8 DTMF Active *
 257 - Port 8 DTMF Active #
 258 - Port 9 DTMF Active 0
 259 - Port 9 DTMF Active 1
 260 - Port 9 DTMF Active 2
 261 - Port 9 DTMF Active 3
 262 - Port 9 DTMF Active 4
 263 - Port 9 DTMF Active 5
 264 - Port 9 DTMF Active 6
 265 - Port 9 DTMF Active 7
 266 - Port 9 DTMF Active 8
 267 - Port 9 DTMF Active 9
 268 - Port 9 DTMF Active A
 269 - Port 9 DTMF Active B
 270 - Port 9 DTMF Active C
 271 - Port 9 DTMF Active D
 272 - Port 9 DTMF Active *
 273 - Port 9 DTMF Active #
 274 - Port 10 DTMF Active 0
 275 - Port 10 DTMF Active 1

276 - Port 10 DTMF Active 2
 277 - Port 10 DTMF Active 3
 278 - Port 10 DTMF Active 4
 279 - Port 10 DTMF Active 5
 280 - Port 10 DTMF Active 6
 281 - Port 10 DTMF Active 7
 282 - Port 10 DTMF Active 8
 283 - Port 10 DTMF Active 9
 284 - Port 10 DTMF Active A
 285 - Port 10 DTMF Active B
 286 - Port 10 DTMF Active C
 287 - Port 10 DTMF Active D
 288 - Port 10 DTMF Active *
 289 - Port 10 DTMF Active #
 290 - Port 11 DTMF Active 0
 291 - Port 11 DTMF Active 1
 292 - Port 11 DTMF Active 2
 293 - Port 11 DTMF Active 3
 294 - Port 11 DTMF Active 4
 295 - Port 11 DTMF Active 5
 296 - Port 11 DTMF Active 6
 297 - Port 11 DTMF Active 7
 298 - Port 11 DTMF Active 8
 299 - Port 11 DTMF Active 9
 300 - Port 11 DTMF Active A
 301 - Port 11 DTMF Active B
 302 - Port 11 DTMF Active C
 303 - Port 11 DTMF Active D
 304 - Port 11 DTMF Active *
 305 - Port 11 DTMF Active #
 306 - Port 12 DTMF Active 0
 307 - Port 12 DTMF Active 1
 308 - Port 12 DTMF Active 2
 309 - Port 12 DTMF Active 3
 310 - Port 12 DTMF Active 4
 311 - Port 12 DTMF Active 5
 312 - Port 12 DTMF Active 6
 313 - Port 12 DTMF Active 7
 314 - Port 12 DTMF Active 8
 315 - Port 12 DTMF Active 9
 316 - Port 12 DTMF Active A
 317 - Port 12 DTMF Active B
 318 - Port 12 DTMF Active C
 319 - Port 12 DTMF Active D
 320 - Port 12 DTMF Active *
 321 - Port 12 DTMF Active #
 322 - Patch DTMF Active 0
 323 - Patch DTMF Active 1

- 324 - Patch DTMF Active 2
- 325 - Patch DTMF Active 3
- 326 - Patch DTMF Active 4
- 327 - Patch DTMF Active 5
- 328 - Patch DTMF Active 6
- 329 - Patch DTMF Active 7
- 330 - Patch DTMF Active 8
- 331 - Patch DTMF Active 9
- 332 - Patch DTMF Active A
- 333 - Patch DTMF Active B
- 334 - Patch DTMF Active C
- 335 - Patch DTMF Active D
- 336 - Patch DTMF Active *
- 337 - Patch DTMF Active #
- 338 - Tried to hang up patch when was already hung up.
- 339 - Before turn HF mode on
- 340 - After turn HF mode off
- 341 - HF Band 160m
- 342 - HF Band 80m
- 343 - HF Band 40m
- 344 - HF Band 30m
- 345 - HF Band 20m
- 346 - HF Band 17m
- 347 - HF Band 15m
- 348 - HF Band 12m
- 349 - HF Band 10m below 29MHz
- 350 - HF Band 10m above 29MHz
- 351 - HF Band 6m
- 352 - HF Band 2m
- 353 - HF Band 125cm
- 354 - HF Band 70cm
- 355 - HF Band 33cm
- 356 - HF Band 23cm
- 357 - HF Band Other
- 358 - Hang Up Command 115 Blocked
- 359 - TX 1 Tail Message 1
- 360 - TX 1 Tail Message 2
- 361 - TX 1 Tail Message 3
- 362 - TX 2 Tail Message 1
- 363 - TX 2 Tail Message 2
- 364 - TX 2 Tail Message 3
- 365 - TX 3 Tail Message 1
- 366 - TX 3 Tail Message 2
- 367 - TX 3 Tail Message 3
- 368 - TX 4 Tail Message 1
- 369 - TX 4 Tail Message 2
- 370 - TX 4 Tail Message 3
- 371 - TX 5 Tail Message 1
- 372 - TX 5 Tail Message 2
- 373 - TX 5 Tail Message 3
- 374 - TX 6 Tail Message 1
- 375 - TX 6 Tail Message 2
- 376 - TX 6 Tail Message 3
- 377 - TX 7 Tail Message 1
- 378 - TX 7 Tail Message 2
- 379 - TX 7 Tail Message 3
- 380 - TX 8 Tail Message 1
- 381 - TX 8 Tail Message 2
- 382 - TX 8 Tail Message 3
- 383 - TX 9 Tail Message 1
- 384 - TX 9 Tail Message 2
- 385 - TX 9 Tail Message 3
- 386 - TX 10 Tail Message 1
- 387 - TX 10 Tail Message 2
- 388 - TX 10 Tail Message 3
- 389 - TX 11 Tail Message 1
- 390 - TX 11 Tail Message 2
- 391 - TX 11 Tail Message 3
- 392 - TX 12 Tail Message 1
- 393 - TX 12 Tail Message 2
- 394 - TX 12 Tail Message 3
- 395 - Patch Tail Message 1
- 396 - Patch Tail Message 2
- 397 - Patch Tail Message 3
- 398 - Autopatch Line Sense Hangup. Enter 157
398 114 to make the patch automatically hang up when the phone hangs up. Audio is routed to nowhere by default. If call the hangup command, it automatically routes to the correct ports.
- 399 - Reverse Patch Answered - default audio routing is to the autopatch port.
- 400- Reverse Patch Password OK - makes command 158 speak "Control"
- 401 - Command Entered from Reverse Patch - Makes command 158 reset patch time-out timer.
- 402 - 30 seconds until patch time-out - doesn't make command 158 do anything.
- 403 - 20 seconds until patch time-out - doesn't make command 158 do anything.
- 404 - 10 seconds until patch time-out - doesn't make command 158 do anything.
- 405 - Patch Dialing Cover Tone - makes command 158 send a cover tone while

- dialing a number.
- 406 - Mode 1 Connect - Someone answered reverse patch while ringing in mode 1.
 - 407 - Mode 2 Connect - Someone answered directed reverse patch.
 - 408 - Directed Reverse Patch No Pager - makes command 132 speak "No P A G E R" to the person on the phone if they try to do a directed page to someone that has reverse patch paging disabled with command 192.
 - 409 - Directed Reverse Patch No Answer - happens whenever command 132 is used, no one enters the reverse patch answer command, and the controller gives up. It makes command 132 speak "No Answer" to the person on the phone.
 - 410 - Directed Reverse Patch Cancelled - happens when someone enters the hangup code while command 132 is being used.
 - 411 - Directed Reverse Patch Clear
 - 412 - Semi-Private Patch Cover Tone - makes command 158 send a cover tone during semi-private patch operation.
 - 413 - Repeat Dial Message - happens when command 129 is used. Speaks "Repeat Dial".
 - 414 - Nothing to Re-Dial Message - happens when command 129 is used.
 - 415 - Call Aborted Message - Hang up patch before dial forward completed. Speaks "Cancel call." Must be programmed to execute command 158.
 - 416 - Dial Timer Expired, Port 1
 - 417 - Dial Timer Expired, Port 2
 - 418 - Dial Timer Expired, Port 3
 - 419 - Dial Timer Expired, Port 4
 - 420 - Dial Timer Expired, Port 5
 - 421 - Dial Timer Expired, Port 6
 - 422 - Dial Timer Expired, Port 7
 - 423 - Dial Timer Expired, Port 8
 - 424 - Dial Timer Expired, Port 9
 - 425 - Dial Timer Expired, Port 10
 - 426 - Dial Timer Expired, Port 11
 - 427 - Dial Timer Expired, Port 12
 - 428 - Dial Timer Expired, Patch
 - 429 - PTT Active, Port 1
 - 430 - PTT Active, Port 2
 - 431 - PTT Active, Port 3
 - 432 - PTT Active, Port 4
 - 433 - PTT Active, Port 5
 - 434 - PTT Active, Port 6
 - 435 - PTT Active, Port 7
 - 436 - PTT Active, Port 8
 - 437 - PTT Active, Port 9
 - 438 - PTT Active, Port 10
 - 439 - PTT Active, Port 11
 - 440 - PTT Active, Port 12
 - 441 - PTT Active, Patch
 - 442 - PTT Inactive, Port 1
 - 443 - PTT Inactive, Port 2
 - 444 - PTT Inactive, Port 3
 - 445 - PTT Inactive, Port 4
 - 446 - PTT Inactive, Port 5
 - 447 - PTT Inactive, Port 6
 - 448 - PTT Inactive, Port 7
 - 449 - PTT Inactive, Port 8
 - 450 - PTT Inactive, Port 9
 - 451 - PTT Inactive, Port 10
 - 452 - PTT Inactive, Port 11
 - 453 - PTT Inactive, Port 12
 - 454 - PTT Inactive, Patch

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

<226> 'ddd' 0 'x..x'	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: Commands Used By RCI (Windows™ Software)

The commands in this chapter would normally be used only by RCI, the Windows™ software used to manage the RLC-DSP402.

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-DSP402 is understanding what the audio routing variable needs to be in each different situation. Fortunately, the RLC-DSP402 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-DSP402 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 3 (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
001 ONE

002 TWO
003 THREE

004 FOUR	052 V	100 BETWEEN
005 FIVE	053 W	101 BLOWING
006 SIX	054 X	102 BLUE KNOB
007 SEVEN	055 Y	103 BOARD
008 EIGHT	056 Z	104 BOOST
009 NINE	057 ABORT	105 BOZO
010 TEN	058 ABOUT	106 BRAKE
011 ELEVEN	059 ABOVE	107 BRAVO
012 TWELVE	060 ACKNOWLEDGE	108 BREAK
013 THIRTEEN	061 ACTION	109 BROKEN
014 FOURTEEN	062 ADJUST	110 BUSY
015 FIFTEEN	063 ADVANCED	111 BUTTON
016 SIXTEEN	064 ADVISE	112 BY
017 SEVENTEEN	065 AERIAL	113 CABIN
018 EIGHTEEN	066 AFFIRMATIVE	114 CALIBRATE
019 NINETEEN	067 AIR	115 CALL
020 TWENTY	068 AIRPORT	116 CALLING
021 THIRTY	069 AKRON	117 CALM
022 FORTY	070 ALERT	118 CANCEL
023 FIFTY	071 ALL	119 CAUTION
024 SIXTY	072 ALOFT	120 CEILING
025 SEVENTY	073 ALPHA	121 CELSIUS
026 EIGHTY	074 ALTERNATE	122 CENTER
027 NINETY	075 ALTITUDE	123 CHANGE
028 HUNDRED	076 AMATEUR	124 CHARLIE
029 THOUSAND	077 AMPS	125 CHECK
030 MILLION	078 AND	126 CIRCUIT
031 A	079 ANSWER	127 CLEAR
032 B	080 APPROACH	128 CLIMB
033 C	081 APRIL	129 CLOCK
034 D	082 AREA	130 CLOSED
035 E	083 ARRIVAL	131 CLUB
036 F	084 AS	132 CODE
037 G	085 ASSOCIATION	133 COLUMBUS
038 H	086 AT	134 COME
039 I	087 AUGUST	135 COMPLETE
040 J	088 AUTO	136 COMPUTER
041 K	089 AUTOMATIC	137 CONDITION
042 L	090 AUTOPILOT	138 CONGRATULATIONS
043 M	091 AUXILIARY	139 CONNECT
044 N	092 AVON	140 CONNECTICUT
045 O	093 AVON MOUNTAIN	141 CONTACT
046 P	094 A.M.	142 CONTROL
047 Q	095 BAND	143 CONVERGING
048 R	096 BANK	144 COSHOCTON
049 S	097 BASE	145 COUNT
050 T	098 BATTERY	146 COURSE
051 U	099 BELOW	147 CRANE

148 CROSSWIND	196 FAST	244 HERTZ
149 CURRENT	197 FEBRUARY	245 HIGH
150 CUYAHOGA FALLS	198 FEET	246 HOLD
151 CYCLE	199 FILED	247 HOME
152 DALLAS	200 FINAL	248 HOTEL
153 DANGER	201 FINDLAY	249 HOUR
154 DATE	202 FIRE	250 HOURS
155 DAY	203 FIRST	251 ICE
156 DAYS	204 FLAPS	252 ICING
157 DAYTON	205 FLIGHT	253 IDENTIFY
158 DECEMBER	206 FLOW	254 IGNITE
159 DECREASE	207 FOG	255 IGNITION
160 DECREASING	208 FOR	256 IMMEDIATELY
161 DEGREES	209 FOURTH	257 IN
162 DELTA	210 FOXTROT	258 INBOUND
163 DEPARTURE	211 FREEDOM	259 INCH
164 DEVICE	212 FREEZING	260 INCREASE
165 DIAL	213 FREQUENCY	261 INCREASING
166 DINNER	214 FRIDAY	262 INCREASINGTO
167 DIRECTION	215 FROM	263 INDIA
168 DISPLAY	216 FRONT	264 INDICATED
169 DIVIDED	217 FULL	265 INFLIGHT
170 DOOR	218 GALLONS	266 INFORMATION
171 DOWN	219 GATE	267 INNER
172 DOWNWIND	220 GAUGE	268 INSPECTOR
173 DRIVE	221 GEAR	269 INTRUDER
174 DRIZZLE	222 GET	270 IS
175 DUST	223 GLIDE	271 IT
176 EAST	224 GO	272 JANUARY
177 ECHO	225 GOLF	273 JULIET
178 ELECTRICIAN	226 GOODBYE	274 JULY
179 ELEVATION	227 GREEN	275 JUNE
180 EMERGENCY	228 GREENWICH	276 KENTUCKY
181 ENGINE	229 GROUND	277 KEY
182 ENTER	230 GURNEE	278 KILO
183 EQUAL	231 GUSTINGTO	279 KNOTS
184 EQUALS	232 HAIL	280 LAND
185 ERROR	233 HALF	281 LANDING
186 ESTIMATED	234 HAM	282 LATE
187 EVACUATE	235 HAMFEST	283 LAUNCH
188 EVACUATION	236 HAMVENTION	284 LEAN
189 EXIT	237 HAVE	285 LEFT
190 EXPECT	238 HAZARDOUS	286 LEG
191 FAIL	239 HAZE	287 LESS THAN
192 FAILURE	240 HEAVY	288 LEVEL
193 FARAD	241 HELLO	289 LIGHT
194 FAHRENHEIT	242 HELP	290 LIMA
195 FARMINGTON	243 HENRY	291 LINE

292 LINK	340 NEXT	388 PRIVATE
293 LIST	341 NIGHT	389 PROBE
294 LITTON	342 NO	390 PROGRAMMING
295 LOCK	343 NORTH	391 PULL
296 LONG	344 NORTHEAST	392 PUSH
297 LOOK	345 NORTHWEST	393 P.M.
298 LOW	346 NOT	394 QUEBEC
299 LOWER	347 NOVEMBER	395 RADAR
300 LUNCH	348 NUMBER	396 RADIO
301 MACHINE	349 OAKS	397 RAIN
302 MAINTAIN	350 OBSCURED	398 RAISE
303 MANUAL	351 O'CLOCK	399 RANGE
304 MARCH	352 OCTOBER	400 RATE
305 MARKER	353 OF	401 RATTLESNAKE
306 MAY	354 OFF	MOUNTAIN
307 MAYDAY	355 OHIO	402 READY
308 ME	356 OHMS	403 REAR
309 MEAN	357 OIL	404 RECEIVE
310 MEASURE	358 ON	405 RED
311 MEETING	359 OPEN	406 RELEASE
312 MEGA	360 OPERATION	407 REMARK
313 MESSAGES	361 OPERATOR	408 REMOTE
314 METER	362 OSCAR	409 REPAIR
315 MICRO	363 OTHER	410 REPEAT
316 MIKE	364 OUT	411 REPEATER
317 MILES	365 OUTER	412 RICH
318 MILL	366 OVER	413 RICHMOND
319 MILLI	367 OVERCAST	414 RIG
320 MINUS	368 PAPA	415 RIGHT
321 MINUTES	369 PARTIALLY	416 ROAD
322 MIST	370 PASS	417 ROGER
323 MOBILE	371 PASSED	418 ROMEO
324 MODERATE	372 PATCH	419 ROUTE
325 MONDAY	373 PATH	420 RUNWAY
326 MONTH	374 PELLETS	421 SAFE
327 MORETHAN	375 PER	422 SAINT PETERSBURG
328 MOTOR	376 PERCENT	423 SAND
329 MOUNT HAMILTON	377 PHONE	424 SANTA CLARA
330 MOUNT TAMALPAIS	378 PICO	425 SAN LEANDRO
331 MOVE	379 PLEASE	426 SATURDAY
332 MOVING	380 PLUS	427 SCATTERED
333 MUCH	381 POINT	428 SECOND
334 NEAR	382 POLICE	429 SECONDS
335 NEGATIVE	383 POSITION	430 SECURITY
336 NET	384 POWER	431 SELECT
337 NEW	385 PRACTICE	432 SEPTEMBER
338 NEWINGTON	386 PRESS	433 SEQUENCE
339 NEW HAVEN	387 PRESSURE	434 SERVICE

435 SET
 436 SEVERE
 437 SEXY
 438 SHORT
 439 SHOWERS
 440 SHUT
 441 SIDE
 442 SIERRA
 443 SIGHT
 444 SLEET
 445 SLOPE
 446 SLOW
 447 SMOKE
 448 SNOW
 449 SOUTH
 450 SOUTHEAST
 451 SOUTHWEST
 452 SPEED
 453 SPRAY
 454 SQUAWK
 455 STALL
 456 START
 457 STOP
 458 STORM
 459 SUNDAY
 460 SWITCH
 461 SYSTEM
 462 TANGO
 463 TANK
 464 TARGET
 465 TARPON SPRINGS
 466 TAXI
 467 TEEN
 468 TELEPHONE
 469 TEMPERATURE
 470 TERMINAL
 471 TEST
 472 THANK YOU
 473 THAT
 474 THE (LONG E)
 475 THE (SHORT E)
 476 THE
 477 THIN
 478 THINLY
 479 THIRD
 480 THIS IS
 481 THIS
 482 THUNDERSTORMS

483 THURSDAY
 484 TIME
 485 TIMER
 486 TIMES
 487 TO
 488 TODAY
 489 TOMORROW
 490 TONIGHT
 491 TOOL
 492 TORNADO
 493 TORONTO
 494 TOUCHDOWN
 495 TOWER
 496 TRAFFIC
 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..008
 841 xxx - analog 001..008
 high value
 842 xxx - analog 001..008
 high time
 843 xxx - analog 001..008
 low value
 844 xxx - analog 001..008
 low time
 848 xxx - read analog 1..8 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-DSP402. 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.

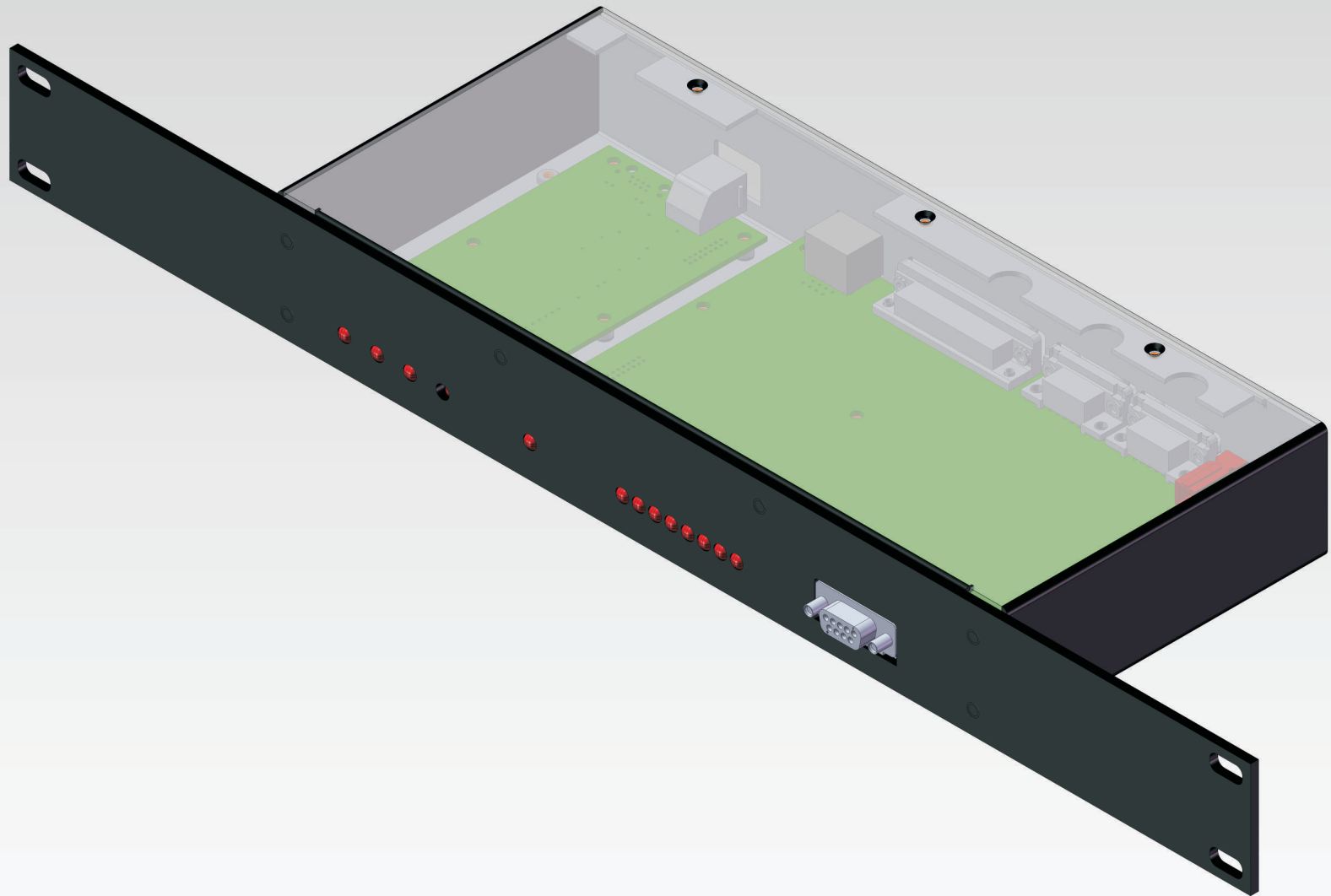
"Initialization" (sometimes called "re-initialization") resets all of the controller's internal settings back to the factory defaults. It does cause you to lose all of your programming. You will almost always have to initialize the controller when you install a new version of software, but rarely otherwise. If you are trying to learn to program the RLC-DSP402 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-DSP402 in any way - there is no EEPROM or anything to wear out. To reinitialize the RLC-DSP402, follow one of the two methods below:

Method #1: Press and hold the INIT button on the motherboard. Turn on the power. Wait for 30 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 30 seconds. Release the INIT button.

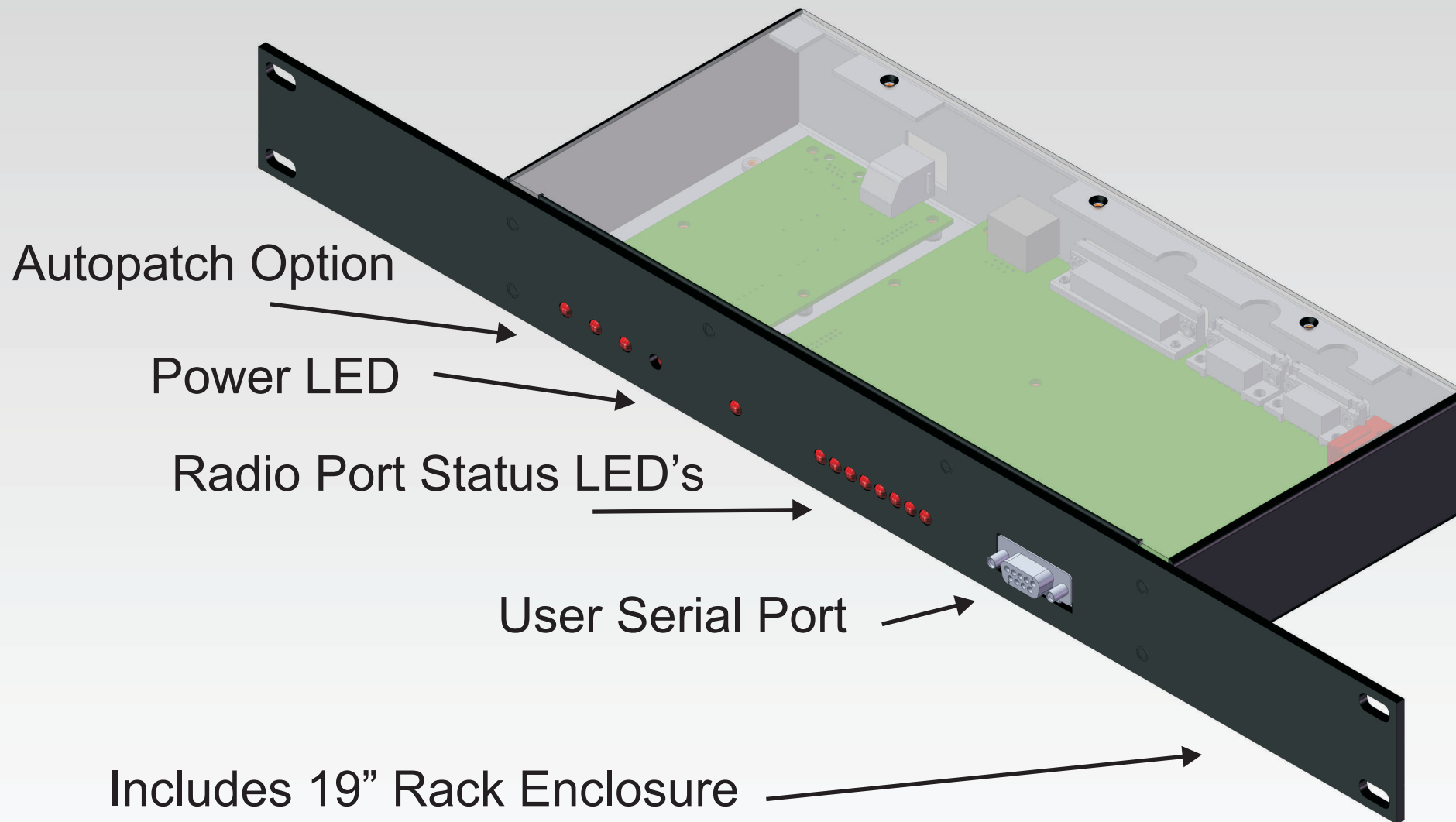
If you are successful you will hear the message "I-N-I-T" out of the transmitter that is hooked to port 1 and see the message "All settings have been reset to factory defaults" on the serial terminal.

Appendix E: Hardware Documentation

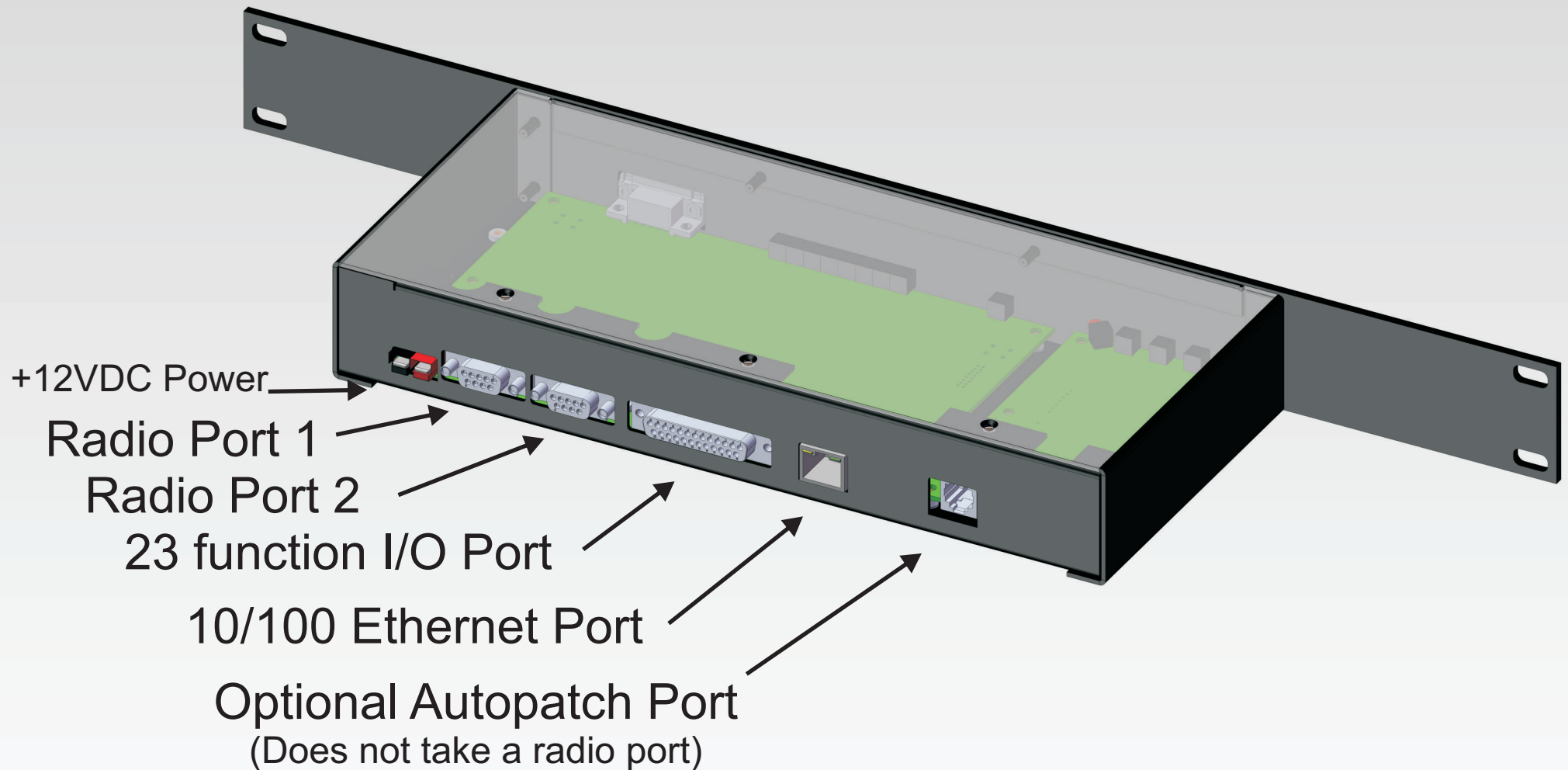


RLC-DSP402 Advanced IP Radio Controller

RLC-DSP402 Advanced IP Radio Controller

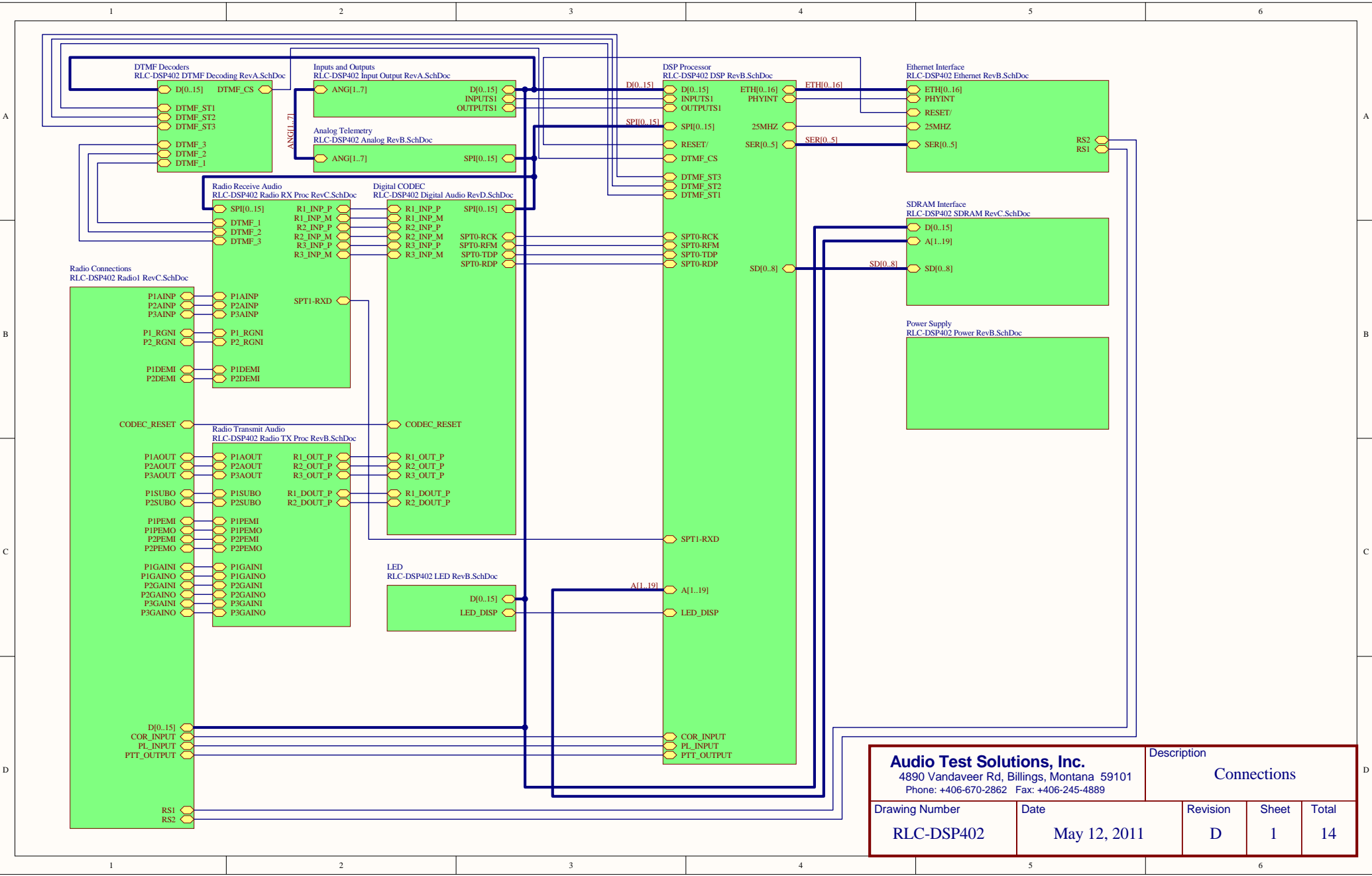


RLC-DSP402 Advanced IP Radio Controller

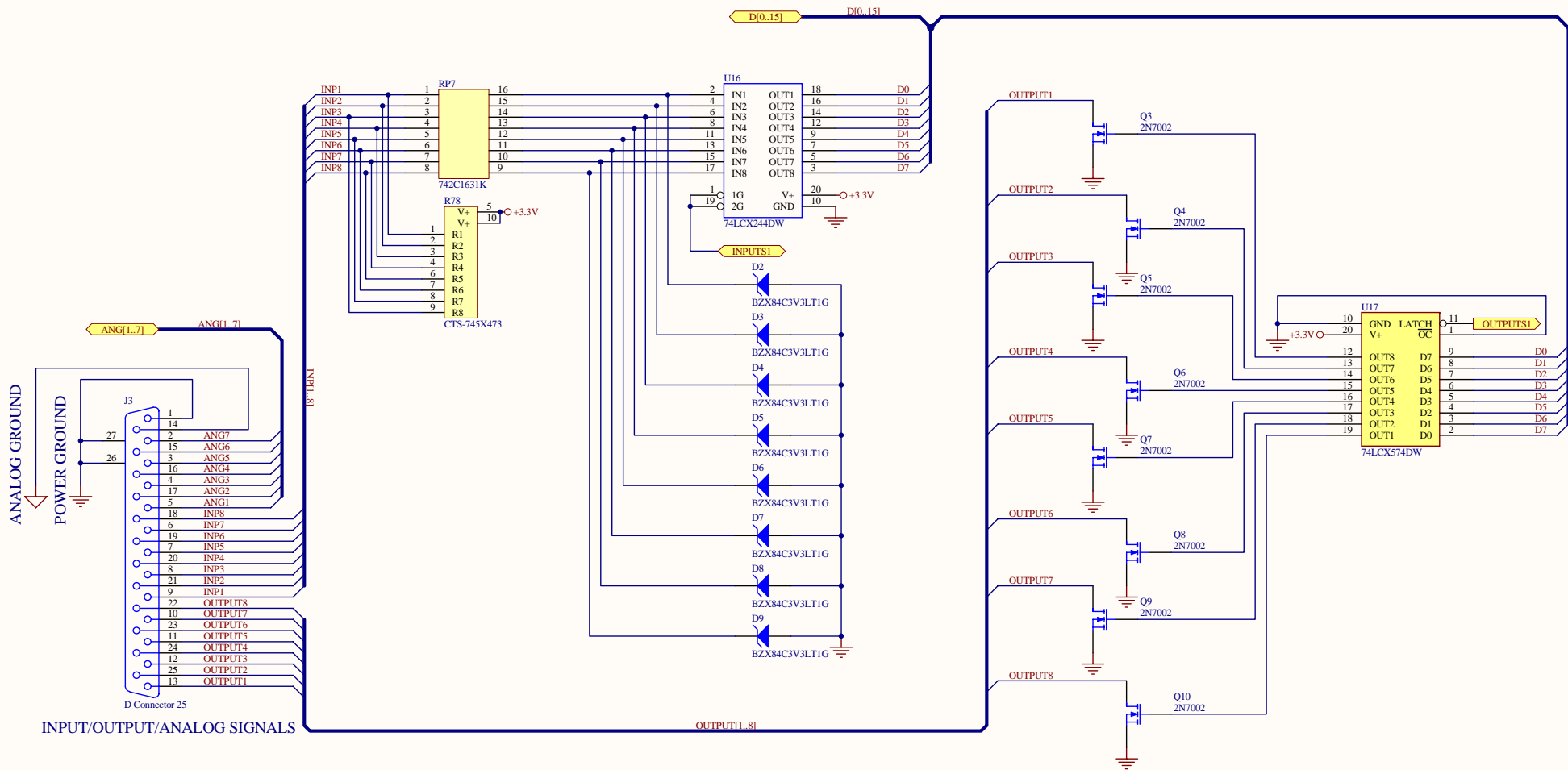


Bottom Legend Layer:





Audio Test Solutions, Inc. 4890 Vandaveer Rd, Billings, Montana 59101 Phone: +406-670-2862 Fax: +406-245-4889		Description Connections		
Drawing Number	Date	Revision	Sheet	Total
RLC-DSP402	May 12, 2011	D	1	14



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Description

I/O Section

Drawing Number

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Date

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Revision

D

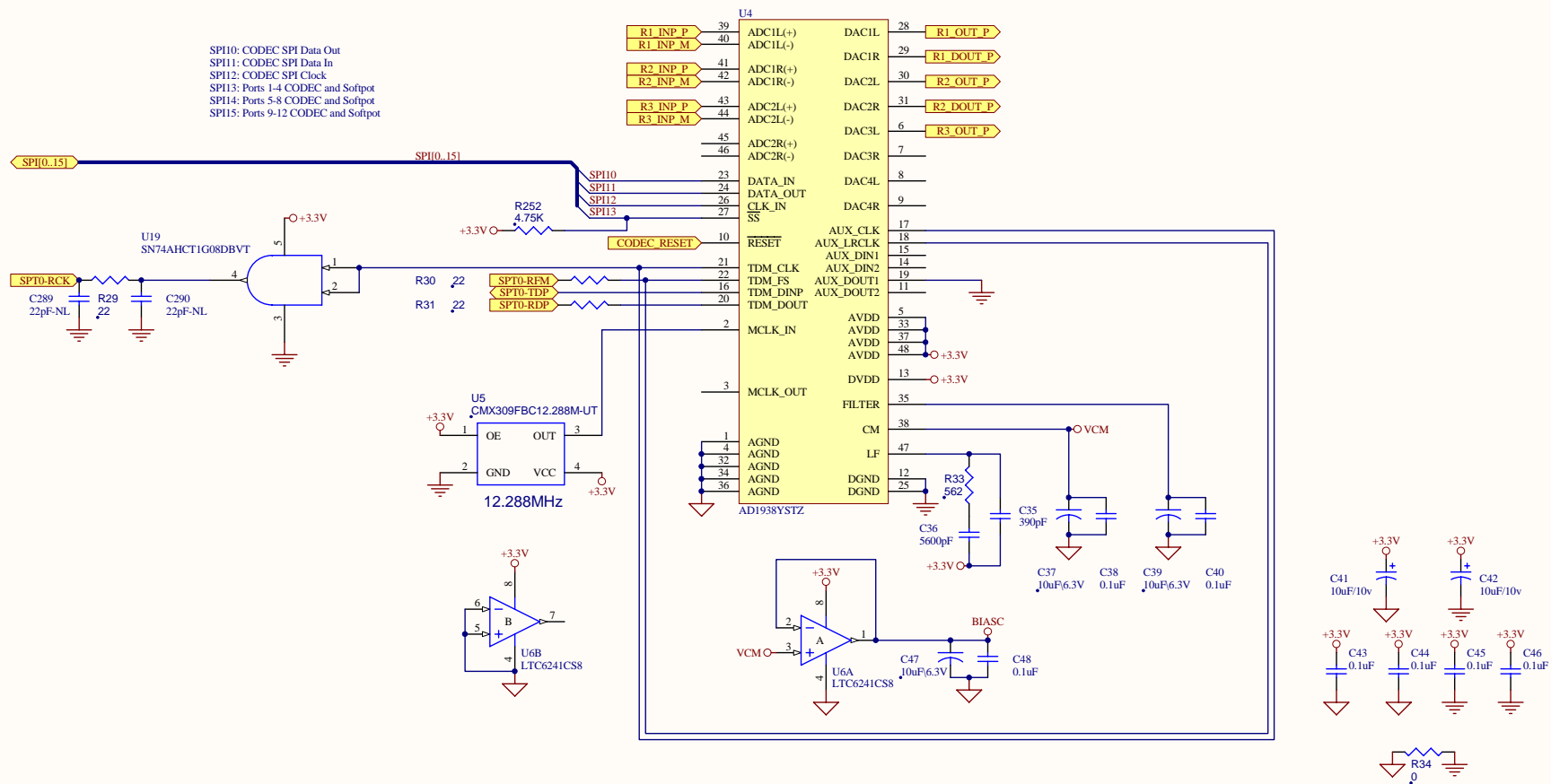
Sheet

2

Total

13





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Description

Digital Conversion Section

Drawing Number

Date	
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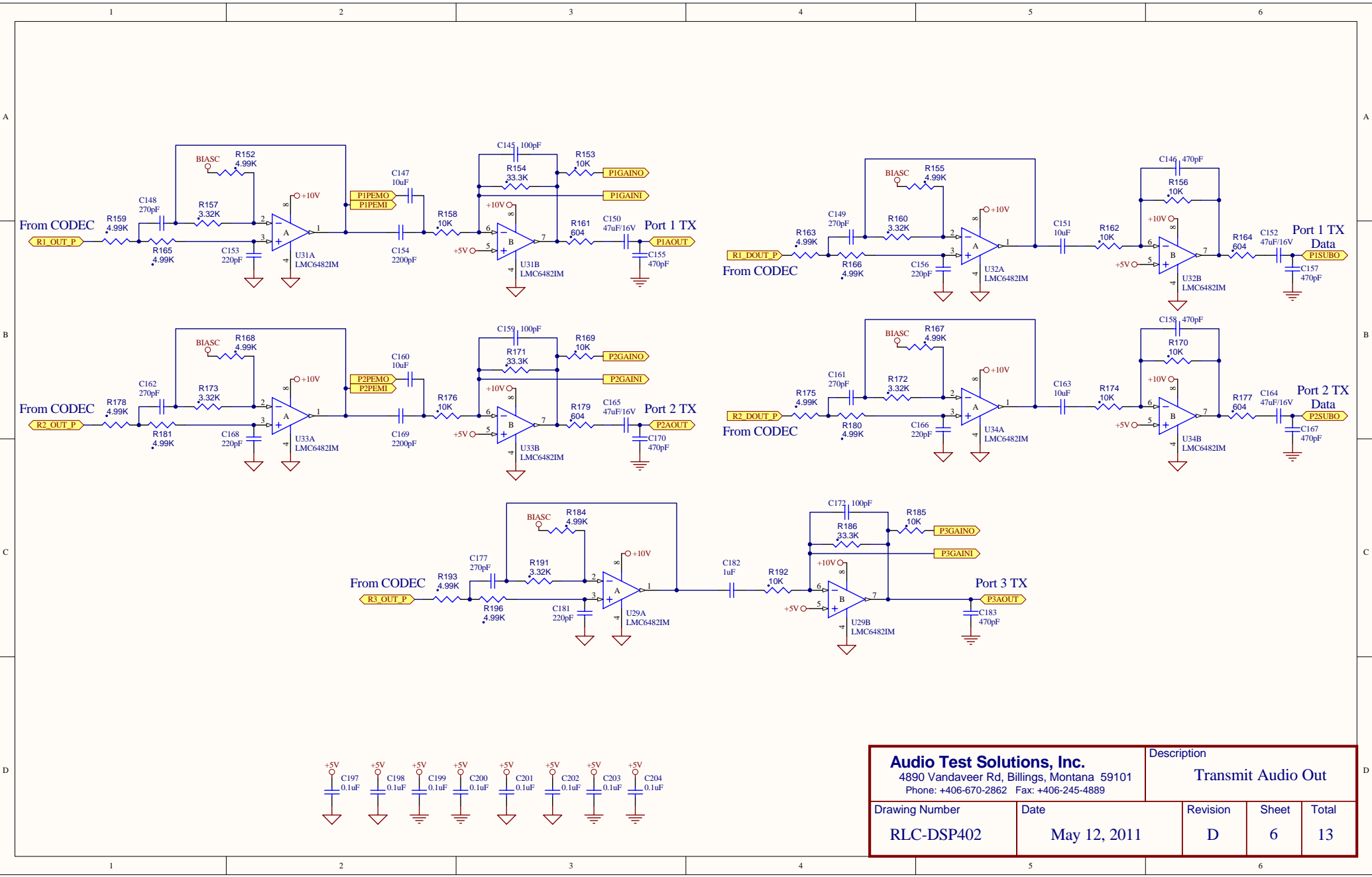
May 12, 2011

Revision

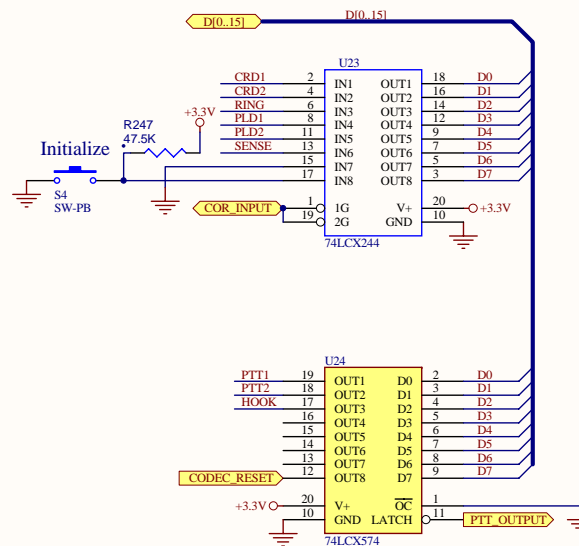
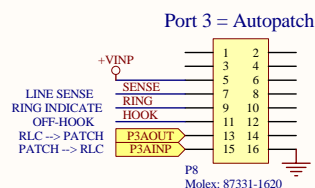
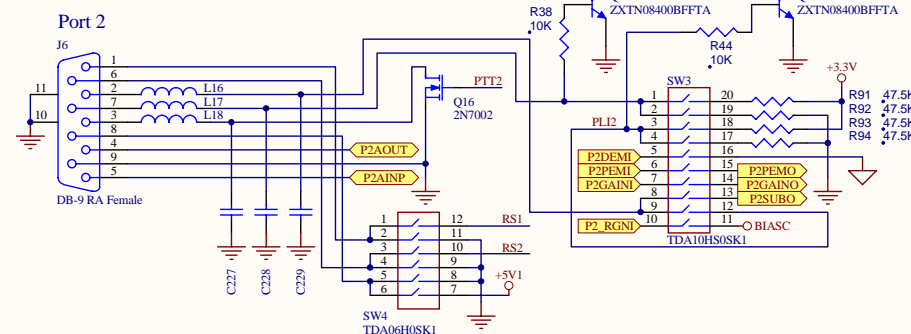
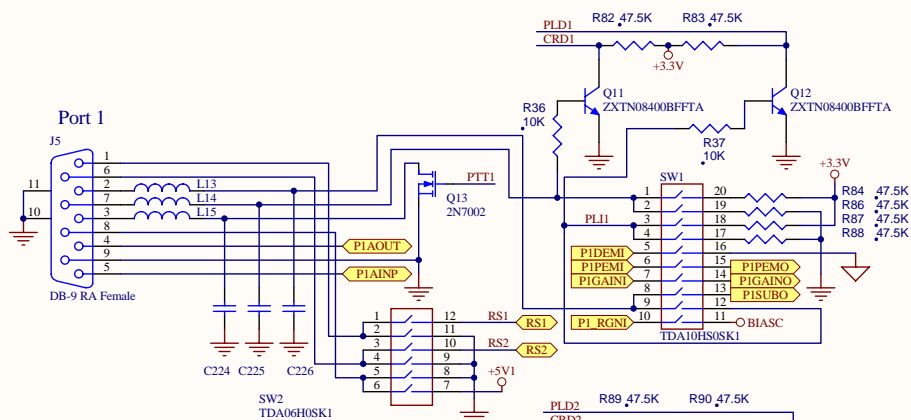
Sheet

Total	100%
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RLC-DSP402



Audio Test Solutions, Inc. 4890 Vandaveer Rd, Billings, Montana 59101 Phone: +406-670-2862 Fax: +406-245-4889		Description Transmit Audio Out		
Drawing Number RLC-DSP402	Date May 12, 2011	Revision D	Sheet 6	Total 13



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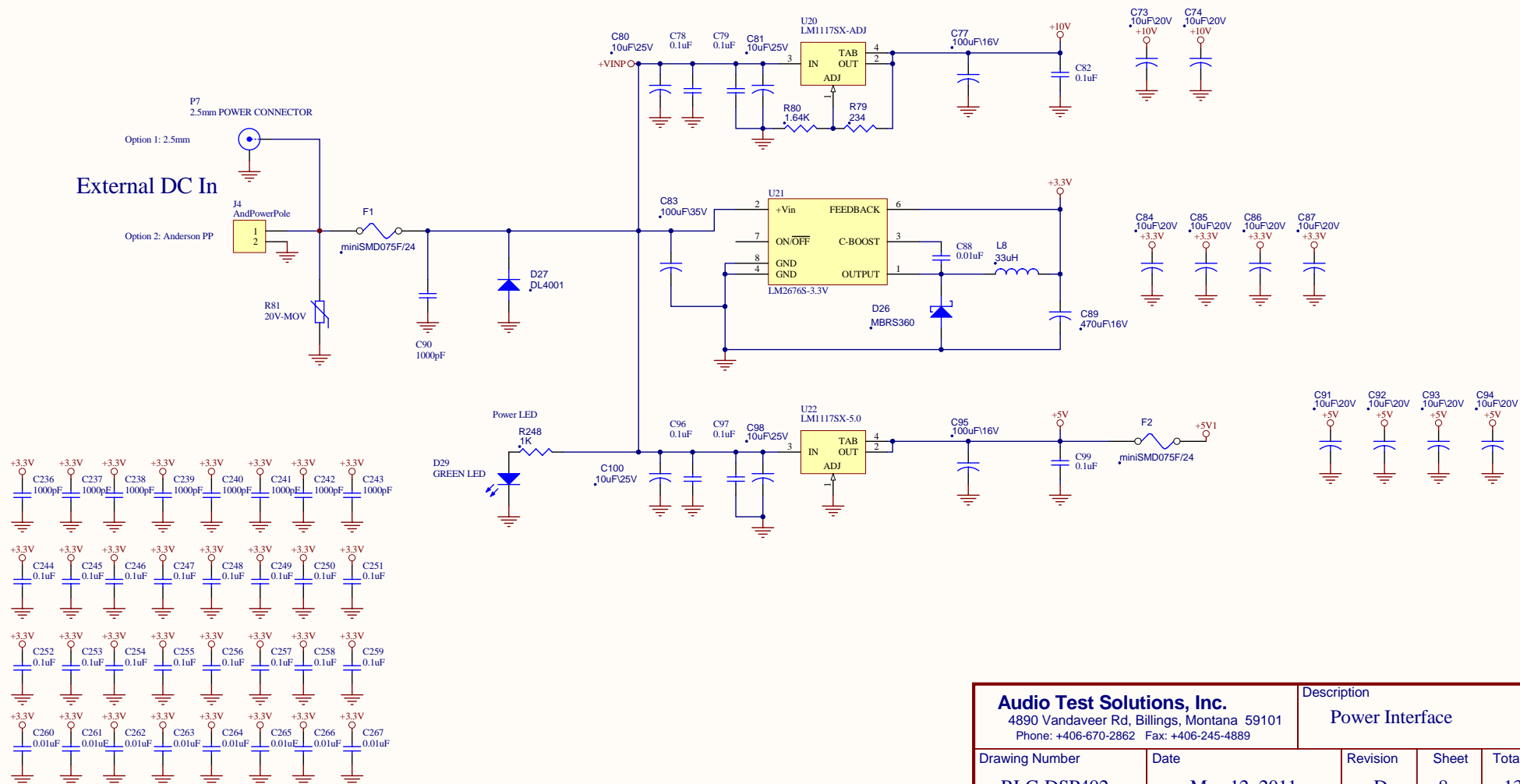
Description
Radio Interfaces

Drawing Number	Date	Revision	Sheet	Total
RLC-DSP402	May 12, 2011	D	7	13

External DC In

P7
2.5mm POWER CONNECTOR
Option 1: 2.5mm

J4
AndPowerPole
Option 2: Anderson PP



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Description

Power Interface

Drawing Number

RLC-DSP402

Date

May 12, 2011

Revision

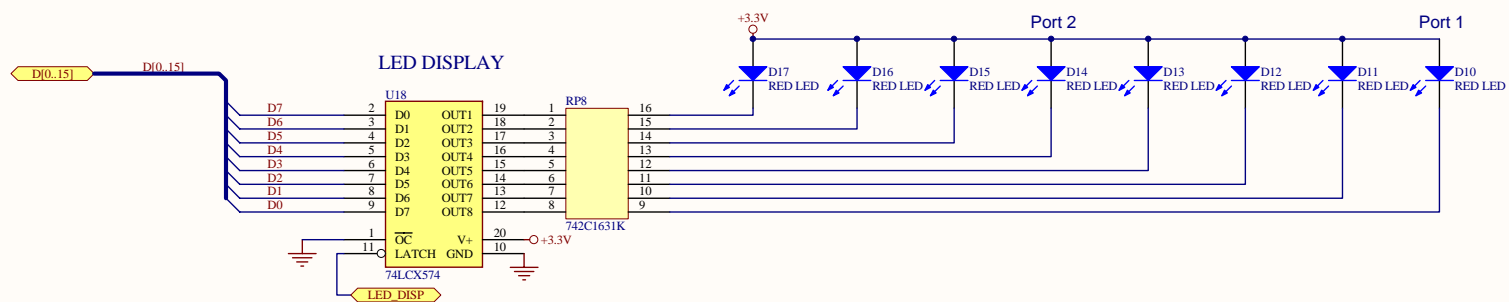
D

Sheet

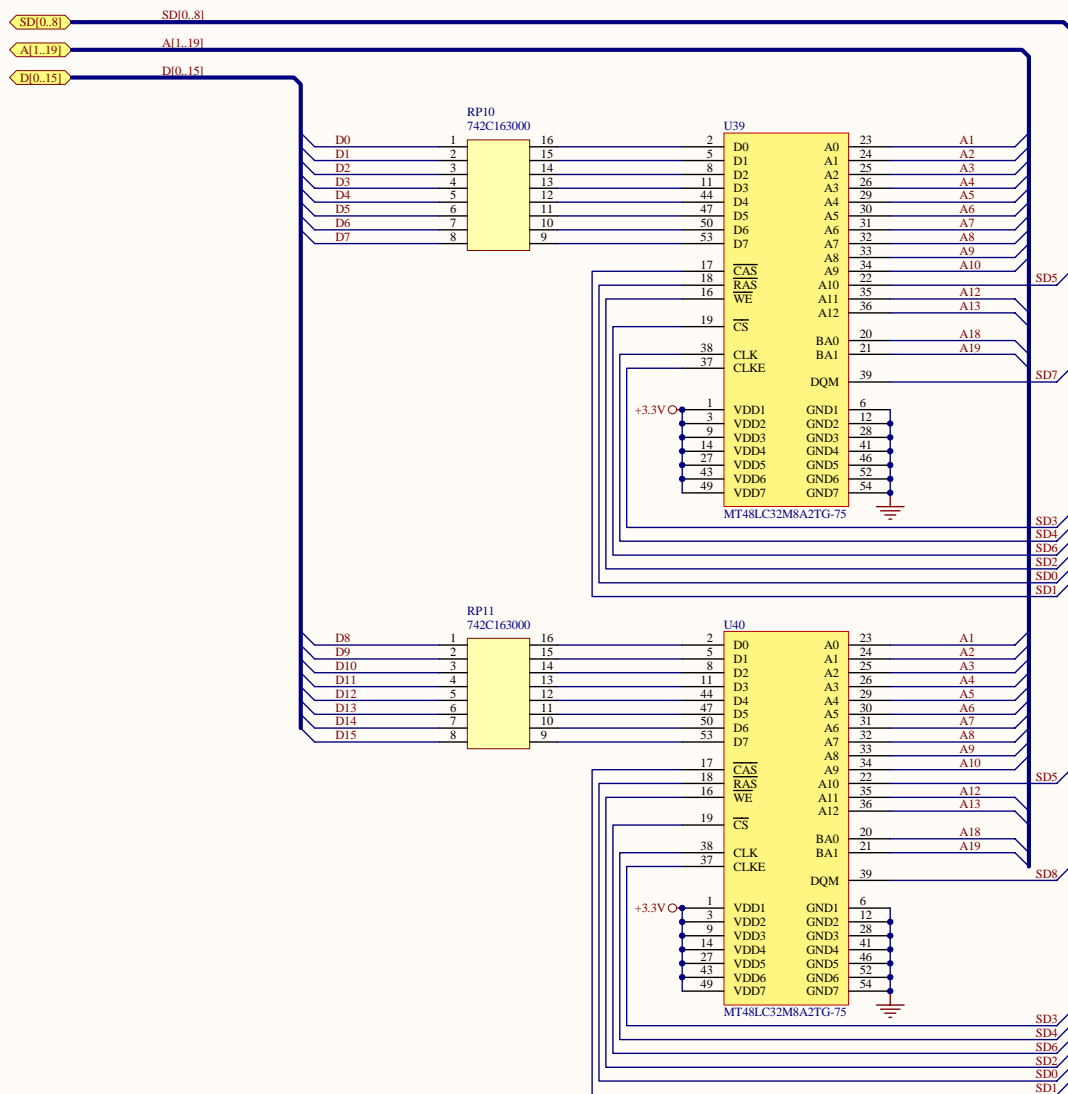
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Total

13



Audio Test Solutions, Inc. 4890 Vandaveer Rd, Billings, Montana 59101 Phone: +406-670-2862 Fax: +406-245-4889		Description LED and LCD Parts		
Drawing Number	Date	Revision	Sheet	Total
RLC-DSP402	May 12, 2011	D	10	13



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Phone: +406-670-2862 Fax: +406-245-4889

Description

64MB SDRAM and SD Flash

Drawing Number

RLC-DSP402

Date

May 12, 2011

Revision

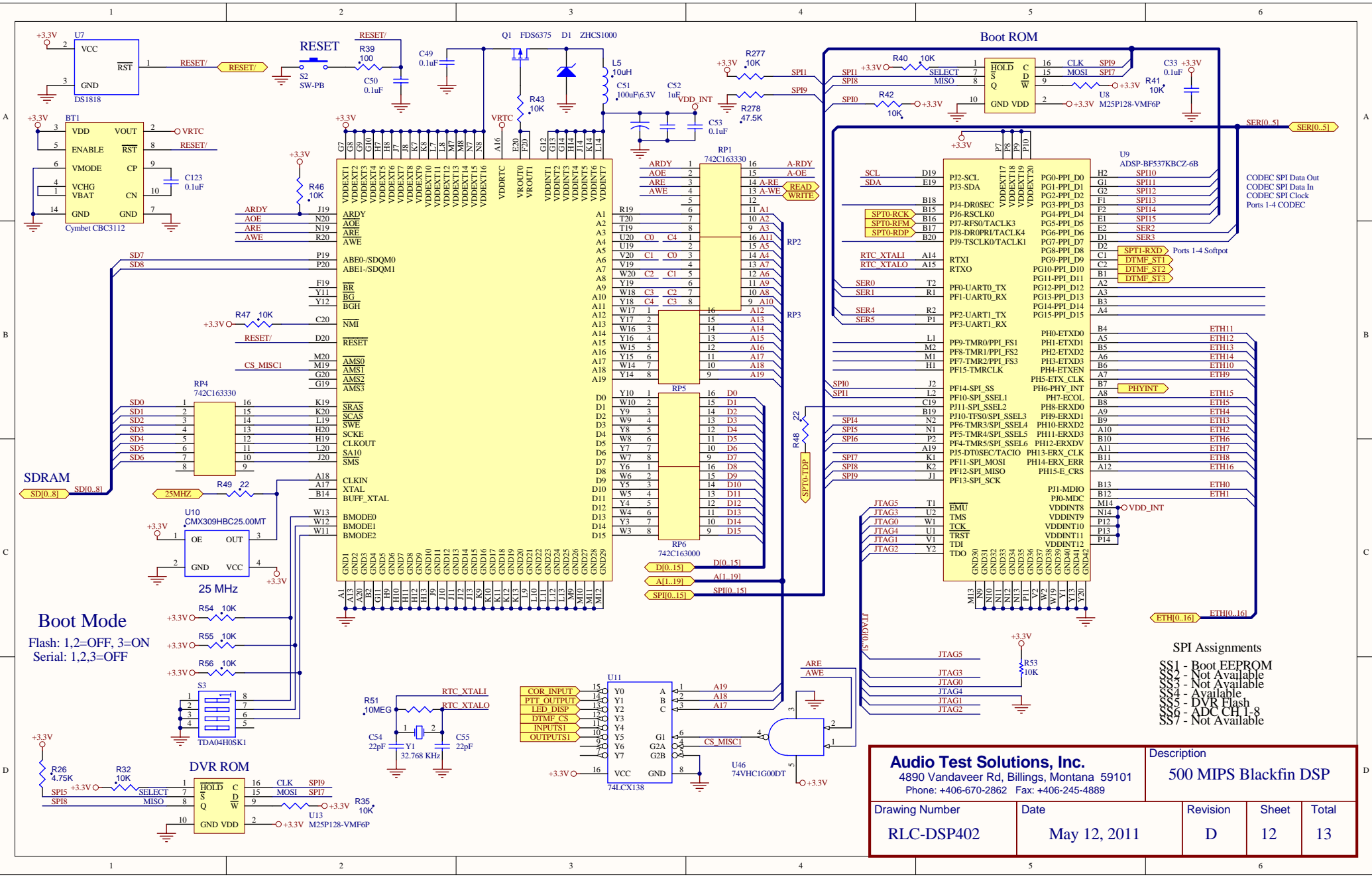
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Sheet

11

Total

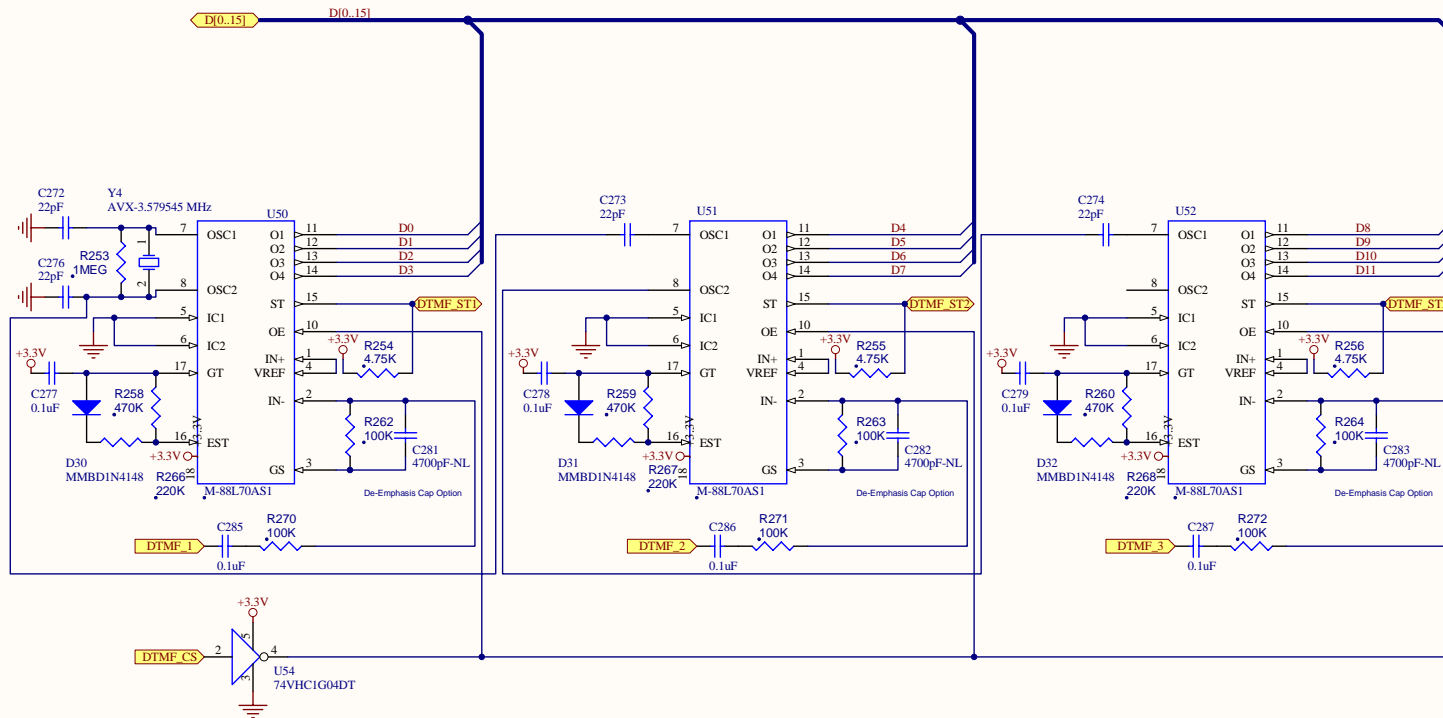
13



SPI Assignments

SS1	- Boot EEPROM
SS2	- Not Available
SS3	- Not Available
SS4	- Not Available
SS5	- Available
SS6	- DVR Flash
SS7	- ADC CH 1-8
SS8	- Not Available

Audio Test Solutions, Inc.		Description			
4890 Vandaveer Rd, Billings, Montana 59101		500 MIPS Blackfin DSP			
Phone: +406-670-2862 Fax: +406-245-4889					
Drawing Number	Date	Revision	Sheet	Total	
RLC-DSP402	May 12, 2011	D	12	13	



Audio Test Solutions, Inc.

4890 Vandaveer Rd, Billings, Montana 59101
Phone: +406-670-2862 Fax: +406-245-4889

Description

DTMF Decoding

Drawing Number

RLC-DSP402

Date

May 12, 2011

Revision

A

Sheet

13

Total

13

Appendix F: Setting Up the Controller with a Computer

Traditionally, repeater controllers have been set up by entering commands using the DTMF pad on a radio. Most of the commands in this manual can be entered with only the 12 standard DTMF digits (0-9, * and #). If the radio being used has a 16-digit DTMF pad (with digits A-D), a few extra features are available (such as using D like an ENTER key, to force a command to execute without unkeying). While the ability to enter commands using a DTMF pad is convenient when you aren't at the same location as the controller, it can be cumbersome to enter a lot of codes.

The RLC-DSP402 also makes it possible to enter commands using a computer by connecting it to the controller using a serial cable or Ethernet network (crossover cable, LAN or over the Internet). You will need to run some terminal software on the PC to make it communicate over the serial cable or network. See the web site http://rlccontrollers.com/wiki/index.php?title=Programming_Using_a_Computer for more information about the options (HyperTerminal, which is included with Windows 95 through XP but not in Vista is commonly used). That website also has information about software that is available for some controllers to provide a point-and-click rather than command line interface. For most people, it is easiest to set up the RLC-DSP402 using the RCI software described in Chapter 1. Some advanced features are not yet supported in that software, entering commands as described in this chapter is a good way to fix in those gaps. Note that the terminal window in RCI (open it from the Communications window) can be used both to enter individual commands and to upload text files containing list of commands as described below. Alternately, standard serial communications or telnet client software can be used to access the command line interface. When you get a "root:~>" prompt, type "client" (without the quotes) and press enter to get a "DSP4>" prompt before trying to enter the commands from this manual. If you wish to return to the root:~> prompt (where you can enter Linux shell commands, press CTRL-X (hold the CTRL key down while and pressing the X key).

Entering commands from the computer using terminal software 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-DSP402 to send the voice responses out any port (or more than one), or nowhere at all. The command needed to keep it from sending voice responses depends on which "client" connection the command was entered from. In most cases it will be client connection #1, but you can check the message you get when you first start the client to make sure. Assuming connection #1, enter "050 14 0" and press enter (you can also make that the first line of your upload files). To turn them back on, enter "050 14 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 (which is harmless but prevents you from hearing all of the responses). You either have to upload very slowly or turn the voice off during uploads to avoid this. In most cases, there is no reason to leave the voice on, as the commands print responses to the terminal program so you can tell how it is progressing and see any error messages.

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-DSP402 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. 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 01
050 13 1 ;          Turn on voice responses to port 1
036 135;           Speak the word "Complete"
```

Save the file as "RLC-DSP402.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-DSP402. 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. You can find more information about using upload files and programming examples on the support web site, http://rlccontrollers.com/wiki/index.php?title=Programming_Using_a_Computer

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:

007 01 1 ; Turn DTMF muting on for port 01

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-DSP402 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-DSP402 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-DSP402 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-DSP402 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-DSP402. 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-DSP402 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:

007 01 1 ; ~~~

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.

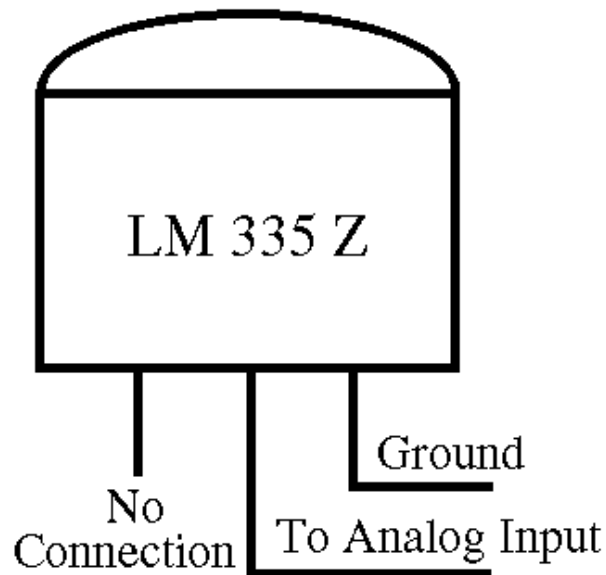
Appendix G: ASCII Chart

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	075 K	118 v	162 ó	205 =	248 °
033 !	076 L	119 w	163 ú	206 ¶	249 ·
034 "	077 M	120 x	164 ñ	207 ÷	250 ·
035 #	078 N	121 y	165 Ñ	208 ∟	251 √
036 \$	079 O	122 z	166 ª	209 ⊥	252 º
037 %	080 P	123 {	167 °	210 ∟	253 ²
038 &	081 Q	124 |	168 ¿	211 ∟	254 ■
039 '	082 R	125 }	169 ₪	212 ⊥	255
040 (	083 S	126 ~	170 ¬	213 ₪	
041)	084 T	128 Ç	171 ½	214 ¶	
042 *	085 U	129 ü	172 ¼	215 ¶	
043 +	086 V	130 é	173 ¡	216 ¶	
044 ,	087 W	131 â	174 «	217 ¶	
045 -	088 X	132 ä	175 »	218 ¶	
046 .	089 Y	133 à	176 ☐	219 ■	
047 /	090 Z	134 å	177 ☐	220 ■	
048 0	091 [	135 ç	178 ☐	221 ■	
049 1	092 \	136 ê	179 |	222 ■	
050 2	093]	137 ë	180 |	223 ■	
051 3	094 ^	138 è	181 =	224 α	
052 4	095 _	139 ï	182 =	225 β	
053 5	096 `	140 î	183 π	226 Γ	
054 6	097 a	141 ï	184 ¶	227 π	
055 7	098 b	142 Ä	185 ¶	228 Σ	
056 8	099 c	143 Å	186 ∟	229 σ	
057 9	100 d	144 É	187 ¶	230 μ	
058 :	101 e	145 æ	188 ¶	231 τ	
059 ;	102 f	146 Æ	189 ∟	232 Φ	
060 <	103 g	147 ô	190 ∟	233 Θ	
061 =	104 h	148 ö	191 ¶	234 Ω	
062 >	105 I	149 ò	192 ∟	235 δ	
063 ?	106 j	150 û	193 ∟	236 ∞	
064 @	107 k	151 ù	194 ⊥	237 φ	
065 A	108 l	152 ÿ	195 ⊥	238 ε	
066 B	109 m	153 Ö	196 —	239 ∩	
067 C	110 n	154 Ü	197 ⊥	240 ≡	
068 D	111 o	155 ¢	198 ⊥	241 ±	
069 E	112 p	156 £	199 ∟	242 ≥	
070 F	113 q	157 ¥	200 ∟	243 ≤	
071 G	114 r	158 ₣	201 ¶	244 ∫	
072 H	115 s	159 f	202 ∟	245 ∫	
073 I	116 t	160 á	203 ⊥	246 ÷	
074 J	117 u	161 í	204 ¶	247 ≈	

Appendix H: Using the LM335 Temperature Sensor

The RLC-DSP402 supports the National Semiconductor LM335Z temperature sensor. The sensor converts temperature into voltage. This voltage is read by the controller's 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. To power the sensor, turn on the pullup resistor by turning on the corresponding DIP switch (switch 1 for analog input 1, switch 7 for analog input 7, etc.). For analog inputs 1-7, the DIP switch can be found on the DSP402's main board; for analog inputs 9-16 on the expansion board (if installed). See Command 102 in Chapter 9 for information about how to tell the controller to interpret the voltage as a temperature and to calibrate the reading. An example can be found online at <http://tinyurl.com/3q7jtku>



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

Audio Test Solutions Inc. Numbers: 406 - 245 - 4889 (Fax) 406 - 245 - 5002 (Voice)
email: feedback@rlccontrollers.com

Name _____

Serial # _____

Phone # _____ Fax # _____

Request: _____

Number of Pages: _____

Appendix K: Internet Linking (VoIP)

The RLC-DSP402 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 73 600 ;
```

```
; set event trigger to automatically execute macro 601 (so it will
; stop sending PL) when all connected receivers are inactive
157 85 601 ;
```

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 513" is generated by macro 513; you can delete it by entering "055 513". 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. Entering "003 0*" from port 02 will query which transmitters are connected to receiver 02, just as "003 02" would. 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.

Hardware Reference Section