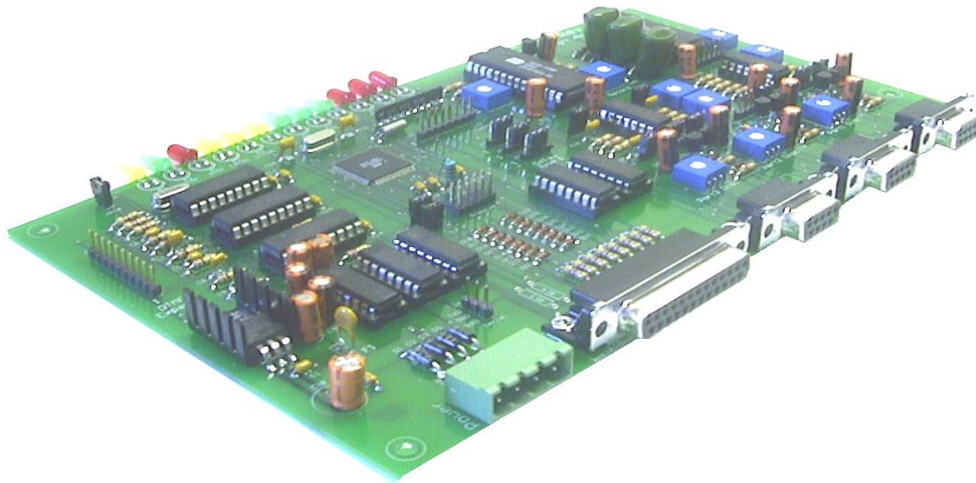




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RC210 Repeater Controller

Operations and Programming Manual

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RCP Windows® Programming Software

For detailed information on using our RCP Software, please refer to the RCP Manual, which may be found at our website:

<https://www.arcomcontrollers.com/documents/rc210/rcp/rcp.pdf>

Command Reference

Command Structure

The RC210 provides an extremely flexible and powerful command structure. Each port is capable of being controlled independently as well as controlling any other port.

There are 3 types of commands in the RC210:

Port Specific - Those commands that are specific to a particular port. For example, if you wanted to select a different courtesy tone on Port 1, you could do so without affecting the courtesy tone on the other ports.

Global - Those commands which don't affect a specific port. A good example would be reading a meter face.

Programming - Those commands which change the operating parameters of the RC210. Some programming commands affect only a specific port. For example, programming the amount of Hang Time on Port 1. Other programming commands affect things that are not port specific. For example, entering a Remote Base Prefix.

Evaluation Of Entered Commands

The controller evaluates and acts on entered DTMF digits under two conditions - upon COS (or CTCSS) closure of the receiver receiving the digits or upon receipt of the DTMF Terminator Digit. For example, there is an interfering signal on the receiver you're currently using. Obviously, the controller would never detect COS (or CTCSS) closure under this condition. By ending your entered command with a "D", you force the controller to act regardless of the COS (or CTCSS) state. This feature also permits you to string commands together, separated by a "D" and the controller will act on them one-at-a-time. This allows for automated programming, such as is done by our RCP Programming Software. **Note: this terminator digit can be changed to be something other than "D". See the Programming section for details.**

Command Accessibility

As it arrives from the factory, all commands in the RC210 are protected behind the unlock commands. This means that most commands will **not** be accepted by the RC210 unless one of its 3 ports first unlocked. Exceptions to this are Remote Base, Autopatch and TT Pad Test function which work without the controller first having to have a Port. Not to worry however, as you can easily assign any function in the RC210 ("re-map") to be accessible without first unlocking the RC210 (this is explained in the Macro section of this manual).

To some, this may seem a strange way to do things but there are distinct advantages to doing so:

- Most repeater system owners don't make the majority of functions available to general users.
- Since every RC210 is shipped with the same default codes, you don't need to spend time reprogramming every, single command in order to prevent malicious users from "playing". Only those functions you specifically make available are accessible.
- You can assign your own custom code to every function as needed.

As you can see, this method gives you complete control over who will have access to which functions in your repeater system without compromising security on your system. And without you having to do a ton of work!

Conventions in this Manual

The examples given in this manual demonstrate programming of the controller by DTMF "over the air". If you are programming using our RCP Windows© Software you should refer to the RCP Manual (and RCP HELP File) for programming information.

Default Commands Accessible When Unlocked

This section deals with those commands that allow you to change the operating conditions of the RC210. Except where noted, the settings affected by these commands are stored in non-volatile memory and will survive a power cycle of the controller. For example, if you have CTCSS Access selected on Port 1, that port will require CTCSS until you specifically change the setting, even if the controller loses power.

Supervisory Commands

These commands are those which typically control the behavior of the RC210, such as enabling and disabling features. They are only accessible while any of the 3 ports is unlocked but may be re-mapped using Command Macros to allow access even though no ports are unlocked. An asterisk next to each description signifies the default power up state of that function (this can be changed by programming).

Important

Any Port's Supervisory Commands are accessible regardless of which port is currently unlocked and regardless of which Port you're actually connected to. For example, you could unlock Port 3 and change the Carrier/CTCSS setting on Port 1, even though you're actually using a radio connected to Port 2.

It is strongly recommended that these Supervisory Commands only be used when initially setting up the RC210 and afterwards used sparingly once your controller is deployed as you must first Unlock a Port in order to access them and this might present a security risk to your system. As any Supervisory Command can be remapped to a Command Macro and then assigned any DTMF code to execute that Macro, we believe it is best to do so before deploying your repeater.

Receiver Enable/Disable

Each port's receiver may be temporarily disabled individually to prevent a signal from that receiver from being recognized. Note that this setting is not stored in non-volatile memory and upon a controller reset or power up, all receivers will once again be enabled. Also note that for safety reasons, you cannot disable the receiver on the Port to which you're currently connected nor if that Port isn't in Repeat Mode.

1101 Port 1 Receiver Enable*	2101 Port 2 Receiver Enable*	3101 Port 3 Receiver Enable*
1100 Port 1 Receiver Disable	2100 Port 2 Receiver Disable	3100 Port 3 Receiver Disable

Transmitter Enable/Disable

Each port's transmitter may be disabled individually to prevent keying by itself or other ports. This command completely disables the transmitter on that port, including ID's

1111 Port 1 Enable*	2111 Port 2 Enable*	3111 Port 3 Enable*
1110 Port 1 Disable	2110 Port 2 Disable	3110 Port 3 Disable

Carrier/CTCSS AND Carrier

Each port supports an external CTCSS (or digital) decoder, the action of which may be controlled with these commands.

1120 Port 1 Carrier Only*	2120 Port 2 Carrier Only*	3120 Port 3 Carrier Only*
1121 Port 1 CTCSS AND Carrier	2121 Port 2 CTCSS AND Carrier	3121 Port 3 CTCSS AND Carrier

Mute DTMF ON/OFF

This command selects whether DTMF digits received on the selected port are retransmitted or muted.

1211 Mute DTMF ON*	2211 Mute DTMF ON*	3211 Mute DTMF ON*
1210 Mute DTMF OFF	2210 Mute DTMF OFF	3210 Mute DTMF OFF

TouchTone® Covertone

Whenever a DTMF digit is pressed and Muting is enabled, the receiver audio from that port is muted. Optionally, a covertone may be selected so users aren't faced with "dead air" while audio is muted.

1131 Port 1 Touchtone® Covertone ON*	2131 Port 2 Touchtone® Covertone ON*	3131 Port 3 Touchtone® Covertone ON*
1130 Port 1 Touchtone® Covertone OFF	2130 Port 2 Touchtone® Covertone OFF	3130 Port 3 Touchtone® Covertone OFF

Courtesy Tone Selection

There is a pool of unique 10 programmable courtesy tone sets that may be shared (selected for use) amongst the 3 Ports.

1134x Port 1 Courtesy Tone Select x = 1-10 (1*)	2134x Port 2 Courtesy Tone Select x = 1-10 (1*)	3134x Port 3 Courtesy Tone Select x = 1-10 (1*)
---	---	---

Note: Courtesy Tone selection is not stored in non-volatile memory and will revert to Courtesy Tone #1 upon controller startup. You may define which Courtesy Tone to use upon startup by defining it in the Startup Macro. See the Programming section for details.

Kerchunk Filtering

Each port has its own filtering command to prevent users from "kerchunking" that port. When turned on, these filters require that users key up for a period of at least the setting of the Kerchunk Timer before the RC210 will recognize it as a valid signal.

1151 Port 1 Kerchunk Filter On	2151 Port 2 Kerchunk Filter On	3151 Port 3 Kerchunk Filter On
1150 Port 1 Kerchunk Filter Off*	2150 Port 2 Kerchunk Filter Off*	3150 Port 3 Kerchunk Filter Off*

Repeating/Non-Repeating Operation

Each port may be defined as repeating, where a signal on that port's receiver is retransmitted out that port's transmitter. Or it may be defined as non-repeating, where a signal on that port's receiver is NOT retransmitted out that port's transmitter. For example, if you wanted to use Port 2 for a half-duplex/simplex remote base, you would not want its transmitter to be activated by its receiver. You would therefore define that port as being non-repeat. Of course if you want to use a particular port (or all ports) for a repeater, that port needs to be defined as repeating.

1141 Port 1 Repeat*	2141 Port 2 Repeat	3141 Port 3 Repeat
1140 Port 1 Non-Repeat	2140 Port 2 Non-Repeat *	3140 Port 3 Non-Repeat *

Mix Monitored Audio with This Port RX Audio

This function selects whether audio from the monitored port(s) is mixed with the audio from the monitoring port or muted when there is activity on the monitoring port.

1191 Monitor Mix*	2191 Monitor Mix*	3191 Monitor Mix*
1190 Monitor Mute	2190 Monitor Mute	3190 Monitor Mute

Speech Override ON/OFF

Setting the Override to OFF causes user audio to be mixed with non-ID Speech. Setting the Override to ON causes non-ID speech to be stopped if a signal appears on that port's receiver.

1201 Speech Override ON	2201 Speech Override ON	3201 Speech Override ON
1200 Speech Override OFF*	2200 Speech Override OFF*	3200 Speech Override OFF*

Speech ID Override ON/OFF

Setting the Override to OFF causes user audio to be mixed with ID Speech. Setting the Override to ON causes ID speech to be stopped if a signal appears on that port's receiver, in which case the voice ID reverts to CW in order to ensure the repeater is properly identified.

1181 Speech ID Override ON*	2181 Speech ID Override ON*	3181 Speech ID Override ON*
1180 Speech ID Override OFF	2180 Speech ID Override OFF	3180 Speech ID Override OFF

Enable/Disable Port DTMF

Each port may have its DTMF decoder disabled. This function is useful under several circumstances, such as when a user is causing problems. As a precaution, it is not possible to disable DTMF on the port to which you're currently connected. For example, you must be using a radio (or repeater) connected to Port 2 or 3 in order to disable DTMF on Port 1.

1161 Port 1 DTMF Enable*	2161 Port 2 DTMF Enable*	3161 Port 3 DTMF Enable*
1160 Port 1 DTMF Disable	2160 Port 2 DTMF Disable	3160 Port 3 DTMF Disable

Require/Not Require CTCSS for DTMF

Each port may be configured to either require a user's signal to contain CTCSS or not require it, in order to enter DTMF commands. This selection controls DTMF access regardless of the state of the access required for repeater access on that port. In other words, it is possible to have a port configured for carrier squelch access, yet require CTCSS for DTMF commands to work.

1170	Port 1 no CTCSS for DTMF*	2170	Port 2 no CTCSS for DTMF*	3170	Port 3 no CTCSS for DTMF*
1171	Port 1 CTCSS for DTMF	2171	Port 2 CTCSS for DTMF	3171	Port 3 CTCSS for DTMF

DTMF Evaluation on COS or CTCSS

You may control how evaluation of entered DTMF commands by either COS closure or CTCSS decoder closure. This can be helpful if your squelch locks open and may be selected on a Port-by-Port basis

1221	Port 1 DTMF Command Evaluation on CTCSS Closure
2221	Port 2 DTMF Command Evaluation on CTCSS Closure
3221	Port 3 DTMF Command Evaluation on CTCSS Closure

1220	Port 1 DTMF Command Evaluation on COS Closure
2220	Port 2 DTMF Command Evaluation on COS Closure
3220	Port 3 DTMF Command Evaluation on COS Closure

Using A Control Receiver

Because of the RC210's ability to control any Port from any other Port, there is no need for a special, dedicated control receiver port. By using the right combination of Macro Functions, you can easily and quickly disable or enable any function the RC210 is capable of performing. For example, you have a repeater on Port 1 and a link on Port 2. There is some user randomly entering DTMF, causing disruption to the users of the repeater. You could "come in" through your link and turn off DTMF on Port 1 by unlocking Port 1 and entering the command to turn DTMF off. This could be done without your presence being known to the users on Port 1 if you so chose.

You could even use an existing link or repeater as your control receiver and you will still have positive control of your system at all times. The possibilities are only limited by your imagination and needs of your system.

Port Linking

Monitoring A Port from Other Ports

Any port may be selectively monitored by any other port. In the RC210, with multiple monitor commands you can create any combination of monitoring from port to port. This provides considerable flexibility in audio routing. Each of these monitoring commands is a **one-way** connection. In other words, if you select to monitor Port 2 from Port 1, activity on Port 1 will not be retransmitted on Port 2.

To create a two-way path between ports, you have two choices. You can either establish 2, one-way connections between ports or you could use the Linking Commands (this is explained below).

Assume you're on Port 1 and want to monitor activity on Port 2. Enter the command **1301** and a one-way connection is established, allowing the monitoring **of** Port 2 **by** Port 1. Now, activity on Port 2 is retransmitted out Port 1, but Port 1 is not retransmitted out Port 2. It doesn't matter what port is used to issue these commands.

1301 Monitor Port 2 From Port 1 ON
1300 Monitor Port 2 From Port 1 OFF*

2301 Monitor Port 1 From Port 2 ON
2300 Monitor Port 1 From Port 2 OFF*

3301 Monitor Port 1 From Port 3 ON
3300 Monitor Port 1 From Port 3 OFF*

1311 Monitor Port 3 From Port 1 ON
1310 Monitor Port 3 From Port 1 OFF*

2311 Monitor Port 3 From Port 2 ON
2310 Monitor Port 3 From Port 2 OFF*

3311 Monitor Port 2 From Port 3 ON
3310 Monitor Port 2 From Port 3 OFF*

After monitoring for a while, you decide you want to join in the conversation. By issuing the command **2301**, activity on Port 1 is now retransmitted out Port 2. In other words, there is now a two-way connection between Ports 1 & 2.

A two-way connection made in the above manner can be taken down by first turning off monitoring from the port you are on from being monitored by the other port. Then stop monitoring that other port with a second command. For example, if you have a two-way monitor between Ports 1 and 2, and you are actively using Port 1, send the command **2300** first so Port 1 activity does not appear on Port 2, then send **1300** to stop monitoring Port 2. It can be taken down the other way, but if there is an interruption you will be transmitting Port 1 audio on Port 2 and not realize when Port 2 is busy.

Linking Ports Quickly

You may also establish two-way connections (linking) between ports quickly and easily by using only one command. Likewise, you can also disconnect (unlink) ports using these commands. **Note: Even if you established port monitoring using the Monitor Commands above, you may use the Linking Commands to turn them off or modify them. In other words, the Linking Commands take precedence over Monitoring commands.**

A11 Link Port 1 to Port 2
A21 Link Port 1 to Port 3
A31 Link Port 2 to Port 3
A41 Link all ports to all other ports

A10 Unlink Port 1 from Port 2*
A20 Unlink Port 1 from Port 3*
A30 Unlink Port 2 from Port 3*
A40 Unlink all ports from all other ports*

Note that you may also interrogate the status of Port linking by using the following commands:

1401 Interrogate Port 1 Status
1402 Interrogate Port 1 Status
1402 Interrogate Port 1 Status

User DTMF Pad Test

By using this feature, users can test their DTMF pads to make sure their digits are being properly decoded by the RC210. By sending the User DTMF Pad Test Command Prefix, followed by up to 16 digits, the RC210 will read back each digit it correctly decodes.

< User DTMF Pad Test Command Prefix> <up to 16 DTMF digits>

See the Programming Section of this manual for programming the Command Prefix for this feature.

Note: This is a very good feature to remember if you're having issues getting your DTMF digits to decode properly.

By default, the Prefix is 85

Auxiliary Audio Inputs

These inputs can be used for connecting external audio devices, such as a weather receiver. When turned on, the selected transmitter is locked on for a period selected by a programmable timer. After this timer times out, the audio is disconnected and the transmitter is unkeyed. Which port a particular input is routed to is determined by programming commands.

1961	Turn Auxiliary Audio Input 1 ON	3961	Turn Auxiliary Audio Input 3 ON
1960	Turn Auxiliary Audio Input 1 OFF	3960	Turn Auxiliary Audio Input 3 OFF
2961	Turn Auxiliary Audio Input 2 ON		
2960	Turn Auxiliary Audio Input 2 OFF		

General Logic Outputs

There are 7 switched outputs (8 if using a 3.4 version pc board and later) that can be commanded on or off. They can also be pulsed (100 ms open, 100 ms low and back open again.). When an output is high, it is actually an open drain JFET. If you need a logic high present, you must provide a pull up resistor (up to 30 vdc).

1810	Logic Output 1 Open Drain	1850	Logic Output 5 Open Drain
1811	Logic Output 1 Low	1851	Logic Output 5 Low
1812	Logic Output 1 Pulsed (open, low, open)	1852	Logic Output 5 Pulsed (open, low, open)
1820	Logic Output 2 Open Drain	1860	Logic Output 6 Open Drain
1821	Logic Output 2 Low	1861	Logic Output 6 Low
1822	Logic Output 2 Pulsed (open, low, open)	1862	Logic Output 6 Pulsed (open, low, open)
1830	Logic Output 3 Open Drain	1870	Logic Output 7 Open Drain
1831	Logic Output 3 Low	1871	Logic Output 7 Low
1832	Logic Output 3 Pulsed (open, low, open)	1872	Logic Output 7 Pulsed (open, low, open)
1840	Logic Output 4 Open Drain	1880	Logic Output 8 Open Drain
1841	Logic Output 4 Low	1881	Logic Output 8 Low
1842	Logic Output 4 Pulsed (open, low, open)	1882	Logic Output 8 Pulsed (open, low, open)

Note: These outputs are independent of the "Output Sinker" functions provided by the Doug Hall RBI-1 Remote Base Interface. See the Remote Base section of this manual for details.

Extended Logic Outputs

If you have connected external shift registers as described in the RC210 Hardware Reference Manual, you have a total of 32 Extended Logic Outputs available. These are available in addition to the 7 on-board Logic Outputs (8 outputs on a 3.5 version pc board and later)

180xxy	Logic Output xx (1-32) to state y
	y = 0 Logic Open Drain
	y = 1 Logic Low
	y = 2 Pulsed output (Open, Low, Open)

Analog Meter Inputs

Analog measurement capability consists of an 8 channel 10 bit analog to digital converter. Each channel is capable of measuring voltages between 0 and approximately 5 volts DC and may be programmed to reflect actual values. With the proper sensor hardware (see the RC210 Hardware Manual for details), the range of measurement can be anything you need it to be and not only those limited to this range.

Signals may be provided from the receiver's meter and deviation metering circuits, from wattmeters, temperature sensors and other transducers. There are a number of meter face names you can use, including Volts, Amps, Watts, Degrees, Miles per Hour, and Percent. Scaling of these meter faces is completely programmable by the owner.

The voltage from an external sensor is applied to one of the Analog to Digital (A/D) inputs and measured. Then based on how that meter channel is programmed, the RC210 speaks the measured value. For example, if you have Meter 1 programmed to read temperature, the controller will speak the value in "Degrees".

When a meter readback command is entered, the controller reads back a value that represents the average of several measurements taken over the past few seconds. As the A/D measurements are taken every second and smoothed in the controller firmware, this provides for a very stable reading. For maximum accuracy, the reference voltage used by the A/D converter is programmable.

High and low values for each Meter are stored and can be read back by the user on command. This allows for tracking of trends and each high and low value can be cleared using a command for each meter, or by a global command to clear all the stored high and low values with one command.

How to setup Meters and how to calibrate them is explained later in the Programming section of this manual

1400 (channel 1 - 8)	Readback current value
1400 (channel 1 - 8) 1	Readback stored LOW value
1400 (channel 1 - 8) 2	Readback stored HIGH value

To reset a meter's High/Low Stored value:

1500x where "x" is the Meter 1 - 8 channel you wish to clear. Entering a 0 will clear all channels.

Meter Alarms

Each of the Meter Inputs has programmable high and low alarms which when tripped will run a Command Macro. See the Programming section of this manual for details.

Each of the 8 Meter Alarms may be enabled and disabled. To enable or disable a meter alarm:

1600xy where x = 1 to 8 for the meter channel and y = 1 for ON and 0 for OFF

Disabling a Meter Alarm retains that alarm's programming but causes it to be ignored even if "tripped".

Logic Alarms

Each Alarm may be individually turned ON, OFF or interrogated. While enabled, an alarm is triggered by 2 different events – its input line transitioning from a logic high to a logic low and from a logic low to a logic high. Each state may be programmed to call its own Command Macro. See the Programming Reference section for details about programming the Alarms. You may also interrogate the logic state of each Alarm, which is handy for troubleshooting and setup.

1911	Alarm 1 Enabled	4911	Alarm 4 Enabled	2913	Alarm 2 Interrogate
1910	Alarm 1 Disabled	4910	Alarm 4 Disabled	3913	Alarm 3 Interrogate
2911	Alarm 2 Enabled	5911	Alarm 5 Enabled	4913	Alarm 4 Interrogate
2910	Alarm 2 Disabled	5910	Alarm 5 Disabled	5913	Alarm 5 Interrogate
3911	Alarm 3 Enabled				
3910	Alarm 3 Disabled	1913	Alarm 1 Interrogate		

Davis Instruments Weather Station

The following Davis Instrument systems are supported by the RC210:

- Vantage Vue
- Vantage Pro
- Vantage Pro2
- Vantage Pro Plus
- Vantage Pro2 Plus

Using the above units (Consoles) will allow you to recall the following information:

- Current wind speed & direction
- Current Outdoor temperature
- Indoor humidity
- Outdoor humidity
- Wind Speed high & direction (since Midnight)
- Outdoor Temp High (since Midnight)
- Outdoor Temp low (since Midnight)

In addition to the Weather Station itself, you will also need Davis Instruments DataLogger cable Model 6510SER which is available from many sources. And while the cable also comes with a companion software CD, this software is not needed for use with the RC210. You will also need a DB9 male to DB25 male adapter

Connecting the Davis to the RC210

Connection between the Davis Console and RC210 is accomplished by first connecting the 6510SER cable to the console as per the Davis Manual. Once this is done, use the DB9 to DB25 adapter to connect the Davis cable to the RC210's RS232 connector (labeled "Programming" on the back of the RC210R Rack Mount). That's all there is to it!

Note: The Davis Console needs to be set to 9600 baud. Refer to the documentation that came with it for instructions on how to do this.

Using the Davis Instruments Weather Station

In order to communicate with the Console, you must first program some Macros to call the readings you desire. For example, let's say we want our users to be able to find out what the current outside temperature is at the repeater site. We'll use Macro 10 in our example but you can use anyone you wish.

***4002 10 * 593** Program Macro 10 to recall the current outdoor temperature from the Davis Console

Now we can assign this Macro the DTMF code of "123".

***2050 010 123** Users can now enter DTMF "123 and the RC210 will read back the current outside temperature

Hint: You may find it useful to include a Message Macro in the above Command Macro to confirm the recall. For example, you could record a DVR Track with "Outside Temperature is" and then recall the outdoor temperature Macro Function.

Remote Base Operation

Any of the 3 ports may be used to connect a remote base radio. See Appendix A for a list of supported radios.

The type of radio you plan to use with the RC210 is selected by programming commands. In addition, because of the different formats used with radios within the Yaesu line, you must also select which model you wish to use if you program to use a Yaesu radio. See the Programming Reference section of this manual for details. Remote Base Commands are available without unlocking the controller.

The default Remote Prefix is "A7", so you must preface each of the Remote Base codes below with it. You can change the Remote Base Prefix as desired. See page 26 for details.

The commands to control the radio are:

Frequency and Transmitter Offset Entry

A71xxx.xxx y Enter Frequency with transmit offset*.
Frequency entered must be padded with zeros to make it 6 digits long.

Examples:

A 7 1 1 4 6 6 4 0 3 = 146.640 plus offset
A 7 1 4 4 8 3 2 5 1 = 448.325 minus offset
A 7 1 0 1 4 1 9 5 2 = 14.195 no offset
A 7 1 0 0 7 1 5 0 2 = 7.150 no offset

*Note: the offset must always be entered, even if
if you are not in FM mode.*

*The last digit represents the repeater offset .
y equals:
1 - minus
2 - simplex
3 - plus

CTCSS Entry

A72xy Enter CTCSS code and select encode and/or decode. The 2 digit code xx used for a particular frequency is shown in Appendix B.

y equals:
0 = No Tone
1 = Encode only
2 = Encode/Decode

Mode Entry

A73x Mode select. x equals: *Note: This command only has relevance if you're using a remote base radio capable of multimode use.*
1 = LSB
2 = USB
3 = CW
4 = FM
5 = AM
Note: Any port used for a remote base should be defined as non-repeating.

Readback

A7 Readback current frequency, offset and mode that is currently loaded into radio

Memory Selection (Internal RC210 Memories)

The RC210 allows you to recall up to 10 previously stored Remote Base Memories (there are a total of 40 memories if the optional RTC is installed. See the RTC Manual for details). Each of these memories will store operating frequency, transmit offset, CTCSS tone and encode/decode selection and operating Mode. When recalled, these parameters will be spoken by the controller). (see the Programming section of this manual for details on storing Remote Base Memories)

A75xx Recall Remote Base Memories 01-10 (or 01-40 if optional RTC is installed).

Memory Recall When Using the Kenwood TM-V7a/TM-G707/TM-271A/TM-281A/TS-2000

When any of these radios are selected as the remote base radio, up to 255 of their memories may be recalled (180 total for the V7a).

A77 x y where x selects which band's memory to recall and "y" is Memory 1 to 255.

The Band Select digit is necessary because the Kenwood mobiles have no idea which memory we're going to recall. This digit is therefore used to tell the radio which band's memory to use. 1 = VHF, 2 = UHF.

However, in the case of the TS-2000, you directly recall the desired memory using all 3 digits as the Memory Channel selection.

Examples:

A77012 Recall Memory 12

A77121 Recall Memory 121

A77299 Recall Memory 299

Remote Base Power Select When Using the Kenwood TM-V7a/TM-G707/TM-271A/TM-471A or Doug Hall RBI-1

A79 x Select Transmitter power of the connect remote base radio, where x

<u>Kenwood</u>	<u>Doug Hall</u>
0 High Power	0 Low Power
1 Medium Power	1 High Power
2 Low Power	2 Medium Power (only if radio supports this selection)

Note: Also see *Programming Kenwood TM-V7a/TM-G707/TM-271A/TM-471A Memories* in the Programming section of this manual.

Using the Doug Hall RBI-1 Remote Base Interface

There are extra remote base commands available for use if you have selected the Doug Hall RBI-1 for use as your remote base. **Note:** **these only work if "5" is selected as your remote base radio type**

User Function Outputs

The RBI-1 provides 7 *User Function* outputs that can be used (in addition to Logic Outputs of the RC210) to control hardware at the repeater site. Refer to the Doug Hall manual for details on making connections.

A74 x y User Outputs 1 through 7, where "x" is the output and "y" = 1 ON, 2 OFF

Memory Select

The Doug Hall RBI-1 provides for memory recall of up to 20 memories within the controlled radio

A76x Select Memory 1 – 20

Power Select

A79x

- x = 1 Low Power
- x = 2 Mid Power
- x = 3 High Power
- x = 5 Radio Power OFF

AutoPatch Operation

The optional AP1 Autopatch board provides for full autopatch operations, including reverse patch that allows for programming of the controller from the phone line. Please refer to the AP1 Autopatch Manual for programming and operating instructions.

Command Macros

Command Macros serve several purposes:

- To remap controller functions so they'll be available without having to first unlock the controller. By default, the RC210 will not accept commands unless one of the 3 ports is first unlocked. By remapping controller functions in a macro, these functions are made available without having to first unlock a port. This is how you provide commands for your general users.
- To execute many different functions with one single command. This allows the owner to program multiple controller functions to take place by the entering of only one command.
- To generate and direct speech messages. These are generally used for such things as Good Morning/Afternoon/Evening messages that the scheduler uses.
- To generate DTMF digits and direct them to a Port. This is very useful for sending commands to a remote site linked by radio or for use with an EchoLink or IRLP node.

There are 3 types of Command Macros - "Long", "Short" and Extended:

- Command Macros 1 to 40 can store up to 15 functions each in "slots"
- Command Macros 41 to 90 can store up to 6 functions each in "slots"
- Command Macros 91 to 105 only exist if your RC210 has a 3.5 or later version pc board or you have the optional EEPROM board installed on an older version board. These Extended Macros can store up to 20 functions each in "slots"

Typically, Command Macros 41 to 90 are used to remap functions and you can include up to 6 functions in a single one of these macros. Remember however that there is nothing preventing you from using ANY Command Macro you like to accomplish this, but most RC210 owners will probably want to reserve the Long and Extended Macros for those things where many functions are to be done with a single command. This is however, totally up to you.

Some important things you need to remember when programming Command Macros:

- **"Slots" are the space Macro Functions take in memory**
- **Any Macro Command Function that is numbered higher than 255 requires two slots.**
- **Any Macro Command Function that is numbered higher than 509 requires three slots**
- **Any Macro Command Function that is numbered higher than 764 requires four slots**

Each macro may be assigned its own unique DTMF code, so you can define one of your own choosing. See the Programming Reference section of the manual on how to program both the macro codes, as well as the macros themselves.

Macros may also be called from the Scheduler, General Timers and the Alarms to automate commands. See the Scheduler, General Timers and Alarm sections in the Programming section of this manual for details. Finally, you may manually recall the contents of any Command Macro and the controller will read back those contents.

Macro Subset

It is possible to program a smaller contiguous range of Command Macros, known as a Macro Subset. This Subset can be defined as any contiguous number of Command Macros. For example, you could define this Subset to be Macros 1 through 15. Or perhaps Macros 40 through 80. It is totally up to you how large or small this Subset should be. Once programmed, you can selectively enable and disable them as needed. For example, let's say you have Macros 10 through 15 defined as your Subset and they contain only the most basic of functions; the intent being to limit your users to only these functions overnight. During the day, they can have access to all your Macros. You enable Subsets with a Macro Function and disable them the same way.

You could also do some trickery with a tone decoder and an Alarm input to restrict users without tone to only the Subset of Macros. But if they have the proper tone, they'd have access to all. It's totally up to you how you want to use this feature!

A Few Words About Command Macro 1

Macro 1 is a special case in that it is automatically run whenever the RC210 is first powered or otherwise starts up. This allows you to have the controller "come up" in a known state, such as Port linking, Courtesy Tone selection other than #1), etc.

It is worth remembering that most programmed parameters of the RC210 are stored in non-volatile memory. That is to say that they stay set as set them until you explicitly change them. The only exceptions are:

- Courtesy Tone Selection – this always defaults to CT #1 up start up
- Port Linking Status – all Ports are unlinked from each other at start up.

Aside from the above 2 items, there is rarely a reason to include other functions.

Message Macros

There are 40 Message Macros (or 70 if the optional RTC is installed. See the RTC Manual for details), each of which is capable of storing up to 9 words (or DVR tracks) of speech and can be used in conjunction with any Command Macro. These are typically used to provide a message that reflects the action taken by a Command Macro.

For example, you might have a 2 meter remote base connected to Port 2 and you've defined a Command Macro to link Port 2 and Port 1. You could include a message such as "2 Meter Remote Base Link On" by using a Message Macro. Or perhaps you want a scheduled message to be sent at the top of each hour.

Note that Message Macros 39 and 40 are used to store the Timeout and Timeout Cancel messages that are used when a Port times out (and recovers from a Timeout). By default, these messages are "Repeater Timeout" and "Repeater Timeout Cancel" respectively. You may change them as you can any other Message Macro to personalize your system if you so desire.

ID Extras

ID Extras allow you to add various "phrases" to the Voice ID Messages. These ID Extras allow you to include such messages as "Good Morning/Afternoon/Evening (automatically selected by the controller for the appropriate time of day), the time of day or date before OR after the actual ID. See the Programming section of this manual for details.

IRLP®/Echolink® DTMF Regeneration

When you need to send DTMF to an external device, such as an IRLP® / Echolink® node, whether directly connected to the RC210 or via a radio link, it is desirable to ensure that DTMF is clean and unprocessed for maximum reliability.

To use this feature, all a user needs do is enter the Regenerate Prefix, followed by the DTMF digits to be sent to the node/link. The DTMF sequence after the Prefix will then be sent. Optionally, you may include a voice message that will be spoken before the DTMF sequence is sent. **Note: this feature is available while the controller is locked.** By default, the Command Prefix is # .

<digits to send>

See the Programming section of this manual for details on how to program the Command Prefix and DTMF Regeneration parameters.

Real Time Clock And Calendar

If the Real Time Clock has been set since the last power outage, this command will announce the current time.

1700 Announce current time

Note: If the Real Time Clock has not been set since the past power outage and you don't have the RTC installed, the controller will say "Clock Not Set".

If the calendar has been set since the last power outage, this command will announce the current date

1701 Announce current date

Note: If the Calendar has not been set since the past power outage and you don't have the RTC installed, the controller will say "Date Not Set"

Digital Voice Recorder (DVR)

The RC210 includes an on-board DVR that allows for recording of custom messages that can be used in any programmable message (ID's and Message Macros). It also allows your users to record their own transmission, for checking the quality of their signal.

The DVR has a total recording time of 64 seconds (128 seconds with optional DVR IC) and divided into 20 "tracks". There is no time limit per track, other than the total recording time available. See the Programming section of this manual for details on recording DVR tracks for use in messages.

DVR Track 19 is a special case, as that can be used to allow your users to check the quality of their signal into the repeater. This function is available as a Macro Function, so you must specifically define it in order for it to be available to your users.

To use the feature, users enter the Command Code you've programmed, then unkey. The controller responds with "Ready", at which point the user has 4 seconds to key again and speak their message. When they're done, they unkey and the controller will play what was recorded. If after the controller speaks "Ready" and the user does nothing, the controller will timeout the recording and announce such.

Obviously, there needs to be "free" minutes available in the DVR in order for this feature to be useable. If there are no free minutes available and this feature is used, the controller will respond with "Error" instead of the Ready message and the function will be terminated.

General Timers

There are 6 General Timers that may be used for any purpose you may have. Each timer is independent of the others and may run concurrently with others as well. Each of these timers is programmable in seconds and when it times out, it will run a Command Macro of your choice. These timers may be used for everything from beacon IDs to automatically turning a feature on or off after functioning it. The use of these timers is only limited by your imagination. See the Programming section of this manual for details.

Programming The RC210

General Programming Overview

Each port on the RC210 is programmed individually and the programming for one does not affect the others. The programming commands for each port are identical - the only difference being the port you've "unlocked" to program. This makes it easier to remember the code for programming a particular command and/or function.

For example, the code to program the Initial ID Timer is *1002, regardless which port you wish to program. What differentiates which port is being programmed is determined by which port you unlocked through the use of its unlock code.

While you are in programming mode you can re-enter an Unlock Code at any time to unlock a different port without having to lock the controller first. For example, if the controller's Port 1 is already unlocked, you can simply enter Port 2's unlock code and change over to programming Port 2. **Furthermore, any Port may be unlocked and programmed, regardless of which Port you're actually connected to. For example, you may program Port 1 while actually using a radio or repeater connected to Port 2 or 3.**

As mentioned in the Command Reference section of this manual while any port is unlocked, you can use any of the default command codes.

In addition, by prefacing any Macro Command with "* *", you can recall any previously programmed Macro without having to first "lock" the controller.

Unlock Code Programming

The RC210 comes programmed with a default unlock codes for each port. To unlock any port for the first time, enter the default code.

15281	Port 1 default unlock code
25281	Port 2 default unlock code
35281	Port 3 default unlock code.

For example, to unlock Port 1 for the first time, enter 1 5 2 8 1 and unkey. The controller will respond with "ULP1", indicating that Port 1 is now unlocked and ready to accept programming. The code to reprogram the unlock code is * 9 0 0 0 followed by up to 8 digits - those digits will become your new unlock code for that port.

Note: For security reasons, you should try and use all 8 digits for the unlock codes.

For example, you want to program the unlock code for Port 1 to "22334455". Key your radio and enter * 9 0 0 0 2 2 3 3 4 4 5 5 and unkey. The controller should respond with "CODE". Your new code is now set and will stay set until you explicitly change it, even through power off cycles. It is suggested the first thing you do is reprogram the unlock code for each port.

Some owners prefer to use a prefix, followed by a command unlock code. This makes it even easier to remember the codes. For example, you could program Port 1 unlock code as **12463683**, Port 2 as **22463683** and Port 3 as **32463683**. Of course this is strictly up to you, but the flexibility of the RC210 allows you this sort of freedom.

Important: Write your unlock codes down and keep them in a safe place. Should you lose them, it is possible to reset them back to factory defaults but this cannot be done without physical access to the RC210.. See "Resetting your unlock codes" on Page 45 for details on how to do this.

See Programming Commands Quick Reference at the end of this manual for how to reset the Unlock Codes should you forget them.

A Word About Programming Codes

The RC210 allows you to define custom DTMF Codes (DTMF digits that users must enter over the air) to access various features. Everything from the codes used to cause a Command Macro to run, to the Autopatch Prefix may be custom programmed as you desire. However, while planning your customizations, you should take care not to duplicate codes in more than one section. For example, if you define your Autopatch Hang Up Code to be "#", you should not use # for any other Prefix nor Command Macro Codes. Failure to observe this may result in unintended operation.

Note: DTMF codes while Unlocked are a special case and may be reused if the controller is otherwise Locked. That is to say that if your Unlock Code is # - which it is by default – you may reuse # for, let's say, a Command Macro Code

Pre Command Prefix

Sometimes it may be desirable to be able to access commands that haven't been remapped using a Command Macro without having to first unlock a Port. By defining a Pre Command Prefix (up to 4 digits is permissible), you can access those commands that normally require unlocking a Port with the exception of programming commands that start with a star (*). Any command shown in Appendix C is accessible in this manner. You may also disable this feature if it's not needed by programming a zero:

***2109x** where x is from 1 to 4 digits for use as. If programmed to 0, no Prefix is used and this feature is disabled.

If disabled you must first unlock a Port in order to access commands.

Pre Access Code

You may program a *Pre Access Code* which will then be required to be prepended to all commands EXCEPT UNLOCK CODES AND COMMANDS ENTERED WHILE THE RC210 IS LOCKED. In other words, you will need to use any programmed *Pre Access Code* before any Command Macro. This is not to be confused with the Pre Command Prefix above.

Probably the most common use of a *Pre Access Code* is as a *Site Prefix* in a multi-controller, linked system. By using such a prefix, all controllers in the system can use identical codes with *the Pre Access Code* serving as a site address. For example, let's say we have a linked system consisting of 3 repeaters, all linked together full-time. At each site, we use the command of "ABC" to read backup battery voltage. So we assign site #1 a Pre Access Code of "1", site #2 to "2" and site #3 to "3". Now we access site #3 from site #1 and send DTMF digits **3 A B C**. Site #3 will now read back its backup battery voltage down the link back to site #1. Similarly, we can use addresses in this manner for and from anywhere within our system.

***2108x** where x is 1 to 3 digits. If programmed to 0, no Pre Access Code is used.

Locking (Leaving Program Mode)

To lock the controller when you're done programming, you use a (by default) single "#". The controller will respond with "LOCK", confirming you are no longer in program mode. Also, when any port is unlocked, a timer is started. Should no valid DTMF digit be received at least every 2 minutes, the controller will automatically lock itself and announce that fact.

Programming A Custom Lock Code

Perhaps # conflicts with your intended code scheme, so the RC210 allows you to reprogram the Lock Code to be up to 4 digits long. **This code is not unique to any port and will be used to lock the controller regardless of which port is unlocked at the time.**

***9010xxxx** where "xxxx" is your new Lock Code of any length from 1 to 4 digits.

Programming A Custom Terminator Digit

By default, the RC210 recognizes a "D" as its terminator digit, forcing any DTMF digits beforehand to be evaluated by the command decoder. Under some circumstances, "D" may conflict with a code used for some other function. If necessary, you can reprogram the terminator digit to be any other single DTMF digit.

***9020x** where "x" is the single DTMF digit that will cause the RC210 to evaluate DTMF digits preceding it.

A Word Of Caution Regarding The Terminator Digit

Should you decide to change the Terminator Digit from its default value, remember that you can no longer use that new digit anywhere in any command. For example, it would be a bad idea to use "1" as your Terminator Digit, as you would not be able to use "1" in any other command, as well as losing access to the defaults commands that have a "1" in their code. Nor would "*" be a good idea, as you'd never again have access to those programming commands that start with an asterisk (which is just about all of them!).

Generally speaking, if you wish to redefine the Terminator Digit, you should strive to use one of the less commonly used DTMF digits, such as A, B, C or D. But you must also make certain that whichever digit you decide to use does not conflict with a default command either. For example, A is used as part of the default Remote Base Prefix Code. If you wish to use A, you should first reprogram the Remote Base Prefix Code so as not to use A.

Port Unique Versus Global Programming

There are two types of programming commands:

Those that affect only the port you currently have unlocked. These are referred to as *Port Unique Programming Commands*, which may be done from any radio port. In other words, you can program Port 2 while actually using a radio connected to Port 1.

Those commands which are shared between all ports or don't apply to a specific port. These are referred to as *Global commands*. For example, reading an ADC channel or controlling a remote base radio.

Port Unique Programming Timer Programming

Unless otherwise noted, all of the following commands may be programmed with only those digits necessary. In other words, if the value you wish to enter is "20", you need only enter "20". If you want to enter "1234", you simply enter "1234" for that programming command.

Hang Time

Each port has 3 unique programmable hang timers that are usable whether that Port is in Repeat or Non-Repeat Mode. They are programmed in 1/10 second intervals. For example, 1 second would be programmed with a value of "10".

***1000yx** where "y" is the Hang Timer 1, 2 or 3 and "x" is the amount of hang time for that Hang Timer in 1/10 seconds. The range is 0 to 25.5 seconds (0 to 255 entry). The controller responds with "H A N G TIMER <1,2 or 3> SET". **Note: setting a timer to 0 gives zero hangtime**

Time Out Timer

Each port is provided with a time out timer that will drop the transmitter should a signal appear on its receiver input for longer than the programmed time out period.

***1001x** where "x" is the time out period for that port's transmitter in seconds. The range is 1 to 32767. The controller responds with "TIMEOUT SET". **Note: Setting the timer to zero disables it.**

Time Out Reset Timer

Each port is provided with a time out timer that will drop the transmitter should a signal appear on it's receiver input for longer than the programmed time out period (this only applies if that port is in full-duplex).

- x where "x" is the amount of time to wait after either the signal disappears or Courtesy Tone segment has run (See "Selecting The Timeout Timer Reset Point" on Page 25) before re-enabling the repeater transmitter after a Timeout has occurred. Programmed in tenths of a second.

Initial ID Timer

This timer sets the amount of time the repeater must be idle before sending the Initial ID. For example, if you set this timer to 10 minutes and that port is in full-duplex and unused for at least 10 minutes, this ID will play upon initial keyup. It won't play again until the repeater sits idle for another 10 minutes.

***1002x** where "x" is the amount of time in minutes between ID's. The default time is 10 minutes and there is really no need to change it, but it can be changed from 1 to 255 minutes. The controller responds with "IID TIMER SET".

NOTE: You may disable ID's completely on any Port by programming a value of 0 for the Initial ID Timer. You will usually want to do this on a Port not set as a repeater Port.

Pending ID Timer

After the initial ID is sent, the Pending ID timer is started. While this timer is running, if during this time there is activity on that port, the Pending ID message will be sent. If activity continues, the Pending ID will be sent every period, programmed by its timer. If there is no activity after the initial keyup, no further IDs are sent until the Initial ID period has elapsed. Also see the Pending ID Speech Timer below for more information on how this works.

***1003x** where "x" is the amount of time in minutes the Pending ID waits after an Initial ID occurs. The default is 10 minutes and there is really no need to change it, but it can be changed from 1 to 255 minutes. The controller responds with "PID TIMER SET".

Fan Timer

The RC210 provides a convenient method of controlling a cooling fan, while eliminating unnecessary wear and tear. When any Port is keyed, the fan is started and will remain on for a period determined by the Fan Timer. It will then automatically shut off.

***1004x** where "x" is the amount of time you want the fan to remain on after any transmitter unkeys in minutes. The range is 1 to 255 minutes. The controller responds with "FAN TIMER SET".

Port Inactivity Timer

When ports are connected to other ports, this timer is started. If there is no receiver activity on this port for the period determined by this timer, it will run a macro of your choice (see Programming section of this manual).

***1005x** where "x" is the amount of time a connected port should remain connected to *this* port if there no is activity for x minutes. The range is 1 to 255 minutes. The controller responds with "PORT x TIMER SET" (where x is the port number). **Note: Programming the timer to zero disables it.**

DTMF Mute Timer

If DTMF muting is enabled on a port, audio from its receiver is muted upon receipt of DTMF. Furthermore, if the DTMF Covertone is enabled on this port, it will be used during the mute period as well. When the COS closes, the receiver is again unmuted and (if enabled) the Covertone is stopped. But what happens if a signal remains on the receiver? Obviously, the receiver wouldn't unmute until after that signal went away.

To prevent this from becoming a problem, the DTMF Mute Timer will unmute the receiver and stop the Covertone after a DTMF digit is first received and after certain amount of time. As long as DTMF digits are received, this timer is reset and the muting and Covertone will continue until the user unkeys.

***1006x** where "x" is the amount of time in 100 milliseconds steps that the DTMF mute timer should generate DTMF cover tone and the receiver should remain muted between DTMF digits. The range is 0 to 9999 milliseconds (ms). For example, 1 = 100 ms, 7 = 700 ms, 50 = 5 seconds. Regardless of this setting, the receiver will unmute and covertone will be stopped immediately upon COS closure or the receipt of DTMF "#".

CTCSS Encode Dropout Timer

If you have connected the CTCSS encode control line to an external encoder, you can program this parameter to select how long encoded CTCSS will continue to be transmitted after the receiver COS closure or Courtesy Tone completion.

***1007x** where "x" is the amount of time in 1/10 seconds CTCSS should continue to be sent after COS closure or Courtesy Tone completion. The range is 0 to 25.5 seconds.

Note: programming a 0 disables the timer and the CTCSS encode line will "turn off" immediately upon COS closure. If programmed to 254, CTCSS encode will never occur. If programmed to 255, CTCSS encode will remain on at all times.

Note: See the command *1021 for selecting the CTCSS Encode polarity

Kerchunk Timer

This timer determines how long a signal must appear on a receiver before it will be recognized as valid, if Kerchunk filtering is enabled. The range is 1 to 6000, with 1000 representing approximately 1 second.

***1018x** Set Kerchunk Filter Timer

Kerchunk Timeout Timer

When the Kerchunk Filter is enabled, it is required that users key up for a period of at least the setting of the Kerchunk Timer before the RC210 will recognize it as a valid signal. Once that is done, Kerchunk filtering is disabled for a period determined by the Kerchunk Timeout Timer period. That is to say that there will be no delay when users key up as long as the Kerchunk Timeout Timer has not timed out. Once it does time out, then the Kerchunk Timer is once again enforced

***1008x** Program Kerchunk Timeout Timer where x = 0 to 255 seconds

Timer Programming (continued)

Auxiliary Audio Timers

When you turn on one of the Auxiliary inputs, a timer is started. When this timer times out, that input will automatically be turned back off. The default time is 300 seconds (5 minutes) and the range is 1 to 32767 seconds.

- *1013x Set Auxiliary Input 1 Timeout
- *1014x Set Auxiliary Input 2 Timeout
- *1015x Set Auxiliary Input 3 Timeout

Pending ID Speech Timer

The RC210 normally uses a spoken ID for its Initial ID (this is selectable with a programming command). The Pending ID may be done as speech or in CW, depending on the setting of this timer. This timer looks for activity on its respective port for the past X seconds. If there has been activity, the Pending ID will be done in CW, otherwise it will be made with the next Voice ID in rotation. Setting this timer to the value of the Pending ID Timer will make it NEVER use a Voice ID for the pending ID. Setting it to zero will make it ALWAYS use a Voice ID for the pending ID. The range is 1 to the value of the Pending ID Timer but is entered in seconds. For example, 10 minutes is 600 seconds.

- *1019x Set Pending ID Speech Timer

Examples (assuming the Pending ID Timer is set to 10 minutes):

- *1019 60 Look for activity for the last 60 seconds. If there has been, the next Pending ID will be CW otherwise it will be Voice
- *1019 600 Pending ID's will always be done in CW
- *1019 0 Pending ID's will always be done in Voice

Tail Message Timer

This timer allows you to send programmed Tail Messages based on this timer instead of the number of transmitter "tails". When programmed, this timer starts to run upon keyup of that Port and is reset if there are new keyups during that Port's Hangtime. When used, the Tail Message is **sent only once**.

- *1020 300 Send currently selected Tail Message 5 minutes after last activity.
- *1020 0 Disable Tail Message Timer (turn off timed Tail Messages)

See the Tail Messages section of this manual for details on how Tail Messages work and how to program them.

Note: Tail Messages only work on Ports defined as repeating. If linked, the linked Port will also cause a Tail Message to be generated, if so programmed.

Timer Programming (continued)

The General Timers

The 6 General Timers are not related to Ports and any combination may be used on any port. When a General Timer times out, it runs a Command Macro. Each Timer is started and stopped by using a Macro Function (see the Macro Function List, Page 34 for their assignments). It should be noted that once enabled, these Timers will continue to run until it is explicitly disabled. This makes them useful for such things as Beacon ID's but may be used for other purposes as well.

To program the General Timer time period:

***1017x y** where **x** is the Timer (1 - 6) to program and **y** is number of seconds 1 - 32767 that the timer should run when started.

Note: Programming the seconds to 0 will disable that Timer

To Program the Command Macro to run:

***2092x y** where **x** is the Timer (1 - 6) and **y** is the Command Macro to run 1 – 90 (optionally 1 -105 if your pc board version is 3.5 or later or you have the optional EEPROM board installed).

A Practical Example:

In this example, we want to use a Command Macro 10 to Unlink Ports 1 & 2 and automatically relink them 15 minutes later.

First, we program up Macro 10 to speak Message Macro 1 out Port 1 and link Ports 1 & 2 and start General Timer 1

***4002 10 * 162 * 187 * 122 * 347** Macro 10 speaks Message Macro 1 out Port 1, link Ports 1 & 2 and start General Timer 1

Now we program Macro 11 to relink Ports 1 & 2 and stop Timer 1 (in this example, relinking doesn't cause a message to be spoken. You could of course, include a message as well if you desire):

***4002 11 * 118 * 391** Link Ports 1 & 2 and stop Timer 1

Now that the required Macros are programmed, we now program the General Timers. First, we program the Timer period:

***1017 1 900** Program Timer 1 to 900 seconds (15 minutes)

Next, we program Timer 1 to run Macro 11

***2092 2 11** Program Timer 2 to run Command Macro 11

Whenever Macro 10 is run, the ports will be unlinked and 15 minutes later, they will be relinked.

CTCSS Encode Control Programming

CTCSS Encode Control Line Polarity

Each Port's CTCSS Encode Control Line may be programmed to be an active low or active open collector. In other words, you can program whether the Control Line should be pulled to ground or allowed to float when you want encoded by an external CTCSS encoder.

***1021x** Select Control Line polarity. If **x = 1**, then the output will float when active. If **x = 0** then output will pull to ground when active.

CTCSS Encode Timer Start After COS or After Courtesy Tone

The CTCSS Encode timer may be selected to start on closure of COS or upon completion of Courtesy Tone. This allows for easy timing to end of hang time. For example, many system owners like to stop the CTCSS tone a few hundred milliseconds before the transmitter drops.

***2088x** where **x** selects when to start the encode dropout timer. 1 = After Courtesy Tone, 0 = After COS closure

CTCSS Encode During ID's

You may select to have the RC210 send CTCSS during ID's .

***2089x** where **x =1** to send CTCSS during IDs and 0 to not send CTCSS during IDs.

Real Time Clock And Calendar

If you do not have the option RTC Real Time Clock Module installed, it is necessary to set the Real Time Clock and Calendar before you'll be able to use the features they provide, such as the time readback and the Scheduler. When programming, it will read back the current time in order to confirm your entry.

Setting The Real Time Clock

***5100 hh mm [ss]** where "hh" is the hours in 24 hour time and "mm" is the minutes. Both must consist of 2 digits. If only hours and minutes are entered, the clock will assume zero seconds when programmed. Alternately you may include seconds when programming for maximum accuracy.

Examples:

***5100 01 22** Set the clock to 1:22 AM
***5100 15 04** Set the clock to 3:04 PM
***5100 12 12 23** Set the clock to 12:12:23 PM

Setting The Calendar

***5101 mm dd yy** Set the calendar to MM month, DD day, YY year. When programming, the controller will read back the current day of the week, month, day and year in order to confirm programming.

Examples:

***5101 06 11 03** Set June 11, 2003 as the current date
***5101 10 04 11** Set October 4, 2011 as the current date

Enabling/Disabling Year Readback

You may turn ON/OFF the readback of the year when the date is spoken.

***51020** Turn OFF year readback
***51021** Turn ON year readback

Selecting 12 or 24 Hour Readback

You may select 12 or 24 hour readback of the Real Time Clock.

***51030** 12 Hour readback
***51031** 24 Hour readback

Selecting "Hours" To Be Spoken As Part of 24 Hour Readback

You may select whether to include or not include the use of the word "hours" as part of the 24 Hour Readback mode.

***51040** Don't say Hours
***51041** Say Hours

Adding A Correction Factor To The Real Time Clock

As is the case with any clock that is not referenced to standard such as WWV, the RC210's Real Time Clock may gain (or lose) a few seconds over time. This is unavoidable due to temperature changes, crystal tolerances, etc. Fortunately, the RC210 allows you to "bump" the clock + or - up to 59 seconds in order to obtain the best accuracy possible.

For example, you may notice after your RC210 has been running for a week that its Real Time Clock has lost 2 seconds. With this command, it is a simple matter to add 2 seconds to the clock's time.

***5105 2** Add 2 seconds to the Real Time Clock's current time

***Note: If you need to subtract seconds from the Real Time Clock, preface the seconds with an "A". For example *5105 A 3 will subtract 3 seconds from the clock's current time**

In addition to adding 2 seconds to the time, this command also stores this correction factor into non-volatile memory. This allows you to set a scheduler setpoint (in our example above, you'd program a setpoint to run once a week) and automatically apply it to the clock by storing the Macro Function Number into a Command Macro and have the scheduler run that macro at, let's say, Friday night at midnight. See the Command Macro and Scheduler programming sections of this manual for details.

NOTE: If you have the optional RTC Module installed, you should not use this feature as the RTC is very precise

Using DayLight Savings

The RC210 allows for automatic Daylight Savings Time (DST) control. As the beginning and end days of Daylight Savings varies throughout the world, you may program the Month and occurrence of Sunday in that month as your start and end dates, as well as the hour at which time the change should occur, with the following commands:

Setting the Start and Ending Month of which Sunday of the Month

***2131x yy z** where x = 1 is to program the START month and 0 is to program the END month yy is the month (01-12) and must be 2 digits and z is the occurrence of Sunday in that month (1 – 5).

For example, in the United States, Daylight Savings time begins the 2nd Sunday in March and ends the 1st Sunday in November:

***2131 1 03 2** <----Program START month for March, the 2nd Sunday

***2131 0 11 1** <----Program END month for November, the 1st Sunday

Setting the Start and Ending Hour

You may individually select the hour at which the DST change starts and ends are made.

***2132 x yy** where x = 1 for Start Hour and 2 for End Hour and yy = 00 - 23

For example, in the United States, the Start and End Hours are both 2 AM

***2132 1 02** <-----Program DST Start Hour to 2 AM

***2132 2 02** <-----Program DST End Hour to 2 AM

NOTE: To disable DST program the START month to 0, i.e. *21310

Miscellaneous Programming

DTMF Mute On 1st Or 2nd Digit

If DTMF Muting is enabled on a port, this command will select whether muting starts on the 1st or 2nd digit.

***2090x** where x=1 to mute on the 1st digit or x=2 to mute on the 2nd digit

Delay Before Speech/CW Starts

You may program a delay time to allow the transmitter to fully come up to power before speech or CW actually starts.

***1022x** Set Delay time, where "x" is the amount of time in milliseconds to delay before speech or CW starts. Range is 0 to 32767.

User DTMF Pad Test Command Prefix

This programming command is used to set the Prefix for the User DTMF Pad Test

***2093x** where x = 1 to 5 digits used for the User DTMF Pad Test

Which Version Firmware Is Installed?

You can find out which version firmware is currently installed with the following command:

***299999** Speak Version Number

Controlling TimeOut Between Linked Ports

This feature controls whether linked Ports should be allowed to timeout other Ports. For example, if Ports 1 & 2 are linked, this feature determines if activity on Port 2 should be allowed to cause Port 1's transmitter to time out or not. Likewise, should activity on Port 1 be allowed to cause Port 2's transmitter to time out (the timeout period is selected by each Ports own Timeout Timer) or not. This setting affects all Ports if linked to any other Port.

Example:

Port 1 is linked to Port 3 and this feature is enabled. Port 3 is receiving a signal that lasts longer than Port 1's Timeout Timer setting, so Port 1's transmitter drops until the signal on Port 3 is removed. If this feature was not enabled, then Port 3 would not timeout Port 1 regardless of how long a signal is received on Port 3 and vice versa. Of course, a Port's own received signal will always timeout its own transmitter regardless of the setting of this feature.

Summary:

If programmed to 1, a Port's transmitter will time out based on itself or when activity on any linked Port exceeds the Timeout Timer period of that Port

If programmed to 0, a Port's transmitter will timeout ONLY when a timeout occurs on itself.

***2051x** where x = 1 for timeouts affecting linked Ports, 0 for timeouts not affecting linked Ports

Selecting The Timeout Timer Reset Point

You may select when the Timeout Timer is reset, depending on your needs:

***2122x** where x = 0 to 4

- 0 = After COS
- 1 = After CT Segment 1
- 2 = After CT Segment 2
- 3 = After CT Segment 3
- 4 = After CT Segment 4

Fan Operation

You can select one of 2 modes of fan operation. The first mode will start for any transmitter activity while the second mode will start the fan only when there is a valid signal received on a Port, an Autopatch call is made or an Auxiliary Audio Input is on. This can help to reduce wear and tear on your fan and associated relays.

***2119 1** The fan will start for any transmitter activity.

***2119 0** The fan will only start when there is receiver, Autopatch or Auxiliary Audio activity.

Voice Response or Generic CW Response

You can select whether the controller will give detailed voice responses to entered Programming Commands or simple CW responses.

***2135 1** Detailed Voice Responses

***2135 0** Generic CW Response – 'R' for good, '?' for error

Remote Base Programming

The RC210 is capable of controlling several different types of remotely controllable transceivers for use as a remote base.

- Kenwood - all radios that utilize a computer interface that may be directly connected to an RS-232 compatible serial port, such as the TS-2000 and TS-870
- Kenwood single band and dual band mobiles, TM-V7a, TM-G707, TM-271A
- Elecraft radios
- Icom models IC-706MKIIG, IC-746, IC-756, IC-7000
- Yaesu FT-100D, FT-817, FT-847, FT-857, FT-897

The RC210 also supports the Doug Hall RBI-1 Remote Base Interface, Please refer to its manual when connecting the RC210.

Selecting The Type Of Remote Base Radio

You select which type of radio you are using by programming:

***2083x** where "x" is the radio type

- 1 = Kenwood
- 2 = Icom
- 3 = Yaesu
- 4 = Kenwood V7a
- 5 = Doug Hall RBI-1
- 7 = Kenwood g707
- 8 = Kenwood 271A
- 9 = Kenwood V71a

***for Kenwood radios with a computer comport, the RC210 uses a baud rate of 19,200**

***The RC210 expects to see an Icom radio as the CI-V address of 48H with the baud rate set to "9600". Yaesu radios should be set to a 9600 baud rate.**

***this supports the Kenwood TM-V7a mobile dual-band transceiver**

***this supports the Kenwood TM-g707 mobile dual-band transceiver**

***this supports the Kenwood single band mobile TM-271A**

***this supports the Kenwood TM-V71a mobile dual-band transceiver**

If you select Yaesu, there is an additional programming step to take (if not using Yaesu, you may disregard this step):

***2084x** where "x" is:

- 1 = FT-100D
- 2 = FT817, FT-857, FT-897
- 3 = FT847

Programming Remote Base Memories (non-Doug Hall)

The RC210 has 10 internal Remote Base Memories that, once programmed, allow for a single command to recall frequency, transmitter offset, CTCSS tone selection and encode/decode operation. (If the optional RTC Module is installed, there are a total of 40 memories)

To store a memory, first program the remote base with the frequency, Offset, CTCSS and Mode information you wish to store. Then, with the controller unlocked, enter:

***2086x** where x is the Memory to store, 1- 10 (1-40 if the optional RTC is installed)

Programming Kenwood TM-V7a/TM-G707/TM-271/TM-281 Memories

When using either of these radios as a remote base, it is possible to store and later recall its memories (see the *Memory Recall When Using the Kenwood TM-V7a/TM-G707/TM-271A/TM-471A* section of this manual).

To store a memory, you first need to set up the data that will be stored. This means frequency, transmitter offset, CTCSS tone frequency and CTCSS encode/decode selection. Assuming the default Remote Base Prefix Code of A7:

First, we program the frequency to be stored in a memory, along with its offset

A71 1470203

Now we program the CTCSS data. In our example, we will program a CTCSS tone code (from Appendix B) of 11, to encode only.

A72 11 1

This is automatically sent to the radio and we can now store it in a memory.

In our example below, we'll store it into Memory 22 of the radio by first unlocking any port (it doesn't matter which) and entering

***2087 22**

Notice that unlike the memory recall feature, we don't need to use a band select digit when programming memories. This is because the band selection is automatically determined from the frequency that was previously entered.

Remote Base Prefix

You can define a prefix that must be prepended to the remote base commands. This allows you to customize the codes required. If changed from the factory default value of "A7", the new Remote Base Command codes must be prepended with the defined prefix code. For example, if you change the Remote Base Prefix Code to "AB", a user would need to enter "A B 3 x " in order to change modes.

***2060xxxx** Define Remote Base Prefix Code - maximum 5 digits. If "0" is entered, any existing code is erased, thereby allowing the factory default codes to be used.

Examples:

***2060 AB** Define Remote Base Prefix to be "AB"

***2060 0** Erase Remote Base Prefix

Port Inactivity Macro

If any two (or more) ports are linked together, a timer is started. As long as activity occurs on the linked **TO** port, this timer is reset. If no activity occurs during the programmed period, a Command Macro will be run. For example, you could call a Command Macro that disconnects the ports and speak a message to let users know. Of course, you can program the Macro to do whatever you'd like.

When programming this, remember that you're programming only that port that is currently unlocked.

***2114 x** where x is the Command Macro 1 to 90 to call

Programming The RC210 Command Macros

In order for users to be able to control functions in the RC210 without them being required to first unlock the controller, you define a *Command Macro*. The contents of a Command Macro are *Command Macro Functions* which are the actual functions to be performed. In addition, each of the 90 Command Macros (optionally 105 if your pc board version is 3.5 or later or you have the optional EEPROM board installed) may be assigned a unique *Command Code*, which is the code that will be entered by users to run that Command Macro.

You may use any valid DTMF digit in any Command Code except:

- "D" if you're using the default Command Terminator Digit or
- Any DTMF digit you reprogrammed for use as your Command Terminator
-

Programming Command Macro DTMF Codes

***2050 xxx yyyyyyyy** where xxx is the 3 digit Macro number (001-105) and yyyyyyyy is the DTMF code up to 8 digits

Take the time to plan your code strategy prior to actually programming. You can program any of the Command Codes to be from 1 to 8 digits long.

It is strongly suggested that you plan ahead by making a list of command codes you want to program and then double check them for duplicates. If you accidentally program the exact same code into more than one Macro, only the first occurrence will work with subsequent occurrences being ignored by the controller. You will then have to identify with commands aren't working and re-program their code accordingly. Take the time to plan your code structure and you will avoid having to take these steps.

Remember when programming Macro DTMF codes, each one MUST be unique. "12345" is unique from "54321" however.

Some system owners prefer the concept of having a prefix for a certain group of commands in order to make them easier to remember.

For example, you could program a group Command Macros that all control link functions and then group them together. By assigning them to start with a prefix of "AB", it would be a simple matter to remember that the digit that follows the prefix controls a specific function of port linking.

AB1 - Link Port 1 to Port 2
AB2 - Link Port 1 to Port 3
AB3 - Link Port 2 to Port 3
AB4 - Link all ports
AB5 - Unlink Port 1 from Port 2
AB6 - Unlink Link Port 1 from Port 2
AB7 - Unlink Port 2 from Port 3
AB8 - Unlink all ports

Of course, these are strictly examples and only limited by a maximum of 8 digits for each Macro Command Code and your imagination!

Other system owners prefer a different code strategy and will assign commands based on different groups of users, such as general users and authorized Control Operators. Only some commands will be given to each group, with the Owner reserving programming commands and other deemed critical functions only for themselves.

Again, this is totally up to you and how you wish to organize your system. The RC210 gives you the flexibility to do it any way you want.

Command Macro Functions are run in the order they appear in that Macro.

For example, consider the following Command Macro contents:

114 121 45 101

When this Command Macro is run, it will be done sequentially. That is to say that Function 114 will be run first, followed by 121, 045 and finally 101. Note they are not run in *numerical* order.

The only exception to the above is when a Command Macro calls another Command Macro

For example, let's say you have a Command Macro containing the following Macro Functions:

906 901 944 921

When this Macro is run, these functions will be run in numerical order regardless of their ordering within the Macro. That is to say 901 will be run first followed by 906, 921 and finally 944.

Keep the above in mind when planning your Command Macro programming

Command Macros

The RC210 allows for storing up to 90 different (optionally 105 if your pc board version is 3.5 or later or you have the optional EEPROM board installed) *Command Macros* that are stored in non-volatile memory and can be recalled with a single command. Each command in the RC210 is assigned a Function Number (FN) that is then used to store that function in each macro (see the Macro List on Page 33).

Macros are programmed by first entering the macro programming command for the macro you wish to program, followed by a series of function numbers to be programmed into that macro. The command syntax is:

***4002 <Macro #> * <Macro function #> * <Macro function #> * <Macro function #>**

IMPORTANT NOTES ABOUT COMMAND MACROS

All Macro programming must have an asterisk (*) between elements.

Memory locations where Macro Function Numbers are stored are called "slots".

Long Macros (Macros 1 – 40) contain 15 slots while Short Macros (Macros 41 – 90) contain 6 slots and Extended Macros (91 – 105) contain 20 slots.

Macro Function Numbers use slots based on the below list

- **001 – 254 – 1 slot**
- **256 – 509 – 2 slots**
- **511 – 764 – 3 slots**
- **766 and above – 4 slots**

For example, we want to program Macro 2 so it will turn on CTCSS Access on Port 1, connect Port 1 to Port 2 and change Port 2's courtesy tone to #4. By looking up these functions on the Macro Function Number chart, we see the function commands we want are 001, 118 and 062. We enter - all in one transmission:

***4002 2 * 1 * 118 * 62**

The controller responds with "M A C R O" and the number of the macro we just programmed.

We can even program macros to include other macros. For example, we want to create a macro that in addition to doing what Macro2 already does, we also want it to change Port 1's courtesy tone to #9. Instead of having to repeat the commands previously stored in Macro 1, we can simply create a new macro containing the additional function and include Macro 2 as well:

***4002 3 * 57 * 902**

Macros may be embedded into other macros any number of times, up to the limit that macro can hold.

Using Command Macros To Remap Controller Functions

Another use for Command Macros is to allow user access to controller functions without having to first unlock a port. This gives you complete control over whom should have access to which functions in the RC210.

Let's say you want your users to be able to read the RC210's real time clock easily and you want them to enter "1111" with their radios in order to do so. First, we program a Command Macro for that function. In this example, we'll use one of the Short Macros - Macro 41 - since we only need it perform a single function:

***4002 41 * 116**

We can now assign Macro 41 the code of "1 1 1 1".

***2050 041 1111**

Now when someone enters "1 1 1 1", the RC210 will speak the current time (provided you've set the clock that is!). It's that simple.

You can use any of the 90 Command Macros (optionally 105 if your pc board version is 3.5 or later or you have the optional EEPROM board installed) for remapping commands as needed.

Command Macro Priority

Command Macros have 3 different levels of priorities - low, medium and high.

- High - Once a Command Macro starts, nothing will stop it
- Medium - If a Command Macro contains any speech functions, that speech will be controlled by the Speech Override and Speech ID Override settings. This is the default priority level of all Command Macros.
- Low - Any COS activity on the last active Port will stop that Command Macro and exit.

Priorities are particularly useful for controlling Command Macros that contain speech. For example, you recorded a DVR track with an informational message, such as "This Repeater Requires a Tone Frequency of 100 Hertz", which plays immediately following an ID. Some users might take great delight in kerchunking in the middle of the informational message, stopping it because you have Speech Override turned on. By assigning this Macro a high priority, it will always play uninterrupted.

You assign a Command Macro a priority level by including one of the following function numbers within that macro, as the first one entered.

228 High Priority
229 Low Priority

Example: Command Macro 12 will play DVR Track 1 and then play an ID on Port 1, as High Priority:

***4002 12 * 228 * 162 * 126 * 181**

After a Command Macro runs, its priority level is automatically reset to Medium.

Startup Macro

Macro 1 is a special case in that it is run every time the controller is powered up or otherwise resets. This allows you to define a known startup state of your RC210. You may include any Function within Macro 1, including calling other macros.

Macro Subset (Guest Macros)

Programming a Macro Subset allows for selectively controlling access to only those Command Macros. This Subset is a range of Command Macros that you define

***4009xxx yyy** where xxx is the 3 digit starting Command Macro number and yyy is the 3 digit ending Command Macro number.

Examples:

***4009 005 010** Define Subset range from Command Macro 5 to 10
***4009 023 052** Define Subset range from Command Macro 23 to 52
***4009 066 068** Define Subset range from Command Macro 66 to 68

Even though you may have a Subset defined, it is not actually in effect until it is specifically enabled. This is done either by unlocking a Port and using the following codes:

2800 Disable Macro Subset
2801 Enable Macro Subset

Or alternately, you may use the appropriate Macro Function to enable and disable as needed (see Macro Function List for the Function Numbers).

Some Useful Hints On How To Use The Macro Subset

The Macro Subset can be used to allow users to have access to all Command Macros during the day and only a limited number of Command Macros overnight when there may be no control operator available. This may be done either manually or by the Scheduler to automate the process. All you need do is program two Command Macros to enable and disable Macro Subsets. Of course, be sure to use Command Macros that you'll have access to even if Macro Subsets are enabled!

Another useful trick is to use a tone decoder whose tone is not published connected to an Alarm Input and having that Input call a Command Macro which enables the Subset when no tone is being received. When the decoder receives the correct tone, it will change logic states and that same Alarm Input now calls another Command Macro which disables the Subset. This way, users without the proper tone only have access to some Command Macros while users with the proper tone can access them all.

You could even use 2 decoders (one whose tone is published and the other whose tone is kept secret), diode OR the outputs to the appropriate Radio Port connector and also connect the "secret" decoder'

Determining The Contents Of A Command Macro

This command will cause the RC210 to read back the contents of the selected Command Macro. For example, we think that Command Macro 2 is programmed to speak the current time out Port 1. We can check that by using the following command:

***4008x** where x is Macro 1-90 (optionally 105 if your pc board version is 3.5 or later or you have the optional EEPROM board installed)

So we enter ***4008 2** and the controller reads back "M A C R O Two One Six Two One One Six". This confirms the contents of Command Macro 2. If we attempt to read back a Command Macro that has no contents, the controller will let you know by speaking "Error".

Erasing Command Macros

You may erase any Command Macro with the following command:

***4003x** where x is the Macro Number 1-90 (optionally 105 if your pc board version is 3.5 or later or you have the optional EEPROM board installed).

Or you can erase **ALL** Command Macros with:

***400499** Clears all Macros

Using Receiver Macro Functions

Receiver Macro Functions allow the running of Command Macros based on a Port's receiver either becoming active or inactive. This allows for some very creative programming!

For example, maybe you want to switch an external relay whenever someone keys up on Port 1 but want it based on actual receiver activity and not simply the transmitter being active (of course for a non-repeating Port, its transmitter would never go active in the first place!).

First, program that Port's Macro to call (in our example, we are going to use Macros 80 & 81 and unlock Port 1)

***2113 1 80** Program currently unlocked Port's receiver going active to call Macro 80

***2113 0 81** Program currently unlocked Port's receiver going inactive to call Macro 81

Now we also want to program a couple of Macros to allow us to turn this feature ON & OFF as needed (we'll use Macros 82 & 83)

***4002 82 * 358** Enable Port 1 Receiver Active Function

***4002 83 * 361** Disable Port 1 Receiver Active Function

And finally, we program up Macros 80 & 81 to handle turning UF1 on and off in response to receiver activity

***4002 80 * 95** Turn UF1 ON

***4002 81 * 102** Turn UF1 OFF

Controlling Command Macro Access By Port

By default, any Command Macro will work from any Port. There may be times however, where you want to restrict access to a particular Command Macro to a certain Port or combination of Ports. You can then program which Port(s) to allow:

***4005 xxx yyy** where "xxx" is the Command Macro number (001 -090) (optionally 105 if your pc board version is 3.5 or later or you have the optional EEPROM board installed) and "yyy" is the port(s) designation:

1 Port 1	13 Ports 1 & 3
2 Port 2	23 Ports 2 & 3
3 Port 3	123 All Ports*
12 Ports 1 & 2	

Note: If a port is unlocked, that port may run any macro, regardless of its access programming.

For example, you may only want users on Ports 1 and 2 to be able to link the two ports. In our example above, we programmed Command Macro 42 to link Ports 1 and 2 this. To restrict the use of this Command Macro to only Ports 1 and 2, we program:

***4005 041 012**

Note: You can change a previously defined port restriction by programming a new one "over the top" of an existing one.

Erasing All Command Macros Port Restrictions

If you ever need to clear all the Command Macro port restrictions, you can use the following programming command and all Command Macros will be accessible from any Port:

***400699**

Message Macros

The RC210 provides 40 *Message Macros* (70 if the optional RTC module is installed. See the RTC Manual for details) that can be used to store custom responses to user entered commands, scheduler events, Alarm events and so on. Each Message Macro can store up to 9 vocabulary words, DVR tracks or any combination of the two.

For example, Command Macro 42 is going to be used to re-map the Port 1 and Port Linking function. When a user uses this macro to link the ports, we want the controller to speak "Link Port One And Two". In our example, we'll use Message Macro #1. With the controller unlocked, we program:

***2103 01 139 181 001 063 002** programs Message Macro 1 to speak "Link Port One And Two"

Important: You must always use 3 digits for vocabulary words or DVR tracks, when programming Message Macros. Failure to do so will result in unpredictable results.

We now program Command Macro 42 to link the ports and also include Message Macro 1:

***4002 42 * 187 * 118**

NOTE: While DVR Track 20 is available to call directly from Command Macros, when called from a Message Macro it is not possible to call Track 20 directly. If you need to use Track 20, call directly from a Command Macro

Hint: notice that we entered the Message Macro function number first, then the function that actually connects the ports. You'll find that when linking ports, it works best if the message is first played then the link established. When unlinking ports, the actual unlinking function should be first, with the Message Macro being last. The reason being that if you have Monitor Mix and/or Speech Override selected for that port, any receiver activity will interfere with the Message Macro being spoken.

Note: If you program a Message Macro with a content of 0, it will erase that Message Macro

Speech Control Within Command Macros

Normally, speech command acknowledgment is sent out to the port from which the command was entered. For example, if you link Ports 1 & 2, entering the command from Port 1, the command acknowledgment will only be sent to Port 1.

And in the case of Scheduler, Alarm or other instances when a Command Macro is not called by a DTMF command, we need a way to tell the RC210 which port(s) should be used when sending a speech announcement.

Also, under certain circumstances, you may want any such speech sent out to other ports as well. In the above case, it might be useful to have it sent to both ports involved so users on both ports are advised as to the current status of the link. One solution to this would have been for the firmware to automatically send speech to ports that are linked, but this creates a problem - what if one of the ports involved isn't used as a link but rather as a remote base? It's a bad idea to send speech acknowledgments and other "repeater" messages out a remote base since a remote base should emulate the operation of a simplex radio. Simple solution you say - "Why not just program the controller to send speech messages out both ports, unless the linked to port is configured to be half-duplex?"

With so many different system designs out there, many repeater systems use half-duplex links. If the controller did this routing automatically, you'd never be able to direct speech where you want it. So it seems we need more a more flexible solution than simply an automatic one. Also, the controller has no idea which Port(s) speech message should be sent to as part of scheduled speech events.

The solution is to allow you to select, within a Command Macro, which port(s) should receive speech. In our example above, we decide we want speech to be sent out both Ports 1 & 2. We therefore program a macro that will link the two ports and also send speech to Ports 1 & 2:

***4002 10 * 165 * 118**

By recalling Command Macro 10, Ports 1 & 2 will be linked, with the connect message being sent to both ports.

Now we can program another Command Macro to disconnect the ports and send the speech where we want it:

***4002 11 * 165 * 122**

By recalling Command Macro 11, Ports 1 & 2 will be unlinked, with the disconnect message being sent to both ports.

Important: If a macro contains a speech direct command, the speech direct function code MUST be the first one used in that macro. This is important as if it doesn't appear first within the macro, speech may not be properly directed.

List Of Port Direction Commands For Use In Macros

162 Port 1	166 Ports 1 & 3
163 Port 2	167 Ports 2 & 3
164 Port 3	168 All Ports
165 Ports 1 & 2	

In addition to the above steering functions, you can also force the speech out the same port as the macro was called from. For example let's say you have macro 10 defined to send speech out Port 1 but there may times you may call that macro from one (or both) of the other ports. By including function 251 in your macro in addition to speech being routed to the ports you specified in that macro, speech would also be routed to the port you recalled that macro from.

Macro Function Number List

<u>FN</u>	<u>Description</u>	<u>FN</u>	<u>Description</u>
1	Port 1 CTCSS Access	61	Port 2 Courtesy Tone 3
2	Port 2 CTCSS Access	62	Port 2 Courtesy Tone 4
3	Port 3 CTCSS Access	63	Port 2 Courtesy Tone 5
4	Port 1 Carrier Access	64	Port 2 Courtesy Tone 6
5	Port 2 Carrier Access	65	Port 2 Courtesy Tone 7
6	Port 3 Carrier Access	66	Port 2 Courtesy Tone 8
7	Port 1 DTMF Covertone ON	67	Port 2 Courtesy Tone 9
8	Port 2 DTMF Covertone ON	68	Port 2 Courtesy Tone 10
9	Port 3 DTMF Covertone ON	69	Port 3 Courtesy Tone 1
10	Port 1 DTMF Covertone OFF	70	Port 3 Courtesy Tone 2
11	Port 2 DTMF Covertone OFF	71	Port 3 Courtesy Tone 3
12	Port 3 DTMF Covertone OFF	72	Port 3 Courtesy Tone 4
13	Port 1 TX Enable	73	Port 3 Courtesy Tone 5
14	Port 2 TX Enable	74	Port 3 Courtesy Tone 6
15	Port 3 TX Enable	75	Port 3 Courtesy Tone 7
16	Port 1 TX Disable	76	Port 3 Courtesy Tone 8
17	Port 2 TX Disable	77	Port 3 Courtesy Tone 9
18	Port 3 TX Disable	78	Port 3 Courtesy Tone 10
19	Monitor Port 1 from Port 2	79	Port 1 DTMF Muting ON
20	Monitor Port 1 from Port 3	80	Port 2 DTMF Muting ON
21	Disconnect Port 1 from Port 2	81	Port 3 DTMF Muting ON
22	Disconnect Port 1 from Port 3	82	Port 1 DTMF Muting OFF
23	Monitor Port 2 from Port 1	83	Port 2 DTMF Muting OFF
24	Monitor Port 2 from Port 3	84	Port 3 DTMF Muting OFF
25	Disconnect Port 2 from Port 1	85	CTCSS Encode ON (for the duration of this Macro)
26	Disconnect Port 2 from Port 3	86	CTCSS Encode OFF (for the duration of this Macro)
27	Monitor Port 3 from Port 1	87	Port 1 Zero Hang Time Select
28	Monitor Port 3 from Port 2	88	Port 2 Zero Hang Time Select
29	Disconnect Port 3 from Port 1	89	Port 3 Zero Hang Time Select
30	Disconnect Port 3 from Port 2	90	Reserved For Future Use
31	Port 1 Monitor Mute	91	Reserved For Future Use
32	Port 2 Monitor Mute	92	UF1 ON
33	Port 3 Monitor Mute	93	UF2 ON
34	Port 1 Monitor Mix	94	UF3 ON
35	Port 2 Monitor Mix	95	UF4 ON
36	Port 3 Monitor Mix	96	UF5 ON
37	Port 1 Repeat ON	97	UF6 ON
38	Port 2 Repeat ON	98	UF7 ON
39	Port 3 Repeat ON	99	UF8 ON
40	Port 1 Repeat OFF	100	UF1 OFF
41	Port 2 Repeat OFF	101	UF2 OFF
42	Port 3 Repeat OFF	102	UF3 OFF
43	Port 1 Speech Override ON	103	UF4 OFF
44	Port 2 Speech Override ON	104	UF5 OFF
45	Port 3 Speech Override ON	105	UF6 OFF
46	Port 1 Speech Override OFF	106	UF7 OFF
47	Port 2 Speech Override OFF	107	UF8 Pulse
48	Port 3 Speech Override OFF	108	UF1 Pulse
49	Port 1 Courtesy Tone 1	109	UF2 Pulse
50	Port 1 Courtesy Tone 2	110	UF3 Pulse
51	Port 1 Courtesy Tone 3	111	UF4 Pulse
52	Port 1 Courtesy Tone 4	112	UF5 Pulse
53	Port 1 Courtesy Tone 5	113	UF6 Pulse
54	Port 1 Courtesy Tone 6	114	UF7 Pulse
55	Port 1 Courtesy Tone 7	115	UF8 Pulse
56	Port 1 Courtesy Tone 8	116	Say Time
57	Port 1 Courtesy Tone 9	117	Say Date
58	Port 1 Courtesy Tone 10	118	Link Port 1 to Port 2
59	Port 2 Courtesy Tone 1		
60	Port 2 Courtesy Tone 2		

<u>FN</u>	<u>Description</u>
119	Link Port 1 to Port 3
120	Link Port 2 to Port 3
121	Link All Ports
122	Unlink Port 1 from Port 2
123	Unlink Port 1 from Port 3
124	Unlink Port 2 from Port 3
125	UnLink All Ports
126	Play DVR Track 1
127	Play DVR Track 2
128	Play DVR Track 3
129	Play DVR Track 4
130	Play DVR Track 5
131	Play DVR Track 6
132	Play DVR Track 7
133	Play DVR Track 8
134	Play DVR Track 9
135	Play DVR Track 10
136	Play DVR Track 11
137	Play DVR Track 12
138	Play DVR Track 13
139	Play DVR Track 14
140	Play DVR Track 15
141	Play DVR Track 16
142	Play DVR Track 17
143	Play DVR Track 18
144	Play DVR Track 19
145	Play DVR Track 20
146	Auxiliary Audio 1 ON
147	Auxiliary Audio 2 ON
148	Auxiliary Audio 3 ON
149	Auxiliary Audio 1 OFF
150	Auxiliary Audio 2 OFF
151	Auxiliary Audio 3 OFF
152	Alarm 1 ON
153	Alarm 2 ON
154	Alarm 3 ON
155	Alarm 4 ON
156	Alarm 5 ON
157	Alarm 1 OFF
158	Alarm 2 OFF
159	Alarm 3 OFF
160	Alarm 4 OFF
161	Alarm 5 OFF
162	Speech Out Port 1
163	Speech Out Port 2
164	Speech Out Port 3
165	Speech Out Ports 1 & 2
166	Speech Out Ports 1 & 3
167	Speech Out Ports 2 & 3
168	Speech Out All Ports
169	DTMF Enable Port 1
170	DTMF Enable Port 2
171	DTMF Enable Port 3
172	DTMF Disable Port 1
173	DTMF Disable Port 2
174	DTMF Disable Port 3
175	DTMF Require CTCSS Port 1
176	DTMF Require CTCSS Port 2
177	DTMF Require CTCSS Port 3
178	DTMF Not Require CTCSS Port 1
179	DTMF Not Require CTCSS Port 2
180	DTMF Not Require CTCSS Port 3

<u>FN</u>	<u>Description</u>
181	Force Next Voice ID In Rotation On Port 1
182	Force Next Voice ID In Rotation On Port 2
183	Force Next Voice ID In Rotation On Port 3
184	Force Next CW ID In Rotation On Port 1
185	Force Next CW ID In Rotation On Port 2
186	Force Next CW ID In Rotation On Port 3
187	Play Message Macro 1
188	Play Message Macro 2
189	Play Message Macro 3
190	Play Message Macro 4
191	Play Message Macro 5
192	Play Message Macro 6
193	Play Message Macro 7
194	Play Message Macro 8
195	Play Message Macro 9
196	Play Message Macro 10
197	Play Message Macro 11
198	Play Message Macro 12
199	Play Message Macro 13
200	Play Message Macro 14
201	Play Message Macro 15
202	Play Message Macro 16
203	Play Message Macro 17
204	Play Message Macro 18
205	Play Message Macro 19
206	Play Message Macro 20
207	Play Message Macro 21
208	Play Message Macro 22
209	Play Message Macro 23
210	Play Message Macro 24
211	Play Message Macro 25
212	Play Message Macro 26
213	Play Message Macro 27
214	Play Message Macro 28
215	Play Message Macro 29
216	Play Message Macro 30
217	Play Message Macro 31
218	Play Message Macro 32
219	Play Message Macro 33
220	Play Message Macro 34
221	Play Message Macro 35
222	Play Message Macro 36
223	Play Message Macro 37
224	Play Message Macro 38
225	Play Message Macro 39
226	Play Message Macro 40
227	Good Morning/Afternoon/Evening Runtime Variable
228	Macro Priority High
229	Macro Priority Low
230	Enable Kerchunk Filter Port 1
231	Enable Kerchunk Filter Port 2
232	Enable Kerchunk Filter Port 3
233	Disable Kerchunk Filter Port 1
234	Disable Kerchunk Filter Port 2
235	Disable Kerchunk Filter Port 3
236	Enable Receiver Port 1
237	Enable Receiver Port 2
238	Enable Receiver Port 3
239	Disable Receiver Port 1
240	Disable Receiver Port 2
241	Disable Receiver Port 3

<u>FN</u>	<u>Description</u>	<u>FN</u>	<u>Description</u>
242	Port 1 Speech ID Override ON	298	Disable Meter 3 Alarm
243	Port 2 Speech ID Override ON	299	Disable Meter 4 Alarm
244	Port 3 Speech ID Override ON	300	Disable Meter 5 Alarm
245	Port 1 Speech ID Override OFF	301	Disable Meter 6 Alarm
246	Port 2 Speech ID Override OFF	302	Disable Meter 7 Alarm
247	Port 3 Speech ID Override OFF	303	Disable Meter 8 Alarm
248	All Courtesy Tones OFF Port 1	304	CTCSS Encode Force OFF
249	All Courtesy Tones OFF Port 2	305	CTCSS Encode to Programmed Value
250	All Courtesy Tones OFF Port 3	306	Bump Clock By Correction Factor
251	Force Audio To Entered Port	307	Say year as part of date
252	Stop ID/Disable Timeout Timer Port 1	308	Don't say year as part of date
253	Stop ID/Disable Timeout Timer Port 2	309	Port 1 Tail Message OFF
254	Stop ID/Disable Timeout Timer Port 3	310	Port 2 Tail Message OFF
256	Resume ID/Enable Timeout Timer Port 1	311	Port 3 Tail Message OFF
257	Resume ID/Enable Timeout Timer Port 2	312	Port 1 Tail Message 1
258	Resume ID/Enable Timeout Timer Port 3	313	Port 2 Tail Message 1
259	Send DTMF Memory 1	314	Port 3 Tail Message 1
260	Send DTMF Memory 2	315	Port 1 Tail Message 2
261	Send DTMF Memory 3	316	Port 2 Tail Message 2
262	Send DTMF Memory 4	317	Port 3 Tail Message 2
263	Send DTMF Memory 5	318	Port 1 Tail Message 3
264	Send DTMF Memory 6	319	Port 2 Tail Message 3
265	Send DTMF Memory 7	320	Port 3 Tail Message 3
266	Send DTMF Memory 8	321	Remote Base Memory 1
267	Send DTMF Memory 9	322	Remote Base Memory 2
268	Send DTMF Memory 10	323	Remote Base Memory 3
269	Send DTMF Memory 11	324	Remote Base Memory 4
270	Send DTMF Memory 12	325	Remote Base Memory 5
271	Send DTMF Memory 13	326	Remote Base Memory 6
272	Send DTMF Memory 14	327	Remote Base Memory 7
273	Send DTMF Memory 15	328	Remote Base Memory 8
274	Send DTMF Memory 16	329	Remote Base Memory 9
275	Send DTMF Memory 17	330	Remote Base Memory 10
276	Send DTMF Memory 18	331	Read ADC Channel 1
277	Send DTMF Memory 19	332	Read ADC Channel 2
278	Send DTMF Memory 20	333	Read ADC Channel 3
279	Clear All Meter Hi/Low Readings	334	Read ADC Channel 4
280	Clear Meter 1 Hi/Low Readings	335	Read ADC Channel 5
281	Clear Meter 2 Hi/Low Readings	336	Read ADC Channel 6
282	Clear Meter 3 Hi/Low Readings	337	Read ADC Channel 7
283	Clear Meter 4 Hi/Low Readings	338	Read ADC Channel 8
284	Clear Meter 5 Hi/Low Readings	339	Enable Speech ID's Port 1
285	Clear Meter 6 Hi/Low Readings	340	Enable Speech ID's Port 2
286	Clear Meter 7 Hi/Low Readings	341	Enable Speech ID's Port 3
287	Clear Meter 8 Hi/Low Readings	342	Disable Speech ID's Port 1
288	Enable Meter 1 Alarm	343	Disable Speech ID's Port 2
289	Enable Meter 2 Alarm	344	Disable Speech ID's Port 3
290	Enable Meter 3 Alarm	345	User DVR Record test, erase after auto playback
291	Enable Meter 4 Alarm	346	User DVR Record test, don't erase after auto playback
292	Enable Meter 5 Alarm	347	Start General Timer 1
293	Enable Meter 6 Alarm	348	Start General Timer 2
294	Enable Meter 7 Alarm	349	Start General Timer 3
295	Enable Meter 8 Alarm	350	Stop General Timer 1
296	Disable Meter 1 Alarm	351	Stop General Timer 2
297	Disable Meter 2 Alarm	352	Stop General Timer 3

FN	Description
353	Remote Base Power Select 1
354	Remote Base Power Select 2
355	Remote Base Power Select 3
356	Guest Macros ON
357	Guest Macros OFF
358	Receiver 1 Macros ON or Enabled
359	Receiver 2 Macros ON or Enabled
360	Receiver 3 Macros ON or Enabled
361	Receiver 1 Macros OFF or Disabled
362	Receiver 2 Macros OFF or Disabled
363	Receiver 3 Macros OFF or Disabled
364	Extended Logic Output 1 ON
365	Extended Logic Output 2 ON
366	Extended Logic Output 3 ON
367	Extended Logic Output 4 ON
368	Extended Logic Output 5 ON
369	Extended Logic Output 6 ON
370	Extended Logic Output 7 ON
371	Extended Logic Output 8 ON
372	Extended Logic Output 9 ON
373	Extended Logic Output 10 ON
374	Extended Logic Output 11 ON
375	Extended Logic Output 12 ON
376	Extended Logic Output 13 ON
377	Extended Logic Output 14 ON
378	Extended Logic Output 15 ON
379	Extended Logic Output 16 ON
380	Extended Logic Output 17 ON
381	Extended Logic Output 18 ON
382	Extended Logic Output 19 ON
383	Extended Logic Output 20 ON
384	Extended Logic Output 21 ON
385	Extended Logic Output 22 ON
386	Extended Logic Output 23 ON
387	Extended Logic Output 24 ON
388	Extended Logic Output 25 ON
389	Extended Logic Output 26 ON
390	Extended Logic Output 27 ON
391	Extended Logic Output 28 ON
392	Extended Logic Output 29 ON
393	Extended Logic Output 30 ON
394	Extended Logic Output 31 ON
395	Extended Logic Output 32 ON
396	Extended Logic Output 1 PULSE
397	Extended Logic Output 2 PULSE
398	Extended Logic Output 3 PULSE
399	Extended Logic Output 4 PULSE
400	Extended Logic Output 5 PULSE
401	Extended Logic Output 6 PULSE
402	Extended Logic Output 7 PULSE
403	Extended Logic Output 8 PULSE
404	Extended Logic Output 9 PULSE
405	Extended Logic Output 10 PULSE
406	Extended Logic Output 11 PULSE

FN	Description
407	Extended Logic Output 12 PULSE
408	Extended Logic Output 13 PULSE
409	Extended Logic Output 14 PULSE
410	Extended Logic Output 15 PULSE
411	Extended Logic Output 16 PULSE
412	Extended Logic Output 17 PULSE
413	Extended Logic Output 18 PULSE
414	Extended Logic Output 19 PULSE
415	Extended Logic Output 20 PULSE
416	Extended Logic Output 21 PULSE
417	Extended Logic Output 22 PULSE
418	Extended Logic Output 23 PULSE
419	Extended Logic Output 24 PULSE
420	Extended Logic Output 25 PULSE
421	Extended Logic Output 26 PULSE
422	Extended Logic Output 27 PULSE
423	Extended Logic Output 28 PULSE
424	Extended Logic Output 29 PULSE
425	Extended Logic Output 30 PULSE
426	Extended Logic Output 31 PULSE
427	Extended Logic Output 32 PULSE
428	Extended Logic Output 1 OFF
429	Extended Logic Output 2 OFF
430	Extended Logic Output 3 OFF
431	Extended Logic Output 4 OFF
432	Extended Logic Output 5 OFF
433	Extended Logic Output 6 OFF
434	Extended Logic Output 7 OFF
435	Extended Logic Output 8 OFF
436	Extended Logic Output 9 OFF
437	Extended Logic Output 10 OFF
438	Extended Logic Output 11 OFF
439	Extended Logic Output 12 OFF
440	Extended Logic Output 13 OFF
441	Extended Logic Output 14 OFF
442	Extended Logic Output 15 OFF
443	Extended Logic Output 16 OFF
444	Extended Logic Output 17 OFF
445	Extended Logic Output 18 OFF
446	Extended Logic Output 19 OFF
447	Extended Logic Output 20 OFF
448	Extended Logic Output 21 OFF
449	Extended Logic Output 22 OFF
450	Extended Logic Output 23 OFF
451	Extended Logic Output 24 OFF
452	Extended Logic Output 25 OFF
453	Extended Logic Output 26 OFF
454	Extended Logic Output 27 OFF
455	Extended Logic Output 28 OFF
456	Extended Logic Output 29 OFF
457	Extended Logic Output 30 OFF
458	Extended Logic Output 31 OFF
459	Extended Logic Output 32 OFF

<u>FN</u>	<u>Description</u>	<u>FN</u>	<u>Description</u>
460	Play Message Macro 41	514	Remote Base Memory 34
461	Play Message Macro 42	515	Remote Base Memory 35
462	Play Message Macro 43	516	Remote Base Memory 36
463	Play Message Macro 44	517	Remote Base Memory 37
464	Play Message Macro 45	518	Remote Base Memory 38
465	Play Message Macro 46	519	Remote Base Memory 39
466	Play Message Macro 47	520	Remote Base Memory 40
467	Play Message Macro 48	521	Send DTMF Memory 21
468	Play Message Macro 49	522	Send DTMF Memory 22
469	Play Message Macro 50	523	Send DTMF Memory 23
470	Play Message Macro 51	524	Send DTMF Memory 24
471	Play Message Macro 52	525	Send DTMF Memory 25
472	Play Message Macro 53	526	Send DTMF Memory 26
473	Play Message Macro 54	527	Send DTMF Memory 27
474	Play Message Macro 55	528	Send DTMF Memory 28
475	Play Message Macro 56	529	Send DTMF Memory 29
476	Play Message Macro 57	530	Send DTMF Memory 30
477	Play Message Macro 58	531	Send DTMF Memory 31
478	Play Message Macro 59	532	Send DTMF Memory 32
479	Play Message Macro 60	533	Send DTMF Memory 33
480	Play Message Macro 61	534	Send DTMF Memory 34
481	Play Message Macro 62	535	Send DTMF Memory 35
482	Play Message Macro 63	536	Send DTMF Memory 36
483	Play Message Macro 64	537	Send DTMF Memory 37
484	Play Message Macro 65	538	Send DTMF Memory 38
485	Play Message Macro 66	349	Send DTMF Memory 39
486	Play Message Macro 67	540	Send DTMF Memory 40
487	Play Message Macro 68	541	Send DTMF Memory 41
488	Play Message Macro 69	542	Send DTMF Memory 42
489	Play Message Macro 70	543	Send DTMF Memory 43
490	Remote Base Memory 11	544	Send DTMF Memory 44
491	Remote Base Memory 12	545	Send DTMF Memory 45
492	Remote Base Memory 13	546	Send DTMF Memory 46
493	Remote Base Memory 14	547	Send DTMF Memory 47
494	Remote Base Memory 15	548	Send DTMF Memory 48
495	Remote Base Memory 16	549	Send DTMF Memory 49
496	Remote Base Memory 17	550	Send DTMF Memory 50
497	Remote Base Memory 18	551	Load RTC Date & Time into RC210 Onboard Clock/Calendar
498	Remote Base Memory 19	552	CTCSS During ID ON
499	Remote Base Memory 20	553	CTCSS During ID OFF
500	Remote Base Memory 21	554	Port 1 Amount of time transmitter has been active
501	Remote Base Memory 22	555	Port 2 Amount of time transmitter has been active
502	Remote Base Memory 23	556	Port 3 Amount of time transmitter has been active
503	Remote Base Memory 24	557	Reset Port 1 Activity Timer to 0
504	Remote Base Memory 25	558	Reset Port 2 Activity Timer to 0
505	Remote Base Memory 26	559	Reset Port 3 Activity Timer to 0
506	Remote Base Memory 27	560	RSSI (Signal Strength Readback)
507	Remote Base Memory 28	561	Restart controller (same as cycling power)
508	Remote Base Memory 29	562	Port 1 Number of Keyups since last reset
509	Remote Base Memory 30	563	Port 2 Number of Keyups since last reset
510	NOT USED	564	Port 3 Number of Keyups since last reset
511	Remote Base Memory 31	565	Reset Port 1 Keyup Counter to 0
512	Remote Base Memory 32	566	Reset Port 2 Keyup Counter to 0
513	Remote Base Memory 33	567	Reset Port 3 Keyup Counter to 0

FN	Description
568	Reserved for future use
569	Reserved for future use
570	Readback A/D Channel 1 Stored Low
571	Readback A/D Channel 2 Stored Low
572	Readback A/D Channel 3 Stored Low
573	Readback A/D Channel 4 Stored Low
574	Readback A/D Channel 5 Stored Low
575	Readback A/D Channel 6 Stored Low
576	Readback A/D Channel 7 Stored Low
577	Readback A/D Channel 8 Stored Low
578	Readback A/D Channel 1 Stored High
579	Readback A/D Channel 2 Stored High
580	Readback A/D Channel 3 Stored High
581	Readback A/D Channel 4 Stored High
582	Readback A/D Channel 5 Stored High
583	Readback A/D Channel 6 Stored High
584	Readback A/D Channel 7 Stored High
585	Readback A/D Channel 8 Stored High
586	Disable Port 1 Timeout Timer ONLY for 60 min.
587	Disable Port 2 Timeout Timer ONLY for 60 min.
588	Disable Port 3 Timeout Timer ONLY for 60 min.
589	Enable Port 1 Timeout Timer ONLY for 60 min.
590	Enable Port 2 Timeout Timer ONLY for 60 min.
591	Enable Port 3 Timeout Timer ONLY for 60 min.
592	Current Wind Speed & Direction
593	Current Outdoor temperature
594	Indoor Humidity
595	Outdoor Humidity
596	Wind Speed high & direction (since Midnight)
597	Outdoor Temp High (since Midnight)
598	Outdoor Temp Low (since Midnight)
599	Reserved for future use
600	Reserved for future use
601	Fan Timer OFF
602	Fan Timeout Set to 1 Minutes
603	Fan Timeout Set to 5 Minutes
604	Fan Timeout Set to Programmed Value
605	Speak Current Remote Base Freq & Offset
606	Start General Timer 4
607	Start General Timer 5
608	Start General Timer 6
609	Stop General Timer 4
610	Stop General Timer 5
611	Stop General Timer 6
612	Disable Port 1 Inactivity Timer
613	Disable Port 2 Inactivity Timer
614	Disable Port 3 Inactivity Timer
615	Port 1 Inactivity Timer to Programmed Value
616	Port 2 Inactivity Timer to Programmed Value
617	Port 3 Inactivity Timer to Programmed Value
618	Pause Macro Execution for 1 seconds
619	Pause Macro Execution for 2 seconds
620	Pause Macro Execution for 4 seconds
621	Port 1 Hangtimer 1 Select
622	Port 1 Hangtimer 2 Select
623	Port 1 Hangtimer 3 Select
624	Port 2 Hangtimer 1 Select
625	Port 2 Hangtimer 2 Select
626	Port 2 Hangtimer 3 Select
627	Port 3 Hangtimer 1 Select
628	Port 3 Hangtimer 2 Select
629	Port 3 Hangtimer 3 Select
630-639	Port 1 Next Courtesy Tone 1-10
640-649	Port 1 Following Courtesy Tone 1-10
650-659	Port 2 Next Courtesy Tone 1-10
660-669	Port 2 Following Courtesy Tone 1-10
670-679	Port 3 Next Courtesy Tone 1-10
680-689	Port 3 Following Courtesy Tone 1-10
690	Power Down Doug Hall Interfaced Radio
691	Reserved For Future Use
692	Play Port 1 Pending ID
693	Play Port 2 Pending ID
694	Play Port 3 Pending ID
695	Interrogate Port 1 Link Status
696	Interrogate Port 2 Link Status
697	Interrogate Port 3 Link Status
698	Autodial 911
699	Autopatch To Programmed Port(s)
700	AutoPatch Disabled
810 – 849	Suspend Setpoint 1 – 40
850 – 899	Resume Setpoint 1-40
901 – 1005	Call Macro 1 – 105 (901 – 990 if external EEPROM <u>not</u> installed)

Keyup Counter and Activity Timers

The RC210 keeps track of both the number of times a Port's transmitter has been keyed as well as the amount of time it has been active. You can reset both the Counter and the Timer to 0 and select whether to store (and report) the time in minutes or hours.

***2125x** Selects whether to store and readback amount of time currently unlocked Port's transmitter has been active where x = 0 for minutes and x = 1 for hours

***212699** Readback amount of time currently Unlocked Port's transmitter has been active (in minutes or hours depending on selection above)

***212799** Reset currently Unlocked Port's TX Activity Timer to 0

***212899** Readback the number of Keyups of the currently Unlocked Port's transmitter

***212999** Reset the currently Unlocked Port's Keyup Counter to 0

In addition to the above commands (when a Port is Unlocked), there are several Macro Functions that you can use instead. See the Macro Function List above for their exact number (the range is from 554 to 567)

RSSI (signal strength) Reporting

You can supply the RC210 an RSSI signal from your repeater's receiver and use that to indicate to a user how well they're "making" the repeater. A/D Channels 6,7 and 8 are used for Port 1, 2 and 3 respectively. The necessary hardware connections are explained in the RC210 Hardware Manual.

There are 3 different ranges that the RC210 uses to decide if the signal level is to be considered "Weak", "Medium" or "High" and it uses CW to report that.

W for weak

M for medium

H for high

You should first make sure your RSSI connection is calibrated for an indicated range of 0 to 100 and choose "Percent" as the Meter Face. See *Programming Meter Faces* on Page 52 for details.

Once calibrated, you must tell the RC210 the ranges you want to be used to indicate the strength level. For example, you want a signal indication of 20 or lower to be reported as *weak*, between 21 and 69 to be considered *medium* and 70 and above to be reported as *high*.

You would use the following command to program these settings:

***2130 1 20**

***2130 2 70**

In order to actually use the RSSI report, you need to program a Command Macro with Function 560. For example, let's say you wanted to use the RSSI report as a Courtesy Tone on Port 1.

First, let's program up a Macro (41 in our example but use whichever one you want) to use RSSI. So Unlock Port 1 then:

***4002 41 * 560**

As we want to hear the RSSI report when a user unkeys, we program Port 1's receiver going INACTIVE to call Macro 41:

***2113 0 41** Program currently unlocked Port's receiver going INACTIVE to call Macro 41

And to make sure we don't have a conflict, let's program Port 1's receive going ACTIVE to call a non-used Macro (in this example, 90 but use whichever makes sense in your setup)

***2113 1 90** Program currently unlocked Port's receiver going ACTIVE to call Macro 90

Now we also want to program a couple of Macros to allow us to turn this feature ON & OFF as needed (we'll use Macros 82 & 83)

***4002 82 * 358** Enable Port 1 Receiver Active Function

***4002 83 * 361** Disable Port 1 Receiver Active Function

That's it!

Of course if you prefer not to have a Courtesy Tone reported RSSI, you could simply program a Macro to use Function 560 and allow your users to run that Macro on command instead.

Tail Messages

There are 3 Tail Messages per port, which can be "played" based on either the number of repeater "tails" (hang time) or based on the Periodic Message Timer. Each Tail Message may be programmed to use one of the 90 (optionally 105 if your pc board version is 3.5 or later or you have the optional EEPROM board installed).

Command Macros (which are generally used to play a spoken message).

***2110 x y** where x is the Tail Message number (1 - 3) and y is the Command Macro to use 1 - 90 (optionally 1 -105 if your pc board version is 3.5 or later or you have the optional EEPROM board installed).

To select which Tail Message is to be used:

***2111 x** where x is the Tail Message Number to use 1, 2 or 3.

Note: Setting the Tail Message Number to 0 turns off all Tail Messages on that Port

To play a Tail Message based on the number of tails:

***2112 x** where x is the number of repeater tails from 1 to 254

To play a Tail Message based on the Periodic Message Timer:

***1020 x** Set the Period Message Timer to play the selected Tail Message x seconds after the last Hangtime expiration.

Note that it is possible to play a Tail Message based on both the Tail Counter AND the Period Message Timer. If you only want to use Tail Messages based on the Tail Counter, program the Period Message Timer to 0, which will disable it. Conversely, If you only want to use Tail Messages based on the Periodic Message Timer, program the Tail Timer to 0, which will disable it.

Tail Messages may be turned ON and OFF "on the fly" by using their appropriate Macro Function. See the Macro Function List for their Function Number.

Note: Tail Messages only work on Ports defined as repeating.

Some Practical Examples Of Tail Message Programming

In this example, we will program Tail Message 1 to play Message Macro 1 every 10 tails:

We've recorded DVR Track 1 which says "The ARC will hold its meeting tonight at 7 PM" which will be called by Command Macro 10:

First, we program Command Macro 10 to play DVR Track 1

***4002 10 * 126**

Note that we do not need to use a Port Steering Function in this Macro as the RC210 knows to send Tail Message speech out the proper Port. You can however, include a Port Steering Function if you desire.

Now we program Tail Message 1 to use Command Macro 10

***2110 1 10**

Next, we program this port to use Tail Message 1

***2111 1**

Next, we program the Tail Counter to count 10 repeater tails:

***2112 10**

Finally, we disable the Periodic Message Timer

***1020 0**

Now DVR Track 1 will be sent every 10 repeater tails.

In this next example, we want to send this same DVR track to users 5 minutes after Hangtime expiration. First, we disable the Tail Counter:

***2112 0**

Now we set the Periodic Message Timer to 300 seconds (5 minutes)

***1020 300**

Now DVR Track 1 will be sent 5 minutes after the last Hangtime expiration.

And finally, we want to send DVR Track 1 every 5 tails AND 15 minutes after the last Hangtime expiration.

First, we program the Tail Counter:

***2112 5**

Lastly, we program the Periodic Message Timer to 900 seconds:

***1020 900**

As you can see, there is a lot of flexibility in the use of Tail Messages.

Special Features

Temporarily Disabling ID's And Timeout Timer

The RC210 allows for easy use when "broadcasting" special events, such as a AR News Line bulletin or Shuttle Audio event. By programming a Command Macro with the appropriate function(s), you can disable IDs on a Port and suspend its Timeout timer for 60 minutes. When the special event is over, you use another Command Macro to re-enable the IDs and timer. And if you combine these powerful features with the scheduler, you can set up the RC210 to completely handle most of the tasks associated with this usually cumbersome chore.

Macro Functions

252	Stop ID And Disable Timeout Timer Port 1
253	Stop ID And Disable Timeout Timer Port 2
254	Stop ID And Disable Timeout Timer Port 3
256	Resume ID And Re-Enable Timeout Timer Port 1
257	Resume ID And Re-Enable Timeout Timer Port 2
258	Resume ID And Re-Enable Timeout Timer Port 3

Example: Program Command Macro 11 to suspend ID and Timeout Timer on Port 1, link Port 1 to Port 2 to allow a WestLink broadcast that is transmitted via a link on Port 2.

***4002 11 * 252 * 118**

If the event lasts longer than 60 minutes, you can simply run Command Macro 11 again to restart the 60 minute suspend period.

At the end of the event, Command Macro 12 to resume IDs and re-enable the Timeout Timer on Port 1, unlink Ports 1 & 2:

***4002 12 * 256 * 122**

DTMF Memories

There are 20 DTMF memories (or a total of 50 if the optional RTC is installed. See the RTC Manual for details), which can store up to 10 DTMF digits each. This is useful for sending preformatted DTMF digits to one (or any combination) of the radio ports. Maybe you'll use them in conjunction with a Command Macro to control a remote link or an IRLP or EchoLink node.

Once programmed, the memories can then be recalled in any Command Macro.

***2105xx** y y y y y y y y y y where "xx" is the number of the memory 01-20 (or 01-50 if the optional RTC is installed) and y up to 10 DTMF digits.

Note: You select which port to send DTMF to by the same method as speech. See Page 34)

DTMF Digits Duration and Time Between Digits

To accommodate different radio link paths, you can program both the duration and time between DTMF Memory digits:

***2106x** where "x" is the duration of each DTMF digit transmitted. The range is 1 to 255 milliseconds.

***2107x** where "x" is the time between DTMF digits. The range is 1 to 255 milliseconds.

IRLP®/Echolink® DTMF Regeneration

In order for users to have access to this feature, several parameters need be programmed first.

The Regenerate Prefixes are the sequence of DTMF characters that users preface to the DTMF digits they want sent to a connected IRLP®/Echolink® or link radio. There are 3 different Prefixes you can program and each can be from 1 to 5 digits. By default, they are programmed to #1, #2, and #3 by default.

***2104x yyyyyy** where x = 1, 2 or 3 for which Regenerate Prefix to program, up to 5 digits.

The RC210 needs to know which Port you want the user-entered DTMF sequence to be sent.

***2117x y** Set Port(s) to send, where x = 1, 2 or 3 for which Prefix and y:

1 -	Port 1
2 -	Port 2
3 -	Port 3
12 -	Ports 1 & 2
13 -	Ports 1 & 3
23 -	Ports 2 & 3
123 -	All Ports

Finally, you may prepend a Macro action stored in a Command Macro, to be run before the DTMF is sent.

***2118x y** where x = 1, 2 or 3 for which Prefix and y = which Macro 1 – 90 (or 1- 105 if EEPROM is installed) to run before sending DTMF. Programming to a 0 results in no Macro being used.

The Scheduler

The Scheduler lets you automate many routine tasks by defining a specific day of the week, the hour of that day and the number of minutes past the hour you wish that task to run. Such a definition is called a *setpoint*, which is programmed to run a specific macro at a specific time of day. Only macros may be run by the scheduler, however that macro may contain any command(s), including speech commands such as Time of Day.

Note: Setpoints are one-shot events that occur only once at the scheduled time

One example of a setpoint would be if you wanted to link Port 1 to Port 2 for a net that lasts for an hour every Tuesday at 7 PM. You'd define a macro to link Port 1 to Port 2, then define a setpoint to call that macro at 7 PM. After the net is over, another setpoint could be defined to call a different macro that disconnects the ports.

How Do We Define Setpoints?

A programming commands allows us to program each setpoint by defining the time and day of week that setpoint should run and the macro to be executed. The format is:

***4001 S * DOW * MOY * Hours * Minutes * Macro**

S is the setpoint number 1 - 40

DOW refers to the Day of Week and is 1 digit:

1 = Monday	6 = Saturday
2 = Tuesday	7 = Sunday
3 = Wednesday	8 = Weekdays
4 = Thursday	9 = Weekends
5 = Friday	0 = Everyday

However, you may alternately use 2 digits for DOW entry and it now becomes DOM (Day Of Month) and consists of 2 digits. The first digit signifies which week within a month to use and the second digit signifies the day of that week to use. For example, if an event is wanted for the 2nd Thursday of every month, you'd enter 24 for the DOW entry.

MOY refers to the Month of Year:

1 = January	8 = August
2 = February	9 = September
3 = March	10 = October
4 = April	11 = November
5 = May	12 = December
6 = June	0 = Every Month
7 = July	

Hours and Minutes are the time in 24 hour format. For example, 10 24 = 10:24 am or 22 10 = 10:10 pm

Hint: The hours digits may be set to a wildcard value with a DTMF "99". Setting the hours to "99" causes a match every hour at "minutes" after.

Macro is the macro to be executed at the appointed time and may be any macro you have defined 01-90 (optionally 01 - 105 if your pc board version is 3.5 or later or you have the optional EEPROM board installed). **You must use at least 2 digits.(01 – 90 or 01-130)**

More than one setpoint can be run at a particular time. For example, if more than one setpoint qualifies at a particular time, the lowest numbered one will be run first, then the next and so on. You can cancel any previously defined setpoint by setting it to a time that will never occur, i.e 25 00 hours.

Recurring Voice Messages And The Scheduler

You may want to define a setpoint that announces the time every hour (using the hourly wildcard) during morning commute time on weekdays. Easy enough, we'll just program a setpoint to recall a macro that calls function 116 (Say Time), speak on Port 1 and call that macro with a scheduler setpoint to run every hour, starting at 6 AM. The RC210 will now speak the time every hour, on the hour. But we have a problem now - there is no way to stop the hourly announcements without actually reprogramming that setpoint so that it doesn't announce the time any more. Since the controller will now announce the time every hour, 24 hours a day, this obviously doesn't work out the way we want!

So how can we stop that setpoint from continuing to run until we reprogram it? Without something to tell the scheduler to stop running that setpoint, in fact we can't. So once started, the controller is going to announce the time every hour until we do something about it.

In order to get around this problem, the RC210 incorporates another set of commands that allow you to suspend a currently occurring setpoint without having to actually erase that setpoint. These commands are known as the Suspend and Resume commands. What the Suspend command does is to prevent a setpoint from occurring by setting a flag. The RC210's program then knows that since the Suspend flag is set, it shouldn't continue to execute that setpoint. To start it running again, we simply use another setpoint to run another macro that calls the Resume command. The setpoint to announce the time is now free to run once more.

First, we program up the needed macros:

```
*4002 2 * 162 * 116    ←Macro 2 calls Say Time on Port 1
*4002 3 * 810          ←Macro 3 sets the Resume flag On SetPoint 1
*4002 4 * 850          ←Macro 4 sets the Suspend flag On SetPoint 1
```

Note: Since Macro 1 is called at controller startup, it should only be used to announce the time if you have the optional RTC installed.

Now we program our setpoints:

```
*4001 1 * 8 * 0 * 99 * 00 * 02    ←Call Macro 2 every hour on weekdays
*4001 2 * 8 * 0 * 06 * 00 * 03    ←Resume Macro 3 at 6 AM on weekdays (we don't need to use the Port setting here)
*4001 3 * 8 * 0 * 09 * 00 * 04    ←Suspend Macro 4 at 9 AM weekdays (again, we don't need to use the Port setting)
```

Now the controller will announce the time every hour on Port 1, starting at 6 AM on weekdays and stop announcing at 9 AM

Plan! Plan! Plan!

The most important step you can do is PLAN. You need to figure out exactly what you want the repeater to do, then how the scheduler should be programmed in order to accomplish that. The scheduler is pretty smart, but it can't read your mind!

First of all, let's decide on what we want the scheduler to do. Maybe you'd like to turn off certain features at night, leaving them on until later on the weekends for the night owls. Maybe you have a swap net on Mondays that you would like to monitor. You want to automatically link Port 1 to Port 2 5 minutes before the start time of the net and turn it back off when the net is over. During the weekday morning commute, you'd like to change to a different courtesy tone on Port 2 and announce the time every 15 minutes for the commuters. You also want to put all ports into CTCSS access mode between midnight and 7 am on weekends. Remember that the scheduler can only call macros, so we need to define some macros to do our bidding

From the above, we first define our setpoints and the macro we'll store the function in:

<u>Setpoint</u>	<u>Time</u>	<u>Day</u>	<u>Macro</u>	<u>Description</u>
1	6:00 am	weekdays	2	Weekday mornings - change to courtesy tone #2 on Port 2, announce the time
2	9:00 am	weekdays	3	Weekday mornings - back to courtesy tone #1 on Port 2, stop announcing time
3	7:00 pm	Monday	5	Turn link on for net
4	8:00 pm	Monday	6	Turn link off after net ends
5	12:00 am	weekdays	7	Change all ports to CTCSS access on weekends at midnight
6	6:00 am	weekdays	8	Change all ports to carrier access on weekend mornings at 7 am

We first need to program the appropriate macros to function those things we want changed:

***4002 2 * 163 * 61 116** Program Macro 2 to change to courtesy tone #2 on Port 2 and announce the time.
***4002 3 * 60 * 351** Program Macro 3 to change to courtesy tone back to #1 on Port 2 and suspend announcing the time.
***4002 4 * 371** Program Macro 4 to resume running Macro 1
***4002 5 * 118** Program Macro 5 to link Ports 2 & 3
***4002 6 * 122** Program Macro 6 to unlink Ports 2 & 3
***4002 7 * 2 * 4 * 6** Program Macro 7 to change all ports to CTCSS access
***4002 8 * 1 * 3 * 5** Program Macro 8 to change all ports to carrier access

We can now program the scheduler setpoints:

***4001 1 * 8 * 0 * 06 * 00 * 02** Call Macro 2 at 6 AM on weekdays
***4001 2 * 8 * 0 * 09 * 00 * 03** Call Macro 3 at 9 AM on weekdays
***4001 3 * 8 * 0 * 06 * 00 * 04** Call Macro 4 at 6 AM to restart Macro 1
***4001 4 * 8 * 0 * 18 * 55 * 05** Call Macro 5 at 6:55 PM to link Ports 1 & 2
***4001 5 * 8 * 0 * 20 * 00 * 06** Call Macro 6 at 8 PM to unlink Ports 1 & 2
***4001 6 * 9 * 0 * 00 * 00 * 07** Call Macro 7 at midnight on weekends
***4001 7 * 9 * 0 * 07 * 00 * 08** Call Macro 8 at 7 AM on weekends.

As you can see, if you take the time to plan your setpoints, the RC210 will handle many tedious chores for you, automatically.

Erasing Scheduler Setpoints

You can erase any setpoint by simply programming a time that will never occur, i.e 2500 hours. However, there may be times when you want to clear all setpoints and start "fresh". This command allows you to do so

***400799** Clear all setpoints

Determining Setpoint Status

This command allows you to interrogate the status of any Setpoint. This may aid in troubleshooting why a Scheduler Setpoint isn't working as expected.

***4010xx** Interrogate Scheduler Setpoint where xx = Setpoint 01 – 20. (controller says "Start" for Resume, "Stop" for Suspend)

Voice IDs

<u>Command</u>	<u>Description</u>	<u>Maximum Number Of Words</u>
*80041	Initial Voice ID #1	22
*80051	Initial Voice ID #2	22
*80061	Initial Voice ID #3	22
*80042	Pending Voice ID #1	22
*80052	Pending Voice ID #2	22
*80062	Pending Voice ID #3	22

You may use any combination of vocabulary words and DVR tracks in all ID Voice Messages.

Important: You must always use 3 digits for vocabulary words or DVR tracks when programming ID Messages. Failure to do so will result in unpredictable results. Hint: You may use AA1, AA2, AA3, AA4, AA5, AA6, AA7 and AA8 to review your stored ID's while that port is unlocked

ID Extras

ID Extras allow you to include special messages as part of your Voice ID's:

*8007x yy where "x" is the ID # of the currently unlocked port and "yy" is the extra message to use in that ID:

- | | | | |
|---|---|----|--|
| 0 | Cancel ID Extras | 6 | Say Good M/A/E and the time AFTER the ID |
| 1 | Say Good M/A/E BEFORE the ID | 7 | Say Good M/A/E BEFORE the ID and say the time AFTER the ID |
| 2 | Say Good M/A/E AFTER the ID | 8 | Say the time BEFORE the ID and Good M/A/E AFTER the ID |
| 3 | Say the time BEFORE the ID | 9 | Say the time and Good M/A/E BEFORE the ID |
| 4 | Say the time AFTER the ID | 10 | Say the time and Good M/A/E AFTER the ID |
| 5 | Say Good M/A/E and the time BEFORE the ID | 11 | Random rotation of 1 through 10. |

Enable/Disable Voice IDs

You may disable all Voice ID's and force all ID's to be made in CW. By default, Voice ID's are enabled

*8008x Enable Voice IDs
 x = 1 Enabled* *Factory default
 x = 0 Disabled

Selecting ID Timer Start

You may select whether the ID Timers start on receiver or transmitter activity

*2121x ID Timers Start
 x = 1 PTT*
 x = 0 COS

Constant ID

You may select to have ID's continually sent regardless of repeater activity based on the Pending ID Timer time period (be sure to check your local regulations as to the legality involved)

*8009x where x=0 for OFF and 1 for ON

While unlocked, you may also play back your ID messages, based on which port you're currently "connected to". This allows for easy verification of your ID messages as you program them.

AA1	The currently unlocked port CWID # 1	AA6	The currently unlocked port Pending Voice ID # 1
AA2	The currently unlocked port CWID # 2	AA7	The currently unlocked port Pending Voice ID # 2
AA3	The currently unlocked port Initial Voice ID # 1	AA8	The currently unlocked port Pending Voice ID # 3
AA4	The currently unlocked port Initial Voice ID # 2		
AA5	The currently unlocked port Initial Voice ID # 3		

CW IDs

CW Speed Programming

***8000x** where "x" is the speed of up to 2 digits. The allowable range is 5 - 50 wpm.

Examples:

- ***8000 5** Program CW speed to 5 wpm
- ***8000 22** Program CW speed to 22 wpm

CW Tone Programming

Each Port's CW tone may be programmed to be a single or dual tone. If you use only 4 digits to program the tone frequency, the RC210 will generate single tone CW. If you enter more than 4 digits, dual-tones will be generated:

***8001xxxx (xxxx)** where "x" is the tone frequency in Hz of up to 4 (or 8) digits . The allowable range is 0 - 3500 Hz for each.

Examples:

- ***8001 800** Program cw tone of 800 Hz.
- ***80011000** Program cw tone of 1000 Hz.
- ***8001 0660 0440** Program dual tone of 660 and 440 Hz.

CW ID Programming

There are 2 CW ID messages, each of which may be programmed with up to 15 characters each (See Morse Code Character Table). They normally rotate as the Pending IDs. However if you have Speech Override ON and a signal appears on that port's receiver during a Voice ID, it will revert to CW and play CW message 2. To minimize disruption, it is recommended that you keep CW ID #2 as short as possible.

- ***8002xx-xx** Program CWID #1
- ***8003xx-xx** Program CWID #2

Examples

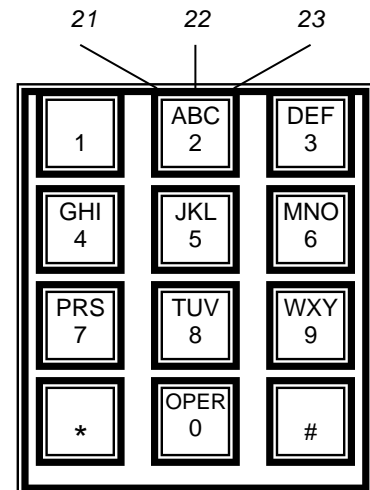
- ***8002 21 42 06 53 32 12 21 82 92** Program "AH6LE/AUX" into ID #1
- ***8003 21 42 06 53 32 12 72** Program " AH6LE/R" into ID #2

Note: If you exceed 15 characters, all characters that follow will be ignored.

Figure 6 below shows the relationships between the codes and the layout of a standard Touchtone© pad. As you can see, it makes it easier to remember the code for a particular character without having to look up codes (Q and Z are treated as special cases).

Fig 6 Morse Code Character Table

A	21	U	82	Word	
B	22	V	83	Space	11
C	23	W	91	-	10
D	31	X	92	/	12
E	32	Y	93	AR	13
F	33	Z	90	,	14
G	41			?	20
H	42	0	00	SK	60
I	43	1	01		
J	51	2	02		
K	52	3	03		
L	53	4	04		
M	61	5	05		
N	62	6	06		
O	63	7	07		
P	70	8	08		
Q	71	9	09		
R	72				
S	73				
T	81				



Using The Digital Voice Recorder (DVR)

The RC210 includes an on-board DVR, which allows you to record up to 20 different "tracks" (messages) of audio. There is a total of 126 seconds recording time available, which can be divided up any way you like. You can have any combination of recorded tracks as long as the total time doesn't exceed the maximum recording time available. DVR tracks may be used in Voice ID's or Message Macros.

Recording DVR Tracks

To record a track, the controller must have one of its ports first unlocked. The syntax is:

***7001x** where "x" is the track number you wish to record 1 - 20

The controller responds with the number of seconds of recording time you have available and then says "Ready". At this point it is waiting for you to key before starting to record. You must start recording within 5 seconds after the controller speaks "Ready" or the command will be canceled. Once started, simply unkey to stop recording and your message is will be stored in memory. Don't worry if it's not perfect, as you have some editing commands available with which to "clean it up".

Playing A Recorded DVR Track

While in programming mode, you can use the following command to play back any recorded DVR Track. This is very useful to check the quality of your recording, both before and during editing.

123x where "x" is the DVR track to play 1- 20

NOTE: If you'd like to record DVR tracks using wav files on your computer, please consult the RCP Manual

Erasing Tracks

Once a track is recorded, it cannot be recorded again without first erasing it (this safeguard prevents you from accidentally recording over a previously recorded track). You can erase a particular track or, should you want to completely "wipe the slate clean", you may erase ALL tracks. When you erase tracks, the controller will let you know how many seconds recording time you have available after the track(s) is cleared.

***7002x** where "x" is the track number you want to erase 1 - 20

***7003x** where "x" is any DTMF digit to Erase all DVR tracks

Editing Recorded Tracks

Rarely will a recorded track be perfect, especially at the end of that recording. The DVR will faithfully record (and playback) whatever it is asked to - squelch bursts and other noise may appear at the end of your recording. The RC210 gives you 2 commands with which to remove (or add) the last 200 milliseconds of a recording, which is very effective at editing those noises from the end of your recordings.

Let's say you've recorded an ID in Track 10 but at the end of it, there is a squelch burst. You can remove the last part of this track in 200 milliseconds increments by using the following command

***7004x** where "x" is the Track number to remove the ending 200 millisecond segment.

You can then use the **123 x** command to play back that Track to see how it sounds.

It may be that you will need to remove more than one 200 millisecond segment - perhaps you stopped speaking and didn't unkey for longer time than you should have. You may remove as many segments as you need.

It is possible to remove too many segments, which results in chopping off too much from the end! Fortunately, the RC210 lets you easily add back a previously removed segment with the following command

***7005x** where "x" is the Track number to add back the last removed 200 milliseconds segment.

You can add back as many segments as you need.

Finding Out How Much Recording Time You Have Left

The DVR will keep track of the total amount of recording time you have used. It will also let you know how many seconds of recording time you have left every time you record or erase a track (or erase all tracks). In addition, you can also use the following command at any time you're in programming mode to find out how many seconds of total recording time remain.

***7006x** where "x" is any DTMF digit to Read back the amount of available recording time, in seconds.

Notes:

When editing tracks, you must do so before you record any new ones or the results may be unpredictable.

Be ready to start speaking immediately when you start transmitting to minimize the amount of recording space used. You can not edit the beginning of a track.

User DVR Recording

You can program a Command Macro to allow users to record themselves in order to check how well they're "getting into the repeater". This Macro Function will record, playback and then erase the DVR Track (this function uses DVR Track 19). Simply include Macro Function **345** in your Macro.

Alternately, there may be times you want to allow someone to record a message without giving them access to your Unlock Code(s). By using Macro Function **346**, they can record and playback their message. But DVR Track 19 will not be erased afterwards. An example of its use would be to allow a user to record a SkyWarn® warning for inclusion in a Scheduled message.

A Note About Saving DVR Tracks

Whenever you record a DVR Track, whether over-the-air or using our RCP Software, the RC210 stores the track information (which Track, how long the recording is, etc.) in non-volatile memory. And when you download your configuration from the RC210 to your computer, DVR Track data is also downloaded. As such, it is good practice to download from the RC210 – as soon as possible - after you've finished recording your DVR Tracks. You don't need to download after every Track you record – you can simply wait until you're done with all of them.

Auxiliary Audio Inputs

Each of the 3 Auxiliary Inputs may be routed to any port's transmitter, or any combination of Ports by the use of Port Steering Macro Functions to control where Auxiliary Audio is routed. You must also use the Port Steering Function to turn that Auxiliary off when you're done with it.

Restarting The RC210

At times it may be advantageous to restart the controller. Doing this does two things. Firstly, it verifies the operation of the hardware watchdog timer. If you enter the Restart command and for some reason the watchdog timer fails, you'll receive a message saying "Timer Not Set". As it is a fail-safe message, you should never hear it. Upon a successful restart, you'll hear the power up message with the version number.

In addition to testing the watchdog timer, the Restart command also forces the controller to start the controller from a known condition. And finally, if you have Macro 1 stored, the controller will run it upon restart.

***21999** Restart the controller

Note: Restarting the controller does not overwrite any custom programming you have made. In other words, a restart does not restore factory defaults

Using Yaesu Fusion Repeaters

If you are using a Yaesu Fusion DR1x® repeater and are powering your RC210 from it, there needs to be a delay after power up of the controller as the DR1x boots up (which can take as long as 5 seconds). By enabling this feature, the RC210 will delay for 5 seconds after startup in order to give the DR1x ample time to boot itself before the RC210 starts its Startup Announcement.

***2124x** where x = 0 for Disable and 1 for Enable. It is disabled by default)

Courtesy Tone Programming

There are 10 sets of courtesy tones that you can custom program and be shared amongst the 3 Ports. Each Courtesy Tone can be defined with up to 4 tone segments, duration of those segments and delays between segments. Courtesy tones consist of:

Delay time from the end of a user transmission (when the squelch on a port closes)

The 1st tone segment

Delay time from the end of the first tone segment.

A 2nd tone segment

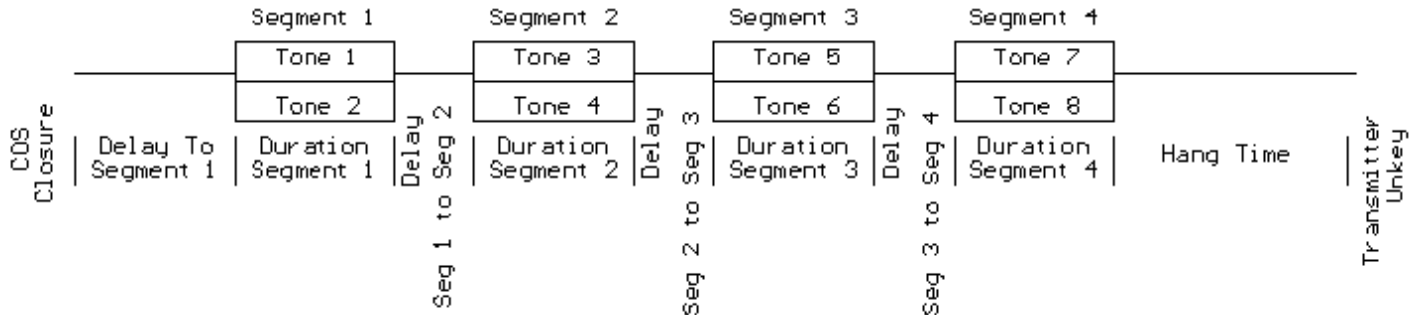
Delay time from the end of the 2nd tone segment

A 3rd tone segment

Delay time from the end of the 3rd segment

A 4th tone segment

To program the courtesy tones, the following command is used. Each of the 4 segments have their own programming code.



***31CT** Delay to segment 1 * duration of segment 1 * Tone 1 * Tone 2 *

***32CT** Delay to segment 2 * duration of segment 2 * Tone 3 * Tone 4 *

***33CT** Delay to segment 3 * duration of segment 3 * Tone 5 * Tone 6 *

***34CT** Delay to segment 4 * duration of segment 4 * Tone 7 * Tone 8 *

CT refers to the courtesy tone set you wish to program and is entered as 01, 02, 03 and so on, up to 10. The delay and duration parameters are in milliseconds (ms) and the tone parameters are in hertz (hz). The * separators must be used.

While each segment allows two tones to be programmed, you can zero out either one for single tones.

Examples:

Program Courtesy Tone 1 to a single 1000 hz tone, 75 ms long, that starts 100 ms after COS closure:

***3101 100 * 75 * 1000 * 0 ***

or

***3101 100 * 75 * 0 * 1000 ***

Both of the above are identical in function.

Program Courtesy Tone 2 for multiple segments.

Segment 1 - dual tones, 880 and 660 hz, 75 ms long, that start 100 ms after COS closure

Segment 2 - dual tones, 1000 and 880 hz, 50 ms long, that start 75 ms after segment one finishes

***3102 100 * 75 * 880 * 660 ***

***3202 75 * 50 * 1000 * 880 ***

You can erase any segment by entering null information for it. For example, to completely erase Courtesy Tone 3, segment 3, you can enter

***3303 ***

Using A DVR Track Or Vocabulary As A Courtesy Tone

You may program a Courtesy Tone to use a Message Macro instead of tones. By simply programming Segment 1 Tone 1 to a value of 1 – 40 (representing Message Macro 1 – 40), you will cause that Courtesy Tone to use that Message Macro. Note that when you program a Courtesy Tone in this manner, only Tone 1's value must contain data. The rest may be left blank:

Examples:

Courtesy Tone 1 to use Message Macro 1:

***3101 * 1 * * ***

Courtesy Tone 4 to use Message Macro 10:

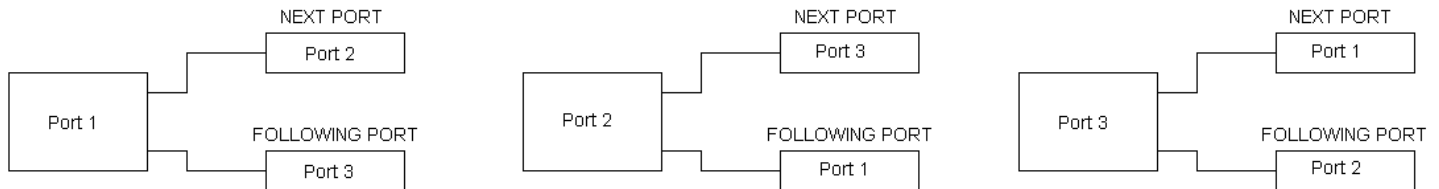
***3104 * 10 * * ***

Courtesy Tone 9 to use Message Macro 32:

***3109 * 32 * * ***

Courtesy Tone Behavior When Ports Are Linked

When one or more ports are linked together, additional Courtesy Tones are sent to allow easy identification of the signal heard. For example, if you have Ports 1 and 2 linked and you're currently talking on Port 1, you'll hear an additional Courtesy Tone whenever someone unkeys on Port 2. The Courtesy Tones that are used to indicate that a signal has come from a linked-to Port are called "Next" and "Following" and the relationship can be visualized as follows:



Next Port

If your currently used Port is 1, the Next Port is 2
If your currently used Port is 2, the Next Port is 3
If your currently used Port is 3, the Next Port is 1

Following Port

If your currently used Port is 1, the Following Port is 3
If your currently used Port is 2, the Following Port is 1
If your currently used Port is 3, the Following Port is 2

By default, each Port's "Next" Courtesy Tone is that Port's #9 and the "Following" one is #10. You can change which Courtesy Tone is used for these however by the appropriate Macro Function as shown in the Macro Function List (see Functions 630 through 689).

For example, Port 1 is linked to Port 2 and a signal arrives on Port 2's receiver. From our list above, we see that Port 2 is Port 1's "next" Port, so Port 1's Courtesy Tone #9 will be sent whenever the signal on Port 2's receive disappears.

Programming Meter Faces - 10-bit A/D Converters

The command syntax is:

2064 C * M* X1* Y1* X2* Y2 C= Channel 1 to 8 M=Meter Type 0 to 6 X1, Y1, X2, Y2 represent two calibration points. There must be 6 parameters entered to define a meter face, each value ending with *.

There are 8 meter faces corresponding to the 8 Analog inputs, with each meter face programmed with 1 of 6 values. The programming command consists the **input port**, meter **face type (name)**, and **4 values** representing:

- The low sensed voltage appearing on an input (X1)
- The low meter face reading (Y1)
- The high sensed voltage appearing on an input (X2)
- The high meter face reading (Y2)

Each meter face is calibrated with two *points* to define the sensor you wish to use on that channel. To clear a meter face, simply enter the input port number, then 0 for the meter face name and 4 more 0s, separated by a # sign, to complete the 6 values needed to define a meter face.

A "Meter Face" is an imaginary software meter that is defined by selecting which of the 8 analog inputs you will use, what kind of measurement is being made (volts, amps, etc.) and two data points on the meter. While this may seem confusing at first, the advantage of this method is that it allows you complete flexibility in scaling a particular meter face to the voltage actually being measured. The definable meter faces are:

- 0 Meter OFF
- 1 Volts
- 2 Amps
- 3 Watts
- 4 Degrees
- 5 MPH
- 6 Percent

Note: The calibration data (X1, Y1, X2, Y2) is the actual data that you have measured multiplied 100 and rounded off to the nearest whole number. The controller divides your input values by 100 to reestablish the decimal point.

Wattmeter example: If the output of your wattmeter produces 0.25 volts for 10 watts and 2.1 volts for 40 watts you would multiply each of the calibration values by 100 before you enter them:

.25 x 100 = 25	←Low voltage actually appearing on the ADC pin (X1)
10 X 100 = 1000	←Low meter face reading (Y1)
2.1 x 100 = 210	←High voltage actually appearing on the ADC pin (X2)
40 x 100 = 4000	←High meter face reading (Y2)

We wish to use ADC channel 6 for the Watt meter sensor (meter face 3) using the above calibration data, so we would program:

2064 6* 3* 25* 1000* 210* 4000

Voltmeter example: You want to use ADC channel 4 for a Voltmeter (Meter face 1) and you have a sensor that produces 0 volts when the voltage is 0, and it produces 2.5 vdc when the actual dc voltage is 20 volts. Multiplying the sensor and actual data by 100 and rounding produces X1=0 Y1=0 X2=250 Y2=2000. To define this meter, you would enter the following program codes:

2064 4* 1* 0* 0* 250* 2000

Notice that the same programming code (*2064) is used to setup each of the 8 ADC inputs.

Percent (Quieting) Meter Example: You want to assign ADC port 2 to Percent Quieting. You have a sensor that measures FM discriminator "noise" by rectifying it (similar to the way an S-meter works on FM). More noise means less quieting. You notice full quieting (100 percent) produces about 0.2 volts on the sensor, and no signal on the input (Zero percent) produces about 1.84 volts on the sensor. X1=0 Y1=100% X2=1.84 Y2=0%. To define this "Percent quieting" meter on ADC port 2 with these values you enter:

2064 2* 6* 20* 10000* 184* 0

If someone with a full quieting signal accesses this meter, it might say "95 percent" or some reasonable indication of high quieting. **Data Entry Limits:** Physical values must be between -327 and +327 AND the difference between High and Low cannot exceed 327. A range of 0 to 327 is okay, or -150 to +150. Also, calibration points should be in the range of actual expected meter readings.

Programming Meter Alarms

Each of the Meters has a high and low alarm *trippoint*. Once programmed, when a meter reading reaches either of these points, a Command Macro will be run. For example, a meterface can be defined to read temperature from an external sensor. If the measured temperature exceeds the programmed high level, a Macro will be run. If the temperature drops below the programmed low limit, a Macro will be run. Of course the same Macro can be programmed for both the high and low points but different macros will generally be used for each trippoint. The format for programming a meter alarm is:

***2066 alarm number * meter number * alarmtype * trippoint * macro to run ***

There are 8 meter alarms, 1 through 8

Meter Number is 1 through 8 (for the ADC channels)

AlarmType determines the action taken by that alarm:

- 1 - Low Alarm
- 2 - High Alarm

Trip point is the value to use for the high or low setting, multiplied by 100 and rounded to the nearest whole value. In our example above, we defined the meterface to measure temperatures from -35 to +150 degrees. We want our high trippoint to be set to +100 degrees, so we take "100" and multiply by 100 which gives us "10000". This is the number we enter for the trippoint value. If we want to enter a negative value for the trip point (for example, -10 degrees), we simply preface the calculated value with a DTMF "A". For example, we want to set the low trip point to -10 degrees. $-10 \times 100 = -1000$, so we would enter "A1000" for the trippoint value.

Macro to run is the Command Macro we want to be executed when our alarm trips.

A Practical Example

Let's say that we have a temperature sensor connected to Meter Input 1. We also have the PA power control line connected to Logic Output 5. Once our meterface is programmed (as shown in the Programming Meter Faces section above), we want to program a Meter Alarm to put the PA into its low power mode when the sensed temperature rises above 135 degrees. Since our PA control line requires that it be pulled to ground in order to enter low power mode, we need to turn ON the appropriate logic output and we'll use Command Macro 22 for this. And since this is our first Meter Alarm definition, we'll use Meter Alarm 1.

First, we program Macro 22 to turn on Logic Output 1

***4002 22 * 95**

Now we program the Meter Alarm itself

***2066 1 * 1 * 2 * 13500 * 22 ***

Now, if the sensed temperature rises above 135 degrees, the PA control line will be pulled low. Of course, we'd like a way to put the PA back into high power mode once the temperature drops back down to a safe temperature. We decide that once the PA temperature falls back down to 80 degrees, it is safe to put it back into high power mode. We'll use Meter Alarm 2 and use Macro 23 to turn Logic Output 1 back off.

We program Macro 23 to turn Logic Output 1 off

***4002 22 * 100**

Program the Meter Alarm:

***2066 2 * 1 * 1 * 8000 * 23 ***

When the sensed temperature falls below 80 degrees, the PA will be put back into high power mode.

The Differences Between Accuracy And Precision

It is easy to become confused when the issues of precision and accuracy are raised. Let's take a few minutes to understand what these terms mean in relation to the RC210. The RC210 can provide accurate measurements good to 3 decimal places of precision, if you take the time to setup the inputs correctly. It might help to explain accuracy and precision to understand how to improve both:

Accuracy - The ability of a measurement to match the actual value of that which is being measured. For example, if you measure 3.32 volts, knowing the voltage you're measuring is actually 3.32 volts. The RC210 has a built-in reference voltage of 2.56 volts that is supposed to be accurate. You can also provide an external reference voltage. The accuracy of the reference voltage, V_{ref} , is the major factor in determining the overall accuracy of the A/D conversion process.

Precision - The number of significant digits to which a value has been reliably measured. The precision of the RC210 is dependent on the 10-bit A/D converter. With 10-bits, the A/D device can distinguish among 1024 separate values in the input, from 0 volts to V_{ref} , which is roughly about 5 volts). If your sensor puts out 0 volts at the lowest expected level of the quantity it is measuring, and V_{ref} (5.00 volts for example) at the highest expected level of the quantity you are measuring, you will have all 10 bits of precision available to measure the physical quantity.

The next major issue in getting precise measurements is the characteristics of the sensor you use (design, buy, etc.) and how well it matches the A/D converter measurement range (0 to V_{ref}) when measuring physical quantities.

Suppose you want to measure 0 to 100 watts with a sensor and feed the sensor voltage to the controller to read back watts. You have a sensor to monitor the power of your repeater transmitter. You have measured the output of your sensor while measuring the power output on a calibrated watt meter and record the following values

At 0 watts the sensor produces 0.1 volts
At 100 watts the sensor produces 0.6 volts

As you can see, this is a small range of sensor voltage output -- only 0.5 volts. If V_{ref} is 5 vdc, this is using only 10.0% of the full range of the A/D input. Therefore, only 10.0% of the possible 1024 distinct measurement values is being used, or about 102 distinct measurement points. The range of Watts being measured is 100 watts. Dividing this 100 watts by the 102 points of resolution means the meter will be able to resolve about 1 watt per "division" which is not bad! However if you wanted more precise readings, find a sensor that produces a wider output voltage. For example, a sensor that produces 0.2 volts at 0 watts, and 4.2 volts at 100 watts. Now the sensor voltage range is 4 volts of the 5.0 vdc V_{ref} maximum. This is 80 percent of the 1024 points of resolution, or about 800 distinct measurement values. Now, for the same 100 watt range being measured, your improved sensor would now have a resolution of $(100 \text{ watts}) / (800 \text{ divisions}) = 0.125 \text{ watts per "division"}$. As you can see, a sensor that uses more of the V_{ref} voltage range increases the precision of your measurement.

In conclusion, the RC210 can resolve a sensor voltage change of as small as $V_{ref} / 1024$. However, as you can see from the above example, the resolution of the physical "thing" being measured is directly affected by the behavior of the sensor. For best results, try to find sensors that produce sensor output voltages between 0 and V_{ref} over the range of desired physical measurements. This isn't an absolute requirement to get useful and accurate readings, but it will help increase the precision of the measurements.

Programming the Reference Voltage Value for the A/D Converters

As it comes from the factory, the RC210 comes with the reference voltage value programmed to 5.00 volts. Since component tolerances obviously vary, you will want to measure the actual reference voltage of your RC210 and then program that value into the controller. **Note: This one reference voltage is used by all the A/D inputs. Setting it accurately will improve the measurement accuracy.**

How to measure the V_{ref} : Using a high impedance, precision voltmeter (a digital, not an analog one is recommended) and with power applied to the RC210, carefully measure the voltage at pin 21 of the I/O connector, J1. Write this voltage down - it is only necessary to include two decimal places). For example, if your meter displays "4.962", simply round it off to "4.96". Multiply this value by 100 as our value to enter as V_{ref} . The example below shows how to enter this measured V_{ref} .

*2065 4 9 6

Note: NEVER apply voltages higher than 20 volts to any A/D channel input. It is best to keep any input voltages at or below V_{ref} .

Measuring Voltages Higher Than Vref - A Practical Example

The first step is to decide what the range of actual voltages will be measured:

Suppose the Low end of expected actual voltage 10 volts, and the High end of the expected actual voltage is 18 volts

Since we realize that applying a voltage to the RC210 higher than the programmed reference voltage will "pin" the meter face, we need to "scale" the actual voltage. This can be accomplished using either a pair of resistors as a voltage divider, or a variable resistor to get just a portion of the 18 volts as the maximum value to connect to the ADC input. Using a 5-K pot would be a good choice.

What you want is to have the High end of voltage range (18 volts) to be less than Vref. If Vref is 5.00 volts, you might choose to set the resistor divider (or variable resistor) to produce 4.5 volts as the "sensor" voltage when the actual voltage is 18 volts.

If we look at the math, we see that 4.5 volts is 18 volts divided by 4 so the "sensor" needs to provide $\frac{1}{4}$ of the actual voltage. If the power supply is currently providing 13.8 volts, divide this by 4 to get 3.45 volts. If you are using a variable resistor (as shown in the Hardware Reference Manual), hookup your "sensor" to the battery, and adjust the pot to produce 3.45 volts on the wiper. This "sensor" will work fine with the ADC input. If the battery voltage ever gets to 18 volts, the wiper of the pot will see 4.5 volts, below the Vref of 5.0 volts, which is what is desired.

We then need to program the meter face used. For this example, we will use Meter 1 and assume the Voltage Reference Value has been left at the factory default of 5.00 volts:

2064 1* 1* 250* 1000* 450* 1800*

This programs Meter 1 to use the voltmeter meter face and tells the controller that when the sensor is 2.5 volts, this means the actual voltage is 10 volts, and when the sensor (ADC input) is 4.5 volts, the actual voltage is 18 volts. Note that each of the calibration points is the actual measured value multiplied by 100 then rounded to the nearest whole value. This is done because there is no "decimal" point on the DTMF pad, so the controller assumes that the "real" values are whatever you put in, divided by 100.

Using the above example, you should be able to accommodate just about any external sensor.

Alarm Programming

The RC210 incorporates 5 alarm inputs that can be used to remotely monitor such things as a door open, high temperature of the repeater PA, etc. Each Input responds to a logic level change, such as going from high-to-low and low-to high (this is known as rising and falling edge triggering). When enabled (and triggered), each transition will call its own macro to execute.

For example, you could connect Alarm 1 to an over-temperature switch on the repeater's PA heatsink that closes to ground. You could then program a Macro that turns one of the Logic Outputs on (or off as needed) to select high/low power on the transmitter and speak a message to let you know. Once the PA cools down to the point that the over-temperature switch opens again, the Alarm would run a different Macro, place the repeater back into high power and speak another message to let you know.

Or perhaps you want to connect a weather receiver with S.A.M.E. alerts at the repeater. You simply connect the receiver's S.A.M.E. decoder output to an Alarm Input and program a Macro to play a short message (perhaps "Weather Alert") and also turn on the Aux Audio Input to which you have the weather receiver's audio connected. When NOAA sends a S.A.M.E. Alert, you'll be automatically notified and hear their broadcast.

Programming Which Macro To Use With An Alarm

As explained earlier, each Alarm Input responds to a change of voltage on its input. For example, if the voltage goes from +5 volts to ground (this is called "*falling*"), that will trigger the Alarm and call a Macro. If the voltage goes from ground to +5 volts (this is called "*rising*"), that will call a different Macro. As you can see, this allows for great flexibility

To program which Macro should be called for a *falling* transition:

***2101 <Alarm #> <Macro #>**

To program which Macro should be called for a *rising* transition:

***2102 <Alarm #> <Macro #>**

Examples:

***2101 1 10** Falling Alarm 1 calls Macro 10

***2102 5 2** Rising Alarm 5 calls Macro 2

Updating The Firmware

The RC210 was designed with ease of firmware upgrades in mind. This allows it to be easily upgraded in the field as new firmware versions are released.

All that is needed to upload updates to the RC210 is a computer running Windows© Win98/NT/XP/2000/Win 7/Win 8 and a serial cable (and adapter).

Downloading And Installing The Required Software On Your Computer

The programming software may be downloaded at our web site:

<http://www.arcomcontrollers.com/index.php/firmware-downloads/updater/updater-for-new-cpu>

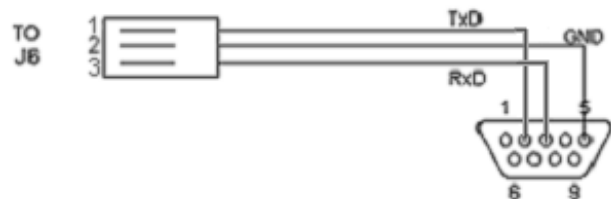
Once downloaded, simply run the setup program to install the Arcom Updater program on your computer.

Programming Cable

In addition to the software and a standard serial cable, you will also need an adapter that allows connection to the RC210 (note that these connections are not "standard", in that Rxd and Txd are reversed. This is by design and allows you to use a straight through serial cable between your computer and the RC210 without the need for a null modem adapter)

DB9 Pin 3 Pin Header Pin J6

2	1 (Txd)
3	3 (Rxd)
5	2 Gnd



Note: If you purchased the RC210R Rack Mount Enclosure, you already have a DB25 Programming Connector installed and you may disregard the above.

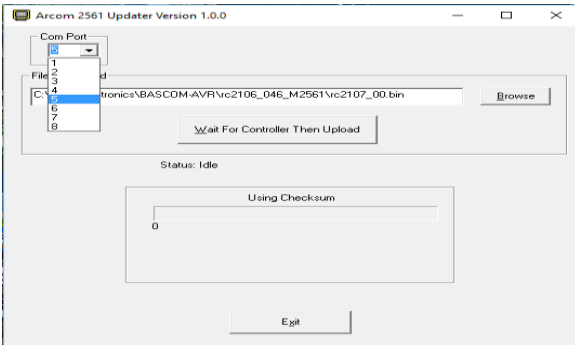
Note: If your computer does not have a standard comport (as many today do not), you will need a USB to serial converter, available through many sources. Arcom recommends one based on the FTDI chipset and not the Prolific chipset.

Downloading Firmware Updates

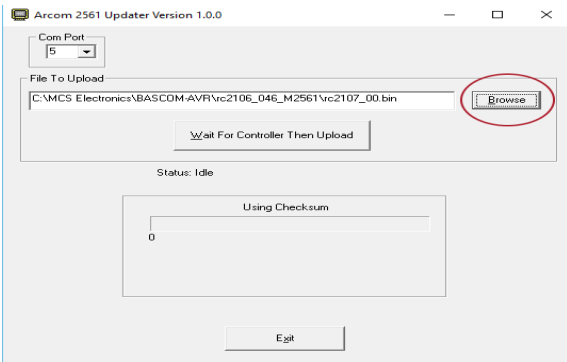
Once you've installed the program on your computer and have the programming cable, you'll need to download the firmware update from our website:

<http://www.arcomcontrollers.com/index.php/firmware-downloads/rc210-m2561-new-cpu-firmware-downloads>

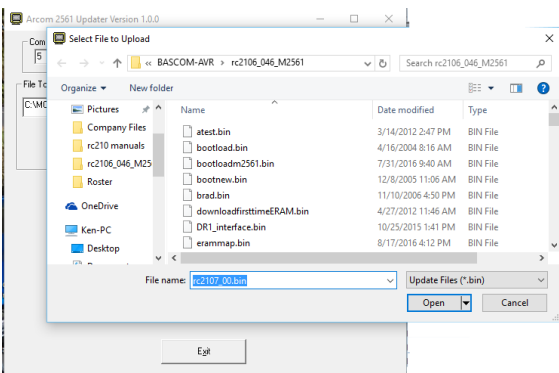
Running Updater For The First Time



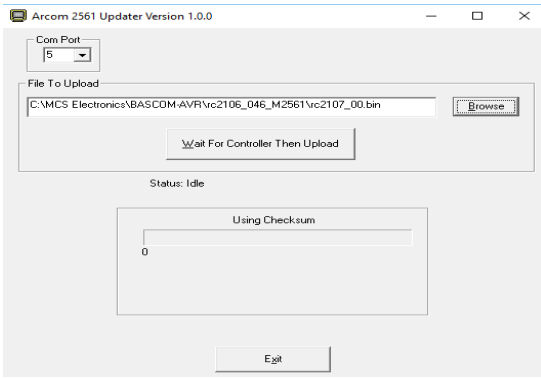
The first time you run Updater, you need to select which com port on your computer you wish to use. Simply make your selection from the drop down menu. After you select this, Updater will remember which port you selected.



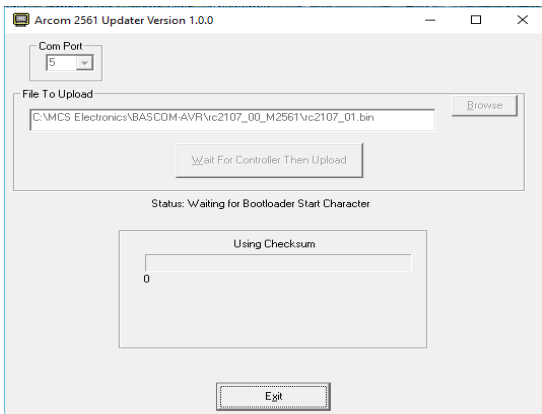
You now need to tell Updater where the update file you want to load is located. Click the Browse button and the usual Windows file window will appear.



Chose the path and filename where you unzipped the update file and click Open

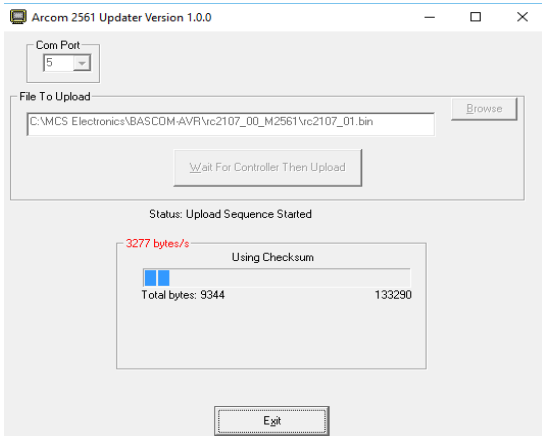


You are now ready to actually upload the update into your RC210. Make sure one end of your serial cable is plugged into the correct com port on your computer and the other end is plugged into the RC210's serial connect (via the adapter cable). Click the Wait for Controller Then Upload button

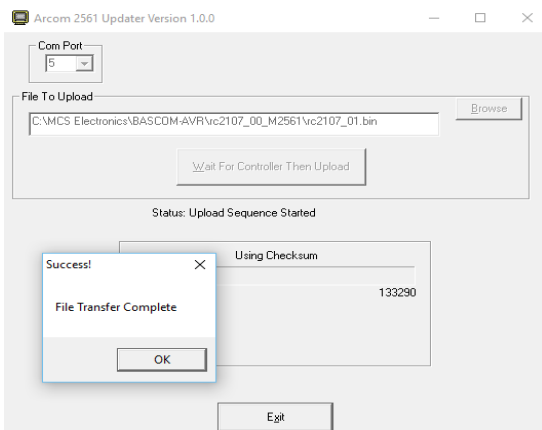


You'll notice the Status Line will now display that it is waiting for the Bootloader. The Upload should automatically start within 5 to 10 seconds but if it doesn't, you might need to power from your RC210 and reapply it to start the upload.

NOTE: It is very important that you reapply power "cleanly". This is to say that simply unplugging the power connector and reconnecting it will probably not work properly and you'll receive an error. If at all possible, turn off the power supply, wait a second or two, and turn it back on instead



Updater will now automatically start the upload. Notice the Status Line changes to Upload Sequence started and you can watch the progress of the upload in the box below



When the upload is complete, Updater will notify you and the RC210 should start on its own. Click OK the Exit to close Updater. You are all done!

Appendix A

Frequency Agile Radios Supported

Kenwood - All model radios with a computer port to allow control of radio, such as TS-2000, TS-570, etc.

Kenwood - mobiles TM-V7A, TM-G707A, TM-271A, TM-281a, TM-v71a, TM-D701

Elecraft - All models with a computer port

Yaesu - FT-817, FT-847, FT-857, FT-897, FT100D, FTDX1200, FTDX3000

Icom - IC706MKIlg, IC-746, IC-756, All IC-7xxxx series bases and mobiles

Doug Hall RBI-1 Remote Base Radio Interface

Factory Default Programming Values

When you first receive your RC210, the following values are programmed as default:

Port Specific

Carrier/PL Access	Carrier squelch All Ports
Hang time	Port 1 – 5/5/5 seconds. Ports 2 & 3 – 0/0/0 seconds
Timeout	180 seconds All Ports
Cw Tone	Port 1 - 600 Hz. Ports 2 & 3 - 800 Hz
CW Speed	20 wpm All Ports
Monitor Mix	Yes All Ports
Port Enabled	Yes All Ports
Link to other Ports	OFF All Ports
Repeat Mode	Port 1 - Repeat, Ports 2 & 3 - Non-Repeat
Port Enabled	Yes All Ports
Receiver Enabled	Yes All Ports
DTMF Covertone	ON All Ports
Courtesy Tone	# 1 All Ports
DTMF Mute	ON All Ports
Speech Override	ON All Ports
Speech ID Override	ON All Ports

Global

Logic Output 1 - 7	Open (inactive)	Port 1 Unlock Code	15281
Alarm 1 - 5	Disabled	Port 2 Unlock Code	25281
Auxiliary Audio Inputs	OFF	Port 3 Unlock Code	35281
Analog Meter Inputs	None defined	Lock Code	#
Command Macros	None programmed	DTMF Terminator	D
Macro Recall Codes	10901 – 109090 (10901-1090105)	Autopatch HangUp	C0
Remote Base Type	Kenwood Serial Type	Autopatch Dial	C1
Fan Turn Off Time	5 minutes	Autopatch AutoDial	C2
Yaesu DR1x Startup	OFF	Autopatch Timer Extend	C3
Remote Base Prefix	A7		
Say Year	ON		
RTC Correction Factor	None		

Appendix B

CTCSS Codes

Kenwood (All except TM-271/281/v71a)

Yaesu (note: for FT-847, see manual for correct CTCSS codes)

#	Freq	#	Freq	#	Freq	#	Freq	#	Freq	#	Freq	#	Freq	#	Freq
01	67.0	11	97.4	21	136.5	31	192.8	01	67.0	11	94.8	21	131.8	31	186.2
02	71.9	12	100.0	22	141.3	32	203.5	02	69.3	12	97.4	22	136.5	32	192.8
03	74.4	13	103.5	23	146.2	33	210.7	03	71.9	13	100.0	23	141.3	33	203.5
04	77.0	14	107.2	24	151.4	34	218.1	04	74.4	14	103.5	24	146.2	34	210.7
05	79.7	15	110.9	25	156.7	35	225.7	05	77.0	15	107.2	25	151.4	35	218.1
06	82.5	16	114.8	26	162.2	36	233.6	06	79.7	16	110.9	26	156.7	36	225.7
07	85.4	17	118.8	27	167.9	37	241.8	07	82.5	17	114.8	27	162.2	37	233.6
08	88.5	18	123.0	28	173.8	38	250.3	08	85.4	18	118.8	28	167.9	38	241.8
09	91.5	19	127.3	29	179.9			09	88.5	19	123.0	29	173.8	39	250.3
10	94.8	20	131.8	30	186.2			10	91.5	20	127.3	30	179.9		

Icom (note: not all Icom radios support remote CTCSS selection or they require direct frequency access of CTCSS tones instead of codes. Check your operating manual)

Kenwood TM-271/281/v71a

#	Freq	#	Freq	#	Freq	#	Freq	#	Freq	#	Freq	#	Freq	#	Freq
00	67.0	13	103.5	26	159.8	39	199.5	#	Freq	#	Freq	#	Freq	#	Freq
01	69.3	14	107.2	27	162.2	40	203.5	00	67.0	12	100.0	24	151.4	36	225.7
02	71.9	15	110.9	28	165.5	41	206.5	01	69.3	13	103.5	25	156.7	37	229.1
03	74.4	16	114.8	29	167.9	42	210.7	02	71.9	14	107.2	26	162.2	38	233.6
04	77.0	17	118.8	30	171.3	43	218.1	03	74.4	15	110.9	27	167.9	39	241.8
05	79.7	18	123.0	31	173.8	44	225.7	04	77.0	16	114.8	28	173.8	40	250.3
06	82.5	19	127.3	32	177.3	45	229.1	05	79.7	17	118.8	29	179.9	41	254.1
07	85.4	20	131.8	33	179.9	46	233.6	06	82.5	18	123.0	30	186.2		
08	88.5	21	136.5	34	183.5	47	241.8	07	85.4	19	127.3	31	192.8		
09	91.5	22	141.3	35	186.2	48	250.3	08	88.5	20	131.8	32	203.5		
10	94.8	23	146.2	36	189.9	49	254.1	09	91.5	21	136.5	33	206.5		
11	97.4	24	151.5	37	192.8			10	94.8	22	141.3	34	210.7		
12	100.0	25	156.7	38	196.6			11	97.4	23	146.2	35	218.1		

Appendix C

Default Factory Command Codes

These are the "Factory default" codes when the RC210 is unlocked:

15281	Port 1 Unlock	1180	Port 1 Speech ID Over Off	1700	Say Time
25281	Port 2 Unlock	2180	Port 2 Speech ID Over Off	1701	Say Date
35281	Port 3 Unlock	3180	Port 3 Speech ID Over Off		
1100	Port 1 Receiver Disable	1181	Port 1 Speech ID Over On	18yx	UF1(y) to UF8(y) x=ON/OFF
2100	Port 2 Receiver Disable	2181	Port 2 Speech ID Over On	180	UF Extended
3100	Port 3 Receiver Disable	3181	Port 3 Speech ID Over On		
1101	Port 1 Receiver Enable	1190	Port 1 Monitor Mute	A71	Remote Base Frequency
2101	Port 2 Receiver Enable	2190	Port 2 Monitor Mute	A72	Remote Base CTCSS
3101	Port 3 Receiver Enable	3190	Port 3 Monitor Mute	A73	Remote Base Mode
				A74	Doug Hall User Function
1110	Port 1 Transmitter Disable	1191	Port 1 Monitor Mix	A75x	Memory Select
2110	Port 2 Transmitter Disable	2191	Port 2 Monitor Mix	A76x	Doug Hall Memory Select
3110	Port 3 Transmitter Disable	3191	Port 3 Monitor Mix	A77xy	V7a/G707 Memory Recall
				A79x	RB Power Select
1111	Port 1 Transmitter Enable	1200	Port 1 Speech Over Off	1910	Alarm 1 Off
2111	Port 2 Transmitter Enable	2200	Port 2 Speech Over Off	1911	Alarm 1 On
3111	Port 3 Transmitter Enable	3200	Port 3 Speech Over Off	2910	Alarm 2 Off
				2911	Alarm 2 On
1120	Port 1 Carrier Only Access	1201	Port 1 Speech Over On	3910	Alarm 3 Off
2120	Port 2 Carrier Only Access	2201	Port 2 Speech Over On	3911	Alarm 3 On
3120	Port 3 Carrier Only Access	2201	Port 3 Speech Over On	4910	Alarm 4 Off
				4911	Alarm 4 On
1121	Port 1 CTCSS/Carrier Access	1210	Port 1 DTMF Mute Off	5910	Alarm 5 Off
2121	Port 2 CTCSS/Carrier Access	2210	Port 2 DTMF Mute Off	5911	Alarm 5 On
3121	Port 3 CTCSS/Carrier Access	3210	Port 3 DTMF Mute Off		
				1913	Alarm 1 Interrogate
1130	Port 1 Covertone Off	1211	Port 1 DTMF Mute On	2913	Alarm 2 Interrogate
2130	Port 2 Covertone Off	2211	Port 2 DTMF Mute On	3913	Alarm 3 Interrogate
3130	Port 3 Covertone Off	3211	Port 3 DTMF Mute On	4913	Alarm 4 Interrogate
				5913	Alarm 5 Interrogate
1131	Port 1 Covertone On	1220	Port 1 DTMF on COS	A11	Link Port 1 & Port 2
2131	Port 2 Covertone On	2220	Port 2 DTMF on COS	A21	Link Port 1 & Port 3
3131	Port 3 Covertone On	3220	Port 3 DTMF on COS	A31	Link Port 2 & Port 3
				A41	Link All Ports
1134x	Port 1 CT Select	1221	Port 1 DTMF on CTCSS	A10	UnLink Port 1 & Port 2
2134x	Port 2 CT Select	2221	Port 2 DTMF on CTCSS	A20	UnLink Port 1 & Port 3
3134x	Port 3 CT Select	3221	Port 3 DTMF on CTCSS	A30	UnLink Port 2 & Port 3
				A40	Unlink All Ports
1140	Port 1 Repeat OFF	1300	Monitor Port 2 From Port 1 Off	1960	Aux Audio 1 Off
2140	Port 2 Repeat OFF	1301	Monitor Port 2 From Port 1 On	1961	Aux Audio 1 On
3140	Port 3 Repeat OFF	1310	Monitor Port 3 From Port 1 Off	2960	Aux Audio 2 Off
		1311	Monitor Port 3 From Port 1 On	2961	Aux Audio 2 On
1141	Port 1 Repeat ON	2300	Monitor Port 1 From Port 2 Off	3960	Aux Audio 3 Off
2141	Port 2 Repeat ON	2301	Monitor Port 1 From Port 2 On	3961	Aux Audio 3 On
3141	Port 3 Repeat ON	2310	Monitor Port 3 From Port 2 Off		
		2311	Monitor Port 3 From Port 2 On		
1150	Port 1 Kerchunk Off	3300	Monitor Port 1 From Port 3 Off	AA1	Play CW ID 1
2150	Port 2 Kerchunk Off	3301	Monitor Port 1 From Port 3 On	AA2	Play CWID 2
3150	Port 3 Kerchunk Off	3310	Monitor Port 2 From Port 3 Off	AA3	Play Initial Voice ID 1
		3311	Monitor Port 2 From Port 3 On	AA4	Play Initial Voice ID 2
1151	Port 1 Kerchunk On			AA5	Play Initial Voice ID 3
2151	Port 2 Kerchunk On	1400x	Read Meter	AA6	Play Pending Voice ID 1
3151	Port 3 Kerchunk On	1500x	Reset Meter hi/low value	AA7	Play Pending Voice ID 2
		1600x	Meter Alarm ON/OFF	AA8	Play Pending Voice ID 3
1160	Port 1 DTMF Disable	1401	Interrogate Port 1 Link Status		
2160	Port 2 DTMF Disable	1402	Interrogate Port 2 Link Status	10901 to 109090	Recall Macro 1 to 90
3160	Port 3 DTMF Disable	1403	Interrogate Port 3 Link Status		
1161	Port 1 DTMF Enable				
2161	Port 2 DTMF Enable	2700	Allow DTMF into Phone Line		
3161	Port 3 DTMF Enable	2701	Mute DTMF into Phone Line		
1170	Port 1 no PL for DTMF				
2170	Port 2 no PL for DTMF				
3170	Port 3 no PL for DTMF				
1171	Port 1 PL for DTMF	2800	Macro Subset OFF	109091 to 1090105	Recall Macro 91 to 105
2171	Port 2 PL for DTMF	2801	Macro Subset ON		
3171	Port 3 PL for DTMF				

If Version 3.5 or later pc board or External EEPROM installed on older board:

109091 to 1090105
Recall Macro 91 to 105

Programming Commands Quick Reference

<u>Code</u>	<u>What It Programs</u>	<u>What It Means</u>
*1000yx	Program Transmitter Hang Timer 1, 2 or 3	Programs the Hang Timer 1, 2 or 3 for the currently unlocked Port
*1001	Program Time Out Timer	Programs the Timeout Timer for the currently unlocked Port
*1002	Program Initial ID Period	Programs the Initial ID Timer for the currently unlocked Port
*1003	Program Pending ID Period	Programs the Pending ID Timer for the currently unlocked Port
*1004	Program Fan Time	Programs the length of time the Fan will remain on after xmtr drop
*1005	Program Port Activity Timer	Programs the Link Inactivity Timer for the currently unlocked Port
*1006	Program DTMF Mute Timer	Programs the DTMF Mute Timer for the currently unlocked Port
*1007	Program CTCSS Encode Timer	Programs the CTCSS Encode Timer for the currently unlocked Port
*1008	Program Kerchunk Timer Timeout	Programs how long until the Kerchunk Timer times out
*1013	Program Aux Audio 1 Time Out Timer	Programs how long Aux Audio 1 remains ON
*1014	Program Aux Audio 2 Time Out Timer	Programs how long Aux Audio 2 remains ON
*1015	Program Aux Audio 3 Time Out Timer	Programs how long Aux Audio 3 remains ON
*1017xy	Program General Timer Period	Programs the General Timers timeout period
*1018	Program the Kerchunk Filter Delay Period	Programs the Kerchunk filtering time on the currently unlocked Port
*1019	Set Pending ID Speak Timer	Controls how Pending ID Voice/CW IDs are processed
*1020	Set Announce Timer	Sets how long Tail Message will play after repeater activity stops
*1021	Set CTCSS Encode Control Polarity	Sets whether the Encode Control Line is active high or active low
*1022	Set Speech/CW Delay	Sets wait time before speech or CW if xmtr not currently active
*1024	Set AutoPatch Timeout	Sets the autopatch timeout period.
*1025x	Set Autopatch Number of Rings	Sets how many rings before the Autopatch answers
*2050xx	Program Command Macro Recall Code	Programs the code used to recall remapped Command Macros
*2051x	Program Linked Ports Timeout	Programs whether a linked Port will timeout from another Port
*2060	Program Remote Base Prefix	Programs the Prefix prepended to default Remote Base commands
*2052	Program Autopatch Hangup Code	Programs the Code to hang up the autopatch
*2053	Program Autopatch OffHook Code	Programs the Code to take autopatch OFFHOOK and optionally dial
*2054	Program Autopatch Autodial Code	Programs the Code to dial Autodial numbers 1 - 200
*2055	Program Autopatch Time Extend Code	Programs the Code used to extend Autopatch Timeout Timer
*2056	Program Autopatch Blacklist	Programs numbers to disallow from manually dialing
*2057	Program Autopatch Security Code	Programs the code that must be entered when Autopatch answers
*2064	Program A/D Channel	Programs the channel and meter face
*2065	Program Vref	Programs the voltage reference used for A/D measurements
*2066	Program Meter Alarm	Programs the high and low trip points for the Meter Alarms
*2083	Set Radio Type	Select which type of radio is used as a Remote Base
*2084	Set Yaesu Type	If Yaesu is selected, select which type format to use
*2086	Store Remote Base Memory	Store Remote Base frequency, CTCSS and offset in <i>controller's</i> non-volatile memory
*2087	Store Kenwood V7/G707 Memory	Store memory in radio itself
*2088x	Select CTCSS -COS or Courtesy Tone	Select CTCSS encode timer after COS or after Courtesy Tone
*2089x	CTCSS During ID	1 = CTCSS During ID. 0 = no CTCSS During ID
*2090x	TT Mute on 1st or 2nd Digit	1 = 1st Digit, 2 = 2nd Digit
*2091x	Allow/Don't allow Terminator Speech	Select if speech is generated even with Terminator. 1 = yes, 0 = no
*2092xy	General Timer Macro Select	Selects which Command Macro a General Timer uses
*2093x	User DTMF Pad Test Prefix	Program the prefix used for the DTMF Pad Test (1 - 5 digits)
*2101	Program Falling Alarm Macro	Selects which Macro to run on a High-to-low transition
*2102	Program Rising Alarm Macro	Selects which Macro to run on a Low-to-high transition
*2103	Program Message Macros	Program the messages using in Message Macros
*2104	DTMF Regen Prefix	Programs the prefix to use to send regenerated DTMF to a Port
*2105	Program DTMF Memory	Programs the DTMF sequence to be sent
*2106	Program Send DTMF Duration	Programs the duration of transmitted DTMF digits
*2107	Program DTMF Pause Time	Programs the period between transmitted DTMF digits
*2108x	Program Pre Access Code	Programs whether all codes while unlocked use a prefix
*2109x	Program Pre Command Code	Programs whether there is access to default command when locked
*2110x	Program Tail Message	Programs a Tail Message for the currently unlocked Port
*2111x	Select Tail Message	Selects Tail Message 1, 2 or 3 for the currently unlocked Port
*2112x	Select Tail Counter	Sets the Tail Message Counter (0 to 254) 0 turns the counter OFF
*2113yxx	Program Receiver Macro Function	Program Receiver Active/Inactive Macro Function
*2114x	Port Inactivity Timeout Macro Select	Select which Macro to run when a linked Port Timeout occurs
*2115x	Autopatch Autodial Number Store	Stores Autopatch Autodial numbers for automatic dialing
*2116x	Autopatch Port Restrictions	Programs which port(s) the Autopatch may be used from
*2117x	User DTMF Out Port	Programs which port(s) User DTMF should be sent to.
*2118x	User DTMF Message Program	Programs which Message Macro is spoken before DTMF sent
*2119x	Controls why fan starts	0= start for all xmtr activity 1=start only for valid signal/AP/Aux Aud
*2121x	ID Timers start on COS or PTT	ID Timers start on COS or PTT on the currently Unlocked Port
*2122x	Timeout Timer Reset Select	Selects the point where the Timeout Timer is reset
*2123x	Select Wind Direction Read back	Selects either degrees or compass heading for Wind Direction
*2124x	Select DR1x/DR2x Startup Mode	Select to delay startup to allow DR1x/DR2x to fully boot

Programming Commands Quick Reference (continued)

<u>Code</u>	<u>What It Programs</u>	<u>What It Means</u>
*212599x	Select Tx Timer in Hours or Minutes	Select how Active TX Time is stored
*212699	Amount of active TX time	Readback time currently Unlocked Port's TX has been active
*212799	Reset TX Activity Timer	Resets currently Unlocked Port's TX Activity Timer to 0
*212899	Readback TX Keyup Counter	Readback the number of times the currently Unlocked Port has been keyed
*212999	Reset TX Counter	Reset currently Unlocked Port's TX Keyup Counter
*21999	Reset Controller	Reset the controller
*2130x yy	Program High and Low Trippoints	Programs the Trippoints for the RSSI report
*2131xmmw	Program DayLight Savings START & STOP times	Programs when DayLight Savings (DST) should start and end
*2132x	Program the DST Changeover hour	Programs to change DST status at 1 or 2 AM
*2133x	SET or UNSET the DST Flag	Tells the controller if DST is currently in effect or not
*2135x	Voice Responses ON or OFF	Select whether voice response or generic CW command acknowledgment
*29999	Say Version	Speak the Firmware version currently loaded
*31CTx	Program Courtesy Tone Segment 1	Program Courtesy Tone x Segment 1
*32CTx	Program Courtesy Tone Segment 2	Program Courtesy Tone x Segment 2
*33CTx	Program Courtesy Tone Segment 3	Program Courtesy Tone x Segment 3
*34CTx	Program Courtesy Tone Segment 4	Program Courtesy Tone x Segment 4
*4001	Program Scheduler	Program the Scheduler to run automated events
*4002	Program A Macro	Program a series of functions into one macro command or remap
*4003x	Erase A Specific Command Macro	Erase a previously stored Command Macro by Macro Number
*400499	Erase All Command Macros	Erase ALL Command Macros
*4005	Program Command Macro Port Restrictions	Select which Ports a Command Macro can be called from
*400699	Erase All Command Macro Port Restrictions	Allows all Command Macros to be called from all Ports
*400799	Clear All Setpoints	Erases all programmed Scheduler Setpoints
*4008 x	Readback Macro Contents	Reads back the contents of Macro x
*4009x	Program Macro Subset	Programs the range of Macros to use in Macro Subset
*4010xx	Interrogate Scheduler Setpoint	Determine if a Setpoint is set to RESUME or SUSPEND
*5100	Set Time	Sets the Real Time Clock
*5101	Set Date	Sets the Calendar
*5102x	Say/Don't say year as part of date	Enables/disables readback of the year when the date is spoken
*5103x	Select RTC 12/24 hour Readback	Select Real Time Clock 12/24 hour Readback
*5104x	Say Hours On/Off	Say "Hours" as part of 24 hour Readback. 1= ON, 0=OFF
*5105x	Bump Clock Seconds	Adds or subtracts x seconds from clock time (to allow "fine tuning")
*7001x	Record DVR Message	Record a DVR Track x = Track 1 to 20
*7002x	Erase DVR Message	Erase a DVR Track x = Track 1 to 20
*7003x	Erase ALL DVR Messages	Erases all DVR Tracks 1 to 20
*7004x	Remove last segment of DVR Message	Remove the last 200 ms. of Track 1 to 20
*7005x	Replace last segment of DVR Message	Replace the last 200 ms. of Track 1 to 20
*7006x	Recall Seconds Left	Tells you the remaining recording time available
*8000	Program CW Speed	Programs CW Speed of the currently unlocked Port
*8001	Program CW Tone	Programs the CW Tone(s) frequency of the currently unlocked Port
*8002	Program CW ID 1	Programs the CW Message used for CW ID 1
*8003	Program CW ID 2	Programs the CW Message used for CW ID 2
*8004xyyy	Program Voice ID 1	Programs the message used for either Initial or Pending Voice ID 1
*8005xyyy	Program Voice ID 2	Programs the message used for either Initial or Pending Voice ID 2
*8006xyyy	Program Voice ID 3	Programs the message used for either Initial or Pending Voice ID 3
*8007	Program ID Extras	Programs the Extra message for Voice IDs
*8008x	Enable Voice IDs	Enables/Disables Voice IDs: 1 = Enabled, 0 = Disabled
*8009x	Constant ID Enable	Enables/Disables Constant IDs regardless of activity
*9000	Program Unlock Code	Programs the Unlock Code for the currently unlocked Port
*9010x	Program Lock Code	Programs the code to lock ALL ports
*9020x	Program DTMF Terminator	Programs the DTMF digit used to force command evaluation

Resetting Lock Codes

Should you ever need to reset your unlock codes back to the factory defaults, you will need our RCP Software.

Vocabulary List

000	ZERO	059	ALERT	118	FROM
001	ONE	060	ALL	119	FULL
002	TWO	061	AMATEUR	120	GET
003	THREE	062	AMPS	121	GO
004	FOUR	063	AND	122	GOOD
005	FIVE	064	ANSWER	123	HAM
006	SIX	065	APRIL	124	HELLO
007	SEVEN	066	ASSOCIATION	125	HELP
008	EIGHT	067	AT	126	HERTZ
009	NINE	068	AUGUST	127	HIGH
010	TEN	069	AUTO	128	HOLD
011	ELEVEN	070	AUTOMATIC	129	HOUR
012	TWELVE	071	AUXILARY	130	INTERNET
013	THIRTEEN	072	AVERAGE	131	INTRUDER
014	FOURTEEN	073	A.M.	132	IS
015	FIFTEEN	074	BAND	133	JANUARY
016	SIXTEEN	075	BASE	134	JULY
017	SEVENTEEN	076	BATTERY	135	JUNE
018	EIGHTEEN	077	BELOW	136	LEFT
019	NINETEEN	078	BUSY	137	LIGHT
020	TWENTY	079	BY	138	LINE
021	THIRTY	080	CALIBRATE	139	LINK
022	FOURTY	081	CALL	140	LOCK
023	FIFTY	082	CANCEL	141	LOW
024	SIXTY	083	CARRIER	142	MANUAL
025	SEVENTY	084	CAUTION	143	MARCH
026	EIGHTY	085	CHANGE	144	MAXIMUM
027	NINETY	086	CHECK	145	MAY
028	HUNDRED	087	CLEAR	146	MEETING
029	THOUSAND	088	CLOCK	147	MEGA
030	A	089	CODE	148	MESSAGES
031	B	090	COMPLETE	149	METER
032	C	091	COMPUTER	150	MILES PER HOUR
033	D	092	CONNECT	151	MINIMUM
034	E	093	CONNECTED	152	MINUS
035	F	094	CONTROL	153	MINUTES
036	G	095	CONTROLLER	154	MIX
037	H	096	CURRENT	155	MONDAY
038	I	097	DANGER	156	MONITOR
039	J	098	DATE	157	MORNING
040	K	099	DAY	158	MUTE
041	L	100	DECEMBER	159	NEGATIVE
042	M	101	DEGREES	160	NET
043	N	102	DEVIATION	161	NIGHT
044	O	103	DIRECTION	162	NO
045	P	104	DISCONNECTED	163	NORTH
046	Q	105	DOWN	164	NOT
047	R	106	EAST	165	NOVEMBER
048	S	107	ECHO	166	NUMBER
049	T	108	EMERGENCY	167	OCLOCK
050	U	109	ENTER	168	OCTOBER
051	V	110	EQUAL	169	OF
052	W	111	ERROR	170	OFF
053	X	112	EVENING	171	ON
054	Y	113	FAILURE	172	OPERATOR
055	Z	114	FEBRUARY	173	OUT
056	ABOVE	115	FEET	174	OVER
057	ACTIVE	116	FREQUENCY	175	PATCH
058	AFTERNOON	117	FRIDAY	176	PERCENT

177	PHONE	236	DVR TRACK 1
178	PLEASE	237	DVR TRACK 2
179	PLUS	238	DVR TRACK 3
180	POINT	239	DVR TRACK 4
181	PORT	240	DVR TRACK 5
182	POWER	241	DVR TRACK 6
183	PROGRAM	242	DVR TRACK 7
184	P.M.	243	DVR TRACK 8
185	RADIO	244	DVR TRACK 9
186	READY	245	DVR TRACK 10
187	RECEIVE	246	DVR TRACK 11
188	REMOTE	247	DVR TRACK 12
189	REPEAT	248	DVR TRACK 13
190	REPEATER	249	DVR TRACK 14
191	SATURDAY	250	DVR TRACK 15
192	SECONDS	251	DVR TRACK 16
193	SELECT	252	DVR TRACK 17
194	SEPTEMBER	253	DVR TRACK 18
195	SET	254	DVR TRACK 19
196	SKYWARN	255	DVR TRACK 20
197	SOUTH		
198	SQUELCH		
199	START		
200	STOP		
201	SUNDAY		
202	SYSTEM		
203	TEMPERATURE		
204	THANK YOU		
205	THE (long)		
206	THE (short)		
207	THE TIME IS		
208	THIS		
209	THURSDAY		
210	TIME		
211	TIMEOUT		
212	TIMER		
213	TODAY		
214	TOMORROW		
215	tone		
216	TONIGHT		
217	TRANSMIT		
218	TUESDAY		
219	UNDER		
220	UP		
221	USE (noun)		
222	USE (verb)		
223	VOLTAGE		
224	VOLTS		
225	WAIT		
226	WARNING		
227	WATTS		
228	WEATHER		
229	WEDNESDAY		
230	WELCOME		
231	WEST		
232	YESTERDAY		
233	ZULU		
234	S (makes plural)		
235	SILENCE (pause)		

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