

Implemented Command List for SRS Controller

Code Version srs0112

April 22, 2012

Basic System Management

Code	Operation	Comments
C000 (u)	Reset processor	
C001	Code version	Returns the code version
C002 (u)	Repeater off	Disables all transmitters and processing commands from radio ports. Serial port still active.
C003 (u)	Repeater on	Inverse of C002 & only cmd recognized after C002 [] – command requires unlock code, but is otherwise always allowed.
C004 (u)	Clear reset counters	Sets the reset counters to zero
C005	Reset counter status	Returns reset counts (# resets since *C004). Eight values are returned. 1: total resets 2: command timeout resets (should not happen, probably caused by telemetry or ID not detected as complete – maybe an i2c bus hangup) 3: interrupts off resets (should not happen – never seen in testing) 4: power on resets 5: C000 forced resets 6: watchdog timer resets (whole program hung). (should not happen) 7: i2c/RCB hangup resets. 2 minute timeout; can be induced/tested by pulling RCB with power on. The master clear reset (button on the CPU card) and stack overflow reset increment only the total resets (master clear only happens if you physically push the button; stack overflow should not happen, it would be a serious program bug) 8: brownout resets. The is incremented only if a power on reset does not happen at the same time
C006 (u)	Exit safe mode	This command is obsolete for software versions 0090 and later. In earlier code versions, safe mode was a protected condition that the controller put itself into if it detected too many processor resets, in which the hard coded defaults were loaded and parameter save to eeprom is disabled. It was discovered that many legitimate resets (manually induced during configuration, or automatically

		when site power glitches) could force the controller to go into this condition when it shouldn't, so safe mode will never be entered.
C007 (u)	Nradios status	Returns recognized number of radio cards
C010 (u)	Boot CRC	Returns CRC values determined at last configuration reset (first boot after programming CPU card processor, or first boot at eeprom valid byte reset, C100). The first value in the program ROM CRC, the second is the configuration parameter CRC in eeprom, the third is the macro table CRC in eeprom. This can be used to determine if the processor was properly programmed and if the default values were properly restored by the program
C011 (u)	Program CRC	Returns the current program ROM CRC. This takes about 7 seconds to execute.
C012 (u)	Eeprom parameter CRC	Returns the CRC of the current parameter space in the eeprom
C013 (u)	Eeprom macro CRC	Returns the CRC of the current macro storage area in eeprom
C014 (u)	Radio card program CRC	Computes the CRC of the program ROM in one radio card. Syntax is C014r, where r is the physical port number of the radio card. This several seconds to execute.
C015 (u)	Radio card CRC status	Returns the last computed value of the radio card CRC. Syntax is C015r. R is the physical port number.
C016 (u)	Return main loop processing time	Returns statistics on the time required to go around the main loop once since the previous time this command was called. Five values are returned: the number of times the loop has taken 10, 50, 100, and 1 second, respectively; and the maximum time through the loop, in units of 5 ms. This command clears these timers.
C017 (u)	Return never used stack space	Returns number of bytes of stack space that have never been used (really just number of continuous bytes at the end of the stack which are 0). Useful for verifying that the CPU card program is not overrunning the C software stack.
C021 (u)	Radio card software version	Returns the version string for one radio card. Syntax is C021r. r is the physical port number.
C100 (su0)	Force default configuration load on next processor reset.	Sets serial eeprom valid byte to 0, invalidating the eeprom. New eeprom values will be loaded from the hard coded defaults on the next reset. BEWARE – this command will wipe out all configuration changes made to the controller,

		including setting the ID, levels, etc. Avoiding the accidental executing of this command is one reason to NOT use the super unlock code 0 on a routine basis. This does reset all unlock codes, including setting unlock code 0 to 138065
C101 (u)	Eeprom valid status	Tells if the eeprom contains valid data. This should normally return VALID, as it is fixed with the first eeprom write on the first boot after code load. It will return INVALID following successful execution of the C100 command and before the processor is reset. It is useful primarily for debugging
C102 (u)	Configuration backup	The system configuration is stored in a serial eeprom external to the main processor on the CPU board. The serial eeprom has space for 3 copies of the configuration parameters, including the table of macros. They are designated the working set, backup set, and deep backup set. This command copies the working set to the backup set. It should be used after changes are made to the controller configuration and are verified to be working properly. Note that all of the configuration backup and restore commands check for a correct eeprom valid status byte in the set to be copied before starting the copy. This command should be issued after any unlock code changes are made; a configuration restore will restore all unlock codes except unlock code 0.
C103 (u)	Configuration restore	Restore configuration from backup set to working set. Most controller operations use values of working parameters stored in RAM on the CPU and Radio Control board processors. To make the restored parameters active, a processor reset (C000) should be done after using this command. This will restore all unlock codes except unlock code 0. Note that this means that someone with an ordinary unlock code can cause unlock codes, included super unlock code #1 to revert to previous values. The means that C102 MUST be executed after changing unlock code #1, and it is recommended that it be issued after changing any unlock code.
C104 (su)	Deep configuration backup	Copy backup configuration set to the deep backup set. This command should be used after the configuration backup command after a new configuration has been thoroughly tested.

C105 (su)	Deep configuration restore	Copy deep backup configuration set to working set. Notice that this is NOT the inverse of the deep backup command which copies from the backup set to the deep backup set. This is changed from version of the program prior to 0094d. This will restore all unlock codes, except unlock code 0.
C106 (u)	Set eeprom byte	Sets a byte in the configuration eeprom. The syntax is *C106aaaBnnnD. The address in eeprom is aaa, and the decimal value (0..255) to which it is to be set is nnn. Valid addresses are 0 ... EEPROMLASTADR (13823). In addition, value within the password table, the radio type bytes and the super disabled mask byte cannot be set with this command. Use this to set parameters for which there is no explicit set command.
C108 (u)	Set eeprom word	Sets a 16 bit unsigned word in the configuration eeprom. Syntax is *C108aaaBnnnnnD. Valid addresses are as for C106.
C10A(su)	Set eeprom bytes	Sets multiple sequential bytes in the configuration eeprom. Syntax is *C10AaaaBnnnBnnnBnnn...D. The eeprom starting address is specified by aaa, and the byte values (in decimal) to be written to each byte are specified by nnn. There is currently an 80 character limit to the sequence aaaBnnnB....D, and up to 16 bytes can be specified with each call to this command. This command is super unlock code protected so that it cannot be used to set unlock codes using only an unlock code. Valid address ranges are 0 ... EEPROMLASTADR (13823) and EEPROMSCRATCH (41504) ... 65535. Nothing will be returned if the address is out of range. The super unlock code 0 will not be written, even if it is in the specified address range.
C107 (u)	Get eeprom byte	Returns one byte from eeprom as decimal. Syntax is *C107aaaaD. Valid addresses are as for C106.
C109 (u)	Get eeprom word	Returns one word from eeprom as decimal. Syntax is *C109aaaaD. Valid addresss are as for C106.
C10B (su)	Get eeprom bytes	Returns multiple sequential bytes in the configuration eeprom, as decimal numbers. Syntax is *C10BaaaBnnD, where aaa is the starting address, and nn is the number of bytes to be read, up to 16. If the super unlock code 0 addresses are contained in the address range, they will be returned as 0. Otherwise, the valid address range is the same as for C10B.

C10C (su)	Get macro command table	Copies macro command table to serial eeprom, starting at address 41505. The number 12 is written to eeprom address 41504 to confirm that the macro table was copied. Each command table entry is 9 bytes. The first 6 bytes contain a null terminated command name, the next two bytes contains the command index to be executed (macros are 0x5000+macro number), and the last byte is the command permission, usually 0 for macros, where the permission is in the macro.
C10D (su)	Set macro command table	Writes macro command table from serial eeprom back to program memory (from where it is used). Checks for 12 in eeprom address 41504 before executing.
C110 (su)	Set unlock code	Sets unlock code for enabling locked commands. This command requires a super unlock code (code #0 or #1). The unlock code number is returned in the telemetry if successful. No checking is done for conflicts with commands, so be careful that a command is not the same as the unlock code or is contained in the leading characters of the unlock code. The lowest index blank unlock code is set. Syntax is *C110sssssD. Up to 6 characters can be used (recommended). The terminating D is required. The unlock code characters can be 0..9, ABCD. D is not allowed as the first parameter. Characters A..D are entered by preceding with A. Without the A, B is a space (invalid), C clears the input, and D is the terminator for the command. For example, to make A123 as an unlock code, enter *C110AA123D. Note that the configuration restore command, C103 will restore a previously stored set of unlock codes (except unlock #0), and this command does not require a super unlock code to execute. Therefore, it is important to do a C102 configuration save after changing unlock codes, particularly after changing unlock code #1.
C111 (su)	Delete unlock code	Deletes the matching unlock code. This command requires a super unlock code. Unlock code #0 cannot be deleted with this command. The unlock code index is returned if successful. Syntax is *C111sssssD. Returns "no" if no match is found.
C112 (su)	Delete unlock code index	Deletes a specific unlock code number. This command requires a super unlock code. Unlock code number 0 cannot be deleted. Confirms if an unlock code is deleted. Does not confirm if index

		is out of range, or no unlock code currently exists at the specified index. Syntax is *C112nnD. There is space for 20 unlock codes, with index 0..19.
C113 (u)	Check unlock code	Returns the index of a matched unlock code. Returns “no” if there is no match. Syntax is *C113sssssD. Returns the index of the first empty unlock code slot if a zero length code is tested.
C114	Set unlock code 0 (no radio control cards)	Sets unlock code 0. No unlock code is required, but all radio control cards must be removed from the controller first. Syntax is *C114sssssD. []
C115 (su0)	Set unlock code 0	Sets unlock code 0. Requires unlock code 0 to be used to unlock the controller first. Syntax is *C115sssssD.

Basic Configuration

C116 (u) S116	Set ID	<p>Sets the primary ID string. Syntax is *C116c1c1c2c2c3c3c4c4...D. Each character in the string is defined by two dtmf keys. ‘2’ is specified by “20”, ‘A’ is specified by “21”, ‘B’ by “22”, etc. The complete character translation table is included following this command table. If the *C116 command is used from the serial port, spaces may be inserted between characters for clarity (eg. *C116 c1c1 c2c2...<CR></p> <p>The S116 version is designed to be used via the RS232 port. It takes the characters directly. All spaces are included. Return terminates the string. ! escapes. For example, *S116 kj6k <CR> sets the ID to “ kj6k “. This command does not download the new ID to the radio cards. Issue a processor reset (C000) to do this. One or two leading spaces should be included with the ID to give the transmitter enough time to come up before the CW starts; there is no delay in the program. The ID strings can be up to 19 characters long.</p>
C117 (u)	Get ID	Returns the primary ID string
C118 (u) S118	Set ID2	Sets the secondary ID string. This is used by radios for which the secondary ID flag bit is set.
C119 (u)	Get ID2	Returns the secondary ID string
C120 (u) S120	Set prefix	Sets the prefix string. Syntax is the same as for Set ID. Beware that only 0..9, A..D, and # can be used. The prefix can be up to 4 characters long.
C121 (u)	Get prefix	Returns the prefix
C122 (u) S122	Set location string	Sets the location string. Syntax is the same as for Set ID. The location strings can be up to 9

		characters long.
C123 (u)	Get location	Returns the location string
C124 (u) S124	Set location string 2	Sets the secondary location string. Syntax is the same as for Set ID. This location string will be appended to the ID for ports with the append location flag bit set (default is not set).
C125 (u)	Get location 2	Returns location string 2
C126 (u) S126 (u)	Set link name	Sets the link name for one port. This is transmitted in the link status response along with the link number and status. Syntax is as for set macro below, with the first character defining the logical port number (link map applied). The maximum length for the name string is 6 characters.

Macro Configuration

C130 (u) S130 (u)	Set macro	Defines a macro. C130 is for dtmf input, S130 is for rs232 input. Syntax is *C130c1c2c2, where the syntax is as for set ID, except the first few characters must define the macro number, followed by a space. Note that the each digit of the macro number is entered via a 2 character sequence, just as the characters of the macro itself. For example, to set macro number 56 to C3311 (turn on port 1), use C1305060012330301010D. For S130, syntax is *S130nnn ssssssss<CR>. For example, to set macro number 56 to C3311, use S13056 C3311<CR>. The macro can be up to 30 characters long.
C131 (u)	Get macro	Returns the macro string. Syntax is *C131mD, where m is the macro number.
C132 (u)	Set macro permission	Syntax *C132mBpD, where m is the macro number is p is the permission byte
C133 (u)	Get macro permission	Returns the macro permission byte. Syntax is *C133mD.
C134 (u)	Turn off macro tel mute	Turns off the muting of function complete during macros. Reset by remote normal or site normal.
C135	Macro site normal telemetry	Macros normally send the function complete telemetry associated with the last command in the macro when the macro exits. This command forces that telemetry to be the site normal telemetry if placed last in the macro. This command is useful if the group normal command, C307, is to be used as the site normal command. The command does nothing outside of a macro.
C136	Macro function complete	If placed last in a macro, this command forces

	telemetry	function complete telemetry at macro end. This is useful if a configuration command is implemented by the macro, and it is desirable for the telemetry to be function complete instead. This command does nothing outside of a macro.
C137	Macro configuration complete telemetry	If placed last in a macro, this command forces configuration complete telemetry at the macro end. This command does nothing outside of a macro.
C138	No macro complete telemetry	If placed last in a macro, the macro will not issue function complete telemetry when it completes. This is useful if the macro calls a status command followed by a command which normally returns a function complete. In that case, it might be preferred that only the CW status be returned. This command does nothing outside of a macro.

Miscellaneous Configuration

C139 (u)	Set cw wpm	Sets the CW wpm for command telemetry
C13A (u)	Send PARIS 8 times	Used to measure WPM. PARIS is 1 word
C140 (u)	Set real time clock date	Syntax is C140 yyyy mm dd w. The year must be a complete 4 digit year. W is the numerical day of the week, from 1..7, with Sunday=1. Spaces or B may be used between parameters.
C141 (u)	Set real time clock time	Syntax is C141 hh mm ss. The hours are in 24 hour (0..23) syntax.
C142 (u)	Get real time clock date	Returns date as yyyy.mm.dd ww. Ww is the day of the week, as a two letter abbreviation.
C143 (u)	Get real time clock time	Returns time is 24 hour format as hh:mm:ss. The CW response delivers the : as a space.

Complex Configuration – Port Setup

C200 (u)	Set link map	Sets the link map which maps the logical port number to the physical port number. Syntax is *C200p0p1p2...D, where p0 is the physical port number (0..7) that will be recognized as port 0, p1 is the physical port number recognized as port 1, etc. Any ports not listed will be assigned in increasing order following the last one specified. If there is a local repeater port, the first one should be logical and physical port 0 – not absolutely required, some of the commands which treat the lower numbered physical port which is a local radio as the primary repeater port will may not send telemetry to the correct port if this is not done.
C201 (su)	Set local radios	Sets the port types. Syntax is *C201r1r2...D,

C202	Set link radios	<p>where r1r2... is a list of physical ports from 0 to 7. For example *C2010D sets the first port (physical port 0 as the only local repeater port), and *C2021234567D would set all of the other ports as link ports. Any conflicts between these commands are resolved as the command is entered, in favor of values specified in that command. The receive signal detect qualification and unqualification delays for each radio are set to the respective normal values for the radio type. The PL/COR required state is set to the defaults for the radio type. Be very careful in using these commands remotely. The change takes place immediately and a mistake can make it difficult to control the system. Sets all group linked values for ports changed by this command to default values (linked for local and link ports, not linked for remote base and irlp ports). Simplex link ports can be defined by setting corresponding bits in the simplexlinkports configuration variable. This forces short link delay for that port if and only if it is a link or voip link port. Be aware that simplexlinkports is not reset by the C202 command.</p>
C203	Set remote base radios	
C204	Set irlp port	
C205	Set voip link port	

Complex Configuration – Group Setup and Operation

C210 (u)	Define group	Sets a group membership. Syntax is *C210gr1r2r3D, where g is the group number (0..4), and r1, r2, ... are port numbers (linkmap applied). Does not affect the port linked/unlinked normal behavior.
C211 (u)	Define group linked	Sets the group members which are linked by default. Syntax is *C211gr1r2r3D, where g is the group number (0..4), and r1, r2, ... are port numbers (linkmap applied). Ports which are not listed in r1r2... will be normally link off. The C2180 and C2181 commands are better to use than this one in most circumstances.
C212 (u)	Create linked group	Used to create a temporary group to link groups together. Syntax is *C212rrrrrD, where each r is a digit from 0 to 7 used to list the radios in the group. Local, link and irlp port types are link on by default; remote base ports are link off. Radio types do not change. Linkmap translation is applied. The group number for this temporary group is group 4. This does not save to eeprom, so

		it reset when the processor is reset. It is also reset by site normal, C300, and restore groups, C213
C213 (u)	Restore groups	Restore the configuration to the programmed group configuration. Used to undo C212.
C214 (u)	Set current group	Explicitly set the current group. Syntax is C214n, where n is the new current group number
C215 (u)	Set current group, radio	Explicitly set the current group to the one to which the specified port is a member. Syntax is C215n, where n is a port number. Linkmap is applied.
C216 (u)	Reset current group	Sets the current group to the normal value (group containing the command source).
C217 (u)	Append to linked group	Used to temporarily append to a specific link group. Syntax is *C217grrrrD, where g is the group number (0..4), and each r is a digit from 0 to 7 used to list the ports in the group. Local, link, and irlp port types are added to the group with link on by default; remote base ports are link off. Linkmap translation is applied. Ports not listed in the command stay in the group they were previously in. This does not save to eeprom, so it reset when the processor is reset. It is also reset by site normal, C300, and restore groups, C213
C2180 C2181(u)	Set port normal unlinked Set port normal linked	Used to set the normal linked state of a port across all groups. Syntax is C2180r or C2181r, where r is the logical port number.

Audio Amplitude and Deviation Calibration

C219 (u)	Turn on test tone	Turns a 1 kHz tone on and off for test purposes. Syntax is *C219r, where r is the physical port of the radio (0..8, where 8 is the cpu card).
C220 (u)	Turn off test tone	Turns off the test tone from C219. Syntax is *C220r, as for C219.
C221 (u)	Set the test tone frequency	Sets the test tone frequency. Syntax is *C221ffffD, where ffff is the frequency in Hz. The value must be less than 4500 Hz. The default value is 1000 Hz, and is reset whenever the processor is reset. This value is not written to eeprom and is therefore not retained across resets.
C222 (u)	Set the test tone amplitude	Sets the test tone amplitude. Syntax is *C222aaaD, where aaa is the amplitude, from 0..255. The default value is 127, and is reset whenever the processor is reset. The test tones are not pre-emphasized, even when the pre-emphasis configuration bit (preempflg) is set (the default), so a given amplitude corresponds to approximately the same deviation for all frequencies. As a note,

		CW is also not preemphasized. This should be considered in setting the CW telemetry amplitude configuration parameters.
C223 (u)	Set radio pot	Sets one radio pot value. Syntax is *C223rpv, where r is the physical port (0..8, where 8 is the cpu card), p is the pot (0..3), and v is the value (0..255). See the schematics for pot function. The CPU telemetry pot is #3. The Radio receive, transmit, and telemetry pots are 2, 1, and 3, respectively.
C224 (u)	Set radio pot interactive	Sets the value of one pot, interactively. Syntax is *C224rp....D, where r is the physical port (0..8, where 8 is the cpu card), p is the pot (0..3), and is a sequence of keystrokes to interactively set the pot value. 1 and 7 increment and decrement the pot value by 1. 2 sets the pot value to 255, 5 sets the pot value to 127, 8 sets the pot value to 0, 3 and 9 increment and decrement the pot values by 10, respectively. D saves the value, * escapes and returns the value to what it was before entering this command.

Telemetry Configuration

C225 (u)	Set teltolocal=0	Command telemetry goes only to source. Responsiveness to RS232 serial port commands is much faster if CW telemetry is turned off while entering commands from the serial port. This command should normally be invoked before configuration via the serial port for that reason.
C226 (u)	Set teltolocal=1	Command telemetry goes to local (and source). This is the default.
C227 (u)	Set radio normal behavior	Set radio specific rcvqdelays, rcvunqdelays, and qualification mask, based on normal values. Use after changing one of these variables, before making any specific radio changes
C229 (u)	Send test telemetry	Sends sound sequence from sound library. Syntax is C229nnnD, where nnn is the index of the sound sequence in the sound library. The tone amplitude is the same as that set for the test tone via command, C222.
C22A (u)	Set serial port telemetry options	Sets the configuration variable, serialoptions (EEPROM address 822). Syntax is C22AnnnD, where nnn is the options value. Bits: 0: enable unlock entry confirmation 1: enable all command telemetry to serial port 2: enable DTMF entry streaming

		<p>3: enable receive/transmit status streaming</p> <p>4: enable port status streaming</p> <p>5: direct streaming to serial port #2</p> <p>6: enable DTMF streaming while commands are active (during parameter entry).</p> <p>Bit 0 enables “ok” confirmation on entering an unlock code from the serial port</p> <p>Bit 1 enables all command telemetry to be repeated to the serial port.</p> <p>Bit 2 enables all DTMF input to be repeated to the serial port. For bit 2 set, each DTMF character detected will send the sequence <p:c>, where p is the port number and c is the DTMF character.</p> <p>Bit 3 enables receive and transmit active state streaming. The format is [hh hh hh hh hh]<CR><LF>, where hh is a 2 digit hex number with each bit representing the state of a corresponding port. The states streamed are COR, PL, qualified receive, DTMF active, and PTT. [01 01 01 00 ff] would be sent if port 0 receive is active and all transmitters are active. This is sent every 100 seconds and whenever the state changes.</p> <p>Bit 4 enables port connection state streaming. The format is {hh hh hh hh hh hh}<CR><LF>, where hh is a 2 digit hex number with each bit representing the state of a corresponding port. The states streamed are link on/off, loopback, disabled, sudisabled, split group, and interfaced, respectively. This is sent every 100 seconds and whenever a command is executed.</p> <p>Command response telemetry is not surrounded by any bracket characters.</p> <p>This command does not write to eeprom, and will therefore be reset to the stored value on a reset.</p>
C230 (u) C231 C232 C233 C234 C235 C236	Set rrnlksnd Set rlnkintsnd Set rlnkcardelsnd Set rremmonsnd Set rremmonlsnd Set rrbasesnd Set rrbaselksnd	Set all radio specific sound parameters to the corresponding normal sound parameter (same names without the first r). Use after changing the normal parameters and before setting any radio specific exceptions. These commands read the normal sound parameters from eeprom (and set those values in RAM), so reset is only required after these commands, and not before.

Special Operations

C250 (u)	Turn on loopback	Turns on loopback (repeats input to output) for a specific port in the current group. Useful for
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		testing links. Syntax is *C250n, where n is a logical port number (linkmap applied).
C251 (u)	Turn off loopback	Turns off loopback for a specific port in the current group. Useful to turn off loopback on the local repeater when using loopback on a distant site. Syntax is *C251n, where n is a logical port number (linkmap applied)
C252	Loopback normal	Globally – all groups and ports – turns on loopback for local ports, turns off loopback for all other ports.
C253 (u)	Disable DTMF muting	Turns off DTMF muting for one port. Syntax is *C253n, where n is a logical port number (linkmap applied). Cancelled by C254, site and remote normals, and timeout. Behavior controlled by nomuteopt and nodtmfntos configuration variables.
C254 (u)	Cancel DTMF mute disable	Cancels C253 for all ports.
C260 (u)	Delay	Does nothing but delays for a while. Syntax is *C260nnnD, which nnn is the delay in increments of 5 ms. The maximum value for nnn is 255 (1.275 sec).
C296	Reset receive timeout	Resets received timeouts to re-enable receivers after timeout. Normally not required, as prefix will do the same thing. Always allowed so that commands can't be locked out if toopts is set incorrectly
C297 (u)	Reset transmit timeout	Resets all transmitter timeouts
C298 (u)	Force transmitter on	Keys up a specific transmitter. Syntax is *C298n, where n is the physical port number. This will timeout after 5 minutes, even if it is not reset with C299. This command is over-ridden, but not cancelled by C29A. The purpose of this command is for testing, primarily for setting audio levels.
C299	Cancel 298	Turns off force transmitter on. Syntax is *C299.
C29A(u)	Force transmitters off	Forces transmitters off. Syntax is *C29Ar1r2...D, where r1r2... is a sequence of port numbers. Linkmap is applied to the port numbers. This is reset by the "normal" commands and will timeout after 30 seconds. This command overrides C298, but does not cancel it (if 298 is issued first, then C29A, transmitter will go off; after C29B it will come on again). This command is for test purposes.
C29B	Cancel 29A	Turns off force transmitters off. Syntax is *C29B
C29C(u)	Turn off timeouts	Temporarily turns off receive and transmit

		timeouts, for all ports.
C29D(u)	Restore timeouts	Restores receive and transmit timeout masks from eeprom, for all ports (cancels C29C).
C2A0(u)	Command telemetry to links	Enable command telemetry to be sent to all local and link ports linked to the command source for one command following this one. Useful for macro to send ID out all of the ports with link on state.
C2B0(u)	Execute macro	Executes any macro. Syntax is C2B0nnn, where nnn is the macro number. This can be used to call a macro for which there is no command table entry pointing to it.

Operational Commands

C300 (u)	Site normal	Sets normal conditions for the entire controller (all groups). Sets PL on, sets link delay on, connects or disconnects (link on/off) ports according to their normal link state as defined in the group definitions (all on in the default configuration), resets loopback condition to local ports (repeaters) only, turns remote monitor modes off, disables remote base transmitters, executes remote normal (C303) function.
C301 (u)	Link normal	Operates on the current group only (the whole controller in the default configuration). Connects link ports according to their normal link state as defined in the group definitions (all on in the default configuration). Breaks the interface connection between the links and the remote ports (locals, remote base, IRLP). Disables remote base transmitters (use C380r to enable).
C302 (u)	Interface normal	Operates on the current group only (the whole controller in the default configuration). Connects link ports according to their normal link state as defined in the group definitions (all on in the default configuration). Connects the interface between the remote ports (locals, remote base, IRLP) and the link ports. Disables the remote base transmitters (enable with C380r). This can be used to reconnect the repeaters after a link normal (C301) command.
C303 (u)	Remote normal	Clears unlocked conditions (an unlock code will need to be reentered before executing subsequent commands which require an unlock code), turns off the force transmitter on test condition, turns off the test tones. Returns the remote ports (locals,

		remote base, IRLP) to their normal conditions (disables remote base).
C304 (u)	Link reset	Operates on the current group only (the whole controller in the default configuration). Connects link ports according to their normal link state as defined in the group definitions. Does not affect the interface connection between the link port and the remote ports (local, remote base, and IRLP). Turns off remote monitor if Inkrstdefs bit 2 is set (default is not set). Turns link delay on if Inkrstdefs bit 1 is set (default is set). Set link PL to normal state if Inkrstdefs bit 0 is set (default is set). Remote base transmitters disabled (can be subsequently enabled with C380r).
C305 (u)	Local reset	Connects the normally connected local ports in the current group. Does not changed the link on/off status of non-locals. Executes additional functions if corresponding bits are set in localnormdefs configuration parameter; bit 0: resets local PL on/off to normal values, bit 1: sets link carrier delay on. Both default to 0.
C306 (u)	Link reset flexible	Takes single byte options parameter to define command behavior, as for Inkrstdefs configuration parameter in C304. Syntax is C306o, where o is the option byte defined as Inkrstdefs is defined in C304, above. Always turns off remote base transmitters.
C307 (u)	Group normal	Same as site normal, but only operates on the current group.
C308 (u)	Break all links	Disconnects all ports in the current group.
C310 (u)	Force ID	Set ID timer to 0 on all radios in current group, thereby forcing 1064 Hz ID on all. Default for the *808 macro. Cactus manual says 808 should only go to local radios. Palomar manual says it goes to all but doesn't key up the link transmitters unless they already are (same as this implementation)
C311 (u)	Force local ID	Same as C310, but forces only all the local radios in the current group.
C312 (u)	Send ID	Sends ID as status: 800 Hz CW. Currently goes only back to command source radio. This includes the primary local radio if telto local=1 (the default) This can be preceded by the C2A0 command so that it is sent out all linked local and link ports for diagnostic purposes.
C313 (u)	Send location string	Returns the location string.
C320 (u)	440 off	Inverse of C321. Disables 440 repeat.

C321 (u)	440 on	Enables repeat (loopback) on the local from which the command comes, or the lowest logical radio in the same group as the source if it is a link, Connects the link if it was linked before. [plre] – command is not blocked if it comes from a local even if other conditions would block it.
C322 (u)	440 disconnect	Unlinks 440 from the rest of the group. Acts on the local from which the command comes, if it is a local, or the lowest logical radio in the same group as the command source if the source is a link.
C323 (u)	440 connect	Links 440 to the rest of the group.
C324 (u)	440 status	Provides on/off/disconnected status for local from which command comes, or lowest logical local in the same group as the command source if the source is a link.
C325 (u)	Kill specific path	This is used to create an asymmetric connection. Syntax is C325ft, where f is the from port and t is the to port (linkmap applied). The link path from port f to port t will be blocked even if link is on for both ports. This is not saved to eeprom and is reset by the normal command be default. In the unusual case where a one way path is desired for normal operation, a macros need to be modified or created to execute this command.
C326 (u)	Clear killed paths	This command cancels all killed paths set by the C325 command.
C330 (u)	Link off	Unlinks specific radio in current group. Syntax is *C330r, where r is the logical port number (linkmap is applied). This works with any port, including port 0, not just link ports.
C331 (u)	Link on	Links specific radio to all other linked radios in group. Link is mapped to radio number by linkmap. [plre] – command is allowed from a link that is off if it is to turn on the same link. Syntax is *C331r, as for C330. This works with any port, including port 0, not just link ports.
C332 (u)	Send link status	[plre] – command is allowed from a link that is off if it is to turn on the same link. Syntax is *C332r, as for C330. This works with any port, including port 0, not just link ports.
C333 (u)	Split group links	Syntax is C333r1r2..rnD. This command takes the ports r1..rn and links them together, leaving the other currently linked ports in the group linked as is. Link map is applied. If entered with no radio specified (C333D), or with an invalid parameter, it will clear the split link, rejoining the ports. This

		applies only to the current group. Consider an example in which a group contains a repeater on port 0, and links on port 1, 2, and 3, and all are initially linked together. Issuing C33303D will link the repeater and port 3, and unlink both from ports 1 and 2. Ports 1 and 2 will remain linked together. The original state is returned by issuing C333D. The split link condition is only reset by C333D, the break all links command, C308, or by the global site normal, C300. It should be appended to user macros for other “normal” commands if it is desired for those commands to reset this condition.
C334 (u)	Link delay off	Sets link delay off for link radios in current group.
C335 (u)	Link delay on	Sets link delay on for link radios in current group.
C3480(u)	Long link delay off	Configures long link carrier delay off for all ports.
C3481(u)	Long link delay active	Configures long link carrier delay for all link ports. See longxtoacts, xlongtoports, and xmittimeouts_xlong parameters.
C3482(u)	Long link delay specific ports	Syntax is C3482r1r2...D. Configure long carrier delay for specific ports. Linkmap is applied.
C3484(u)	Set long link delay time	Syntax is C3484ssssD. Sets the long link carrier delay time in seconds
C349 (u)	Link carrier delay status	Returns link carrier delay status for command port group. Responds with “LCD OFF/ON/LONG”
C336 (u)	This link off	Turns off the port from which the command is entered
C337 (u)	This link on	Turns on the port from which the command is entered [p]
C338 (u)	This link status	Returns link on/off status for the port from which the command is entered. [p]
C339 (u)	Send link status verbose	Returns complete link status, with L/R/P/RB to indicate link, repeater, irlp, or remote base port, followed by the logical port number, then the port name, if one has been assigned, then ON TO all logical port numbers to which it is linked, or OFF, or DIS and/or SUDIS, followed by CMDLO, if commands are locked out from this port. Syntax is C339r, where r is the logical port number. 0 is allowed. [plre].
C33A (u)	Send this link status verbose	As C338, with verbose status as for C339. [p]
C33B (u)	Remote to specific ports	Syntax is C333Br1r2...D. This is a higher level version of C333. It connects command source port, if it is a local, or the lowest numbered local port in the same group as the command source to

		the specified ports and all of the non-local ports in the remote side of the group, disconnecting from the other ports in the group. The connection will be made even if the interface is off via link normal. Specified ports will be turned on.
C33C	Interface off	Disconnects the remote ports from the link ports in the current group.
C33D	Interface on	Connects on-link remote ports to on-link link ports in the current group.
C340 (u)	Remote monitors off	Turns off remote monitor for the command source, with exception given above for remote monitor on. If the local port is in remmonl mode, then all remmonl ports in the group will have remmon cleared. If it is in remmon mode, remmon will be turned off for only that port.
C341 (u)	Remote monitors on	Turns on remote monitor for the command source port, if that is a local (repeater). Otherwise, turn remote monitor on for the lowest numbered logical port local in the group of which the source port is a member. If the command comes from the serial port, set remote monitor on for the lowest numbered local logical port in group 0.
C342 (u)	Remote monitor on with local link enabled	Turns on remote monitor for all of the currently linked local (repeater) ports in the same group as the command source. The local repeater ports remain fully linked to each other.
C344 (u)	Remote monitor off, port specified	Turns off remote monitor as if the command came from the specified port. Syntax is *C344n, where n is the logical port number
C345 (u)	Remote monitor on, port specified	Turns on remote monitor as if the command came from the specified port. Syntax is *C345n, where n is the logical port number.
C346 (u)	Remote monitor on with local link enabled, port specified	Turns on remote monitor with local link enabled as if the command source came from the specified port. Syntax is *C346n, where n is the logical port number.
C348-C349	Additional link carrier delay functions	See above, near C335
C350 (u)	COR mode	COR only required for local repeater (command source port if it is a repeater, lowest logical numbered repeater port in the same group as the command source if the source is a link port). [pe] – command is not blocked if coming from a local even if PL is on and missing.
C351 (u)	PL mode	PL required for local repeater (target port determined as for C350).

C352 (u)	Send PL status	Uses status of first local in group. [pe] – command is not blocked if coming from a local even if PL is on and missing.
C354 (u)	COR mode for specific port	Set COR only for a specific radio. This is not sticky, it will be reset on site normal or processor reset. Syntax is *C354r, where r is the port to change (link map is applied). [] – command always allowed.
C355 (u)	PL mode for specific port	Set PL required for a specific radio. This is not sticky, it will be reset on site normal or processor reset. Syntax is *C355r, where r is the port to change (link map is applied).
C35A (u)	PL only mode for specific port	Set PL only (no COR needed) for a specific ratio. This is not sticky, it will be reset on site normal or processor reset. Syntax is *C35Ar, where r is the port to change (link map is applied).
C356 (u)	Send PL status for specific port	Returns PL status for specific radio. Syntax is *C356r, where r is the port to change (link map is applied in versions after srsc0090e). [pe] – command is not blocked if coming from same port whose status it is requesting, even if PL is on and missing.
C357 (u)	Save PL mode for specific port	Save the PL/COR mode for specific radio to eeprom. Syntax is C357r, when r is the port number (link map is applied). After this command is executed, the current PL state for this port will be reloaded each time the processor is reset.
C358 (u)	Reset link PL mode to normal value	Reset the PL mode for all non-local radios in the current group to the eeprom stored normal values.
C359 (u)	Reset local PL mode to normal values	Reset the PL mode for all local radios in the current group to the eeprom stored normal values
C35B	all port PL status	Reports with PL rrrr ON or PL OFF. rrrr is a list of ports (link map applied) with PL required.

Lockout and Disabling Commands

C360 (u)	Disable specific port	Disable a radio. Syntax is C360n, where n is the port number, with link map applied. This command does not save the state to eeprom, so will be reset to its previously saved state on a processor reset. Use C363 to save it permanently. This command is designed to be allowed only in unlock or super unlock mode and therefore will work on any radio, independent of the radio's group. This command is designed stop operation of a port, and block commands from the port. The 440 off command uses this same function.
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C361 (u)	Enable a disabled port	Enable a radio. Syntax is as for C360. This command does not save the state to eeprom, so will be reset to its previously saved state on a processor reset. Use C363 to save it permanently. This command is designed to be allowed only in unlock or super unlock mode and therefore will work on any radio, independent of the radio's group. [pe] – command is not blocked if coming from the same radio it is commanding.
C362 (u)	Send disabled status	Sends disabled status. Will not send status back to command source if the source port is disabled or super disabled. Syntax is as for C360. This command is designed to be allowed only in unlock or super unlock mode and therefore will work on any radio, independent of the radio's group. [pe] – command is not blocked if coming from the same radio it is commanding.
C363 (u)	Save disabled states	Saves the disabled status for one radio to eeprom, so that it will be retained across a processor reset. Syntax is as for C360.
C364 (su)	Super disable specific port	Super disable a radio. Syntax is C364n, where n is the port number, with link map applied. This command does not save the state to eeprom, so will be reset to its previously saved state on a processor reset. Use C367 to save it permanently. This command is designed to be allowed only in unlock or super unlock mode and therefore will work on any radio, independent of the radio's group. This is a more secure version of the C360 command. It is unlikely to ever be needed – it is designed to be used if you have a Jack Gerritson both using and trying to control your system over a link, and he has one of the unlock codes.
C365 (su)	Enable a super disabled port	Enable a super disabled radio. Syntax is as for C364. This command does not save the state to eeprom, so will be reset to its previously saved state on a processor reset. Use C367 to save it permanently. This command is designed to be allowed only in unlock or super unlock mode and therefore will work on any radio, independent of the radio's group. [pe] – command is not blocked if coming from the same radio it is commanding.
C366 (u)	Send super disabled status	Sends super disabled disabled status. Will not send status back to command source if the source port is disabled or super disabled. Syntax is as for C364. This command is designed to be allowed only in

		unlock or super unlock mode and therefore will work on any radio, independent of the radio's group. [pe] – command is not blocked if coming from the same radio it is commanding.
C367 (su)	Save super disabled state	Saves the super disabled state for one radio to eeprom, so that it will be retained across a processor reset. Syntax is as for C364.
C368 (u)	Command lockout specific radio	Set command lockout for a radio. Syntax is C368n, where n is the port number, with link map applied. This command does not save the state to eeprom, so will be reset to its previously saved state on a processor reset. Use C36A to save it permanently. This command is designed to be allowed only in unlock or super unlock mode and therefore will work on any radio, independent of the radio's group. After executing this command the port will still operate normally, but will not accept commands. It is designed to block a hacker trying to control the system from one of the links.
C369 (u)	Enable a command locked out radio	Turn off command lockout for a radio. Syntax is as for C368. This command does not save the state to eeprom, so will be reset to its previously saved state on a processor reset. Use C36A to save it permanently. This command is designed to be allowed only in unlock or super unlock mode and therefore will work on any radio, independent of the radio's group. [pe] – command is not blocked if coming from the same radio it is commanding.
C36A (u)	Save command lockout state	Save the command lockout condition for one radio to eeprom, so that it will be retained across a processor reset. Syntax is as for C368. [pe] – command is not blocked if coming from the same radio it is commanding.
C36B(u)	Send command lockout status	Sends command lockout status for one radio. Will not send status back to command source if the source port is disabled or super disabled. Syntax is as for C368. This command is designed to be allowed only in unlock or super unlock mode and therefore will work on any radio, independent of the radio's group.
C36C (u)	Send complete lockout status	Sends three number 0..255 providing the disabled, super disabled, and command lockout bit patterns for all radios. Port 0 is in the 1's place, port 1 is the 2's, place, etc. The ports are physical ports, not logical ports (linkmap NOT applied). For example,

		if 2 16 192 is returned, then physical port 1 is disabled, physical port 4 is super disabled, and physical ports 6 and 7 are command locked out. The normal condition would be 0 0 0. This command is designed to be allowed only in unlock or super unlock mode and therefore will work on any radio, independent of the radio's group. [p] – command is only blocked by missing PL.
C36DA	Disable specific port with transmit dead	Syntax is C36DAr, where r is the radio port number with linkmap applied. Disables the specific port and sets the disableddead flag, so the port transmitter will not turn on – this means that no dial tone or other telemetry will be returned to this port, until it is re-enabled using C361. This does not save to eeprom. Use C363r to save to eeprom.
C36DB	Super disable a specific port with transmit dead	Syntax is C36DBr, where r is the radio port number with linkmap applied. This is the same as C36D, except that the super disabled state is set. Use C367r to save to eeprom.

Auxiliary I/O Commands

C370 (u)	Set GPIO	<p>Sets general purpose i/o pins. Syntax is *C370nnnn, where r is radio number 0..7 (linkmap applied), or 8 for the CPU card gpio outputs. Nnn is a number from 0..31 to define the state of the 5 pins on a radio card, or 0..255 for the 8 pins on the CPU card. Specific pins on the RCB DB15 auxiliary i/o connector are as follows:</p> <ul style="list-style-type: none"> Pin 15, bit 0 Pin 8, bit 1 Pin 7, bit 2 Pin 14, bit 3 Pin 6, bit 4 <p>Specific pins on the CPU DB25 connector are as follows:</p> <ul style="list-style-type: none"> Pin 5, bit 0 Pin 18, bit 1 Pin 6, bit 2 Pin 19, bit 3 Pin 7, bit 4 Pin 20, bit 5 Pin 8, bit 6 Pin 21, bit 7 <p>These outputs are all open collector outputs without a pullup resistor on the card. The outputs</p>
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		are high for a 0 and low for a 1 (active low). The output polarity can be changed to active high on a bit by bit basis by changing the routinvermask or cpugpioimask configuration parameters. All of these outputs are initialized to inactive (high impedance with default invert mask) on processor reset.
C371 (u)	Set GPIO bit	Sets or resets one bit on general purpose i/o. Syntax is *C371rbv, where r is the radio (0..8), b is the bit (0..4), and v is the value (0 or 1). Linkmap is applied for r<8, and designates the CPU card for r=8.
C372 (u)	Get GPIO	Returns the state of the CPU card GPIO bits, as a decimal number 0..255. The bits are associated with the state of pins on the CPU card DB 25 connector as follows: Pin 9, bit 0 Pin 22, bit 1 Pin 10, bit 2 Pin 23, bit 3 Pin 11, bit 4 Pin 24, bit 5 Pin 12, bit 6 Pin 13, bit 7 +5V on the pin is a 1, Ground is a 0
C373 (u)	Get GPIO bit	Syntax is C373b, where b is the bit number, as indicated above for C372. If the pin has +5V, "ON" is returned. If it is at ground, "OFF" is returned.
C375 (u)	Enable serial port 2	Enable serial port 2 on the CPU card. The transmit and receive lines for this serial port are brought directly from the 18F8722 processor to backplane pins 26 (transmit) and 25 (receive). The signals are active low TTL (5V) levels. Transmission parameters are hard coded as 8 bit, no parity, 9600 baud. Characters received on serial port 2 are directly appended to the command buffer. The command source is set to 8 (same as for serial port 1) unless the controller is currently prefixed from one of the ports 0..7, in which case the command source is not changed. With this approach, commands sent from serial port 2 in response to a command originating from one of the radio ports can automatically generate telemetry which goes back to that originating port.
C376	Send string to CPU serial	Syntax is C376ssssD to send characters normally

S376 (u)	port 1	accessible from DTMF pad. A is an escape character to be followed by A..D, 7 or 9 to send A..D, * and #. Alternate syntax is S376ssss<CR>, where s are arbitrary ASCII characters. The string can be up to 75 characters long. <CR><LF> will be appended to the string before it is sent.
C377 S377 (u)	Send string to CPU serial port 2	Syntax is as for C376. This command will enable serial port 2 before executing. Testing of this command can be done by tying pin 25 to pin 26 on the backplane, and sending S377C001<CR> to serial port 1, or C377AC001D via DTMF from a radio port. Serial port 2 will receive the transmitted C001<CR><LF> and put C001 on the command buffer. The controller will then execute this command the return the code version.. The <CR><LF> is ignored by the controller.

Remote Base Commands

C380 (u)	Enable remote base port transmit	Enables remote base port transmit. Syntax is C380r, where r is the logical port number 0..7. Will not do anything unless the port link status is on.
C381 (u)	Disable remote base port transmit	Disables remote base port transmit. Syntax is C381r, where r is the logical port number 0..7.
C382 (u)	Disconnect all remote base ports	Disconnects all remote base ports (disables transmit and sets link on/off status to normal state). Normally used by remote base timeout.
C385 (u)	Send dtmf string	Sends dtmf string to a specific radio port. Syntax is *C385rsssss..., where r is the port (0..7, linkmap applied), and s is a dtmf string of up to 16 characters. 0..9 are entered directly, D is the termination for completion, C clears the input to start over, B inserts a space, A is an escape character for entering the remaining dtmf characters: AA gives A; AB, AC, AD give B..D. A7 gives *, and A9 gives #. Returns function complete after the dtmf string has been successfully initiated. This command and C386 activate PTT. There is no built-in delay between PTT going active and the start of the first DTMF character. Use a space character in the DTMF string if a delay is needed. If the rbdtmfptt configuration bit is set (default is not set), then this command will activate PTT on a remote base port even if transmit is not enabled – this is useful in macros using DTMF to control a remote base

		transceiver before remote base transmit is enabled.
C386 (u)	Send dtmf string	Sends dtmf string to a specific port, alternate version. Syntax is *C385rsss..., where r is the logical port, and s is a dtmf string of up to 16 characters. All characters are entered directly. By default, D is the terminator and cannot be sent. The terminator is taken from the configuration parameter dtmf2term. If dtmf2term is '\0', then input is terminated with the receiver goes inactive (user releases PTT). At this point * and # can only be entered via a hard code macro or via the serial port command input – * or # via DTMF are separately captured. Space characters are allowed and will insert a delay of one character length (0.1s).
C400 (u)	Set remote base radio type	Syntax is C400rnnnn, where r is the logical port number and nnn is the radio type 0:none, 1: ICOM 706, 2:ICOM725, 3:BCD, 99:dummy This is not sent automatically. It should be included as part of a macro used to turn on the remote base. It also will not reset the radio defaults if the remote base radio type has already been set. If an absolute reset is required when after this command has previously been issued for the same radio type, issue this command twice: once to set to type 0, and the second time to reset the type to the desired type. For the ICOM 706, this sets the radio to VFO mode, sets the mode to FM, and sets the frequency to 146.46 MHz. For the Syntor, this set PL to 100.0 Hz, PL off, power level to 2 and frequency to 146.52 MHz
C401 (u)	Set remote base emission mode	Syntax is C401rnnnn, where r is the logical port number and nnn is the emission type, as follows 0: fm, 1:am, 2:lsb, 3:usb, 4:cw
C402 (u)	Set remote base radio frequency in MHz	Syntax is C402rffffff, where r is the logical port number and ffffff is the frequency in MHz.
C403 (u)	Set remote radio base frequency in kHz	Syntax is C403rffffff, where r is the logical port number and fffffff is the frequency offset from the set band value, in kHz.
C404 (u)	Set remote base radio frequency in Hz	Syntax is C404rffffffff, where r is the logical port number and fffffffff is the absolute frequency in Hz. The maximum value is 2^{32} Hz, or a little over 4 GHz. For radios capable of higher frequencies, the frequency entered is interpreted

		as 10's of Hz.
C405 (u)	Set remote base radio frequency last digit of MHz and kHz	Syntax is C405rffff, where r is the logical port number and ffff is the frequency offset from the last set frequency value truncated to the nearest 10 MHz. For example, C402146D sets the frequency to 146 MHz. However, the C405 value will be added to 140 MHz. A subsequent C40526520D sets the frequency to 146.52 MHz.
C406 (u)	Set remote base radio frequency interactively	Not yet implemented
C407 (u)	Set remote base radio repeat mode	Syntax is C407rnnn, where r is the logical port number, and nnn designates the repeat mode, as follows: 0:simplex, 1:repeat – offset, 2:repeat + offset, 3:repeat – odd offset, 4:repeat + odd offset The state of the repeat mode after using any of the set frequency commands is radio type dependent.
C408 (u)	Set remote base radio repeat offset	Syntax is C408rnnnnnn, where r is the logical port number, and nnnnn is the odd repeat split offset, in kHz. Plus or minus is indicated by the set repeat mode command.
C409 (u)	Set remote base radio repeat reverse	Syntax is C409r, where r is the logical port number. This command swaps transmit and receive from the normal setting (the previous set frequency value is the transmit frequency instead of the receive frequency). The state of this mode after entering any of the set frequency commands is radio type dependent. NOT YET IMPLEMENTED
C40A(u) C40B C40C C40D0 C40D1 C40D2 C40D3	Get remote base radio receive frequency	Syntax is C40Ar, where r is the logical port number. The format of the returned frequency is different for each of these commands: C40A complete frequency, in Hz C40B frequency in kHz C40C 1's digit of MHz and kHz C40D0 kHz part of frequency only C40D1 1's digit of MHz and kHz, with least significant digit of kHz not sent if it is 0. C40D2 complete frequency, in Hz, with "Hz" appended to the end C40D3 frequency in kHz, with "kHz" appended to the end
C410 (u)	Set auto repeat and offset mode	Syntax is C410rn, where r is the logical port number. If n=1, automatically sets automatic repeat mode and offset on change of frequency. 0 leaves mode as set by C407.

C411 (u)	Set remote base radio repeat mode normal	Syntax is C410r, where r is the logical port number. This command undoes C409 NOT YET IMPEMENTED
C411 (u)	Set remote base radio transmit PL frequency	Not yet implemented
C412 (u)	Set remote base radio receive PL frequency	Not yet implemented
C414(u)	Set band mask	Syntax is C414rnnnnnnnnnnD, where r is the logical port number, and n is the 32 bit unsigned long band mask, in decimal. Each 1 bit in the mask enables the frequency bands of the corresponding band table entry.
C415(u)	Set band block mask	Syntax is C415rnnnnnnnnnnD, where r is the logical port number, and n is the 32 bit unsigned long band mask, in decimal. Each 1 bit in the mask enables blocking transmit for the frequency bands of the corresponding band table entry.
C416(u)	Set band block configuration	Syntax is C416rnnnnD, were r is the logical port number and n is the 8 bit band block configuration byte.
C417(u)	Set monitor mute mode	Syntax is C417r, where r is the logical port number. Sets remote base monitor mute mode (the default). When remote base is on, but transmit is disabled, the remote base receive is muted when other traffic is present. This does not change the normal value stored in eeprom in the rbmonmute parameter. This is reset to the eeprom value by a processor reset or global site normal (C300).
C418(u)	Set monitor mix mode	Syntax is C418r, where r is the logical port number. Sets remote base monitor mix mode (disables muting of remote base due to other traffic). This does not change the normal value stored in eeprom in the rbmonmute parameter. This is reset to the eeprom value by a processor reset or global site normal (C300).
C419 (u)	Set remote base PL	Syntax is C419rnnD, where r is the logical port number and nn is the PL index. Set remote base transmit PL. PL is defined by nn in the range 1..32. The corresponding PL frequencies are given in the table below.
C41A (u)	Set PL in Hz	Syntax is C41ArnnnD, r is the logical port number and nnn is the PL frequency. Set remote base transmit PL with frequency specified in Hz. For standard PL frequencies that are not integral Hz values, specify by truncating the fractional value. For example, to set 127.3 Hz on a remote base at

		logical port 3, use C41A3127D. This command is not supported by the ICOM radios.
C41B (u)	transmit PL on	Syntax is C41Br, r is the logical port number. Turns on remote base transmit PL
C41C (u)	transmit PL off	Syntax is C41Cr, r is the logical port number. Turns off remote base transmit PL.
C41D (u)	Set remote base power	Syntax is C41DrxxxxD, where r is the logical port number and xxxx is an arbitrary power level, with 0 the lowest. 2 is the maximum value for Syntor remote base radio type.
C420 (u)	Set BCD inverted logic	Syntax is C420rnD, r is the logical port number, and n is a logic inversion mask for the BCD serial radio interface (used only for radio type 3, Syntor/BCD). A 1 bit inverts the logic. Bit 0: data, bit 1: clock, bit 2: strobe. The default for all is inverted logic (data inverted, clock on falling edge transfer data on strobe line low). If this command is used, it should be entered before the C400 command to initialize the remote base radio.
C421 (u)	Read memory	Syntax is C421rmmD, r is the logical port number, mm is the memory number. For ICOM radios, this command sets the memory number and transfers the memory to the display frequency (normally the VFO), and reads the radio frequency so that the get frequency commands return the correct frequency. Not frequency masking is done.
C422 (u)	Write memory	Syntax is C422rmmD, r is the logical port number, mm is the memory number.
C423 (u)	Read frequency	Syntax is C423r, r is the logical port number. This command transfers the current frequency in the radio to the radio control board software. It does not return any telemetry. This is supported only on ICOM radios and is provided primarily for test purposes.
C424 (u)	Switch radio to memory mode	Syntax is C424r, r is the logical port number. This will switch an ICOM radio from VFO mode to memory mode. It is provided primarily for test purposes.
C425 (u)	Switch radio to VFO mode	Syntax is C425r, r is the logical port number. This will switch an ICOM radio from memory mode to VFO mode. It is provided primarily for test purposes.

Timeouts and Trigger Related Commands

C520 (u)	Set repeater power high	Sets all repeater ports with pwrctl bits=1 to high
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		power.
C521 (u)	Set repeater power low	Sets all repeater ports with pwrctl bits=1 to low power.
C522 (u)	Set repeater power low automatic	Sets all repeater ports with pwrctl bits=1 to low power. Leaves the pwrmode PWRLMODE bit equal to 1, so that automatic power control is not disabled.
C523 (u)	Automatic repeater power on	Enables automatic repeater power control. Turns repeater power to high.
C524 (u)	Automatic repeater power off	Disables automatic repeater power control. Does not change the current power state.
C525 (u)	Repeater power mode save to EEPROM	Saves the current high/low, auto on/off, power mode to EEPROM.
C52A (u)	Repeater power status	Returns the repeater port high/low power status. If automatic low power timeouts is enabled, the power status will be reported as “HPA” or “LPA”. If the automatic power transition is disabled, the power status will be reported as “HP” or “LP”. By default, the power is managed via the bit 1 GPIO output line on each port. This line will be active and low for low power, and inactive and high for high power. All repeater ports will be controlled by these commands if the unless there is a 0 in the corresponding port bit in the pwrctl configuration parameter (all default to 1).

Table of codes for generating ASCII strings

first digit	second digit				
	0	1	2	3	4
0	0	space	= BT	(KN	+ AR
1	1	.	,	/	?
2	2	A	B	C	@ AC
3	3	D	E	F	#
4	4	G	H	I	\$ SK
5	5	J	K	L	~ AS
6	6	M	N	O	% macro parm input
7	7	P	Q	R	S
8	8	T	U	V	*
9	9	W	X	Y	Z

Comments

1. Commands succeeded by a (u) or (su) require an unlock or super-unlock code, respectively.
2. Code for other command blocking conditions, listed in square brackets at the end of the comment section of each command:
 - p: blocked if receive condition not met (eg. PL missing when PL is on)
 - l: blocked if port receiving command is not linked
 - r: blocked if no repeater is linked (so command won't be monitored)
 - e: blocked command allowed if explicit conditions are metMost commands have blocking conditions of [plr]. Only those with different conditions are shown in the list.
3. The objective with version 0.98 is to get in most of the base functionality that will be in version 1.0, with very stable code that can be put in the field. Comments on bugs and opinions of functionality that should be either different or added are welcome.
4. The default super unlock code for protected commands is 138065. It occupies unlock code slot 0. It cannot be deleted, but can be changed with commands C114 or C115. Additional unlock codes can be added and deleted using the C110, C111, and C112 commands. These commands require a super unlock code. A second super unlock code can be added to slot 1. All other unlock codes are non-super unlock codes. Super unlock code 0 should only be used to set the super unlock codes. After that, the slot 1 super unlock code should be used to manage other unlock codes. Other unlock codes should be used for all other commands requiring unlock codes. This will reduce the likelihood of a hacker obtaining the super unlock codes.
5. The command codes are all table driven. There are two command tables. The first contains the commands listed in this document. The second contains commands that call macros, which is how most user accessible commands are implemented. The tables are stored in program ROM due to both the need for fast searching and the large size of the table. The second command table, used for macros can be edited. This is most easily done with a configuration program running on a PC connected to the controller via the serial port. The contents of macros are also changeable.
6. The serial port communicates at 9600 baud, 8 bits, no parity, with no flow control.
7. Note that in parameter entry, B acts as a space between parameters, and D acts as the terminator for the parameter sequence. C clears the characters entered so far and starts parameter entry over again (without renewing the prompt). * exits without executing the command and leaves the * on the command buffer. Anything else (A or #) exits without executing the command. There is only one command character buffer – parameter entry pulls from the same buffer as commands execution. Therefore, the parameters for a command must be entered in order after the command, before any other commands.
8. Guidelines for command names:

Commands and unlock codes cannot be leading substrings of one another (eg. you can't have 123 and 1234 – 123 would get recognized and immediately executed).

Commands should not begin with D. This allows a D parameter terminator to be inserted even if the parameter entry completes with sufficient characters entered. A dummy command recognizing D is in the command table to implement this.

9. Command syntax inconsistencies.

Note that the syntax for commands with parameters is not consistent. Commands in which the first parameters are always numerical digits do not allow spaces (or 'B' when sent via DTMF) before or between the parameters. This makes quick entry via DTMF easier.

10. To pull command parameters from the user within a macro, insert the % character in the macro. This will jump forward in the command table to the first character after the end of the macro, and continue reading from there until the parameter entry is complete.

11. Most commands that take parameters take numeric parameters which are entered directly via DTMF. In these cases, B is used to enter a space, C clears the input buffer so you can start over with the parameter entry, and D finalizes the entry. Some commands also allow A, B, C, D, and possible * and # as parameters – this includes the set unlock code, send to serial port and send dtmf commands. In those cases, the non-numeric characters are entered by preceding them with an A. * is entered using A7, and # is entered using A9. For example, to set an unlock code of ABCD9, you would enter *C110AAABACAD9D. Commands which accept full alphanumerical parameters (set ID, define macros, etc.) use the table above to define each of the characters. B, C, and D are used as editing keys, as for other parameter entry.

12. The real time clock uses a Dallas Semiconductor DS1302 clock chip. Its power is backed up by a 0.047F supercapacitor, which keeps the clock running for more than 24 hours (can't count on much more than that) in case power to the controller is interrupted. Time of day and time of week macro triggers are based on this clock. Other functions in the controller do not depend on it.

Table of “normal” function behavior

	global (acts on current group only if no “x” here)	Sets links, voip, remote base ports to normal linked state	Sets local ports to normal linked state	Disconnect locals	Resets link PL to normal state	Resets local PL to normal state	Resets link carrier delay	Clear remote monitor mode	Resets unlock state, test tones, xmit on	Resets group setup	Resets split group links
Site normal	x	x	x		x	x	x	x	x	x	x
Link normal		x		x	a0		a1	x			
Interface normal		x	x		b0	b0	b1	b2			
Remote normal			c3			c0	c1	c2	x		
Link reset		d3			d0		d1	d2			
Link reset flexible		d3			d0		d1	d2			
Local normal			x			e0	e1	x			
Group normal		x	x		x	x	x	x	x		

Table notes:

An “x” in a box designates an active operation for that function. A letter a..e followed by a bit number designates an operation which is activated by that function if the corresponding bit is set in that function’s configuration parameter. For example, for link normal to reset the link carrier delay, bit 1 of lnknrmdefs must be set. Bits which are set by default are shown in **bold**. Configuration variables for each of the functions are as follows:

Link Normal (a) lnknrmdefs

Interface Normal (b) intnormdefs

Remote Normal (c) remnormdefs

Link Reset (d) lnkrstdefs

d3 is special; if it is set, all non-local ports are set to normal values, if it is clear, only link ports are set to normal values

Link Reset Flexible same bit definitions as Link Reset, but specified in command parameter

Local Normal (e) localnormdefs

These configuration parameters may be set by directly writing to the appropriate addresses in the serial eeprom using the write eeprom byte command C106. The addresses are documented in the SRS Controller Software Configuration spreadsheet.

Differences between port types

The table below describes the differences in behavior between ports configured as repeaters, links, irlp nodes, and remote bases. Some of these are just the default behavior that is created when the port type is defined, and can be changed, either by port type or by individual port. Others (such as ability to accept commands) are built into the programmed behavior of the port type. See the SRS Controller Software Configuration spreadsheet for a detailed description of all of the parameters which can be changed. Transmit carrier off delay for link ports can be forced to the short value (default 0.1 s) by setting bits in the simplelinkports configuration variable.

	Repeater/ local	Link	VOIP link	IRLP	Remote base
Retransmits input on output	x				
Accepts commands preceded by *	x				
Accepts commands preceded by #prefix		x	x		
Transmits ID	“polite” algorithm	“link ID 2” algorithm			
Default CW ID frequency (Hz)	1064	1064			
Default CW ID speed (WPM)	20	24			
Default ID level (0..255)	80	40			
Default transmit carrier off delay (s)	4.0	4.0 0.1 with link delay off	Same as link	0.1	0.1
Default COR/PL recognition delay (ms)	50	50	0	0	50
Default COR/PL drop recognition delay (ms)	150	5	0	0	150
Default PL status	PL on	PL on	PL off	PL off	PL off

Macro permission byte bit definitions

1	Block the command if COR and a required PL is not detected
2	Block the command if the port from which the command is being entered is not currently linked
4	Block the command if no local radio (repeater) is currently linked – if you want to be able to always hear if someone is controlling the machine while

	monitoring from the local repeater, this should be set.
8	Block the command unless an unlock code has been entered
16	Block the command unless a super unlock code has been entered (note, that macros can be changed with an unlock code, so this is not effective security, unless the base command being called by the macro requires a super unlock code).
128	Allow the command to be executed if there is explicit code in the command to allow it when other conditions are not met. This is used primarily for link on commands directed at the same port from which the command is coming – it should be allowed even if link is off for that port and link on for other ports would be blocked.

Block configuration byte bit definitions

bit	behavior if bit is set (1)
0	transmit blocked if outside of frequencies in band table
1	transmit blocked if inside frequencies in band block table
2	transmit blocked if contained in list of blocked channels (not yet implemented)
4	receive blocked if outside of frequencies in band table
5	receive blocked if contained if inside frequencies in band block table
6	received blocked if contained in list of blocked channels (not yet implemented)

The default is to block both receive and transmit if not in band table, to block transmit if contained in the band block table, and to block both receive and transmit if contained in blocked channels list. To do this, bits 0, 1, 2, 4, and 6 need to be set. So, blockconfig is $1+2+4+16+26 = 87$.

If blockconfig is 0, all frequencies are allowed

Transmit is always blocked if receive is blocked

Band table with allowed remote base frequencies

	lower limit	upper limit
0	1,800,000	2,000,000
1	2,500,000	2,500,000
2	3,500,000	4,000,000
3	5,000,000	5,000,000
4	5,330,500	5,330,500
5	5,346,500	5,345,500
6	5,366,500	5,366,500
7	5,371,500	5,371,500
8	5,403,500	5,403,500
9	7,000,000	7,300,000
10	10,100,000	10,150,000
11	14,000,000	14,350,000
12	15,000,000	15,000,000
13	18,068,000	18,168,000
14	21,000,000	21,450,000

15	24,890,000	24,990,000
16	28,000,000	29,700,000
17	50,000,000	54,000,000
18	144,000,000	148,000,000
19	162,400,000	162,550,000
20	222,000,000	225,000,000
21	420,000,000	450,000,000
22	902,000,000	928,000,000
23	1240,000,000	1300,000,000

This table is defined to allow receiving on all of the U. S. ham bands through 23 cm, plus WWV and the VHF weather channels.

As an example of how to configure the band table mask, if a remote base assigned to port 4 supports only 2 meter operation plus received on the weather frequencies, then the band table mask for port 4 should have only bits 18 and 19 set. So, the value of this parameter is $2^{18}+2^{19} = 786432$. This can be set by entering C4144786432D.

Band table for transmit blocked frequencies

	lower limit	upper limit
0	2,500,000	2,500,000
1	3,500,000	3,600,000
2	5,000,000	5,000,000
3	7,000,000	7,125,000
4	10,000,000	10,000,000
5	10,100,000	10,150,000
6	14,000,000	14,150,000
7	18,068,000	18,110,000
8	21,000,000	21,200,000
9	24,890,000	24,930,000
10	28,000,000	28,300,000
11	50,000,000	50,100,000
12	144,000,000	144,100,000
13	162,400,000	162,550,000

This table is defined to block transmit in the CW/data sections of the U. S. ham bands and on the WWV and weather frequencies.