

MICRO-RC

Repeater Controller

Owners Manual

1 Introduction

The Micro-RC (μ RC) repeater controller is designed to be a small yet highly powerful repeater controller with features and performance that rival many high-end controller designs. The firmware utilizes a small but extremely fast preemptive real-time operating system (RTOS) executing multiple tasks concurrently. This multi-threaded firmware design allows the μ RC to perform a variety of tasks concurrently and reliably with superior performance compared to crude single threaded “super loop” state machine techniques. Additionally the complete source code is GNU open source licensed making it one of the first multi-threaded open source repeater controllers available.

A number of onboard hardware components provide features commonly missing on small repeater controller designs; some of these features include:

- Powerful flash upgradeable 16 MHz ATmega1281 RISC processor.
- Real preemptive multi-threaded RTOS executing multiple tasks.
- A smart 2x20 LCD display providing real time system status display.
- Onboard full duplex PL encode/decode with up to 15 RX PL tones.
- Onboard adaptive smart squelch under real-time CPU control.
- Onboard temperature and battery monitoring.
- DTMF decoder for remote control and configuration.
- ISD Chip-Corder digital audio voice recorder/playback.
- RS-232 port with full modem support for remote TTY administration support.
- Onboard Dallas RTC time/date chip with battery backup.
- Smart cooling FAN driver for external box-fan control.
- Expansion I/O connector allows for future upgrades.

All of hardware functional components are managed and serviced by various RTOS threads in real time. These threads and associated interrupt handlers all execute under synchronized control by the RTOS. Thus, dedicated threads service the various hardware components as system events occur. In turn the threads may communicate with each other through the RTOS queuing and messaging systems to process the repeater controller events and notifications as needed.

The μ RC also provides full duplex PL encode/decode facilities with the CML Microsystems MX828 PL encoder/decoder chip. This advanced PL decoder allows decoding up to fifteen different PL tones from a receiver. Additionally, the MX828 is also capable of providing an outgoing PL tone simultaneously giving true full duplex encode/decode support. A standard DTMF decoder chip is also provided to allow remote DTMF control and configuration.

2 Controller Interfacing

The μ RC controller radio interface is fairly simple. Connector X3 near the trimmer potentiometers provides all the TX/RX radio interface signals. Refer the schematic when making any connections to avoid mistakes. Connector X3 has the following pin connections:

Pin	Description
1	PTT to transmitter, open drain to ground, 1A max.
2	Fan driver, open drain to ground, 1A max.
3	External COS signal, +5V max to trigger
4	Digital signal ground
5	Analog signal ground
6	Receiver discriminator audio input (non-filtered)
7	Transmit audio output
8	Auxiliary audio output

The Molex connector pins are crimp style and should be crimped with the appropriate Molex crimping tool to assure proper connection and avoid damage to the pin.

2.1 Interface Signal Descriptions

2.1.1 PTT Driver

The PTT signal is used to enable the repeater transmitter. The PTT driver uses a high current MOSFET open drain configuration that completes the path to GROUND to enable the transmitter. This is the function equivalent of pulling the transmitters PTT wire to ground to activate the transmitter.

2.1.2 Fan Driver

The fan driver also uses a high current MOSFET open drain configuration and is capable of driving fan loads up 1A safely. With a 12V box fan, the hot (+) side of the fan motor should be connected to +12V. The ground (-) side of the fan lead should be connected to the pin-2 of X3. The fan output is activated anytime the transmitter keys up and runs for the configuration duration specified after transmission stops.

2.1.3 External COS Input

The external COS input is sent from the receiver to indicate a valid squelch and/or PL signal is present when the controller is configured for external COS use. This signal should not exceed +5V to prevent damage to the input buffer or processor. When a +5V logic high is present, the controller sees this as external COS active and enables the transmitter output to begin a transmit cycle. Once the COS pin goes low, this indicates the transmit cycle should return to the idle state.

2.1.4 Digital Signal Ground

The digital signal ground is tied to internal PCB digital ground plane. Normally this should be left open to avoid ground loops through the board.

2.1.5 Analog Signal Ground

The analog signal is tied to the PCB analog ground plane feeding the audio circuits. The audio signal ground feeding the external receive and transmit audio should use this ground.

2.1.6 Receive Discriminator Audio Input

The discriminator audio from the receiver should be connected to this pin. The audio must be taken from the discriminator prior to any filtering at a level of around 200mV. Do not use the audio from a speaker amp or other line level source that passes through any sort of filtering. The μ RC requires unfiltered audio in order for the onboard PL decoder and squelch circuit to work properly.

2.1.7 Transmit Audio Output

The transmit audio output should be fed to the input of the transmitter audio exciter stage. The overall transmit audio level is adjusted via the trimmer potentiometers described in the next section. The MX8282 tone decoder contains a BP filter that removes any incoming RX PL tone prior to feeding the transmit audio output mixer stage. Thus, the transmit audio will be free of any incoming PL tone but may contain an outgoing PL tone if the controller is configured for TX PL operation. The transmit audio may also contain courtesy tones and/or voice recorder messages if enabled as well.

2.1.8 Auxiliary Audio Output

The auxiliary audio contains receive audio only free of any incoming or outgoing PL data. This may be used to feed an external audio amplifier for local monitoring purposes. The audio level of this output is controlled by software by setting the MOD1 attenuator output level (DTMF command 60).

3 Audio and Squelch Level Adjustments

The μ RC controller contains a number of level and adjustment trimmers that must be adjusted for proper operation. Refer to the schematic when adjusting these levels to get a better picture of the signal path and audio mixer insert points.

Trimmer	Description	
R71	Beep Level	This trimmer sets the standard PWM beep level used for simple courtesy tone and chirp type effects. This setting does not control the SelCall PL tones generated by the MX828 internally.
R52	Output Level	This trimmer sets the overall transmit audio output level from the controller audio output mixer stage. The input receive level should be adjusted first to approximately 200mV at test point TP6 prior to adjusting the transmit audio output level. Adjust this trimmer for proper transmit audio deviation from the transmitter.
R75	Play Level	This trimmer sets the voice recorder play level for voice messages. This trimmer should be adjusted after the receive level and transmit output levels have been adjusted for proper level. The voice recorder input level trimmer R65 should be adjusted also best record level.
R27	Squelch Cal Level	This trimmer set the onboard smart squelch ADC full scale reading and must be adjusted after the receiver is setup functional. Adjust this trimmer so the LCD reads just under 1024 (full scale) with full noise present at the receiver. This adjustment represents the maximum noise level the receiver generates with no signal present. The displayed value should not remain fixed at full scale but allow a little movement just below 1024. Typically around 980-1000 range is good.
R63	Receive Level	This trimmer sets the receive level in the audio output mixer stage relative to PL injection level (MOD2), the voice recorder level and the PWM beep level. In general this trimmer should be adjust to about the $\frac{3}{4}$ range to obtain enough receive audio.
R26	Input Level	This trimmers set receiver input level into the controller and the PL and DTMF decoder. If the level is to high the incoming signal will be distorted and create PL or DTMF decoding problems. Likewise to low of a level will cause PL decode and low transmit audio levels from the controller. The MX828 needs around 200-250mV of audio signal present for best performance.
R65	Record Level	This trimmers set the voice recorder input record level. Adjust this trimmer relative to the play level trimmer R52 for best sounding playback audio. If the record level is too high the recording will sound distorted.

3.1 Audio Emphasis

Jumper JP4 should be set for emphasized or flat audio response depending on your receiver. If the audio sounds thin or tin like, try this jumper in the alternate position. Many receivers will use emphasized audio. If your receiver used flat audio then set this jumper accordingly.

4 DTMF Commands and System Configuration Programming

The Micro-RC repeater controller supports a number of global and administrative DTMF commands for system use and configuration programming. All commands are executed when the pound sign '#' key is pressed. The asterisk '*' is used as a delimiter for commands requiring multiple parameters. The alphanumeric 'D' key is used as an abort command and resets the key input buffer to the empty state. The controller LCD display shows all DTMF keys as they are entered.

4.1 Global Commands

The Micro-RC controller has number of global commands that may be activated at any time by any user via DTMF commands. The following global DTMF commands are available:

1 - PLAY STATION CW ID

Syntax: 1#

Parameters: (none)

Description: This command causes the controller to play the CW ID at any time.

2 - PLAY ANNOUNCEMENT MESSAGE

Syntax: 2#

Parameters: (none)

Description: This command causes the controller to play the voice recorder announcement message at any time.

3 - PLAY NORMAL VOICE ID MESSAGE

Syntax: 3#

Parameters: (none)

Description: This command causes the controller to play the voice ID message at any time.

4 - PLAY ALTERNATE VOICE ID MESSAGE

Syntax: 4#

Parameters: (none)

Description: This command causes the controller to play the alternate voice ID message at any time.

5 – SIGNAL REPORT

Syntax: 5#

Parameters: (none)

Description: This command causes the controller to record up to ten seconds of received audio and plays the audio back to allow the user to hear the received audio as a means of a signal report. After the command is issued the controller issues a beep to indicate record mode is ready. The controller will then wait for the next received signal to begin recording up to ten seconds of audio. Recording ends when the transmission ends or the time limit is reached. The recorded audio will play back immediately after the user ends the record transmission.

4.2 Administrative Commands

Administrative commands require the user to perform a valid session login (command 10) before any other commands can be executed. After the user has successfully logged in, administrative commands may be executed to configuration the controller. The controller will automatically close the administrative login session if no commands are executed after the session timeout expires. The default session timeout is five minutes.

Note all commands that modify system configuration parameters act on values currently stored in temporary SRAM. All configuration parameters are loaded from EPROM into SRAM prior to system startup. Therefore, you must execute command 92 (STORE CONFIG TO EPROM) to store any newly modified parameters into EEPROM permanently. Otherwise, any newly modified parameters will be lost when the power is cycled and the configuration settings are reloaded from EPROM.

10 - SESSION LOGIN

Syntax: 10*{password}#

Parameters: {password} = up to 15 digits (0-9) max

Description: This command allows the system administrator to login to the system and issue configuration commands. The controller emits a sweeping up tone sequence to confirm a valid password and session login; otherwise, a single courtesy tone is emitted. The default system password is "1234" and may be changed later via command 12.

11 - SESSION LOGOUT

Syntax: 11#

Parameters: (none)

Description: This command closes a previous session login. After logout, the user must execute a session login again to execute subsequent administrative commands. The controller emits a sweeping down tone sequence to confirm logout.

12 - SET ADMIN PASSWORD

Syntax: 12*{password}#

Parameters: {password} = up to 31 digits (0-9) max

Description: This command configures the administrator password. The default system password is "1234" until modified by the administrator. Note you must store the system setting to EPROM via command 92 to permanently store the new password settings.

13 - SET STATION CW ID STRING

Syntax: 13*{param}#

Parameters: *[see description below]*

Description: This command sets the CW ID string used to identify the station. A callsign is entered as using two digits for each letter and number in the callsign. The first digit is the key on which the letter appears (using 1 for 'Q', 'Z' and space), and the second digit is 1, 2, 3, or 4 to indicate which letter is being entered. Numbers are entered as the digit followed by a 0 (e.g. 02='2'). A word space is entered as a 13. For example, the letter "K" is entered as "52", the letter "Q" is entered as "11", and the digit "7" is entered as "70".

Examples:

```
13*313213912260936142# = "DE WB6YMH"  
13*313213524140536232# = "DE KG4LNE"  
13*31321391717331808090# = "DE WPSD889"
```

14 - PLAY CW ID

Syntax: 14#

Parameters: (none)

Description: This command causes the controller to play the system CW ID and is equivalent to global command "1".

15 – PLAY VOICE MESSAGE

Syntax: 15*{param}#

Parameters: 0 = initial welcome message (30 sec max)
 1 = normal ID message (30 sec max)
 2 = alternate ID message (30 sec max)
 3 = TX-timeout message (30 sec max)
 4 = announcement message (30 sec max)
 5 = reserved message 1 (30 sec max)
 6 = reserved message 2 (30 sec max)

Description: This command causes the controller to play the specified voice recorder message.

16 - RECORD VOICE MESSAGE

Syntax: 16*{param}#

Parameters: 0 = initial welcome message (30 sec max)
 1 = normal ID message (30 sec max)
 2 = alternate ID message (30 sec max)
 3 = timeout-timeout message (30 sec max)
 4 = announcement message (30 sec max)
 5 = reserved message 1 (30 sec max)
 6 = reserved message 2 (30 sec max)

Description: This command allows the user to record various voice recorder messages. After the command is executed, release the transmitter key to arm for recording. Key the transmitter again and begin recording your message immediately by speaking into the microphone. When complete, release the transmit key to end recording your message. The controller will replay the message immediately afterwards to confirm the message recorded.

17 - SET SYSTEM TIME

Syntax: 17*HHMMSS#

Parameters: HH = Hour 00 -> 23
 MM = Minute 00 -> 59
 SS = Second 00 -> 59

Description: This command sets the real-time-clock (RTC) time in 24-hour military format. The RTC is battery backed up by a lithium coin cell in the event of power loss.

18 - SET SYSTEM DATE

Syntax: 18*MMDDYY#

Parameters: MM = Month 01 -> 12
 DD = Day of month 01 -> 31
 YY = Year (20xx)

Description: This command sets the real-time-clock (RTC) system date. RTC is battery backed up by a lithium coin cell in the event of power loss.

19 - SET SYSTEM DAY OF WEEK

Syntax: 19*D#

Parameters: D = day of week 1 -> 7

Description: This command sets the real-time-clock (RTC) day of the week.

20 - SET COURTESY TONE MODE

Syntax: 20*{param}#

Parameters: 0 = no courtesy tone
 1 = normal courtesy tone
 2 = chirp on CAS trigger
 3 = chirp on CAS drop
 4 = enable AUX port normal courtesy tone

Description: This command configures the courtesy tone mode of the repeater controller. The courtesy tone is briefly emitted whenever a station drops transmission to indicate the end of a transmission to any stations listening.

21 - SET STATION ID MODE

Syntax: 21*{flag}*{mode} ...*{mode}#

Parameters: flag:
 0 = disable
 1 = enable
mode:
 0 = sets or clears all modes based on {flag}
 1 = enable CW ID message
 2 = enable CW ID message on idle timeout
 3 = enable VOICE ID message
 4 = enable ALTERNATE VOICE ID message
 5 = enable VOICE ID message on idle timeout
 6 = beacon ID at every idle timeout period

Description: This command is used to configure the station identification modes the repeater controller will use. Note the {mode} values represent bit number flags and may be set or cleared in any combination of the above {mode} values listed.

Examples:

21*1*2*4 (enables CW-ID and VOICE-ID message on idle timeout)
 21*0*0 (clears all ID message mode bits)

22 - SET CW ID SPEED

Syntax: 22*{param}#

Parameters: 10-100 = delay in ms between characters.

Description: This command configures the speed of the CW ID keyer.

23 - SET CW ID TONE FREQUENCY

Syntax: 23*{param}#

Parameters: 600-3000 = tone frequency in kHz.

Description: This command configures the tone frequency (pitch) of the CW ID keyer.

24 - SET COURTESY TONE FREQUENCY

Syntax: 24*{param}#

Parameters: 0-15 = SelCall sound frequency index (see Table-2).

Description: This command configures the courtesy tone frequency. The controller supports up to 15 standard SelCall CCIR tone frequencies.

25 - SET COURTESY TONE DURATION

Syntax: 25*{param}#

Parameters: 0-1000 = duration in ms.

Description: This command configures the courtesy tone frequency duration in milliseconds.

26 - SET DELAY BEFORE COURTESY TONE

Syntax: 26*{param}#

Parameters: 0-1000 = duration in ms.

Description: This command configures a short delay time prior to playing the courtesy tone. This brief delay is provided to allow the calling station to hear the courtesy tone after dropping a transmission. Otherwise, the courtesy tone may be emitted to quickly and get clipped by the squelch on the calling stations receiver upon dropping carrier. Basically it gives the caller time to hear the courtesy tone being transmitted back after dropping a transmission.

30 - SET REPEATER HANG TIME

Syntax: 30*{param}#

Parameters: 0-100 = tenths of seconds (100=10secs)

Description: This command configures the repeater transmitter hang time after a remote station drops ends a transmission. Once the repeater receiver detects a signal has been dropped, the audio is muted and the transmitter remains enabled for the specified hang time duration to help avoid squelch crashes at the listening stations.

31 - SET TRANSMIT TIMEOUT

Syntax: 31*{param}#

Parameters: 0-60 = timeout in minutes (0=infinite)

Description: This command configures the maximum transmit time timeout. If nonzero, the repeater will play the voice recorder transmit timeout message and terminate the transmission when the timer expires. This transmitter will reactivate once the remote station stops transmitting and replay the transmit timeout message so the offending station is notified also.

32 - SET REPEATER IDLE TIMEOUT

Syntax: 32*{param}#

Parameters: 5-60 = timeout in minutes

Description: This command configures the repeater idle timeout period. If the repeater has been idle for this duration, it will replay the initial CW ID and/or greeting (if configured and enabled) at the next key-up.

33 - SET DTMF DIGIT TIMEOUT

Syntax: 33*{param}#

Parameters: 1-32 = digit timeout in seconds

Description: This command configures the DTMF inter-digit timeout in seconds. The users must enter at least one digit within this interval or a timeout will occur and any digits in the buffer will be discarded and the input buffer is reset to empty state.

34 - SET COOLING FAN RUNTIME DURATION

Syntax: 34*{param}#

Parameters: 0-30 = cool time in mins (0=fan off)

Description: This command configures the fan runtime duration after each transmission has ended. The controller stops the fan no further transmissions are executed by the controller and the timeout expires. Thus, the fan always runs during and after any transmission for this minimum duration.

35 - SET DISPLAY BACKLITE MODE

Syntax: 35*{param}#

Parameters: 0 = Off
1 = On
2 = Auto, follows fan

Description: This command configures the LCD display backlight mode. Normally the LCD backlight is enabled whenever the FAN is running to indicate system activity.

36 - SET BATTERY ADC ZERO OFFSET

Syntax: 36*{param}#

Parameters: 0-1000 = ADC offset value (default = 128)

Description: This command allows adding or subtracting an offset to the ADC reading for the battery voltage measurement display. This value can be used to adjust the voltage measurement displayed by measuring the voltage at the controller power input connector and adjusting the offset till the readings match for best accuracy.

37 - SET TEMPATURE ADC ZERO OFFSET

Syntax: 37*{param}#

Parameters: 0-1000 = ADC offset value

Description: This command allows adding or subtracting an offset to the ADC reading for the temperature measurement display. This value can be used to adjust the temperature measurement displayed by measuring the temperature at the thermistor on the controller board and adjusting the offset till the readings match for best accuracy.

60 - SET MOD1(Aux Audio) ATTENUATION

Syntax: 60*{param}#

Parameters: 0-31 = AUX audio level (0=mute, 31=0dB)

Description: This command configures the audio level of the AUX line output from the controller board. The AUX audio level is pure PL filtered audio and contains no PL /courtesy tones or voice recorder audio. The AUX audio output is intended for local monitoring or link output audio applications.

61 - SET MOD2(PL/SelCall Inject) ATTENUATION

Syntax: 61*{param}#

Parameters: 0-31 = PL/SelCall audio level (0=mute, 31=0dB)

Description: This command configures the outgoing CTCSS and SelCall courtesy tone audio injection level to the main audio output mixer. This feature allows remote level adjustment of the outgoing PL and courtesy tone level if needed. Typically the audio levels should be adjusted via the trim pots to the levels required by the radio. This parameter may be used to reduce the PL injection level relative to the main TX-audio output level if required.

70 - SET CTCSS TX PL TONE FREQUENCY

Syntax: 70*{param}#

Parameters: CTCSS-code-index = 0-47 (0=disable, see Table-1)

Description: This command configures any outgoing CTCSS tone from the controller. The controller supports any one of 48 outgoing PL tones if needed (refer to Table-1). A value of zero disables the outgoing PL tone feature.

71 - SET CTCSS RX PL TONE FREQUENCY

Syntax: 71*{decode-index}*{CTCSS-code-index}#

Parameters: decode-index = 0-15
CTCSS-code-index = 0-47 (0=disable, see Table-1)

Description: This command allow configuration of up to 15 different receive CTCSS PL tones each with a different frequency. The 'decode-index' specifies which slot in the 15-entry decode table to use and the 'CTCSS-code-index specifies which PL frequency to use for the slot.

72 - SET CAS/COS MODE

Syntax: 72*{param}#

Parameters: 0 = COS
1 = COS-AND-PL
2 = COS-OR-PL
3 = PL ONLY

Description: This command sets the CAS/COS mode used by the controller. Note that only modes 0 or 1 are recommended for reliable operation. Other settings may leave the controller in an unusable or unreliable state depending on the squelch mode and settings.

73 - SMART SQUELCH ENABLE/DISABLE

Syntax: 73*{param}#

Parameters: 0 = Disabled (External COS)
1 = Enabled (COS from onboard squelch)

Description: This command is used to enable the onboard smart squelch. The controller rx-input requires a discriminator input signal (not a filtered rx-audio signal) from a receiver for smart squelch operation.

74 - SET SQUELCH LEVEL

Syntax: 74*{param}#

Parameters: 0-1023 = squelch threshold (512 default)

Description: This command configures the smart squelch comparator threshold. The default value is 512. An ADC value of 1023 represents the maximum receiver noise level with no signal preset from the receiver. A lower value (0-512) represents receiver quieting (signal present).

75 - SET PL/TX DROP DELAY (“chicken burst”)

Syntax: 75*{param}#

Parameters: 0-500 = PL/TX drop delay in milliseconds.

Description: The transmitter is held active for this duration after dropping any active outgoing PL tone. This is used as an alternative to reverse burst PL to prevent squelch crashes on the callers radio when outgoing PL is active and the callers is also using a receive PL decoder. Basically this delay allows the callers PL decoder time to mute before dropping the repeaters transmit carrier.

76 - SET PL ACTIVE DETECT VALIDATION PERIOD

Syntax: 76*{param}#

Parameters: 10-255 = validation period in milliseconds.

Description: This command configures the PL decoder’s active state detection time period. A received PL tone will only be considered valid after this period expires. This feature is designed to allow tuning of the PL decoder detect state to prevent false PL detects.

77 - SET PL DROP DETECT VALIDATION PERIOD

Syntax: 77*{param}#

Parameters: 10-255 = validation period in milliseconds.

Description: This command configures the PL decoder’s drop state detection time period. A received PL tone will only be considered dropped after this period expires and a successful detect state has occurred. This feature is designed to allow tuning of the PL decoder detect state to prevent PL dropouts during weak signal or hill-topping conditions.

78 - SET KERCHUNK FILTER TIMEOUT

Syntax: 78*{param}#

Parameters: 0-3000 = validation period in milliseconds.

Description: This command configures the “kerchunk” filter timer and defines the minimum transmission time to key up the repeater. Any valid signal must remain active for this duration before the controller responds initially. Afterwards the kerchunk filter is bypassed as long as the transmitter remains in the active state (i.e. for the duration of the hang timer after CAS is dropped). Once the transmitter state goes idle again, the kerchunk timer must expire again before the repeater will go active again. Therefore, a reasonably long hang time should be configured when this option is enabled.

80 - GLOBAL FLAGS CONTROL

Syntax: 80*{flag}*{mode} ... *{mode}#

Parameters: flag:
 0 = disable
 1 = enable
mode:
 0 = sets or clears all modes based on {flag}
 1 = transmitter disable
 2 = ISD voice recorder disable
 3 = outgoing TX PL generation disable
 4 = incoming RX PL detection disabled
 5 = Mute DTMF tones to TX port
 6 = Mute DTMF tones to AUX port
 7 = Outgoing TX PL active when RX is active

Description: This command is used to globally disable/enable various system flags or features quickly or temporarily. Note the {mode} values represent bit number flags and may be set or cleared in any combination of the above {mode} values listed.

Examples:

80*1*1 (disable the transmitter)
 21*0*0 (clears all global flags to the default normal state)

90 - RESET CONFIG TO DEFAULTS

Syntax: 90#

Parameters: (none)

Description: This command restores all the default controller settings to SRAM. You must issue command 92 afterwards to store these values to EPROM if you wish the defaults to be used the next time the controller is power cycled.

91 - RECALL CONFIG FROM EEPROM

Syntax: 91#

Parameters: (none)

Description: This command recalls all global configuration parameters from EPROM into SRAM. The controller always uses configuration settings contain in SRAM during execution. The command allows any previous settings stored in EPROM to be recalled.

92 - STORE CONFIG TO EEPROM

Syntax: 92#

Parameters: (none)

Description: This command stores the current configuration settings contained in SRAM to EPROM for permanent storage. At power up, the controller loads all configuration settings from EPROM into SRAM prior to execution. The controller always uses configuration settings contain in SRAM during execution.

95 - RE-INITIALIZE CONTROLLER

Syntax: 95#

Parameters: (none)

Description: This command reinitializes the controller and hardware using the current configuration settings in SRAM. This command is intended for hardware diagnostic purposes only.

99 - SET DEBUG DISPLAY MODE

Syntax: 99*{param}#

Parameters: 0 = Debug mode on
1 = Display squelch, CAS and PL info
2 = Display ADC debug level info

Description: This command is used to enable debug display mode on the LCD for diagnostic purposes only. Normally the controller runs with debug mode disabled and this value should be set to zero.

Table 1 – CTCSS Tone Index Values

Index	CTCSS Tone	Index	CTCSS Tone
0	NO TONE	24	146.2 Hz
1	67.0 Hz	25	151.4 Hz
2	69.3 Hz	26	156.7 Hz
3	71.9 Hz	27	159.8 Hz
4	74.4 Hz	28	162.2 Hz
5	77.0 Hz	29	167.9 Hz
6	79.7 Hz	30	173.8 Hz
7	82.5 Hz	31	179.9 Hz
8	85.4 Hz	32	183.5 Hz
9	88.5 Hz	33	186.2 Hz
10	91.5 Hz	34	189.9 Hz
11	94.8 Hz	35	192.8 Hz
12	97.4 Hz	36	196.6 Hz
13	100.0 Hz	37	199.5 Hz
14	103.5 Hz	38	203.5 Hz
15	107.2 Hz	39	206.5 Hz
16	110.9 Hz	40	210.7 Hz
17	114.8 Hz	41	218.1 Hz
18	118.8 Hz	42	225.7 Hz
19	123.0 Hz	43	229.1 Hz
20	127.3 Hz	44	233.6 Hz
21	131.8 Hz	45	241.8 Hz
22	136.5 Hz	46	250.3 Hz
23	141.3 Hz	47	254.1 Hz

Table 2 - SelCall Tone Index

Index	SelCall Tone
0	1981 Hz
1	1124 Hz
2	1197 Hz
3	1275 Hz
4	1358 Hz
5	1446 Hz
6	1540 Hz
7	1640 Hz
8	1747 Hz
9	1860 Hz
10	2400 Hz
11	930 Hz
12	2247 Hz
13	991 Hz
14	2110 Hz