

WA1LMV Repeater Controller

User's Manual

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This manual is written for my close friends and is not intended for general distribution. Please do not divulge any information about the *6900 series codes and use extreme caution about releasing any other codes. The Macro Functions (#0 through #9) should be sufficient for most casual users.

Controller Hardware/Software

The WA1LMV Repeater Controller consists of an INTEL 8085 CPU. This is an 8-bit processor with a 5.185 MHz. clock. The board has provisions for up to 32K of EPROM and 4K of Static RAM. The board contains the INTEL family of support chips. The 8253 Programmable Interval Timer is used to provide the 1 ms interrupt for the background timing system. It is also used as a programmable pitch audio source for MCW and other tones. The 8251 USART is used for CRT console I/O at 19,200 bps. This board is a single board computer which was discarded during an upgrade of a Kodak Ektachem Blood Analyzer.

External to the main board is an expansion board which contains two DTMF decoders (an SSI-202P decoder and an SSI-75T2089 encoder/decoder), the watchdog timer, an MM58167 time of day clock/calendar with battery back-up and the SSI-263 Speech Synthesizer.

The 8259 Programmable Interrupt Controller is used to process interrupts from the 8253 as well as two DTMF decoders and the 8251 USART for the CRT console. The single CPU supports the four interrupt-driven processes and many more polled events.

Although the software was written in Z80 assembly language, it does not use any Z80-specific instructions so it can run on the 8085. The 200+ page source code assembles down to a 17K machine language program.

Several software error traps are incorporated. During each 1 ms interrupt, the processor stack pointer address is examined. If it is determined that the stack pointer address is not within the assigned address of the stack, the software will generate a master reset. Interrupt RST 7 will also cause a Master Reset. Should the processor find itself executing instructions where no memory exists, the contents of memory at that address will be OFFH (a floating data bus). The instruction OFFH is the RST 7 instruction which will call the master reset routine.

On the hardware side, there is a watchdog timer which must be pulsed ("ticked") by the software. If periodic pulses to the watchdog timer stop for around one second, the timer will time-out and reset the processor through the hardware reset line. In order to ensure that both the background and foreground tasks are properly executing, the watchdog bit is set ("tick") in the background and reset ("untick") in the foreground. Of course, the generated square wave is not symmetrical but the timer only needs to see a pulse stream to keep it reset.

The controller supports a CRT console. The console displays the current status of the I/O ports and the control state. Through the console keyboard, commands can be entered in the same way that they would be entered through DTMF over the radio or phone line. In addition, 26 lettered "speed commands" are available to perform quick commands during equipment maintenance. The display is updated 4 times per second except during certain tasks such as MCW or Speech.

As command letters or digits are entered, they are displayed across the bottom of the screen. Command letters or digits are simultaneously accepted from the console, radio DTMF or phone DTMF. The command line is fully buffered and supports type-ahead from all sources. X-ON/X-OFF protocol is supported at the console.

Input and Output signals can be enabled/disabled on the bit level. This can be done either through the console or through DTMF as well. A special routine converts the DTMF two digit sequences of #1 through #6 into the Alpha Characters A through F for I/O capability in HEX. The controller can speak the contents of any memory location in HEX in MCW or Speech for remote testing, diagnostics or parameter changes.

The software was written to emulate the existing commands and functionality of the hard wired logic system in place at WA1LMV/R for 13 years. Except for the courtesy tones (which were not previously supported) there was almost no way to tell that changes were made to the repeater until it spoke with that foreign accent! MCW pitch and speed, timers and response times matched the parameters of the old system.

All controller commands begin with either the (*) or (#) keys. Most controller codes are five character codes beginning with (*). Two levels of commands allow certain users access to some repeater features without giving them access to critical repeater control. Codes in the *2500 through *2599 series are user codes (autopatch, links, etc.) while codes in the *6900 through *6999 series are reserved for control station functions like transmitter and receiver control. The first two digits (25) and (69) are the unlock codes and are programmable. The second two digits are the function codes.

The Macro Functions begin with (#). These are ten programmable codes (#0 through #9) which translate into any (*) series control code as a form of "speed command". See "Macro Functions" later in this manual.

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Receivers Access/Release Delays

There are separate timers on each main receiver and auxiliary receiver for Access and Release Delays. The Access Delay is used to keep the repeater from keying due to very brief opening of the receiver squelch or tone gates. The Release Delay is used to keep the time-out timers from being reset due to very brief momentary loss of receiver signal during noisy conditions. The Release Delay is also instrumental in keeping the courtesy tone from annoyingly beeping during noisy signals. The Access and Release Delays do not affect the receiver audio gates. The audio gates are processed almost instantaneously in order to achieve the tightest squelch and PL tails.

Main Receivers Time-Out Timers

There is a separate time-out timer on each main receiver. It is set for three minutes. When a carrier is detected on the input, the timer begins to count down to zero. When it reaches zero, the repeater will begin to send a rapidly pulsing audio beep during the last 5 seconds of transmit time. This is the time-out alarm, used to signal the other users that someone is timing-out the repeater.

When the user releases his carrier, the repeater will immediately come back on the air and send the words "BEER BEER" in MCW to indicate that the user timed-out the repeater and owes everyone a beer.

The controller can inhibit the time-out timer if the incoming signal has PL. If the user has PL, the repeater will not time-out for that user. PL time-out inhibit can be enabled with a control code.

PL Time-Out Inhibit Control

450 PL Time-Out Inhibit

Enable - *6984

Disable - *6983

6M PL Time-Out Inhibit

Enable - *6974

Disable - *6973

Courtesy Tones

Activity on the main receivers will cause some type of courtesy tone (if enabled). Generally, the 450 Receiver produces a high-to-low pitch tone and the 6M receiver produces a low-to-high pitch tone. When either auxiliary receiver is enabled, additional tones are added to the courtesy tone. By default, AUX RX #1 sends a high pitch MCW "R" and AUX RX #2 sends a low pitch MCW "R". The "R" changes to a "T" when the respective transmitters are enabled. The indicators can be any MCW character. The indicator tones for the AUX RX/TX equipment can not be disabled. They operate when the respective equipment is enabled.

There are three courtesy tone modes: Mode 0 is all tones disabled, Mode 1 causes a courtesy tone only for the first receiver key-up, and Mode 2 causes courtesy tones for every receiver key-up.

Six Meter Receiver Courtesy Tone Mode:

***2583n** where n is the desired mode.

450 Receiver Courtesy Tone Mode:

***2584n** where n is the desired mode.

Mode 0 = all courtesy tones disabled.

Mode 1 = Courtesy tones only for initial receiver key-up.

Mode 2 = courtesy tones for every receiver key-up.

Main Receivers Control

Both main repeater receivers can be set to one of three modes:

1 - Completely Disabled, 2 - Enabled with PL, or 3 - Enabled without PL.

Six Meter Receiver Control:

Enable (with PL) - *6971 Enable (no PL) - *6972 Disable - *6970

450 Receiver Control:

Enable (with PL) - *6981 Enable (no PL) - *6982 Disable - *6980

Both main receivers can also respond to a temporary PL disable command from the users. This command will disable the PL on the respective receiver only for the default time of 60 seconds. The command is a single digit command.

6M Temporary PL Inhibit - 1

450 Temporary PL Inhibit - 2

Reset Both Main Receivers PL Inhibit - 3

There is a control function to enable/disable either function.

6M Temporary PL Inhibit

Enable - *6976

Disable - *6975

450 Temporary PL Inhibit

Enable - *6986

Disable - *6985

The Six Meter Repeater currently has two separate antennas selectable through an antenna relay via control command. Antenna #1 is the Phelps Side-Mount Dipole at 100'. Antenna #2 is the same model antenna at 50'.

**Antenna #1 Select - *2541
Macro Command - #4**

**Antenna #2 Select - *2542
Macro Command - #7**

Main Transmitters Control

6M Transmitter

Enable - *6993

Disable - *6992

450 Transmitter

Enable - *6991

Disable - *6990

450 Transmit Limit Control

The 450 Transmitter has a function which will limit the time that the 450 transmitter remains on the air if a conversation is in progress where all the stations are on six meters. If the repeater has been idle for five minutes, any station will cause both main transmitters to come on. If stations are using only six meters, the 450 transmitter will drop out after ten minutes of repeater usage. Any station keying up on the 450 input will reset the ten minute timer and restore the 450 transmitter to operation. Any DTMF digit received on either main receiver will also reset the 10 minute timer. The ID will be broadcast on 450 at the same time it is sent on six meters. However, if the 450 TX limit timer has timed out, the 450 transmitter will drop out as soon as the ID is complete.

If the repeater remains unused for five minutes, the limit timer will be reset and the transmitters will again respond in tandem.

A control function is available to disable the 450 Transmit Limit.

450 Transmit Limit Control

Enable - *2531

Disable - *2530

Identifier

The controller supports MCW and Speech ID. There is a 7 minute ID timer. 7 Minutes was chosen so that the total maximum ID time will not exceed 10 minutes. The receiver time-out timers are set to three minutes. Because the ID is polite, and will wait for the user to stop transmitting, the maximum ID interval will be the ID time plus the time-out time. (Note that with PL Time-Out Inhibit, it is possible to exceed the 10 minute maximum ID time required by the FCC.)

The controller uses MCW ID during repeater usage. After the repeater usage stops, it will do a final ID (called Broadcast ID) one time at the next ID timer time-out. The Broadcast ID will be in Voice.

ID Start Commands:

MCW: *2508	or	Macro Command #8
Speech: *2509	or	Macro Command #9

Autopatch

The Autopatch is full-duplex using a standard hybrid and dual-line amplifier on a touchtone phone line without special services like Totalphone. The Autopatch has a 2 minute inactivity dump timer which is reset by activity on either main receiver.

Access - *2501	or	Macro Command #1
Release - *2500	or	Macro Command #0

The basic access command will draw dialtone. Dialing of the phone number will now be made using the tones you send over the radio.

Touchtone Regeneration

The controller has a touchtone encoder which can also dial the phone. To use the encoder to regenerate the number received over the radio, append the desired phone number to the access code.

Access - *2501 nnnnnnn	or	Macro Command #1 nnnnnnn
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For example, using the code *2501 5890960 will cause the dialer to regenerate the number 589-0960 and dial the telco test tone. Likewise, dialing #1 5890960 will do the same thing.

Speed Dialer

There are ten programmed Speed-Dial numbers stored in the controller.

Access - *2502 n **or** **Macro Command #2 n**

where "n" is the desired Speed Dialer number from 0 to 9. Speed Dialer slot "0" always stored the last number manually entered through the Touchtone Regeneration function above. You could use *2502 0 or Macro Command #2 0 to re-dial the last manually dialed number.

Default Speed Dialer Assignments:

- 0 - Last Manually Dialed Number**
 - 1 - WA1LMV House**
 - 2 - WA1SZU House**
 - 3 - K1ZSG Shop**
 - 4 - WA1ZDF House**
 - 5 - WA1YHM House**
 - 6 - WA1LMV Shop**
 - 7 - Telco Test**
 - 8 - WA1SHC House**
 - 9 - State Police**
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Time, Date and Alarm Clock Functions

The controller uses the National MM58167 Time of Day Clock/Calendar. The time and date can be spoken by the speech synthesizer.

Speak the Time

The time will be spoken in 12 hour AM/PM format.

Access - *2506 **or** **Macro Command #6**

Speak the Date

The date will be spoken in numeric format.

Access - *2536

Program Scheduled Events

***6913 e p hh mm cccccc**

where e = the event (0 to 9)
p = the priority (0 = Low, 1 = High)
hh = hours (0 to 23)
mm = minutes (0 to 59)
ccccc = control code (i.e. *2505)
or silent commands (i.e. **6972)

***6913 e**

this command (without time or control code) toggles the active/not active status of event 'e'. The controller will respond in MCW or Speech with 'on' or 'off' to indicate the current status.

A special function - ***2539** is available to call the "Curly" routine from the Scheduler when the hourly chime is disabled. This function calls the time, ID and Curly so that it can be used from the scheduler to announce only at selected times, such as Noon and Midnight.

Programmable Macro Keys

The controller software supports ten programmable Macro Functions. These are speed-commands which consist of #0 through #9. Any five digit (*) command can be programmed into the ten Macro Command slots.

Default Macro Command Settings:

#0 - Autopatch Off	(*2500)
#1 - Autopatch On	(*2501)
#2 - Speed Dialer	(*2502)
#3 - Speak Last Number	(*2503)
#4 - Antenna #1	(*2541)
#5 - Curly Routine	(*2505)
#6 - Speak Time	(*2506)
#7 - Antenna #2	(*2542)
#8 - MCW ID Start	(*2508)
#9 - Voice ID Start	(*2509)

The controller software substitutes the (*) code for the related (#) Macro Command. This means that if the (*) code accepted additional digits at the end of the code, the (#) will accept them the same way. For example, to access the autopatch and dial the number 589-0960, you would dial #1 5890960. This is the same as entering *2501 5890960. To dial speed dialer slot 6, you would use #26 which is the same as entering *25026.

Programming Macro Function Keys

***6952 n ccccc** **where n is the Macro Key to program (0 to 9)**
 and ccccc is the command to store, i.e. *2501

Example: *6952 1 *2501 will store *2501 Autopatch On into
Macro Key #1

Enable/Disable Macro Commands

Enable - *6951

Disable - *6950

Landline Control

The controller supports dial-up callers (reverse autopatch) and dial-up control system access. The phone number is **(860) 673-4390**.

The control system can disable the ring detector. This is useful when a prankster (or Extra Class Licensee) stumbles upon the repeater phone number and delights in playing havoc.

Ring Detector:

Enable - *6963

Disable - *6962

Reverse Autopatch: The caller simply calls the number. After 4 rings, the controller answers. After 5 seconds, the transmitters will key and the controller will generate a audible ringing signal for the next 45 seconds or until a repeater user accesses the autopatch. After 45 seconds, the system resets if no one answered the phone.

Dial-up Control: After 4 rings, the controller answers the phone. You have 5 seconds to unlock the control system by pressing the digit ZERO. The controller will send two tones back at you to signal that you were successful. You now have full access to all the control functions. You have a ten minute time limit before the controller hangs-up. The time is preset back to ten minutes each time the dial-up user presses any valid touchtone digit.

Here are a few control codes of particular interest to Dial-up Users:

Phone Number: 582-8024

***2591 - Full Autopatch ON** (same as *2501)

***2590 - Full Autopatch OFF** (same as *2500) (also turns Monitor Mode OFF)

***2597 - Monitor Mode ON** (half-patch -- listen only mode)

***2596 - Monitor Mode OFF**

***2598 - Reset Landline Control** (hangs up when you are done)

Remember that if you are dialing-up to disable a receiver with open squelch, don't enter the Monitor Mode or access the Autopatch. The open receiver noise may block your phone line touchtones from being processed by the landline DTMF decoder. In any event, you can always try again in ten minutes!

During a landline control session, only the *259n series codes have audible response feedback to the control user on the phone. This is in the form of two DTMF tone bursts. If the control user enabled the monitor mode (*2597), he will hear Speech or MCW readout as it is being sent over the repeater. During a landline control session, the controller will not error out on random DTMF digits entered over the phone unless they begin with a (*) or (#) and were not a valid control or macro sequence. Pressing any DTMF digit will preset the landline control time limit back to 10 minutes.

DTMF Decoder Commands

There are several DTMF decoder control functions provided to enhance system versatility. You can require PL on either main receiver in order to respond to DTMF. You can disable the DTMF audio mute.

450 PL required for DTMF

Enable - *6921

Disable - *6920

6M PL required for DTMF

Enable - *6923

Disable - *6922

DTMF Mute Control

This function will enable or disable muting of Touchtones. Remember that there is another function called "DTMF Pass-Thru" (shown below) which will do the same thing for a fixed period of time and then self-reset.

Enable - *6925

Disable - *6924

DTMF Pass-Through

Using this command, you can temporarily suspend controller processing of DTMF input so that your tones can go out over the transmitters unmuted and unrecognized by the controller. There is a ten second automatic time-out of the function. The controller will acknowledge with an MCW "OK" when the function is activated.

DTMF Pass-Through - (single digit) 9

MCW/Speech Modes

There are three modes in which MCW and speech functions operate. Mode 0 is all Speech and MCW disabled (except for MCW ID which is always enabled). Mode 1 is the MCW-Only Mode. This mode is forced if the controller does not find the SSI-263 Speech Chip when the software initializes. If the chip is not physically there and the user sends the command to enter Mode 2, MCW/Speech enabled, the controller will test again for the existence of the chip, not find it, and force Mode 1 again along with an MCW "NO" to indicate the function was not allowed.

Set MCW/Speech Mode - *2581n

where n is the desired mode:

0 = All MCW and Speech Disabled (except for MCW ID)

1 = MCW-Only Mode

2 = MCW/Speech Mode

Diagnostic Functions

Memory or Port Read/Write Functions

Provisions are made to read the contents of any memory location or input port. You can also write to any memory location or output port. Because the software is very dynamic, you should remember that there are many memory locations and output ports which are frequently updated by the various routines. Just because you deposited a certain byte in memory doesn't mean that the controller software won't update that location with its own value during the next 1ms interrupt! You have to know what you are doing and you should have a copy of the latest repeater software source code listing in order to be effective and successful.

Read Memory/Port - *6930 aaaa

Write Memory/Port - *6931 aaaa #0 dd

where: aaaa = Memory or Port Address in HEX
dd = Data in HEX

Alpha HEX characters are entered with a two-digit DTMF sequence where A=#1, B=#2, C=#3, D=#4, E=#5 and F=#6. #0 is a space character and is used to separate the address from the data.

Several commands exist for testing the repeater or for use by people testing equipment in the field:

Key Transmitters for 5 Minutes

This command will key both transmitters for 5 Minutes. Any main receiver input will reset the transmit tail to 5 seconds. The ID is started before the 5 Minute cycle so that the time will not be interrupted by an unexpected ID.

Key Transmitters - *6961

Test Tone and Speech Deviation

Two commands are available for testing the deviation of the MCW ID and Courtesy Tones as well as the Speech Synthesizer. They will key the main transmitters for 5 Minutes and provide either a constant audio tone or a constant speech syllable (say 'Ahhh!'). Any input from either main receiver will reset the transmit tail to 5 seconds but will not necessarily stop the tone or speech. If courtesy tones are enabled, then the receiver input will also cause a courtesy tone which would stop the test tone. If a speech test is in progress, the only ways to stop the speech are the OFF function or to start any event which causes speech.

Test Tone Deviation ON - *6933

Test Tone Deviation OFF - *6932

Test Speech Deviation ON - *6935

Test Speech Deviation OFF - *6934

Master Reset and User Reset Functions

Two reset control codes are provided.

User Reset

This User Reset command restores all User level commands to a default state (i.e. Autopatch OFF, all Link RX/TX OFF, Courtesy Tones ON, etc).

User Reset - *2599

Master Reset

This Master Reset command completely re-starts the controller and copies ALL default ROM parameters to working memory. This will wipe-out any changes made to any parameters before the command was initiated.

Master Reset - *6999

WA1LMV Repeater User and Control Codes as of 11/09/1992

General User Functions

Control Code	Macro Code	Description
*2501	#1	Autopatch ON (Radio Dialing)
*2501 nnnnnnn	#1 nnnnnnn	Autopatch ON (with DTMF Regeneration)
*2502 n	#2 n	Speed Dial (0 to 9) (0 is last manually dialed no.)
*2503	None	Speak the last dialed number
*2500	#0	Autopatch OFF
*2505	#5	"Curly" Routine (also see *2539)
*2506	#6	Current Time
*2507	None	"Super Beep" (Just for test)
*2508	#8	MCW ID Start
*2509	#9	Voice ID Start

Two Meter Remote Base Functions - 147.75 TX / 147.15 RX

*2511	None	Two Meter Receiver ON (also forces TX OFF)
*2512	None	Two Meter Transmitter ON
*2510	None	Two Meter Receiver and Transmitter OFF

Ten Meter Remote Base Functions - 29.6 TX / 29.6 RX **Not In Service**

*2521	None	Ten Meter Receiver ON (also forces TX OFF)
*2522	None	Ten Meter Transmitter ON
*2520	None	Ten Meter Receiver and Transmitter OFF

Clock and Hourly Chime Functions

*2506	#6	Speak the Time
*2536	None	Speak the Date
*2535	None	Enable Hourly Chime
*2534	None	Disable Hourly Chime

MCW and Speech Modes

*2581 0	None	MCW/Speech Disable (Mode 0) (MCW ID always enabled)
*2581 1	None	MCW Only Mode (Mode 1)
*2581 2	None	MCW/Speech Mode (Mode 2)

6M Receiver Courtesy Tone Modes

*2583 0	None	Courtesy Tone Disabled (Mode 0)
*2583 1	None	Courtesy Tone on first RX Key-Up (Mode 1)
*2583 2	None	Courtesy Tone on each RX Key-Up (Mode 2)

450 Receiver Courtesy Tone Modes

*2584 0	None	Courtesy Tone Disabled (Mode 0)
*2584 1	None	Courtesy Tone on first RX Key-Up (Mode 1)
*2584 2	None	Courtesy Tone on each RX Key-Up (Mode 2)

Antenna Relay Functions

*2541	None	6M Antenna #1 Side Mount Dipole at 100'
*2542	None	6M Antenna #2 Side Mount Dipole at 50'

Landline Control Functions

Call (203) 582-8024. Press Zero when phone answers.

*2591	#1	Full Autopatch ON (Same as *2501)
*2590	#0	Full Autopatch and Monitor Mode OFF
*2597	None	Monitor Mode ON
*2596	None	Monitor Mode OFF
*2598	None	Reset Landline Control

Single Digit User Commands

1	6M Temp PL Disable
2	450 Temp PL Disable
3	Reset Temp PL Disable
9	DTMF Pass-Thru

Master Reset User Functions

*2599	None	Master Reset User Functions to ROM Defaults
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Control Functions Series *6900 Codes

Autopatch Control Functions

*6901	Autopatch Enable
*6900	Autopatch Disable
*6902 s nnnnnnnnnn	Program Speed Dialer Slot (s = slot, nnn is number)
*6903 s	Speak Speed Dialer Number (s = slot)
*6963	Ring Detector Enable
*6962	Ring Detector Disable

DTMF Decoder Functions

*6921	450 DTMF PL Enable
*6920	450 DTMF PL Disable
*6923	6M DTMF PL Enable
*6922	6M DTMF PL Disable
*6925	DTMF Mute Enable
*6924	DTMF Mute Disable
9	DTMF Pass-Thru

Clock/Calendar Control Functions

*6911 hh mm ss	Set the Time: hh - Hours 0 to 23 mm - Minutes 0 to 59 ss - Seconds 0 to 59 (optional)
*6912 mm dd yyyy	Set the Date: mm - Month 1 to 12 dd - Day of the Month 1 to 31 yyyy - Year (1992) or yy (92)
*6913 e p hh mm ccccc	Program Scheduled Event: e - Event Number 0 to 9 p - Priority 0 = low, 1 = high hh - Hours 0 to 23 mm - Minutes 0 to 59 cccccc - Desired Control Code (i.e. *2500 or silent command option, i.e. **2500)
*6913 e	Toggle Event Active Status e - Event Number 0 to 9

Clock/Calendar Control Functions

*6914	Subtract One Hour from current time
*6915	Add One Hour to current time

Six Meter Receiver Control Functions

*6971	6M RX Enabled with PL Enabled
*6972	6M RX Enabled with PL Disabled
*6970	6M RX Disabled
*6974	6M RX Time-Out Inhibit during incoming PL Enabled
*6973	6M RX Time-Out Inhibit during incoming PL Disabled
*6976	6M RX Temp PL Override Enable (User Function 1)
*6975	6M RX Temp PL Override Disable (User Function 1)

450 Receiver Control Functions

*6981	450 RX Enabled with PL Enabled
*6982	450 RX Enabled with PL Disabled
*6980	450 RX Disabled
*6984	450 RX Time-Out Inhibit during incoming PL Enabled
*6983	450 RX Time-Out Inhibit during incoming PL Disabled
*6986	450 RX Temp PL Override Enable (User Function 2)
*6985	450 RX Temp PL Override Disable (User Function 2)

Main Transmitters Control Functions

*6991	450 TX Enabled
*6990	450 TX Disabled
*6993	6M TX Enabled
*6992	6M TX Disabled
*2531	450 TX Time Limit Enabled
*2530	450 TX Time Limit Disabled

Macro Commands Control Functions

*6952 n ccccc	Program Macro Command: n - the desired macro function to program 0 to 9 cccccc - the desired control code to store, i.e. *2500
*6951	Macro Functions Enabled
*6950	Macro Functions Disabled

Miscellaneous Control Functions

*6952	User Functions Enabled (*2500 Series Codes)
*6953	User Functions Disabled
*6961	Preset Transmit Time to 5 Minutes for Testing (The next main receiver input will reset to 5 seconds)
*6930 aaaa	Read Memory or Port: aaaa - the desired address in HEX
*6931 aaaa #0 dd	Write Memory or Port: aaaa - the desired address in HEX #0 - required as a space between address and data dd - the desired data to write in HEX To enter alpha characters: #1=A, #2=B, #3=C, #4=D, #5=E and #6=F
*6933	Test Tone Deviation and Transmit for 5 Minutes
*6932	Test Tone Deviation Off
*6935	Test Speech Deviation and Transmit for 5 Minutes
*6934	Test Speech Deviation Off
*2599	Reset User Functions to ROM Defaults
*6999	Master Reset the Controller and Default ALL Parameters

Silent Transpond Mode: To disable MCW or Speech transpond of control or user functions, double up on the first * or #. For example, to make *2500 a silent command, enter the command as **2500 instead of *2500. To make #1 a silent command, enter it as ##1.