Pion and Simon Electronics

PSE-508-3
Repeater Controller User's Guide

Document Version 1.0

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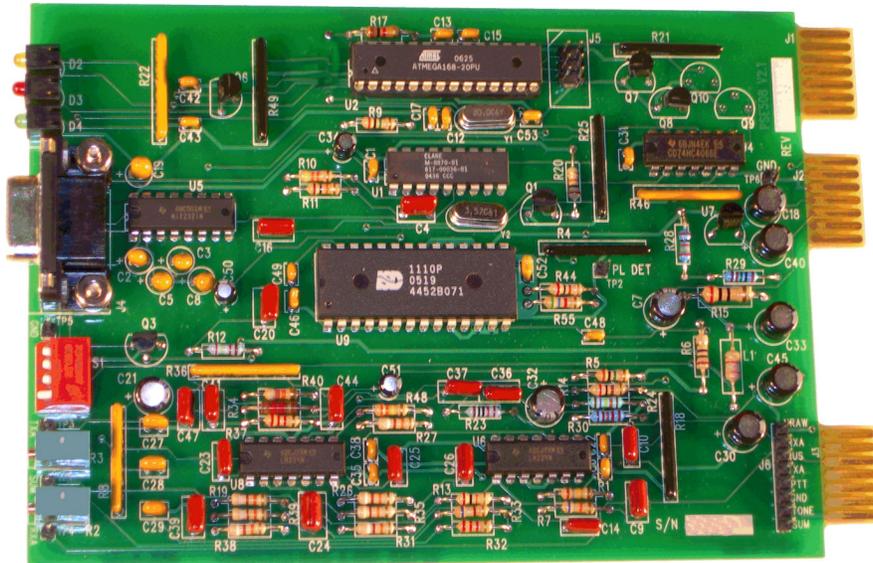
Change History

Date	Ver	Who	Description
060616	1.0	ALP	Initial Release, cloned from '-2' document with changes for '-3'

Contents

1. Introduction

1.1. Scope

This document describes the setup, configuration, and general usage of the PSE-508-3 repeater controller. It contains some Mastr II setup information; however it does not attempt to provide sufficient information to set up and maintain the Mastr II. For that information please reference the appropriate GE documents for your specific transmitter and receiver.

1.2. General

The PSE-508 series are single channel repeater controllers specifically designed for repeaters based on the GE Mastr II Base Station radio. They consists of a double-sided printed circuit board with a card-edge connector designed to fit into the Mastr II control shelf motherboard, in the AUDIO slot adjacent to the 10-volt regulator card. They interface with the signals on the Mastr II backplane, and implement complete repeater control without the requirement of any additional wiring[1].

The PSE-508-3 provides the following features:

- Easy installation and setup,

- "Plug and Play" repeater control for the GE Mastr II,

- Low (<60mA) power requirements,

- RS-232 setup and parameter configuration,

- Password protected DTMF commands for most common control functions,

- Built in 4-channel CTCSS tone decoder,

- Built in 4-channel CTCSS tone encoder,

- User selectable reverse burst feature on CTCSS encoder,

- CW repeater identification,

- Built-in voice record-playback for ID and/or announcements,

- Independently adjustable CW, courtesy beep, and voice levels,

- User programmable timers for transmit timeout, repeater identification, and transmit hang time,

- User selectable CW and Courtesy Beep tone frequency and level, and CW word-per-minute rate,

- Status LEDs for power-on, squelch open, and PTT active,

- PTT enable/disable switch, and PTT on/off switch,

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[1] A jumper must be installed in the radio cabinet to enable CTCSS encoding.

1.3. Glossary of Names and Acronyms

Courtesy Beep   A tone that is transmitted after the user's carrier drops and before the hang time begins. The purpose of the courtesy beep is to inform listening users that the current user has ceased to transmit and the repeater now is available for other users to transmit.

CWID   An identification string consisting of alphanumeric characters transmitted using Morse code. The purpose of the CWID is to periodically identify the repeater in compliance with FCC rules.

DTMF   Dual-Tone Multi-Frequency. DTMF tones were originally designed by the phone company for use in "Touch Tone" telephones. Many VHF radios have the capability to transmit DTMF tones via buttons on the radio's keyboard or microphone. DTMF tones consist of the digits 0 through 9 and the letters A, B, C, and D, and the special characters * and # for a total of 16 tones.

Hang Timer   A timer which, while running, causes the transmitter to continuously transmit an unmodulated carrier. The duration of this timer is referred to as the "Hang Time". The purpose of the hang timer is to allow the transmitter to transmit continuously when a user begins a new transmission after the previous user's carrier has dropped, thereby preventing excessive transmit relay operation.

CTCSS Tone   A sub-audible tone that is transmitted by a radio along with the user's audio. The PSE-508 is capable of decoding a CTCSS tone and using its presence or absence to either open or close, respectively, the repeater's squelch. The PSE-508 is additionally able to encode CTCSS tones with the user's audio and transmit the encoded audio.

Toggle   Toggling is a process by which the state of a switch may be changed. If the switch is off, toggling it will turn it on. If the switch is on, toggling it will turn it off.

Transmit Timeout   A timer which, when timed out, causes the transmitter to cease transmitting until the received carrier is no longer present. The purpose of the Transmit Timeout timer is to protect the transmitter power circuitry by preventing it from continuously transmitting for too long a period of time.

2. Printed Circuit Board Features

Figure 1 shows the PSE-508's front panel. The front panel contains several controls, indicators, and testpoints in a convenient location.

Figure 1: PSE-508 Front Panel
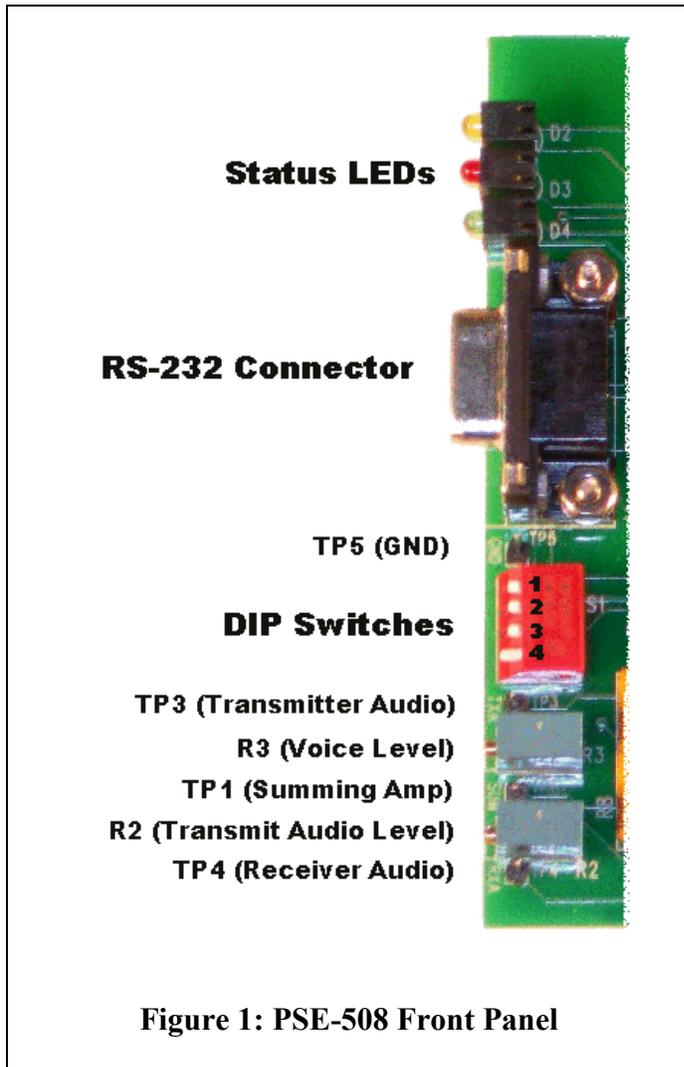
2.1. Testpoints

The following testpoints are present on the card edge for easy connection to a meter or scope during setup and troubleshooting.

- TP1 (Summing Amp): Combined Audio. This signal contains the combined audio (CW + Stored Voice + Receiver Audio) before it is sent to the transmit audio amplifier. It is an AC signal riding on a 5-volt bias.

- TP2 (CTCSS Detector). This signal contains the filtered and limited CTCSS signal that is read by the microcontroller for CTCSS detection. (Not shown in the Figure. This testpoint is located behind U9). It is a 0 to 5 volt signal.

- TP3 (TXA): Transmitter Audio Out. This is the audio that is sent to the Mastr II transmitter. This signal is the same as Mastr II TX_AUDIO_HI pin.

- TP4 (RXA): Discriminator Audio In. This signal is the same as the Mastr II VOL_SQ HI_signal.

- TP5 (GND): Signal Ground. This testpoint carries the signal reference (0 V) and is suitable for connection to a multimeter or oscilloscope ground connector while making measurements via the other testpoints.

2.2.   Status LEDs

The status LEDs are shown in Figure 2.

- Power On (Green): This LED is on when power is applied to the PSE-508.

- PTT (Red): This LED lights when the REMOTE_PTT signal is asserted to the Mastr II exciter.

- Unsquelched (Yellow): This LED lights when the PSE-508 is receiving a receiver-unsquelched signal from the Mastr II (RUS high).
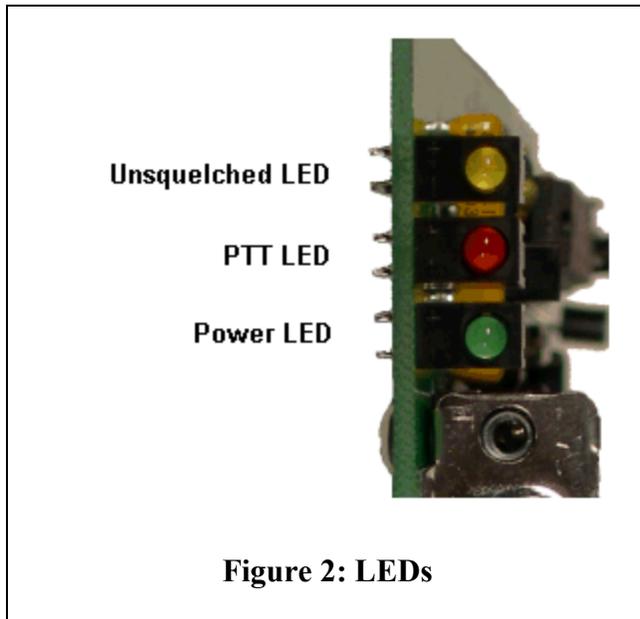
2.3.   RS-232 Connector

This connector is used to connect an RS-232 compatible terminal (or computer) to monitor and modify the PSE-508's internal parameters. See section 4.3.12.

2.4.   DIP-Switches

The DIP-switches are shown in Figure 1. They allow the user to enable or disable certain features of the PSE-508 without connecting an RS-232 compatible terminal.

A DIP-Switch is closed when it is pressed down towards the printed circuit board. A DIP-Switch is open when it is raised.

Figure 2: LEDs

- Switch #1 and Switch #2 are currently unused.

- Switch #3 causes PTT to be activated for as long as the switch is closed. When switch #3 is open the PSE-508 microcontroller controls PTT. Switch #3 will cause PTT to activate even if switch #4 is open. Closing switch #3 will not cause the CTCSS encoder to turn on. To turn on both the CTCSS encoder and PTT, see the "J" command (section 5.4.9).

- Switch #4, when closed, allows the PSE-508's microcontroller to enable and disable the PTT signal sent to the Mastr II exciter. When switch #4 is open, PTT is blocked and the PSE-508 will be unable to activate the transmitter. This allows the user to disable the transmitter during PSE-508 setup and troubleshooting.

2.5.   R2 (Transmit Audio Level)

Potentiometer R2 is shown in Figure 1. It allows the user to adjust the overall audio level sent to the Mastr II exciter via the TX_AUDIO_HI signal. Monitor TP3 when adjusting this pot.

2.6.　R3 (Voice ID Audio Level)

Potentiometer R3 is shown in Figure 1. It allows the user to adjust the audio level of the voice playback circuit. Use the "W" command to play back the voice message while adjusting this pot.

3. Installation and Setup

The PSE-508 was designed for installation in Mastr II base station radios. Before it will function properly, the Mastr II must be configured as a repeater and the receiver and transmitter must be properly adjusted as specified by GE. For more information on how to set up your Mastr II repeater, see our website at

http://www.pionsimon.com/index.php/Repeater_Setup

More information is available at the Repeater Builder website at

http://www.repeater-builder.com/rbtip/geindex.html

The PSE-508 expects to see the following inputs and outputs from/to the repeater. All the following are supplied by the GE Mastr II base station via the backplane connector. See section 6.1 for more details regarding these signals:

- Supply voltage (VRAW) as specified VRAW is supplied by the 10 volt regulator card in the Mastr II station control shelf.

- Active high "unsquelched" signal (RUS) from the Mastr II receiver,

- Active low "push-to-talk" signal (PTT) to the Mastr II exciter,

- Audio signal from the Mastr II receiver (VOL_SQ_HI),

- Audio signal to the Mastr II exciter (TX_AUDIO_HI).

3.1. Setup Instructions

A properly adjusted GE Mastr II receiver provides a 1.0 VRMS audio level on the "VOL/SQ HI" signal when excited by an on-frequency RF input modulated by a 1 KHz audio tone with 3 KHz deviation. A properly adjusted transmitter limits the output deviation of the transmitted RF signal to below 5 KHz. The remainder of this section assumes that the transmitter and receiver are adjusted according to the instructions in the GE manual.

Figure 3: Board Installation

3.1.1. Installing the PSE-508 Inside a Mastr II Cabinet

Open the Mastr II cabinet and install the PSE-508 in the "AUDIO" slot (not the "REPEATER CONTROLLER" slot) in control shelf above the radio enclosure. The AUDIO slot is the one directly adjacent to the 10-volt regulator. Install the PSE-508 with the component side toward the 10-volt regulator as shown in Figure 3. Be sure to insert the board all the way back into the slot so it fully engages the card-edge connectors on the motherboard.

3.1.2. Installing the Jumper for CTCSS Encoding

The PSE-508 brings the CTCSS encoder signal to the exciter by routing it via the COMP_AUDIO signal. The COMP_AUDIO signal is present in standard Mastr II base stations, and routes from the AUDIO slot in the control shelf motherboard to P934 pin 2 on the system board inside the radio cabinet. A jumper must be installed inside the radio cabinet to connect the COMP_AUDIO signal to the

Figure 4 Jumper Placement for CTCSS Encoding

CG_HI pin in order to route the CTCSS tone to the exciter.

Figure 4 shows the placement of the jumper in the radio cabinet. The jumper is placed between connectors P934 pin 2 (COMP_AUDIO) and P908 pin 7 (CG_HI) on the system board. Figure **5** shows a close-up of the connection. Figure 6 is a copy of the system board PCB layout with the jumper marked in.

After installing the jumper, install the PSE-508 in the audio card slot in the control shelf and connect the RS-232 connector to a suitable terminal as per the instructions in section 5.1. Power up the repeater and verify that the PSE-508 has signed on to the terminal.

Using the PSE-508-3's N and P commands (sections 5.4.12 and 5.4.13), select the desired CTCSS mode and frequency to be encoded. Note that this may be a different tone than the tone that is being decoded.
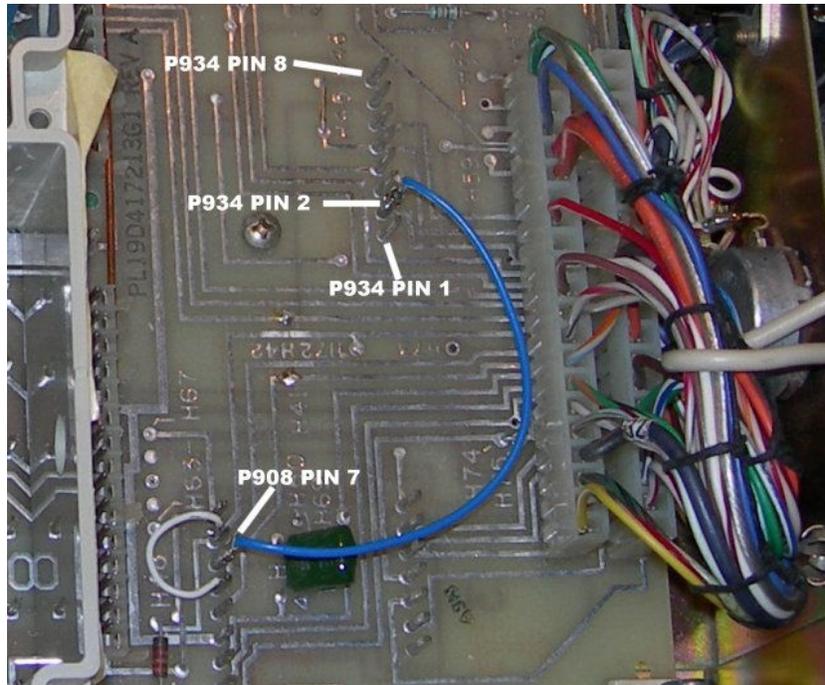
Figure 5 Jumper Placement for CTCSS Encoding, Close-Up

Using the J command (section 5.4.9), enable PTT and CTCSS encoding. Adjust the CG modulation pot on the Mastr II exciter board for proper tone deviation level (approximately 750 Hz) as per GE's transmitter alignment procedure.

3.1.3. RS-232 Communications Setup

See section 5.1 to set up communication with the PSE-508 via RS-232.

3.1.4. Useful Conversions for AC Voltmeters

An AC voltmeter is required in addition to the other instruments listed below. Voltages are cited in this section as RMS, but many low-cost meters don't read RMS, they read "average". If your meter doesn't read RMS, or if you are using an oscilloscope, you may use the following conversions. Note that these conversions are technically only valid for single-frequency sine waves:

$V_{RMS} = 0.707 * V_{peak}$.

$V_{RMS} = 0.354 * V_{peak-to-peak}$

$V_{RMS} = 1.112 * V_{avg}$
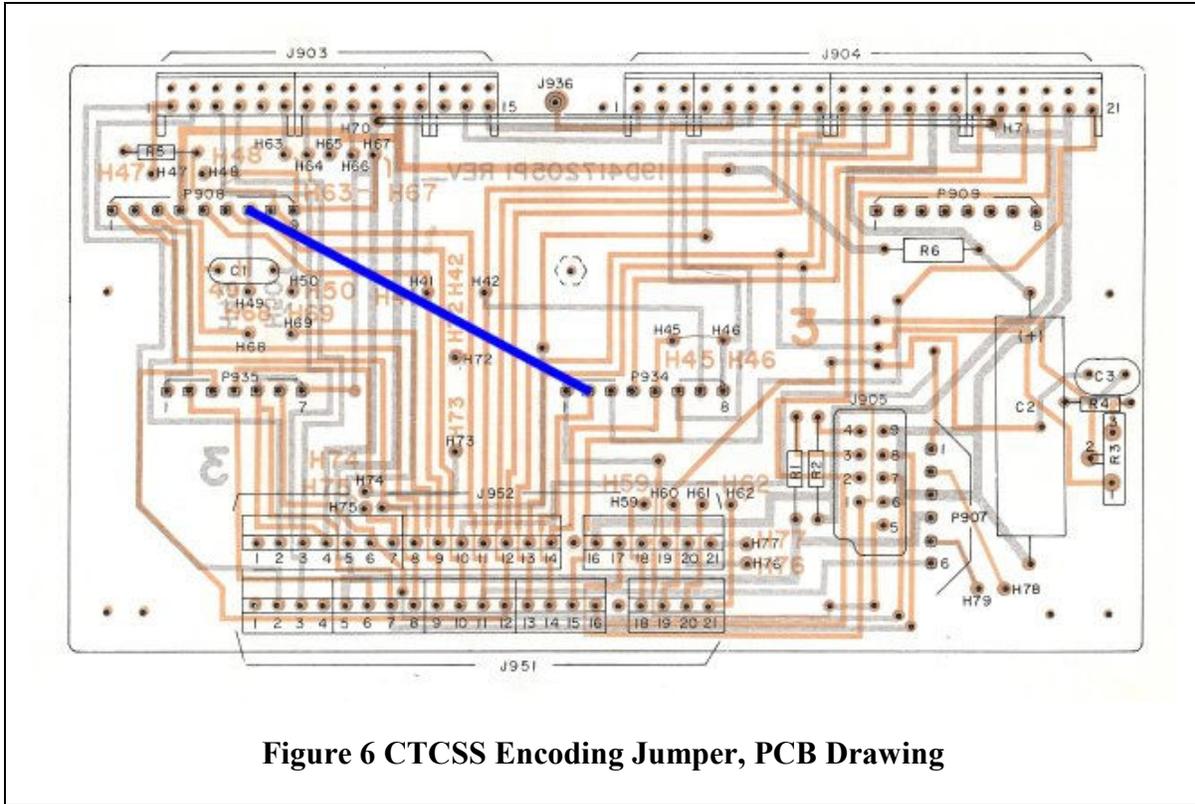
Figure 6 CTCSS Encoding Jumper, PCB Drawing

3.1.5. Adjusting the Transmit and Receive Audio Levels

There are several ways to adjust the audio levels. The one you should use depends on the kind of test equipment you have available. Here are 4 methods, listed in the order of preference.

- Using an RF generator and a modulation meter, (can be separate instruments, contained in two separate service monitors, or contained in a single service monitor with "duplex" capability)

- Using a single "non-duplexed" service monitor,

- Using a hand-held transmitter and a modulation meter.

- Using a hand-held transmitter only.

3.1.5.1.   Using an RF Generator and Modulation Meter

1) Set the RF generator to inject an on-frequency signal into the Mastr II receive port, modulated with a 1 KHz audio tone at 3 KHz RF modulation, at a sufficiently high RF signal level (approx. 10 uV) to open squelch and insure a full-quieting signal. Open PSE-508 dip switches 3 and 4. Connect the modulation meter to the Mastr II exciter output.

2) Connect the positive lead of the AC voltmeter to PSE-508 TP4 and the negative lead to TP5. Both testpoints are located on the outside edge of the PSE-508 PCB. Adjust the audio level potentiometer on the Mastr II receiver until the voltmeter reads 1.0 VRMS +/- 100 mVRMS.

3) Close PSE-508 dip switch 4. Adjust PSE-508 potentiometer R2 until the modulation meter reads 3 KHz modulation.

4) Remove the RF generator, modulation meter and AC voltmeter.

3.1.5.2.   Using a Non-Duplexed Service Monitor

1) Set the service monitor's RF generator to inject an on-frequency signal into the Mastr II receive port, modulated with a 1 KHz audio tone at 3 KHz RF modulation, at a sufficiently high RF signal level (approx. 10 uV) to open squelch and insure a full-quieting signal. Open PSE-508 dip switches 3 and 4.

5) Connect the positive lead of the AC voltmeter to PSE-508 TP4 and the negative lead to TP5. Both testpoints are located on the outside edge of the PSE-508 PCB. Adjust the audio level potentiometer on the Mastr II receiver until the voltmeter reads 1.0 VRMS +/- 100 mVRMS.

2) Turn the repeater off. Remove the service monitor from the receiver and attach the service monitor to the exciter output. Set the service monitor to receive and display RF modulation. Connect a computer or terminal to the PSE-508's RS-232 port.

3) Turn the repeater back on. You should receive the PSE-508 sign-on message similar to the one shown below. Issue the "B" command on the terminal to cause the PSE-508 to generate a 1 KHz tone. Use the default level.

```
07 PSE-508 Repeater Controller
June 16, 2006

> B ON OK
>
```

4) Close PSE-508 dip switch 4. This will enable PTT and will send the tone generated by the PSE-508 to the exciter. Adjust PSE-508 potentiometer R2 until the modulation meter reads 3 KHz modulation.

5) Remove the service monitor and AC voltmeter.

3.1.5.3.   Using a Hand-Held Transmitter with DTMF Capability and a Modulation Meter

This method relies on the fact that most modern transmitters with DTMF capability transmit DTMF codes at approximately 3 KHz modulation.

1) Set the hand-held to transmit on the repeater's receive frequency. Adjust the repeater's squelch so that the hand-held breaks squelch and generates a full-quieting signal. Open PSE-508 dip switches 3 and 4. Connect the modulation meter to the Mastr II exciter output.

2) Connect the positive lead of the AC voltmeter to PSE-508 TP4 and the negative lead to TP5. Both testpoints are located on the outside edge of the PSE-508 PCB.

3) While transmitting a DTMF tone using the hand-held, adjust the audio level potentiometer on the Mastr II receiver board until the voltmeter reads 1.0 VRMS +/- 100 mVRMS. (Note that the PSE-508 will not mute tones 0 thru 9, so use one of these tones).

4) Close PSE-508 dip switch 4. While transmitting a DTMF tone using the hand-held, adjust PSE-508 potentiometer R2 until the modulation meter reads 3 KHz modulation. Remove the modulation meter and AC voltmeter.

3.1.5.4. Using a Hand-Held Transmitter with DTMF Capability and a Voltmeter

This method relies on the fact that most modern transmitters with DTMF capability transmit DTMF codes at approximately 3 KHz modulation. It also assumes that your Mastr II exciter will produce 3 KHz modulation with an audio level of approximately 100 mVRMS. While this is not as exact as the previous methods, it may suffice if no other method is available.

1) Set the hand-held to transmit on the repeater's receive frequency. Adjust the repeater's squelch so that the hand-held breaks squelch and generates a full-quieting signal. Open PSE-508 dip switches 3 and 4.

2) Connect the positive lead of the AC voltmeter to PSE-508 TP4 and the negative lead to TP5. Both testpoints are located on the outside edge of the PSE-508 PCB.

3) While transmitting a DTMF tone using the hand-held, adjust the audio level potentiometer on the Mastr II receiver board until the voltmeter reads 1.0 VRMS +/- 100 mVRMS. (Note that the PSE-508 will not mute tones 0 thru 9, so use one of these tones).

4) Move the positive voltmeter to lead to TP3. While transmitting a DTMF tone using the hand-held, adjust PSE-508 potentiometer R2 until the voltage reads 100 mVRMS.

3.1.6. Configure Internal Parameters Stored in EEPROM

Use the commands in section 5 to configure your operating parameters.

4. DTMF Commands (Remote Control)

The following commands may be issued from a remote radio that has a DTMF keypad. In the following descriptions, the command, as entered at the DTMF keyboard, is shown in **`bold courier font`** followed by a short description of the command. The entire sequence contained in bold must be entered in a single continuous transmission, and then the radio must be unkeyed to receive the PSE-508's response.

Each individual digit must be held for a minimum of 200 milliseconds, and the quiet time between digits must be at least 200 milliseconds. The command will be canceled and a timeout message will be transmitted to the user if the transmission takes longer than the current setting of the Transmitter Timeout timer. (See the "T" command, section 5.4.16).

After a command has been issued, the controller will respond in CW with "OK" if the command is accepted, or "ERR" if the command was entered incorrectly.

DTMF Command Codes	Command Description
C00	Disable Transmitter
C01	Enable Transmitter
C10	Disable CTCSS Decoder
C11	Enable CTCSS Decoder
C12	Unused
C13	Unused
C14	Disable Courtesy Beep
C15	Enable Courtesy Beep
C16	Mute DTMF Tones
C17	Unmute DTMF Tones
C18	Disable Reverse Burst CTCSS Encoding
C19	Enable Reverse Burst CTCSS Encoding
C2	Enable Voice Recording
C3	Set ID / Announcement Mode
C4	Set CW ID String
C5	Play ID String
C6	Log Off
C7	Set CTCSS Encoder Mode
B	Sync Announcement Timer
A or *	Play Announcement

4.1. Command Prefix

All DTMF commands must be prefixed by the 'C' key to indicate that a command is to follow. For users with keypads that do not have the A through D keys, the "#" key

may also be used as the command prefix, and the '*' key may be also used to play announcements. For the purpose of this document the command prefix is assumed to be 'C', and the announcement key is assumed to be 'A'.

4.2.   Entering DTMF Password

The user must first enter the DTMF password before any DTMF codes (other than 'A' or '*') can be accepted. The password consists of the letter 'C' followed by 3 numeric digits. The numeric digits are set using the "E" command at the RS-232 terminal (section 5.4.5). If the user does not set the password, it defaults to C958.

To enter the password, simply key a radio on the receive frequency and enter the 4 characters at the radio's DTMF keypad. After entering the characters un-key the radio. If the password was entered correctly the repeater will respond in CW with an "OK". If it responds with "ERR", the password was entered incorrectly.

Once the password has been correctly entered, you have 60 seconds to enter a DTMF command. The 60-second timer is reset each time you enter a valid DTMF key. If the timer expires, you must re-enter your password to continue to enter more DTMF commands.

After you enter all your commands, you may either allow the timer to expire in 60 seconds, or you may issue the "C6" command to log off.

Note that all DTMF commands consist of the letter C followed by one or more numeric digits.

4.3.   DTMF Command Descriptions

4.3.1. Enable or Disable Transmitter

C00   (Disable Transmitter)

C01   (Enable Transmitter)

These commands tell the controller to disable or enable the transmitter. Once the transmitter is disabled it will respond with an "OK", do an ID, and then no further transmissions shall take place until the transmitter is re-enabled.

4.3.2. CTCSS Encoder/Decoder Master Enable On/Off

C10   (CTCSS Encoders/Decoders Master Enable Off)

C11   (CTCSS Encoders/Decoders Master Enable On)

These commands act as a master enable/disable for all 4 CTCSS channels. The master enable must be on for any CTCSS encoder or decoder channel to function. Individual channels may be enabled or disabled separately by using the DTMF commands in section 4.3.3 or the P serial port command (section 5.4.13).

 "OK" or "ERR" will be sent by the controller via CW in response to the command, to indicate that the command was accepted or rejected, respectively.

4.3.3. Enable or Disable Individual CTCSS Encoder/Decoder Channels

C12x (Disable CTCSS Encoder/Decoder Channel x)

C13x (Enable CTCSS Encoder/Decoder Channel x)

These commands tell the PSE-508-3 to disable or enable individual CTCSS Encoder/Decoder channels. The x should be replaced by the channel number desired. Individual channels may also be enabled or disabled by using the P serial port command (see section 5.4.13).

Upon proper entry of either of these commands the PSE-508-3 will respond with an "OK" in CW.

Examples: C121   Disable CTCSS channel 1.

C133   Enable CTCSS channel 3.

4.3.4. Enable or Disable Courtesy Beep

C14   (Disable Courtesy Beep)

C15   (Enable Courtesy Beep)

 These commands tell the controller to disable or enable the courtesy-beep. Upon proper entry of either of these commands the PSE-508 will respond with an "OK" in CW.

4.3.5. Mute or Unmute DTMF Tones

C16   (Mute DTMF Tones)

C17   (Unmute DTMF Tones)

These commands tell the controller to mute or unmute incoming DTMF tones. Upon proper entry of either of these commands the PSE-508 will respond with an "OK" in CW.

When muting is selected, only tone sequences that begin with the letter "C" (that is, valid PSE-508 commands) will be muted. No other tone sequences will be muted. This allows the typical numeric sequences used in IRLP or Echolink systems to be passed through to the transmitter whether or not muting was selected.

DTMF muting may also be selected via RS-232 command. See the F command (section 5.4.6) for more details.

4.3.6. Enable or Disable Reverse-Burst CTCSS Encoding

C18   (Disable Reverse-Burst)

C19   (Enable Reverse-Burst)

These commands allow the user to enable or disable reverse-burst during CTCSS encoding. Reverse-burst, if enabled, causes the PSE-508 to reverse the phase of

the CTCSS tone by 235 degrees and hold PTT active for an additional 160 milliseconds after it would otherwise shut off.   Reverse-burst enables some receivers to squelch more quickly thereby eliminating a squelch tail.

"OK" or "ERR" will be sent by the controller via CW in response to the command, to indicate that the command was accepted or rejected, respectively.

4.3.7. Recording a Voice ID or Announcement

C2   (Enable Voice ID or Announcement Recording)

This command tells the controller that a voice ID or announcement recording is about to be made. To record a voice ID or announcement, issue the "C2", then unkey the radio to receive the "OK" or "ERR" CW response. If the "OK" response was received, you have 10 seconds to re-key your radio and record your voice ID or announcement. The transmitter will not transmit during your recording. The ID or announcement must be less than 10 seconds long to fit into the voice memory.

Unkey your radio when finished recording. You may now enable the voice ID or announcement using the "C3X" command (see section 4.3.8) and test your recorded ID using either the "C5" command (for IDs) or the "A" command (for announcements).

If you did not begin recording your ID within 10 seconds of receiving the "OK" response, the transmitter will be re-enabled and you must re-issue the "C2" command to record a voice ID.

4.3.8. Selecting ID and Announcement Modes

C30   (Select CW ID Mode)

C31   (Select Voice ID Mode)

C32   (Select CW ID and Timed Announcement Mode)

C33   (Select CW ID and Manual Announcement Mode)

These commands tell the controller which form of ID and/or announcements to use.   See the "K" command (section 5.4.10) for a complete description of the 4 modes.

Before enabling voice ID or announcements, the user should use either the "R" RS-232 command (section 5.4.14) or "C2" DTMF command (section 4.3.7) to record and store a voice message, otherwise the message memory will be blank and no message will play. Similarly, the user should use either the "I" RS-232 command (section 5.4.7) or the "C4" DTMF command (section 4.3.9) to enter a CW ID string before enabling CW ID or announcement modes.

"OK" or "ERR" will be sent by the controller via CW in response to the command, to indicate that the command was either accepted or rejected, respectively.

4.3.9. Set CW ID String

C4   (Set CW ID String)

This command allows the user to enter a CW ID string via DTMF codes. The user must enter the "C4" command followed by a string of DTMF digit-pairs representing the letters and/or numbers of the desired CW ID string. Each CW ID character is represented by a pair of DTMF digits as shown in the table below. All characters in the string must be entered following the "C4" command without un-keying the transmitter until the last digit is entered. The CW ID string may store up to 19 characters. See the example following the table.

CW ID Char	DTMF Digits	CW ID Char	DTMF Digits	CW ID Char	DTMF Digits
A	00	O	14	2	28
B	01	P	15	3	29
C	02	Q	16	4	30
D	03	R	17	5	31
E	04	S	18	6	32
F	05	T	19	7	33
G	06	U	20	8	34
H	07	V	21	9	35
I	08	W	22	/	36
J	09	X	23	-	37
K	10	Y	24	.	38
L	11	Z	25	?	39
M	12	0	26	(space)	40
N	13	1	27		

Example: To encode the string "KK7XO/R" for CW ID, the following sequence of DTMF digits must be entered: C410103323143617

"OK" or "ERR" will be sent by the controller via CW in response to the command, to indicate that the command was either accepted or rejected, respectively.

4.3.10.   Play ID

C5   (Play ID)

This command causes the current value in the CW ID string or the voice ID track to be played out over the air. It can be used to verify the ID entered via the "C4" or "C2" commands above.

"OK" or "ERR" will be sent by the controller via CW in response to the command, to indicate that the command was either accepted or rejected, respectively. If the command was accepted, the current contents of the CW ID string or voice ID track will be sent following the "OK".

4.3.11.　　　Log Off

C6　(Log Off)

This command closes the DTMF session. To begin a new session the password must be re-entered. This command has the same effect as a timeout of the password timer, except that its effect is immediate.

"OK" or "ERR" will be sent by the controller via CW in response to the command, to indicate that the command was either accepted or rejected, respectively.

4.3.12.　　　Set CTCSS Encoder Mode

C71　(CTCSS Encode on RUS Only)

C72　(CTCSS Encode on PTT)

These commands tell the PSE-508-3 which form of CTCSS encoding is to be used. See the "N" command (section 5.4.12) for a complete description of the 2 modes. See the "P" command (section 5.4.13) or "C1xx" command (section 4.3.3) to see how to individually enable/disable CTCSS encoder/decoder operation.

"OK" or "ERR" will be sent by the controller via CW in response to the command, to indicate that the command was either accepted or rejected, respectively.

4.3.13.　　　Sync Announcement Timer

B　(Sync Announcement Timer)

This command sets the starting time of the announcement timer. The announcement timer will start as soon as the "B" is entered. See section 5.4.10 for more information on announcement modes. Be sure the DTMF password was entered within 60 seconds of issuing this command.

"OK" will be sent by the controller via CW to indicate that the command was accepted.   There will be no "OK" or "ERR" if the command did not synchronize the timer.   If no "OK" was received, it is because the DTMF password was not entered first, or because the password timed out.

4.3.14.　　　Play Announcement

A　(Play Announcement)

This command plays an announcement immediately in either timed or manual announcement mode. Unlike the other DTMF commands this command does not require that a password be previously entered. This command is intended to allow repeater users to play an announcement at their convenience when one is available. If timed announcement mode has been selected, this command will not restart the timer.

5. Issuing Commands via the RS-232 Port

5.1. Initial Setup and Terminal Configuration

Follow these steps to configure the controller and your computer or terminal to communicate with each other.

1. Power down PSE-508

2. Connect the 9 pin D connector on the PSE-508 to a computer or RS-232 compatible terminal using a "straight-through" cable. No null-modems or crossed signal cables are required.

3. On your computer, run a terminal program such as HyperTerminal. HyperTerminal may be found on virtually all Windows compatible machines under the "Accessories" sub-menu.

4. Set up terminal program to use 19200 baud, 8 data bits, 1 stop bit, no parity, and no flow control.

5. Power Up PSE-508. You should see a sign-on message from the terminal port similar to the one below (the date printed on the second line is the date of the last software revision, not the current date):

```
05 PSE-508-3 Repeater Controller
Firmware Version 3.1 Feb  7 2007

EEPROM Checksum OK.

>
```

6. At the ">" prompt you may enter a command as shown in the command descriptions below.

If you do not get the sign-on message when the PSE-508 is powered up, check your cables, connectors, serial port settings, Mastr II 10-volt regulator, and so on. When the PSE-508 is powered on, the power-on LED should light up. See Figure 2.

The "05" that prints at the start of the first line indicates the source of the reset, in this case, a power-up reset.

The date on the second line indicates the revision date of the software. If you experience difficulty in operating the PSE-508, please have this revision date handy when you call technical support. It's a good idea to write it down somewhere, like on the title page of this User's Guide.

5.2. Command Descriptions, General

Each command consists of a single letter followed by zero or more numeric or alphanumeric parameters. Command letters may be entered using an UPPER CASE or lower case character. If parameters are required, separate the command letter from the parameters with a space. Separate each parameter from other parameters with a

comma or space. Complete each command by pressing the "Enter" key. Enter only one command per line.

If the command is accepted, "OK" will print at the end of the line. If the command is not entered properly, the word "ERR" followed by an error number will print at the end of the line. Error numbers are listed with their descriptions in section 5.5.

In the following descriptions, the command letters and parameters are shown in a table, as well as the default values. Parameters are shown in angle brackets after the command letter, however, do not enter the angle brackets when entering the parameter.

Each command has a default value. The default is defined as the state of the command immediately after the board is reset and before the user enters any commands. The defaults are acceptable in a large number of applications.

5.3.   Functional Command Listing

This section contains tables that group the RS-232 commands into functional groups. The command details can be found in the section corresponding to the command listed in the tables.

5.3.1. Commands to Set and Modify Operational Parameters

The following commands are used to set and modify parameters used in the normal operation of the repeater. See section 5.3.2 for commands used in testing and adjustment of audio levels.

Command Letter	Parameters	Function	Section
C	`<rate> <freq> <level>`	Set CW ID rate, frequency, and audio level	5.4.3
D	`<freqHz> <delay> <level>`	Set Courtesy Beep Frequency	5.4.4
E	`<string>`	Set DTMF password	5.4.5
F	`<txEna> <ctcssEna> <beep> <rev> <DMute>`	Enable or disable flags	5.4.6
I	`<string>`	Set CW ID string	5.4.7
K	`<mode>`	Set ID and Announcement Mode	5.4.10
M	`<timeMin>`	Set Announcement Period	5.4.11
N	`<mode>`	Set CTCSS Encode Mode	5.4.12
P	`<channel> <ena> <mode> <dec> <enc>`	Set CTCSS tone encode/decode enable and frequency	5.4.13

Command Letter	Parameters	Function	Section
R		Enable the recording of a Voice ID	5.4.14
S		Print the status of all parameters	5.4.15
T	`<id>, <timeout>, <hang>`	Set or change the duration of the various timers	5.4.16
W		Play back voice or CW ID	5.4.17
X	8958	Set all parameters back to default	5.4.18

5.3.2. Testing and Adjustment Commands

The following commands are used to test the repeater and controller board, and to adjust the gain levels through the controller, set the CWID level, and so on.

Command Letter	Parameters	Function	Section
A		Toggle Receiver Audio Gate On/Off	5.4.1
B	`<freqHz>, <level%>`	Output an Audio Tone	5.4.2
G	`<tone>`	Generate Test Tone	5.4.7
J		Toggle PTT On/Off	5.4.9

5.4. Alphabetical Command Listing

This section provides command details for all commands available using the RS-232 monitor port:

5.4.1. Toggle Audio Gate

Command Letter	Parameters	Default
A		OFF (Gate Disabled)

This command is used for repeater setup and testing. Each time the command is issued, it toggles the electronic gate that mutes or unmutes the audio signal presented to the board on the "VOL/SQ HI" connector pin. When the gate is enabled, the receiver audio is allowed to pass to the "TX AUDIO HI" connector. When it is disabled, the audio is blocked and only on-board generated signals (such as CW or voice ID) are passed to the "TX AUDIO HI" (TXA) port. After entering the "A" command the PSE-508 responds with "ON" (signifying the audio gate is enabled) or "OFF" (signifying the audio gate is disabled).

5.4.2. Toggle Audio Tone

Command Letter	Parameters	Default
B	<freqHz>, <level%>	1000 Hz, 75%

This command causes the PSE-508 to generate an audio tone at the frequency and level indicated by the parameters. Both parameters may be missing, in which case the default values are used. Also, the <freqHz> parameter may be present and the <level%> parameter may be missing, in which case the default value for <level%> is used. The <level%> parameter may not be entered alone (it must be preceded by the <freqHz> parameter).

The <freqHz> parameter may be any number between 600 Hz and 1200 Hz, inclusive. The <level%> parameter may be any number between 0 % and 100 % inclusive.

The actual level at TP1 produced for a given <level%> parameter varies somewhat depending on the frequency selected. For a 1000 Hz audio tone, a level of 75 % corresponds to approximately 3 KHz deviation in the Mastr II. See the table in section 5.4.3 for more details.

The B command is a toggle. That is, entering a B command will turn the tone on, and entering a subsequent B command will turn the tone off.

5.4.3. Set CW ID Rate, Frequency and Level

Command Letter	Parameters	Default
C	`<rateWPM>,<freqHz>,` `<level%>`	20 wpm, 800 Hz, 50%

This command sets the CW rate, audio frequency, and audio level of the CW ID. The `<rateWPM>` parameter is entered in words per minute, and can be between 10 and 20 inclusive. Note that current US FCC regulations (97.119 b(1)) do not allow amateur radio repeaters to ID at a rate greater than 20 wpm. The `<freqHz>` parameter is entered in hertz, and may be between 600 and 1200 inclusive. The `<level%>` parameter is entered in percent and may be between 0 and 100 inclusive.

The PSE-508 controls the audio level of the generated tone using digital means (that is, without a potentiometer). The level may be set from 0 to 100 in units of percent, where 0 is no signal and 100 is the maximum signal level the PSE-508 is capable of generating.

The following two tables give the correspondence between the `<level>` parameter and the approximate transmitter deviation. It assumes that the receive and transmit levels have been adjusted according the one of the procedures in section 3:

Level %	Approximate Deviation (Hz)	Level %	Approximate Deviation (Hz)
0	0	50	2000
10	400	56	2250
13	500	60	2400
20	750	63	2500
25	1000	69	2750
30	1250	75	3000
38	1500	80	3225
44	1750	90	3625
		100	3950

Example: > C 15, 750, 60

In this example, the CW rate is set to 15 words per minute and the audio frequency is set to 750 Hz with a 60% level.

5.4.4. Set Courtesy Beep Frequency, Delay and Level

Command Letter	Parameters	Default
D	<freqHz> <delay> <level>	700 Hz, 500mS, 50%

This command sets the audio frequency, initial delay, and audio level of the courtesy beep. The <freqHz> parameter sets the audio frequency and is entered in hertz. It may be between 600 and 1200 inclusive. The <timeMs> parameter sets the delay from receiver-squelched to start-of-courtesy-beep in milliseconds, and may range from 100 to 10,000 milliseconds. The <level%> parameter sets the audio level of the courtesy beep, is entered in percent, and may be between 0 and 100 inclusive.

See section 5.4.3 for tables giving the approximate correspondence between the <level%> parameter and the resulting transmitter deviation.

Example: > D 750 200 30

In this example, the courtesy beep frequency is set to 750 Hz with a 200 millisecond delay after squelch and a level of 30%

5.4.5. Set DTMF Password

Command Letter	Parameters	Defaults
E	<string>	958

This command sets the 3 digit password that must be entered via DTMF before access to any remote commands may be obtained. See section 4.1. The string may consist of any 3 decimal digits. It may be changed only via this serial port command.

When the password is entered via DTMF, the 3 digits set by this command must be preceded by a "C", so the default password is entered as "C958"

5.4.6. Enable or Disable Flags

Command Letter	Parameters	Defaults
F	`<flag string>`	B1,D1,H1 P0,R0,T1

This command enables or disables various options in the PSE-508. The parameter `<flag string>` must contain at least one and up to six *flag commands*. Each *flag command* is represented by a letter code identifying the flag, followed by a 0 (to clear the flag) or a 1 (to set the flag). Only flags listed in `<flag string>` are changed, and all other flags remain unchanged. The meaning of each flag is given below:

B0 or B1 (Courtesy Beep Enable Flag): If this flag is set (B1), the controller will issue a "courtesy beep" after detecting that the receiver has closed the squelch. If this flag is cleared (B0), the controller will not issue a "courtesy beep". The audio frequency of the courtesy beep may be set via the "D" command (section 5.4.4).

D0 or D1 (DTMF Mute Flag): If this flag is set (D1), the controller will mute incoming DTMF tones that begin with the letter "C" (valid PSE-508 commands). If this flag is cleared (D0), the controller will pass all DTMF tones to the transmitter.

H0 or H1 (Hang Time Enable Flag): If this flag is set (H1), the controller will delay for the period set by the hang-time timer, after the receiver has been squelched, before dropping PTT. If this flag is cleared (H0), the controller will drop PTT immediately after squelch.

P0 or P1 (CTCSS Decoder Enable Flag): If the "P" flag is set (P1), the receiver must detect a carrier and a CTCSS tone must be present in the audio signal to open the squelch and enable the transmitter to repeat the received audio. If the "P" flag is cleared (P0), the squelch will open and the transmitter will repeat the received audio if the receiver simply detects a carrier. (The "P" flag used here to enable CTCSS should not be confused with the "P" command, which sets the actual frequency of the CTCSS tone, see section 5.4.12). The CTCSS Decoder Enable Flag may also be set or cleared via DTMF commands. See section 4.3.2.

R0 or R1 (CTCSS Encoder Reverse Burst Flag): If this flag is set (R1), the controller will output a reverse burst tone before the CTCSS tone is turned off. If this flag is cleared (R0), the controller will not output a reverse burst.

The reverse burst causes the transmitted tone to be reversed by 235 degrees for 160 milliseconds to help eliminate the squelch tail in receiving radios. Not all radios have the capability to detect the reverse burst. In general, the ability to detect a reverse burst is usually found in commercial and repeater receivers.

T0 or T1: (Transmitter Enable Flag): If the "T" flag is set (T1), the transmitter is enabled during normal repeater operation. If the "T" flag is cleared (T0), the transmitter is disabled and the repeater will not repeat when a signal is received. (The receiver, however, is always enabled). The Transmitter Enable Flag may also be set or cleared via DTMF commands. See section 4.3.1.

Example: > F T1, H0, B1

In this example, the transmitter is enabled, hang-time is disabled and a courtesy beep is enabled. The other flags are unchanged.

5.4.7. Toggle CTCSS Encoder Tone (Test and Setup Purposes Only)

Command Letter	Parameters	Defaults
G	<tone_ID>	Tone 10 (100.0 Hz)

The G command is used to generate a test encoder tone for setup and testing. It is a toggle, that is, the first time G is entered the encode tone and PTT is turned on, the second time the G is entered the tone and PTT are turned off. If the user does not specify a <tone_ID> parameter following the G, 100.0 Hz will be output. Otherwise, any frequency contained in the table in section 5.4.13 (P Command) below may be specified by using the corresponding code for the <tone_ID> parameter.

Once activated, the encode tone may be used to adjust the Channel Guard gain pot in the Mastr II exciter.

    Example 1:   > G

In this example, 100.0 Hz will be output on the encoder signal.

    Example 1:   > G 20

In this example, 141.3 Hz will be output on the encoder signal.

5.4.8. Set CW Identification String

Command Letter	Parameters	Defaults
I	<string>	NO CWID

This command allows the user to enter an alphanumeric string to be transmitted for station identification. The character set can be found in the table in section 4.3.9. The alphabetic characters "A" through "Z" may be entered in either upper or lower case. The string may be up to 19 characters long.

Example: > I KK7XO/R

In this example, the CW ID string is set to "KK7XO/R"

5.4.9. Toggle PTT

Command Letter	Parameters	Default
J		OFF (PTT Disabled)

This command is used for repeater setup and testing. Each time the command is issued, it toggles the PTT signal (and the CTCSS encoder, if enabled) on or off. The PTT signal causes the transmitter to transmit the audio signal present at the Mastr II's "TX_AUDIO_HI" connector.

5.4.10.   Set ID and Announcement Mode

Command Letter	Parameters	Default
K	<mode>	Mode 0 (CW ID Only)

This command is used to configure the PSE-508 to provide station ID and announcements. The PSE-508 contains a CW generator and a voice record-playback unit. They can be configured to produce station ID and/or announcements. Here are the possible modes:

Mode 0: CW generator produces station ID, voice record-playback unit not used. No announcements. This is also referred to as CW ID Mode.

Mode 1: Voice record-playback unit provides station ID, CW generator unused. No announcements. This is also referred to as Voice ID Mode.

Mode 2: CW generator produces station ID, voice record-playback unit plays an announcement whenever the announcement timer times out, or whenever a DTMF "A" is pressed on the repeater user's radio. This is also referred to as Timed Announcement Mode. An announcement timer must be set in order to use this mode. The current setting of the announcement timer will be used, or the default value if no other value has been entered The timer will begin immediately after the mode is changed.

Mode 3: CW generator produces station ID, voice record-playback unit plays an announcement whenever a DTMF "A" is pressed on the repeater user's radio (see section 4.3.14). This is also referred to as Manual Announcement Mode.

The timer duration may be set and synchronized to a clock via RS-232 using the "M" command (see section 5.4.11). See section 4.3.13 for instructions on how to synchronize the timer to a clock via DTMF.

Example: `> K 2`

In the above example, mode 2 is set. The CW generator will produce the ID and the voice record-playback unit will give an announcement each time a DTMF "A" is received by the controller.

5.4.11.   Set Announcement Period

Command Letter	Parameters	Default
M	`<period>`	`360 minutes` `(6 hours)`

This command sets the time period between announcements. The units of the `<period>` parameter are in minutes.

The timer is re-started the instant the "M" command is entered. This fact is used to synchronize the timer to a watch. The timer may also be synchronized via DTMF (see section 4.3.13).

Example: `> M 60`

In this example, the time period between announcements is set to one hour.

5.4.12.   Set CTCSS Encoder Mode

Command Letter	Parameters	Defaults

N	`<mode>`	`Mode 0`
		`(Encoder`
		`disabled)`

This command allows the user to set the CTCSS encoder operating mode. One of the following 2 modes may be set by entering 1, or 2 for the `<mode>` parameter:

Mode 1: CTCSS tones are encoded only when the receiver is unsquelched. This means that tones are not encoded during courtesy beep, hang time, ID, and announcements. If reverse burst is selected, (see F command) the reverse burst will start when the receiver goes squelched.

Mode 2: CTCSS tones are encoded whenever PTT is active. If reverse burst is selected, (see F command) the reverse burst will start at the beginning of hang time.

Example: > N 1

In this example, the CTCSS encoder is enabled only when the receiver is unsquelched.

5.4.13.   Set CTCSS Encoder/Decoder Enable and Frequency

Command Letter	Parameters	Defaults
P	0, \<ena\>, \<mode\>, \<dec\>, \<enc\> \<chan 1-3\>, \<ena\>, \<dec\>, \<enc\>	0, 0, 1, 10, 10 1, 0, 12, 12 2, 0, 14, 14 3, 0, 16, 16

Parameter Description:

\<chan\>   CTCSS Decoder/Encoder Channel Number: Either 0, 1, 2, or 3 to select the channel being addressed for the remaining parameters.

\<ena\>   Enable/Disable: If this parameter is 0, the channel will be disabled. If this parameter is 1, the channel will be enabled.

\<mode\>   Decode/Encode Mode (for Channel 0 only, skip this parameter for channels 1 through 3):

0: Channel 0 is Decode/Encode. The controller will open sequelch if the radio squelch is open and if the tone indicated by the \<dec\> parameter is present. It will encode the tone indicated by the \<enc\> parameter on the transmitted signal. Both the \<dec\> and \<enc\> parameters must follow on the command line.

1: Channel 0 is Decode Only. The controller will open sequelch if the radio squelch is open and if the tone indicated by the \<dec\> parameter is present. No tone will be encoded. The \<dec\> parameter must follow on the command line.

2: Channel 0 is Encode Only. Squelch is opened by presence of a carrier. The tone indicated by the \<enc\> parameter will be encoded on the transmitted signal. The \<enc\> parameter must follow on the command line. Note that if channel 0 is set to encode-only, all other channels should be set to mode 0 (unused). See note below.

<dec>   Decoder Tone Number: A number from 0 to 36 indicating the tone to be decoded. See the following table. This parameter must be specified for channel 0 if the mode is Decode/Encode or Decode-Only. It must always be specified for channels 1 through 3.

<enc>   Encoder Tone Number: A number from 0 to 36 indicating the tone to be encoded. See the following table. This parameter must be specified for channel 0 if the mode is Decode/Encode or Encode-Only. It must always be specified for channels 1 through 3.

This command sets the CTCSS decoder frequency. Use the following table to select the proper code for the frequency desired. After setting the frequency, you may enable the CTCSS decoder with the "F" command (section 5.4.6) via the serial port, or via DTMF command (section 4.3.2).

Example 1: `> P 0, 1, 0, 10, 10`

In this example, decoder/encoder channel 0 is enabled and set to decode/encode mode. The decoded and encoded tones are both the same, namely 100.0 Hz.

Example 2: `> P 2, 0`

In this example, decoder/encoder channel 2 is disabled.

Example 3: `> P 0, 1, 2, 2`

In this example, decoder/encoder channel 0 is enabled and set to encode-only mode. The encoded tone is 74.4 Hz. Note that since this channel is encode-only, all other channels should be disabled.

Example 4: `> P 0, 1, 1, 22`

In this example, decoder/encoder channel 0 is enabled and set to decode-only mode. The decoded tone is 151.4 Hz.

Example 5: `> P 2, 1`

In this example, decoder/encoder channel 2 is enabled. The mode and frequencies are not specified on the command line, so they will default to the mode and frequency that was last set up.

Example 4: `> P 3, 1, 20, 22`

In this example, decoder/encoder channel 3 is enabled. Channels 1 through 3 are always in decode/encode mode. Here. channel 3 is set to decode 141.3 Hz and encode 151.4 Hz.

Notes: Only channel 0 may be set to decode-only or encode-only. Channels 1 through 3 are always in decode/encode mode. If channel 0 is set to encode-only it implies that the repeater is operating on carrier squelch. In such a system it does not make sense to set up additional channels as encode/decode because the repeater's squelch will always open in the presence of a carrier whether or not

there is a tone present. If channel 0 is set to encode-only it is best to disable all other channels by setting their `<ena>` parameters to 0.

CTCSS Tone Code Table

Tone Code	CTCSS Tone Frequency (Hz)	Tone Code	CTCSS Tone Frequency (Hz)
0	67.0	19	136.5
1	71.9	20	141.3
2	74.4	21	146.2
3	77.0	22	151.4
4	79.7	23	156.7
5	82.5	24	162.2
6	85.4	25	167.9
7	88.5	26	173.8
8	91.5	27	179.9
9	94.8	28	186.2
10	100.0	29	192.8
11	103.5	30	203.5
12	107.2	31	210.7
13	110.9	32	218.1
14	114.8	33	225.7
15	118.8	34	233.6
16	123.0	35	241.8
17	127.3	36	250.3
18	131.8		

5.4.14.   Enable Voice ID or Announcement Recording

Command Letter	Parameters	Defaults
R	(None)	N/A

This command prepares the voice recording circuit to receive a new voice file. The "R" command requires no parameters. The user records a voice ID or message as follows:

Issue the "R" command from the serial port.

Key a transmitter set to the repeater's receive frequency within 10 seconds and begin speaking the ID or message.

When finished, unkey the transmitter. The message is automatically stored in the PSE-508's voice file.

The user may now enable repeater voice ID using the "F" command (section 5.4.6) and play the stored voice message back with the "W" command (section 5.4.17). Voice ID may also be recorded using a DTMF command. See section 4.3.7.

5.4.15.   Print Status of All Parameters

Command Letter	Parameters	Defaults
S	(None)	N/A

This command allows the user to see the current setting of all user settable parameters.

Example:

```
S

C 20, 800, 35
D 700, 500, 42
E 958
F B1, D0, H1, P0, R0, T1
H 1000
I KK7XO/R
K 2
M 360
N 0
P 10
Q 10
T 420, 120, 1500

OK
>
```

Note that the parameters are displayed in the same fashion as if they were entered from the keyboard.

5.4.16.   Set Timers

Command Letter	Parameters	Default
T	`<id>, <timeout>, <hang>`	420,180,1500

This command sets the CWID, Transmitter Timeout, and Hang timers. The parameters for the ID and Timeout timers are in units of seconds. The parameter for the Hang timer is in milliseconds.

`<id>` (ID Timer): This timer determines how often the repeater shall issue its ID. The repeater shall ID using either the voice ID recording or CW ID string, depending on the setting of the ID mode (see section 5.4.10). The ID Timer may be set from 60 to 1920, inclusive, in units of seconds.

`<timeout>` (Transmitter Timeout Timer): This timer determines how long the transmitter shall be allowed to continuously transmit. If the timeout timer expires, the controller will issue an ID and turn the transmitter off until the user unkeys. The Transmitter Timeout Timer may be set from 10 to 600, inclusive, in units of seconds.

`<hang>` (Hang Timer): This timer determines how long the transmitter will transmit an unmodulated carrier after a user has unkeyed and the courtesy beep has sounded. The Hang timer may be set from 200 to 10,000, inclusive, in units of milliseconds.

Note: The PSE-508 employs a courteous ID algorithm and will not attempt to ID over a user who is currently transmitting. Instead, the controller will wait until that user unkeys and will then begin the ID before the courtesy beep. If during the ID period a user begins transmitting, the ID will drop to ½ volume and continue under that user's audio.

Since the ID will not begin until a user unkeys, some care must be used when choosing the settings for the ID and timeout timers to insure that an ID will occur in all cases before the FCC imposed deadline of 10 minutes in the US.   In order to insure that the ID occurs on time, the sum of the ID timer and Transmit Timeout timer must be less than or equal to 10 minutes.

To understand why, consider the following scenario: One second before the ID timer expires, a user keys the repeater and transmits continuously. The ID will not occur until the user unkeys. If the user keeps the key down as long as possible, the transmitter will not unkey until the transmit timer times out. When the transmit timer times out an ID will occur. This is the worst case. The ID will occur within the 10 minute timeframe if the sum of the ID timer and Transmit Timeout timer are less than or equal to 10 minutes.

Example: `> T 300,120,100`

In this example, the CWID timer is set to 5 minutes, the Transmitter Timeout timer is set to 2 minutes, and the hang timer is set to 100 milliseconds.

5.4.17.   Force Playing of ID (CW or Voice)

Command Letter	Parameters	Default
W	None	N/A

When issued, this command forces the controller to assert PTT and play either the voice or CW ID, depending on which ID mode is currently selected. See section 5.4.10 for a discussion of ID and announcement modes.

5.4.18.   Reset Controller

Command Letter	Parameters	Default
X	8958	N/A

When issued, this command resets the controller and sets all parameters to their default values. Any stored voice ID is also cleared.

5.5.   *Command Error Numbers*

If an error is made during the entry of a command via the RS-232 port, the controller will indicate the type of error by printing an error number after the command. The following error numbers are used:

Error Number	Description
Error 1	Command name not found.
Error 2	Not used.
Error 3	Extra characters at end of command. (Too many parameters for command).
Error 4	Parameters contained out-of-range values for the command, or all necessary parameters were not entered.
Error 5	Parameter improperly formed. (Alpha character embedded in numeric parameter, and so on.)
Error 6	Expected parameter not present.

6. Specifications

6.1. Electrical Specifications

6.1.1. J6 Signal Descriptions (Schematic Names in Parenthesis)

VRAW: 10 volt regulated power supplied by Mastr II regulator board.

RXA (VOL_SQ_HI): Receive Audio. Audio signal from the Mastr II receiver into the PSE-508. It is supplied by the Mastr II "VOL_SQ_HI" signal.

RUS: Receiver Unsquelched. High (≥ 2.0 volts) when the receiver is receiving an on-frequency RF carrier. Low (≤ 1.0 volts) when receiver is not receiving a carrier.

TXA (TX_AUDIO_HI): Transmit Audio. Audio signal from the PSE-508 into the Mastr II exciter.

PTT (REMOTE_PTT): Push to Talk. This signal goes low (0.2 volts) to enable the Mastr II transmitter. DIP-switch 4 (S1-D) is in series with this signal, so the transmitter may be disabled by opening this switch. See note 1 below.

GND: Zero volt power supply return.

TONE (CTCSS_ENCODE): CTCSS encoder signal to Mastr II exciter. AC signal, ground referenced.

SUM (TX_AUDIO): Summing amplifier (U6-A) output. This is an AC signal riding on a 5V DC level. Used for test purposes.

6.2. Absolute Maximum Ratings

Parameter or Signal	Conditions	Min		Max	Units
Regulated Supply Voltage (VRAW)		0		13	Volts DC
Receiver Audio Input (RXA)				3.5	Volts RMS
RUS		-0.7		18.0	Volts DC
PTT		-0.7		VRAW	Volts DC
Storage Temperature		-65		150	°C

Note: Absolute maximum ratings are those values beyond which damage to the device may occur.

6.3. Operational Ratings

Parameter	Conditions	Min	Typ	Max	Units
Operating Temperature Range		-30		70	°C
Regulated Supply Voltage (VRAW)		9.5	10.0	10.5	Volts DC
RUS input low level	Receiver Squelched		0.0	1.0	Volts DC
RUS input high level	Receiver Unsquelched	2.0	5.0		Volts DC
RUS input impedance			10K		Ohms
PTT Active, Output Low Level	$R_{Load} \geq 200$ ohm			0.2	Volts DC
PTT Pull-Up to VRAW (note 1)		646	680	714	ohms
RXA input impedance	Fin = 1000 Hz	65	73	80	Kohms
Transmit Audio, Output Impedance			200		ohms
VRAW Supply Current (I_{RAW})			40	65	mA
CTCSS Encoder Frequency Range		60.0		260.0	Hz
CTCSS Encoder Voltage Level	R_{load} = 5K ohm f_{out} = 100.0 Hz	480	535	590	mVRMS
CTCSS Output Impedance	f_{out} = 100.0 Hz		450		ohms
Reverse Burst Phase Delay			-235		degrees
Reverse Burst PTT Delay			160		milliseconds

Notes:

1. The PTT signal is driven low with a transistor that is pulled up to VRAW with a 680 ohm ¼ watt resistor. Therefore, when PTT is inactive its output impedance is approximately 680 ohms resistive.