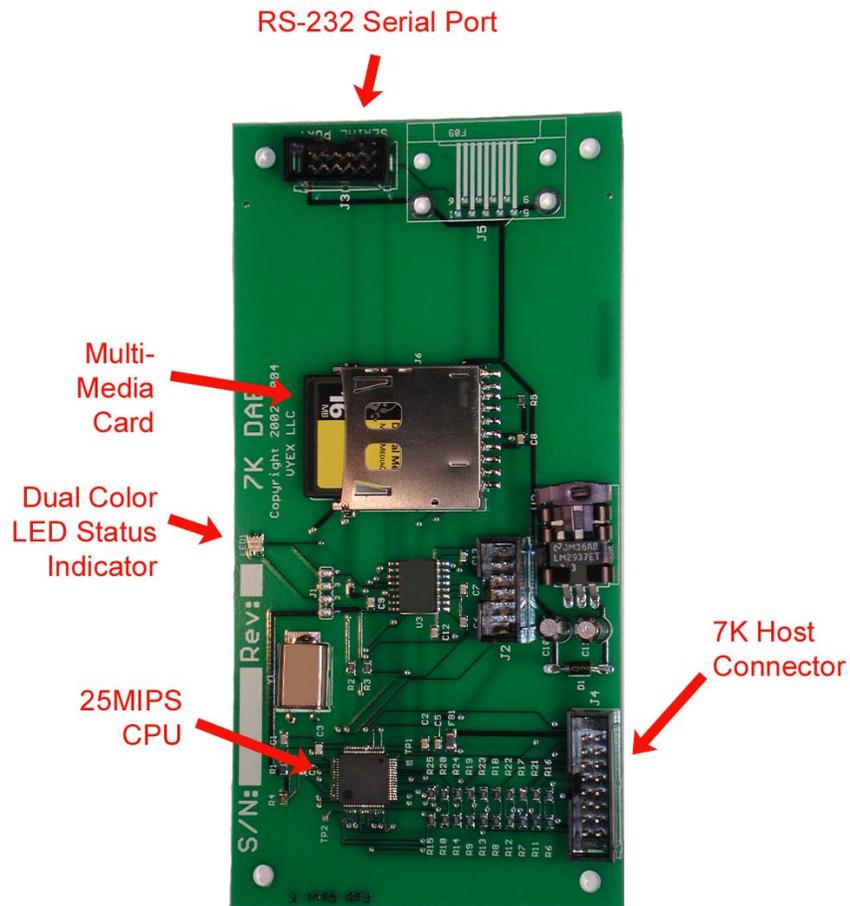


# 7K Digital Audio Board



Revision 2.0  
19-Aug-2007

Vyex LLC  
[www.vyex.com](http://www.vyex.com)

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## Introduction

Thank you for purchasing the 7K Digital Audio Board (DAB).

The DAB has been designed as a “drop-in” replacement for the Speech Synthesizer board in the S-Com 7K repeater controller, but does more than just talk.

The DAB utilizes a fast, FLASH based, single chip microprocessor to support audio playback from a FLASH based Multi-Media Card (MMC) which is used to store digitized speech files played back in response to commands from the 7K repeater controller.

The MMC media card is the same type of solid state storage media that is used in many consumer devices such as cameras, personal digital assistants, and MP3 players. The file system used on the FLASH card is the same FAT16 file system used on desktop computers for years and is thus compatible with any third party MMC I/O device that supports this type of file system. The FAT16 file system constrains the total storage space to approximately 2 Gigabytes, which provides the potential to store hours of audio material. The user is free to upgrade the amount of storage space available at any time simply by purchasing higher capacity FLASH cards from the vendor of their choice.

The audio files are stored in the well-known WAV file format, which is a subset of the Microsoft Resource Interchange File Format (RIFF) file format. This flexible file format supports dozens of different audio compression methods, of which the DAB supports only a few specific types.

The DAB also has an RS-232 serial port that can be used to send or retrieve files from the FLASH card in order to allow the update of audio files, product firmware, and to make product configuration changes.

The DAB's product firmware is fully field updateable and new firmware revisions can be installed by the end as they become available.

If you have any questions or comments regarding this product, please know that your feedback is always appreciated.

Contact information:

Vyex LLC  
S64 W24740 Susan Street  
Waukesha, WI 53189

262.513.0150

[support@vyex.com](mailto:support@vyex.com)

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This warranty does not cover damage caused by any of the following:

- Physical damage of any kind.
- Improper installation or connection.
- Electro-static discharge damage caused by improper product handling.
- Lightning.
- Any product in which the customer has attempted to make field repairs or modifications.

During the term of the warranty, Vyex LLC will cover the cost of product repair including parts, labor and return shipping.

Vyex LLC may not support all third party manufacture's Multi-Media Cards as viable storage devices for use with this product.

Vyex LLC reserves the right to refund the purchase price as its exclusive warranty remedy.

For service contact Vyex at 262.513.0150

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Microsoft, Windows, and MS-DOS are registered trademarks of Microsoft Corporation.

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## Installation

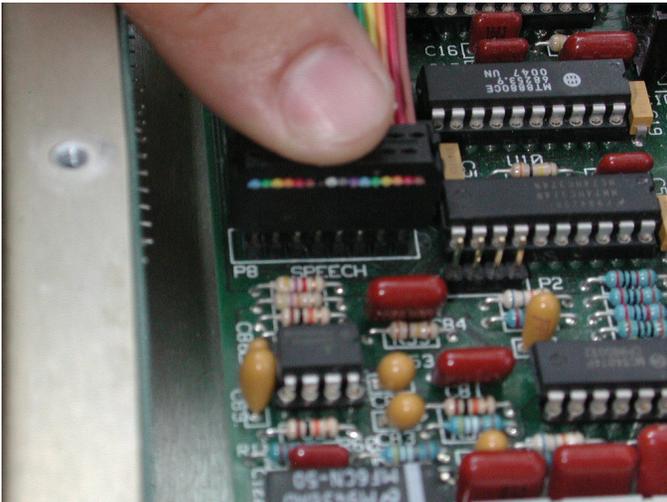
### CAUTION:

The DAB is a static sensitive electronic device. Proper precautions should be exercised when handling the DAB.

Installation and connection of the DAB can only be performed with power removed from the controller.

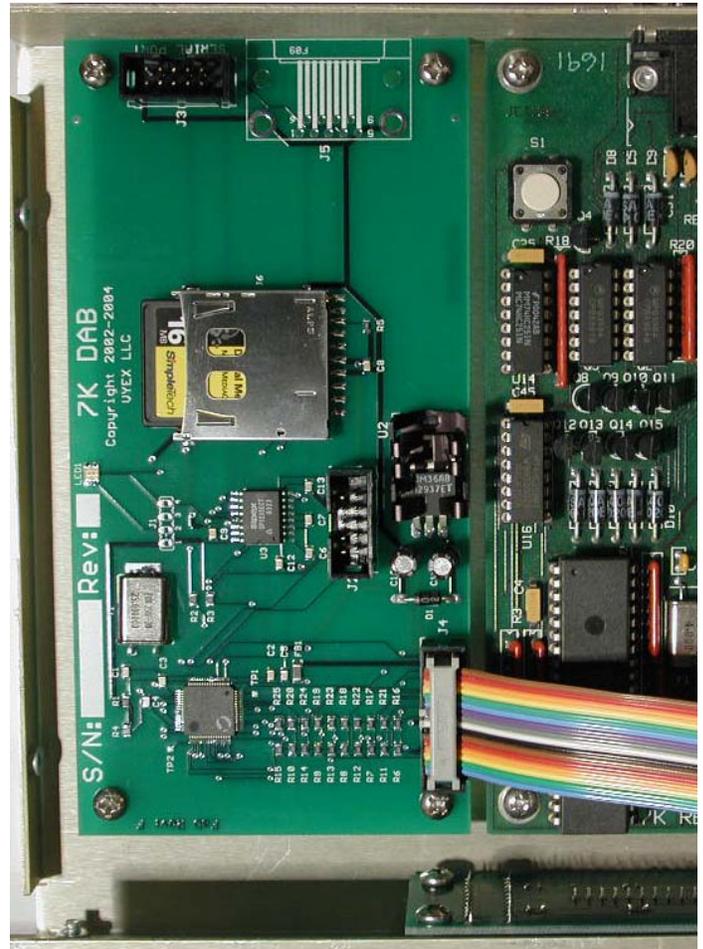
### *Installation into the rack mount cabinet.*

The DAB is installed in the controller cabinet to the left of the repeater controller circuit board and secured in place with four 6-32 screws.



Using the supplied ribbon cable, connect the ribbon cable between J4 on the DAB and the speech board connection, P8, on the 7K repeater controller PCB.

As the 7K does not use a keyed or shrouded connector, use due caution when making the connection to the 7K connector. **If the cable is not inserted correctly, severe damage may occur to the DAB and will not be covered by warranty.**



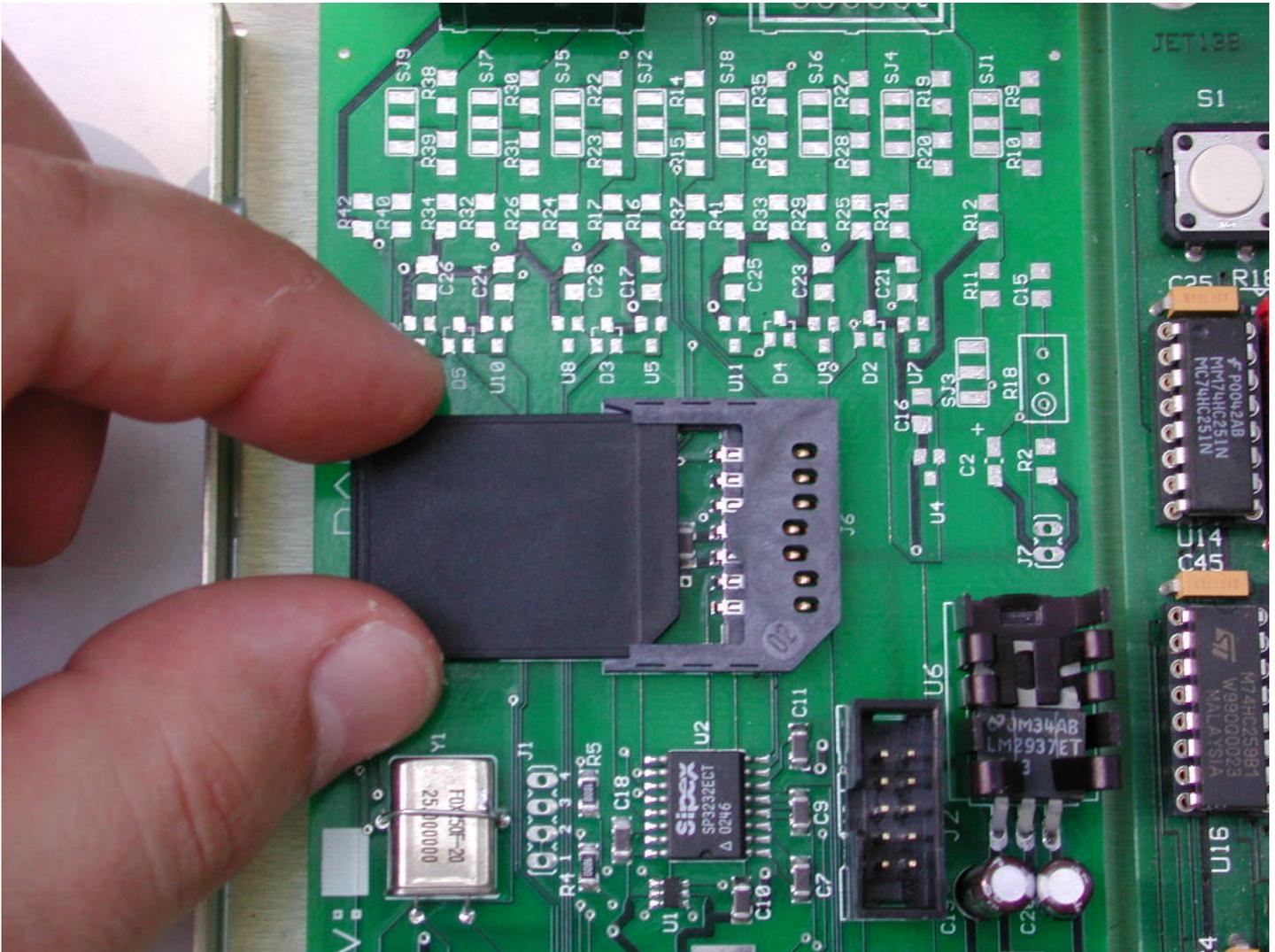
If the serial port on the DAB will be utilized, the short ribbon cable assembly containing the DB-9 connector can be connected to J3 on the DAB. The method of routing the cable out of the 7K cabinet and/or mounting of the DB-9 connector in the cabinet is left to the end user. Please note that the modification of the controller cabinet may void your warranty with S-Com.

If you do attempt to modify the cabinet, please use proper precautions to guard against physical damage to the circuit boards inside the cabinet, and against any metal debris which could potentially short components on the PCB's.

## Installing the FLASH Card

The multi-media FLASH card should be inserted into the connector as shown, with the gold contacts facing downward.

When the card is not installed in the DAB, do not touch the gold contacts.



## Updating the 7K repeater controller firmware

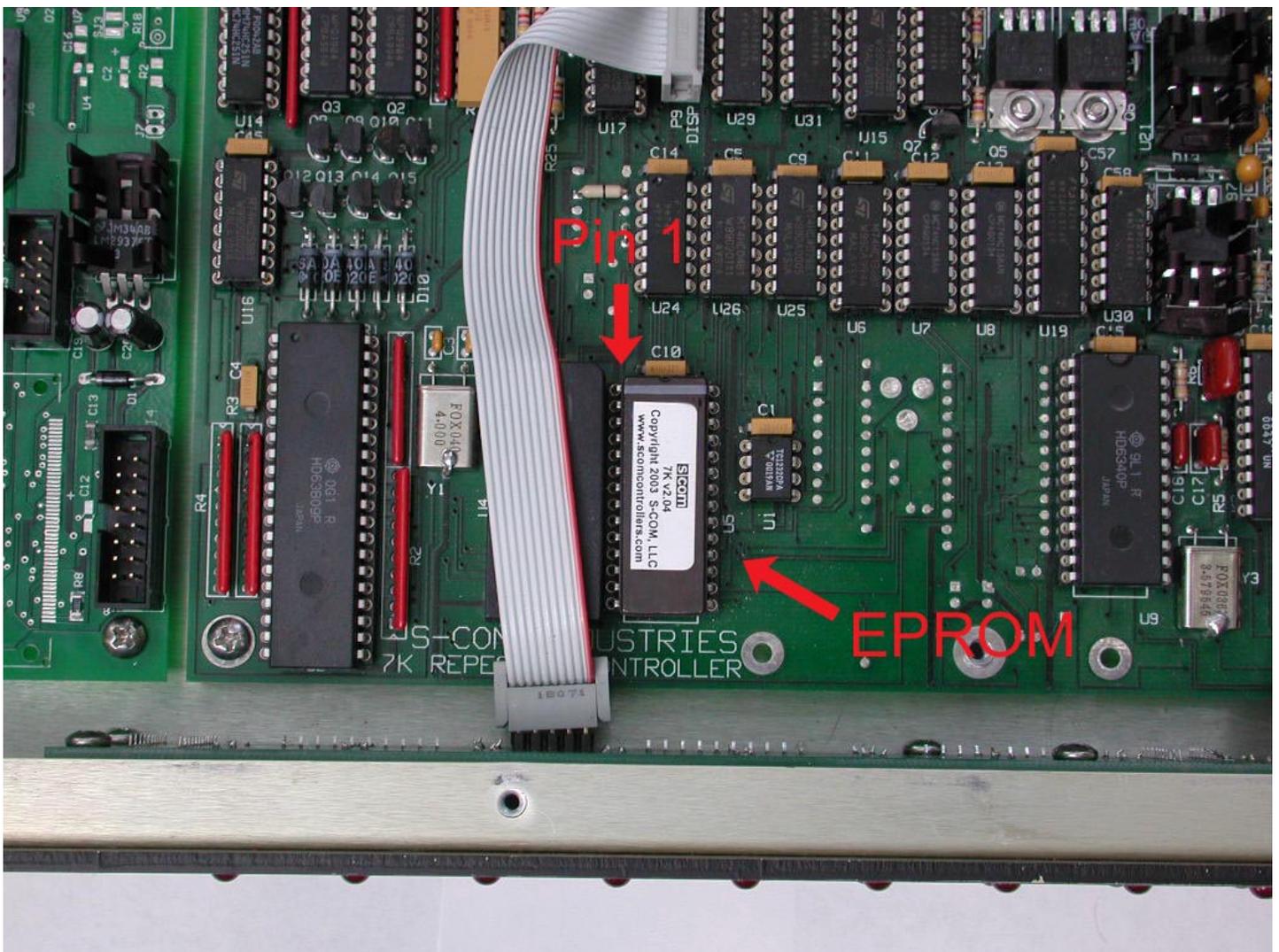
An EPROM containing new firmware for the 7K has also been included with the DAB. This new firmware provides better integration between the DAB and 7K controller as well as providing new, generic, features to the 7K itself.

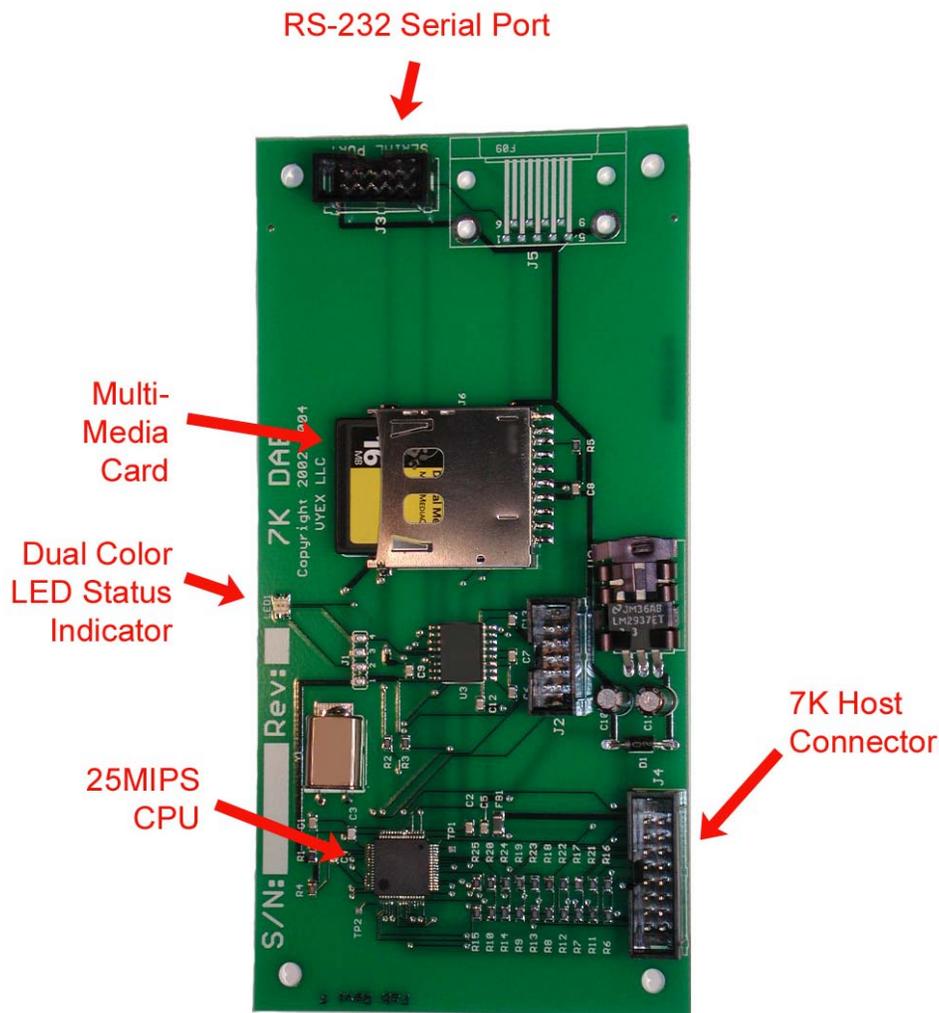
**When version 2.04 firmware is installed in the 7K, the 7K will need to be re-initialized before it will work, and the user will need to reload their program into the controller.**

The DAB will work with any version of S-Com firmware that supported the speech synthesizer module, and you may elect to defer the installation of the new controller firmware.

If your controller is not already at a 2.x version status, and you wish to utilize the new firmware, you will need to contact S-Com regarding upgrading other components on the 7K controller board.

To change the Firmware, use an IC extraction tool to exert equal force on each end of the old EPROM while pulling straight up. Place the old EPROM in conductive foam, and then install the new EPROM as shown in the picture below. Pin one, on the notched end of the EPROM, should be facing towards the rear of the cabinet.





## Using the DAB

### *LED Status indicator*

The DAB has a dual color surface mount LED mounted near the board edge near the FLASH card connector.

If the FLASH card is present upon power up, the dual color LED on the DAB should briefly illuminate green as the FAT file system code initializes its internal variables.

If the FLASH card is removed, both LED's will illuminate and provide a yellowish glow to indicate the absence of the card.

When the FLASH card is present, if the LED glows solid Red, with brief flashes of Green, this indicates that the FLASH media is not correctly formatted.

In normal operation, the Green LED will flicker when the FLASH card is being accessed for reading, and the Red LED will flicker when the FLASH card is being accessed for writing.

## **Basic use**

In its simplest form, the DAB will mimic the original S-Com speech synthesizer board, and thus it is compatible with any version of 7K firmware that supported the speech board.

The default speech library included with the DAB includes digitized versions of the original TI speech synthesizer vocabulary. The recordings of the TI speech synthesizer have been low pass filtered to provide a sound which is less harsh than the original speech synthesizer.

In addition to the original vocabulary, additional words have been recorded by a professional voice over talent. The list of those words can be found in Appendix A.

If the user wishes to have custom words and phrases recorded in the same voice they may contact:

Sean Caldwell, KF4IWT

Phone: 212.898.1222

<http://www.seancaldwell.com/>

Sean has agreed to contract with the end users of this product for a very reasonable price.

## ***Supported WAV File formats***

For those that wish to create their own WAV files, you will need to know about some specific constraints of exactly what the DAB does and does not support.

PCM. 8 or 16 bit linear (uncompressed) values, in either mono or stereo format. The maximum supported sample rate is 22.05kHz.

muLaw. This is a logarithmically compressed format which stores 8 bits per sample and expands to approximately 12 bits of precision. Mono and Stereo forms are supported. The maximum supported sample rate is 22.05kHz.

IMA/DVI ADPCM. Adaptive Delta Pulse Code Modulation essentially stores the difference from one sample to the next. Several different ADPCM methods and subsets are part of the WAV file specification, the one that the DAB supports is specifically this type, with 4 bits per sample, in mono format only. The maximum supported sample rate is 16kHz.

For the types that support stereo file playback, no attempt is made to “mix” the two channels together and the data stream for only the left channel will be audible.

If a WAV file is stored using an unsupported compression method, or at too high of a sample rate, the DAB will simply treat the file as a missing file and refuse to play it.

## ***Things to consider when deciding file storage parameters***

If the user wishes to provide for the highest fidelity playback, then the files should be stored as 16 bit PCM files. Using this storage method consumes two bytes of disk space per sample.

If the user wishes to conserve as much disk space as possible, then the ADPCM compression method is recommended. Using this storage method, two samples are stored in one byte of disk space.

The default speech libraries included with the DAB utilize muLaw compression for the TI synthesizer recordings, and ADPCM for the live recordings. Both types are sampled at 11.025kHz.

It was found that applying ADPCM compression to the TI synthesizer recordings resulted in objectionable artifacts when the files were played, but these same artifacts were not nearly as noticeable for the live recordings.

The practical limit of a narrowband FM voice channel is about 48dB Signal to Noise ratio, so what may sound objectionable in your recording studio, may be inaudible to the end user.

**Sample rates higher than 11.025kHz will be of little practical use when the high frequency rolloff of a normal two-way radio is considered. In fact, the end user may find that recordings at 8kHz sample rates are quite satisfactory.**

When making your own live recordings using “built-in” audio hardware in your budget desktop computer, you may find that recording at these lower sample rates results in muddy sounding audio, and come to the conclusion that even a 22.05kHz sample rate just isn’t enough. In this case, the real culprit is the poor performance of the low cost audio card in your computer. Here you have two potential solutions. Either record at a higher sample rate, such as 44.1kHz and then downsample to a lower rate, or buy yourself a professional grade audio card that doesn’t have these same performance limitations.

## ***Recommended editing programs***

Adobe Audition, formally Syntrillium Software's Cool Edit Pro product, is a preferred tool we use here.

<http://www.adobe.com/>

SoX – Sound eXchange is a useful tool that claims to be the “swiss army knife of sound processing programs”. This useful utility can convert from just about any sound format to another format, change sample rates, pitch, speed, filter, etc.

<http://sox.sourceforge.net/>

Goldwave – is a low cost, simple digital audio editor.

<http://www.goldwave.com/>

Sound Forge – is a higher end digital audio editor, with capabilities similar to Adobe's Audition product.

<http://www.sonicfoundry.com/>

There are literally hundreds, if not thousands of software utilities available to edit, and manipulate WAV files, and to cover them all in this manual would be impossible. The short list above represents those we have direct experience with and wouldn't hesitate to recommend.

## **Storing files on the FLASH card**

### ***Multi-Media Card adapters***

A wide range of options exist in both internal and external FLASH card adapters that are compatible with modern desktop computers. One of the most common adapters plugs into the USB port on your computer and allows you to read and write files to one or more FLASH card media types.

These types of media adapters can generally be purchased new for less than \$20 at your local computer store.

Due to the variety of products available, it is beyond the scope of this manual to provide a tutorial on their use.

## ***File system requirements***

The Multi-Media Card needs to be formatted with a DOS FAT16 file format. For smaller media types, the default of the format program you utilize may format the card with a FAT12 file system, and you will need to override the default settings.

Example:

To format a 16MB card under Windows 2000, open a Command Prompt Window and type:

```
FORMAT d: /a:1024
```

Where 'd' equals the drive letter corresponding to the MMC card, and 1024 equals the size, in bytes, of each cluster.

You will be prompted:

```
Insert new disk for drive d:  
and press ENTER when ready...
```

Hit [Enter] to continue.

```
The type of the file system is FAT.  
Verifying 15M  
Initializing the File Allocation Table (FAT)...  
Volume label (11 characters, ENTER for none)?
```

Hit [Enter] to continue.

Format complete.

```
15,960,064 bytes total disk space.  
15,960,064 bytes available on disk.
```

```
1,024 bytes in each allocation unit.  
15,586 allocation units available on disk.
```

```
16 bits in each FAT entry.
```

```
Volume Serial Number is 10D5-D722
```

The key thing here is to select a cluster size for the disk that results in the format program showing a summary of "16 bits in each FAT entry."

The most efficient disk utilization will generally be realized when the smallest possible cluster size is selected, however other factors, such as the increase in the FAT table size may offset any gains that may occur through any increase in disk utilization efficiency.

## ***File system structure for the Audio Files***

The WAV files need to be stored in a predetermined manner in order on the FLASH card.

The Root directory needs to contain a "WAV" subdirectory, and the WAV subdirectory needs to contain additional four digit numeric subdirectories corresponding to the "hundreds" portion of the word number to be spoken. Within each of those subdirectories, up to 100 WAV files can be stored.

The file naming convention for each WAV file simply correlates one-for-one with the word number issued from the 7K command 15.

For example if you wanted to associate a given WAV file with word 3024 you would name the file "3024.WAV" and store it in the "\WAV\3000\" subdirectory. Similarly word 0007 would be named as "0007.WAV" and stored in the "\WAV\0000\" subdirectory.

With the exception of the reserved word "0000" and words greater than "9699", you may utilize as many of the word numbers as you like, up to the limits of the storage space on your FLASH card.

## ***Special files stored in the root directory***

### **CONFIG.INI**

This text file contains user settings that need to survive a power failure. It is a simple text file that contains a variable keyword, equals sign, and desired setting for the associated parameter.

Comment lines can be preceded with a semicolon, or simply contain white space.

The supported keywords are:

- **BaudRate.** Specify any standard baudrate up through 115200 baud. If not specified, the default baudrate of 115200 baud will be used.
- **Password.** This is the case sensitive password used to protect access to the serial port. Only the first 8 characters are used, and if not specified, the serial port will not require a password.
- **BusyMsg.** Specify a Morse code message to be played when the 7K commands the 7KDAB to play a file during periods when the file system is busy. Only the first 9 characters are used. If not specified, the default message of "BZ" will be used.

Example file contents:

```
; Configuration file for 7K-DAB
BaudRate = 38400
Password = Secret
BusyMsg = WR9ACY/R
```

### **DAB-MAIN.BIN**

This file contains the microcontroller's firmware. If this file exists, its contents are checked against the current program stored in the microcontroller's own FLASH memory. If they are different, the microcontroller will reprogram itself and reboot to begin execution of the new firmware.

## DAB-BOOT.BIN

This file contains the small bootstrap loader used to reprogram the microcontroller. If this file exists, its contents are checked against its program storage space in FLASH memory. If they are different, the microcontroller will reprogram this portion of the FLASH memory.

## 7K-IMAGE.BIN

This file contains an image of the 7K controller's battery backed SRAM. Special commands can be used to save or restore the contents of the controllers programming.

## 7K-PATCH.BIN

This file contains a program image of the 7K firmware patch area.

## Special Words

Words 9700 through 9799 have been reserved for use by the DAB. When these special words are "spoken" they trigger special things to occur. Some of the functions represent a stand-alone function performed by the DAB and others represent a cooperative effort between the new firmware on the 7K and the DAB.

### ***9700 – Custom Delay***

When this word is spoken, the word that follows it is used as a delay factor with its time specified in milliseconds.

For example, "9700 1000" would cause a 1 second silent pause during playback.

The maximum delay that can be specified is 5000ms.

### ***9701 – Long word continuation***

With 7K firmware revisions prior to 2.04, there is a hard coded timeout timer in the 7K firmware designed to detect a failed speech board. While the 7K documentation documents this timeout timer as being 5 seconds, in reality a software bug caused it to be 25 seconds.

In order to allow a DAB user to playback a speech file longer than 25 seconds, the DAB has a timer which artificially signals the 7K that a phrase has been completely spoken even though playback continues. If the next word received is 9701, the DAB will continue to play the file already in progress, and approximately 25 seconds later signal the 7K that the phrase has been completely spoken.

For example, "{PW} 15 9960 5000 9701 9701 9701" would allow 5000.WAV to play for approximately 100 seconds if needed.

There is no harm in issuing too many 9701 continuation words. If no playback is in process, the DAB will simply handshake with the 7K and move on to the next word.

**This command is not needed with version 2.04 firmware as the keep-alive handshake will occur automatically in the background.**

## **9702 – Playback Speed Factor**

When this word is spoken, the word that follows it is used as a playback speed multiplier against the playback rate specified in the WAV file header. The word value supplied is specified as a percentage of the playback speed with 0100 (100%) being the normal playback rate.

The value specified can range from 1 to 255%, but if the resulting playback rate exceeds the sample rate limits for the WAV file, the playback rate will be limited to appropriate maximum playback rate.

The playback speed factor is a static value which defaults to 100% on reset. Whenever a user supplied value is specified, that playback speed factor remains as the new playback rate until either a new factor is specified, or until a reset occurs.

For example, "{PW}15 9960 9702 0120" would set the playback rate to 120% of normal speed.

## **9710 – Play Random File**

When this control word is issued, the next two word values are used as a starting and ending word value for the controller to pseudo-randomly play an audio file within the inclusive range supplied. There is no restriction on the start or end value other than that they need to be in the range of 0001 through 9699.

Due to the integer math used, and the fact that any pseudo-random number generator has its limitations, the user will find that the span will affect the apparent randomness of the file chosen. Spans that represent a power of two will appear to give the best degree of randomness, but the span may be of any desired size and should still to be sufficiently random for the purposes of this function.

Some examples:

{PW} 15 9960 9710 3000 3010 ;play one audio file from the range of 3000 – 3010

{PW} 15 9960 9710 1000 4000 ;play one audio file from the range of 1000 - 4000

{PW} 15 9960 9710 4021 4022 ;play either audio file 4021 or 4022

**Note: This will also select and play CW files included within the selection range, so it is conceivable to mix audio tracks with CW messages if desired.**

## **9720 – Send Serial Characters**

In order to allow a modem to share the same phone line that the repeater controller is connected to, one or more macros will need to be created in the 7K to cause the modem to answer, or place a call on its own.

Once special word 9720 is encountered, the decimal of each word encountered after it will be used to determine which ASCII character to send on the serial port. Any word value greater than 0256 will exit the ASCII character mode.

A null character can be sent by using a word value of 0256.

A chart of ASCII characters is provided in Appendix B.

In the following example, two macro's are created to allow the 7K to answer the phone line. The first macro causes the modem to generate answer tones, and then, after pausing, executes a second macro to cause the 7K to hang up the phone line. The delay in this process ensures that the phone call is not dropped in the process of handing off the call to the modem.

```
; Macro 5782 sends "ATA<CR>" to modem, delays for 2 seconds, then triggers macro 5783  
{PW} 20 5782 {PW} 15 9960 9720 0065 0084 0065 0013 0500 9700 2000 9999 5783
```

```
; Macro 5783 disconnects Autopatch line.  
{PW} 20 5783 {PW} 83
```

If you wanted the repeater to call you back on a separate modem line you could configure macro's as follows.

```
;Macro 5784 disconnects the autopatch line, pauses for two seconds then sends "ATDT5551212<CR>".  
{PW} 20 5784 {PW} 83  
{PW} 29 5784 {PW} 15 9960 9700 2000 9720 0065 0084 0068 0084 0053 0053 0053 0049 0050 0049 0050 0013 0500
```

Obviously you will need to replace 555-1212 with the phone number you desire the modem to call.

## **9790 – Force 7KDAB Reset**

In the event that the 7KDAB firmware should get "stuck", it may be possible to issue this word to force the 7KDAB to reset.

Although the 7KDAB does contain a hardware watchdog that will reset the CPU in the event that the 7KDAB should stop executing as desired, there may be unforeseen situations where the software may appear to operate properly yet fail to respond to the serial port. Because the 7K host interface software operates at an interrupt level, it may be possible for the 7KDAB to respond to this command.

Example:

```
{PW} 15 9960 9790
```

## Notice:

The following special word commands were included to aid in the overall firmware development process and are somewhat experimental. While they are implemented, they are not supported at this time, but are documented here for the sake of completeness.

Whenever any of these special word commands are issued, 100% of the 7K's CPU time is dedicated to executing the associated command. As such, all other controller activity is frozen... meaning any transmitters currently on the air, will stay on the air, no DTMF commands will be possible, etc.

Issuing these commands with mismatched versions of firmware, may cause either the DAB or the 7K controller to hang indefinitely.

Full support may be available in a future release.

### ***9796 – Load 7K Patch file***

This causes a patch file to be loaded into the 7K's firmware patch area. The user needs to be certain that the patch file exists before issuing this command, or the firmware load will fail ungracefully by resetting the controller.

### ***9797 – Provide RTC data to DAB***

This will cause the real time clock maintained in the 7KDAB to be set to the current time in the 7K.

### ***9798 – Load 7K-IMAGE.BIN***

Issuing this word causes the contents of the 7K's battery backed SRAM to be overwritten with the contents in this file. The image upload takes approximately 25 seconds, after which the 7K will reset.

Note that this literally will restore the controller to the state that it was in when the save command was executed. Beware of what you ask for... for surely you will find it.

### ***9799 – Save 7K-IMAGE.BIN***

Issuing this word cause the contents of the 7K's battery backed SRAM to be written to the FLASH card. The image download takes approximately 5 seconds.

# Morse Code Features

## *Message File Location*

Text files containing the desired message along with special control sequences to control pitch, speed, and amplitude can be stored in the same directory structure along with the audio files.

As with the audio files, the Morse code filenames begin with the four digit numeric value of the desired phrase number, but in this case use the file extension "CW".

When the 7K controller commands the 7KDAB to play a given word, the 7KDAB will first check to see if a 'xxxx.WAV' file exists, and if none is found, then it will check to see if a 'xxxx.CW' file exists, and if present will begin playback of the Morse message file.

## *Message File contents*

The text file should contain regular ASCII text characters. In addition to letters and numbers, standard punctuation characters are supported. The full list of characters is included in Appendix C.

Any unsupported characters will be translated to a inter-word delay, or "space" character.

With version 2.04 firmware installed in the 7K controller, the only limitation to the length of a file is the size of the FLASH memory card.

As with speech messages, a Morse message playback may be stopped with the {PW} 16 command (available in 2.04 7K firmware), or by issuing the "STOP" command at the serial console prompt.

## *Message file control characters*

Unless otherwise specified, the default for a CW message playback is a pitch of 720Hz at 20WPM and one-half maximum amplitude. These values are reset at the beginning of each new message playback.

Special control character sequences are used to set the pitch, speed, and amplitude of the message and can appear anywhere within a message. The control sequences consist of a single control character followed by numeric digits and terminate with the first non-numeric character.

**Note: If the first desired character after a command sequence is a numeric value the command sequence can be terminated with a forward slash ( / ) character, which in that specific circumstance will not be treated as a inter-character delay.**

### Pitch

A character sequence beginning with a tilde ( ~ ) character denotes a change pitch command. The pitch is specified in Hertz, and can range from 1Hz to 5000Hz inclusive.

**Note: The internal frequency resolution is limited to about 600mHz so the specified frequency will vary slightly from the specified value. Also note that precision of the frequency is limited to that of the microprocessor grade crystal.**

## Speed

Two different control characters are supported for setting the speed. For normal cadences, the percent sign ( % ) is used to select a speed ranging from 1 to 50 words-per-minute.

For code practice purposes, the inter-character speed may be supplied separately by using the asterisk ( \* ) character to select a speed ranging from 1 to 50 words-per-minute.

**Note: When the '%' character is used, it will set timing values for both the inter and intra character timing values, so when using the '\*' control character, the '%' control setting should precede the '\*' control setting.**

## Amplitude

A character sequence beginning with a up-caret ( ^ ) character denotes a change in amplitude command. The amplitude is an 8 bit linear value and can range from 0 (off) to 255 (maximum).

## Sending 'Prosigns'

To send a prosign such as AR, AS, BT, SK, etc., any number of characters can be enclosed in brackets. The left bracket ( [ ) has the effect of reducing the inter-character delay time to one dit time, and the right bracket ( ] ) has the effect of restoring the inter-character delay time to three dit times.

Examples:

The following message sets the pitch to 880Hz, the amplitude to 128 (or half volume), 20WPM for the character timing, and 13WPM for the inter-character timing, then sends "This is a Morse code message".

```
~880^128%20*13This is a Morse code message
```

The following example sends "DE KA9FUR" using a different pitch for each character. Note that the command prior to sending the '9' is terminated using a backslash.

```
^255%13~1000D~1100E~1200 K~1300A~1400\9~1500F~1600U~1700R
```

The following example shows how to send a message containing a prosign.

```
Wx here is sunny [SK]  
Send 8 dits like this [HH] or this [IIII] or this [EEEEEEEE]
```

## **7KDAB 'Busy' message**

If the 7K attempts to command the 7KDAB to play a file while the 7KDAB is otherwise preoccupied with another action which requires the use of the FLASH file system (such as the user uploading new files to the card), after waiting for 2 seconds, the 7KDAB will play a short CW message in place of the desired word.

By default, the message is simply "BZ", but can be changed by specifying a message of up to 9 characters. This message is specified in the "CONFIG.INI" file with the keyword 'BusyMsg', which is read when the FLASH file system is initialized.

For situations where the user may have multiple words playing in succession to form a message, the 7KDAB will only play the busy message once during a 30 second time window.

The intent of this feature is to allow a legal identification to occur during periods of time when file system maintenance is occurring. While the preferred method of handling this situation would be to create a macro that changes any system messages from speech to Morse code, this provides an alternate means of handling this situation.

Example CONFIG.INI File contents:

```
BusyMsg = KA9FUR/R  
Password = Secret  
Baudrate = 115200
```

# Using the Serial Port

## **Hardware Interface**

Connecting the DB-9 serial port connector to a PC type computer can be accomplished with a straight through cable.

The DB-9 connector pinout is as follows:

1. No Connection
2. Transmit Data from DAB
3. Received Data to DAB
4. Ready to send from PC
5. Ground
6. DTR from DAB
7. Connected to pin 8
8. Connected to pin 7
9. No Connection

When the DAB sees pin 4 go ready, it will start a new command line session. If a password has been set, the DAB will prompt the user for a password. When used with a modem, this pin should be tied to the modem's carrier detect signal.

Pin 6 will normally be true, but at the end of a session timeout, or as the result of too many incorrect password attempts, this line will go false for two seconds and then return true. This can be used, with proper modem configuration, to disconnect a dialup caller.

Modem Wiring:

DAB (DB9)	Modem (DB25)
2	2
3	3
4	8
5	7
6	20

## **Baudrate**

The serial port's baud rate is determined by a setting in the CONFIG.INI file. Any baud rate up to 115200 can be specified in the configuration file.

## **Password**

The session password, if set in the CONFIG.INI file, must be entered correctly before access is given to the DAB's command line interface. Please note that this password is case sensitive.

Up to three attempts at entering the correct password are allowed before the DAB drops the DTR signal to disconnect the caller.

## ***Connecting a Modem to the Serial Port***

Since every modem tends to be a bit different, it is not possible to provide a single example that will work for everyone, but we can point out the important steps that need to be taken.

First, the modem itself needs to be configured as follows:

- Fixed DTE Speed. Possible command "AT&B1"
- Normal Carrier Detect (CD) operation. In other words, CD should indicate whether or not a carrier is present. Possible command "AT&C1"
- Normal DTR operation. Modem should disconnect a caller if DTR goes false. Possible command "AT&D2"
- No Hardware Flow Control. Possible command "AT&H0"
- Modem should ignore RTS. Possible command "AT&R1". Alternately, adding a jumper between pins 4 and 5 on the modem's DB25 connector may provide the same results.
- Modem should not send result codes. Possible command "ATQ1"
- Modem should not echo characters. Possible command "ATE0"

Most modern modems should allow you to save these settings to EEPROM. Possible command is "AT&W"

Some modems have dip switches that allow the same sort of power on settings to be accomplished, yet others may require a combination of dip switch and EEPROM settings to be configured.

The modem can share the telephone line with the repeater controller by creating a couple of simple macro's. Examples of how to do this were provided a few pages ago under the description of how special word 9720 can be used to send characters to the serial port.

Modem wiring may also vary slightly, but in general you will need to connect the four signal wires, plus ground as shown on the previous page.

## ***The Command Line Interface***

Using the Command Line interface (CLI) the user can effect the management of files on the FLASH card. Upon gaining access to the DAB's command line interface the user is presented with the prompt:

```
7kDAB->
```

As a preface to the list of the following commands, it is important to note that the file system software in the DAB is single threaded. This means that while a WAV file is being played, file system management commands are temporarily locked out.

Similarly, if file management commands are in use, any attempts by the 7K to play a WAV file will fail. In this circumstance, the DAB would simply handshake with the 7K as though the file had been played.

If the user needs to remotely update files on the DAB during periods of repeater use where speech would be regularly needed, it is suggested that a user macro be written to temporarily change the repeater's behavior so that speech is not a normal part of the repeater's operation.

### **CD – Change Directory**

While similar to the change directory command under MS-DOS, this command only accepts a fully qualified path name. When the present working directory is changed, it is reflected in the CLI prompt.

Right:

```
7kDAB-\>cd \wav\1000
7kDAB-\WAV\1000>
```

```
7kDAB-\WAV\4300>cd \wav\1000
7kDAB-\WAV\1000>
```

Wrong:

```
7kDAB-\WAV\4300>cd ..\1000
Directory not found
```

## DIR – Directory command

While similar to the directory command under MS-DOS, this command does not accept any parameters. It simply lists all the files within the present working directory.

Example:

```
7kDAB-\>dir
MMC Card MID: 6, PNM: KODAK , PSN: 428348449

08/19/2003  14:04  [D----]                WAV
01/01/2001  01:00  [-----]                82  CONFIG.INI
Free Space is: 2160 clusters, 2211840 bytes
```

The first line of information shows manufacturer information about the MMC card contained in the card identifier.

The Manufacturer Identifier (MID) shows the numeric value of the manufacturer of the card. Known values are:

- 1 – Infineon
- 2 – Sandisk
- 6 - Hitachi

**NOTE: If you have a card with an identifier not listed above, please let us know so that we can add it to our list.**

The Product Name (PNM) field displays the contents of the six character text field in the card identifier header. The text may include the products model number, or simply the vendor name.

The Product Serial Number (PSN) field shows the 32 bit serial number of the card.

The file attributes are shown inside brackets and include:

- D – Directory
- H – Hidden
- R – Read Only
- S – System
- V - Volume

Other than the directory attribute, the DAB ignores all other file attributes.

The number of free clusters, which is the smallest disk allocation unit, and the number of free bytes remaining on the FLASH card are displayed at the bottom of the directory listing.

## DEL – Delete File

While similar to the delete file command under MS-DOS, this command will only delete files in the present working directory, and will not accept wild cards.

Example:

```
7kDAB-WAV\4300>del 4380.wav  
File Deleted
```

## REN – Rename File

While similar to the delete file command under MS-DOS, this command will only rename files in the present working directory, and will not accept wild cards.

Example:

```
7kDAB-\WAV\5000>ren 5024.wav 5035.wav  
File 5024.WAV renamed to 5035.WAV
```

## FIND – Find a file

This command's primary purpose is to show file access time performance information and will display the amount of time needed to find a given file within the file system.

The user may find this command interesting to show the performance benefits of smaller vs. larger cluster sizes, and how the ordering of directory entries affects file access times.

Example:

```
7kDAB-\>find \wav\1000\1000.wav  
File Found. 22ms elapsed
```

```
7kDAB-\>find \wav\4300\4390.wav  
File Found. 61ms elapsed
```

```
7kDAB-\>find \wav\4300\4399.wav  
File not Found. 53ms elapsed
```

## SY – Send Y-Modem

Allows a file to be sent from the DAB to the users computer via the serial port.

Most any popular terminal program written in the past 10-15 years will support Y-Modem file transfers. Since each program is different, please consult that software's documentation for use of the file transfer capabilities of your terminal emulation program.

The filename you wish to download into your computer should be specified on the command line, and needs to exist in the present working directory.

Example:

```
7kDAB-\>sy config.ini  
Start your YMODEM Download now.
```

At which point you would start your file transfer software.

## RY – Receive Y-Modem

Allows one or more files to be sent to the DAB from the users computer via the serial port.

Example:

```
7kDAB-WAV\4300>ryCCCCC
```

The "C"s shown in the example above are sent periodically by the DAB to signal to the host computer that the DAB wishes to start receiving files using the CRC checksum method. One startup character is sent every 3 seconds, and up to 20 attempts are made before timing out.

## LO – Logout

This command simply terminates a command line session, and will cause a modem to disconnect.

## REBOOT – Reboot DAB

This command unceremoniously causes the DAB to reboot. It may be used to take advantage of new settings in the CONFIG.INI file.

## SMHOST – Force Smart Host Present Flag

This command is needed after a *Reboot* command is issued in order to simulate a special handshake sequence that occurs when the 7K controller containing Version 2.04 software first powers up. Unless this handshake sequence is seen by the DAB, some of the more advanced features, such as being able to send commands to the 7K, will be locked out.

Do not issue this command unless your 7K controller has Version 2.04 software.

## STOP – Stop current WAV file playback

Immediately terminates the playback of any WAV file. This may be useful if the command line user wishes to interrupt the playback of a long WAV file in order to gain access to file management commands.

## TIME – Display or Set the current Time and Date

This command will display or set a time of day clock in the 7KDAB. The time and date maintained within the 7KDAB will be used for the time and date stamp on any files written to the FLASH card.

Note that when setting the time and date, only basic range checking is performed and that in some instances, the day of month will be set to the maximum number of days for that particular month.

**Note that the time of day maintained within the 7KDAB does not survive a power cycle, and that the clocks accuracy is not specified and may accumulate error of several minutes per day.**

Set time example:

```
7kDAB-\>time 13:33:00
7kDAB-\>
```

Set time and date example:

```
7kDAB-\>time 13:33:14 8/23/2007
7kDAB-\>
```

Display time and date example:

```
7kDAB-\>time
13:33:15 08/23/2007
```

## TYPE – Type a file to the console

Causes the contents of a file to be echoed to the console serial port.

Control-C can be used to abort the file echo. Control-S will pause the file echo, and Control-Q will resume.

## **Command line interface commands available with 7K firmware 2.04**

**#!;** - Issuing commands to the 7K

Perhaps one of the more appealing additions to the 7K firmware, when used in conjunction with the DAB, is that commands to the 7K can be entered on the serial port.

Any digits preceded with an exclamation point will be sent to the 7K and treated as DTMF digits that appear to originate from within the controller.

Input lines to the command processor are limited to 80 characters in length, but for long lines a continuation character “\” can be placed at the end of a line to signify more digits for a given command sequence will appear on a subsequent line.

Command execution occurs when the Carriage Return character is received.

White space characters may be freely inserted if it makes the line more readable.

Multiple commands can be entered on one line by using the asterisk (“\*”) to signify the end of one command and the start of the next.

The octothorpe (“#”) can be used to cancel a command in progress.

Any lines proceeded with an octothorpe (“#”) or a semicolon (“;”) are treated as comment lines and are simply ignored. This allows a commented script file to simply be uploaded with a terminal program to the DAB in order to program the controller.

If the user desires to use a text file upload method to program the controller, the terminal program should be setup to pace itself either by waiting for a new command line prompt from the DAB to appear, or by adding a delay at the end of each line.

Example:

```
7kDAB->;Program courtesy tone for Rx1
7kDAB->!99 31 9981 9911 76 55 57045912 57051204

7kDAB->;This is an example of a line continuation
7kDAB->!99 31 9981 9911 76 55 57045912\
7kDAB->!57051204
```

## RFP – Remote Front Panel

The remote front panel command allows real time viewing of the controller activity via the serial port. When this command is invoked a representation of the controller's front panel, along with some additional data is displayed on your screen.

A group of three reverse video spaces is used to form a block to denote an indicator that is 'lit' whereas a lower case 'o' is used to indicate an indicator which is 'dark'.

When speech playback is active, the current audio track being played will be shown in the upper right hand corner of the screen.

The lower part of the screen is set aside to display decoded DTMF digits as they arrive, and to show where those digits are being received from. A new line is started each time a command is terminated with an asterisk (\*) or octothorpe (#), or if the DTMF source changes.

If for some reason the screen becomes garbled due to a missed character, you can type the letter "R" to refresh the screen. When the screen is repainted, the historical DTMF digit information of the screen is lost.

The display mode can be exited at any time by hitting the escape key.

Hit [ESC] to exit or 'R' to refresh Playing: 1027

COR1	CTCSS1	COR2	CTCSS2	COR3	CTCSS3	PTT1	PTT2	DTMF	BZIN	BZOUT	RING	ENC
■	■	o	o	o	o	■	o	o	o	■	o	■
IN1	IN2	IN3	IN4	IN5	IN6	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7
o	o	■	o	o	o	o	o	o	o	■	o	o
USR1	USR2	USR3	USR4	USR5	USR6	USR7						
o	o	o	■	o	o	o						

Rx1 856\*  
Rx3 80  
Rx1 8754\*  
LL 9979500\*  
LL 99717\*  
LL 99705\*  
LL 9983\*  
Rx1 8713\*

Indicators in addition to those already provided on the real front panel include:

- RING Phone line ringing status
- ENC CTCSS Encoder output status
- USR1-7 Indicate the current values of user function soft switches 92 through 98

Real time updates are not possible during DAB audio playback due to the fact that during playback, the interface between the 7K and DAB is dedicated to handshaking between these two units in a way that is compatible with the original S-COM speech synthesizer module. Information regarding controller operation can only be sent to the DAB during periods when the interface is otherwise available and I/O status change information will be sent to the DAB once speech playback has completed.

The DAB firmware utilizes VT100 terminal commands to provide a fast and efficient means of updating the screen, and thus the user needs to utilize a suitable terminal or terminal emulation program to accomplish this. The list of software companies that provide terminal emulation and file transfer software is quite extensive and beyond our ability to provide a list of those that do work correctly vs. those that do not. However, limited testing of freeware, shareware, and commercial programs clearly demonstrate that "you get what you pay for" in terms of faithful emulation.

“Hyperterm” users will need to visit the Hilgraeve website <http://www.hilgraeve.com/> and download a current version of this free terminal emulator in order for all characters to be properly displayed. For many years, Microsoft has bundled Hilgraeve’s terminal emulation software with Windows, and those bundled versions have some issues with some of the commands that the DAB uses. Hilgraeve’s website is silent as to when the bug(s) related to the screen redraw functions were addressed, but their version 6.3 appears to work fine.

Hilgraeve’s product is the only “free” emulator known at this time to provide true VT100 emulation and YMODEM file transfer capabilities. If you find other programs that work, please let us know.

## SCRIPT – Execute text file to program the 7K controller

Issuing the script command followed by a text file’s name will echo the contents of that file to the console, and any lines beginning with an exclamation point (!) will be parsed and sent to the 7K controller in the same manner that a command may be directly executed from the command line. Just as with manually entered commands, long lines can be continued on the next line by ending the line with a back slash (^).

Lines beginning with an exclamation point are limited to 80 non-white space characters. Lines exceeding this length will prematurely terminate the file transfer to the 7K and display an error message.

Keep in mind that the file will be transmitted as quickly as the 7K can receive it and if command responses are enabled could cause the 7K’s 400 byte message buffer to wrap resulting in some messages being lost or corrupted.

Also keep in mind that the while this command is executing, no speech words can be played and will cause the 7K’s message system to stall and time out each individual word or phrase. Therefore, it is advised that any enabled command responses not utilize speech responses.

Control-C can be used to abort the file execution. Control-S will pause execution, and Control-Q will resume.

Example:

```
7kDAB-\>script test.scr

;play warble tones
!99 15 9900 40 40 9910 5850 74 55 10 20 10 20 10 20

;play morse ditty
!99 15 9900 40 40 54 14 28 14 40 14 14

7kDAB-\>
```

## **Firmware Update Procedure.**

The product firmware can be updated by placing a new firmware image file in the root directory of the MMC card. This can be accomplished in one of two ways.

### ***MMC card reader/writer attached to your computer running Windows***

It is beyond the scope of this manual to provide a tutorial on the use of specific computer peripherals, as well as to make specific brand name recommendations for these third party devices.

Your local computer store, or your favorite on-line retailer, should have these products readily available, although you may find the term "Secure Digital" more widely used than "MultiMedia Card" or "MMC". The two technologies are similar, with Secure Digital being an extension of the MultiMedia Card standard. Secure Digital cards are slightly thicker, and cannot be used in 7KDAB boards prior to board revision "F", but a Secure Digital card reader should accept a MMC card.

- 1.) Download the new firmware binary file to a temporary storage location on your computer.
- 2.) Remove the MMC card from the DAB and place it in your FLASH card drive.
- 2.) Copy the firmware binary file into the root directory on the card.
- 3.) After the file copy has completed, wait at least 30 seconds before removing the card from the drive to allow the system to flush any unwritten data to the disk.
- 4.) Re-insert the card into the DAB
- 5.) When the card is re-inserted and power is applied, you will see the message "Updating FLASH program", followed by a reset message indicating a software reboot. You should note that the power on message indicates that the new version of firmware is running.
- 6.) Once the firmware update is complete, you may delete the firmware binary file from the MMC card.

### ***Use your terminal emulator to transfer a file to the MMC card***

- 1.) Download the new firmware binary file to a temporary storage location on your computer.
- 2.) Using a terminal emulator, issue the "RY" command at the "7kDAB> prompt.
- 3.) Within your terminal emulator, initiate a Y-MODEM file transfer of the new binary firmware file. You only have 30 seconds to start the file transfer or the DAB will timeout and cancel the file transfer.
- 4.) When the file transfer is complete, issue the "reboot" command at the command prompt.
- 5.) When the DAB reboots, you will see the message "Updating FLASH program", followed by a reset message indicating a software reboot. You should note that the power on message indicates that the new version of firmware is running.
- 6.) Once the firmware update is complete, you may delete the firmware binary file from the MMC card.

# Appendix A Library Contents

## 7K SSM Words

Words 0001 through 0597 and 4097 through 4388 are simply recorded versions of the S-COM SSM library using the latest speech ROM versions. Please refer to the appropriate S-COM documentation for a list of those words.

In addition to the standard library two additional synthesized words are included in the library:

- 4389 – Milwaukee
- 4390 – Repeater (a pleasant sounding version)

## Sean Caldwell Words

A	1000	alarm	1038	Appleton	1076
A.M.	1001	alarmed	1039	approach	1077
A.P.U.	1002	Alaska	1040	approaches	1078
A.T.V.	1003	Albany	1041	April	1079
abeam	1004	Alberta	1042	are	1080
Abel (able)	1005	Albuquerque	1043	area	1081
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serial	2234
service	2235
set	2236
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seventeen	2238
seventh	2239
seventy	2240
severe	2241
sewage	2242
seymour	2243
Sheboygan	2244
Shoals	2245
short	2246
shortwave	2247
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shut	2249
shuttle	2250
side	2251
Sierra	2252
sighting	2253
sigmet	2254
sign	2255
signal	2256
silver	2257
simulcast	2258
single	2259
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sixteen	2263
sixteenth	2264
sixth	2265
sixty	2266
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Sky Warn	2268
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slower	2271
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snow	2275
solar	2276
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South Dakota	2280
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southern	2283
southwest	2284
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spare	2286
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Speaker	2288
special	2289
speed	2290
spill	2291
spirit	2292
spoil	2293
spoilers	2294
spray	2295
Springfield	2296
square	2297
squawk	2298
squawking	2299
sqlch	2300
St. Paul	2301
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stabilizer	2303
stable	2304
stall	2305
standby	2306
star	2307
starboard	2308
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State	2310

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stereo	2314
stern	2315
stop	2316
storm	2317
street	2318
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strobe	2320
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supply	2328
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than	2363
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thir-	2374
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this	2379
this_is	2380
This_is_the	2381
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Trenton	2417
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trip	2420
tripped	2421
true	2422
trunk	2423
try	2424
tube	2425
Tuesday	2426
Tug	2427
Tunnel	2428
Turbulence	2429
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turquoise	2431
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twelve	2433
twentieth	2434
twenty	2435
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V.O.R.	2463
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Virginia	2484
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visual	2487
voice	2488
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vortac	2492
W	2493
W 9 H H X	2494
W R 3 I R S	2495
W.W.V.	2496
W.W.W.	2497
wait	2498
wake	2499
warning	2500
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Washington	2502
waste	2503
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Waterford	2507
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watts	2509
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Wausau	2511
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way	2513
we	2514
weather	2515
Web	2516
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weekday	2519
weekend	2520
Weekly	2521
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well	2523
Welsh	2524
West	2525
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yankee	2563
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Yearly	2566
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Ynez	2570
Yoke	2571
York	2572
you	2573
Young	2574
your	2575
yours	2576
you've	2577
Yukon	2578
Z	2579
Zebra	2580
zed	2581
zero	2582
zone	2583
Zulu	2584

## Test Tones

	Duration	Tone	dBFS
5000	2 Sec.	1kHz	0
5001	2 Sec.	1kHz	-3
5002	2 Sec.	1kHz	-6
5003	2 Sec.	300Hz	0
5004	2 Sec.	300Hz	-3
5005	2 Sec.	300Hz	-6
5006	2 Sec.	2kHz	0
5007	2 Sec.	2kHz	-3
5008	2 Sec.	2kHz	-6
5010	280ms	Stardust	-6
5011	385ms	Duncecap	-6
5012	200ms	Piano Chord	-6
5020	900ms	MF Sequence	-6
5021	2 Sec.	US Dialtone	-6
5022	1 Sec.	UK Ringback	-6
5023	2 Sec.	US Ringback	-6
5024	500ms	US Busy Tone	-6

## Appendix B ASCII Character Chart

Dec	Char	Name	Dec	Char	Dec	Char	Dec	Char
0	^@	NUL	32	SP	64	@	96	`
1	^A	SOH	33	!	65	A	97	a
2	^B	STX	34	"	66	B	98	b
3	^C	ETX	35	#	67	C	99	c
4	^D	EOT	36	\$	68	D	100	d
5	^E	ENQ	37	%	69	E	101	e
6	^F	ACK	38	&	70	F	102	f
7	^G	BEL, <b>\a</b>	39	'	71	G	103	g
8	^H	BS, <b>\b</b>	40	(	72	H	104	h
9	^I	TAB, <b>\t</b>	41	)	73	I	105	i
10	^J	LF, <b>\n</b>	42	*	74	J	106	j
11	^K	VT, <b>\v</b>	43	+	75	K	107	k
12	^L	FF, <b>\f</b>	44	,	76	L	108	l
13	^M	CR, <b>\r</b>	45	-	77	M	109	m
14	^N	SO	46	.	78	N	110	n
15	^O	SI	47	/	79	O	111	o
16	^P	DLE	48	0	80	P	112	p
17	^Q	DC1	49	1	81	Q	113	q
18	^R	DC2	50	2	82	R	114	r
19	^S	DC3	51	3	83	S	115	s
20	^T	DC4	52	4	84	T	116	t
21	^U	NAK	53	5	85	U	117	u
22	^V	SYN	54	6	86	V	118	v
23	^W	ETB	55	7	87	W	119	w
24	^X	CAN	56	8	88	X	120	x
25	^Y	EM	57	9	89	Y	121	y
26	^Z	SUB	58	:	90	Z	122	z
27	^[	ESC	59	;	91	[	123	{
28	^\ ^]	FS GS	60 61	< = >	92 93 94	\ ] ^	124 125 126	 } ~
30	^^	RS	62	>	94	^	126	~
31	^_ ^_	US US	63 63	? ?	95 95	 _	127 127	 DEL

## Appendix C – Morse Code Characters

A	. —	J	. — — —	S	...	1	. — — — —
B	— ...	K	— . —	T	—	2	. . — — —
C	— . . . .	L	. — . . .	U	. . —	3	. . . — —
D	— ...	M	— —	V	. . . —	4	. . . . —
E	.	N	— .	W	. — —	5	. . . . .
F	. . — .	O	— — —	X	— . . —	6	— . . . .
G	— — .	P	. — . . .	Y	— . — —	7	— — . . . .
H	. . . .	Q	— — . —	Z	— — . . .	8	— — — . . .
I	. .	R	. — .	0	— — — — —	9	— — — — .

Period [ . ]	. — . — . —	Colon [ : ]	— — — . . .
Comma [ , ]	— — . . — —	Semicolon [ ; ]	— . . . . .
Question Mark [ ? ]	. . — — . .	Double Dash [ = ]	— . . . —
Apostrophe [ ' ]	. — — — — .	Plus [ + ]	. — . — .
Exclamation Mark [ ! ]	— . — . — —	Hyphen, Minus [ - ]	— . . . . —
Forward Slash [ / ]	— . . — .	Underscore [ _ ]	. . — — . —
Open Parenthesis [ ( ]	— . — — .	Quotation Mark [ “ ]	. — . . . .
Close Parenthesis [ ) ]	— . — — . —	Dollar Sign [ \$ ]	. . . — . —
Ampersand [ & ]	. — . . .	At Sign [ @ ]	. — — . — .

# Appendix D Version History

## ***Product Firmware Revisions***

Product firmware revision history is available on the website support page: <http://www.vyex.com/support.html>

## ***User Manual Revisions***

### 1.0c – 1-Sept-2003

- First General release.

### 1.2 – 21-Oct-2003

- Added new command word 9710
- Corrected sample rate limitations for WAV files. ADPCM will support a maximum of 16kHz, not 22.05kHz as previously stated.

### 1.3 – 10-Dec-2003

- Added PCB revision “E” schematic.
- Added daughter board schematic and installation instructions.
- Added commentary regarding bugs fixed in 7K firmware version 2.04a

### 1.5 – 9-Feb-2004

- Added information regarding speed factor command 9702
- Modified information regarding DIR command to reflect new card identifier information
- Corrected example given for word 9710 and clarified example in 9701.

### 1.5a – 17-Feb-2004

- Added version release notes for 7K firmware version 2.04b

### 1.6 – 20-Mar-2004

- Added version release notes for 7K firmware version 2.04c & 2.04d

### 1.6a – 12-May-2004

- Updated pictures and schematic to depict current PCB revision.

### 1.7 – 25-July-2004

- Added information regarding 2.04e 7K firmware

### 1.7a – 13-May-2006

- Added information regarding 2.04f 7K firmware

### 1.8 – 14-Aug-2007

- Added information regarding version 7KDAB version 1.8 firmware

### 2.0 – 19-Aug-2007

- Added information regarding version 7KDAB version 2.0 firmware

## Appendix E 7K Version 2.04 Release Notes

### ***Disclaimer***

While this software is derived from SCOM's Version 2.03b firmware, it is not supported by SCOM. Any support issues related to this software need to be directed to Vyex LLC.

The copyright for this software is still held by SCOM and it is SCOM's sole discretion that determines how this firmware may be made available.

### ***Overview***

This firmware version contains new functionality to better integrate the 7K Digital Audio Board (DAB) with the operation of the repeater controller.

In addition to DAB specific additions, additional controller enhancements were introduced and are presented in this appendix.

## New Commands

{PW} 16 Stop playback of current speech word

Issuing this command will kill a spoken word currently in progress. It's intent is to provide a means of halting a long informational message.

{PW} 24 xxxx Remove Command From Macro

Removes last command from Macro 'xxxx'.

Reports "OK" if successful, or "? LAST" if there is only one command left in the macro.

To delete the last command in the macro, you need to delete the macro and re-create it.

{PW} 36 T F xxxx Modify ID Timers

T = '1' for Transmitter 1, or '2' for Transmitter 2

F = function code

- 0 Terminate ID timer activity. If ID is pending, it is cancelled.
- 1 Set ID timer to maximum. ID is NOT triggered.
- 2 Set ID timer to maximum. ID is immediately triggered.
- 3 Ensure Normal ID cycle. Start's ID timer if not already running, otherwise this command has no effect.
- 4 Ensure Final ID cycle. Start's ID timer if not already running, and sets the pending ID flag as though user activity had occurred. If timer was running, this command has no effect.
- 5 If ID timer is not running, set the ID timer to maximum and execute macro 'xxxx'

xxxx = Macro name for function 5

Example use showing a friendly on the hour ID:

```
{PW} 28 01 8001 99 99 06 59 ;enable on the hour ID's starting at 6:59am
{PW} 28 02 8002 99 99 21 01 ;disable on the hour ID's ending at 9:01pm
```

```
{PW} 20 8001 {PW} 28 00 4000 99 99 99 00 ;create hourly scheduler setpoint
{PW} 20 8002 {PW} 28 00 ;delete hourly scheduler setpoint
```

```
{PW} 20 4000 {PW} 36 5 4001 ;if ID timer is not running, call macro 4001
;and start the ID timer running
```

; Macro 4001 speaks "KA9FUR repeater" and if interrupted by user activity will revert to "KA9FUR" in CW

```
{PW} 20 4001 {PW} 15 9981 9961 000 0260 0001 0335 0149 0540 0401 0421 9902 54 59 0852 67 20 10 09 15 30 27
```

## {PW} 49 90/91/92/93 xx Message Handler Initial Message Delay

Timer's 90 through 93 now allow the user to determine the initial message delay value for individual message types.

In previous versions, these timer delay values were fixed at 1.0 seconds. The user can now specify a timer value of zero to 5.0 seconds with 100ms resolution.

Timer:

- 90 – CW pre-message delay associated with special message character '54'
- 91 – Beep pre-message delay associated with special message character '54'
- 92 – Paging pre-message delay that is always present
- 93 – Speech pre-message delay associated with special word '0000'

These timer delay's are utilized only at the beginning of a new message sequence, and with the exception of a paging sequence, the delay only occurs if the message begins with the special message character or word.

Examples:

```
{PW} 49 90 15 ;set CW initial delay to 1.5 seconds
{PW} 49 93 20 ;set speech initial delay to 2.0 seconds

;send CW message "KA9FUR" with an initial delay
{PW} 15 9900 54 59 0852 67 20 10 09 15 30 27

;send speech message "KA9FUR repeater" with an initial delay
{PW} 15 9960 0000 0260 0001 0335 0149 0540 0401 0421
```

## {PW} 49 94/95 xx Logic output pulse duration

### **These timers were introduced in version 2.04f.**

Timer 94 now sets the logic pulse ON duration, and timer 95 sets the logic pulse OFF duration. Timer units are in 10ms increments with the minimum value of 10ms and the maximum of 2540ms.

The pulsed output duration may vary up to +/-10ms.

**NOTE: If new firmware is installed in a controller that previously contained an older 2.04 variant AND the controller is not cold initialized, the timer values will default to zero, meaning the pulsed outputs will not work. In order to retain backward compatibility either manually set both of the timer values to '50' (500ms), OR cold initialize the controller.**

Examples:

```
{PW} 49 94 50 ;set logic output pulsed on delay to 500ms
{PW} 49 95 10 ;set logic output pulsed off delay to 100ms
```

{PW} 76 ff yyyy (zzzz) IF-THEN-ELSE

'ff' is the feature to be tested

'yyyy' is the macro to be executed if the feature tests non-zero / true.

'zzzz' is the optional macro to be executed if the feature tests zero / false.

Function 'ff'	Item Tested	Function 'ff'	Item Tested
00	7KDAB installed	33	Rx1 Anti-Kerchunk Timer
01	User Input 1	34	Rx1 Anti-Kerchunk Rearm Timer
02	User Input 2	35	Rx1 Timeout Penalty Timer
03	User Input 3	36	Rx1 Activity Timer
04	User Input 4	37	Tx2 ID Timer
05	User Input 5	38	Tx2 Unkey Delay Timer
06	User Input 6	39	Rx2 Activity Timer
07	User Output 1	40	Rx3 Activity Timer
08	User Output 2	41	Autopatch Redial Timer
09	User Output 3	42	Autopatch Timeout Message Timer
10	User Output 4	43	Autopatch Call Duration Timer
11	User Output 5	44	Landline Control Timer
12	User Output 6	45	Landline Ringout Message Timer
13	User Output 7	46	Landline Timeout Warning Timer
14	Rx1 COR	47	Landline inter-ring timer
15	Rx1 CTCSS	48	User Timer 1
16	Rx2 COR	49	User Timer 2
17	Rx2 CTCSS	50	User Timer 3
18	Rx3 COR	51	User Timer 4
19	Rx3 CTCSS	52	User Timer 5
20	PTT 1	53	User Timer 6
21	PTT 2	54	User Timer 7
22	Land Line Busy Input	55	User Timer 8
23	Land Line Ring Input	56	User Timer 9
24	Land Line Busy Output	57	User Timer 10
25	Tx1 ID Timer	58	User Switch 1 (cmd 63 92 x)
26	Tx1 Post Activity Timer	59	User Switch 2 (cmd 63 93 x)
27	Tx1 Drop Out Timer	60	User Switch 3 (cmd 63 94 x)
28	Tx1 Courtesy Timer	61	User Switch 4 (cmd 63 95 x)
29	Tx1 Unkey Delay Timer	62	User Switch 5 (cmd 63 96 x)
30	Rx1->Tx1 Timeout Timer	63	User Switch 6 (cmd 63 97 x)
31	Rx2->Tx1 Timeout Timer	64	User Switch 7 (cmd 63 98 x)
32	Rx3->Tx1 Timeout Timer		

Example:

```
{PW} 76 03 2001 2000 ;test user input 3, if input is active then execute macro 2001,
;otherwise execute macro 2000.
```

## ***New Switches***

{PW} 63 16 x                      Daylight Savings time correction

This switch defaults to 'off'.

If switch is turned on, one hour will be added to the Real Time Clock at 2:00am on the first Sunday in April, and one hour will be subtracted at 2:00am on the last Sunday in October.

{PW} 63 19 x                      Ignore Landline Busy Input

This switch defaults to 'off'.

If switch is turned on, the landline busy input will be ignored by the interconnect routines and becomes available for the user to utilize as a generic user input with the commands that are otherwise already available.

{PW} 63 33 x                      Enable "OK" Command Responses

{PW} 63 34 x                      Enable "?ERR" Command Responses

These two switches default to 'on'.

Note: Switch 02 still acts as a master enable/disable function for command responses.

{PW} 63 35 x                      Courtesy message can be queued during message playback

This switch defaults to 'off'.

Turning this switch on will, for example, allow a courtesy message to play after the initial ID.

{PW} 63 36 x                      Suppress command responses within macro execution

This switch defaults to 'off'.

Turning this switch on will, inhibit simple (i.e. "OK", and "ERR?") command responses when commands are executed from within a macro.

***This switch command was introduced in 2.04e.***

{PW} 63 92 x	User Soft Switch 1
{PW} 63 93 x	User Soft Switch 2
{PW} 63 94 x	User Soft Switch 3
{PW} 63 95 x	User Soft Switch 4
{PW} 63 96 x	User Soft Switch 5
{PW} 63 97 x	User Soft Switch 6
{PW} 63 98 x	User Soft Switch 7

All user switches default off and survive power failure. The user can test switch conditions with new user command 76.

## Changed Commands

{PW} 02 f ...

### CTCSS Encoder

Function code 'f'	Description
0	CTCSS Encoder OFF
1	CTCSS Encoder ON continuously when transmitter is active
2	Tx1 coupled OFF delay. Turns on when Transmitter goes active, and turns off when delay timer expires.
3	Receiver for Tx1 coupled OFF delay. Turns on when any receiver with a path to Tx1 goes active, and turns off when delay timer expires.
4	Receiver for Tx1 coupled loss OFF delay. Turns on when any receiver with a path to Tx1 is active, and upon signal loss starts delay timer. When delay timer expires, encoder is turned off.
7	Zero's the dynamic timer value, forcing the encoder to immediately turn off.
8 'xxx'	Set's the default timer value to 'xx.x" seconds. Valid range is 0 to 12.7 seconds.
9 'x'	Associates user output 'x' with the CTCSS encode function. 0 disables feature, 1-6 associate a User output with this feature.

#### Examples:

Encode during user transmissions and hold the encoder active for an additional 200ms after receiver squelch closes to allow for mobile flutter. Use this example for making your repeater more compatible with an on air linking method, such as IRLP, that relies on the CTCSS encoder following user activity.

```
{PW} 02 8 2 ;set timer value to 200ms  
{PW} 02 9 3 ;(optional) associate user output 3 with CTCSS encode function  
{PW} 02 4 ;set mode 4 to cause CTCSS to be encoded during all user transmissions
```

Function '7' could be used to disable the CTCSS encoder after a courtesy message is sent.

```
{PW} 02 8 127 ;set timer to maximum value  
{PW} 02 4 ;select mode 4  
{PW} 20 1234 {PW} 02 7 ;create macro 1234 with cmd 02 function 7  
{PW} 31 10 9910 74 09 9999 1234 ;60ms, 440Hz beep followed by macro 1234
```

## {PW} 40 r xxx                    Set Transmit Timeout Timers

The new 'r', receiver, parameter allows the user to independently set different transmit timeout timer values based on the active receiver(s). Valid values are 1, 2, or 3.

The valid range for 'xxx' remains the same. A value of '0' (zero) disables the timeout timer for a given receiver.

The timeout logic was changed such that each receiver now has its own timeout timer. Once ANY timer is started, it is not reset until the courtesy message event occurs.

Command 10 will reset ALL timeout timers simultaneously.

## {PW} 89 ...                    Select DTMF Priority/Scan

This command was changed to cause the DTMF decoder immediately re-prioritize the DTMF inputs rather than waiting for a high priority device to release it.

## {PW} 50 0/1 99                Review Initial and Normal Tail ID's

This command now only sends the tail ID message rather than causing the full ID to be sent. The change was necessary due to some code restructuring related to how these messages are stored internally.

## {PW} 96 t xx                 Set DTMF Mute Delay

The DTMF muting logic has been changed to utilize two separate mute delay timers. One timer applies only to the first DTMF digit, the other timer applies to all subsequent digits. Setting the mute time for the first digit relatively short or to zero, and the mute timer for all subsequent digits substantially longer will provide better performance in situations where decoder falsing has been a problem.

When a "\*" or "#" command terminator is received, the 1<sup>st</sup> digit delay timer value will be loaded into the mute timer, thus un-muting the audio more quickly upon command completion.

A 't' (timer) value of zero (0) allows the first digit delay timer to be set, and a value of one (1) allows the delay timer for all subsequent digits to be set.

The timer value 'xx' is set in 100ms units and can range from zero to 2.5 seconds.

On a cold reset, both timers default to 500ms.

Example:

```
{PW} 96 0 3     ;set 1st digit delay timer to 300ms  
{PW} 96 1 25   ;set subsequent digit delay timer to 2.5 seconds
```

## {PW} 63 xx 0/1/2/3            Set User Switch

In version 2.04e, if the switch values of '2' or '3' are used, they will turn the corresponding switch 'off' or 'on' but will not send any command response. This addition was made for those who wish to eliminate command responses from within macros, but who do not wish to use the new functionality in user switch 36 to suppress all command responses from within a macro.

## ***New Message Types***

Four new message types were added to support interruptible speech and Morse messages.

9901 - CW Primary  
9902 - CW Secondary  
9911 - Beep Primary  
9912 - Beep Secondary  
9961 - Speech Primary  
9962 - Speech Secondary

Primary messages will cease playback if a receiver with its path enabled to a transmitter associated with the message playback is active at the time the playback commences, or any time during message playback.

Secondary messages will only play in circumstances when a primary message would not.

Examples:

This message would speak "KA9FUR Repeater" but if a receiver went active would revert to "KA9FUR" in CW.

```
{PW} 15 9981 9961 0260 0001 0335 0149 0540 0401 0421 9902 59 0852 67 20 10 09 15 30 27
```

The following set's the courtesy tone as mixed on Tx1 as a secondary beep message such that any activity on the repeater will cause the courtesy message to be discarded. When the new switch "35" is enabled, courtesy messages will be queued when the repeater is initially activated and an ID is sent. If the resulting courtesy message is not sent as a "primary" message, then the courtesy message would be sent immediately after the initial ID even if there was user activity present.

```
{PW} 31 10 9981 9911 76 55 57 0459 12 57 0512 04 ;set courtesy message
```

## ***Operational Changes***

Added area codes 877 and 866 to the toll free table.

Command 30 and 80 will now accept 1 or 2 digit timer values.

Command 32, transmitter drop out delay, will now accept 1, 2, or 3 digit timer values of up to 12.7 seconds.

Commands 40, 65, and 79 will now accept a single zero rather than requiring 3 zeros.

A new courtesy message will not be placed in the global message queue if there is still a courtesy message pending in the queue. Note that this change only applies to the courtesy message ({PW} 31 10...) and that the courtesy event macro will still be triggered without regard as to whether the courtesy message has been sent or not.

The speech board timeout timer is now 10 seconds rather than the 25 seconds in previous versions (even though it was documented as being 5 seconds it was really 25 seconds).

The number of permissible macros has been increased to 340.

Fixed CW messages were modified to include the special initial delay character '54' at the beginning of the message such that an initial delay is present.

## **Bug Fixes and Changes**

### **Version 2.04**

Special Messages 9860 through 9895 will no longer cause the controller to crash.

Fixed a problem that could cause the hardware watchdog to trip during cold initialization.

**Note: When upgrading from one version 2.04 variant to another, there is no need to cold initialize the controller.**

### **Version 2.04a**

This version fixes the macro corruption problem in commands 00, 02, 40, 50, 76, and 96.

A potential problem related to the courtesy beep was addressed. There was a potential that could require the controller to be cold initialized in order for the controller to once again generate a courtesy beep message.

An initial delay character, 54, was added to command 33's message playback to allow more time for the control user to hear the entire command response.

### **Version 2.04b**

This version fixes a problem with command 76. Some of the IF tests were incorrectly testing some byte wide variables as words and vice versa. Due to the nature of the bug, there is no way to tell, at any given movement, which tests would be made incorrectly.

Command 76 was also changed to queue any resulting macro at the head of the work queue rather than at the end of the queue. This allows the immediate execution of the macro, which in turn also allows the nesting and stacking of IF tests.

Command 65 was broken in the transition from 2.03b to 2.04 and was not setting the timer to the user supplied value. The command now works correctly.

### **Version 2.04c**

This version fixes additional problems with command 76. The tests of hardware inputs did not work correctly and always returned TRUE.

As a result of the changes in 2.04c, when this version is run for the first time, all appropriate input transition events will execute once on power up. This is due to the way that the last known input state is stored in non-volatile memory.

### **Version 2.04d**

This version fixes an old bug in the Remote Base software that was exposed as a result of unrelated changes made in 2.04 to the way that the interrupt time slicing works. Specifically when entering a command such as RBPW 41 147000 2 the controller would incorrectly return ?ERR 2 rather than allowing the command to execute.

### **Version 2.04e**

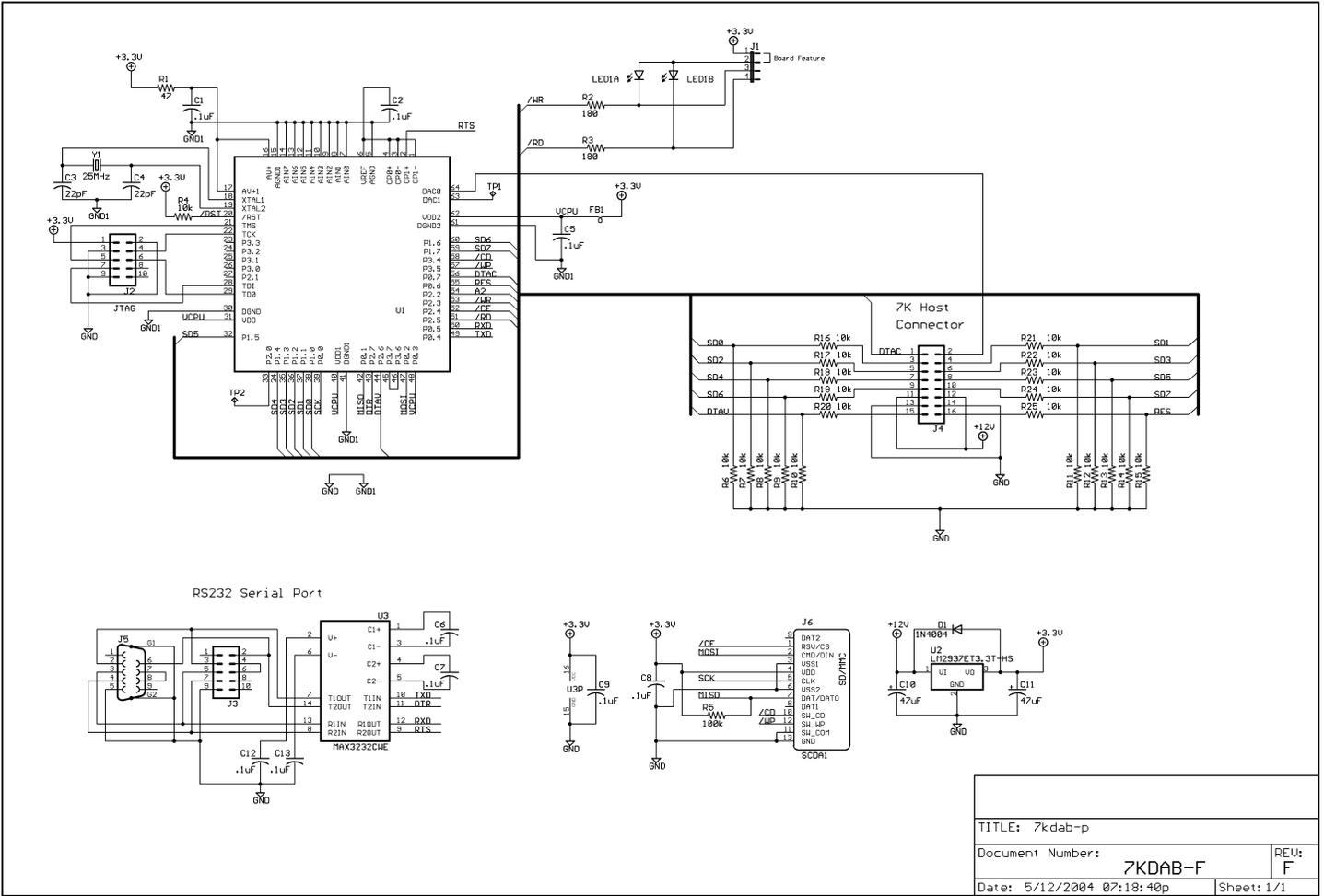
This version added additional functionality to command 63 to suppress command responses from within macros, as well as new user switch 36, which modifies the behavior of command responses as a result of command execution from within a macro.

## **Version 2.04f**

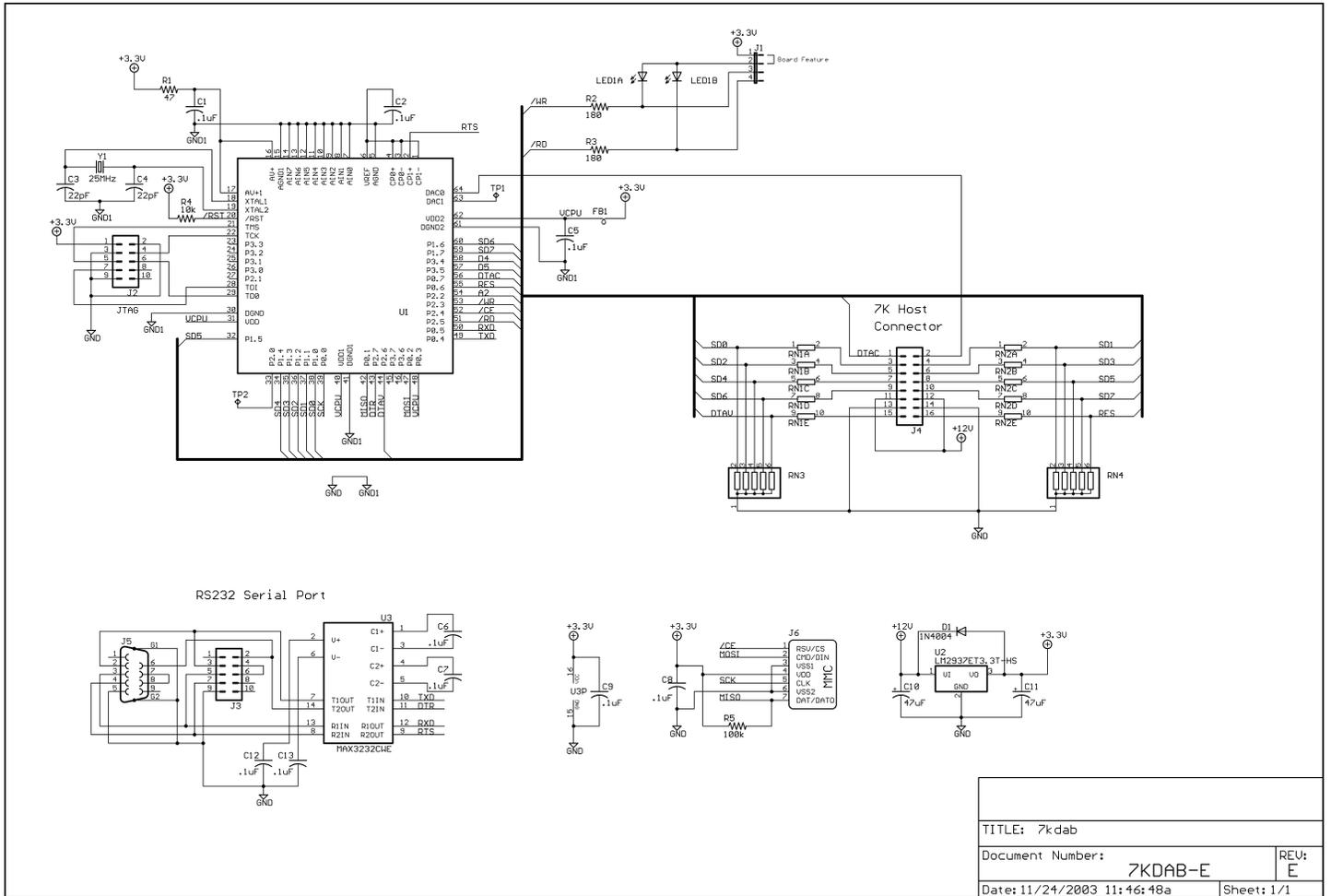
- Fixed a problem introduced in version 2.04a related to being able to queue multiple courtesy beep messages while a message playback was already in progress.
- Added separate time-out timer reset delay timers to prevent a situation where a short transmission on one receiver could prematurely cause a time-out of a receiver with a longer time-out time set. An example of this would be if the time-out timer for Rx1 was set to 30 minutes, and Rx2 was set to 3 minutes, if a long transmission was in progress on Rx1 and a brief transmission occurred on Rx2, the repeater would time out based on the shorter 3 minute time even though Rx2 had gone inactive. The new method will allow the individual time-out timers to be reset after the courtesy delay period has elapsed even though a courtesy message was not necessarily generated... in other words, the courtesy reset time is still imposed on individual receivers even though a different receiver still remains active.
- Added programmable logic output pulse on/off duration periods.
- Added new feature such that if the internal INIT button is held for 5 seconds AFTER power up has occurred, the Master Password will be reset to default (99) and the Warm Reset message will be sent as an acknowledgement. Useful for regaining control if the password(s) are lost, forgotten or mistakenly changed.
- The software version runtime variables for CW (9898) and Speech (9899) now include the version suffix as part of the message.

# Appendix F Schematics

Revision F



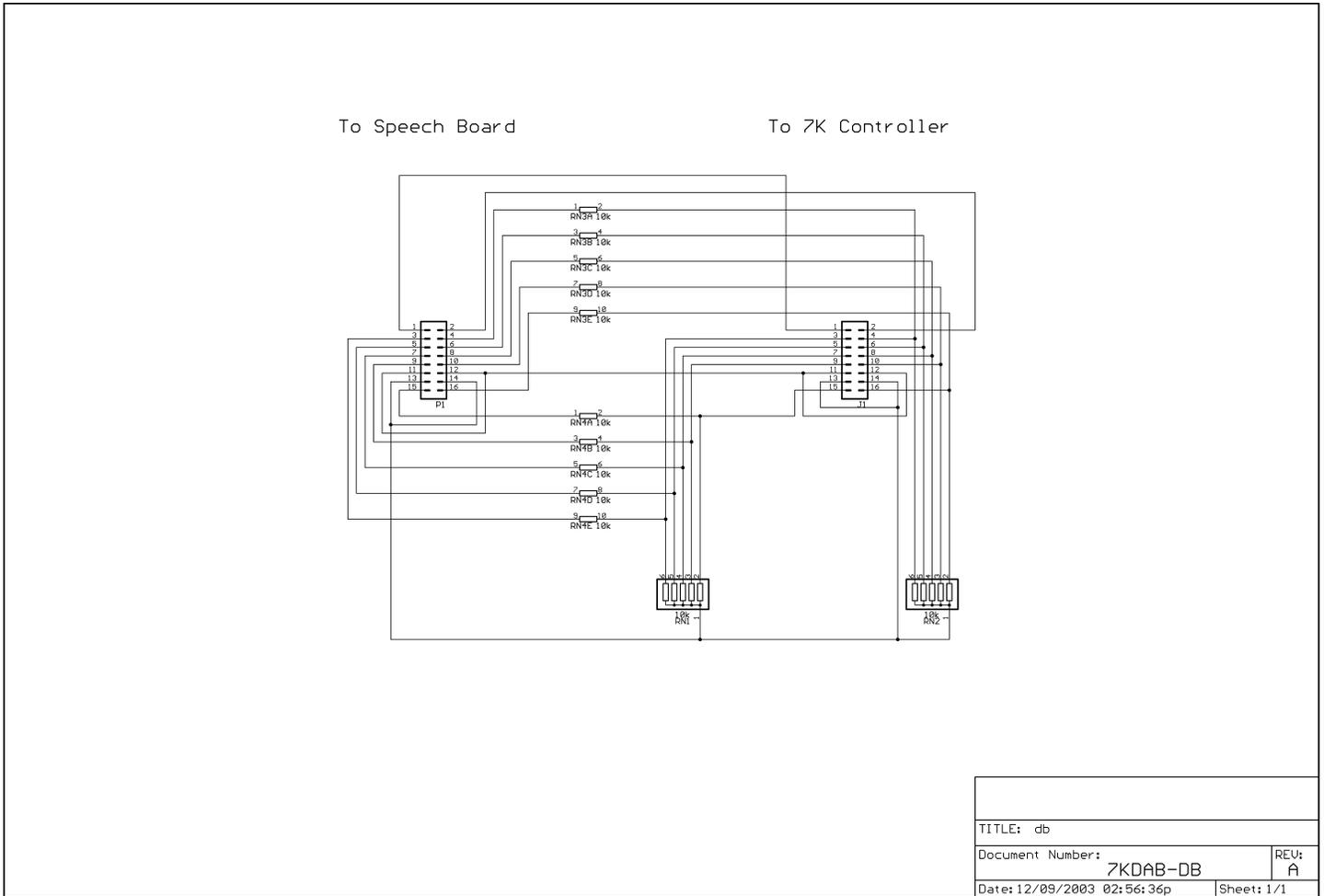
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Document Number:	7KDAB-F
Date: 5/12/2004 07:18:40p	Sheet: 1/1



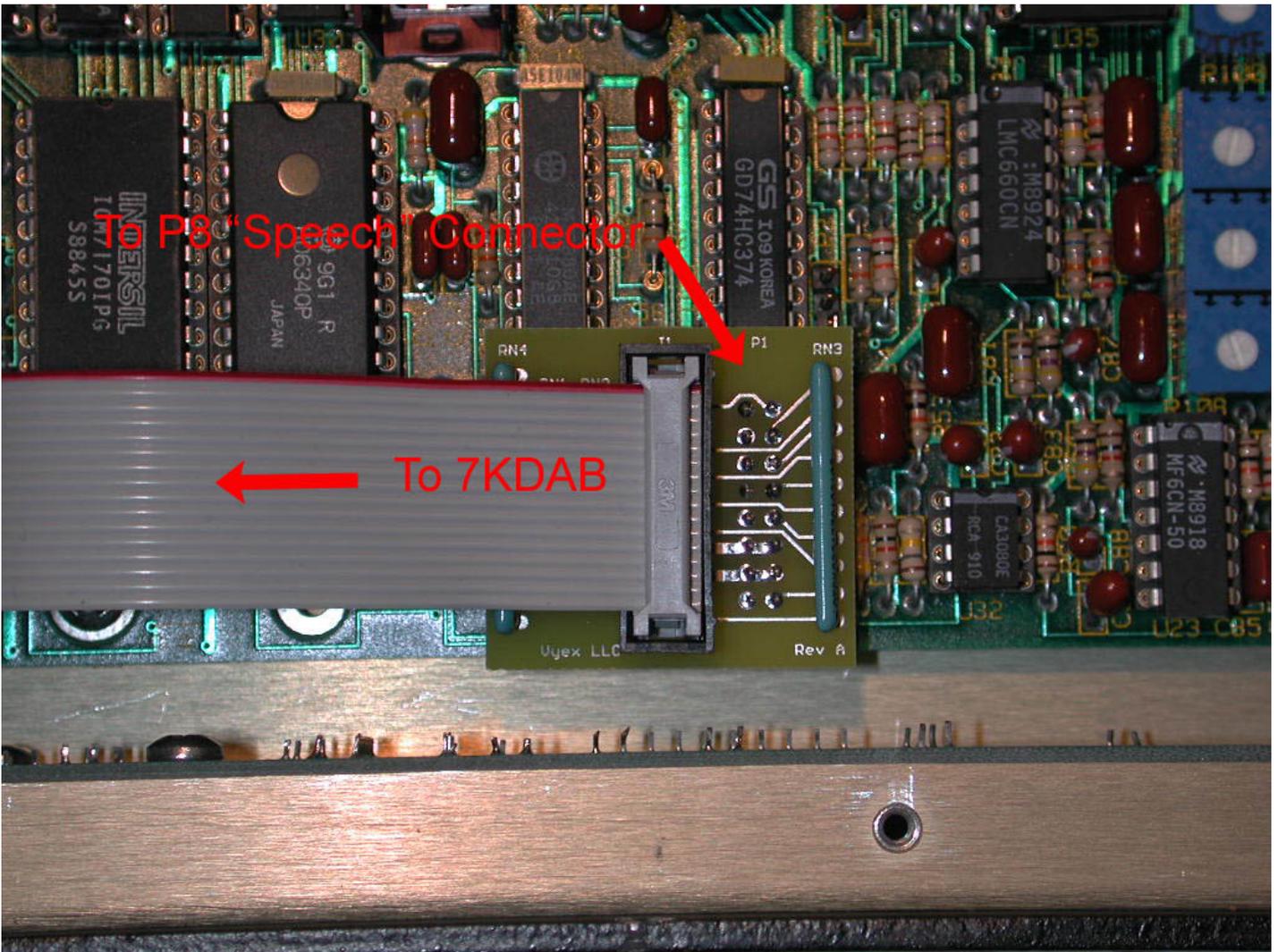
TITLE: 7kdab	
Document Number:	7KDAB-E
Date: 11/24/2003 11:46:48a	REV: E
	Sheet: 1/1



Daughter board used with Digital Audio Boards prior to revision "E", to correct speech bus voltage overshoot problem.



## Appendix G – Daughter PCB Installation



The daughter board must be used in conjunction with 7KDAB revisions A through D1.

The board is properly installed when the writing on the printed circuit board is correctly oriented when viewed from the front of the controller.

When installing the daughter board, take care to properly align the female header connector with the Speech connector on the 7K main printed circuit board. **Extreme damage can occur if any of the ribbon connectors are misaligned or if the daughter board is plugged in 180 degree's from its proper orientation.**