

mp

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MUSICA 2

Moderato mosso

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sf

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a tempo

Moderato VII

p

VII

p

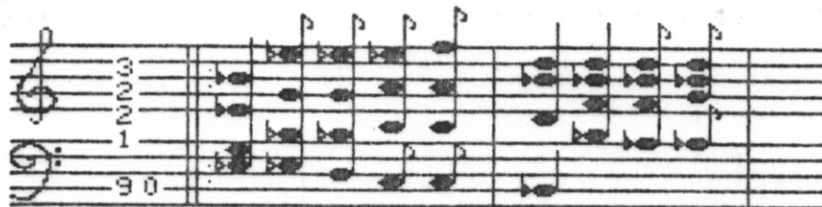
Broadly

p

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MUSICA II

A Versatile Software Music Synthesizer
For the Radio Shack 32K Color Computer



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INTRODUCTION -----1

Congratulations on your purchase of MUSICA II! You have joined the ranks of the hundreds of other Color Computer owners who have discovered that MUSICA is the best music program you can buy for your color computer!

This program requires a Radio Shack Color Computer with 32K memory and either a disk drive or a cassette recorder (Extended Basic required). This program is compatible with all disk ROM versions.

Some of the features of MUSICA II include:

Entry of music is almost as easy as writing it on paper since all notes are displayed on standard musical treble and bass staves. The pitches of each note are selected by moving a cursor up and down with the arrow keys or a joystick. No more fussing with complicated music codes!

Editing of entered music is a snap with simple to use insert, delete, and block move commands.

Music can be played at any time during the entry process; there is no wait for compilation.

Up to four voices (chords in four-part harmony) can be entered.

Each voice can have its own timbre (such as the sound of a violin, flute, or oboe); up to four timbre definitions can be specified and the assignment to each voice can be varied during the composition.

The user may synthesize an almost unlimited number of timbre definitions using a super-fast waveform synthesis option.

The tempo of the music can be varied during the composition.

Sections of music can be repeated with the use of a standard repeat bar.

Music can be saved to disk or tape using standard format files.

Music can easily be played from a BASIC program; complete documentation for the interfacing machine language program is provided.

The program is 100% machine language (except for a short BASIC I/O interface), making all operations almost instantaneous.

Sound output can be through either the TV or the "STEREO PACK".

Sound quality has been optimized to make the most of the Color Computer's capabilities.

Over 1,700 chords can be entered.

Special effects include chorus or vibrato, 3-position stereo, and exchanging stereo channels during music.

Sound quality may be greatly improved with the "fast play" option which runs the CPU at twice the normal speed.

A special help command makes it easy to learn how to use MUSICA II

A complete musical score can be dumped to a printer; instructions for interfacing your printer are included.

The disk and cassette versions are identical; no need to buy an expensive upgrade program if you add a disk drive to your system.

A NOTE TO OWNERS OF PREVIOUS VERSIONS OF MUSICA: You will find this new version of MUSICA has many more features than the old versions! Compatibility between the old and new versions has been preserved. Music written with all versions may be played on MUSICA II and music written with MUSICA II may be played on older versions of MUSICA. The only difference is that the repeat bars supported by MUSICA II will be ignored by previous versions of MUSICA. THERE IS ONE IMPORTANT DIFFERENCE, HOWEVER. The tape files of MUSICA II are located in the same place in memory as disk files. This means that you must use the "CONVERT" program supplied with MUSICA II to convert old tape files to either a new tape file or disk file. If you are converting old tape to disk files, the program will auto-load all the tape files on a tape and save them to disk without you having to do anything

other than get it started.

DISK/TAPE CONTENTS -----2

MUSICA/BIN	
JOPLIN/MUS	"The Entertainer" by Joplin
*BEERBARL/MUS	"Beer Barrel Polka"
GMINSYM/MUS	Symphony #40 by W. Mozart
PRIERE/MUS	"Priere" from Suite Gothique by L. Boellman
ARIOSO/MUS	"Arioso" by Bach
NACHTMUS/MUS	"Eine Kleine Nachtmusik" by W. Mozart
*CHIKENRL/MUS	"Chicken Reel"
VIVALDI/MUS	1st Movement, the Concerto Grosso #11 Vivaldi
PLAY/BIN	The BASIC interfacing program
PLAYSTER/BIN	Same as PLAY/BIN; for the STEREO PACK
BASS DBL/CMD	Used with the "A" command (Disk only)
CLRVOICE/CMD	Used with the "A" command (Disk only)
CONVERT/BAS	Converts tape music files from earlier MUSICA to MUSICA II files (see introduction)

*The two files marked with an asterisk are from ORCHESTRA 100 and ORCHESTRA 200, available from Speech Systems. They are large collections of music that can be played with MUSICA II.

START-UP -----3

After turning the computer and disk drive or tape recorder on, load the program by typing (C)LOADM "MUSICA":EXEC:RUN and then press the ENTER key. After a short pause, the TV screen will display treble and bass staves with a copyright notice. Press any key; the notice will erase and the memory and voice indicators will appear. You are now ready to start composing!

Once you get the hang of how MUSICA II works, you will find it rather easy to use. Most of the commands operate just as you would expect, almost like writing music on paper.

LOADING MUSIC -----4

Let's hear some music! After loading the program as described above, press the "L" key and then either "T" or

"D" depending on whether you want to load from tape or disk. If you load from disk, a directory of the music files on the disk will be displayed. Enter the name of the music you want to load (pressing ENTER without a name loads the next file in a cassette load). As soon as the composition has loaded, the screen will display the first 12 chords. Press the "P" key to play.

Should you goof in entering the name of the music file, the program will halt and Basic will give you an error message. Merely enter "RUN" and try again.

GETTING STARTED -----5

Almost all of MUSICA II's commands utilize a single key. MUSICA II has a "help" feature that will save you trips back to this manual. Press "?" and then the key you want to get help on. If you wish, you can get started experimenting right away! Just use the help key to discover the many commands that MUSICA II has.

ENTERING MUSIC -----6

Whenever you see a little flashing black box on the music score, you are in the "command mode". This means you can enter or edit music. This flashing black box is called a cursor. It marks the exact spot in a composition where a command will take place.

In the middle of the screen is a line that reads "1705=MEMORY 1=VOICE". MEMORY tells you how much room there is left for more music. VOICE is a reminder of which of the four possible voices you are entering music into.

To enter a note, select the correct pitch by moving the cursor up and down with the arrow keys and then press ENTER. Since MUSICA II can play up to four notes at once, you must specify which part (or voice) you want a note to be in. This can be selected by pressing "V" and then "1", "2", "3", or "4".

Sharps and flats may be entered by pressing either "S" or "F" before pressing ENTER.

In addition to entering notes pitches by the up/down arrow, "S", and "F" keys, the right joystick can be used. First press the "J" key and try moving the joystick up and down.

The cursor should move accordingly. When you have the cursor positioned correctly, press the "FIRE" button to enter a note. Sharps and flats are written by moving the joystick to the right for sharps and left for flats before pressing "FIRE". To turn the joystick off, press the "J" key again. While the joystick is on, you will notice that the cursor flashes more rapidly than usual, and is gray instead of solid black.

EDITING MUSIC -----7

If you press "ENTER" immediately after entering a new note, you will find that the note is erased. Individual notes can be changed this way. Of course, only the note in the voice part indicated by the "VOICE" marker will be affected. The cursor does not need to be positioned on the desired note; just line it up vertically (directly under or above) and press "ENTER". The desired note will disappear and the cursor will be positioned where the note was.

In addition to changing individual notes, MUSICA II can add or delete chords. This requires the use of the "I" or "D" keys. Pressing the "I" key will copy the chord at the position of the cursor whereas the "D" key will delete the chord.

CHANGING NOTE LENGTHS -----8

Position the cursor directly on, under, or above the chord you want to change (the vertical position is not important) and press 1 to get a whole note, 2 for a half note, 3 for a triplet, 4 for a quarter note, 5 for an eighth triplet note, 6 for a sixteenth note, 7 for a thirty-second note, 8 for an eighth note, and 9 for a sixty-fourth note. Note that all four notes in a chord are affected. It is not possible to write a chord with notes of different lengths.

MUSICA II plays consecutive notes without a break between notes. This is important because it enables you to enter a note of any length. For example, to enter a dotted eighth note, enter an eighth note and then a sixteenth note of the same pitch. While you see two notes on the screen, when they are played you will hear only one, a dotted eighth note. If you want repeated notes to have breaks between them, you will have to insert rests between each note. A good rule of thumb is to half the note length, and make the rest the same value. For example, repeated quarter notes should be written

as eighth notes with eighth rests between.

When entering polyphonic music (music in which all the voices move independently of each other), remember that MUSICA II understands only chords. If the first voice is moving in eighth notes but the fourth voice is only half notes, the fourth voice must be changed so that it is a string of 4 eighth notes for each half note.

MUSICA II does not always display all the flags of notes in a chord when several voices are close together. This feature greatly improves the legibility of the score without sacrificing accuracy.

RESTS -----9

Rests are displayed as a blank space with a number over the middle C position indicating the value of the rest. This number has the same meaning as the numbers 1, 2, 3, 4, 5, 6, 7, 8, and 9 described above for note values.

To enter a rest, press "R". A rest will be entered at the cursor position.

MOVING THE CURSOR QUICKLY -----10

Once you have entered a fair amount of music, there are some cursor commands that will save you time pressing the arrow keys. "B" will reset the cursor to the start of the music whereas "E" will position it at the end. Pressing "SHIFT" and either the right or left arrow keys will move you forward or backward 12 notes. "SHIFT" and either the up or down arrow keys will move the cursor up or down an octave.

Another useful key is the "T" key which allows you to find the next tempo and tone table change marker (see section 17).

Any time you press a key during the playing of a composition, the music will immediately stop and you will be able to edit the composition. Normally the screen will return to the position in the music before you pressed "P"; the exception is if you press the key "U" which will cause the screen to update to the point at which you stopped the music.

Long compositions may be edited by the use of the "U" key.

Position the cursor to the start of the composition with "B" and play it with "P". As soon as you hear an error, stop the playing with "U". The screen will update by displaying the music starting with the note you interrupted. If you overshoot the part you want to change, use the arrow keys to move backward. Pressing "P" now will start playing the music where the cursor is positioned. Use this feature to see whether you made the right change.

HANDLING MORE THAN ONE VOICE -----11

MUSICA II can handle up to 4 separate parts of music. Each part is called a "voice" and is numbered 1 through 4. Each voice must be entered separately. Once you specify which voice you want to work with by the "V" key, the program will enter all notes into that voice until you specify another voice. You can easily tell which voice you are in by looking at the right hand side of the screen. Just after loading the program, you will see "1=VOICE". This means that all notes will be entered into the first voice. You can change the voice by pressing "V" and then 1, 2, 3, or 4.

SAVING MUSIC -----12

To save a composition, press the "K" (keep) key and then "T" or "D" for tape or disk. Enter the composition name and press "ENTER".

HIGHLIGHTING VOICES -----13

When you have entered a large amount of music in four parts, it can be very difficult to figure out what notes are in voice 1 (soprano) or which are in voice 3 (tenor). This problem may be remedied with the "H" key. All voices except for the one selected are displayed in half-tone, making it very easy to follow a particular voice through your composition. Note that the highlighting effect takes effect on all notes following the current cursor position, and that it has no effect on the actual music code stored in memory.

ENTERING BARLINES -----14

Entering barlines will greatly improve the legibility of

your music when you are in the process of editing it. Simply position the cursor at the spot you want a barline and press the "M" (measure) key. As you would expect, barlines have no effect on the music, but they do use up memory.

MARKING REPEATS -----15

The "N" key can be used to mark sections of music that you wish to repeat when played. The beginning and end of each section to be repeated must be marked with this key. When you press the "N" key, a standard repeat bar will appear on the screen. MUSICA II keeps track of the start and end of repeat sections by changing the positions of the two pairs of dots.

When the music is played, the first repeat bar is ignored until the second one is encountered. The program goes back to the previous repeat bar and continues playing.

MUSICA II will not perform correctly if you start playing music in the middle of a repeat section. For best results, start playing music with the cursor positioned just before the start of a repeat section or at the very beginning of the music.

CHANGING TIMBRE AND VOLUME -----16

Each voice may be assigned a particular timbre, or distinctive sound such as a flute, violin, or oboe. In MUSICA II, the timbre of each voice is controlled by a list of numbers called a "tone table". There are four tone tables, numbered 1 through 4. You can generate new timbres for each tone table if you wish.

All voices are assigned to tone 1 initially. You can change this assignment by pressing the "C" key. More on this in the next section.

When you press the G key, two rows of numbers will appear. The first number in each group of 12 numbers identifies the table (1-4). Next is another number followed by a colon. This is the volume. After the colon are 8 numbers. These numbers control the timbre of the table and are called the harmonics.

You may change the volume or harmonics of any of the 4 tone tables by moving the cursor around with the arrow keys. When

you are finished, press "ENTER".

MUSICA II keeps track of the numbers you enter for each tone table while you use the program, and stores them with the music code on tape or disk. This way you can easily adjust volume or timbre based on your previous entries.

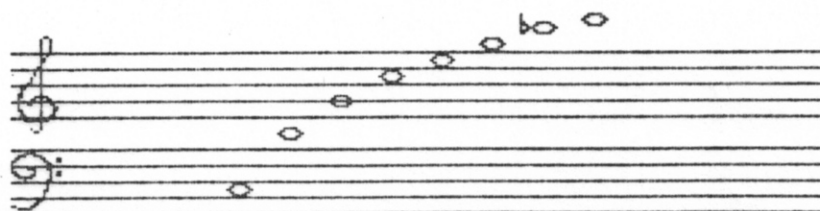
The best way to use this program is to do a lot of experimentation. Here are some suggested numbers to use:

1 9:90000000	Pure flute sound ("sine" wave)
1 9:99090000	Bright flutey sound
1 9:90900000	Imitation clarinet sound
1 9:98765432	Buzzy, reedy sound
1 9:90090009	Sparkling flutey sound
1 9:97250000	A good "basic" sound

You may be wondering, "what are harmonics?" Harmonics are the rudiments of any musical sound that give it character. It is the harmonic content of the sound of a flute that distinguishes it from the sound of an oboe. When an instrument sounds a note (such as "440 A", for example), the pitch that is heard is called the first harmonic. Depending on the instrument, a whole series of additional pitches (generally less prominent) will also sound. It is these additional pitches which give the sound its distinctive character; they are called the Harmonics.

Harmonics are related to each other in a fixed manner. The second harmonic is one octave above the first harmonic, the third is a fifteenth above, the fourth is two octaves, etc.

Here is an example of the first 7 harmonics of the C below middle C (128 cps):



Tones may be created to simulate a solo voice with accompaniment. By changing the value of the number just before the colon in the tone table descriptor, you can vary the volume of the table. Adjust the volume of a tone table if you find the accompaniment drowns out the solo.

There are a few things that may help you in generating

useful new sounds with MUSICA II. First of all, the program is limited by the Color Computer's clock speed of less than 1 megahertz. This means that rather important elements of sound such as attack and decay have to be totally ignored. For example, an even tone such as the sound of an organ or flute can be approximated whereas the sound of a guitar, piano, or xylophone is not possible.

Here are some tips that will help maximize the variety of sounds that MUSICA II can produce. Program the following examples on only one voice at first. To begin with, try these settings:

```
1 9:90000000
1 9:99000000
1 9:99090000
1 9:99090009
```

All of these sounds are pretty "straight", and have little character to distinguish them except that they sound progressively brighter. The harmonics utilized are the "octave" harmonics (1, 2, 4, and 8).

Now try these settings:

```
1 9:90900000
1,9:90900900
```

Notice how these are quite different from the first. In addition to the first harmonic, the "fifth" harmonics are used (3 and 6). These harmonics are good for creating solo voices. Of course, you can use numbers other than 9 to get a lot of variety.

The octave and fifth harmonics can be mixed with very good results, to spruce up a straight sound or tone down a solo voice. Examples:

```
1 9:99590000 compared to: 9:99090000
1 9:99930000 compared to: 9:90900000
```

(The first one is a spruced up straight sound, and the second is a toned down solo voice.)

The other harmonics (5 and 7) are quite pungent and need to be used with care, usually with smaller numbers. This is particularly true of the 7th one. But give these combinations a try:

```
1 9:90905000
1 9:90000420
```

The amplitude of the first harmonic determines the "fatness" of the resulting sound. Try these to see what is meant:

```
1 9:90930000 compared to: 1 9:40930000
1 9:99450000 compared to: 1 9:39450000
```

The second ones sound rather thin compared to the first, don't they?

If you are entering music that is mostly melody with an accompaniment, pick out the melody voice and set up a nice solo tone for it. The remaining voices probably would do best with something quiet, such as:

- 1 9:9093100 for the solo voice
- 2 6:9410000 for the accompaniment (volume decreased to 6).

Occasionally you may hear some crackling distortion when playing four-part music with all the tone tables set at maximum volume. Fortunately this problem is easily corrected. Just decrease the volume of one or more tone tables.

If you use MUSIC II with music generated with one of the earlier versions, there will be no set of tone table numbers with the music code. MUSICA II will assign a "default" set of numbers. This will be a problem only if you try to change a tone table. If you do, the other 3 tone tables will be changed to the default values.

CHANGING TEMPO AND TONE TABLE ASSIGNMENTS -----17

This command allows you to take full advantage of the many different sounds that can be synthesized with the "G" key. As previously mentioned, all 4 voices are assigned to tone table 1 initially. The "C" command allows you to change this assignment and also to change the tempo.

After pressing "C", the screen will tell you what the last assignment was (4 numbers, corresponding to voices 1 through 4) and ask you to enter a new assignment. As soon as you have entered your assignments (pressing "ENTER" makes no change), they will be displayed vertically on the treble score. Next you will be asked to enter the tempo (the speed at which the music is played). You will be prompted to enter a number from 01 to 99 (you must enter 2 numbers). By pressing "ENTER", no change will be made.

If you enter "1243" for the voice assignments, voice 1 will have the timbre of tone table #1, voice 2 of #2, voice 3 of #4, and voice 4 of #3.

Tone and tempo assignments may be made anywhere in the music as many times as you wish. Use this feature to give tonal variety to your composition, and to produce changes in speed (accelerandos and ritardandos).

USING THE STEREO PACK -----18

The STEREO PACK, produced by SPEECH SYSTEMS, is a metal black box about the size of a disk controller that plugs into the side of the Color Computer. Besides providing two phono plugs to connect to two speakers or your stereo system, the STEREO PACK greatly improves the sound quality of MUSICA II.

If you have the STEREO PACK, connect it according to the instructions that come with it. If you want to use it with a disk drive, you will need a Y-connector or an expansion interface such as the Multi-Pak Interface. Load MUSICA II and whatever music you want to play. Before pressing "P", press the "@" key. An "S" will appear in the middle of the bottom of the screen. Press "@" again, and the "S" will disappear. When the "S" is on, all music is channeled to the STEREO PACK.

With the STEREO PACK, music is split into two channels; voices 1 and 3 are sent to one and 2 and 4 are sent to the other. This makes 2 and 3 position stereo possible as described in the special effects section.

You may be wondering, "why buy the STEREO PACK?" Once you have heard the difference in the quality of sound that MUSICA II makes with the PACK, you will decide that the cost is worth it. The port greatly cuts down on noise (the hissing sound) and distortion (the high pitched out of tune noises).

SPECIAL EFFECTS -----19

Two special effect keys are "X" (exchange) and "Y" (copy). The "X" key is of interest only if you have the STEREO PACK attached. It allows flip-flopping of the stereo channels (voice 1 is exchanged with voice 2, and 3 with 4). This effect starts at the current cursor position and continues to the end of music. Multiple flip-flops may be made through the music, producing an "echo" effect.

The "Y" key can have a number of effects. It will copy the notes of a given voice to a second voice. Be careful when you use it because it will destroy whatever was in the second voice (the voice that was copied to). By pressing "0"

in response to the prompt "DEPTH OF VIBRATO (0=NONE)?", the notes of one voice will be copied exactly to the next. If, however, you press any other number key (1 through 9), a number proportional to the key you pressed will be subtracted from the first voice before it is stored in the second. The second voice now has notes that are slightly flat to the notes in the first. When a note is played with another note that is slightly flat, an undulating "beat" is created. This causes a useful effect when the music is played: vibrato or chorus, depending on the number pressed. Numbers 1 through 3 give a rather pleasing chorus effect, while higher numbers give a progressively faster vibrato. Remember, when you use this command, you reduce the number of available voices by one.

When you use the "Y" command to produce a chorus or vibrato effect, MUSICA II will not be able to recognize the off-pitch notes. At any time the screen has to be completely updated (such as pressing "B"), MUSICA II will display a warning message "UNRECOGNIZED PITCH". This is just a reminder that you have used the "Y" key to create notes that do not have standard pitches. These non-standard notes also are not displayed. They will sound correctly, however, when you use the "P" command.

The other effect that "Y" has is of interest only if you have the STEREO PACK attached. When music is played, voices 1 and 3 are sent to one channel, and 2 and 4 go to the other. If you are writing music in 3 parts, and want to have each part sound separate (rather than having two voices on one channel and the other voice by itself on another channel), a voice may be moved so that it sounds "in the middle". For example, suppose that a composition uses voices 1, 2 and 3, and you wish to have voice 3 sound "in the middle". Use the "Y" command to copy voice 3 to voice 4 with no vibrato. Now when the music is played back, the desired effect will be realized. You will probably find it necessary to assign a separate tone table to the "middle" voice that has a volume half that of the other voices because it otherwise will be too loud.

MOVING MUSIC AROUND -----20

Sections of music may be easily moved using the block move command. First mark the beginning of the section by pressing ".". Now move the cursor forward to one note after the end of the section and press "." again. Now move the cursor to where you want this block moved and press "." then "Y".

HIGH SPEED OPERATION -----21

If your computer is capable of running at twice the usual clock speed, you will be able to realize a significant improvement in the quality of sound from MUSICA II, particularly if you have the STEREO PACK attached.

Before you try this command, be sure you have saved whatever music you have in memory. This is because MUSICA II permanently alters the music code and your computer may lock up while attempting to run in the speeded up mode. In addition, all half and whole notes must be changed to quarter notes (use the insert to copy 4 quarter notes for each whole note, etc.).

Press the "O" key. If you have saved the music, press "Y" in response to the question displayed. If all goes well, music will be produced as with the "P" command. The screen display will be lost until the end of the music. If when the music ends the screen returns to normal with the flashing cursor, all is well!

Resetting to the start with "B" will point out an important change. Probably not all the notes will display. This is because MUSICA II lowers the pitch of each note and doubles the note values to compensate for the increased speed. When the high speed play is over, it restores the pitches and note values to close to their original value. In some cases, "close" is far enough off to be unrecognizable to MUSICA II. As mentioned in the previous section, this may cause the "UNRECOGNIZED PITCH" warning to show. You will find that even though the graphics is of no help, the music may be played again in either the normal or high speed mode.

This problem may be corrected with the "U" key. This is exactly the same as "O" except that after playing the music, MUSICA II restores the music code so that you can go back and edit music if you wish. The only problem with this command is that if the music is lengthy, it can take up to 20 seconds to restore the music code.

PRINTING MUSIC ON A PRINTER -----22

MUSICA II has a command that allows you print music on a dot matrix printer. Because there are many different printers on the market, you may need to install the appropriate graphics codes for your printer before you use it.

MUSICA II comes set up to print music on the GEMINI 10X printer or other EPSON compatible printers (such as the EPSON MX-80 with Graftrax or certain Panasonic printers).

If you do not have one of these printers, you will need to do a little work. To begin with, get your printer manual out and find out what control codes are needed to make your printer print graphics.

A part of MUSICA II has been reserved for the user to place the control codes of his printer. Here is a description of each byte, and what each one is for:

ADDRESS (HEX)	DESCRIPTION
MARGIN 270A	1 byte sets the left-hand margin.
BIT TYPE 270B	1 byte: 0=most significant bit controls the top dot, 1=least significant bit control the top dot of the printer.
OFFSET 270C	1 byte: if the most significant bit must equal 1, OFFSET=128; otherwise =0.
BAUD 270D	1 byte sets the Baud rate (see the Color Computer manual); default is 87, which is 600 Baud.
BITS 270E	1 byte: the number of dots printed at once by the printer (usually 7 or 8).
LINEFEED 270F	9 bytes: the first byte is the number of bytes you define for this function. The remaining bytes are sent to the printer at the start of printing, and so can be used to set linefeed size or some other function.
GRAPHIC CODE 2718	9 bytes: the first byte is the number of bytes you define for this function. These bytes are sent to the printer at the start of each line and can be used to set the graphics mode.
NEW LINE 2721	9 bytes: the first byte is the number of bytes you define for this function. These bytes are sent to the printer at the end of each line.
FORM FEED 272A	9 bytes: the first byte is the number of bytes you define for this function. These bytes are sent to the printer at the end of the page to move the paper to the start of the next page.

Load MUSICA II into memory but do not run it yet. Poke the data you have determined to correctly set your printer for

graphics printing into memory.

For example, most Radio Shack printers (specifically the Line Printer VII and the DMP-120 printers) require the following codes:

MARGIN: 112
BIT TYPE: 1
OFFSET: 128
BAUD: 87
BITS: 7
LINEFEED: 0 (not needed)
GRAPHICS CODE: 18
NEW LINE: 13
FORM FEED: 0 (not available)

Type the following to enter the codes into memory:

```
A=&H270A
POKE A,112
POKE A+1,1
POKE A+2,128
POKE A+3,87
POKE A+4,7
POKE A+5,0
POKE A+14,1:POKE A+15,18
POKE A+23,1:POKE A+24,13
POKE A+32,0
```

After the correct codes have been entered, save the program by typing

```
(C)SAVEM"MUSICA",&H2100,&H3E54,&H3E3D
```

Now MUSICA II will permanently have the right codes for your printer.

Load the music you wish to print from MUSICA II. Make sure your printer is ready to run. Press the "W" key and the printer will start to print music! The printing will start where the cursor is and continue until the end of the music.

ADDING A TITLE AND COMMENTS -----23

The ";" key allows you to write two lines of a message that is displayed every time the music is played. This is useful for giving specific directions on how to play the music, a copyright message, or a title. Use the right and left arrow keys to move the cursor and type in whatever you want. Exit by pressing "BREAK" or "ENTER" twice.

ADDITIONAL COMMANDS (DISK ONLY) -----24

The "A" key opens MUSICA II to a host of user-definable commands as well as a few additional supplied commands. Pressing the "A" key causes a directory of the available commands on disk to be displayed. Entering a name will load the appropriate program into memory, execute it, and return to MUSICA II.

Supplied commands include "BASS DBL" which lowers the pitch of voice 4 an octave, and "CLRVOICE" which clears a specified voice (starting at the current cursor position).

Most users of MUSICA II will not create their own commands because it requires a good knowledge of machine language. However, if you are interested, turn to the "Technical Notes" section for details.

PLAYING MUSIC FROM BASIC -----25

Music may be played independently of MUSICA II and merged with a BASIC program of your creation. Before you try to play music with the "PLAY" program, you should be aware of the following: the volumes of all the tone tables must be halved before playing with the "PLAY" program. The reason for this is to prevent the rather bad distortion that would otherwise occur. This problem does not occur when playing music with "PLAYSTER".

Here is how to do it:

1. Create your BASIC program.
2. Include at its start the statement "CLEAR N,&H3EFF" where N depends on how much string space you need (100 is a good general value to use).
3. Load the music file using the command "(C)LOADM F\$" where F\$ is the filename with the extension "/MUS" and then load the interface program ("PLAY/BIN").
4. Stop the disk motor with "POKE &HFF40".
5. Start playing the music with the "EXEC &H3F00" command.

Here is an example:

```
(DISK)
10 CLEAR 100,&H3EFF
20 LOADM "SABER/MUS"
30 LOADM "PLAY"
```

```
(TAPE)
10 CLEAR 100,&H3EFF
20 CLOADM "SABER"
30 CLOADM "PLAY"
```



```
40 POKE &HFF40
50 EXEC &H3F00
60 END
```

```
40 EXEC &H3F00
50 END
```

You will probably want to copy the "PLAY" program to the start of another tape if you have the tape version. This is how to do it. First reserve memory with CLEAR 50,&H3EFF. Now load the program with CLOADM"PLAY". Change the tape in the recorder, prepare to record, and then start recording with CSAVEM "PLAY", &H3F00, &H3FFF, &H3F00.

A music file may be modified so that merely typing EXEC after loading it will play the music. Make sure you have reserved memory with the appropriate CLEAR command (as above). Load the music file. Determine the ending address by typing A=HEX\$(256*PEEK(&H9D) + PEEK(&H9E)) then load the PLAY program. Save with (C)SAVEM"F", &H3F00, A, &H3F00. "F" is the filename.

The "PLAY" program is in the public domain; you are free to copy and modify it as you wish.

You should note that "PLAY" does not support repeats; you must use MUSICA II to make use of this feature.

For those of you who have the STEREO PACK, the program PLAYSTER/BIN has been provided. The only difference with PLAY/BIN is that music is routed to the STEREO PACK. The starting address of this program is &H3F00.

HOW DOES IT WORK? -----26

Briefly, MUSICA II generates a stream of numbers that the Color Computer converts to voltages through the sound port (6 bit digital to analog convertor). By varying the numbers and thus the voltages at the appropriate rate, a tone is produced through the TV speaker. The character of the tone produced ("timbre") depends on a table of numbers known as a "tone table". In its simplest form a tone table is merely the list of the values of a sine wave. If the values of the sine wave are repetitively sent to the sound port, a sine wave is produced that would make the TV speaker sound a pure flute tone.

The rate at which the numbers are sent to the sound port is fixed at about 8000 numbers per second (the technical term for this is the "sampling rate"). Pitch is varied by skipping a certain number of values in the tone table. Thus, a tone that is generated by skipping every other number is

an octave higher than one that utilizes every number.

This method of varying pitch makes it possible to produce more than one note at once. The correct value for each note is calculated, the values are all added together, and sent to the sound port. The result is the production of 1 or more tones, each independent of the other.

If you are interested in learning more about the theory of digital music production, an excellent reference is "Musical Applications of Microprocessors" by Hal Chamberlin published by Hayden.

COMMAND SUMMARY -----27

- A: Additional commands (disk only)-user definable commands may be loaded from disk and executed
- B: Begin-reset the program to the start of the present composition
- C: Change-change the tone assignments for each voice and the tempo; pressing "ENTER" at each prompt will assign the default (current) values
- D: Delete-delete the chord (all 4 voices) at the position of the cursor
- E: End-move the cursor to the end of music
- F: Flat-make the next note entered flat
- G: Generate-create new timbre and volume
- H: Highlight-highlight a specified voice
- I: Insert-insert a chord at the present position of the cursor; the chord at the cursor position will be duplicated
- J: Joystick-turn on/off the option to use the right joystick to select pitch; right/left positions of the joystick correspond to sharp/flat; use the "FIRE" button to enter notes; all other keys except for the up/down keys work as before
- K: Keep-save the present composition to disk or tape.
- L: Load-load a composition from disk or tape. With the disk version, a directory of music files will be displayed.
- M: Measure-write a barline at the current cursor position
- N: Repeat bar-marks the beginning or end of a section of music to be repeated when played
- O: Same as "P" except that the CPU runs at double speed; the result is music of much higher tone quality. All half and whole notes must be changed to quarter note equivalents before using this option to prevent them from becoming silent during playing. Be sure that you have saved the composition before using this option as it permanently alters the music code.
- P: Play-play the composition starting at the current cursor

position. This command may be interrupted at any time by pressing any key; if the "U" key is pressed, the score is updated to the point where you interrupted the music.

R: Rest-enter a rest

S: Sharp-make the next note entered sharp

U: Update-when used from the command mode, acts the same as "O" except that the altered notes are restored.

V: Voice-used to change the current voice assignment

W: Write-print music on your printer.

X: Exchange voices 1 and 3 with 2 and 4; this results in flip-flopping of the channels if you are using the STEREO PACK

Y: Copy from one voice to another. Use this option only after completion of music entry and only with 3-part harmony. This command may be used to create chorus or vibrato effects or 3-position stereo if you are using the STEREO PACK

Z: Exit-exit to BASIC

1-9: Change the note value of the chord or rest at the current cursor position. 1=whole note, 2=half note, 3=triplet, 4=quarter, 5=eighth triplet, 6=sixteenth, 7=thirty-second, 8=eighteenth, 9=sixty-fourth

@: STEREO PACK/TV port flip flop; select where the sound will go. When the STEREO PACK is selected, an "S" at the middle bottom screen will appear; to reset to TV, press "@" again

[: Enter title and message; exit by pressing the "BREAK" or "ENTER" key

.: Block move command; mark the beginning and end of the section of music to be moved, then where it is to be moved with the "." key

?: Help command: either press the ENTER key to review all the commands or the key you want to review.

"BREAK"-Cancels the commands Q,Y,G,H, and C.

"CLEAR"-Erase the music memory; when the copyright notice is displayed, press any note to continue

"ENTER"-Enter a note (or erase one if the current voice assignment is the same as a note under or above the cursor) at the current cursor position. The note may be written in any one of 4 voices (see the "V" command). This command affects only the current voice displayed at the right-hand side of the bottom of the screen

"UP ARROW"-Move the cursor up

"DOWN ARROW"-Move the cursor down

"RIGHT ARROW"-Move the cursor forward

"LEFT ARROW"-Move the cursor back

"SHIFT UP ARROW"-Move the cursor up an octave

"SHIFT DOWN ARROW"-Move the cursor down an octave

"SHIFT RIGHT ARROW"-Move the cursor forward 12 chords

"SHIFT LEFT ARROW"-Move the cursor back 12 chords

1-Memory map:

\$009D-\$009E	Address of last note in a music file after it has been loaded into memory
\$0E00-\$3FFF	Reserved for use by the program
\$2702-\$2703	Current end of music pointer
\$2704-\$2705	Current cursor position pointer
\$2706-\$2707	Used in interfacing your own printer screen dump routine
\$4000-\$40FF	Tone table #1
\$4100-\$41F	Tone table #2
\$4200-\$42FF	Tone table #3
\$4300-\$43FF	Tone table #4
\$4400-\$4404	Default assignments of tempo and tone tables
\$4405-\$7FFF	Music code

2-Description of music code:

Each chord is represented by 9 bytes. The first byte is the note length or an indicator of a barline or tone table and tempo assignment change. The first bit of this byte is always "0" if it represents the note length. Barlines, new tone table and tempo assignments, and repeat bars are marked by having the first bit of the first byte set to "1" (a barline is marked with the first byte set to a value of \$FF, new tone table assignments with \$FE, repeat bars with \$FD). The first byte is followed by 4 2-byte words which control the pitch of the 4 voices. The end of the music is marked by all 9 bytes being set to zero.

Byte #	0	1	2	3	4	5	6	7	8
Contents	Chord Descriptor	Voice 1	Voice 2	Voice 3	Voice 4				

3-Description of music disk (and tape) files:

Each file consists of memory from \$4000 to the end of the music code and then 118 bytes containing the tone table descriptors and title. A file may be loaded with the standard "LOADM" ("CLOADM") command. The address of the last byte in the composition may be determined after it is loaded into memory by entering "PRINT 256 * PEEK(&H9D) + PEEK(&H9E)".

4-Notes for Hi-Fi buffs:

While the sound can be considerably improved by connecting the color computer's output to a stereo system (using the "aux" jack of the cassette cable), harmonic distortion and signal noise remain a problem. The operating speed of the 6809 CPU is only 0.879 megahertz which limits the production of high frequencies. If the harmonic content of the tone table includes too many high harmonics, the result is a rather distorted signal. This distortion can be reduced by making the 6809 run faster. Your computer may be capable of running at 1.7 megahertz by using the "O" command. Noise is mostly due to the nature of the 6 bit digital-to-analog convertor used in the Color Computer. The noise can be drastically reduced with Speech System's "STEREO PACK" dual 8 bit digital-to-analog convertor. In addition to reducing noise, it also allows true stereo production with direct connections to either a pair of speakers or a stereo system. If you have a serious interest in music, you will find the investment in this product well worth the expense. You will notice that no provision has been made to control the envelope of the sounds generated by MUSICA II. While this makes percussive sounds impossible, it is felt that if a choice has to be made whether to include envelope control and have a rather low quality sound, or ignore envelope and have a relatively good sound, the proper choice is to ignore envelope control. The reason for this is that the 6809 runs at a speed that is too slow to control envelope and produce a good quality sound at the same time.

5-Assembly-language listing of the play subroutine:

(This is the listing of the program titled "PLAY/BIN" which allows you to call music from BASIC programs.)

```
PLAY  ORG $3F00
      LDA #$3F      SET DP REGISTER
      TFR A,DP
      SETDP $3F
      LDA $FF01     TURN ON TV SOUND PORT
      ANDA #$F7
      STA $FF01
      LDA $FF03
      ANDA #$F7
      STA $FF03
      LDA #$3C
      STA $FF23
      PSHS CC       SAVE CONDITION REGISTER
      ORCC #$50     DISABLE INTERRUPTS
      LDX #$4400    X=NOTE POINTER
      LDA ,X+       LOAD TEMPO FROM MUSIC
```

	STA TEMPO	
	LDD ,X++	LOAD TONE TABLE HIGH ADDRESSES
	STA <V1PT	
	STB <V2PT	
	LDD ,X++	
	STA <V3PT	
	STB <V4PT	
	BRA NEWNT1	
TEST	CMPA #\$FE	TEST FOR NEW WAVE TABLE POINTERS
	BNE NEWNOT	
	LDD 0,X	UPDATE WAVE TABLE POINTERS
	STA <V1PT	
	STB <V2PT	
	LDD 2,X	
	STA <V3PT	
	STB <V4PT	
	LDA 4,X	UPDATE TEMPO
	STA <TEMPO	
NEWNOT	LEAX 8,X	ADVANCE NOTE POINTER
NEWNT1	LDA ,X+	LOAD NOTE DURATION
	BMI TEST	IF DURATION>\$7F, NOT A NOTE
	BEG PLAY2	DURATION=0 IF END OF MUSIC
PLAY1	STA <DUR	
	LDB <TEMPO	SAVE TEMPO
	STB <TEMPO+1	
MAIN	LDA [V1PT]	OUTPUT VOICES TO SOUND PORT
	ADDA [V2PT]	
	ADCA [V3PT]	
	ADCA [V4PT]	
	STA \$FF20	
	LDD <V1PT+1	INCREMENT VOICE POINTERS
	ADDD ,X	ONLY THE LSB AND "FRACTIONAL"
	STD <V1PT+1	BYTES ARE CHANGED.
	LDD <V2PT+1	SECOND VOICE
	ADDD 2,X	
	STD <V2PT+1	
	LDD <V3PT+1	THIRD VOICE
	ADDD 4,X	
	STD <V3PT+1	
	LDD <V4PT+1	FOURTH VOICE
	ADDD 6,X	
	STD <V4PT+1	
	DEC <TEMPO+1	UPDATE TEMPO COUNTER
	BNE WAIT	
	DEC <DUR	UPDATE DURATION COUNTER
	BEG NEWNOT	
	LDB <TEMPO	RESTORE TEMPO COUNTER
	STB <TEMPO+1	
	BRA MAIN	
WAIT	LEAX 0,X	(TO EQUALIZE LOOP TIMES)
	LEAX 0,X	

```

LEAX 0,X
LEAX 0,X
LEAX 0,X
BRA MAIN
PLAY2 CLRA          RETURN FROM SUBROUTINE
      TFR A,DP
      PULS CC,PC
V1PT  RMB $3       VOICE TONE TABLE POINTERS
V2PT  RMB $3       ONLY THE LAST 2 BYTES ARE
V3PT  RMB $3       CHANGED; THE 3RD BYTE IS
V4PT  RMB $3       "FRACTIONAL"
DUR   RMB $1
TEMPO RMB $2
      END PLAY

```

7-ADDING COMMANDS TO "A" (DISK ONLY)

As mentioned previously, the user may construct his own commands and call them by pressing the "A" key. If you have a working knowledge of assembly language, you will find this option interesting and rewarding!

All commands are stored on disk as machine language files with the extension "/CMD". To interface your program with MUSICA II, you will need to review the material presented in parts 1 and two of this section. Particularly important is the current cursor position pointer at \$2704. This pointer, 2 bytes long, is the address of the chord in memory that the cursor is now positioned at. Also, pay especial attention to the description of the 9 bytes used to define a chord (part 2).

All command programs start at \$3F00, end before \$4000, and terminate with a RTS instruction.

COPYRIGHT NOTICE -----29

Please respect the copyright on this program. It takes hundreds of hours to produce a program. You may make copies of the programs supplied for your own use. Remember that giving or selling copies to your friends is not only a violation of the law but discourages software writers from producing high quality, low cost programs for your enjoyment.

ADDENDUM FOR VERSION 2.4

There are a few changes in MUSICA II that have been made since the manual was printed that you should be aware of.

Page 5: ORCHESTRA 100 and 200 have been renamed to Music Library 100 and 200.

Page 15: Section 20 about moving music around, should be changed so that references to "moving" music should be changed to "copying" music.

Pages 16-18: Ignore all references to installing your own printer codes. You may select your printer type and baud rate from a menu that is displayed when the "W" key is pressed to print music. IF YOUR PRINTER DOES NOT APPEAR ON THE MENU, PLEASE CONTACT SPEECH SYSTEMS!

Page 20: Top line, change line 40 of the disk Basic program to "40 POKE &HFF40,0".

Several new commands have been added to MUSICA II. The "," key causes barline numbers to be turned on or off. The numbers appear directly above the barlines. The "Q" key is the second. This allows you to move the cursor directly to any barline in music by entering the number of the barline. Pressing "ENTER" will enter whatever is on the screen. You will find this useful in editing music.

The block copy command "." has been expanded to include a block delete. First mark the beginning and end of the block of music as with the block copy. Then press the "-" key. The block of music will be deleted.

The shift forward and shift backward commands have been changed so that the cursor moves rapidly until another key is pressed.

SPEECH SYSTEMS
38 W 255 Deerpath Road
Batavia, IL 60510

MUSICA 2 COMMAND SUMMARY

- A - Additional commands (disk only); user's definable commands may be loaded from disk and executed.
- B - Begin; move's the cursor to the start of the present score.
- C - Change's the tone assignment and the tempo for each voice, pressing <enter> at each prompt will assign the current default value.
- D - Delete's all 4 voices (chord) at current cursor position.
- E - End; move's the cursor to the end of the present score.
- F - Flat; next note entered will be a flat.
- G - Generate; create's new timbre and volume.
- H - Highlight's a specific voice.
- I - Insert's or duplicate's a chord at the current cursor position.
- J - Joystick; turn's option to use right joystick on or off, up/down select's pitch nad left/right select's flat/sharp, press FIRE button to enter notes. All other keys except up/down arrows work as before.
- K - Keep; save's the present score to disk or tape.
- L - Load's a score from disk or tape, pressing <D> will display a directory of the music compositions on disk.
- M - Measure; insert's a bar at the current cursor position.
- N - Repeat; insert's repeat bars at the beginning or end of the section of the music to be repeated when played.
- O - Same as "P", except's that the CPU runs at double speed, result is music of much higher tone quality. All half and whole notes must be changed to 1/4 note equivalent before using this option to prevent them from becoming silent during playing. Be sure you have saved the score before using this option as it will permanently alter the score.
- P - Play's the composition starting at the current cursor position. Press any key to stop; if "U" is pressed, the score is updated to the point where you interupted the music.
- Q - Quick find; press number of the bar you wish displayed.
- R - Rest; enter's a rest at the current note value.

- S - Sharp: next note entered will be a sharp.
- T - Go to the next "C" marker.
- U - Update: when used from the command mode, acts same as "O" except that the altered notes are restored.
- V - Voice: used to change the current voice assignment.
- W - Write: print's the current composition on your printer.
- X - Exchange voices 1 & 3 with 2 & 4 (used with stereo pack).
- Y - Copy from one voice to another. Use only after completion of score & only with 3 part harmony. May be used to create chorus or vibrato effects.
- Z - Exit to Basic.

Numbers 1 to 9: Changes time value of note, chord or rest at the current cursor position.

1 = whole note	2 = 1/2 note	3 = 1/8 triplet
4 = 1/4 note	5 = 1/16 triplet	6 = 1/16 note
7 = 1/32 note	8 = 1/8 note	9 = 1/64 note

@ - Select's Stereo Pack

; - Enter's title & message (two lines), press <break> or <enter> to exit.

. - Block move: mark beginning & end of section of score to be moved. place cursor at the desired position & press <.>.

? - Help: press <enter> to review all the commands or the key you wish to review.

- - Delete block. marked with "."

. - Barline number on/off: number the barline if you wish.
<BREAK> - Cancel's commands Q, Y, G, H, & C.

<CLEAR> - Erase the music memory: when the copyright notice is displayed, press any note to continue

<ENTER> - Enter's a note at the current cursor position & voice assignment (or erases a note if the voice assignment is the same as the note under or above the cursor). The note may be entered in any one of 4 voices. This command affects only the current voice displayed at the right hand side of the bottom of the screen.

ARROWS - Move cursor:

UP - up	RIGHT - forward one note
DOWN - down	LEFT - back one note

SHIFT UP - up 1 octave	SHIFT RIGHT - forward 12 chords
SHIFT DOWN - down 1 octave	SHIFT LEFT - back 12 chords